REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1865.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1866.

IN THE SENATE OF THE UNITED STATES, *July* 25, 1866.

Resolved, That there be printed for the use of the Senate seventeen thousand extra copies of the Report of the Commissioner of Agriculture for the year 1865, and the accompanying documents; and three thousand extra copies of the same for the use of the Department of Agriculture.

IN THE HOUSE OF REPRESENTATIVES, *July* 19, 1866.

On motion of Mr. Latham, from the Committee on Printing,

Resolved, That there be printed of the Report of the Commissioner of Agriculture for the year 1865 one hundred and sixty-five thousand copies: one hundred and forty-five thousand copies for the members of this House, and twenty thousand copies for the Commissioner of Agriculture.

CONTENTS.

ILLUSTRATIONS.

REPORT

OF

THE COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., November 27, 1865.

SIR: I have the honor to submit to you my fourth annual report, but the first which it has been my privilege to make while the people of our beloved country, from one end to the other, were at peace pursuing their wonted avocations.

But the results of the various operations of the department which I am able to lay before you are necessarily exclusive of the States recently in insurrection; the brief lapse of time since the cessation of hostilities, and the imperfect mail facilities of those States, not permitting systematic correspondence by which could be obtained accurate and reliable information from that section of the country.

I most sincerely congratulate the country upon the return of peace to our people, and render thanks to Him who doeth all things well for his merciful kindness and manifold blessings; for while one section of our fair country has been laid waste, and her citizens subjected to the devastating consequences of war—their implements of husbandry allowed to rust for want of use, and the earth to rest from yielding its products for the people's support—the other section has exhibited a condition of prosperity and plenty that would seem to ignore (were it not for the absence and loss of some of her best and bravest sons) the existence of a war. While more than a million of the hardy sons of toil have been called from their industrial pursuits to engage in warfare for the preservation of the Union, those at home have applied themselves with redoubled energy; and with the influence of higher wages in calling forth and economizing labor, and the aid of agricultural machinery and labor-saving implements and appliances, the farmer has been enabled to gather an abundant harvest. Thus those engaged in peaceful pursuits have been rewarded, even during the period of a most desolating war, with liberal wages for their labor and remunerative returns for the products of the farm.

The earth, too, has seemed to respond to the increased demand upon its fertility, and has given us, with the aid of the husbandman, an abundance having no parallel in the history of that portion of the country, feeding the army and navy as well as the great mass of people in civil life, and leaving a surplus for exportation to foreign countries, and charitable donations for the alleviation of the suffering people of other nations.

While these products have commanded seemingly exorbitant prices, the industrial classes have had constant employment at remunerating wages; nor have these rewards of labor been depreciated or sensibly affected by the return of a vast army to the ranks of industry, or by the emancipation of four millions of slaves. So great are our resources calling urgently for development, that instead of fears of competition from returned soldiers, emancipated slaves, or foreign immigrants, (now flocking to our shores,) there is seen a decided buoyancy in the labor market, with a demand for increase of wages and fewer hours of toil.

Not only the necessaries, but even the luxuries of life are therefore easily attainable. How immeasurably preferable is this condition of things for the laboring classes, to a necessity for comparative idleness with lower prices; for low rates would then fail to bring the comforts of life within their control, while, with employment and adequate compensation, scarcely any price can place them beyond their reach. The great aim of the government should be to adopt a policy by which the agricultural, mechanical, manufacturing, and other industrial interests throughout the country should be fostered and encouraged, and the present time would seem most propitious for the initiation of such a policy.

The great contest in which we have been engaged is, I trust, forever ended. The courage, strength, and physical endurance of our people has been fairly tested, and, in the providence of God, has been decided for the country. A free republican government has been sustained, and the great problem of the capability of the people for self-government has been solved, and we stand to-day before the world, after the most desperate and persistent conflict that history records, a united and, I trust, a wiser and better people, full of charity for our erring brethren, and gratitude to those who have perilled their lives for their country's sake.

The energies of the people are now required to build up the waste places. The results of the war having changed the system of labor in some of the States, wise counsels and wholesome legislation, with just and charitable discretion, will be demanded in directing and dealing with the freedmen. I have no fear of the results, if employers and employed will mutually adapt themselves to the existing state of things; and I believe that a higher state of prosperity than was ever before enjoyed by the people of the South will be ultimately attained. It may be that the system of free labor will not prove favorable to large landed estates; and I am willing to confess my full belief that such a result will be beneficial to the great masses and to the country. The average size of farms in the United States, in 1860, was 199 acres; almost double the average for Great Britain, which, in 1851, was 102 acres only, notwithstanding the great size of many baronial and aristocratic "holdings"—there being no less than 170,814 farms in the kingdom, or considerably more than one-half of the entire number, having less than 50 acres each. But the average in the southern States is far greater than the general average for the United States, as the following table will show:

	Acres of improved lands.	Acres of unimproved lands.	Number of farms.	Average No. of acres in each farm.
Delaware	637,065	367,230	6,658	151
Maryland	3,002,267	1,833,304	25,494	190
Virginia	11,437,821	19,679,215	92,605	324
North Carolina	6,517,284	17,245,685	75,203	316
South Carolina	4,572,060	11,623,859	33,171	488
Georgia	8,062,758	18,587,732	62,003	430
Florida	654,213	2,266,015	6,568	444
Alabama	6,385,724	12,718,821	55,128	346
Mississippi	5,065,755	10,773,929	42,840	370
Louisiana	2,707,108	6,591,468	17,328	536
Texas	2,650,781	22,693,247	42,891	591
Arkansas	1,983,313	7,590,393	39,004	245
Tennessee	6,795,337	13,873,828	82,368	251
Kentucky	7,644,208	11,519,053	90,814	211
Missouri	6,246,871	13,737,939	92,792	215
Total	74,362,565	171,101,718	764,867	320

The large proportion—almost three-fourths—of unimproved land in farms, in addition to the unimproved public lands, illustrates pointedly the necessity that vastly more labor be applied to their cultivation. The most populous States in the Union have the smallest farms, commanding the highest price per acre; and the value per acre is, as a general fact, inversely proportionate to the size of the farms. Thus the farms of Massachusetts average 94 acres; of Rhode Island, 96; of Connecticut, 99; of New York, 106; of Pennsylvania, 109; and of Ohio, 114 acres.

Every head of a family should have a homestead if possible. Thus an incentive to industry is created, and a spirit of enterprise encouraged, that will soon double the products of the country, increase the wealth of the States, and add to the resources of the nation.

In this new order of things I feel the importance of the position which this department should assume towards the people of the States now reassuming their former relations with the rest of the country. With the question of reconstruction, or, more properly, reorganization, I have no concern; believing the subject to be in competent hands, and that its final and satisfactory settlement will be accomplished in due time. I shall, therefore, cheerfully put forth my exertions, to the best of my ability, in aid of measures of reconciliation and for the advancement of the interests of agriculture throughout the whole country, believing that branch of industry to be the foundation of the prosperity of all nations, and the fostering of its interests by the government to be absolutely essential to such prosperity. History furnishes abundant illustrations of this truth.

The southern States will need much aid and encouragement in the coming season. Their favorable climate and prolific fields should invite capital and stimulate labor. In no other section can crops be cultivated with less labor, nor are there any crops more remunerative than such as are peculiarly adapted to that section of the country. Their cotton is the best that has yet been produced in any country, and their sugar crop is one of great importance—Louisiana alone having produced in 1859 221,726 hogsheads of sugar and 13,439,772 gallons of molasses.

I have endeavored so to conduct the affairs of this department as to commend it to the favorable consideration of Congress and the approval of my countrymen, not doubting that its operations will be duly appreciated, and its labors ultimately crowned with complete success. I shall seek to increase its practical value and extend its influence, and hope it may continue to receive the liberal and fostering attention of Congress, and that those engaged in agriculture may be thereby stimulated to greater exertions and higher aims.

Our country possesses an advantage in soil and climate unsurpassed by any other on the globe for cultivating and perfecting all the necessary elements of subsistence and comforts for our entire population, with luxuries in abundance for the most cultivated tastes. With our extended and daily increasing system of internal improvements a failure of crops in one section of the country would scarcely be felt. These vast resources and appliances which spring into existence at the bidding of an industrious and energetic people daily add to the wealth and greatness of the nation, enhancing the happiness of the people; hence all are alike interested in the success of agricultural science; and if those engaged in it will pursue it with half the energy that characterizes those in other pursuits—availing themselves of all means of improvement, profiting by the practical experience of the most successful, and managing their farms systematically upon business principles—abundance and wealth will be their sure reward. From the wealth thus created and diffused throughout society will come with grateful pleasure the taxes for the support of the government and payment of the national debt, which, under equal and just laws, will be entirely extinguished with unprecedented celerity.

During the past year I have availed myself of the services of Messrs. V. D. Collins and John H. Klippart, gentlemen of skill and intelligence, well known to be devoted to the interests of scientific and practical agriculture, to visit parts of Europe and Asia, at a very small pecuniary outlay, compared with the advantages to be derived from their labors in the investigation of questions of present importance in the agriculture of this country. No reports having yet been received, the results of their labors will be given in detail in the agricultural report for 1865.

A very malignant disease among cattle, called the "rinderpest," or cattle plague, has been prevailing for some time, with fatal effect, in Russia, Great Britain, and other European countries. Its ravages have been exceedingly severe, destroying in many instances whole herds of the most valuable and carefully bred cattle of Europe. It seems to be both contagious and infectious, and much apprehension is felt for the safety of the cattle of this country. The importance of the subject seems to demand the immediate action of Congress, prohibiting the importation of farm-stock during the prevalence of the disease.

The rooms now occupied by this department are entirely inadequate for its accommodation, being located, in part, in the Patent Office building, with other rooms in buildings disconnected from it. The increasing demand of the Bureau of Patents for additional room must shortly render it a matter of necessity to surrender the rooms now occupied by this department. For the better arrangement of the increasing collection of specimens in the museum, or object-library, and for greater convenience in the transaction of the business of the office, additional and more contiguous accommodation is highly desirable. I trust, therefore, that Congress will take measures for the erection of a suitable building, at as early a day as possible, for the use of the department.

Large quantities of new and valuable seeds, cuttings, and plants have been distributed during the last year throughout the country, in order to test the adaptability of such varieties to the various soils and climates of the different sections. These experiments, whenever they have proved a success, have been of inestimable value, not only improving qualities, but also increasing the crop productions per acre, and inciting to emulation in the introduction of new varieties.

In the distribution of seeds, 234,945 packages have been delivered to senators and representatives in Congress, 119,693 to agricultural and horticultural societies, and 408,593 to regular and occasional correspondents, and in answer to personal applications—making a total distribution of all varieties of seeds of 763,231 packages.

The distributions from the experimental and propagating garden during the past year have been mainly confined to varieties of the small fruits, such as grapes, strawberries, gooseberries, raspberries, and currants. Of these about 35,000 plants have been distributed through the usual channels.

The process of testing the respective merits of varieties of fruits is in active progress, so far as the capacities of the garden will permit. Additions are constantly being made to the list of plants selected for the above purpose. It is my constant endeavor to preserve the distinguishing feature of the garden for the propagation and dissemination of specialties, under intelligent supervision, and avoid its degeneration into a commercial nursery.

A new propagating house has been erected, substantially fitted with the most improved facilities, and is now in successful operation.

For the purpose of ascertaining whether among the many valued fruits of tropical regions there may be any worthy of artificial culture, I have had an apartment in one of the green-houses arranged in a suitable manner for their growth, and have opened a correspondence towards securing as complete a collection of these plants as practicable.

The assignment to this department of reservation No. 2, lying immediately west of the Smithsonian grounds, for the purpose of an experimental farm, has afforded an opportunity for the initiation of a series of experiments designed to test the value of foreign cereals, forage plants, and garden vegetables.

The grounds, with an unbroken soil of somewhat tenacious clay, came into my possession about the middle of April, quite too late to admit of being put in proper tilth for obtaining the best results during the present season. A few acres, duly fertilized and suitably pulverized, were planted with 346 varieties of seeds, including 18 kinds of Indian corn, 34 of beans, 13 of peas, 77 of potatoes, (52 of which were seedlings,) 33 of melons, and many varieties, respectively, of tomatoes, beets, and other vegetables.

Specimens of cotton matured quite perfectly with the aid of fertilizers and high culture. Some of the foreign seeds promise to be acquisitions to our agriculture, either by virtue of excellence in quality, productiveness, or adaptation to special uses, soils, or climate. Further experiments will develop more completely and accurately their peculiar characters and values.

During the autumn the remaining portion of the grounds has been seeded with grasses and cereals, especially with wheats, embracing sixty-two varieties, from France, Prussia, Russia, Great Britain, Chili, and China. Valuable results are confidently expected to accrue eventually from these experiments.

An office and stable have been erected, at small expense, and a supply of Potomac water brought upon the premises.

The donations and additions to the museum have been increased to such an extent during the past year that the two small rooms appropriated to that purpose have been completely filled, and many of the most interesting specimens of fibres, sugars, seeds, &c., cannot be exhibited for want of space, and are therefore unavailable to those desiring to study them. The museum has been enriched by specimens of sheep and domestic poultry, showing the true types of the various breeds, and to what purpose each breed is specially adapted.

In my former report it was recommended that the collection of insects, birds, and model fruits belonging to Mr. Townend Glover, entomologist of the department, should be purchased by the government, and made the nucleus of a national agricultural and economic museum. This subject is earnestly pressed upon the attention of Congress.

The sum of five hundred dollars has been expended in sending Mr. Glover to Paris, to represent the interest of this department at the exposition of insects useful or injurious to the crops, which was held at the industrial palace, under the patronage of the minister of agriculture of France; where I am happy to say he received the first premium of the large gold medal of the Emperor Napoleon for his yet unfinished work on the insects of America, a work as original in its plan of arrangement as it will prove to be valuable in its proposed remedies for the destructive insects. He was nearly four months absent, and on his return brought specimens of the various silk cocoons and silk-producing insects, together with prepared skins of animals and game birds which are susceptible of domestication, and may with advantage be introduced and acclimated in this country. It is sincerely to be hoped that a portion of the propagating grounds, or some other convenient place, may be set apart for the purpose of commencing a garden of acclimation, from whence the llama, cashmere goat, and the improved breeds of domestic fowls, might be distributed to different parts of our country.

The ailanthus silkworm, which has succeeded so well in France, has been re-introduced this year from Paris. This insect may now be considered as perfectly acclimated, and the silk produced by it is very strong and of good quality.

Since my last report the laboratory has been fitted up and provided with apparatus and other means of investigation. In regard to the practical results obtained I would refer to the report of the chemist, as showing that some original investigations have been made, and many questions answered which have been propounded by farmers, technologists, sugar-producers, and others, in all parts of the country.

Minerals, ores, and geological specimens have been received by mail and otherwise, in considerable quantities. Such as proved valuable, and could be properly identified as to locality, were retained as a nucleus for a mineralogical cabinet.

The field open for chemical science never was so great as at the present time. Chemistry being indeed the life and soul of an intelligent, rational agriculture, the governments of Europe—Germany taking the lead—impressed with this unquestionable fact, have established experimental agricultural stations, consisting of an experimental garden and a complete analytical laboratory. The chemist, provided with assistants, institutes on the spot such original experiments, and tests such theoretical problems in reference to agriculture, as would seem most prolific of benefit to the farming community and the world at large. To instruct the farmer as to the difference between robbing and tilling the land, to teach him to understand and take a lively interest in the practical experiments above alluded to, travelling teachers have been appointed, connected with these agricultural stations, whose office it is to impart useful knowledge to the masses by lectures and conversations. Thus every one may gradually be prepared to receive and profit by the rich stores of science open to every intelligent farmer.

Such is the appreciation of chemical science in Germany, where schools and private laboratories so abound, that at the present time two large laboratories on the most complete scale, are in the course of construction at Berlin and Bonn, at the expense of the state.

In the collection of statistics, during the past year, unusual attention has been given to farm stock. The waste of horses and mules by war, and the army consumption of meats, excited fears of deficient supplies of domestic animals, rendering necessary a reliable exposition of the number, price, and value of each kind in the several States—a labor undertaken with much care, and accomplished, it is believed, notwithstanding its difficulty, with a fair measure of success.

The tables of statistics resulting from these labors are applied to important uses—foiling the designs of speculators and correcting their misrepresentations; enabling the farmer to obtain the worth of his cereals, wool, meats, and other agricultural products; and directing the purchaser of store animals in what quarter to obtain most easily and cheaply his needed supplies for fattening. Accurate statistics, affecting commercial dealings in farm products, may thus prove of immediate and almost incalculable service to the agricultural community.

I may here remark that this system of collecting, compiling, and publishing farm statistics is attracting the attention and eliciting the commendation of European nations, and that many of their most practical statisticians acknowledge freely its superiority over prevailing European systems.

That these statistics, obtained monthly through thousands of intelligent correspondents, upon specific subjects peculiarly appropriate to the season, should be placed before the country at the time, and not be deferred until the publication of the annual report, is indisputable. The leading purpose in their presentation is to furnish a guide to producers in the necessary mutations of crop and stock production, and to act on the markets before the disposition is made of cereals, meats, and fibrous products of the farm. Hence the necessity and the origin of the monthly report. Its publication, at first opposed by several agricultural papers, under the erroneous impression that it might conflict with private interests, excites no opposition since it is seen to avoid ordinary topics pertaining to agriculture, and to consider only those that are national in their character or bearing.

The annual and monthly reports are entirely distinct in their character. The first treats of subjects of a permanent nature, in the form of carefully written essays. The second is confined to topics less permanent, and often of transient or passing importance; it considers them briefly, touching upon leading points only, avoiding details, and ignoring the ornaments of style and a labored arrangement.

A brief general summary of the more important statistics of this division are as follows:

GENERAL SUMMARY RELATING TO FARM STOCK.

Showing the total number of live stock for January, 1864 *and* 1865, *the increase and decrease thereof, the general average price of each kind, the value of each kind, and the total value of all.*

Animals.	1864.	1865.	Increase.	Decrease.
Horses	4,049,142	3,740,933		308,209
Mules	280,847	247,553		33,294
Cattle and oxen	7,965,439	7,072,591		892,848
Cows	6,066,748	5,768,130		298,618
Sheep	24,346,391	28,647,269	4,300,878	
Hogs	16,148,712	13,070,887		3,077,825
Total	58,857,279	58,547,363	4,300,878	4,610,794

Number, average price, and total value in January, 1865.

Animals.	Number.	Average price.	Total value.
Horses	3,740,933	$80 84	$302,425,499
Mules	247,553	102 08	25,041,488
Cattle and oxen	7,072,591	26 17	185,090,087
Cows	5,768,130	36 70	211,718,270
Sheep	28,647,269	5 40	154,807,466
Hogs	13,070,887	8 55	111,796,318
Total value			990,879,128

GENERAL SUMMARY RELATING TO CROPS

Showing the number of bushels, &c., of each crop, the number of acres of each, the value of each, and the bushels, acres, and value of all, and the increase and decrease of the same, for the years 1863 *and* 1864, *and the comparison between the same years.*

AMOUNT OF CROPS.

	1863.	1864.	Increase.	Decrease.
Indian corn	397, 839, 212	530, 451, 403	132, 612, 191	....
Wheat	173, 677, 928	160, 695, 823	....	12, 982, 105
Rye	19, 989, 335	19, 872, 975	....	116, 360
Oats	170, 129, 864	175, 990, 194	5, 860, 330	....
Barley	12, 158, 195	10, 716, 328	....	1, 442, 567
Buckwheat	15, 786, 122	18, 700, 540	2, 914, 418	....
Potatoes	98, 965, 198	96, 532, 029	....	2, 433, 169
Total	888, 546, 554	1, 012, 959, 292	141, 386, 939	16, 974, 201
Tobacco	163, 353, 082	197, 460, 229	34, 107, 147	....
Hay	18, 346, 730	18, 116, 691	....	230, 039

ACREAGE OF CROPS.

	1863.	1864.	Increase.	Decrease.
Indian corn	15, 312, 441	17, 438, 752	2, 126, 311	....
Wheat	13, 098, 936	13, 158, 089	59, 153	....
Rye	1, 439, 607	1, 410, 983	....	28, 624
Oats	6, 686, 174	6, 461, 750	....	224, 424
Barley	557, 299	540, 317	....	16, 982
Buckwheat	1, 054, 060	1, 051, 700	....	2, 360
Potatoes	1, 129, 804	902, 295	....	227, 509
Tobacco	216, 423	239, 826	23, 403	....
Hay	15, 641, 504	15, 034, 564	....	606, 940
Total	55, 136, 248	56, 238, 276	2, 208, 867	1, 106, 839

VALUE OF CROPS.

	1863.	1864.	Increase.	Decrease.
Indian corn	$278, 089, 609	$527, 718, 183	$249, 628, 574	....
Wheat	197, 992, 837	294, 315, 119	96, 322, 282	....
Rye	20, 589, 015	31, 975, 013	11, 385, 998	....
Oats	105, 990, 905	139, 381, 247	33, 390, 342	....
Barley	13, 496, 373	16, 941, 023	3, 444, 650	....
Buckwheat	12, 660, 469	21, 986, 763	9, 326, 294	....
Potatoes	55, 024, 650	77, 184, 043	22, 159, 393	....
Tobacco	24, 239, 609	29, 335, 225	5, 095, 616	....
Hay	247, 680, 855	365, 707, 074	118, 026, 219	....
Total	955, 764, 322	1, 504, 543, 690	548, 779, 368	....

The above tables of the general summary do not show the exact comparative differences between the years 1863 and 1864, because the latter year embraces the crops of Kentucky, which are not in the year of 1863. Deducting Kentucky from 1864, the comparison will be as follows:

Table of comparison between 1863 *and* 1864.

	1863.	1864.	Increase.	Decrease.
Total, bushels	888, 546, 554	959, 821, 150	71, 274, 596	
Total tobacco, pounds	163, 353, 082	140, 503, 760		22, 849, 322
Total hay, tons	18, 346, 730	18, 004, 366		342, 364
Total acreage	55, 136, 248	53, 950, 797		1, 185, 451
Total value of crops	$955, 764, 322	1, 440, 415, 435	$484, 651, 113	

The table of comparison between 1863 and 1864 exhibits much that is important. The increase in the bushels of grain is large, and the decrease in the pounds of tobacco raised is also great. The decrease in acres cultivated is 1,185,451, but the increase in the value of the above crops is $484,651,113.

The first increase is from the corn crop, and the last may be attributed to an increase in the currency, or a spirit of speculation.

General summary of the amount of the crops of 1865, *compared with those of* 1864 *and* 1863.

	1865.	1864.	1863.
Wheat, bushels	148, 552, 829	160, 695, 823	179, 404, 036
Rye, bushels	19, 543, 905	19, 872, 975	20, 782, 782
Barley, bushels	11, 391, 286	10, 632, 178	11, 368, 155
Oats, bushels	225, 252, 295	176, 690, 064	173, 800, 575
Corn, bushels	704, 427, 853	530, 581, 403	451, 967, 959
Buckwheat, bushels	18, 331, 019	18, 700, 540	15, 806, 455
Potatoes, bushels	101, 032, 095	96, 256, 888	100, 158, 670
Total bushels	1, 228, 501, 282	1, 013, 429, 871	953, 288, 632
Hay, tons	23, 538, 740	18, 116, 751	19, 736, 847
Tobacco, pounds	183, 316, 953	197, 468, 229	267, 267, 920

In the western States the wheat crop is very deficient in quality. It has been estimated by the department that the deficiency in both *quantity* and *quality* is 26,241,698 bushels; in quantity alone 12,172,944 bushels. The quality of the corn crop is excellent, and that of the remaining crops is believed to be an average. The number of bushels in 1865 exceeds those of 1864 by 215,071,411.

The prices, average, and value of the crops of 1865 will not be calculated until February next. The greatness and excellence of the corn crop must be gratifying to all.

The balance of the appropriation for the service of the fiscal year ending June 30, 1865, remaining unexpended on the 1st of December, 1864, was $95,891 51. There was appropriated for the fiscal year ending June 30, 1866, $155,300.

The expenditures from December 1, 1864, to November, 1865, amount to $152,614 70, leaving an unexpended balance of $98,584 81.

Since my last report of the special appropriation of $20,000 "for investigations to test the practicability of preparing flax and hemp as a substitute for cotton," there has been expended $4,500 40, leaving a balance of $10,500 remaining in the United States treasury.

The increasing demand made upon the department for the agricultural report, which is yearly becoming more extended and urgent as the appreciation of its value and usefulness is widened and intensified, induces me to ask Congress for an additional number of copies. The limited number allowed for circulation by the department forbids a very liberal distribution among those engaged in agricultural pursuits, who especially desire and seek the information it contains; many of whom are dependent upon the department for their supply. A single copy to each of its correspondents would alone absorb nearly the entire annual allotment to the department.

There should also be retained a sufficient number of each volume for the future supply of foreign exchanges, libraries, and agricultural and kindred associations.

Respectfully submitted,

ISAAC NEWTON,

Commissioner of Agriculture.

His Excellency ANDREW JOHNSON, *President.*

REPORT OF THE SUPERINTENDENT OF GARDEN.

SIR: I have the honor to submit the following notes and remarks upon the progress and practical operations of the garden:

At the risk of repetition, I would again allude to the limited area of the garden. It is highly necessary that the department should possess complete orchards of the various hardy fruits. At least one tree or plant of every variety should be kept, thus forming a living museum, which would be of great value for reference. As it is, only the small fruits can be accommodated, and, to test all the new varieties even of these, it is found necessary to eradicate those that proved to be comparatively worthless. This, although perhaps no great loss, does not fully serve the purpose of a national garden, which should preserve specimens of all, in order to assist in the identification of sorts, and also exhibit the progress made in their improvement.

GRAPES.

Inquiry is frequently made as to the best mode of propagating the grape, the information sought, however, having reference more to the character of plant produced than to the mode of manipulation—whether the best plants are those produced from long cuttings, single eyes, or layers; and also to the relative merit of plants produced partially or altogether under glass, and those grown wholly in the open border. So far as the health of the plant is involved, as having an influence upon its future growth, there is no difference in any of the above-mentioned modes, provided it has ripened and thoroughly matured both wood and roots. Plants of the very best description have been produced from single eyes of young green shoots taken off in May, rooted, and kept in pots during summer. These have made growths from six to eight feet in length, thoroughly ripened to the tips of the shoots, and formed as fine plants as may be desired for permanent planting.

To produce plants from such soft and succulent cuttings, it is absolutely essential that they be placed under glass and in a warm bed, technically bottom heat, and as soon as roots are formed the young plants are potted and kept growing freely under glass—but not in a close atmosphere—a position they may occupy until growth is complete; or, they can be planted out in the open ground by the end of July. Unless with new or rare varieties there is seldom any necessity for this mode of propagation, which requires considerable skill and care; but it is proper to state that as good plants can be procured by this as can be by any other mode, and, in respect to being exempt from old wood, it is superior to any other mode of propagation by cuttings. It is a system of multiplying all kinds of plants more universally adopted than any other, and answers quite as well with the grape as with any other plant.

Where cuttings are plentiful, the most economical method of raising plants is by long cuttings in the open border. These should not be less than four inches in length, and need not be over six inches. Selecting a well pulverized soil, rather light or sandy, insert the cuttings in rows, pressing them down so that the bud rests on the surface; the soil should be made firm around them, and if slightly covered with strawy manure (only a sprinkling—chaff will answer better if obtainable,) to prevent surface evaporation, a very large percentage will form fine plants without any further care than that necessary to keep down weeds and cultivate the surface.

Ordinarily there is no better mode of propagating grapes than that known as by the single eye or bud. As indicated, these are made with one bud retained, and about one inch of wood below it. Plants from these have but very little old wood in their structure, and so approach as near as possible to a plant produced from seed, although, as far as this is concerned, the plant from a green wood cutting has decidedly the advantage. Single eye cuttings of old wood are generally placed under glass, and receive a slight bottom heat. This, however, is not indispensable, and they will do well on a green-house shelf. The great point in their management is to preserve sufficient moisture in the soil so as to prevent the sap in the cutting from exhaustion until the roots are formed. They may be planted out doors and succeed if caution is taken not to allow the surface to become dried; it is merely a question of evaporation. A slight bottom heat is useful to force the plant, but it should be applied very gently until indications of rooting appear. In climates where the growing season is comparatively short there is advantage gained in getting the plants well advanced before setting out.

When roots are sufficiently advanced, the plants are placed singly in small pots, and planted in the open border as soon as the weather is favorable. As evidence of the strength and vigor of plants procured in this way, it may be noted that specimens have been grown in one summer, from single eyes set in spring, that have produced several pounds of fruit the following season.

Wood intended for cuttings should be pruned off in November, cut in convenient lengths, and buried at once in the soil, covered at least nine inches. By doing so the sap is retained, and many failures in cuttings can be clearly traced to causes which will in this way be obviated.

Layers of the young wood is another legitimate mode of propagating vines, and from old established plants a few shoots can be laid down during the early part of summer, form good rooted plants before winter, and that without materially injuring the fruit crop.

As previously remarked, it matters but little to the future well-being of the plant as to which of the above modes have been employed in its production, provided it has properly matured its growth.

There is one point in regard to roots which it may be well to mention. When the plants are grown in a deep, porous, rich soil, the roots ramify into numerous small fibres, which have been not inaptly described as "horse-tail-like bunches." Plants having such appendages as roots are not in good condition for removal, inasmuch as these hair-like fibres are destitute of woody matter, and soon decay on exposure to the atmosphere. The possession of such roots is a very convincing proof that the plant has not completed (or rather not matured) its growth, and its future progress will be feeble. Unfortunately there is too great a tendency to the production of such growths, since most of the native grapes are more or less checked with mildew during the growing season, an influence which also extends to the roots. The best plants are those with the greatest amount of hard brown ripened tops, furnished with moderately strong, and what may be termed stout, wiry roots, and although these, to a novice, are not so enticing in appearance, yet they are the best adapted to furnish an abundance of fresh and vigorous spongioles, and, in consequence, vigorous plants.

PLANTING.

When the young vine is planted in its permanent location it should be pruned down to two buds, and this without reference to the manner of its propagation. Even the strongest layers should be so treated. One cane is sufficient to grow, but, to be prepared for possible accident, both buds should be allowed to start until the shoots are long enough to admit of tying to a stake, then the weakest may be removed or pinched back. During the summer the plant should be allowed to grow undisturbed, except tying up the shoots; the more foliage the more strength will the roots attain. The question is frequently asked, "At what age should a vine be allowed to bear?" The only answer that can be given is, simply, *when it is strong enough;* and it should be cut down closely at the annual winter pruning until it sends up a cane of sufficient strength to bear fruit, which it will do, in ordinary culture, the second summer from planting.

PECULIARITIES OF VARIETIES.

Of the Labrusca or Fox species, the most exempt from mildew are the Concord, Hartford Prolific, Ives's Seedling, Dracut Amber, and Northern Muscadine. All of the Cordifolia species are eminently hardy; mildew or rot rarely attacks them. The Clinton is a familiar example of this class, and the most reliable wine grapes will ultimately be produced from improved varieties of this section. The following is the average order of ripening of some of the earliest varieties: Adirondac, Hartford Prolific, Roger's Hybrid No. 3, Dracut Amber, Delaware, Concord, Logan, Creveling, Ives's Seedling, Roger's Hybrid No. 4, Canby's August, Allen's Hybrid, &c. It may be remarked that the same varieties do not always ripen in the same rotation even on the same grounds and location.

The best fox-grapes, or those having a strong musky flavor with great sweetness, are the Dracut Amber, Rachel, Northern Muscadine, and Perkins. These are all robust, and very hardy and productive; excellent for giving the genuine American flavor to wine, which will probably, in course of time, be regarded as a distinguishing characteristic of native wines. They are also good table grapes to those who admire this flavor, a taste for which exists to a larger extent than is generally supposed. Such strong wood-producing varieties as Clinton, Taylor, Alvey, Franklin, etc., do not require to be so closely pruned in the fall as those of less robust habit. They should be allowed considerable extent of trellis or support, so that they can extend the yearly growths to lengths of twelve to sixteen feet, and pruned back but slightly; fruit will then be produced profusely; but, if closely cut in winter, a mass of wood growth only will be the result.

The To Kalon is particularly subject to rot, so much so that it is not a profitable kind to plant.

Of white grapes, the Cassidy and Anna are the most productive, Rebecca and Maxatawny best flavored. Allen's Hybrid and Clara are also good, but being seedlings from foreign varieties, are not always reliable. When they can be protected from mildew, satisfactory crops will be produced. Taylor is a poor bearer, unless on thin soils and with but little done to it in winter pruning. The Concord still maintains its supremacy (all things considered) as the best native grape for general cultivation; although subject (with all of its family) to rot, yet it always produces a fair crop, and being but little troubled with leaf mildew, the wood is well ripened, and consequently is least injured during winter. The Delaware is first-class, but not always reliable. The same may be noted of the Diana and Catawba, fruits of first quality when had in perfection. The Yeddo grape, from Japan, continues to prove unsatisfactory; very liable to mildew, and very late in maturing even when in health; fruit not of first quality when compared with the best native varieties.

Of the Roger's Hybrids there are some very promising varieties. No. 3 is decidedly a good early grape. No. 4 large and fine in bunch and berry, and of medium quality in flavor. No. 1 is productive, later in ripening, but a white fruit of great promise. No. 15, large and very fine. No. 22, high flavored and ripening quite early. These vines are just about as subject to mildew as Catawba and Isabella, are very much better here than when grown where they originated—in this respect resembling the Concord and some other varieties.

The Alvey proves to be a very sweet, tender skinned grape, and may be found of value for wine. It is not objectionable as a table grape.

Ives's Seedling proves very hardy and reliable, but not equal to Concord as a table grape. Said to be valuable as a wine grape.

MILDEW.

This is the great obstacle in the way of extended grape culture, and although the facts connected with its external appearance are very easily traced, the physiological condition of the plant when attacked, and the *modus operandi* of the progress of the disease, have given rise to much speculation, and some very strange fancies have been promulgated on the subject; but, unfortunately, none of them have proved to be of much advantage to the fruit grower. So far, the following points have been deduced from observation:

1. That mildew on the leaves of the grape is mainly the result of atmospheric influences.
2. The *Peronospora*, or mildew, that attacks the leaves on their under surface, is encouraged by the atmospherical conditions accompanying dull, cloudy weather, with occasional showers; or when heavy dews are deposited in positions where the rays of the sun cannot penetrate, or, at least, where the moisture cannot readily be evaporated.
3. That, so far as is known, no peculiar constitution of soil, or mode of soil culture, has any influence in its prevention.
4. That, so far as known, no mode of pruning or training, except so far as they agree with the fifth paragraph, has any effect in warding off the disease.
5. That shelter and protection by covered trellises, or masses of foliage, will greatly modify, if not entirely prevent injury from mildew.
6. That varieties of grapes having downy foliage are much more liable to be attacked than those that are smooth or shining.
7. That all grapes having downy foliage are not equally sensitive to the conditions favorable to the fungoid development, but where a pubescent foliage and a smooth foliage are growing side by side, the former, even of the most robust variety, may be attacked while the latter may be exempt from injury.
8. That the appearance termed *sun scald* is simply the result of this mildew.
9. That timely and repeated applications of sulphur, dusted on the foliage, will check the growth of fungi.

Occasionally another form of mildew may be observed on the vine. This shows itself on the upper surface of the foliage, giving the leaves the appearance of having been dusted with flour; this belongs to the Erysiphe family of mildews, and, although very destructive, is not so fatal as the *Peronospora*.

This floury looking substance can easily be removed by brushing the foliage; it is most frequently to be seen on foreign grapes, but may be observed on native varieties in seasons of extreme drought—dry weather seeming to favor the spread of this particular species. The young fruit and even young shoots are sometimes coated with this mildew. It retards growth and injures the plant attacked, so that it is easily destroyed by slight frosts. Sulphur will both prevent and cure it.

CAUSES AFFECTING THE HARDINESS OF PLANTS.

The occasional destruction of fruit trees and vines during winter is one of the many annoyances experienced by the cultivator; and it is all the more perplexing when it is found that a plant will sometimes be destroyed by a less degree of cold than it previously endured without the slightest injury. The amount of cold that plants are capable of resisting is a question of much interest, more especially when we reflect that the power of resistance is dependent upon circumstances which are, to a certain extent, under control.

The necessity for protecting plants, even those of reputed hardiness, from the injurious effects of alternate freezing and thawing, is now admitted by the best cultivators, although it is not unusual to meet with those who pretend to place no value upon a plant that cannot "take care of itself;" as if it was not the province of man to assist nature in producing such results as he finds most profitable and useful. Those who "leave plants to nature," after placing them under artificial positions, only frame an excuse for ignorance or indolence.

It has never been shown that frost is beneficial to plants; but it is a growing and well-grounded opinion, founded upon experience and observation, that many of the diseases of plants result from repeated injuries during severe frosts and extreme changes of temperature throughout the winter months. The exact manner in which plants are killed by cold has formed a subject of much speculation. The commonly received opinion is, that frost acts mechanically upon vegetable tissue by expanding their fluids and bursting the cells or vessels in which they are enclosed. This explanation, however, is not sufficient to account for all the phenomena attending the death of plants from cold. Doubtless many plants, especially those of a very succulent nature, may be destroyed from the disruption of tissue by the expansion of the sap in freezing. But it is also well known that the extraction of moisture by evaporation, when in contact with a continual cold, dry atmosphere, very frequently proves fatal. Thus it is that many plants which do not seem to be injured in the slightest by a degree of cold sufficient to freeze the sap, are destroyed by the keen, dry winds of spring, even when the thermometer is above freezing; and hence it is that grapes, roses, raspberries, and other plants suffer more from March winds than they do from January frosts; and hence also the utility of protecting against this destructive evaporation. The effect of these drying winds is apparent in the shrivelled and dried appearance of the buds and bark; and although there is less likelihood of injury to thoroughly matured growths, yet it is in accordance both with theory and observation that plants whose juices are preserved by proper protection during winter will shoot forth more vigorously in spring, are more fruitful, and arrive earlier at maturity than those not sheltered from climatic extremes.

It cannot be too vividly impressed upon the mind of the cultivator that the ripening of the seasonal growth is the greatest desideratum. How much of the disappointment in fruit culture arises from excessive stimulation of shoots that never become mature, it would be no easy task to determine. We are convinced that the time is rapidly approaching when planting fruit trees and vines in highly enriched soil, and treating them with heavy dressings of nitrogenous manures, will be looked upon as conclusive evidence of unskilled culture. Not that all stimulation is unnecessary, but that the production of mere wood-growth and the production of fruit are distinct, and may be carried so far as to become antagonistic processes, and must be recognized before the highest excellence in fruit culture can be attained.

On the best means of prevention from the evil effects of freezing plants, the following remarks of Lindley are to the point: "The mechanical action of frost may, however, undoubtedly be guarded against to a great extent. It is well known that the same plant growing in a dry climate, or in a dry soil, or in a situation thoroughly drained from water during winter, will resist much more cold than if cultivated in a damp climate, or in wet soil, or in a place affected by water in winter. Whatever tends to render tissue moist, will increase its power of conducting heat, and consequently augment the susceptibility of plants to the influence of frost; and whatever tends to diminish their humidity, will also diminish their conducting power, and with it their susceptibility. This is an invariable law, and must consequently be regarded as a fundamental principle in horticulture, upon attention to which all success in the adaptation of plants to a climate less warm than their own will essentially depend. The destructive effects of frosts upon the succulent parts of plants may thus be accounted for independently of the mechanical expansion of their parts; indeed, it is chiefly to that circumstance that the evil effects of cold in spring may be ascribed, for it has been found that trees contain nearly eight per cent. more of aqueous parts in March than at the end of January, and all experience shows that the cultivation of plants in situations where they are liable to be stimulated into growth and, consequently, to be filled with fluid by the warmth and brightness of a mild protracted autumn, exposes them to the same bad consequences as growing them in damp places, or where their wood is not *ripened;* that is to say, exhausted of superfluous moisture, and strengthened by the deposition of solid matter resulting from such exhaustion."

The ripening process consists in the slow but gradual and complete removal of watery matter, and the conversion of fluid organizable materials into the more solid substances which are necessary to form woody fibre; and its effects are not only seen in the power conferred of resisting cold, but also in providing an abundance of the secretions necessary to sustain the growth of the following spring, and produce the flower-buds upon which future hopes depend; for it is well known that flower-buds will not be produced unless the elements of growth have been maintained in due relative proportions.

We can thus partly see how far it is in our power to assist nature in supplying the requisites for perfect maturation of growth. The fruit grower will be careful to avoid planting in wet or highly enriched soil that would tend to encourage prolonged growth in the fall; he will see that his strawberry plants are not neglected during summer after the crop is gathered; that weeds are prevented from gaining a foothold; that the plants are thinned and fully exposed to sun and air, in order to perfect flower-buds for the following spring; that his raspberry plants have been divested of the old bearing wood, the young shoots thinned and disposed at proper distances so as to allow them a free enjoyment of light; that his grapevines have an abundance of healthy foliage, so as to ripen the young wood for his future crop; and that his peach trees are not suddenly denuded of their foliage, while it is as green and fresh as in the month of June.

When a fundamental principle is once determined and understood, operative details are suggested, and from them the best practical mode of application is readily deduced; for instance, many of the most beautiful evergreen ornamental trees, such as the Asiatic conifers as well as those from the western coast of this continent, cryptomerias and deodars, sequoias and taxodiums, have, in our moist fall growing weather, a tendency to make a luxuriant growth which never ripens, and, as a natural consequence, it is destroyed by winter cold. Now, if these growths are checked in September by judicious root-pruning, the wood will mature, shoots become hard and woody, and, instead of being unripe and filled with watery fluid, be solid and firm, and fully prepared to stand the extremes of our wintry climate. The whole subject of the acclimation of plants is based upon maturity of growth.

ROTATION OF CROPS

Among the essentials requisite to maintain a high degree of success in cultivation, a proper system of rotative cropping occupies a prominent place. The advantages of rotation in farm crops are well known; yet, in the garden, the practice is very common to grow the same kind of crops for years in the same spot of ground. It is, perhaps, within the bounds of possibility to pursue this course successfully, but to do so will require an annual return to the soil, in some form, of the several ingredients extracted by the plants. Our knowledge of the application of science will not warrant much faith in this direction, even if chemists were decided as to exact respective amounts of the ingredients used by various crops. But allowing it to be practically attainable, and looking at it in the light of mere economy, a change of crop is every way desirable; since by proper care two dissimilar crops may be produced on the same ground in the same season; and, further, the operations necessary for the culture of one kind of crop are of a nature to form a good preparation for the succeeding one

Physiologists do not altogether coincide in their opinions with regard to the principles upon which the beneficial results attending systematic change of crops are based. Some support what may be termed the repletion or excretory theory, which proceeds on the supposition that the roots of all plants during their growth give out certain substances peculiar to themselves, which, in time, impregnate the soil to such an extent as to render it unfit for the growth of that particular plant, but has no deleterious effect upon the growth of a different family of plants, if, indeed, they are not rather to be considered as capable of promoting growth and acting as stimulants to such.

It is a well ascertained fact that certain if not all plants do impart to the soil, through their roots, a portion of their juices. The soil surrounding the roots of the oak tree has been found impregnated with tannin. The roots of the spurge laurel impart an acid, resinous matter. The poppy exudes a substance analogous to opium; the root of any plant growing in water will soon render it turbid, but the quantity of such matters hitherto detected has not been considered sufficiently important to account for the remarkable beneficial results which have followed a rotative system of cropping.

The above theory has been supported by very high authority, but it seems to be giving way to the following, viz: that although plants are made up of the same primary elements, yet different species require them in widely varying proportions, so that each plant has a characteristic formation peculiar to itself. It therefore follows, that if there is a lack in the supply of these peculiar ingredients of plant food, the plant will not be maintained in healthy growth. From this it appears that the reason why a crop, if constantly grown upon the same spot of ground, shows a yearly loss in productiveness, does not arise from a repletion of any substance, but rather from exhaustion. In a practical view, it is evident, from either of the above theories, that a change of crop is requisite to successful cultivation.

In cultivating garden vegetables great facilities are presented for a frequent change of crop, and there is, also, a wide field for experiment in order to ascertain the kinds best suited to succeed one another in a regular system. For instance, it has been asserted that melons will produce best when grown on soil previously occupied by tomatoes. In general, long, tuberous, rooting plants, as carrots, beets, parsnips, &c., should be followed by those that root near the surface; plants that are cultivated for their seeds should be followed by those grown for their foliage. The seeds of all plants contain a larger amount of the mineral ingredients than their leaves, so that plants grown for their seeds will exhaust the inorganic matter of the soil to a greater degree than will be effected by plants grown only for the use of their leaves.

In the arrangement of crops in the field or garden, there are two methods that may be adopted, either of which will provide for rotation. In the first place a spot of ground is occupied wholly by one crop, and when that is removed its place is immediately occupied by another; or two or more crops are so planted on the same piece of ground that the one will be ready for removal before it interferes with the growth of the other. The first method may be illustrated by planting with early peas or potatoes, which will be removed in time for planting cabbages or celery, or sowing beets, turnips, or spinach. Early crops of carrots and beets will be removed in time for a planting of late dwarf beans. Many modifications will be suggested in practice. Perhaps the most economical method, especially where ground is limited in quantity, is to grow several crops at the same time on the same piece. For instance, peas may be sown in March, in rows, six feet apart; in May a row of melons may be planted between the peas, the shade afforded by the peas will benefit the young melon plants, or, between the peas a row of dwarf beans may be planted, and when the peas are removed their place may be occupied by cabbages, and the beans be succeeded by a crop of turnips. It does not seem necessary to multiply examples, as those who are inclined, and will exercise due foresight, will suggest many expedients.

Much variety can be produced in even a small garden by this method, and it affords great facilities for sheltering young and tender crops by those of more matured or robust growth. It may, however, be remarked, that although most plants are benefited by a little shade and shelter when young and delicate, it is highly injurious when long continued.

FOREIGN GRAPES IN GLASS STRUCTURES.

The simplicity and certainty with which the foreign grape can be produced in glazed houses is not generally known. Many amateurs, whose success with other fruits is quite satisfactory, feel doubtful of their ability to manage the exotic grapery.

To those whose only acquaintance with the subject is derived from perusing publications on the growth of this fruit, the supposition of inability is pardonable; for there is certainly much to appal the beginner, in perusing the various ideas of soil and border making, the conflicting opinions relative to watering, and the multitudinous, fussy details of management, which he will find in print.

So much has been written of late years on this subject, that it would not now be referred to were it not with a hope that information might be imparted that would tend to dispel the idea of difficulty or mystery, in connexion with the culture of this, without exception, most economical of fruit productions. It is well known that, in favorable locations, the Chasselas, Black Hamburg, and many other of the varieties of the foreign grape will occasionally produce perfectly ripened fruit with no further care than that usually given to the Isabellas, or any other native variety. But although the result may occasionally be reached, it is well known that all attempts to cultivate the foreign grape in the open air, east of the Rocky mountains, have, sooner or later, proved abortive.

That these failures are attributable either to a deficiency of sunlight or to a deficiency of summer heat are questions easily answered; for we find that in the climate of Britain, where the dull, sunless days are more abundant, and the summer heat of less intensity and of shorter duration than with us, the Hamburg and other exotic grapes ripen yearly, trained on outside walls and trellises, and this in a climate where the heat is not sufficient to mature Indian corn, tomatoes, or even peaches, in common field culture as with us. Neither can it be supposed that our own summers are too hot, or our winters too cold, as it is well known that there is scarcely any plant that will withstand extremes of summer heat and winter cold so well as the grape, provided it maintains good health. But unfortunately, there are climatic conditions here during which the grape is rendered subject to the attack of fungoids, by which its growth is checked, the wood prevented from maturing, and a general debility engendered which enfeebles the plant to a degree that, sooner or later, ends in its total destruction.

This tendency to mildew is, then, the only obstacle in the way of successful open air culture, in this section, of the best wine and table grapes of Europe; and is the only reason why glass structures have to be employed in their culture, where an artificial temperature, more in accordance with their requirements, may be maintained. The tendency to mildew in the foreign grape, having been found so great a barrier to its extended culture in the open air, recourse was had to glass houses where protection could be afforded and means adopted for the exclusion of this malady; but in many cases, even here, success has not been equal to expectations. The mistaken eagerness of many to keep the plants in an artificial instead of a natural condition, has led to frequent failures. It appears very obvious that a plant which occasionally succeeds in the absence of any particular protection, would be enabled to do so uniformly by a very slight additional care, provided that this additional care was bestowed in the proper direction; and that such is the case has been proved beyond a doubt.

Having on another page of this report treated more particularly on mildew and its origin, it may suffice to remark here, that it is altogether dependent upon the amount of atmospheric moisture, and proper ventilation; and without proper attention to these points, mildew is just as likely to destroy the plants under glass, as it would be those in the open air. Keeping in view that these remarks are intended to refer to the general routine management of what is now more definitely known by the term *cold grapery*, we will briefly allude to what is considered the main points of treatment.

The principal points, then, are *a low night temperature, exclusive top ventilation, and the constant presence of moisture available for evaporation.* The baneful effect of a high temperature in plant-houses has been shown in previous reports. It has been proved repeatedly that low or bottom ventilation in a grapery is conducive to mildew, and aridity must be prevented by the presence of moisture.

It would require considerable space to enter fully into the elucidation of all the principles involved; it will, therefore, be considered sufficient for the present to briefly trace the course of practice deduced from many years' extended observation and experience in the growth of the foreign grape.

As soon as spring growth commences, attention is at once directed to the night temperature, so that it will fall at least 20 degrees below the average heat in the house during the day. In dull, cloudy weather, of course, this difference between day and night may not be so great, and if the nights are frosty, it will be necessary to close the house; but in the absence of actual external freezing, the ventilators should not be wholly closed, even during night. When all danger from night frosts is passed—which will vary, according to locality, from the middle of May to the middle of June—the ventilators may be left open day and night. During dull cool weather it may be necessary to partially close the ventilation both day and night; but as a general rule, the same amount is used day and night. We have seen graperies where the ventilators were never disturbed from the period of blossoming until the ripening of the fruit. No constant anxiety is, therefore, felt about sheltering or opening sashes, and the liability to create sudden changes of temperature, that frequent alterations of the ventilators are sure to produce, is prevented. The temperature of the house will, therefore, participate in the general changes of external atmosphere, and though warm during sunlight, will be cool during darkness. During the warmest portion of the summer, the day temperature may vary from 90 to 110 degrees by day, to 65 to 80 degrees during the night. This lowering of temperature during darkness insures a hardihood of growth that enables the plants to endure any unfavorable change that may occur, without sustaining the least injury.

As air is heated, its capacity for abstracting and containing moisture increases, and unless the moisture is supplied from other sources, it will be drawn from the plants. To supply this evaporation, the soil should be kept damp on the surface. Once a day at least, in bright weather, the soil will require to be sprinkled. It is a good rule never to allow the surface soil to be entirely dry until the fruit is coloring to ripen; but it is important to know that, unless in connexion with constant night ventilation, this treatment may prove injurious.

So far as the management of the atmosphere is concerned, this is all the care required, and a crop of grapes is thus as easily grown as a crop of potatoes, only with more certainty, because more under our control.

With regard to soil, pruning, &c., we will at present only remark, that soil capable of growing good cabbages will grow good grapes, and the strongest yearly growths give the best fruit.

MULCHING.

This is an auxiliary operation in cultivation, that would be more generally practiced if its beneficial effects were better understood.

The objects to be attained by mulching are twofold, viz: to preserve a uniform degree of moisture in the soil during summer, and protect the roots of plants from severe frosts during winter. These conditions are obviously important to vegetation, and they can be very efficiently secured by covering the surface with a stratum of porous materials, such as tan bark, charcoal dust, leaves, or strawy manure, which will prevent the surface soil from becoming compact or hard, and, at the same time, assist in maintaining a uniformity in its mechanical texture favorable to the retention of moisture. Air is the best non-conductor, and bodies are represented as good or bad conductors, just as they are solid or porous. Iron is a better conductor than wood, granite stone a better conductor than brick, hard pressed soil is a better conductor than soil that is loose and porous. A hard trodden path is warmer in summer and colder in winter, than the cultivated ground alongside of it. When the soil particles are in pressed contact, the condition is favorable to rapid conduction; summer winds passing over such a surface, carry off the moisture which the heat evaporates; the surface is speedily parched dry, and vegetation languishes.

When the surface is covered with a mulch of such porous materials as those enumerated, it in effect secures a stratum of air in repose between the soil and the causes of radiation and evaporation. In the case of recently planted trees, the preservation of a uniform degree of moisture in the soil surrounding their roots, is a great point towards their successful growth; and, other things being equal, they will languish or flourish in proportion as this condition of uniform moisture is secured.

Although mulching is really a very simple operation, yet serious losses have occurred from its misapplication. We have seen trees destroyed from too heavy mulchings of grass, manure, and tan bark. Before applying the mulch to a recently planted tree, if in spring, shape the soil around it in basin-form, extending the rim beyond the extremities of the roots; by this configuration of surface, rains will be retained and, if required, artificial waterings can be applied to best advantage. With regard to fall planting, the process should be reversed and a slight mound formed towards the stem of the plant, so as to throw off the heavy rains of winter. Of course such mound should be removed before the following summer.

As already remarked, the principal use of winter mulching is to prevent frosts from reaching the roots. The best material for this purpose is charcoal dust. Where manure is used, it should not be thrown close up to the stem of the plant, otherwise it might prove a harbor for ground mice, which in rough ground, or under a coarse covering, are sometimes very destructive, by eating the bark of young trees. When they are troublesome, the precaution should be taken to trample firmly over the roots and around the stem after heavy snows, and keep the surface clear and compact.

In order to be effectual, it is not necessary that summer mulchings should be heavy. When tan or charcoal dust is used, a layer of two inches in depth will be quite sufficient. Grass cut from lawns is very suitable, but a mere sprinkling only should be applied at a time. Thick coatings promote fungoid growths, which frequently destroy trees. Fruit or ornamental trees that have been transplanted, will rarely be much benefited by mulching after the first year's growth. The advantages of mulching to growing vegetables are equally important. Cabbages, potatoes, peas, onions, and other crops, will thus be enabled to maintain growth during the driest weather. This covering is not intended to supersede stirring the soil, but when plants become so far advanced in growth as to be beyond the hoe and plough, mulching may be applied, and those who give it a fair trial on their crops in a dry season, will not require further promptings to repeat the practice.

HEATING GLASS STRUCTURES.

An efficient system of heating green-houses is always a matter of much interest in their construction and adoption; the expenses attending the fitting up of a heater and the subsequent cost of fuel have always been great obstacles, and have been the means of preventing many persons from building, more particularly since it has been an opinion somewhat prevalent that a boiler and pipes for the purpose of heating and circulating water is indispensable for the proper diffusion of heat. There is no doubt that water is the best conductor of heat, and, where extensive houses are to be warmed the superiority of water in this respect, together with other advantages connected with its application, such as neatness, cleanliness, &c., will always point out that mode as being the most desirable. Looking at it as a matter of mere economy, we can at once decide that the cheapest mode of heating green-houses is by means of well-built and properly constructed flues. At present prices of material and labor it is probable that for a house, say sixty feet long by twenty wide, it would cost ten times more to erect a boiler with sufficient piping than would be required to build a furnace and flue. But the economical advantages of the flue are not all absorbed in its first cost. Even with the best form of boiler there is great waste of heat which may be economized in a good flue. To prove the above assertions would take more space than we purpose, neither is it indispensably necessary at present; the object in view is to show that there is much fallacy extant concerning the great superiority and economy of heating by hot water, and to attempt to describe some points in the construction of an efficient furnace and flue.

The furnace should not be less than two and a half feet in length; one foot wide, and sixteen inches in height; the sides should be lined with good fire-brick placed on edge, backed by four inches common brick. Very little mortar should be used, and that quite thin; indeed, they are frequently laid without mortar—that is, the fire-brick casing. The arch or covering is formed by projecting fire-brick a few inches over the sides, so that the opening left can be covered by one length of the same kind of brick, the whole covered and made level on top by two or three courses of common brick. This is quite as strong for the purpose intended as a regularly built arch, and saves material as well as labor in constructing. On each side of the furnace a space of four inches in width is left to cut off the head from communicating with and being absorbed by the surrounding building or earth. This chamber is continued the whole length of the furnace, and also a few feet on the flue opening into the house. As soon as the sides of the furnace become heated the cold air will rush in, collect the heat radiating from the exterior of the furnace and convey it into the house. thus completely preventing disruption by expansion, a frequent occurrence in furnaces of great apparent solidity. In order to assist in the combustion of the gases of the fuel, and also increase the draft and propulsion of the heat through the flue, an opening at least six inches square should commence at the end of the ash-pit, continuing under and entering into the bottom of the flue two feet from the back of the furnace.

The greatest defect of the smoke flue is its unequal distribution of heat. In this important particular hot water pipes have a great superiority. The whole extent of their surface being heated to a nearly uniform degree, the heat is given off at a comparatively low temperature; whereas, near the furnace the flue is heated to excess, while the greatest portion of it imparts little or no warmth to the atmosphere.

This is the flue as ordinarily constructed with brick set on edge; it has been found, however, that by adopting the principle of diminishing the thickness of the material of which it is constructed, as it recedes from the furnace, a flue can be made so as to radiate heat over its entire surface at nearly the same temperature. As an example, supposing 100 feet of flue were required in a house, then the first ten feet from the furnace would be formed of brick-work four inches in thickness, covered on top with a double thickness of brick; then the following thirty feet would be made of bricks on edge, covered by a single brick; then finish the length with terra cotta piping of eight inches diameter, which is usually about three-quarters of an inch in thickness. A flue so built will absorb heat very regularly over its surface, and so far will approach a hot-water apparatus in efficiency, at a greater economy of fuel and at a cost easily reached.

It is well to have the flue as roomy as possible, especially near the furnace. When common brick are used for covering, the width inside cannot be more than seven inches; if its height is made of three bricks on edge, its dimensions will be about twelve inches by seven inches inside. The less mortar used in the joints, the longer will it stand, and all plastering of the flue, either inside or out, is very objectionable. It is also well to keep in view that hard-burned bricks will transmit heat more rapidly than those that are soft and porous. In all cases, where practicable, the flue should rise one foot in twenty from the furnace. If one foot in ten feet can be gained, so much the better.

MECHANICAL PREPARATION OF SOIL.

The physical or mechanical condition of the soil, its relation to air and water, has not received that attention from agricultural chemists which its importance demands. They have devoted their investigations almost solely to its chemical constituents, seeming to lose sight of the fact that the permeability of the soil to atmospheric influences is of more importance than the most approved manures. If the money that has been expended upon artificial manures during the last twenty years had been devoted to drainage, sub-soiling and trenching, the products of the country would have been vastly increased.

The soil performs various offices towards growth of plants. It serves as a basis in which they may fix their roots and sustain themselves in position; it also supplies inorganic food during all periods of their growth, and may be looked upon as a laboratory in which many chemic changes are taking place, preparing the various kinds of food which it is destined to yield to the growing plant. Analyses have shown that in most soils the presence of all the constituents of the ashes of plants may be detected, though in variable proportions. But the mere presence of certain substances in soils does not insure productiveness, for it has been shown that crops have failed even in soils possessing all the mineral ingredients required, because, although present, they were not in a sufficiently soluble state to be available. Thus in wet, clayey soils, although containing enough of plant food, the water prevents free access to the decomposing influence of the atmosphere, and crops perish; not because of a deficiency of raw material, but on account of the processes for its preparation being arrested.

This leads us to the foundation of all improvements of such soils, viz., draining. It is a remark frequently made by those having no experience, that draining must be worse than useless in a climate where summer droughts are among the greatest calamities against which the cultivator has to contend.

All who have witnessed the effects of draining need not be told, that even in soils not particularly retentive, draining, in connexion with deep culture, will secure a more ample and lasting supply of moisture in dry weather, and maintain a growing vegetation during the most severe droughts. Draining increases the capability of the soil for absorbing moisture; all soils have their certain absorbing properties; like a sponge, they absorb until their pores are filled, and only the superfluous water that cannot be taken up passes through the drains.

Draining is only the first step towards improvement. The soil must be deeply loosened and pulverized, either by subsoiling or trenching. Either process will be beneficial, and circumstances will decide as to which is to be adopted. Trenching involves a thorough reversion of the soil, of more or less depth, according to its nature and the purposes for which it is to be used. Subsoiling is merely a loosening or stirring up of the immediate subsoil, without reversing its position. When the ground is intended for a permanent crop, such as fruit trees, grapevines, &c., trenching may be adopted. The top surface of good soil will then be placed where the roots will be immediately benefited by it, and the crude subsoil brought to the surface, where it can be enriched by the aid of manures and the ameliorating processes of cultivation.

On the other hand, if the ground is to be immediately cropped with small seeds, as in some portions of a vegetable garden, a finely pulverized surface is necessary, and few subsoils can be made available, or be reduced to that condition while in their crude state. Subsoiling will, in such cases, be most advisable, and trenching can be executed as crops will admit of the operation.

The first process, then, towards securing a profitable depth of soil is draining; next breaking into the subsoil, taking into consideration, whether, in view of the crops to be cultivated, it will be most immediately profitable (of ultimate profit there is no uncertainty) to trench it at once, or merely break up and loosen the subsoil, admitting water and other fertilizing agencies to penetrate, and by a gradual trenching improve to the required depth. When all this has been satisfactorily accomplished, manures can be applied to the greatest advantage, and failures from droughts almost entirely obviated.

WILLIAM SAUNDERS.

Hon. ISAAC NEWTON.

REPORT OF THE SUPERINTENDENT OF THE EXPERIMENTAL FARM.

SIR: When I was appointed to take charge of this place, in September, I found the southwest square and the southeast square had been manured and planted with a variety of seeds and roots. The other portions of the ground had been ploughed several times, and a large quantity of first class manure from the government stables had been applied as a top dressing, and subsequently ploughed in. The grounds have been divided into six different lots, a drive going round the whole, and cutting across at two places, with one centre drive, so that all the several lots are of easy access. The land generally is of a clayey nature, with a slight admixture of sand, and had not been ploughed and cultivated for a long period before it was granted to the Department of Agriculture. The soil, naturally tenacious, had been trampled by many cattle while used as a government corral, and the action of the hot sun made it very hard to break up; but with constant stirring and the application of large quantities of well fermented manure, combined with the exposure of as large a surface as possible to the elements, it has become very friable and easily managed. The two south squares are of a more sandy nature, and are better adapted for growing vegetables than any of the other lots. There were no buildings on the place but a small office, but there has since been erected a good five-stalled stable for horses, also a seed-room and tool-house, and attached to the main building there is a cart and wagon shed, also a yard in which the Angora goats are kept. A suitable office of two apartments has been erected at a convenient distance from the other buildings. The several kinds of grain and grasses which had been sown turned out remarkably well, considering the lateness of their planting and the condition of the soil. The sorghum was a fine crop, and from the small quantity sown there was raised two barrels of very fine, pure seed. Seventy-seven kinds of potatoes had been planted, fifty of them seedlings from Germany. The seedlings did not all come to proper maturity, but those which did were selected for further experiment. Some of the other varieties did very well, especially Goodrich Early, and a kind called the Orono Unrivalled; this last yielded immensely, and seems to luxuriate in this climate and soil. When the potatoes were dug, they were all pitted in the open air; first covered with six inches of straw, afterwards with twelve inches of earth, and then thatched with straw again, and during very severe frost a covering of fresh horse-manure was added, but removed on the return of thaw. All the potatoes kept well in this way and were in a fine condition when opened in spring. A small portion of land was sown with buckwheat, called Silver-skinned, the whole of which was saved for the purpose of sowing a greater breadth next season, as the kind is a very valuable one, being a much clearer and thinner skinned variety than the usual kind in cultivation, and quite as prolific. Two acres of corn were sown for fodder; it grew very rapidly and produced an immense quantity of forage, which was well cured and fed to the horses all winter.

The clovers, of which two varieties were sown, have taken with the ground well. The Alfafa or Chili clover grows very luxuriantly in the early part of the season, but does not withstand drought so well as the Alsike clover. The Alsike is perennial in its nature, and will prove a great acquisition to this country, as it produces a very abundant crop, and is likely to suit this climate. Among this clover was found a millet, which appears to be a new variety, as there is nothing of the same kind in cultivation in this quarter. The millet from the Crimea is also a very valuable variety. It produces an immense amount of foliage, and grows about four feet high. There was a small yellow corn from southern Russia, which seems to be of considerable value, as it ripens in ninety days from the period of planting. All the seed is carefully saved for further experiment. There was also a very small bean from Russia, more like a pea than a bean in shape, which deserves especial attention. When first sown, it comes up very slowly; and when other beans, sown at the same period, are beginning to flower, this one has not made much show; but gradually it develops itself and spreads along the ground, covering a great breadth with a perfect mass of rich, dark green, luxuriant foliage, and producing an immense quantity of pods, which are generally about five inches long. The small area of ground experimented with produced at the rate of forty-two bushels per acre. Next season it will be more extensively cultivated.

WHEAT.

In the early part of September, the middle west square was ploughed twice and dragged before sowing with wheat. When the quantities were large, the seed was sown broadcast; but when the quantities were small, which was the case in all but two instances, the seed was drilled at 13½ inches between the rows. Sowing was begun on the 15th of the month, and all the seed sown came up very rapidly, and very soon covered the ground. In fact, some of the kinds made too much headway, as the severe frost killed many of the finest sorts. The following is a list of the kinds of wheat experimented with:

Nursery Wheat, Sole's Winter, Reid's White, Eastern Prussian Scheffell, Western Prussian Scheffell, Frumento Andriolo Esastico Rosso, (Froment Renfle Glabre et Blanc,) Frumento Andriolo Esastico Bianco, (Froment Petanielle Rouge et Glabre,) Frumento Rosso Collo Barbu, (Froment d'Odessa Rouge Barbee,) Granone Winter, Arnautka, Hallett's Pedigree, Tappahannock, Prussia No. 1, Prussia No. 2, seven varieties no name, (from Prussia,) Blue Stone, Sherriff's White Bearded, Premium White Mediterranean from Port Mahon, Red Bearded Mediterranean, Fenton, Trump, Red Chaff, Hopetown, Tauntondean, Tasmanian, Amber, English Wooley Eared, Chinese, Australian, Golden Drop, Rough Chaff, Chiddam, Blue Cone or Rivetts, Sandomir, Small Cujavish, Sherriff's Red Bearded, Browick Red, Spaulding's Prolific, Red Nursery, Red Thickset, Clover's Red, Red Lammas, Clever Highland, Hard or Horny, Kessingland, Flickling's Hallett's Genealogical, Welch, numbers 1, 2, 3, 4, 5 and 6, Puget Sound, Weddell's, Oxford, Nairn Peige, A. Bell's, Champion, Wunder, Blue Jacquin, Golden Swan, Vilmorin's, Dorking's Glory, Essex White, Drowed's, Talavera, Piper's Thickset, Blue Refford, Tall Cluster, Algier, Flickling's Prolific, Brodiè's, John Dunn's, A. Hay's, Old Red, Hunter's White, John Stevens', Schonermark's, Weizacker Winter, Nottingham Red, Eley's Reissen, Eclipse Dwarf, Baxter's, Archer's Prolific, Canadischer, Club Headed, Grinnell's, Lammas, Red Chili, Black Sea.

SPRING WHEATS.

Gherica, April Red Bearded, Arnautka Hard, Oregon, Summer Spelt, Fernor April Summer.

The wheat crop generally, on this place, has been very good, with the exception of some of the varieties which did not stand the winter, and some kinds received too late, and in such small quantities that their merits were not sufficiently tested. On the 15th of September, sowed two ridges of red bearded Mediterranean wheat, and two ridges of premium white Mediterranean wheat, from Port Mahon, both of which came up in four days, and, in consequence of the fine, open weather which prevailed before frost set in, they made a very fine appearance. On the 9th of October a sowing of both of the above kinds was again made; they also came up well, but not so rapidly as the first sown lots. During the winter, the first or September sowing of the premium white Mediterranean wheat withstood the winter very badly, and during the severe frost in the month of January, it was entirely killed; whereas the same wheat sown in October withstood the winter much better than the red bearded Mediterranean wheat, kept ahead the whole season, and was harvested on the 27th of June. This seems to be a wheat well adapted to this climate, large berry, well filled and thin skinned; produced forty-eight bushels per acre. The red bearded Mediterranean wheat sown in October did not stand the severe frost so well as the same kind sown in September, showing that the best period for sowing the red bearded Mediterranean wheat is September, and for the premium white Mediterranean, from Port Mahon, is October. The Tappahannock wheat has been the earliest of all the varieties experimented with, although it does not seem to be so productive as some of the other kinds; still the fine quality of the grain, and its earliness, is very much to be regarded, as an early variety is much less liable to disease and other contingencies. Some of the kinds which promised to be fine crops when growing, turned out very coarse samples. Some of the spring wheats are remarkable for their productiveness and early maturity. The Arnautka hard spring wheat, April red bearded wheat, and Black Sea wheat, are about the best, sown from the 12th to the 29th of March, and harvested 10th of July.

RYE.

The following varieties, mostly from Prussia, have done very well. The kind called Eldenaer Bastard rye is very peculiar—more like wheat than rye, very large and thin-skinned:

Probstier rye, rye from the city of Tirnia, in Saxony, Spanish Double, Corren's, John's Day, Seelander, Champagner, Eldenaer Bastard, Mandschure, Riesen Standen, Shortheaded Corren Standen, Poland, San Joaquin, Bushy Summer, from Saxony.

OATS.

A few winter oats were sown in the fall, but they did not withstand the sudden frosts and thaws to which they were exposed. The following kinds were sown in March, and all drilled in at 13½ inches between the rows. This was a very favorable season for oats, and those experimented with were all good but the Hopetown:

Potato oats, (from R. L. Dorr, Danville, New York,) Hopetown Potato, (from England,) Black Prussian, Great Flag, Cumberland, White Swedish, Yellow Lithuania, White Tartarian, Black Tartarian, Black Poland, Dyoick's Early, Nun's, Berlie, Blainslie, Late Angus, Early Angus.

BARLEY.

Barley requires a colder and more humid climate than this to promote its early growth; although some of the varieties grown did pretty well, still there was a shortness of straw which was against its weight considerably. The varieties grown are all first class of their kind when raised in England. The Hertfordshire Hero barley never came into ear at all. The following kinds have been grown:

Chevalier barley, Hudson Golden Melon, Moldavian, Thanet, Hertfordshire Hero, Golden Drop, Brewer's Delight, Page's Prolific, Peruvian, Great, Laland, Weizacker, Oderbruch.

The last mentioned barley is grown very extensively on the low, formerly swamp lands of the valley of the Oder, but which were drained during the reign of Frederick the Great, and has since produced the very best barley known on the continent of Europe. It is a very favorite variety for the porter brewers of England, and for which they pay a very high price. The sample experimented with, of this variety, was very small, and the season was too far advanced before it was received to test it properly. It, however, came up vigorously, and appears to be of robust growth, but had not time to mature.

RICE.

Four kinds of rice from Japan were sown; the seed must have got heated, or, perhaps, was too old, as none of it ever germinated.

SORGHUM.

Four varieties of sorghum have been grown, viz: red sorghum, sugar, black and red, all from Shantung; the other is sorghum imported from China. They have all been planted as far separate as possible, so as to preserve the different kinds from hybridizing. They all look well, especially the first three varieties, and seem to be something new.

PEAS.

About seventy varieties of peas were sown, four feet apart in the row, on the same kind of land, and all about the same date. The whole did well except a few from Germany, which were in very small lots and did not appear to be of any merit The following kinds were grown:

Early Sugar peas, Sugar, Green Dwarf Market, Knight's Dwarf Market, Dwarf Smooth Honey Market, Early Dwarf Market, Early English Crooked White Flowered, Pole, Green Mammoth, Small Mammoth, Large Mammoth, Dwarf Blue Imperial, Tom Thumb, Bishop's Early Dwarf, McLean's Little Gem, Philadelphia Extra Early, Emperor or Morning Star, Dwarf Sugar, Early Frame, Daniel O'Rourke, Deacon's Double Extra Early, New Early Telegraph, Veitch's Perfection, Eugenie or Alliance, Champion of England, Napoleon or Climax, Blackeyed Marrow, White-eyed Marrow, Evergreen Marrow, Beck's Gem, McLean's Epicurean, McLean's Princess of Wales, Bedman's Imperial, McLean's Premier, the Yorkshire Hero, Small Prussian, Saxton's Prolific, Carter's "first crop," Sutton's Long-podded Tom Thumb, Scimitar, Harrison's Glory, King of the Marrow, Dickson's Favorite, Warner's Emperor, Beck's Prizetaker, British Queen, Ne Plus Ultra, McLean's Princess Royal, Bishop's Long-podded Dwarf, Dickson's First and Best Early, Wheeler's First Early, Hair's Dwarf Mammoth, Knight's Tall Green Marrow, Advancer, Surprise, Early Green Marrow, Wonderful, Sangster's No. 1, Competitor, Wonder of the World, the Washington, White Russian, Partridge, Common Gray, Flack's Victory, Denyer's General Havelock, Champion of Scotland, Fairhead's Excelsior, Magdeburg Gold, Spanish peas from Port Mahon, Naples.

Dickson's "First and Best Early" pea is superior to any of the peas experimented with for earliness, productiveness, and general good qualities. The pod of this pea was longer than any of the other early sorts, and was uniformly filled with large well developed peas. Sown 24th March, bloomed 10th May, and was ready for picking on 28th May.

Carter's "First Crop" is a very early pea, height 2½ feet, not quite so productive as Dickson's "First and Best" pea, but has the advantage of ripening all its pods about the same time. Sown March 21st, bloomed 8th May, and ready for picking 28th May.

Wheeler's "First Early" pea, said to be earlier by one week than "Daniel O'Rourke" or "Sangster's No. 1," but did not prove so here; although a very good early pea, resembling Carter's "First Crop" pea very much, not quite so productive as "Sangster's No. 1." Sown 24th March, bloomed 9th May, and was picked 29th same month.

Sangster's No. 1, a synonym of Daniel O'Rourke, height 3½ to 4 feet, very nearly as productive as Dickson's "First and Best Early" pea, strong habit, and early. Sown 24th March, bloomed 10th May, ready for picking on 29th May.

McLean's "Little Gem" pea, a dwarf, prolific, green wrinkled marrow pea, is a great acquisition; having a fine flavor, sugary, early, and requires no stakes, growing about 14 inches high. Sown 20th March, bloomed 10th May, and was ready for picking 10th June.

Of second early peas, Advancer, Warner's Emperor,. Ne Plus Ultra, McLean's Epicurean, McLean's Princess of Wales, McLean's Premier, Saxton's Prolific, Magdeburg Gold, The Yorkshire Hero, and Dickson's Favorite are all good, and come in soon after the more early varieties, being all good bearers, and suitable for general cropping.

BEANS.

Thirteen kinds of the long-pod Windsor bean, and four varieties of horse beans, were planted. Very few of them ever came to any perfection, being entirely destroyed by insects, and the climate generally being too hot and dry for them. The kidney bean comprises the several sorts grown, viz:

Early Six Weeks, White Kidney, China Red Eye, Newington Wonder, Early Valentine, Robin's Egg Dwarf Kidney, Cream-colored Dwarf Kidney, Canadian Dwarf Yellow, Common Brown Haricot, Variegated Dwarf, White Haricot, Dwarf White Sugar Pearl, Negro Long-podded French, Thousand-fold Dwarf White, Dwarf White Kidney, Black and White Sugar, White Bush, Paris Sugar Dwarf, Dwarf Yellow Sugar, Large White Lima, Horticultural, Black Mexican, and five kinds without names.

POLE BEANS.

White Kidney Pole Bean, Arabian White Flowered, Variegated Runner, Black Stake, Scarlet Runner, and Arabian Colored Runner.

GRASSES AND CLOVERS.

About three acres were seeded down with timothy the first week in October. It came up very regularly, and the land being in good condition, it made a fine start before frost. The winter was very severe, and in the spring its appearance for a crop was very indifferent; but it gradually tillered out, and in the month of June there was cut and cured about eight tons of splendid hay. The aftermath has grown tolerably, and produced about two and a half tons of good hay. The Alsike clover and Alfafa, or Chili clover, both produced good crops of a succulent and nutritious nature. The Alfafa, when young, would make a very fine feed for soiling cattle, but it has a tendency to grow very woody and hard when allowed to mature. The Alsike, on the contrary, keeps green and luxuriant up to its period of ripening, and has not the same tendency to get hard and fibry. The other grasses sown are as follows:

Medicago lupulino, Trifolium filiforme, Trifolium repens, Trifolium incarnatum, Onobrychis sativa, Apium petroselinum, Cynosurus cristatus, Plantago lanceolata, Festuca duriuscula, Festuca pratensis, Festuca ovina, Festuca tennifolia, Festuca elatior, Anthoxanthum odoratum, Alopecurus pratensis, Poa pratensis, Poa trivialis, Poa nemoralis, Poa annua, Bromus Schraderi, Dactylis glomerata, Avena Flavescens, Evergreen rye-grass, Ayrshire perennial grass, Pacey's Perennial grass, Esparset, Pimpernell grass, Franz Ray-grass, Black Nonesuch or yellow clover, yellow suckling clover, white clover, scarlet crimson or Italian clover, sainfoin, sheep parsley, crested dogstail, rib-grass, hard Fescue grass, meadow Fescue grass, sheep's Fescue, fine-leaved Fescue, tall Fescue, sweet-scented vernal, meadow foxtail, smooth-stalked meadow, rough-stalked meadow, annual meadow (from Australia,) orchard grass, yellowish oat grass, burr clover, cocksfoot grass, English Italian rye-grass, clover from Richmond or Turkey clover, soft hairy cockle grass.

CABBAGES.

Eighteen varieties of cabbage have been grown, viz:

Little Pixie, Early Dwarf York, Nonpariel, Early Emperor, Sugar Loaf, Couve Tronchuda, Carter's Matchless, Imperial Oxheart, Extra Fine Red, Shilling's Queen, McEwan's Early, Enfield Market, Wheeler's Imperial, Fearnought, White Cwt., Robinson's Champion Drumhead, Winningstadt, Red Pickling.

Little Pixie, Early Dwarf York, Early Emperor, Carter's Matchless, and Imperial Oxheart, are the five earliest of the above-named varieties. All were sown in the drill March 31, never transplanted, and were fit for table 22d June. Little Pixie is very small, but makes a compact head early. Early

Emperor forms a good large firm head, but the best of the five was Carter's Matchless, having the largest and best formed head of any of those experimented with. Several of the others are very good, but later, especially Robinson's Champion Drumhead, which grows to an immense size.

SAVOYS.

The following kinds have been tested:

Feather Stem Savoy, Dwarf Ulm, Dwarf Green Curled, Drumhead.

The Dwarf Ulm Savoy is the earliest and decidedly the best. The Drumhead is also very good.

LETTUCE.

Fourteen varieties of lettuce have been tested.

Snow's Matchless, Hardy Hammersmith, Moor Park, and Neapolitan are the best, and much deserving of further experiment. Wheeler's Tom Thumb is very good, said to be, by the raiser of the seed imported, the smallest, prettiest, and finest flavored lettuce in cultivation. It has proved itself to be so here. Some of the others are tolerably good, but not equal to those mentioned.

ONIONS.

Thirteen sorts of onions have been grown, viz:

James Keeping, White Globe, Brown Globe, Brown Portugal, White Portugal, White Spanish, Giant Madeira, Nuneham Park, White Lisbon, Danvers New Yellow, Silver Skinned, Red Italian Tripoli, Blood Red.

The onions were sown on the 29th of March, the seed being drilled in three feet apart. They were kept clear of weeds, and the earth constantly stirred with horse hoes and cultivators all summer. The Giant Madeira, White Lisbon, and Red Italian Tripoli have yielded immensely; the others have turned out tolerably well, but are not so large in size. Specimens of the Giant Madeira weigh 1¼ pound, White Lisbon 12 ounces, and Red Italian Tripoli 14 ounces, respectively. All of the different kinds of seeds not enumerated in any of the above lots, but tested here, have turned out, with few exceptions, to be very good. Some of them require to be harvested before much can be said regarding their merits. About thirty-six varieties of seeds were received from Japan. They were all put into the ground, but scarcely one-half of the different kinds came up. There is something very peculiar in the most of those which have grown, and all are evidently new varieties unknown in this country.

There is a cucumber which beats anything grown on the grounds here, for size and productiveness; all the seeds of this kind are being carefully preserved for distribution. Some of the beans promise to be good, but they are not far enough advanced to judge of them sufficiently. There were several varieties of seeds sown which came from Vienna; among them is a white curled endive, which is one of the finest grown. It seems to do well here, and is much superior to the others. There are also six varieties of radishes growing, and there is a white variety called the white monthly radish which is very fine, and pronounced by those who have tested its qualities to be superior to anything they have ever tasted. There are four varieties of Kohl rabi, which are quite distinct from the common English kinds, seeming to be of much finer quality, and likely to be better adapted for domestic purposes.

TOMATOES.

Several varieties of tomatoes have been tested, but the Tilden, and Carter's Yellow tomato from London, England, are the best. The Tilden merits all that has been said about it by those who have recommended it to public notice; but Carter's Yellow far surpasses it in richness and quality of flesh. Seed of this kind is being carefully saved for further experiment.

POTATOES.

Forty-three varieties of potatoes are being tested. Eight of them are directly from the celebrated growers of seedling potatoes, viz., Messrs. Paterson & Son, Dundee, Scotland, and are named, respectively, Paterson's Early, Paterson's Blue, Paterson's Victoria, Paterson's Scotch Blue, Paterson's Alexandra, Paterson's Regent, Paterson's Napoleon, Paterson's Red. These all have great reputations in their native country, but time will develop what they will do here. They look very well and appear to yield good crops here also. The other varieties are very promising and are likely to turn out well. When they are gathered, the ground will be measured, and the quantity produced of each particular kind will be weighed, so that an estimate of their produce per acre may be ascertained. The Goodrich Early keeps ahead of any of the varieties tested, for earliness, although the Samaritan is not far behind it, but does not yield as largely.

MELONS.

Upwards of thirty kinds of cantaloupes and watermelons have been tested. Among the cantaloupes and muskmelons, particularly, there is one from Spain, which has been very much regarded as superior to anything hitherto grown in this country. There is also one called Michies's netted muskmelon, a very superior variety. Several of those from Buenos Ayres and Port Mahon are very good also. The watermelons were late planted, but notwithstanding the coolness of the season they have grown amazingly. There is a watermelon from China which puts all the others in the shade for sweetness, firmness of flesh, and general good qualities; the seed of this kind is perfectly white. There are also some from Russia which have grown well and are very good, having a very thin rind, and the flesh firm and solid.

Several kinds of pumpkins and squashes have also been planted, but at this time have not sufficiently matured to speak of them definitely.

One kind of tobacco was grown which was sent to you from Turkey, without any name, but which, from its appearance while growing, resembles the Latakia tobacco. It is quite different from any of the known varieties of tobacco grown in this country. It does not produce such an amount of leaves as some of the others—the leaves being wider apart on the stem—but they are much thinner and finer in quality. All the seed has been carefully saved off this lot, and will be distributed from the department.

On a place like this, where so many varieties of seeds have been tested, it is almost impossible to arrive at a fair conclusion with one year's experiments; but by carefully comparing the different qualities of each separate variety, and experimenting in succeeding years with those known to be good, and comparing them with new varieties, a more reliable opinion will be arrived at, and also better methods of managing and securing the different kinds of seeds, so that only those which can be relied on will be secured; as it is almost impossible on so limited a space to keep some kinds from hybridizing.

GEORGE REID.

Hon. I. NEWTON.

REPORT OF THE ENTOMOLOGIST.

SIR: During the past year most of my time and attention have been given to the agricultural and economic museum under my charge. This museum or cabinet, illustrating, as it does, in the most practical way, the relations existing between the farmer's insect enemies and his feathered friends, will, when thoroughly established and systematized, form the foundation for a most complete course of instruction in entomology and ornithology as connected with agriculture and horticulture.

Entomology, as a useful science, and to be practicable where most needed, must be placed before those whom it is to benefit in a language which they can understand, and in intimate connexion with the objects of their daily interest and care. Hence the great importance attached to perfecting this system of ocular instruction, and hence, also, as far as possible in this report, terms recognized as peculiar to pure science are avoided; the aim being to come at once to facts in plain words—to talk with the farmer where he lives, and show him by the results of actual investigation wherein his safety lies. Since the opening of this museum every effort has been made, and much private capital spent, to add to it everything desirable that came within reach, besides giving the free use of my own library and collection of birds, insects, insect-plates and model fruits, for the benefit of all coming here for information.

The voluntary contributions for the year, as will be seen by the list appended, though not as numerous as might have been wished, have still added much to the interest of the collection. As no funds have been appropriated for the purpose, many of the skins of birds and animals sent by correspondents from the west have not yet been mounted, and therefore do not appear on exhibition. One of the most successful collectors of specimens, and one to whom the department owes many thanks, is Mr. Allen Crocker, of Kansas. A like attention from others would soon enrich the museum with all that is desirable in the way of natural history.

The insects sent for identification have been almost countless, though comprising few that are new; many, however, are interesting from facts and observations connected with them, as mentioned by correspondents.

Letters of inquiry in regard to insects, their depredations, and the best methods of prevention, have been very numerous from all parts of the country. These have all been answered promptly, and with the request repeated from last year's report, that farmers who try the remedies there proposed for the destruction of noxious insects would report to this department the results of those trials, so that the successful ones may be registered for future use, and the useless ones be thrown out of print as soon as may be. As yet this request has scarcely been heeded, owing, probably, to the fact that the limited number of reports allowed to the department for distribution did not permit of its being put into the hands of multitudes who would have taken deep interest in helping on this work. Hundreds of disappointed applicants, both personally and by letter, from the working and experimenting classes of farmers, attest the truth of this. It is among them that the documents of this department should be most freely distributed, as it is from them we are to obtain the facts most needed to guide science in her mission of usefulness.

The cereals received since last report have been very few, and, with one or two exceptions, not of extraordinary quality. California, Oregon, and Colorado have sent some small samples of very beautiful wheat, and some fine oats, barley, and rye.

The interest in fibres has continued unabated. Specimens have come in from nearly every section of the country, but only in small parcels, simply to show the variety of fibre-producing plants at our command. Fine cottons have been sent from California and the Sandwich Islands, where large quantities were raised in 1865.

Several of our consuls at foreign ports have interested themselves in collecting and forwarding to this department articles of value, among which may be mentioned the fine case of China grass, (*Bœhmeria nivea,*) and the dressed fibre, yarns and fabrics of the same, from the manufactory of Messrs. Ward & Sons, Bradford, England, through G. D. Abbott, esq., United States consul at Sheffield. The fineness and toughness of this fibre, together with its beautiful lustre, promise to make it a valuable addition to manufacturing materials. A correspondent writing from London, England, says of it: "The experiments in the cultivation and manufacture of the plants, made by Colonel Nicolle, in the island of Jersey, enable him to state with entire certainty that the yield of China grass per acre is as great as lucerne, or about forty tons of green matter, of which eighteen tons yield one ton of fibre. The plants attain great perfection in the climate of Jersey, which is very similar to that of Maryland."

The *Phormium tenax*, or New Zealand flax, is also highly spoken of by the same correspondent, successful experiments having been made in the manufacture of cloth and rope therefrom. Small samples of these have been received, and are now in the museum.

Some fine specimens of Spanish merino pure and graded wools have been received from California. From other States very little has come in, and, indeed, it is at present quite as well so, as, in the crowded condition of our rooms there is no place in which they could be safely kept. Nearly all the parcels of wool that were on hand at the organization of the museum, with many since received, have been destroyed by moths, which it has been impossible to prevent for want of air-tight cases and proper fumigating apparatus. Until such safeguards are provided, it will be with the greatest difficulty, even with the constant use of benzine, that the mounted specimens now in the collection can be preserved; and wool in parcels being peculiarly liable to the depredations of the moth, cannot be kept any length of time without proper protection, such as the means now at command do not afford.

The museum is indebted to J. H. McNall, esq., of North Star, Pennsylvania, for a skin of a pure-bred Angora goat, and also to B. K. Tully, esq., of Russellville, Kentucky, for one seven-eighths Angora, both of which have been mounted and are on exhibition, together with some fine samples of Angora wools of various grades.

Through V. D. Collins, esq., now in China, we have received a number of cases of insects peculiar to that country, with a variety of papers, fibres, models of farming implements, irrigating machinery, and other articles, many of which, however, are mere matters of curiosity.

The department is under obligations to Messrs. Vilmorin, Andrieux & Co., celebrated florists of Paris, France, for a full set of the beautiful colored plates of flowers and vegetables, comprising the "Album Vilmorin," and also for a variety of seeds of rare flowers for propagation in the department garden.

Our collection of silk in cocoons and reeled samples has been increased by valuable contributions from the Bohemian Agricultural Society, through the Austrian minister of commerce, and also from M. Guerin Meneville, of Paris, who presented a choice variety to me for that purpose during my late visit to France.

In regard to experiments made in this country with the *Attacus cynthia*, or Chinese Ailanthus silk-worm, there seems very little to be said that is encouraging. The eggs and cocoons of the insect were widely distributed throughout the country, but the reports from them have been very meagre. Some who have written state that the worms when hatched were totally neglected, and so perished. From only one correspondent have we a satisfactory account. Mr. John Akhurst, of Brooklyn, New York, writes under date of November 21, 1865, as follows:

"I received last spring thirty-six cocoons of the Cynthia, with the request that I would report to you my success at the close of the season. I am pleased to say that, so far, all is extremely favorable. From the thirty-six cocoons I have reared upwards of 10,000 cocoons. The greater number were reared in the open air, many in the most exposed situations. Still I found them to thrive remarkably well.

"One fact is proved beyond a doubt, that two broods can be reared with certainty within one season. The second brood of this season proved stronger, and the cocoons much larger than those of the spring brood.

"The Rev. Dr. Morris, of Baltimore, in his paper of 1861, says, 'about ten per cent. of the first brood hatch during the summer.' In this there is a great mistake. I find from seventy-five to seventy-eight per cent. made their appearance, although I had them in a very cool place.

"There remains no doubt in my mind of the success of the experiment, and I believe that with very little care and expense great quantities of silk can be raised in this country. I shall continue to rear the Cynthia next season, and will report my success, whatever it may be."

The cocoons of the Cynthia which I kept for myself produced fine, healthy moths, which, after pairing, laid their eggs upon the inside of the box in which they were kept. The eggs hatched well, and in due time the cocoons were spun, losing only about eight or ten per cent. of the caterpillars. Unfortunately for the next brood, I was obliged to go to Paris, and had to leave the cocoons in care of another person, who reported that several moths came out and laid eggs, but the worms when hatched proved sickly, refused to eat, and so died without making cocoons.

The simple question as to whether the Cynthia can be acclimated here, and will make silk from the ailanthus, no longer admits of doubt. Mr. Gallaher, of this city, has succeeded in reeling the cocoons, and finds the silk even, of fine texture, and good strength. A specimen reeled may be seen in the museum. The utility of the Cynthia here, or, indeed, the practicability of silk-raising at all to any extent in this country, with labor at its present price, is the real question of doubt, and that is not left with individuals to settle, but with the laws which control commerce and regulate demand and supply.

In perfecting the system of instruction upon which this museum is based, small cases covered with glass have been procured, in each of which are arranged the various fibres, silks, &c., beginning with the seed and going through the different stages of growth and manufacture, so that the whole process may be seen at a single glance. This is found peculiarly advantageous in giving explanations, and is very satisfactory to those seeking to inform themselves in regard to any product and its uses. In short, the entire collection is intended as an object library of reference for all time; the design being, if permitted and encouraged to go on with it, to have all the economic products of our country represented here and so arranged, and to make the collection such a centre of useful information, that the department cannot afford to do without it. A national museum of this kind is demanded by the needs of the people; and the system, at once minute in detail and comprehensive in scope and aim, upon which the nucleus is based, is capable of being extended through every branch of husbandry and manufactures. It is, in fact, the initiatory chapter of a boundless volume of national industry illustrated.

If proper rooms and cases could be provided, the wool interests of the country might be largely subserved by adding to the few mounted specimens now on hand such of the pure breeds of sheep and their crosses as are most desirable, and by having connected with them books or cases in which could be preserved the grades of each with other breeds, showing the quality of staple, and for what use it is best adapted This, it will be seen, would be but the beginning of an almost endless series representing the industrial arts arising from and connected with agriculture. Animal as well as vegetable products, with the changes incident upon breeding, growth and manufacture, should be included in this cabinet.

Domestic fowls, of which we have a small collection, should be better represented by true types of the pure breeds, few of which can be had without resorting to importation. When in England recently, I ascertained that most if not all the best varieties might be obtained pure and at reasonable rates from eminent breeders there, and would suggest that measures be taken to procure them as soon as facilities can be afforded for preserving them properly.

The model fruits, of which there are now nearly 3,000 specimens on exhibition, are classified and so arranged as to show the effect of soil, climate and culture; a catalogue, specifying the history and quality of each, being kept for reference. The design is to obtain from each State samples of the various fruits which have been tried and proved, to have them modelled here, retaining one copy to be added to this national collection, and returning duplicates and matrices, correctly named, to each State agricultural society. These models are fac-similes, and are of a durable material, not affected by temperature, and capable of bearing transportation and any amount of handling.

Intimately connected with the fruits are the insects, of which there is a large collection classified, mounted, and conveniently arranged, at the command of all asking for information, besides a great number of colored plates prepared by myself, showing the different forms in which the insects appear, with their names, and references to authors who have treated of their habits and the best methods of destroying them. There is also a carefully prepared list of the vegetable productions injured by insects, alphabetically arranged, with the names of insects feeding upon each, and whether in the larva or perfect state. The list and the plates together form an illustrated cyclopedia, where, the plant or fruit being found, the insect enemy is at once discovered, and, by reference to the engravings, can be seen in all its forms.

The birds mounted in the museum number nearly six hundred, the greater part of them being insectivorous birds of this country. A knowledge of their nature and habits is of as much importance to the farmer and fruit culturist as is the science of entomology; hence the two studies are combined by attaching to each bird a card on which is stated, not only the scientific and common name, with reference to works on ornithology where their history may be found, but also the habits and food peculiar to each, so that the farmer may know his enemies from his friends. In addition to this, the contents of the stomachs of birds, taken at different seasons of the year, have been preserved, and are placed in small boxes beside the specimens, so that they may be referred to at any time.

The following brief synopsis of the number, character, and habits of the birds examined and preserved in this department since last report, will be of interest to the farmer:

Commencing with the birds of prey, we find the turkey buzzard and black vulture both exceedingly useful in devouring offal and dead animals, which would otherwise contaminate the atmosphere.

Hawks are, in general, very injurious to the interests of the farmer, by destroying not only poultry but the small insectivorous birds; at the same time, they kill immense numbers of mice and insects, and thus partially atone for the damage they do. In proof of this, a sparrow-hawk, shot in October, among a flock of reed or rice birds, was found to be filled with grasshoppers, and contained not the slightest vestige of feathers or bones of birds. This bird was remarkably fat. A red-shouldered hawk, or winter-falcon, shot in November, was found filled with crickets and grasshoppers, although its usual food appears to be small birds, animals, frogs, &c. Wilson states that they will even attack ducks.

The rough-legged falcon destroys mice, frogs, and reptiles, but also preys on smaller birds and animals. The marsh hawk, or hen harrier, destroys great numbers of field mice, reptiles, and small birds. Taking the hawks together, the damage they do in destroying poultry and insectivorous birds is by no means counterbalanced by their good deeds in ridding us of mice, insects, reptiles, &c.; and they may be classed as decidedly injurious to the agriculturist.

Eagles are very injurious, by destroying lambs, young animals, and the larger game birds; but as the fish hawk lives upon fish alone, and never molests other birds or animals, it ought to be excepted from the general condemnation passed upon the rest of the hawk species.

The owls being nocturnal birds, feed principally upon rats, mice, beetles, bats, birds, and sometimes even fish. The large owls, such as the great horned or cat-owls, are very destructive to chickens, quails, and squirrels, although they also do some good by destroying rats and mice. The barn owl kills immense numbers of rats, mice, and shrews, but also kills small birds. The mottled and red or little screech-owl feeds on mice, insects, and small birds. The short and long-eared owls feed principally on rats, mice, and beetles. The stomach of one specimen of the long-eared owls in the collection contained the skulls and bones of at least eight field mice, and therefore, when about barns and granaries, these birds must be very useful. Poultry, rabbits, and birds are destroyed by the barred owl, and it also feeds on rats and mice. The large snowy owl, which is occasionally seen in Maryland and other middle States in winter, feeds on grouse, hares and fish; one kept in confinement appeared to prefer fish to any other diet.

In the second order, *Scansores* or climbers, we begin with the cuckoo or rain crow. These birds are very useful in destroying caterpillars, beetles, and insects in general. Nuttall states that when they have young to provide for, their food "consists chiefly of hairy caterpillars rejected by other birds, that so commonly infest apple-trees, and live in communities within a common silky web." The stomach of a specimen shot in New York was found literally crammed with sharp-spined caterpillars of *Vanessa antiopa*. But although these birds are thus useful, they seek and destroy the eggs of other birds. In one instance, when attacking the nest of a robin, the parent bird made such a resistance, and was so much engaged in fighting the cuckoo, that both were taken alive by a spectator. Unlike its European relative, our cuckoo makes its own nest, and is a very careful and attentive parent. Our cow blackbird, or cow-bird, on the contrary, like the European cuckoo, lays its egg in the nest of almost any other small bird.

The woodpeckers are, in general, very beneficial to the orchardist, by destroying the larvæ of beetles, which, if left undisturbed, would probably kill the tree infested by them. The stomach of a specimen of the downy woodpecker, sometimes called sapsucker, (from the erroneous impression that it sucks the sap of trees,) shot in February, was filled with black ants. This bird is said to be injurious by making perforations around the trunks and branches of orchard trees, in regular circles, probably to taste the sap, or feed on the young wood. Nuttall states, however, that "trees thus perforated are not injured, but thrive as well or better than those imperforated." On one occasion a downy woodpecker was observed by myself, making a number of small, rough-edged perforations in the bark of a young ash tree, and upon examining the tree when the bird had flown, it was found that wherever the bark had been injured the young larvæ of a wood-eating beetle had been snugly coiled underneath, and had been destroyed by the bird; thus proving conclusively to my mind that these perforations are made for the purpose of finding insect food.

The stomach of the pileated woodpecker, or black woodcock, was found in October to be filled with the seeds of wild berries, with no insects whatever; its principal food, however, consists of wood-boring larvæ and insects, and it has been accused of eating maize. In the stomach of the red-bellied woodpecker, killed in December, were found pieces of acorns, seeds and gravel, but no insects. Another shot in December contained wing cases of *Buprestis*, and a species of wasp, or *Polistes*, acorns, seeds, and no bark. A third, shot in May, was filled with seeds, pieces of bark, and insects, among which was an entire *Lachnosterna*, or Maybug. The yellow-bellied woodpecker has been accused of feeding upon the young bark of trees, and although Nuttall states that "their principal food is insects, for which they sometimes bore the trunks of orchard trees," it seems not yet satisfactorily settled as to whether its chief food is the bark itself or the insects under the bark. Having had no opportunity to examine the stomach of one of these birds, I am unable at present to answer this question. A piece of bark injured by this bird, sent to the Smithsonian Institute, was certainly eaten out regularly in large square or round holes, as if for the sake of the young bark or wood itself. Dr. Trimble states, however, that the stomach of a yellow-bellied woodpecker contained two seeds, seven ants, one insect like a chinch, and of bark and sap not one trace. Another specimen contained pulp of apple and one ant. Pieces of bark and wood are frequently found in the stomachs of all woodpeckers, but they have probably been merely swallowed with their insect prey, and not for the sake of nutriment. The question as to whether the yellow-bellied woodpecker does really feed upon bark can only be decided by dissecting the bird, observing the structure of the tongue, whether it is barbed, as with other insect-eating woodpeckers, and examining the contents of its stomach at all seasons of the year.

The red-headed woodpecker, in May, contained gravel, small, wood-eating insects, and *Iulidae*. Another shot in May was full of beetles, pieces of bark, seeds, one or two specimens of *Lachnosterna*, or May bug, and other small insects. They are said to be partial to maize when in its milky state, and sometimes also to injure fruit.

The flicker, high-hole, or golden-winged woodpecker, shot in spring, contained a mass of small, yellow ants, with the remains of one small plant-bug. These birds feed, however, on cherries, grapes, and other fruits, and are very partial to ripening corn, and it is therefore probable that they do more damage to our crops than they do good by destroying insects.

We find our most useful allies in the third order of birds, the *Incessores*, which includes all perching birds. The first in this order is the humming-bird, which is generally supposed to live on the honey of flowers, but the stomach of a male humming-bird, dissected by myself, contained some very small spiders, and in others were found the remains of very small insects and spiders.

The chimney swallow, or swift, is very useful, as it feeds entirely upon gnats, mosquitoes, and other small insects found flying in the air. The stomach of one dissected contained nothing but a mass of pulp composed of the remains of soft bodied insects.

The whip-poor-will feeds entirely on large night-flying insects, such as moths and beetles, and should be protected.

The poor night-hawk, under the popular name of bull-bat, although destroying myriads of noxious insects, meets a most undeserved fate. The young sportsmen of the south ruthlessly slaughter them by hundreds as an article of food, little thinking that they are killing their best friends.

The kingfisher we will pass over, as his food consists principally of fish, although he also occasionally takes insects floating on the water.

The king-bird, tyrant fly-catcher, or bee-martin, as it is called in the south, feeds upon beetles, grasshoppers, and insects in general. It has been accused by many naturalists of feeding upon honey bees; others state that it selects only the drones. In defence of this bird, I will state that the stomach of one examined in May contained May bugs, but no bees; and another shot by a farmer, who suspected it of taking his bees, as he had seen it make repeated dives among them from a willow overhanging his hives, contained no less than fifteen *anomala varians*, one *carabus*, and not the vestige of a bee. These insects were so packed together and mixed up in the stomach, that an inexperienced person would have taken them for a mass of bees; and it was only after careful and close examination that they were all identified. This bird may, however, feed upon bees at some particular seasons; and if farmers would only carefully examine the stomachs of such as are killed, or send them for that purpose to some competent naturalist, the question would soon be settled as to whether it ought to be shot as a marauder upon bee-keepers, or protected as a benefactor of farmers. In the southern States I have seen the bee-martin chase and capture the boll-worm moth not ten paces from where I stood.

A great-crested fly-catcher, in May, contained small hymenopterous insects and beetles. The pewee fly-catcher, or phœbe bird, so called from its peculiar note, shot in March, contained seeds of wild plants, and small insects. Two shot in April contained numerous specimens of *Aphodius* [*maculipennis*, *Fimetarius*, and other small insects; and another shot several years ago near a beehive contained a mass of the striped bug so destructive to melons and cucumbers; thus proving how beneficial these small birds are to the gardener. A wood pewee, shot in September, contained a mass of soft-bodied flies, among which was a perfect specimen of *Musca Cæsar;* whilst a yellow-bellied fly-catcher had fed entirely upon *Aphodii* and other small insects.

We now come to the family of Thrushes, the most remarkable and best known of which is the robin. It is true that this bird devours great quantities of our small fruits, such as cherries, &c , but we should remember that during the rest of the year the robin is busily engaged in destroying insects and larvæ which would otherwise ruin our crops. A robin shot in March contained spiders, several noxious insects, and seeds of wild plants; another shot in the same month, n a newly ploughed field, was found to contain the nearly full-grown larvæ of a cicada which had no doubt been turned up by the plough.

I will remark here that in regard to this family of birds, and, indeed, of nearly all others as well, I cannot make this report as full and complete as it should be, on account of the stringent laws here (in Washington) prohibiting the shooting of small birds. So conscientiously law-abiding were the officials, that I could not even get a permit to shoot specimens for examination preparatory to making this report. Yet, notwithstanding this, the markets here in spring are literally overstocked with strings of robins, thrushes, cedar-birds, and even bluebirds, which are brought in and sold for food. Until this public sale of small birds is prohibited, as with game birds at certain seasons, our little harmless songsters will rapidly disappear from the neighborhoods of large cities.

The stomach of a hermit, or little thrush, was found filled with seeds of the *smilax rotundifolia*, although its general food in spring and summer consists of insects. The well-known and favorite bluebird is exceedingly useful to the horticulturist and farmer, by destroying myriads of larvæ and insects which would otherwise increase and multiply to the great injury of vegetation. A bluebird, shot in March, was found to contain grasshoppers, while a naturalist searching for them in the same field could not find a single specimen. Another in the same month contained large cut-worms and various small insects; and a third was filled with small beetles, *Aphodii*, &c., and some wild seeds. Small boxes put in the trees, or around the dwelling-house, will invariably attract bluebirds to build in them. They are sometimes turned out, however, by the small and more pugnacious wren, which, after driving off the rightful occupant, leisurely turns out the eggs, barricades the entrance, and takes possession. I have known a favorite bluebird build in the same box several years in succession, and become so tame as to have no fear of the persons or animals on the premises; and was fully convinced of its utility by observing the numbers of caterpillars and insects it carried to its nest to feed its young.

A tit-lark, shot in March, from a large flock which were busily employed in hunting over a grass field, was found to contain a half-grown grasshopper, several *Iulidae*, and small insects.

The Maryland warbler, or yellow-throat, frequents sandy situations and feeds mostly on insects. In one, shot in September, was found nothing but the remains of insects. Indeed, all the warblers, during their summer and fall residence in the northern and middle States, are ever on the search for insects, and destroy numbers of the smaller ones which are too insignificant for the farmer to observe, yet which do more real damage than many of the large ones daily coming under his notice. A golden-crowned thrush contained, in May, nothing but such small insects; and a yellow-rumped warbler had fed principally on small dipterous or two-winged flies.

In the stomachs of each of three scarlet tanagers, or black-winged summer redbirds, shot in April, were found only grasshoppers, beetles, and flies; and, as another contained two *curculionidæ*, *Epicærus fallax*, no doubt if left undisturbed they would destroy the much-dreaded curculio. One summer red-bird contained nothing but seeds of wild plants, although Nuttall states that "bugs, beetles, stinging bees, flies, and cynips of various kinds also make part of their repast."

Swallows and martins are exceedingly useful in destroying small insects when flying in the air, and thus help to keep down the multitudes of gnats, mosquitoes, and small flies. By one naturalist it has been urged against them that they also feed upon the ichneumon flies, which are destructive to insects; but the damage they do in this way is more than compensated by the benefits they confer by devouring hordes of noxious insects.

The cedar or cherry bird is very destructive to small fruits, and the fruit-growers cannot be blamed for shooting these voracious birds, as, if undisturbed, they will entirely strip his cherry trees. In the autumn, however, they feed upon insects, and Nuttall states that "before the ripening of their favorite fruits, the cherries and mulberries, they repay the gardener for the tithe of his crop, by ridding his trees of more deadly enemies which infest them, small caterpillars, beetles, and various insects then constituting their only food. For hours at a time they may be seen feeding on the all-despoiling canker-worms which infest apple and elm trees." Those shot by myself before the fruit season were almost always filled with seeds of the red cedar and other berries, and no insects whatever. However, as Dr. Trimble states that one cedar bird dissected by him contained thirty-six canker-worms, we may give the bird a little credit; though I very much doubt whether the worms and insects it destroys will repay for the fruit taken.

The shrikes, or butcher-birds, sometimes also in some parts called the French mocking bird, feed upon insects, such as grasshoppers and crickets. This bird has a curious habit of fastening its prey upon thorns and leaving it uneaten. I have frequently seen grasshoppers impaled in this manner, and thus knew that the bird was in the vicinity. They also feed upon small birds, and one frequented a barn the whole winter for the shelter, and for the sake of the mice found in the neighborhood, upon which it fed.

The mocking-bird is accused, and with great truth too, of destroying grapes and other small fruits in the southern States. It is sometimes most ruthlessly destroyed in spite of its melodious song; yet I have seen a female mocking-bird feeding her captive young almost entirely with insects, among which were numbers of the cotton boll-worm moth, so destructive to the crops of the south.

The catbird has very nearly the same habits as the mocking-bird, and though it destroys immense numbers of worms, caterpillars, and insects in general, will make too free with the small garden fruits. One catbird, shot in September, was filled with the seeds of wild berries, as was also a brown thrush or thrasher. As all these birds have similar habits, it is left to the horticulturist to judge whether the fruits they destroy are not more than paid for by the havoc they make among the noxious insects in early spring, before fruit ripens.

The great Carolina, or mocking wren, properly so called, as it almost rivals the mocking-bird in its powers of imitation and song, feeds almost altogether on insects. One shot in Maryland was found to have fed entirely upon them. The stomach of the common house wren, in May, had in it a large cut-worm, and several smaller insects. The wren, like the blue bird, will build in boxes put up for that purpose, and, if encouraged in gardens, is one of the greatest benefactors of the horticulturist. I once took the trouble to notice the frequency of the wren's visits to the nest, and found that at least once in five minutes one of the pair entered the box, and never without a caterpillar or some insect in its beak for its young. Taking only ten hours as an average of the time spent by the birds per day in this work, and not counting the insects they consumed themselves, there were at least one hundred and twenty, and that at a season of the year before they had begun to multiply. Wrens and bluebirds, however, do not agree well together, the wren almost invariably turning the bluebird from the box to find new quarters.

In two specimens of the white-breasted nut-hatch were found pieces of bark, mixed up with wing cases of beetles and one large larva. These birds are often incorrectly called sapsuckers by farmers; indeed, this name appears to be indiscriminately used when speaking of either the small woodpeckers or the nut-hatch. A large gall upon a branch is now in the museum which has been opened in several places by this bird and the larvæ extracted, thus showing its industry and perseverance in search of food. A red-bellied nut-hatch, shot in April, contained among other insects a perfect *Rhagium lineatum*, the larva of which lives under pine bark.

The small black-cap titmouse, or chickadee, is also very beneficial by destroying the eggs of minute larvæ in the same manner as the golden-crested wren. One shot in winter was full of small larvæ and insects which live or hybernate in the crevices of the bark of trees. The tufted titmouse is somewhat musical, and feeds upon insects.

The purple finch, or American linnet, in the spring, feeds upon the expanding buds of trees. On one occasion, when there was a light fall of snow, I found the ground under some peach trees literally strewed with the buds torn open by the strong, sharp bill of some bird, and the stamens and pistils eaten out. On shooting some birds found at work on the trees, they proved to be the purple finch, and their stomachs were completely filled with stamens and pistils of the peach buds. One branch examined had at least two-thirds of the buds thus destroyed. There is no doubt that this bird is, in many cases, the cause of much injury to fruit crops. At the same time Nuttall states that, in summer, their principal food is insects and juicy berries.

The yellow-bird, or American goldfinch, feeds principally upon seeds, and frequently does much damage in gardens by eating lettuce, salsify, and other seeds. Nuttall, however, says that their usefulness in other respects (by eating the seeds of noxious weeds) far more than counterbalances the trifling injuries they do. Of this the gardener must judge for himself. Those shot as specimens were found always to have eaten seeds, and mostly of the lettuce and other garden plants. One author states that they destroy great numbers of the larvæ and pupæ of the wheat midge, improperly called the red weevil, so injurious to wheat.

The crossbill is merely a visitor to the middle States during the winter, and feeds chiefly upon seeds of the pine and hemlock, but also does considerable damage to the orchard in more northern regions by tearing open apples for the sake of the seeds. Those shot as specimens contained merely seeds of the pine. The lesser redpole, likewise a winter visitant, feeds also on seeds.

The buntings and sparrows come next in order, the first of which is the snow bunting. This only visits the middle States during extremely severe winters, and feeds upon insects and seeds. All the sparrows are more or less useful, as their food consists chiefly of insects and seeds of noxious weeds. Several of them, such as the snow-bird, may be seen always when the ground is frozen, hunting for small seeds of weeds, and for hybernating larvæ and insects.

The cardinal grosbeak, red-bird, or by some called the Virginia nightingale, feeds upon seeds, and has been accused of destroying the seeds of orchard fruits. Nuttall says, "they are said occasionally to prey upon bees." Those shot, however, were found to contain only wild seeds.

The towee finch, or ground robin, frequents dense thickets near water, and is said to be particularly fond of *Iulidæ*. It also feeds upon worms, larvæ, and seeds. The stomach of a specimen shot in June, was filled with various insects and seeds of weeds.

The bob-o'-link, or reed-bird of the middle States, and rice-bird of the south, is exceedingly destructive to rice in Carolina and Georgia; yet, when in the more northern States, feeds partially upon insects, and is fond of seeds of dock, dandelion, and grass. Dr. Trimble also states that they destroy canker-worms. Those shot as specimens, in spring, were found to contain seeds, grasshoppers, and other insects.

The troopial or cow blackbird never builds a nest for itself, but deposits its eggs in the nest of some other smaller bird, and, like the European cuckoo, leaves its young to the charge of foster parents. These birds live upon seeds and insects.

The swamp blackbird, formerly known as the red-winged blackbird, does great damage to corn or maize; but during the spring I have always found their stomachs filled with worms, larvæ and insects, mixed with seeds of wild plants. Wilson remarks, "as a balance against the damage they do, there is the service they perform in the spring season by destroying immense numbers of larvæ, which are of kinds most injurious to farmers." Kalm states, that "after the great destruction made among the common blackbirds for the legal reward of threepence per dozen, the northern States in 1749 experienced a complete loss of grass and grain crops which were devoured by insects." A southern planter once stated to me that the cotton-boll worm, which was destroying his cotton crop, had entirely disappeared after the visit of an immense flock of these or some other blackbirds, which, after devouring the worms, immediately left the neighborhood. It is therefore for the farmer to judge whether they do not deserve the toll they take from his crops, for their spring services in destroying his enemies.

The meadow lark, or American starling, is exceedingly beneficial as destroying immense numbers of larvæ, worms and insects in the cultivated fields. The stomachs of all examined were full of insects and small seeds. One shot in March contained nothing but beetles and other insects, and gravel. As it is not known that this bird eats fruit, it may be considered a decided friend to the farmer.

The sprightly and gay-colored Baltimore oriole, golden robin, or hanging bird, as it is often called from the singular pendant nest it forms, feeds upon insects.

Nuttall says, "they feed their young usually with soft caterpillars which they swallow, and then disgorge on reaching the nest." These birds, however, do considerable damage to the pea crop, by splitting open the pods and eating the young peas. It has been suggested that this was done merely to find the larvæ of the destructive pea bug, which lives in the seed. They are accused of taking cherries and other small fruit, but are said in Dr. Trimble's book to eat the curculio, or destructive plum weevil. If this is true, it would atone for any slight fruit-eating propensities they may have. I would observe here, however, that I have never found the plum weevil in the stomach of any bird; and that the nearest approach to it was *Epicærus fallax,* found in the stomach of a scarlet tanager.

The stomach of a rusty blackbird, examined in April, was found to contain snake milipedes in great numbers, worms, caterpillars, and gravel. The crow blackbirds, examined in early spring, before corn was planted, were found to have destroyed numberless noxious insects. Nuttall says, "up to the time of harvest I have uniformly, on dissection, found their food to consist of larvæ, caterpillars, moths and beetles, of which they devour such numbers that, but for this providential economy, the whole crop of grain in many places, would probably be destroyed by the time it began to germinate." But as the damage done to maize by this abundant and destructive bird is in some places almost incalculable, it is no wonder that the farmer renders a verdict against its race, and exterminates them when and wherever he can. At the same time it should be considered, that a mischievous bird is much sooner found and destroyed than the myriads of noxious insects upon which it preys.

We now come to the common crow, a much slandered and persecuted bird, on account of his pilfering propensities in the cornfield. Before condemning him here to certain destruction, let us hear the other side of the question, and consider the great good he does in waging war upon the cut-worms, grubs, and other noxious insects which, if undisturbed in spring, would quite destroy the crops. In regard to the seed-corn which he pulls up and eats, many farmers state that they have always observed that the young corn thus destroyed had almost invariably a cut-worm or other insect preying upon its roots. This may or may not be so; but this bad habit of pulling up seed-corn may be easily remedied by tarring or sulphuring the seed before planting. Some farmers leave a little corn on the surface for the crow to eat; but this most probably would only attract him to search for more. No farmer, when ploughing in spring, can have failed to observe the crows and other birds following in the furrows, and busily engaged in searching for grubs and cut-worms. If shot at this time, they will be found filled with a mass of worms, caterpillars, grubs and other injurious larvæ and insects. Now we must consider that these insects, if left undisturbed in spring, would multiply and spread in the autumn to such an extent that it would be utterly impossible for man to find and destroy even a tithe of them; while, should the crows increase so as to become a nuisance, they may be much more easily discovered and killed. Farmers will abuse the bird for being once seen feeding upon their crops; but seldom think of giving him credit for the hundreds of times when he is at work to save them, by devouring their enemies. A planter in South Carolina informed me that he had seen crows attacking the maize standing in his field, and upon examination the husks were found torn open and much of the unripe corn scattered on the ground; but upon looking closer, every ear of corn thus injured was discovered to have been partially destroyed by the corn-worm, *Heliothis armigera,* and the worm had been taken out and devoured by the bird. Crows are, however, very destructive to small birds, eggs, and to almost anything they can overcome, and, upon the whole, during summer and autumn, are serious pests to the farmer. Indeed, it is hard to estimate whether the good they do is not counterbalanced by their mischievous propensities.

There is a smaller species of crow found along the sea-coast, called the fish-crow, which, it is said, does not injure maize, but feeds entirely on fish, berries and insects, and Nuttall states are therefore "rather friends than enemies."

The food of the blue jay consists of acorns, berries, maize, orchard fruits, insects and caterpillars; but as it has the very bad habit of searching for the nests of small birds, eating their eggs, and even devouring the unfledged young whenever it finds an opportunity, it may well be doubted if this bird ought to be classed among those which are beneficial to the farmer.

The order *Rasores* comprises the pigeons, turkeys, grouse, quails, &c.; and of the habits of these the farmer is able to judge for himself, as well as of their uses. The ruffed grouse, or pheasant of the middle and western States, and partridge of the north, however, sometimes does much damage to orchards by devouring the buds of apple trees. In the stomach of a prairie hen, or pinnated grouse, from the west, were found fifty-six grains of maize, besides a quantity of oats, buckwheat, catkins, and the seeds of wild plants—proving the voracity of these birds, and showing what quantities of grain they destroy.

The American partridge, or quail, is said to be very useful in grain fields, by feeding upon the seeds of hurtful weeds during the autumn and winter. In the Cincinnatus, an agricultural journal published in Cincinnati, is an article stating that "in the crop of a quail, shot in a cornfield, was found one cut-worm, twenty-one striped vine-bugs, one hundred chinches, and a mass consisting of hundreds of chinch-bugs, but not one kernel of corn." If this be correct, it goes far to prove the quail the farmer's friend.

The order *Grallatores* comprises the cranes, herons, bitterns, plover, woodcock, snipe, &c. These birds are all more or less beneficial to the agriculturist, by destroying reptiles, slugs, insects, &c., and, as they do not injure his crops in the least, ought to be protected as much as possible. A tame sand-hill crane I had in Florida exhibited extraordinary sagacity or instinct in finding grubworms under the green sod, where I could not procure worms to fish with, and where there was not a vestige of injury to the grass. When he once commenced digging with his strong and sharp bill he never failed to find the insect hidden underneath.

A killdeer plover, shot in May in a wheatfield, contained nothing but beetles, worms, and small insects. Herons, bitterns, &c., do certainly destroy great numbers of fish and frogs, but at the same time they feed equally on small noxious quadrupeds and reptiles; and as this paper is intended for farmers and not for fishermen, we will not discuss the subject further.

To the order *Natatores* belong swans, geese, ducks, &c.; and as these are well known, they need not be further described. I will merely remark that several gulls and sea-swallows, or terns, feed upon insects as well as fish; and in England I have seen them busily hunting for their insect-food in fields some distance inland.

Among the birds which have been introduced from abroad into this country, for either their song or their utility, may be mentioned the field lark of Europe and the European house sparrow. The last-named bird would certainly do much to rid our cities of the disagreeable span-worms infesting the shade-trees. At the same time there is no doubt that the smaller fruits and the wheat in the vicinity would suffer to a considerable extent. The question, therefore, arises whether citizens would be willing to sacrifice their fruits for the sake of being rid of span-worms and caterpillars. In Philadelphia the great increase of span-worms was doubtless attributable to the decrease of small insectivorous birds in the parks; this decrease being caused by the introduction of squirrels. However graceful, nimble, and ornamental these little animals may be in the public squares, they can only be kept there at the expense of the birds, as they destroy the eggs, and the birds themselves when they can catch them, their constant persecutions causing those not killed to migrate to safer places.

Some persons in England contend that sparrows are much more injurious than beneficial, and have caused them to be killed with gun and strichnine. In regard to these birds and rooks, I quote below from Anderson's Recreations in Agriculture: "Were it not for the birds that frequent our gardens, and insects which prey upon each other, the number of these diminutive creatures produced would be such as soon to overpower the industry of man, and put an end to his miserable existence. The ingenious Dr. Bradley has computed that a pair of sparrows carried to their young, in one week, not less than three thousand three hundred and sixty caterpillars, at which rate, in the course of three months, this family would consume 43,000,680 caterpillars. Let any one compute the damage that these caterpillars, and the infinite progeny that must have issued from them, would have done in that period had they been permitted to get into their winged state, and he will then see reason to doubt how far we do wisely to exterminate these birds, because of the tasting they take of our grain and fruit when they come to maturity. It has often been remarked that after an extensive rookery has been eradicated on account of the damage it did to the cornfields in the neighborhood, those fields, both of corn and grass, have been so infested by grubs as to yield crops much inferior to those which had been reaped from the same fields while the rooks were there; for it is well known that these creatures are so fond of grubs as to prefer them to every other kind of food, and are, therefore, in perpetual search of them, picking them up and devouring them in immense multitudes."

Mr. Florent Prevost, who collected and examined the stomachs of European birds for several years, comes to the conclusion that, from his researches, "birds are in general far more useful than hurtful to the agriculturist, and that the mischief done at certain periods by the graniverous species is largely compensated by the destruction of insects they effect at other periods."

TOWNEND GLOVER.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

REPORT OF THE CHEMIST OF THE DEPARTMENT OF AGRICULTURE.

WASHINGTON, D. C., *July* 1, 1866.

SIR: I have the honor to submit to you the following report of analyses made during the year, and the kind of work performed in the chemical laboratory of the department.

1. QUANTITATIVE ANALYSIS OF A MARLY SOIL FROM VIRGINIA.

Organic matter and moisture	9.75
Peroxide of iron and alumina	14.15
Carbonate of lime	19.52
Carbonate of magnesia	0.28
Potassa	3.85
Soda	0.51
Phosphoric acid	0.38
Sulphuric acid	0.04
Soluble silica	11.45
Insoluble silicates	40.07
Total	100.00

2. ANALYSIS OF THE SUGAR-BEET.

The juice was expressed with a hydraulic press. The method of determination employed was that by Fehling's copper test, a short description of which will be appended to the analysis. The proportion of sugar in beets varies. First, it is greater in some varieties than others; second, it is greater in small than in large beets; third, in dry climates, especially where the climate is dry after the roots have begun to swell; fourth, in light than in heavy soils; fifth, in the part above than that under ground; sixth, when the manure has not been directly applied to the crop. The physical characters which serve to show that a beet-root is of good quality are its being firm, brittle, emitting a creaking noise when cut, and being perfectly sound within; the degree of sweetness is also a good indication. The 45th degree of latitude appears to be the southern limit of the successful growth of beet, in reference to the extraction of sugar. (Ure.)

The beets in question were sent by Gennet Brothers, of Chattsworth, Illinois. They yielded—

Dry residue	4.00
Cane sugar	11.40
Water, &c	84.60
Total	100.00

Fehling's method depends upon the property of grape-sugar, at an elevated temperature, and in the presence of an alkali to deprive oxide of copper of one-half of its oxygen; thus converting it into sub-oxide, characterized by a brownish red color.

The test liquid is prepared as follows: 34.45 grammes (a gramme is equal to *15.434 grains, English) of pure crystallized sulphate of copper are dissolved in about 200 cubic centimetres of distilled water.—(A c. c. or cubic centimetre of pure water is in weight equal to one gramme or 15.434 grains, English, or a little over half a drachm fluid measure.) A concentrated aqueous solution of 173 grammes neutral tartrate of potassa and soda (Rochelle salts) is then prepared and mixed with 480 cubic centimetres of a solution of caustic soda having a specific gravity of 1.14. The copper solution is then poured into this alkaline liquid by small quantities at a time. The whole is finally diluted with distilled water until it measures 1 litre, (=1000 cubic centimetres,) at 17.5° Centigrade (=63. 5° Fahrenheit.) Ten cubic centimetres of this clear violet blue copper liquor require exactly 0.05 grammes (or 0.77 grains, English) of sugar for its decomposition, or, which is the same, its discoloration. It will keep for a long time unchanged if the bottle is well stoppered.

Suppose we fill a burette, graduated into cubic centimetres, with the sugary liquid to be tested, and add it gradually, drop by drop, to ten cubic centimetres of the blue test liquor till the latter has lost its color; what is wanting to make up the original measured quantity of the sweet juice corresponds to 0.05 grammes or 0.77 grains of sugar. The principle involved is this: One equivalent of glucose or grape-sugar is able to decompose ten equivalents of copper vitriol. The equivalent of glucose is 180 (its composition being $C_{12}H_{12}O_{12}$.) Ten equivalents of copper vitriol =1247. The numbers 1247 and 180 are in proportion as 34.65 to 5. Hence one litre (= to 1000 cubic centimetres) of copper liquor containing 34.65 grammes of copper vitriol would be decomposed by 5 grammes of sugar, or, as we take $\frac{1}{100}$ part = to 10 cubic centimetres of it for our experiment, 5 centigrammes (or 50 milligrammes) of sugar represents the quantity necessary to reduce the copper liquor. To obtain accurate results very dilute solutions must be employed. Under no circumstances ought the sugar solution to contain more than *one per cent.* of sugar †For example, we bring ten cubic centimetres of copper solution into a new porcelain dish, and after diluting it with forty to fifty cubic centimetres of distilled water, we heat over a spirit lamp nearly to boiling. From ten to twenty cubic centimetres of fresh juice are mixed with ten to twenty times their bulk of distilled water, and by the drop added to the copper liquor until complete reduction takes place, *i. e.*, until the supernatant liquor is colorless. To reach this point accurately requires some practice; it is therefore advisable to remove the dish from the fire as soon as the precipitate (at first yellow) turns intensely red, and to suffer the same to settle, when the slightest blue tint of the clear liquid is strongly contrasted with the white walls of the porcelain dish. Should we still have our doubts whether to add more sugar liquid or not, we pour a little of the clear liquid into a test-tube, add a drop of juice and apply heat. If there is any undecomposed copper left, a red cloud appears. In that case the tube is emptied into the dish and more juice supplied. Still greater accuracy may be attained by the use of acidulated prussiate of potash, but as those who desire it will probably guide themselves by some more extended directions it will be omitted here. The result may be calculated as follows: Of course that quantity by volume of the sugar solution poured out of the burette into the copper solution

---

* 480 grains equals 1 ounce Troy. 5,760 grains equals 1 pound, Troy.

† Chemists use the French decimal system in weights and measures as a ready means of simplifying calculations.

which it decomposes, contains exactly 0.05 grammes, or 0.77 grains of sugar. Now it is evident that the less of sugar juice required, the greater will be the percentage of sugar, or, in other words, the amount of sugar stands in an inverse ratio to the volume of sugar liquor consumed.

If m (quantity sign) cubic centimetres of juice contain 0.05 grammes of sugar, how much do 100 cubic centimetres contain?

$$\text{Equation: } m : 100 :: 0.05 : x. \quad x = \frac{100 \times 0.05}{m} = \frac{5}{m}$$

It follows, then, that we obtain the percentage of sugar in the juice analyzed, by dividing 5 by the number of cubic centimetres necessary for the complete reduction of the test copper liquor. If the juice was diluted, say with twenty times its volume of water, we have to divide 20×5 by the number of cubic centimetres used. Assume that ten cubic centimetres of original juice were required, and that this was likewise mixed with twenty times its bulk of water, then we have:

$$\frac{5 \times 20}{10} = \frac{100}{10} = 10 \text{ per cent. of sugar.}$$

These brief hints are designed to apply to the determination of cane-sugar alone, previously inverted into grape sugar. The simplicity of the process and the slight difficulty attendant upon the procuring of very correct results induced me to insert it for the benefit of manufacturers and others.

3. SUGAR FROM SORGHUM, OR CHINESE SUGAR-CANE.

This cane is now generally raised by farmers for home consumption, especially in the western States. From carefully conducted analyses by Dr. Charles Wetherill and others, it appears that native sorghum stems contain usually from two to ten per cent. of cane-sugar, associated with more or less of glucose, which may be the result of the action of an acid inverting a portion or all of the cane-sugar. Contrary to my expectations, I found that the expressed sorgho juice of ripe cane,* whether neutralized by lime or not, refused to crystallize, for what solidified or granulated after long standing of the sirup was grape-sugar. This fact has been established by the largest and most skilful farmers and experimenters, and admitted at the western sorghum conventions. The result might be ascribed to the total inversion previously of the cane-sugar by the influence of acid, or of a ferment, but this is not the case, as I have repeatedly been able to prove. The following extreme case may suffice for illustration of this fact: In the sugar determination which is here given, cane-sugar was found, and yet the most persistent efforts failed to produce a single crystal in the concentrated liquid.

Determination of cane-sugar and glucose in the sorghum juice.—The cane, somewhat dry, submitted to a pressure of about 10 tons, yielded in 100 parts 39.9 residue and 60 parts juice. Specific gravity of latter 1.0719.

(1) *Determination of glucose.*—The filtered juice was diluted 20 times with distilled water, and the burette filled.

10 cubic centimetres of copper tartrate were heated in a porcelain dish to 63° C. = to 145° Fahrenheit,† and there was required for reduction—

1st trial, 27 cubic centimetres.
2d trial, 27 2 cubic centimetres.
Mean = 27.1 cubic centimetres.

$5 \times 20 = 100 \div 27.1 = 3.69$ per cent.

* The juice from unripe cane readily crystallizes.

† This temperature must never be exceeded, that the action of cane sugar upon the copper liquor may be prevented.

100 cubic centimetres of juice weighs (having a specific gravity of 1.0719) 107.2 grammes; 107.2 grammes juice hence contain $\frac{3.69 \times 100}{107.2} = 3.45$ per cent. of sugar. Then, since the cane yielded 40 per cent. residue and 60 per cent. juice, the cane contained $\frac{3.45 \times 100}{60} = 2.07$ per cent. of glucose.

(2.) *Determination of cane-sugar.*—Fifty cubic centimetres of juice were mixed with some 50 drops of sulphuric acid, and boiled for about one hour to convert the cane sugar into glucose. The liquid was carefully neutralized with carbonate of soda, and then, after being diluted 20 times, brought in contact with the boiling copper solution:

1st experiment, 4.8 cubic centimetres was required.
2d experiment, 4.6 cubic centimetres was required.
Mean = 4.7 cubic centimetres.

$$\frac{5 \times 20}{4.7} = \frac{100}{4.7} = 21.28 \text{ per cent. of glucose.}$$

The specific gravity of the sugary juice being 1.0719, 100 cubic centimetres sugar liquor weigh 107.2 grammes; hence one hundred cubic centimetres of juice contain $\frac{21.28 \times 100}{107.2} = 19.85$ per cent. of glucose. Again, since the cane furnished 40 per cent. residue, and 60 per cent. juice, the cane must originally contain $\frac{19.85 \times 60}{100} = 11.91$ per cent. of glucose; deducting the quantity of glucose first obtained, 2.07, from 11.91, we have 9.84 per cent. of glucose, which, as 100 parts of glucose correspond to 95 parts cane-sugar, represents 10.31 per cent. of cane-sugar.

A series of experiments was instituted soon after this determination, in the hope of removing the hindrance to crystallization. Although unable thus far to report any method which can be deemed practical, it was demonstrated that the basic acetate of lead, and several other metallic salts, will remove the medium member between sugar and gum which causes this hindrance.

4. ASSAY OF SILVER ORE FROM THE "ISAAC NEWTON LODE," UTAH TERRITORY.

This silver-bearing quartz was plentifully flecked with malachite, (carbonate of copper,) and yielded, upon assay, to the ton of 2,240 lbs.......... $70 78
Another specimen, evidently inferior to the first, gave.......... 56 64

5. ANALYSIS OF SAND ROCK, IMPREGNATED WITH THICK AND HEAVY PETROLEUM, SAID TO COME FROM MECCA, OHIO.

One hundred parts by weight yielded—

Volatile oily matter	7.15
Quartz	92.85
	100.00

Calculated from the specific gravity of the oil, = (.9,) compared with that of water, = (1,) it follows that one ton (2,000 lbs.) of the above sand contains about 20 gallons of lubricating oil. A practical distillation gave the following results. One hundred parts by weight yielded—

Oil	4.26
Coke	1.00
Quartz	92.85
Loss	1.89
	100.00

The oil obtained by distillation was also measured, and the amount contained in one ton of sand calculated. The result showed 11.28 gallons of oil. It will be perceived that by the process of distillation we sustain considerable loss, partly in the form of coke deposited in the retort, and partly by the decomposition of the heavy paraffine oils at a high temperature. Hence, it would appear advisable to procure the oil by an extractive process, such, for instance, as has recently been patented by H. P. Gengembre, of Pittsburg, Pennsylvania, using for that purpose the cheap light petroleum naphtha, which, after having dissolved out of the rock all the heavy oil, can be driven off, recondensed and used again. An analysis later made from a similar specimen from Leavenworth, Indiana, by this process, gave for this rock, by the ton, 39.4 gallons.

6. ANALYSIS OF CALIFORNIA WINE.

This is in some respects a superior specimen of the California wines, containing but a trace of free sugar, and having evidently passed through all the stages of fermentation. Flavor good, though somewhat earthy, a peculiarity which can be removed by the improvement of the soil. Bouquet marked, showing complete fermentation. Color, reddish pale brown. It will be observed that the amount of extractive matters exceeds that of the majority of continental wines; a good property, since in well-cellared wines all the substances found in the extract add to their excellences. It contained—

Alcohol, by volume	15.00	per cent.
Alcohol, by weight	12.00	"
Acid, calculated as dry tartaric	0.05	"
Extract, at 212°, consisting of sugar, salts, coloring matter, non-volatile free acids, &c.	6.05	"
Free sugar	a trace.	

7. ANALYSIS OF A MAGNETIC IRON ORE, FROM WEST VIRGINIA.

Water, at 100° C. (212° Fah.)	1.40
Metallic iron	69.04
Gangue (oxygen and mineral impurities)	29.56
	100.00

8. DETERMINATION OF OXALIC ACID AND MALIC ACID IN THE PETIOLES OF THE GARDEN RHUBARB (RHÈUM RHAPÓNTICUM.)

Bin-oxalate of potassa	0.20	per cent
Acid malate of potassa	1.45	"

The root yields tannin, gallic acid, malate, gallate and oxalate of lime, starch, sulphate, and muriate of iron, and extractive and coloring matter containing oxide of iron, &c., &c.

9. DETERMINATION OF THE PHOSPHORIC ACID AND ALKALIES IN THREE SOILS FROM LAND OWNED BY W. D. SHEPHERD, ESQ., OF WASHINGTON, D. C., AND SAID TO BEAR NEITHER GRASSES NOR CLOVER.

SOIL A.

Matter soluble in water	4.60	per cent.
Phosphoric acid	.05	"
Potash	no trace.	

SOIL B.

Soluble in water	3.75	per cent.
Phosphoric acid	0.133	"
Potash	a trace.	

SOIL C.

Soluble in water	4.90	per cent.
Phosphoric acid	0.085	"
Potash	no trace.	

NOTE.—A preliminary examination having demonstrated the leading defects of these soils, the analyses were conducted with special reference to them alone.

10. ANALYSIS OF COPPER PYRITES FROM MARYLAND.

Metallic copper	4.60	per cent.
Sulphur, sulphuret of iron, and other impurities	95.40	"
	100.00	

11. ANALYSIS OF A SOIL FROM MARYLAND.

Water (at 212°)	14.021
Organic matter and water of combination	7.692
Peroxide of iron and alumina	8.556
Lime	4.754
Magnesia	2.521
Potash	0.243
Soda	0.160
Sulphuric acid	0.190
Phosphoric acid	0.005
Soluble silicates	2.920
Insoluble silica	57.913
Loss	1.025
	100.000

12. ANALYSIS OF A SOIL FROM THE VICINITY OF UTICA, NEW YORK.

Organic matter and moisture	8.170
Insoluble silicious matter	81.000
Soluble silica	0.497
Chlorine	0.002
Peroxide of iron and alumina	9.413
Lime	0.290
Magnesia	trace.
Sulphuric acid	0 043
Carbonic acid	0.100
Potash	0.070
Soda	trace.
Phosphoric acid	trace.
Loss	0.415
	100.000

13. ANALYSIS OF COPPER ORE FROM DAVIS'S FARM, WASHINGTON COUNTY, MARYLAND.

The ore sent came from the surface rock, and was a mixture of red oxide, blue and green carbonate, together with sulphuret of copper, all associated together, even in small pieces of the gangue rock, which was made up of quartz and epidote.

The amount of metallic copper therein found was 27.75 per cent.

14. ANALYSIS OF COPPER ORE FROM THE LAND OF THOS. A. BROWN, WASHINGTON COUNTY, MARYLAND.

One hundred parts of the ore contained—

Sulphur	21.04
Copper	78.24
Silica	0.46
	99.74

The ore occurred in quartz, had the color and lustre of graphite, and, as the analysis shows, is almost pure copper glance, or sulphuret of copper.

15. ANALYSIS OF COPPER ORE FROM THE LAND OF DAVID WINTERS, WASHINGTON COUNTY, MARYLAND.

Character of the ore same as the preceding. In one hundred parts it contained—

Sulphur	20.44
Copper	79.01
Silica	0.55
	100.00

I may state that, in connexion with these and other analyses of copper ores, I made quite an extended personal examination of the "South mountain copper region of western Maryland," the results of which were embodied in a special report published soon after.

16. ANALYSIS OF A SOIL FROM ARKANSAS, WELL ADAPTED FOR THE GROWTH OF COTTON.

Organic matter		4.740
Carbonic acid		traces
Silicic acid		1.299
Soluble in water.—	Alumina	0.230
	Lime	0.389
	Magnesia	0.090
	Soda	0.034
	Common salt	0.107
Soluble in acid.—	Sulphuric acid	0.144
	Soluble silica	0.409
	Peroxide of lime and alumina	3.092
	Lime	0.535
	Magnesia	0.576
	Manganese	0.002
	Potash	0.348
	Sulphuric acid	0.070
Insoluble and silicious matter.—	Phosphoric acid	0.092
	Silica	78.845
	Peroxide of iron and alumina	5.906
	Lime	1.098
	Magnesia	1.142
	Manganese	0.623
		99.771

17. ANALYSIS OF A SOIL FROM GEORGIA.

Organic matter	12.08
Soluble in water	0 49
Soluble in hydrochloric acid	9 43
Insoluble silicious matter	78.00
	100.00

Giving the individual constituents the results in 100 parts, as follows:

Organic matter		12.08
Insoluble silica		78.00
Aqueous solution.—	Potash	0.035
	Soda	0 129
	Magnesia	0.29
	Chlorine	0.032
Acid solution. —	Sulphuric acid	none.
	Peroxide of iron and alumina	8.53
	Lime	0.67
	Magnesia	trace.
	Phosphoric acid	0.033
	Soluble silica	0.20
		99.999

18. ANALYSIS OF AN "OIL ROCK" FROM LEAVENWORTH, INDIANA.

The oil was extracted by means of naphtha, which was afterwards *distilled off.* The yield was found to be 39.4 gallons for the ton of 2,240 lbs.

These selections from the work of the laboratory during the past year will convey an idea of its nature and extent. Much has been done which cannot be displayed in the limited space of this report. Mention will yet be made of a few more important of these undertakings.

A large number of postage stamps, cancelling inks, &c., were examined for the Post Office Department, with a view of testing the merits of each. A full report of the results was made, showing that the experiments occupied much time and demanded careful attention.

Quite a number of disinfectants have been analyzed, but the form and length of the reports upon them render it inexpedient to insert them here.

At the instance of gentlemen from Massachusetts, I was directed to examine and report upon a large deposit of granular quartz, situated in West Virginia. Several days were occupied in the collection of geological data upon the spot, after which the quartz sand was submitted to a series of careful analyses, which were compared with the analyses of the sand used by various large glass manufactories, and executed at the same time. The results were highly gratifying, showing that the substance in question was of sufficient purity for the manufacture of the finest French plate glass.

A difference existing between the buyers and sellers of government whiskey in regard to its strength was satisfactorily settled by a careful comparison of the different instruments used, and the recommendation of a reliable scale. I am happy to learn since that my labor was rewarded by the saving to the government of a very large sum of money.

As in my last report, I have to mention that a large number of inquiries by letter have received full and careful answers, which often involved considerable research and the expenditure of much time. The office which I hold being public, it is impossible to secure that freedom from interruption which is so necessary in all chemical investigations; not unfrequently the whole day is entirely occupied by attention to the queries of visitors who desire information necessitating the suspension and often the recommencement of such processes as were then under way.

I may be allowed to indulge the hope that the day is not far distant when it will be possible to provide for a division of labor in this section of the department also. The amount of work is far more than can be properly performed by one chemist and a clerk, while the apparatus is much in need of additions and renewals. The importance of applied chemistry is each day increasing. With each new want of modern civilization is created a demand for information upon many subjects connected with its most speedy and economical supply.

The science is fast gaining recognition as the key of all success in the arts and manufactures. It is, therefore, of great importance that proper means be adopted by the government for both investigation and discovery, and the dissemination of useful chemical knowledge.

HENRI ERNI, M. D., *Chemist.*

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

REPORT OF THE STATISTICIAN.

SIR: In presenting a report of agricultural statistics of the calendar year 1865, it is proper to say that, having been placed in charge of the statistical division of this department since the expiration of that year, I have not enjoyed the advantage of a supervision of all the data employed in estimates of crops and stock, but have used all of such material that was deemed essential to a condensed summary for the year, and have prepared concise statements of kindred facts originating in other departments of the government, and used such other reliable, though unofficial, material as seemed best adapted to my purpose. I have excluded commercial and financial statistics as subjects not strictly within the province of the statistical division of the department, except in peculiar cases illustrating some important bearing of commercial or monetary interests upon agriculture.

The statement giving the total amount of wool production and consumption in the loyal States during the period (four years) of the war is official so far as relates to the foreign wool, and is believed to be a very close approximation to actual facts in the estimate of the domestic product.

A detailed statement of exports of agricultural products, and of the manufactures immediately derived from them, for the past few years, with a condensed view of such exports for a period of forty years, was believed to be worthy of all the requirements of time and patience necessary for the compilation.

THE CROPS OF 1865.

The principal crops of 1865 were, as a whole, more than usually abundant. Corn, the pride of American husbandry, the national crop of the United States, was a magnificent product. The estimate for 1864 was 530,451,403; in 1865, 704,427,853, an increase of nearly 33 per cent. Illinois heads the list of corn-growing States with 177,095,852 bushels; Indiana follows with 116,069,316; Ohio, 94,119,644; Iowa, 62,997,813; Kentucky, 57,512,833.

Wheat was a smaller crop than that of 1864, and of inferior quality. The estimate is 148,522,827 bushels in the States reported, against 160,695,823 in 1864.

Potatoes were planted in greater breadth than usual, and a superior crop was secured. It would have been still larger but for the drought in the east, and rot in certain localities.

Most other crops were in excess of the products of the previous year.

TABLE A.—*Showing the estimated amount in bushels, &c., of each principal crop of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop, for* 1865.

Products.	Amount of crop of 1865.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
MAINE.					
Indian corn ....bushels..	1,692,020	34	49,765	\$1 21	\$2,037,344
Wheat .... " ..	175,591	13	13,507	2 $21\frac{1}{2}$	388,934
Rye .... " ..	135,042	$14\frac{1}{2}$	$9,310\frac{3}{5}$	1 $33\frac{1}{2}$	180,281
Oats .... " ..	2,348,342	26	90,321	61	1,432,489
Barley .... " ..	735,266	20	$36,763\frac{1}{4}$	96	705,855
Buckwheat .... " ..	356,684	$20\frac{1}{2}$	$17,399\frac{1}{5}$	90	321,016
Potatoes .... " ..	5,391,864	$138\frac{1}{2}$	39,072	57	3,073,362
Tobacco..........pounds..	7,280	750	$9\frac{5}{7}$	22	1,601
Hay ....tons	1,429,511	1	1,429,511	11 81	16,882,525
Total..............	....	....	1,685,699	....	25,023,407
NEW HAMPSHIRE.					
Indian corn ....bushels..	1,468,090	33	$44,487\frac{1}{2}$	1 $21\frac{1}{2}$	1,782,729
Wheat .... " ..	291,098	$15\frac{2}{7}$	$19,406\frac{1}{2}$	2 60	756,855
Rye .... " ..	146,872	16	$9,179\frac{1}{2}$	1 $28\frac{1}{2}$	190,731
Oats .... " ..	1,346,380	$29\frac{1}{2}$	46,427	68	915,538
Barley .... " ..	101,979	$21\frac{1}{4}$	$4,856\frac{1}{3}$	1 $11\frac{1}{4}$	113,551
Buckwheat .... " ..	74,956	$16\frac{1}{4}$	$4,684\frac{3}{4}$	1 $01\frac{3}{4}$	76,268
Potatoes .... " ..	3,183,500	$120\frac{1}{2}$	26,529	68	2,164,780
Tobacco ....pounds..	57,600	800	72	22	12,672
Hay ....tons	793,327	1	793,327	14 70	11,663,907
Total..............	....	....	948,969	....	17,677,031
VERMONT.					
Indian corn ....bushels..	1,796,356	$43\frac{3}{4}$	$40,826\frac{3}{11}$	1 $15\frac{1}{4}$	2,070,300
Wheat .... " ..	558,811	$18\frac{2}{7}$	31,045	2 18	1,218,208
Rye .... " ..	151,748	16	$9,484\frac{1}{4}$	1 $28\frac{1}{8}$	194,426
Oats .... " ..	4,213,926	39	$108,049\frac{5}{13}$	$53\frac{1}{2}$	2,254,450
Barley .... " ..	10,375	$28\frac{3}{4}$	3,461	1 $08\frac{3}{4}$	109,157
Buckwheat .... " ..	210,516	26	8,097	75	157,887
Potatoes .... " ..	5,526,089	164	33,635	42	2,320,957
Tobacco ....pounds..	59,000	750	79	20	11,800
Hay ....tons	991,814	$1\frac{1}{5}$	826,512	11 50	11,405,861
Total..............	....	....	1,061,189	....	19,743,046
MASSACHUSETTS.					
Indian corn ....bushels..	2,363,245	$33\frac{1}{3}$	$70,897\frac{1}{4}$	1 $10\frac{1}{2}$	2,611,385
Wheat .... " ..	107,465	$17\frac{5}{8}$	6,097	2 $21\frac{1}{4}$	237,766
Rye .... " ..	413,957	$14\frac{3}{4}$	28,065	1 $29\frac{1}{2}$	536,073
Oats .... " ..	1,194,827	26	45,955	72	860,275
Barley .... " ..	144,598	$19\frac{1}{2}$	$7,415\frac{1}{4}$	1 21	174,963
Buckwheat .... " ..	96,176	$18\frac{3}{5}$	$5,278\frac{1}{4}$	1 $01\frac{1}{4}$	97,377
Potatoes .... " ..	3,046,391	$104\frac{3}{4}$	$29,013\frac{1}{4}$	$73\frac{1}{2}$	2,239,096
Tobacco ....pounds..	5,746,000	1,200	$4,788\frac{1}{3}$	$22\frac{1}{2}$	1,292,850
Hay ....tons	844,173	$1\frac{1}{3}$	633,130	21 00	17,727,633
Total..............	....	....	830,629	....	25,777,418

TABLE A.—*Showing the estimated amount in bushels, &c.*—Continued.

Products.	Amount of crop of 1865.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
RHODE ISLAND.					
Indian corn ....bushels..	497,918	31½	15,809	1 22½	$609,949
Wheat .... " ..	1,413	....	....	....	....
Rye .... " ..	31,707	18	1,768	1 22½	38,841
Oats............... " ..	140,202	32½	4,314	67½	94,636
Barley .... " ..	31,821	26½	1,201	1 37½	43,754
Buckwheat .... " ..	3,097	....	....	....	....
Potatoes .... " ..	525,727	107½	4,913	82½	433,724
Tobacco ....pounds..	1,479	1,000	1½	30	444
Hay ....tons	64,312	1⅛	57,166	22 50	1,447,020
Total...............	....	....	85,172	....	2,668,368
CONNECTICUT.					
Indian corn ....bushels..	2,265,818	31¼	73,091	1 22½	2,775,627
Wheat .... " ..	71,881	17½	4,107	2 37½	170,717
Rye .... " ..	776,030	14	55,431	1 31¼	1,018,539
Oats............... " ..	2,363,317	35¾	65,648	66⅔	1,575,543
Barley .... " ..	19,200	23½	817	1 37	26,304
Buckwheat .... " ..	300,545	16¼	18,784	1 07½	323,085
Potatoes .... " ..	1,558,177	121¼	12,051½	76¼	1,188,110
Tobacco ....pounds..	8,167,681	1,350	6,050	30	2,450,304
Hay ....tons	596,191	1¼	476,953	23 50	14,010,488
Total...............	....	....	662,932	....	23,538,717
NEW YORK.					
Indian corn ....bushels..	25,344,325	24	1,056,013½	95	24,077,109
Wheat .... " ..	12,556,406	15⅓	837,094	2 08½	26,180,096
Rye .... " ..	5,309,874	15⅕	353,991	1 02	5,416,071
Oats............... " ..	48,675,090	34 3/7	1,533,574	51½	25,067,671
Barley .... " ..	4,329,406	22 1/10	192,245 8/11	1 02	4,415,994
Buckwheat.......... " ..	5,535,553	18	307,531	95	5,258,775
Potatoes .... " ..	30,249,200	107	282,703	62	18,754,504
Tobacco ....pounds..	11,836,607	1,091	10,849⅓	14	1,657,125
Hay ....tons	5,288,352	1⅓	3,777,394	12 33	65,205,380
Total...............	....	....	8,351,395	....	176,032,725
NEW JERSEY.					
Indian corn ....bushels..	9,733,901	42⅓	229,147	85½	8,322,485
Wheat .... " ..	1,265,690	12⅖	102,071	2 32¾	2,945,793
Rye .... " ..	1,246,458	13½	92,330	1 04	1,296,316
Oats............... " ..	6,309,211	32	197,163	51½	3,249,244
Barley .... " ..	27,167	22	1,235	1 12	30,427
Buckwheat.......... " ..	783,069	15¾	49,719	1 32¼	1,035,608
Potatoes .... " ..	4,122,151	90½	45,549	87	3,586,270
Tobacco ....pounds..	170,768	1,000	170¾	20	34,153
Hay ....tons	461,958	1¾	263,976	13 89	6,416,596
Total...............	....	....	981,361	....	26,916,892

A—*Showing the estimated amount in bushels, &c.*—Continued.

Products.	Amount of crop of 1865.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
PENNSYLVANIA.					
Indian corn ....bushels..	35,477,106	40	886,928	80	28,838,168
Wheat .... " ..	11,688,511	$12\frac{1}{5}$	958,075	2 $05\frac{2}{3}$	23,992,704
Rye .... " ..	6,569,690	$13\frac{1}{2}$	486,644	1 $37\frac{2}{3}$	9,034,271
Oats .... " ..	46,571,661	34	1,369,754	48	22,354,397
Barley .... " ..	603,470	$22\frac{1}{3}$	67,423	$96\frac{2}{3}$	583,354
Buckwheat......... " ..	7,199,058	$16\frac{1}{2}$	436,307	1 03	7,415,030
Potatoes .... " ..	12,028,353	$75\frac{1}{4}$	159,842	$98\frac{1}{6}$	11,787,786
Tobacco............pounds..	5,512,096	977	5,641	$09\frac{3}{11}$	511,121
Hay ....tons	2,463,545	$1\frac{3}{5}$	1,542,216	11 23	27,665,610
Total...............	....	....	5,912,830	....	132,682,441
MARYLAND.					
Indian corn ....bushels..	14,308,739	$31\frac{1}{10}$	$475,373\frac{1}{3}$	$76\frac{1}{10}$	10,888,950
Wheat .... " ..	5,479,635	$9\frac{5}{11}$	579,576	2 $06\frac{1}{2}$	11,315,446
Rye .... " ..	476,770	$10\frac{1}{4}$	45,692	$85\frac{7}{9}$	409,035
Oats .... " ..	6,135,779	$24\frac{1}{5}$	255,657	$43\frac{2}{5}$	2,644,520
Barley .... " ..	26,591	$27\frac{1}{2}$	967	$97\frac{1}{2}$	25,926
Buckwheat......... " ..	164,048	$22\frac{1}{5}$	7,411	97	159,127
Potatoes .... " ..	1,274,393	$65\frac{1}{2}$	19,456	84	1,070,490
Tobacco............pounds..	29,963,672	$690\frac{3}{5}$	$43,425\frac{2}{3}$	$11\frac{1}{2}$	3,445,922
Hay ....tons	181,341	$1\frac{1}{2}$	120,894	16 $42\frac{1}{2}$	2,978,525
Total...............	....	....	1,548,452	....	32,937,941
DELAWARE.					
Indian corn ....bushels..	3,892,337	$16\frac{1}{2}$	235,596	75	2,919,253
Wheat .... " ..	527,477	$7\frac{1}{2}$	70,330	2 00	1,054,954
Rye .... " ..	37,038	....	....	1 00	37,038
Oats .... " ..	1,884,437	12	157,036	47	885,685
Barley .... " ..	4,595	7	$656\frac{3}{7}$	95	4,365
Buckwheat......... " ..	15,641	$10\frac{1}{2}$	1,490	1 00	15,641
Potatoes .... " ..	360,294	$112\frac{1}{2}$	3,217	$77\frac{1}{2}$	277,426
Tobacco............pounds..	7,029	500	14	12	8,435
Hay ....tons	29,800	$1\frac{1}{4}$	23,840	17 00	506,600
Total...............	....	....	492,179	....	5,709,397
KENTUCKY.					
Indian corn ....bushels..	57,512,833	34	1,691,554	$43\frac{1}{3}$	24,922,247
Wheat .... " ..	2,788,184	$7\frac{1}{4}$	384,577	1 $70\frac{1}{2}$	4,753,854
Rye .... " ..	476,453	9	52,939	$93\frac{1}{3}$	444,689
Oats .... " ..	4,824,421	$24\frac{1}{3}$	198,264	46	2,219,234
Barley .... " ..	161,778	$21\frac{1}{9}$	7,703	1 09	176,338
Buckwheat......... " ..	13,478	$19\frac{3}{4}$	682	1 $50\frac{5}{8}$	20,301
Potatoes .... " ..	1,395,468	59	23,652	$90\frac{2}{3}$	1,265,224
Tobacco............pounds..	54,108,646	$736\frac{1}{2}$	73,517	12	6,493,037
Hay ....tons	127,301	$1\frac{2}{5}$	90,929	12 10	1,540,342
Total...............	....	....	2,523,817	....	41,835,266

A—*Showing the estimated amount in bushels, &c.*—Continued.

Products.	Amount of crop of 1865.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
OHIO.					
Indian corn ....bushels..	94,119,644	$41\frac{1}{2}$	2,267,943	$44\frac{3}{7}$	41,816,012
Wheat .... " ..	17,601,472	$9\frac{1}{2}$	$1,852,786\frac{1}{2}$	1 $59\frac{5}{7}$	28,112,065
Rye .... " ..	687,350	$12\frac{1}{2}$	54,988	$72\frac{4}{5}$	500,391
Oats .... " ..	18,963,608	$31\frac{2}{3}$	598,851	$34\frac{1}{6}$	6,579,233
Barley .... " ..	1,559,203	$22\frac{7}{10}$	68,687	$89\frac{1}{2}$	1,395,487
Buckwheat .... " ..	1,332,645	16	83,290	$91\frac{1}{3}$	1,217,149
Potatoes .... " ..	4,385,087	83	52,832	$91\frac{5}{6}$	4,026,971
Tobacco............pounds..	26,116,138	744	35,102	$9\frac{1}{10}$	2,376,568
Hay ....tons	2,158,021	$1\frac{2}{3}$	1,294,942	8 00	17,264,168
Total..................	....	....	6,309,421	....	103,288,044
MICHIGAN.					
Indian corn ....bushels..	17,520,305	$38\frac{1}{2}$	455,073	$60\frac{1}{9}$	10,706,850
Wheat .... " ..	16,378,488	$15\frac{2}{3}$	1,045,435	1 65	27,024,505
Rye .... " ..	413,150	$14\frac{1}{2}$	31,941	83	342,915
Oats .... " ..	7,275,331	$37\frac{3}{4}$	192,724	40	2,910,132
Barley .... " ..	391,562	$22\frac{2}{3}$	17,275	$96\frac{1}{2}$	377,847
Buckwheat .... " ..	1,136,365	20	56,818	88	1,000,001
Potatoes .... " ..	5,475,324	$145\frac{3}{7}$	37,760	$37\frac{1}{2}$	2,053,246
Tobacco............pounds..	273,320	1,300	2,103	$15\frac{1}{2}$	42,364
Hay ....tons	1,231,272	$1\frac{4}{5}$	684,040	12 $16\frac{2}{3}$	14,980,476
Total..................	....	....	1,523,169	....	59,438,336
INDIANA.					
Indian corn ....bushels..	116,069,316	$40\frac{2}{5}$	2,873,003	$38\frac{7}{10}$	44,918,823
Wheat .... " ..	13,020,803	$8\frac{1}{2}$	1,531,859	1 $35\frac{1}{2}$	17,643,188
Rye .... " ..	371,123	$12\frac{1}{5}$	30,420	$80\frac{1}{3}$	298,135
Oats .... " ..	8,062,351	$29\frac{3}{5}$	272,376	$35\frac{9}{10}$	2,894,384
Barley .... " ..	350,504	$22\frac{1}{5}$	15,779	$98\frac{1}{2}$	345,246
Buckwheat .... " ..	299,388	18	16,633	$87\frac{2}{3}$	262,426
Potatoes........ " ..	3,527,314	84	41,992	78	2,751,305
Tobacco............pounds..	8,547,889	$639\frac{1}{2}$	13,376	$10\frac{1}{6}$	869,035
Hay ....tons	1,251,646	$1\frac{2}{3}$	750,988	9 40	11,765,472
Total..................	....	....	5,546,426	....	81,748,014
ILLINOIS.					
Indian corn ....bushels..	177,095,852	$35\frac{1}{4}$	5,023,996	$29\frac{1}{4}$	51,800,526
Wheat .... " ..	25,266,745	11	2,296,977	1 09	27,541,732
Rye .... " ..	833,069	$16\frac{1}{3}$	51,004	$49\frac{1}{3}$	410,977
Oats .... " ..	28,088,197	35	802,520	24	6,741,167
Barley .... " ..	1,058,931	21	50,425	$56\frac{3}{4}$	600,943
Buckwheat........ " ..	287,379	$17\frac{1}{2}$	16,422	$89\frac{4}{5}$	258,066
Potatoes .... " ..	5,864,408	117	50,124	$47\frac{1}{4}$	2,770,933
Tobacco............pounds..	18,867,722	777	24,283	$10\frac{7}{16}$	1,969,316
Hay ....tons	2,600,070	$1\frac{1}{2}$	1,733,380	9 30	24,180,651
Total..................	....	....	10,049,131	....	116,274,321

A.—*Showing the estimated amount in bushels, &c.*—Continued.

Products.	Amount of crop of 1865.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
MISSOURI.					
Indian corn ....bushels..	52,021,715	39	1,333,890	52	27,051,292
Wheat .... " ..	2,953,363	$12\frac{3}{4}$	231,636	1 $62\frac{2}{3}$	4,824,336
Rye............... " ..	218,529	$16\frac{2}{3}$	13,111	$89\frac{3}{4}$	196,229
Oats .... " ..	2,501,013	$26\frac{3}{8}$	90,534	$45\frac{5}{6}$	1,146,297
Barley .... " ..	148,855	$23\frac{1}{4}$	6,402	$117\frac{3}{11}$	174,566
Buckwheat......... " ..	72,461	$20\frac{1}{2}$	3,535	89	64,490
Potatoes .... " ..	1,139,057	$122\frac{2}{7}$	9,347	$62\frac{1}{3}$	720,011
Tobacco...........pounds..	15,237,982	940	16,211	$13\frac{3}{8}$	2,038,080
Hay ....tons	519,479	$1\frac{3}{4}$	296,702	12 33	6,301,276
Total...............	....	....	2,001,368	....	42,516,577
WISCONSIN.					
Indian corn ....bushels..	13,449,405	$41\frac{1}{3}$	324,084	46	6,209,726
Wheat .... " ..	20,307,920	$16\frac{4}{5}$	1,208,805	1 09	22,135,632
Rye .... " ..	945,400	$17\frac{1}{4}$	54,806	63	595,602
Oats .... " ..	18,466,758	$40\frac{2}{3}$	454,100	28	5,170,692
Barley .... " ..	843,649	$26\frac{1}{2}$	31,836	$70\frac{7}{10}$	596,455
Buckwheat......... " ..	85,466	20	4,273	69	58,972
Potatoes .... " ..	4,925,341	$141\frac{2}{3}$	34,931	36	1,773,123
Tobacco...........pounds..	162,891	1,300	$125\frac{1}{4}$	12	19,547
Hay ....tons	1,066,182	$1\frac{1}{2}$	710,788	10 14	10,811,085
Total...............	....	....	2,823,748	....	47,370,834
IOWA.					
Indian corn ....bushels..	62,997,813	$42\frac{3}{5}$	1,478,822	30	18,899,344
Wheat .... " ..	13,698,542	$14\frac{3}{5}$	938,229	1 $00\frac{1}{4}$	13,702,788
Rye .... " ..	119,333	$18\frac{1}{3}$	6,629	59	70,406
Oats .... " ..	12,007,380	$38\frac{1}{7}$	315,984	$26\frac{1}{5}$	3,145,934
Barley .... " ..	561,068	$25\frac{1}{7}$	20,403	$56\frac{1}{2}$	317,003
Buckwheat......... " ..	298,646	$18\frac{2}{3}$	15,999	82	244,890
Potatoes .... " ..	3,360,641	$120\frac{1}{3}$	$28,005\frac{1}{3}$	43	1,445,176
Tobacco...........pounds..	419,811	$883\frac{1}{3}$	$475\frac{1}{3}$	$19\frac{1}{2}$	81,863
Hay ....tons	1,018,455	$1\frac{3}{4}$	581,974	7 $35\frac{1}{2}$	7,590,737
Total...............	....	....	3,386,520	....	45,498,141
MINNESOTA.					
Indian corn ....bushels..	5,577,795	38	146,784	$51\frac{1}{2}$	2,872,564
Wheat .... " ..	3,425,467	$20\frac{3}{5}$	171,273	80	2,740,374
Rye .... " ..	178,171	$22\frac{1}{8}$	8,099	65	125,811
Oats .... " ..	3,388,848	$41\frac{1}{2}$	81,659	39	1,321,651
Barley .... " ..	178,310	29	6,149	55	98,071
Buckwheat......... " ..	35,414	23	1,540	80	28,331
Potatoes .... " ..	3,244,711	197	16,420	35	1,136,649
Tobacco...........pounds..	30,029	1,000	30	20	6,005
Hay ....tons	274,217	$1\frac{7}{10}$	161,304	8 59	2,355,524
Total...............	....	....	593,258	....	10,684,980

A—*Showing the estimated amount in bushels, &c.*—Continued.

Products.	Amount of crop of 1865.	Average yield per	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
KANSAS.					
Indian corn ....bushels..	6, 729, 236	$41\frac{1}{6}$	163, 463	53	3, 566, 495
Wheat .... " ..	191, 519	$15\frac{1}{5}$	12, 768	1 77	338, 989
Rye .... " ..	4, 061	23	$176\frac{1}{2}$	1 09	4, 426
Oats .... " ..	155, 290	$34\frac{1}{8}$	$4, 567\frac{1}{3}$	$66\frac{1}{4}$	102, 880
Barley .... " ..	6, 661	$28\frac{1}{3}$	235	1 $10\frac{4}{5}$	7, 332
Buckwheat .... ' ..	24, 288	$25\frac{1}{4}$	962	1 $52\frac{1}{2}$	37, 039
Potatoes .... " ..	276, 720	119	2, 325	97	268, 419
Tobacco...........pounds..	22, 043	533	$41\frac{1}{4}$	25	5, 511
Hay ....tons	118, 348	2	59, 174	8 00	946, 784
Total................	....	....	243, 712	....	5, 347, 875
NEBRASKA TERRITORY.					
Indian corn ....bushels..	2, 494, 084	$46\frac{1}{2}$	53, 636	59	4, 471, 510
Wheat .... " ..	166, 348	18	$9, 241\frac{5}{9}$	1 49	247, 859
Rye .... " ..	2, 080	18	116	1 00	2, 080
Oats .... " ..	335, 926	$38\frac{2}{3}$	8, 614	$53\frac{4}{11}$	179, 262
Barley .... " ..	6, 297	$26\frac{5}{9}$	242	1 $16\frac{7}{8}$	7, 356
Buckwheat .... " ..	6 146	$26\frac{2}{3}$	$230\frac{1}{2}$	1 $37\frac{1}{2}$	8, 440
Potatoes .... " ..	171, 885	$138\frac{2}{3}$	1, 246	$64\frac{1}{2}$	110, 866
Tobacco...........pounds..	1, 270	500	$2\frac{1}{2}$	$20\frac{1}{2}$	260
Hay ....tons	29, 425	2	$14, 712\frac{1}{2}$	5 64	165, 957
Total................	....	....	88, 041	....	5, 193, 590

TABLE B.—*A general summary showing the estimated number of bushels, &c., of each crop, the number of acres of each, the value of each, and the bushels, acres, and value of all, and the increase and decrease of the same, for the years* 1863, 1864, *and* 1865, *and the comparison between* 1864 *and* 1865.

ESTIMATED AMOUNT OF CROPS.

	1863.	1864.	1865.	Increase in 1865.	Decrease in 1865.
Indian corn.bush.	397, 839, 212	530, 451, 403	704, 427, 853	173, 976, 450	....
Wheat ...... do..	173, 677, 928	160, 695, 823	148, 522, 827	....	12, 172, 996
Rye.........do..	19, 989, 335	19, 872, 975	19, 543, 905	....	329, 070
Oats ....do..	170, 129, 864	175, 990, 194	225, 252, 295	49, 262, 101	....
Barley ...... do..	12, 158, 195	10, 716, 328	11, 391, 286	674, 958	....
Buckwheat .. do..	15, 786, 122	18, 700, 540	18, 331, 019	....	369, 521
Potatoes.....do..	98, 965, 198	96, 532, 029	101, 032, 095	4, 500, 066	....
Total....do..	888, 546, 554	1, 012, 959, 292	1, 228, 501, 280	228, 413, 575	12, 871, 587
Tobacco..pounds.	163, 353, 082	197, 460, 229	185, 316, 953	....	12, 143, 276
Hay ....tons.	18, 346, 730	18, 116, 691	23, 538, 740	5, 422, 049	....

ESTIMATED ACREAGE OF CROPS.

Indian corn . acres .	15,312,441	17,438,752	18,990,180	1,551,428	....
Wheat .... do ..	13,098,936	13,158,089	12,304,894	....	853,195
Rye .... do ..	1,439,607	1,410,983	1,396,123	....	14,860
Oats .... do ..	6,686,174	6,461,750	6,894,091	432,341	....
Barley .... do ..	557,299	540,317	542,175	1,858	....
Buckwheat .. do ..	1,054,060	1,051,700	1,057,084	5,384	....
Potatoes .... do ..	1,129,804	902,295	964,614	62,319	....
Tobacco ..... do ..	216,423	239,826	236,363	....	3,463
Hay .... do ..	15,641,504	15,034,564	16,323,852	1,289,288	....
Total ..... do ..	55,136,248	56,238,276	58,709,376	3,342,618	871,518

ESTIMATED VALUE OF CROPS.

Indian corn	$278,089,609	$527,718,183	$324,168,698	....	$203,549,485
Wheat	197,992,837	294,315,119	217,330,195	....	76,984,924
Rye	20,589,015	31,975,013	21,313,283	....	10,631,730
Oats	105,990,905	139,381,247	93,745,314	....	45,635,933
Barley	13,496,373	16,941,023	10,330,294	....	6,610,729
Buckwheat	12,660,469	21,986,763	18,063,325	....	3,923,438
Potatoes	55,024,650	77,184,043	65,218,428	....	11,965,615
Tobacco	24,239,609	29,335,225	23,348,013	....	5,987,212
Hay	247,680,855	365,707,074	273,812,617	....	91,894,457
Total value ...	955,764,322	1,504,543,690	1,047,360,167	....	457,183,523

EXPLANATION OF THE FOREGOING TABLES.

Table A shows the estimated quantity in bushels, pounds, or tons of the crop of 1865, with the average estimated yield per acre, the price and the total value. The quantity is estimated from the returns of county correspondents, reported in tenths of the previous crop, showing increase or decrease as the report gives more or less than ten tenths. These county returns, equitably averaged, give at least the united, deliberate judgment of a corps of careful resident observers; and if it is not absolutely correct, as it is not pretended to be, it is the nearest approximate estimate ever yet attained for the guidance of interested producers and consumers who always do and ever will seek greedily current judgments concerning crop productions, however incomplete, partial, and unreliable.

Table B shows the estimated quantity, acreage, and value of the principal crops of 1863, 1864, and 1865.

The immense value of the nine products enumerated, amounting to one-third of the entire aggregate of the national debt, exhibits the magnitude of our national agriculture. The extraordinary prices prevalent in 1864, arising from the war demand and rise in gold, swell the aggregate to $1,504,543,690, about fifty per cent. more than in 1865, when the aggregate quantity produced was actually greater. It is possible, perhaps probable, that the next exhibit will show prices still further reduced.

If, in addition to these products, the crops of cotton, hemp, sugar-cane, sorghum, tobacco, garden vegetables, fruits, and a multitude of small products, not enumerated, could be introduced into a grand aggregate, the sum would astonish even the political economist.

The following statement of the average rate of gold during the war will assist in understanding these variable values:

Years.	Value of crops.	Rate of gold.	Gold increase per cent.	Increase value of crops per cent.
1862	$706,887,495	131		
1863	955,764,322	147	12	35
1864	1,440,415,435	227	54	50
1865	1,047,360,167	140	38½ decrease.	30.4 decrease.

AVERAGE VALUE OF CROPS PER ACRE.

The following tables are deductions from data furnished by the corps of statistical observers who have reported to this department during the last four years. A comparison of figures for the different States, furnished by independent parties who could have no collusion with each other, will show a similarity in circumstances that are similar, and marked differences where one would naturally expect them from superior culture or proximity to markets, that furnish indubitable evidences of approximate correctness. And yet they are not assumed to be entirely accurate, nor yet so accurate as they may be made in the future.

It will excite surprise in the superficial observer, but not in the thinking mind, that "sterile New England" should show so large a value of products per acre. This value results primarily from the markets created by manufactures, which also furnish the means and the inducements to artificial fertilization, and an encouragement to a greater expenditure of labor. It should be remembered that an acre of corn in New England means more than one hundred and sixty rods of soil slightly scratched; it means also manure and hard work. As to actual profit, in proportion to labor and money expended, it may, or it may not, equal a similar expenditure in the west.

These tables teach, not only the value of *home markets*, but show how excessive charges for transportation are eating out the substance of the west, reducing home prices and farmers' profits, and consigning corn to the grate or furnace. It should teach the west to diversify its industry, and divert labor from wheat-growing to industries which make light products. It should teach the west to consume its own wheat and corn, as far as possible, and save to its soil the elements of its fertility that are now wasted in the rivers of the east and of Europe.

The cost of transportation is in part the cause of the following receding scale of values, from east to west:

States.	Value of corn.	Value of wheat.
Vermont	$48 80	$29 03
New Jersey	37 30	28 25
Maryland	24 19	21 73
Ohio	20 20	16 25
Indiana	17 96	16 30
Illinois	14 47	14 36
Iowa	19 59	12 85

Nor is the difference due to yield, notwithstanding the fertilizers and the labor employed in the east, as is seen:

States.	Bushels corn per acre.	Bushels wheat per acre.
Vermont	37.61	15.07
New Jersey	36.25	15.6
Maryland	25.9	11.5
Ohio	32.91	12.19
Indiana	33.85	13.1
Illinois	32.56	12.83
Iowa	36.06	13.7

These differences scarcely exist as to barley, for which the market is much the same in different sections. It is, moreover, a minor crop.

TABLE C.—*Showing the estimated average value of farm products per acre for the States named, from* 1862 *to* 1865, *inclusive.*

Articles.	MAINE.				NEW HAMPSHIRE.			
	1862.	1863.	1864.	1865.	1862.	1863.	1864.	1865.
Indian corn	$31 96	$36 27	$56 70	$41 14	$34 58	$35 10	$61 72	$40 10
Wheat	24 80	21 12	27 18	28 80	22 95	26 88	33 50	39 74
Rye	17 64	15 60	24 54	19 36	16 38	20 64	29 58	20 56
Oats	15 12	16 75	22 22	15 86	11 56	16 74	22 08	20 06
Barley	22 04	24 84	26 10	19 20	20 54	24 84	30 42	23 63
Buckwheat	18 20	12 76	24 32	18 45	13 80	23 80	25 31	16 53
Potatoes	53 55	50 85	95 81	78 95	39 24	51 52	98 40	81 94
Tobacco	....	....	....	165 00	....	200 00	246 25	176 00
Hay	11 11	11 44	18 37	11 81	13 80	14 00	21 00	14 70

	VERMONT.				MASSACHUSETTS.			
Corn	$30 45	$38 28	$76 05	$50 42	$31 45	$39 60	$64 26	$36 83
Wheat	21 60	18 96	36 05	39 50	27 37	27 16	38 56	38 99
Rye	12 90	17 55	28 57	20 50	13 75	20 64	30 00	19 10
Oats	14 44	19 20	28 71	20 87	17 50	20 80	27 35	18 72
Barley	18 72	27 82	35 42	31 26	22 62	22 88	35 60	23 60
Buckwheat	12 69	14 64	19 99	19 50	15 12	16 53	20 31	18 83
Potatoes	33 75	48 50	87 75	68 88	55 46	72 08	123 22	76 99
Tobacco	....	160 00	....	150 00	160 16	318 00	412 50	270 00
Hay	8 80	8 59	17 95	13 80	14 95	23 44	29 00	28 00

	RHODE ISLAND.				CONNECTICUT.			
Corn	$31 08	$40 95	$63 22	$38 58	$26 88	$39 60	$56 11	$38 28
Wheat	30 00	24 00	37 50	....	24 48	25 05	39 19	41 56
Rye	18 06	20 40	34 00	22 05	12 04	17 36	28 65	18 37
Oats	21 60	19 60	32 58	21 94	15 84	20 88	30 00	23 82
Barley	28 50	27 14	41 00	36 43	21 25	26 50	42 54	32 20
Buckwheat	15 30	18 00	....	....	11 20	13 02	22 41	17 47
Potatoes	69 44	73 15	124 31	88 68	48 60	71 69	108 73	92 45
Tobacco	....	287 50	405 00	300 00	182 00	312 50	362 50	405 00
Hay	19 00	25 00	31 50	25 31	12 60	18 75	32 40	29 37

Estimated average value of farm products per acre, &c.—Continued.

	NEW YORK.				NEW JERSEY.			
Corn	$23 [illegible]	$33 00	$49 28	$22 80	$25 16	$34 00	$53 87	$36 19
Wheat	22 [illegible]	19 46	30 50	31 96	24 70	24 48	34 95	28 86
Rye	14 44	14 98	24 72	15 50	14 04	17 10	22 88	14 04
Oats	16 10	19 60	21 62	17 73	15 18	17 52	29 62	16 48
Barley	30 74	24 78	32 69	22 54	18 75	23 54	35 70	24 64
Buckwheat	11 88	11 68	20 58	17 10	16 33	14 40	24 48	20 83
Potatoes	47 50	42 00	76 12	66 34	55 00	46 50	93 60	78 73
Tobacco	120 00	233 40	212 93	152 74	....	216 00	....	200 00
Hay	14 00	16 25	25 48	17 26	15 00	28 50	41 98	24 30

Articles.	PENNSYLVANIA.				MARYLAND.			
	1862.	1863.	1864.	1865.	1862.	1863.	1864.	1865.
Corn	$20 16	$31 02	$45 64	$32 00	$17 36	$20 93	$34 83	$23 66
Wheat	21 96	19 88	28 80	25 09	19 46	18 04	29 90	19 52
Rye	12 96	14 04	24 25	17 57	12 80	12 96	22 96	8 79
Oats	13 69	17 25	25 45	16 32	10 40	9 45	19 14	10 50
Barley	24 65	26 62	30 78	21 58	27 84	24 00	47 65	26 81
Buckwheat	14 40	12·45	21 87	17 00	18 27	18 69	30 97	21 53
Potatoes	57 00	60 14	98 19	73 87	62 37	50 41	66 00	55 02
Tobacco	156 24	324 80	197 67	89 59	102 63	65 00	102 50	79 41
Hay	16 00	19 00	31 91	17 97	21 00	27 50	36 00	24 64

	DELAWARE.				KENTUCKY.			
Corn	$10 40	$25 00	$31 51	$12 37	....	....	$27 55	$14 73
Wheat	16 80	28 80	30 36	15 00	....	....	20 14	12 36
Rye	10 80	10 00	24 54	....	....	....	18 16	8 40
Oats	8 75	14 00	19 20	5 64	....	....	19 22	11 19
Barley	42 50	24 00	50 63	6 65	....	....	37 14	23 01
Buckwheat	15 00	10 00	20 00	10 50	....	....	27 96	29 74
Potatoes	56 00	60 00	165 00	87 18	....	....	89 01	53 49
Tobacco	36 00	54 00	....	60 00	....	....	92 40	88 38
Hay	19 25	25 00	45 00	21 25	....	....	26 88	16 94

	OHIO.				MICHIGAN.			
Corn	$14 52	$17 76	$30 08	$18 43	$17 22	$20 72	$30 66	$23 14
Wheat	15 36	14 69	19 78	15 17	18 00	17 03	23 52	25 85
Rye	9 60	12 32	16 19	9 09	9 72	11 57	16 70	12 03
Oats	4 95	13 92	20 84	10 82	8 06	14 85	19 68	15 10
Barley	19 75	25 30	36 92	20 31	21 00	22 89	30 03	21 87
Buckwheat	12 19	9 57	18 70	14 61	9 89	9 70	14 22	17 60
Potatoes	40 80	54 72	87 60	76 22	41 54	48 96	64 38	54 53
Tobacco	103 40	105 98	117 52	67 70	130 00	198 03	200 00	201 50
Hay	10 50	16 75	25 77	13 33	12 00	14 06	21 48	21 90

Estimated average value of farm products per acre, &c.—Continued.

	INDIANA.				ILL[illegible]IS.			
Corn	$12 18	$16 32	$27 70	$15 63	$9 20	[illegible]3 64	$24 75	$10 32
Wheat	14 08	15 12	24 50	11 51	10 64	2 60	22 21	11 99
Rye	10 60	14 88	18 34	9 80	8 60	11 84	15 22	8 05
Oats	4 05	13 92	19 18	10 62	4 80	13 44	19 01	8 40
Barley	25 49	28 57	37 44	21 86	21 60	20 90	30 14	11 91
Buckwheat	12 50	13 76	23 00	15 78	9 89	7 81	18 70	15 71
Potatoes	44 80	47 12	79 60	65 52	40 00	51 80	93 44	55 28
Tobacco	133 08	92 28	119 84	65 01	154 14	84 92	146 42	81 09
Hay	12 18	18 12	26 72	15 67	13 60	17 25	23 00	13 95

Articles.	MISSOURI.				WISCONSIN.			
	1862.	1863.	1864.	1865.	1862.	1863.	1864.	1865.
Corn	$9 88	$15 08	$26 00	$20 28	$16 00	$17 01	$29 14	$19 09
Wheat	13 09	16 32	24 85	20 73	13 26	12 88	14 09	18 31
Rye	7 65	10 88	17 44	14 95	8 82	11 10	13 37	10 87
Oats	7 56	14 25	18 05	12 08	14 28	14 04	16 50	11 38
Barley	21 06	22 54	33 97	27 26	23 43	21 12	19 74	18 73
Buckwheat	12 00	10 08	16 81	18 24	11 44	7 60	14 64	13 80
Potatoes	36 49	60 75	68 38	76 23	48 32	37 83	64 90	51 00
Tobacco	120 00	86 25	76 27	125 72	144 00	134 29	147 00	156 00
Hay	12 00	17 50	25 89	21 78	11 80	13 50	14 86	15 21

	IOWA.				MINNESOTA.			
Corn	$30 02	$10 80	$24 78	$12 78	$17 10	$14 03	$31 02	$19 57
Wheat	9 66	10 64	16 48	14 63	11 20	9 80	15 15	16 48
Rye	9 20	10 62	13 80	10 81	6 72	10 80	13 19	14 52
Oats	8 58	10 14	16 96	10 00	13 33	17 28	21 13	16 18
Barley	15 66	20 16	25 25	14 20	16 66	19 20	21 83	15 95
Buckwheat	10 73	14 88	19 95	15 31	10 92	10 79	20 97	18 40
Potatoes	46 08	37 31	84 51	51 74	43 75	45 32	75 60	68 95
Tobacco	113 28	134 10	239 25	172 24	125 40	84 00	160 00	200 00
Hay	16 00	12 25	15 45	12 87	12 00	9 00	14 04	14 60

	KANSAS.				NEBRASKA TERRITORY.			
Corn	$12 80	$13 20	$34 25	$21 82	....	....	$28 21	$27 43
Wheat	15 54	14 08	30 15	26 90	....	....	21 00	26 82
Rye	14 84	12 40	21 25	25 07	....	....	20 64	18 00
Oats	10 23	11 40	27 98	22 60	....	....	19 13	20 63
Barley	24 05	21 50	29 21	31 39	....	....	24 50	31 03
Buckwheat	15 30	13 23	18 75	38 50	....	....	....	36 66
Potatoes	52 92	47 94	115 24	115 43	....	....	107 47	89 43
Tobacco	205 00	176 00	75 94	133 25	....	....	....	102 50
Hay	10 20	10 00	21 67	16 00	....	....	9 99	11 28

TABLE D.—*Showing the average cash value of farm products per acre for four years, from 1862 to 1865, inclusive.*

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Potatoes.	Tobacco.	Hay.
Maine	$41 52	$25 48	$19 28	$17 49	$23 04	$18 43	$69 79	$165 00	$13 18
New Hampshire	42 87	30 77	21 79	17 61	24 85	19 86	67 77	200 00	15 87
Vermont	48 80	29 03	19 88	20 80	28 30	16 70	59 72	155 00	12 28
Massachusetts	43 03	33 02	20 87	21 09	26 17	17 70	81 94	290 16	23 85
Rhode Island	43 46	30 87	23 63	23 93	33 27	18 00	88 89	293 62	25 20
Connecticut	40 22	32 57	19 10	22 63	30 62	16 02	80 37	315 50	23 28
New York	32 04	26 10	17 41	18 76	27 69	15 31	57 99	179 77	18 25
New Jersey	37 30	28 25	17 01	19 70	25 66	19 01	68 46	208 00	27 44
Pennsylvania	32 20	23 93	17 20	18 18	25 91	16 43	72 30	192 07	21 22
Maryland	24 19	21 73	14 38	12 37	31 57	22 36	58 45	87 38	27 28
Delaware	19 82	22 74	15 11	11 90	30 94	13 87	92 04	50 00	27 62
Kentucky*	21 14	16 25	13 28	15 20	30 07	28 85	71 25	90 39	21 91
Ohio	20 20	16 25	11 80	12 63	25 57	13 77	64 83	98 65	16 59
Michigan	22 93	21 10	12 50	14 42	23 95	12 85	52 35	182 38	17 36
Indiana	17 96	16 30	13 40	11 94	28 34	16 26	59 26	102 55	18 17
Illinois	14 47	14 36	10 93	11 41	21 14	13 03	60 13	116 64	16 95
Missouri	17 81	18 75	12 73	12 98	26 21	14 28	60 46	102 06	19 29
Wisconsin	20 31	14 63	11 04	14 05	20 75	11 87	50 51	145 32	13 84
Iowa	19 59	12 85	11 11	11 42	18 82	15 22	54 91	164 72	14 14
Minnesota	20 43	13 16	11 31	16 98	18 41	15 27	58 40	142 35	12 41
Kansas	20 52	21 67	18 39	18 05	26 54	21 44	82 88	147 55	14 47
Nebraska Territory*	27 82	23 91	19 32	19 88	27 76	36 66	98 45	102 50	10 63

*Average of 1864–'65. No returns for 1862–'63.

TABLE E.—*Showing the average yield of farm products per acre for four years, from 1862 to 1865, inclusive.*

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Potatoes.	Tobacco.	Hay.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Lbs.*	*Lbs.*
Maine	31.5	12.86	14.37	27.25	22.50	22.37	136.87	750. ‡	1868.
New Hampshire	32.62	14.19	16.12	28.62	22.06	18.85	126.37	862. †	2075.
Vermont	37.64	15.07	15.3	35.	25.18	24.05	139.62	775. §	2150.
Massachusetts	33.7	16.15	15.18	28.32	21.87	18.71	115.31	1298.5	2408.
Rhode Island	33.44	17. †	18.25	34.62	26.12	17.5	113.5	1166.6†	2219.
Connecticut	31.8	16.5	14.25	31.94	24.25	15.7	116.8	1337.5	2375.
New York	30.33	15.08	15.7	30.1	22.7	18.5	107.8	1078.5	2577.
New Jersey	36.25	15.6	15.	30.47	22.25	17.9	88.05	1100. §	3044.
Pennsylvania	34.6	14.05	14.7	31.3	22.8	18.5	99.14	1070.4	2750.
Maryland	25.9	11.5	16.06	23.5	27.79	23.2	74.9	778.9	2891.
Delaware	20.46	13.13	14.55	20.25	19.75	17.62	106.1	366.66	2750.
Kentucky*	31.25	8.75	11.2	24.29	22.22	20.08	70.05	353.25	2733.33
Ohio	32.91	12.19	13.69	24.9	23.34	16.75	82.75	827.9	2733.33
Michigan	32.96	14.66	14.44	29.19	22.7	16.25	113.6	1066.5	2831.
Indiana	33.85	13.1	15.55	23.65	24.55	19.4	84.5	843.4	3078.
Illinois	32.56	12.83	16.83	27.5	25.4	17.1	92.06	862.75	3100.
Missouri	33.2	14.99	16.58	26.15	24.06	18.8	88.3	813.	2964.
Wisconsin	34.9	14.3	15.62	34.29	23.69	18.1	126.9	1128.25	2809.
Iowa	36.06	13.7	18.53	33.8	24.8	20.29	107.8	882.3	3550.
Minnesota	34.75	16.98	19.66	35.06	26.75	19.9	146.75	910.	3350.
Kansas	37.54	16.8	22.	31.5	28.3	22.8	93.	778.25	3683.
Nebraska Territory*	37.5	16.	17.	16.66	23.27	‡26.66	95.16	587.5	3333.

* For 1864–'65. † Average of 1863–'64–'65. ‡ Average of 1865. § Average of 1863–65.

THE FARM STOCK OF 1865.

The estimates of the number of each kind of farm stock are made for each county by our corps of statistical correspondents according to their best judgment, after careful examination and mature reflection, first, in comparison with the published census returns, and then, year by year, with the estimates of the preceding year, the expression being in a certain number of tenths of such preceding crop. These estimates were made in January, 1866, and show 3,899,019 horses, against 3,740,933 in January, 1865. Mules, 250,151; for 1864, 247,553. Cows, 5,779,644; for 1864, 5,768,130. Other cattle, 6,895,324; for 1864, 7,072,591. Sheep, 32,695,797; for 1864, 28,647,269. Hogs, 13,616,876; for 1864, 13,070,887.

TABLE F.—*Showing the estimated total number and total value of each kind of live stock, and the general average price thereof, for each State, for February,* 1866.

States.	HORSES.			MULES.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	50,844	$83 82	$4,262,955	140	$75 00	$10,500
New Hampshire	34,749	74 38	2,335,139	9	42 22	380
Vermont	47,781	72 31	3,651,752	42	70 00	3,325
Massachusetts	48,509	79 00	3,839,970	119	....	....
Rhode Island	6,828	89 00	607,916	....	....	....
Connecticut	38,009	82 56	3,138,108	105	145 00	15,225
New York	408,763	92 41	37,774,098	2,078	100 43	218,795
New Jersey	79,599	116 77	9,295,228	7,497	122 00	914,715
Pennsylvania	396,623	95 31	37,803,438	13,915	108 43	1,506,848
Maryland	83,334	85 90	7,358,599	10,558	102 65	1,083,852
Delaware	15,523	80 10	1,244,500	2,280	92 28	210,400
Kentucky	209,136	76 97	16,099,176	59,752	101 98	6,073,718
Ohio	520,498	74 37	38,710,308	7,539	89 33	675,251
Michigan	171,956	88 22	15,169,612	699	106 69	74,574
Indiana	377,215	73 80	27,839,973	21,878	91 00	1,991,071
Illinois	574,205	79 61	45,715,740	50,899	98 00	5,033,951
Missouri	235,375	74 11	17,453,777	52,127	95 76	4,982,345
Wisconsin	174,608	100 38	17,527,344	1,956	113 00	221,211
Iowa	342,136	85 82	29,365,545	14,036	110 65	1,553,107
Minnesota	39,500	105 33	4,160,565	789	117 00	93,342
Kansas	32,469	77 28	2,509,383	2,490	92 31	229,854
Nebraska Ter	11,359	97 00	1,022,687	1,243	128 56	147,375
Total	3,899,019	....	326,885,813	250,151	....	25,039,839
Average price	....	83 84	....	....	100 09	....

TABLE F—Continued.

States.	COWS.			OTHER CATTLE.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	129,891	$56 28	$7,310,265	155,541	$41 70	$6,486,625
New Hampshire	74,378	43 22	3,214,617	114,770	38 15	4,378,492
Vermont	162,356	54 28	8,812,684	143,404	43 00	6,169,644
Massachusetts	127,415	62 00	7,899,730	116,758	37 94	4,430,330
Rhode Island	20,581	65 66	1,351,485	20,417	46 53	950,160
Connecticut	112,482	53 75	6,045,907	139,754	41 67	5,824,299
New York	1,237,631	55 14	68,242,973	726,412	38 53	28,995,667
New Jersey	131,170	70 00	9,181,900	89,790	48 58	4,362,510
Pennsylvania	655,397	51 18	33,962,485	693,351	34 72	24,079,491
Maryland	94,845	41 20	3,907,614	115,623	25 43	2,900,022
Delaware	19,215	75 00	1,441,125	30,143	39 72	1,198,555
Kentucky	155,112	50 00	7,755,600	391,764	35 38	13,789,986
Ohio	664,065	47 33	31,432,410	711,531	31 76	22,598,264
Michigan	219,784	43 52	9,564,100	296,111	31 56	9,347,791
Indiana	422,883	50 33	21,285,111	502,844	25 00	12,691,659
Illinois	523,761	34 84	18,247,833	922,874	21 64	19,964,055
Missouri	251,088	32 87	8,253,261	447,456	22 61	10,119,166
Wisconsin	284,286	35 33	10,044,872	375,802	28 12	10,588,108
Iowa	313,739	30 12	9,451,387	570,693	23 15	13,215,097
Minnesota	86,644	34 92	3,025,608	135,653	27 60	3,744,542
Kansas	71,996	27 94	2,013,568	130,307	25 00	3,256,499
Nebraska Ter	20,925	34 86	637,166	64,326	26 22	1,687,174
Total	5,779,644		273,081,701	6,895,324		210,778,136
Average price		47 25			35 57	

States.	SHEEP.			HOGS.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	1,041,724	$4 67	$4,870,060	35,355	$24 64	$771,406
New Hampshire	677,571	4 84	3,273,796	31,333	21 00	660,198
Vermont	1,377,296	5 92	8,163,922	32,908	20 43	672,405
Massachusetts	210,036	5 30	1,063,306	45,549	22 61	1,029,858
Rhode Island	35,884	6 00	216,021	11,690	21 41	250,335
Connecticut	188,308	5 97	1,123,727	52,356	20 12	1,053,664
New York	5,117,148	5 00	25,688,083	671,984	14 33	9,632,890
New Jersey	181,096	6 55	1,186,179	192,630	15 64	3,014,653
Pennsylvania	3,230,440	4 90	15,837,222	892,032	11 94	10,658,259
Maryland	262,576	5 83	1,531,693	368,396	9 17	3,380,033
Delaware	17,500	4 25	74,374	32,098	9 37	300,915
Kentucky	864,068	3 97	3,394,920	1,794,556	7 37	13,234,850
Ohio	6,568,052	4 58	30,103,572	1,838,481	9 62	17,695,377
Michigan	3,473,075	4 26	14,795,200	351,017	8 66	3,139,845
Indiana	2,783,367	3 30	9,393,864	2,261,780	6 83	15,455,393
Illinois	2,446,081	3 77	9,240,417	1,976,208	8 73	17,257,236
Missouri	830,999	2 87	2,391,200	988,857	5 88	5,816,950
Wisconsin	1,260,900	4 71	5,945,143	357,668	9 25	3,308,429
Iowa	1,950,752	3 78	7,378,719	1,423,568	7 71	10,982,827
Minnesota	90,496	4 22	382,119	127,701	9 91	1,265,031
Kansas	82,662	3 80	314,253	95,429	8 42	803,749
Nebraska Ter	15,766	3 67	57,907	35,280	8 20	288,855
Total	32,695,797		146,425,697	13,616,876		120,673,158
Average price		4 50			8 86	

TABLE G.—*Showing the total value of live stock in the following States for the years* 1860, 1865, *and* 1866.

	1860.	January, 1865.	February, 1866.
Maine	$15,437,533	$21,539,128	$23,711,811
New Hampshire	10,924,627	13,560,612	13,862,622
Vermont	16,241,989	24,905,952	27,473,732
Massachusetts	12,737,744	17,638,783	18,263,194
Rhode Island	2,042,044	2,675,029	3,375,917
Connecticut	11,311,079	13,844,574	17,200,930
New York	103,856,296	148,536,690	170,552,506
New Jersey	16,134,693	22,415,429	27,955,185
Pennsylvania	69,672,726	105,862,161	123,847,743
Maryland	14,667,853	19,139,655	20,161,813
Delaware	3,144,706	3,545,607	4,469,869
Kentucky	61,868,237	56,729,634	60,348,250
Ohio	80,384,819	126,979,891	141,215,182
Michigan	23,714,771	47,311,803	52,091,122
Indiana	41,855,539	82,543,704	88,657,071
Illinois	72,501,225	116,588,288	115,459,232
Missouri	53,693,673	44,431,766	49,016,699
Wisconsin	17,807,375	36,911,165	47,635,107
Iowa	22,476,293	66,572,496	71,946,682
Minnesota	3,642,841	8,860,015	12,671,207
Kansas	3,332,450	7,324,659	9,127,306
Nebraska Territory	1,128,771	3,216,312	3,841,164
Total	658,577,284	991,133,353	1,102,884,344

FARM STOCK OF THE UNITED STATES AND EUROPE.

A comparison of the farm stock of this country and European nations illustrates well the extent and munificence of our agricultural resources. A vast area of great fertility has enabled us, in the very brief period of our national history, to secure an ampler supply of meat than any other civilized nation in proportion to population.

There has been a loss, to be sure, since 1860, by the waste of the war, in every thing except sheep. It is a loss, however, that stock-growing enterprise, stimulated by high prices, will soon repair. The increase of sheep to double their numbers in 1860 is an earnest of what can be accomplished by such an incitement. If the States reported in the following tables may be assumed fairly to represent this decrease for the whole country, including the southern States and their heavy losses on the one hand, and the steady increase of stock in the Pacific States on the other, the per centage of decrease since 1860 may be estimated as follows: horses, ten per cent.; mules, twenty per cent.; cattle, seven per cent.; swine, twenty-two per cent.

The following is the statement for 1860 for the whole country:

Horses	6,249,174
Mules	1,151,148
Cattle	25,616,019
Sheep	22,471,275
Swine	33,512,867

But there is another return of the assistant marshals in charge of the census, which includes stock not on the schedules of farmers, representing stock in market, in transitu, or in the hands of individuals not stock-growers. Add this, and the exhibit is as follows :

Horses	7, 434, 688
Mules	1, 317, 934
Cattle	28, 963, 028
Sheep	23, 977, 085
Swine	36, 980, 772

TABLE H—*An exhibit of the estimated numbers of the several kinds of farm stock of U. States in January,* 1866, *as compared with the census exhibit of* 1860.

States.	HORSES.		MULES.		CATTLE.	
	1860.	1866.	1860.	1866.	1860.	1866.
Maine	60, 637	50, 844	104	140	376, 933	285, 432
New Hampshire	41, 101	34, 749	10	9	264, 467	189, 148
Vermont	69, 071	47, 781	43	42	370, 450	305, 760
Massachusetts	47, 786	48, 509	108	119	279, 914	244, 173
Rhode Island	7, 121	6, 828	10	....	39, 105	40, 998
Connecticut	33, 276	38, 009	82	105	241, 907	252, 236
New York	503, 725	408, 763	1, 553	2, 078	1, 973, 174	1, 964, 043
New Jersey	79, 707	79, 599	6, 362	7, 497	238, 794	220, 960
Pennsylvania	437, 654	396, 623	8, 832	13, 915	1, 419, 493	1, 348, 748
Maryland	93, 406	83, 334	9, 829	10, 558	253, 241	210, 468
Delaware	16, 562	15, 523	2, 294	2, 280	57, 721	49, 358
Kentucky	355, 704	209, 136	117, 634	59, 752	836, 059	546, 876
Ohio	625, 346	520, 498	7, 194	7, 539	1, 634, 740	1, 375, 596
Michigan	136, 917	171, 956	330	699	479, 844	515, 895
Indiana	520, 677	377, 215	28, 893	21, 878	1, 069, 384	925, 727
Illinois	563, 736	574, 205	38, 539	50, 899	1, 583, 813	1, 446, 635
Missouri	361, 874	235, 375	80, 941	52, 127	1, 168, 984	698, 544
Wisconsin	116, 180	174, 608	1, 030	1, 956	521, 860	660, 088
Iowa	175, 088	342, 136	5, 734	14, 036	540, 088	884, 432
Minnesota	17, 065	39, 500	377	789	119, 257	222, 297
Kansas	20, 344	32, 469	1, 495	2, 490	93, 455	202, 303
Nebraska Territory	4, 449	11, 359	469	1, 243	37, 197	85, 251
Total	4, 287, 426	3, 899, 019	311, 864	250, 151	13, 599, 880	12, 674, 968

TABLE H—Continuod.

States.	SHEEP. 1860.	SHEEP. 1866.	SWINE. 1860.	SWINE. 1866.
Maine	452,472	1,041,724	54,783	35,355
New Hampshire	310,534	677,571	51,935	31,333
Vermont	752,201	1,377,296	52,912	32,908
Massachusetts	114,829	210,036	73,948	45,549
Rhode Island	32,624	35,884	17,478	11,690
Connecticut	117,107	188,308	75,120	52,356
New York	2,617,855	5,117,148	910,178	671,984
New Jersey	135,228	181,096	236,089	192,630
Pennsylvania	1,631,540	3,230,440	1,031,266	892,032
Maryland	155,765	262,576	387,756	368,396
Delaware	18,857	17,500	47,848	32,098
Kentucky	938,990	864,068	2,330,595	1,794,556
Ohio	3,546,767	6,568,052	2,251,653	1,838,481
Michigan	1,271,743	3,473,075	372,386	351,017
Indiana	991,175	2,783,367	3,099,110	2,261,780
Illinois	769,135	2,446,081	2,502,308	1,976,208
Missouri	937,445	830,999	2,354,425	988,857
Wisconsin	332,954	1,260,900	334,055	357,668
Iowa	259,041	1,950,752	934,820	1,423,568
Minnesota	13,044	90,496	101,371	127,701
Kansas	17,569	82,662	138,224	95,429
Nebraska Territory	2,355	15,766	25,369	35,280
Total	15,419,230	32,695,797	17,383,629	13,616,876

TABLE I.—The following is a table showing the results of the official census recently (and for the first time) taken in Great Britain. As in our own census, the figures are more likely to be too small than too large, on account of the lurking suspicion (which also affects the accuracy of our own census to some extent) that taxation is at the bottom of all inquisition into the farmers' affairs. The English papers stoutly affirm the existence of such a feeling in the present case:

Divisions of United Kingdom.	Date of return.	CATTLE. Cows.	CATTLE. Other cattle.	CATTLE. Total.
England	March 5, 1866	1,290,529	2,016,505	3,307,034
Wales	do	222,546	318,855	541,401
Scotland	do	370,457	566,954	937,411
Ireland	Year 1865	1,386,176	2,107,238	3,493,414
Isle of Man	March 5, 1866	7,755	10,932	18,687
Channel Islands:				
Jersey	do	5,815	6,222	12,037
Guernsey, &c	do	3,030	3,946	6,976
Total for United Kingdom		3,286,308	5,030,652	8,316,960

TABLE K.—*Showing the number of cattle, sheep, and swine, at the dates mentioned, in the several nationalities of Europe.*

Countries.	Date of returns of live stock.	Population according to latest returns.	CATTLE.		
			Cows.	Other cattle.	Total.
United Kingdom	1865–'66	29,070,932	3,286,308	5,030,652	8,316,960
Russia	1859–'63	74,139,394			25,444,000
Denmark, Schleswig, and Holstein.	1861	2,646,051	1,172,895	626,252	1,799,147
Sweden	1860	3,859,728	1,112,944	803,714	1,916,658
Prussia	1862	18,491,220	3,382,703	2,251,797	5,634,500
Hanover, Saxony, Wurtemburg, and Grand Duchies.	1852 to 1863.	9,395,738	1,728,224	1,273,029	4,170,275
Holland	1864	3,618,459	943,214	390,673	1,333,887
Belgium	1856	4,529,461			1,257,649
France	1862	37,386,313	5,781,465	8,415,895	14,197,360
Spain	1865	15,658,531			2,904,598
Austria	1863	36,267,648	6,353,086	7,904,030	14,257,116
Bavaria	1863	4,807,440	1,530,626	1,655,356	3,185,882

Countries.	Date of returns.	Sheep.	Swine.
United Kingdom	1865–'66	25,795,708	3,802,399
Russia	1859–'63	45,130,800	10,097,000
Denmark, Schleswig, and Holstein	1861	2,279,513	471,193
Sweden	1860	1,644,156	457,981
Prussia	1862	17,428,017	2,709,709
Hanover, Saxony, Wurtemburg, and Grand Duchies	1861 to 1864	5,323,223	1,855,114
Holland	1864	930,136	294,636
Belgium	1856	583,485	458,418
France	1862	33,281,592	5,246,403
Spain	1865	22,054,967	4,264,817
Austria	1863	16,964,236	8,151,608
Bavaria	1863	2,058,638	926,522

In an analysis of these tables it appears that the United States led all other nations in 1860 in numbers of cattle and swine, as doubtless, at the present time, it leads in sheep likewise. As compared with population, we had 1.5 people to each sheep, 1.1 to each head of cattle, and less than one to each head of swine. We have now less people than sheep.

In Europe, according to these tables, the comparison with population is as follows: Denmark, 1.4 people to each head of cattle; Bavaria, 1.5; Sweden, 2; Hanover, 2.2; Austria, 2.5; France, 2.6; Holland, 2.7; Russia, 2.9; Prussia, 3.2; Great Britain, 3.5; Belgium, 3.6; Spain, 5.3.

Spain had less than a unit of population to each head of sheep; Prussia, 1; Great Britain, 1.1; Denmark, 1.1; France, 1.1; Russia, 1.6; Hanover, 1.7; Austria, 2.1; Sweden, 2.3; Bavaria, 2.3; Holland, 3.8; Belgium, 7.9.

The contrast between this country and those of Europe in the supply of swine is remarkable. Spain, with a larger population than any other European state had only one-fourth of our supply in proportion to population. Spain had

3.6 people to each head of swine; Austria, 4.4; Hanover, 5; Bavaria, 5.1; Denmark, 5.6; Prussia, 6.8; France, 7.1; Russia, 7.3; Great Britain, 7.6; Sweden, 8.3; Belgium, 9.8; Holland, 12.2.

SHEEP KILLED BY DOGS

The slaughter still goes on, and the useless cur is not even taxed. While all cattle, swine, sheep, and all other animals are sought out by the United States revenue assessors, the dog (which is taxed an equivalent of three dollars in Great Britain, where it is the source of much revenue) is still on the free list. If the dog is property, he may be taxed; if not, any one may kill him without hindrance.

Efforts have been made to get at least partial returns of losses of sheep by these canine nuisances throughout the country. In the monthly circulars of the department inquiries have been placed, and returns from many counties have been received, exclusive of the southern States and of the Pacific States and Territories.

A few of the heavier losses of sheep by dogs (the killed only) in several States are given as follows: Maine: York county, 312 killed. Vermont: Rutland county, 450 killed. Massachusetts: Franklin county, 300 killed. Rhode Island: Hartford county, 294 killed. New York: Steuben county, 605 killed; Tioga county, 450 killed; Genesee county, 500 killed; Chatauque county, 575 killed; Otsego county, 400 killed. Pennsylvania: Philadelphia county, 1,500 killed; Butler county, 350 killed; Erie county, 300 killed. Ohio: Clark county, 627 killed; Champaign county, 540 killed; Fairfield county, 651 killed; Brown county, 619 killed; Coshocton county, 584 killed. West Virginia: Monongalia county, 500 killed; Putnam county, 300 killed. Maryland: Cecil county, 309 killed. Michigan: Ionia county, 1,000 killed; Wayne county, 450 killed. Indiana: Ripley county, 700 killed; Putnam county, 500 killed; Marion county, 500 killed; Daviess county, 500 killed. Kentucky: Boone county, 3,000 killed; Breckinridge county, 586 killed; Warren county 500 killed. Illinois: Brown county, 600 killed; Cass county, 2,000 killed; Scott county, 750 killed; Macon county, 1,500 killed. Iowa: Lucas county, 1,200 killed; Mahaska county, 865 killed; Davis county, 600 killed; Page county 1,094 killed. Wisconsin: Milwaukie county, 654 killed; Fond du Lac county, 381 killed. Missouri: Cooper county, 400 killed; Miller county, 550 killed; Marion county, 1,520 killed; Cedar county, 500 killed; Hickory county, 1,000 killed; Clark county, 500 killed; Lewis county, 500 killed. In thirty counties in Missouri 7,911 are reported killed. Kansas: Doniphan county, 1,300 killed.

TABLE L.—*Exhibiting the number of counties reported, number of sheep killed therein, and average number killed for the counties reported, in the States mentioned.*

	Number of counties reported.	Number of sheep killed by dogs.	Average number killed per county.
Maine	9	1,262	140
New Hampshire	4	88	22
Vermont	5	700	140
Massachusetts	8	588	73½
Rhode Island	1	77	77
Connecticut	2	494	247
New York	27	5,694	211
New Jersey	7	423	60
Pennsylvania	27	4,615	171
Maryland	7	819	117
Delaware	1	200	200
Kentucky	20	8,206	410
Ohio	37	10,664	288
Michigan	20	3,338	167
Indiana	35	7,135	204
Illinois	41	11,051	269½
Missouri	30	7,911	263⅔
Wisconsin	21	3,055	145½
Iowa	33	7,744	234⅔
Minnesota	13	266	20½
Kansas	10	1,879	188
Nebraska Territory	2	35	17½
West Virginia	13	1,610	124
Total	373	77,854	208

These returns are not given as estimates of the total number of sheep killed in the counties mentioned. The inquiry was an exceptional one, and the answers given, as expressly stated, included only a partial exhibit, as far as the immediate knowledge of the correspondent extended. The actual fact, on full return, would possibly double the figures in many counties. It is worthy of notice that far greater losses are reported in Kentucky and Missouri than in Ohio, running up to 1,000, 2,000 and even 3,000 in a county. The counties returned are less than one-fourth of the whole number of counties in those States. The showing, so far as it proves anything, establishes the fact that some of the other States lose far more in proportion to their number of sheep than the State of Ohio, and that the estimates heretofore made upon that basis are rather below than above the truth. Even this partial enumeration of 77,854 sheep killed, multiplied by four to represent the total number of counties in the several States reported, and increased by similar estimates for the southern and Pacific States, would give a round half million of sheep killed by dogs in the country. Then add the injuries inflicted upon sheep, and sum up the total loss, at present prices, and the result would be enormous. The average estimated value last winter was $4 50 for the northern States. Estimated at $4 for the whole country, the loss of half a million sheep this year will prove a tax of two millions of dollars upon the industry of the country; and the injuries would increase the sum by more than fifty per cent., making an aggregate of three millions. But this is not the worst view of the case; a far greater loss results to the productive wealth of the nation by the refusal of farmers to engage in wool-growing, repelled by these discouraging losses.

PRODUCTION AND CONSUMPTION OF WOOL.

An errôneous impression exists in many minds relative to the amount of wool manufactured in this country. Because almost fabulous increases have been effected in army enlistments, the contraction of national indebtedness, and in the popular estimate of national power, it is thoughtlessly assumed that the number of pounds of wool worn annually per capita is augmented in like proportion. There has been much annual waste by a million of men in arms, but they constituted but three per cent. of the population; and with a plethora of currency, and high prices of labor, the people at large were able to wear more woollens. This has increased the per capita consumption from 4½ or 5 pounds to 6 pounds per annum, at a fair estimate.

It should be remembered that in 1830 the value of woollen manufactures was but $14,528,166; in 1840 it was $20,696,999; in 1850, $43,207,545; in 1860, $68,865,965, in which 80,386,572 pounds of wool were consumed. This was the highest figure ever attained before the war. Now, examine the facts of later consumption of wool in manufacture, and the results will show a progress sufficiently encouraging, without indulging in vague and wild estimates which are far beyond the truth.

The following tables are the official figures representing the wool imports from July 1, 1861, to June 30, 1865, inclusive—four years. They show an aggregate of wool and shoddy, (27,155,133 pounds of the latter,) amounting to 279,183,049 pounds. This, with the wool produced in those four years, constitutes nearly the amount manufactured. To be exact, something should be deducted from the aggregate of wool, on account of the greater amount on hand July 1, 1865. The available wool product of the United States is, therefore, fairly estimated as follows:

	Pounds.
1861	55, 000, 000
1862	67, 500, 000
1863	82, 500, 000
1864	95, 000, 000
Total	300, 000, 000

The wool of the above-mentioned years, and the imports referred to, less the difference in the amount on hand, comprise the amount manufactured in that period.

	Pounds.
Amount produced	300, 000, 000
Amount imported	279, 183, 049
Total	579, 183, 049
Yearly average for consumption	144, 795, 762

The estimate of consumption in the calendar year of 1864, made by this department, was 160,000,000 pounds, and 120,000,000 of that aggregate were obtained from actual returns of manufacturers. It is possible that the total aggregate, had it all been obtained from actual returns, would have exceeded slightly 160,000,000 pounds, but the above showing of a wool supply not exceeding 145,000,000 pounds per annum for the four years would corroborate strongly the presumed accuracy of the estimate of last year. In the earlier part of the war the mills were in operation night and day; in the latter part their running time was less, but their number and capacity were greater.

Thus it is seen that we manufacture double the amount of wool that we did in 1860, and that during the entire period of the war the increase over the then unprecedented consumption of that year averaged fully seventy-five per cent.

In addition to the amount of wool manufactured in this country, the amount of woollens imported must be taken into consideration. The sum total, as appears from the following tables, was $87,782,918 during the same period. This is $21,945,729 for each year.

It will be readily seen from these figures that an average supply, in time of peace, of all needed woollens can very soon be attained if wool of the United States is not displaced by low-priced foreign wools.

TABLE M.—*Giving a statement of wool imported during the year ending June 30, 1862.*

Countries.	Wool.		Shoddy or flocks.	
	Pounds.	Dollars.	Pounds.	Dollars.
Russia and dependencies	292, 089	36, 859	....	....
Hamburg and Bremen	208, 799	35, 037	1, 875, 930	107, 300
Holland and Dutch colonial possessions	24, 730	3, 255	51, 154	3, 044
Belgium	1, 023, 439	157, 893	643, 904	38, 337
England, Scotland, and Ireland	16, 006, 963	2, 699, 049	3, 322, 658	271, 725
Canada and British North American possessions	100, 072	11, 149	1, 135	110
British West Indies and South American possessions	44, 651	5, 007	1, 980	125
British possessions in Africa and Mediterranean	3, 920, 257	665, 480	....	....
British East Indies and Australia	783, 670	112, 118	....	....
France	4, 438, 429	813, 373	391, 728	21, 651
Spain and Canary Islands	425, 803	63, 525	....	....
Spanish West Indies, Cuba, and Porto Rico	94, 808	9, 680	....	....
Portugal and Portuguese colonies	129, 275	18, 106	....	....
Italy	429, 793	59, 433	2, 588	84
Austria	112, 610	16, 983	....	....
Turkey in Europe, Asia, and Egypt	3, 710, 506	392, 616	....	....
Mexico	31, 209	3, 560	....	....
New Granada and Venezuela	207, 417	22, 193	....	....
Brazil	618, 481	88, 574	....	....
Uruguay	14, 061	1, 386	....	....
Buenos Ayres	5, 786, 868	838, 850	....	....
Chili	2, 793, 501	289, 895	....	....
China and Japan	7, 714	857	....	....
Sandwich and Pacific Islands	10, 926	1, 112	....	....
Liberia and Western Africa	438, 170	78, 777	....	....
Total dutiable wool	41, 654, 241	6, 624, 767	6, 291, 077	442, 376
Under reciprocity treaty	1, 916, 785	569, 839	....	....
Total	43, 571, 026	7, 194, 606	....	....

TABLE N.—*Giving a statement of wool imported during the year ending June 30, 1863.*

Countries.	Wool.		Shoddy.	
	Pounds.	Dollars.	Pounds.	Dollars.
Russia and dependencies	1, 758, 367	275, 651	68, 412	5, 470
Hamburg and Bremen	356, 461	85, 690	2, 179, 508	137, 066
Holland and Dutch colonial possessions	88, 619	11, 593	26, 186	1, 627
Belgium	2, 988, 889	493, 312	691, 326	45, 213
England, Scotland, and Ireland	17, 619, 123	3, 384, 866	3, 652, 569	325, 382
Gibraltar and Malta	598, 241	67, 341	....	....
Canada and British North American possessions	52, 872	9, 243	15, 789	1, 125
British West Indies, Central and South America	8, 610	905	....	....
British possessions in Africa	6, 711, 975	1, 179, 707	....	....
British East Indies and Australia	118, 234	16, 753	....	....
France	9, 643, 764	1, 632, 843	1, 195, 078	62, 977
Spain and Canary Islands	981, 468	152, 730	6, 055	292
Spanish West Indies, Cuba, and Porto Rico	72, 409	11, 577	....	....
Portugal and colonies	167, 903	27, 492	....	....
Italy	328, 284	51, 038	13, 518	495
Turkey in Europe and Asia	4, 213, 473	618, 776	....	....
Mexico	1, 226, 820	155, 450	....	....
South America	22, 481, 521	3, 168, 434	19, 160	1, 587
China and Japan	19, 750	2, 287	....	....
Sandwich Islands and whale fisheries	38, 906	4, 954	....	....
Ports in Western Africa	2, 442, 065	421, 522	....	....
Total dutiable wool	71, 917, 754	11, 772, 164	7, 867, 601	581, 234
Under reciprocity treaty	1, 980, 053	781, 867	....	....
Total	73, 897, 807	12, 554, 031	....	....

TABLE O.—*Giving a statement of wool imported during the year ending June 30, 1864.*

Countries.	Wool.		Shoddy or flocks.	
	Pounds.	Dollars.	Pounds.	Dollars.
Russia and dependencies	4, 643, 305	801, 291	....	....
Denmark, Norway, and Swedish West Indies	44	3	....	....
Hamburg and Bremen	390, 142	106, 723	1, 850, 283	130, 852
Holland colonial possessions	16, 006	1, 615	7, 989	579
Belgium	1, 511, 347	343, 941	697, 012	51, 273
England, Scotland, and Ireland	13, 099, 501	2, 715, 843	4, 944, 133	379, 461
Gibraltar, Malta, and Greece	244, 678	38, 236	....	....
Canada and British North American provinces	12, 936	2, 579	44, 005	3, 654
British West Indies and Central and South America	1, 101	166	....	....
British possessions in Africa	13, 717, 900	2, 415, 145	....	....
British Australia and East Indies	864, 548	177, 209	....	....
France	10, 945, 299	1, 771, 423	541, 200	53, 920
Spain and Canary Islands	179, 722	28, 734	....	....
Spanish West Indies, Cuba, and Porto Rico	5, 529	1, 255	....	....
Portugal and colonies	230, 914	38, 407	....	....
Italy	1, 261, 078	65, 400	48, 481	1, 756
Turkey in Europe, Asia, and Egypt	5, 534, 693	805, 115	....	....
Mexico	702, 676	96, 111	....	....
Central America	114	21	....	....
South America	31, 134, 935	4, 729, 014	288	19
China and Japan	63, 069	7, 666	....	....
Sandwich Islands and whale fisheries	169, 838	30, 272	....	....
Other Pacific ports	8, 522	1, 236	....	....
Other ports in Africa	2, 455, 565	417, 735	....	....
Total dutiable wool	87, 193, 462	14, 595, 140	8, 133, 391	621, 514
Under reciprocity treaty	3, 202, 642	1, 328, 851	....	....
Total	90, 396, 104	15, 923, 991	....	....

TABLE P.—*Giving a statement exhibiting the quantity and value of wool imported into the United States during the year ending June 30, 1865.*

Countries.	Wool on the skin and wool skins.	Wool: value 12 cents per pound or less.		Wool: value over 12 cents and not over 24 cents per pound.		Wool: value over 24 cts. and not over 32 cts. per pound.		Wool: value over 32 cents per pound.		Wool, scoured: value over 32 cts. per pound.		Woollen flocks or shoddy.	
	Dollars.	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
Russia on the Baltic and North Seas		212, 770	27, 685	258, 836	54, 392								
Russia on the Black Sea		1, 086, 432	111, 166	1, 190, 441	228, 315								
Danish West Indies	79	4, 700	538	682	144								
Hamburg				104, 495	13, 383							1, 286, 731	92, 447
Bremen	1, 656			150	28							175, 589	13, 111
Holland												6, 254	351
Dutch West Indies	140	9, 617	1, 060	2, 430	367								
Belgium		6, 413	851	31, 113	6, 370			6, 704	5, 212	47, 524	26, 587	317, 718	26, 115
England	2, 408	676, 668	74, 052	1, 298, 714	260, 495	3, 062	1, 022	1, 732	941			2, 866, 969	256, 455
Gibraltar				71, 573	12, 638								
Canada						20	5					1, 900	240
British Am. possessions on the Pacific		6, 302	646										
British West Indies	851	1, 027	101	55, 388	9, 580	189	55						
British possessions in Africa	55, 297	32, 230	3, 807	8, 279, 973	1, 529, 989			505	198				
British East Indies		138, 860	16, 611	605, 273	127, 856	27, 773	8, 236	6, 059	2, 293				
Australia	3, 802			408, 592	90, 573								
France: Atlantic								92	122			179, 271	20, 307
France: Mediterranean		111, 305	15, 851	737, 290	126, 698							28, 632	1, 369
Spain				234, 985	38, 506								
Portugal		2, 009	131										
Cape de Verde Islands		1, 874	211										
Italy				63, 107	13, 892								
Austria				32, 946	7, 527								
Greece		234, 852	26, 792										
Turkey in Europe		135, 007	10, 758										
Turkey in Asia		353, 240	41, 589	102, 300	20, 072								
Other ports in Africa		645, 719	93, 198	895, 056	154, 878								
Hayti	20												
Mexico	1, 468	257, 969	29, 371	81, 481	14, 651								
Central America	9												
New Granada		47, 132	4, 353	24, 020	4, 394								
Venezuela													
Brazil		261, 982	29, 380	615, 447	90, 644								
Cisplatine Republic	2, 567	188, 364	19, 022	975, 896	177, 979								
Argentine Republic	39, 470	9, 859, 618	1, 199, 056	6, 244, 271	1, 024, 697								
Chili		3, 019, 861	305, 581	342, 612	64, 614								
Sandwich Islands		3, 236	365	28, 497	4, 783								
China				906	125								
Countries not enumerated	826			294, 694	66, 672								
Total dutiable	108, 593	17, 297, 247	2, 012, 175	22, 981, 168	4, 144, 262	31, 044	9, 318	15, 092	8, 766	47, 524	26, 587	4, 863, 064	410, 395

Wool imported under reciprocity treaty, 3,486,079 pounds; value, $1,527,275. Total, 43,858,154 pounds; value, $7,728,383, exclusive of wool on the skin and shoddy.

Years.	WOOL.		SHODDY OR FLOCKS.	
	Pounds.	Dollars.	Pounds.	Dollars.
1862	41,654,241	6,424,767	6,291,077	442,376
1863	71,917,754	11,772,064	7,867,601	581,234
1864	87,193,462	14,595,140	8,133,391	621,514
1865	40,372,075	6,201,108	4,863,064	410,395
Total	241,137,532	38,993,079	27,155,133	2,055,519

This is the amount of wool bearing a duty, which has been imported in this period.

In addition, the amount introduced free under the reciprocity treaty with Great Britain is as follows:

Years.	Pounds.	Dollars.	Cents per pound.
1862	1,916,785	569,839	29.7
1863	1,980,053	781,867	39.5
1864	3,202,642	1,328,851	41.4
1865	3,486,079	1,527,275	43.8
Total	10,585,559	4,207,832	39.6

The total foreign supply of our woollen manufactures in the four years reported was, therefore, as follows:

	Pounds.	Cost.
Dutiable wool	241,137,532	$38,993,079
Free from Canada	10,585,559	4,207,832
Free in 1862 from other countries	304,825	55,539
Shoddy	27,155,133	2,055,519
Total	279,183,049	45,311,969

TABLE Q.—*Giving a statement of woollens imported for four years ending June 30, 1865.*

	1862.	1863.	1864.	1865.
Woollen cloths and shawls	$5,547,644	$5,147,404	$10,698,035	$5,257,819
Blankets	1,945,707	1,297,864	749,793	838,741
Woollen and worsted yarns	372,523	383,011	434,549	393,130
Delaines and dress goods	17,229	1,744,639	10,069,768	7,817,139
Carpets	466,596	1,016,562	1,658,380	471,659
Flannels	30,798	....	457,410	83,329
Felt and lasting	68,485	....	102,910	87,213
All others	6,435,412	10,822,145	7,968,491	5,398,533
Total	14,884,394	20,411,625	32,139,336	20,347,563

Total woollens imported, 1862	$14,884,394
Total woollens imported, 1863	20,411,625
Total woollens imported, 1864	32,139,336
Total woollens imported, 1865	20,347,563
Total for four years	87,782,918

TABLE R.—*Giving a statement of exports of wools and woollens.*

Years.	PRODUCT OF UNITED STATES.			PRODUCT OF FOREIGN COUNTRIES.		
	Wool.		Woollen goods.	Wool.		Woollen goods.
	Pounds.	Dollars.	Dollars.	Pounds.	Dollars.	Dollars.
1861	....	237,846	....	199,226	56,432	....
1862	1,153,388	296,225	....	332,953	76,708	221,570
1863	355,722	178,434	....	414,427	109,403	206,127
1864	155,482	66,358	81,943	223,475	134,634	120,190
1865	446,182	254,721	132,544	658,582	288,501	431,619

The exports, as heretofore, are of trifling amount. The exports of woollen goods of American manufacture were scarcely deemed worthy of separate enumeration, until 1864, in official summaries.

AGRICULTURAL EXPORTS.

TABLE S.—*Giving a statement of the exports of the growth and agricultural products of the United States, with their immediate manufactures, for the years ending June* 30, 1862, *and June* 30, 1863.

Products and manufactures.	1862.		1863.	
	Quantity.	Value.	Quantity.	Value.
Of animals:				
Hogs .... number..	3,306	$23,562	9,467	$96,363
Pork .... tierces..	2,102	3,980,153	1,155	4,334,775
Do .... barrels..	305,949		326,119	
Hams and bacon .... pounds..	141,212,786	10,290,572	218,243,609	18,658,280
Lard .... pounds..	118,573,307	10,004,521	155,336,596	15,755,570
Lard oil .... gallons..	239,608	148,056	1,259,063	983,349
Horned cattle .... number..	3,634	197,019	5,509	236,547
Beef .... tierces..	57,234	2,017,077	56,372	2,185,921
Do .... barrels..	50,171		61,739	
Tallow .... pounds..	46,773,768	4,026,113	63,792,754	6,738,486
Hides	....	518,687	....	355,855
Butter .... pounds..	26,691,247	4,164,344	35,172,415	6,733,743
Cheese .... pounds..	34,052,678	2,715,892	42,045,054	4,216,804
Candles .... pounds..	6,100,029	901,330	6,838,353	1,187,864
Soap .... pounds..	9,986,984	636,049	9,097,664	736,524
Horses .... number..	1,534	157,442	1,296	132,542
Mules .... number..	3,237	212,187	3,561	332,233
Leather and morocco skins	....	13,049	....	18,719
Leather .... pounds..	1,775,556	389,007	2,203,284	634,574
Boots and shoes .... pairs..	679,594	721,241	1,214,468	1,329,009
Sheep	....	34,600	....	39,504

TABLE S—Continued.

Products and manufactures.	1862.		1863.	
	Quantity.	Value.	Quantity.	Value.
Of animals:				
Wool .... pounds..	1,153,388	296,225	355,722	178,434
Skins and furs	....	794,407	....	2,226,275
Wax .... pounds..	142,312	47,383	258,901	80,899
Apples .... barrels..	66,767	238,923	174,502	364,628
Potatoes .... bushels..	417,138	300,599	517,530	413,581
Onions	....	90,412	....	122,422
Breadstuffs:				
Indian corn .... bushels..	18,904,898	10,387,383	16,119,476	10,592,704
Indian meal .... barrels..	253,570	778,344	257,948	1,013,272
Wheat .... bushels..	37,289,572	42,573,295	36,160,414	46,754,195
Flour .... barrels..	4,882,033	27,534,677	4,390,055	28,366,069
Rye meal .... barrels..	14,463	54,488	8,684	38,067
Rye, oats, &c	....	2,364,625	....	1,833,757
Rice	....	156,899	....	83,404
Biscuit or ship-bread	....	490,942	....	582,268
Cables and cordage ...... cwt..	19,390	199,669	29,011	409,050
Cotton Sea-island ...... pounds..	66,443	} 1,180,113	527,747	} 6,652,405
other kinds ... pounds..	4,998,121		10,857,239	
Cotton piece goods:				
Printed or colored	....	578,500	....	630,558
White, other than duck	....	508,004	....	254,751
Duck	....	221,685	....	69,526
All other manufactures of	....	1,629,275	....	1,951,576
Clover-seed .... bushels..	66,064	295,255	389,554	2,185,706
Flax-seed .... bushels..	15	59	40,759	96,805
Linseed oil .... gallons..	25,062	20,893	25,131	29,861
Oil-cake	....	875,841	....	1,277,735
Hemp .... tons..	124	8,300	546	70,348
all manufactures of	....	31,940	....	123,656
Ginseng .... pounds..	630,714	408,590	372,945	295,129
Hops .... pounds..	4,851,246	663,308	8,864,081	1,733,265
Spirits of turpentine ... gallons..	43,507	54,691	58,565	143,777
Salt .... bushels..	397,506	228,109	584,901	277,838
Beer, ale, porter, and cider	....	54,696	....	129,176
Spirits from grain .... gallons..	768,295	328,834	2,633,391	1,390,610
from molasses.. gallons..	2,496,220	715,694	2,908,436	1,064,717
from other mat's.. galls..	3,956,359	1,577,909	1,855,098	950,245
Molasses .... gallons..	45,009	21,914	39,290	19,465
Vinegar .... gallons..	268,927	29,701	256,956	34,431
Sugar, brown .... pounds..	1,284,849	90,022	380,348	31,497
Sugar, refined .... pounds..	1,470,403	147,397	3,214,661	361,034
Tobacco	....	12,325,356	....	19,752,076
Tobacco, manufactured	4,071,963	1,068,730	7,025,248	3,384,544
Snuff .... pounds..	38,839	7,914	44,924	13,633
Wood and its products:				
Staves and heading ..... M..	}	} 7,917,417	}	} 14,342,058
Shingles .... M..				
Boards, plank and scantling, M feet..				
Hewn timber .... tons..				
Other lumber				
Oak bark and other dyewood				
Manufactures of wood				
Ashes, pot and pearl ...... cwt.	74,895	457,049	61,313	513,704
Tar and pitch .... barrels..	9,765	55,884	11,956	102,566
Rosin and turpentine.. barrels..	65,441	293,400	17,025	237,991

TABLE T.—*Giving a statement of the exports of the growth and agricultural products of the United States, with their immediate manufactures, for the years ending June* 30, 1864, *and June* 30, 1865.

Products and manufactures.	1864.		1865.	
	Quantity.	Value.	Quantity.	Value.
Of animals:				
Hogs ....number..	9,199	$86,907	1,400	$12,771
Pork ....tierces..	....	....	838	6,843,135
Do ....barrels..	317,597	5,828,030	207,294	
Hams and bacon...pounds..	110,886,446	12,323,327	45,990,712	10,521,702
Lard ....do....	97,190,765	11,260,728	44,342,295	9,107,435
Lard oil ....gallons..	440,546	377,994	99,250	155,454
Horned cattle.....number..	6,191	117,573	9,588	159,179
Beef ....tierces..	....	....	50,392	3,304,771
Do ....barrels..	178,332	3,023,018	59,822	
Tallow ....pounds..	55,197,914	6,215,260	30,622,865	4,979,135
Hides ....number..	56,071	305,111	205,950	1,023,596
Butter ....pounds..	20,895,435	6,140,031	21,388,185	7,234,173
Cheese ....do....	47,751,329	5,638,007	53,089,468	11,684,927
Candles ....do....	5,765,869	1,088,882	5,017,712	1,259,168
Soap ....do....	8,185,088	790,872	7,327,834	983,477
Horses ....number..	821	72,674	690	110,270
Mules ....do....	15	2,488	350	52,115
Fine leather and morocco, skins..	....	21,108	....	150,828
Leather ....pounds..	824,762	290,657	1,287,407	517,717
Boots and shoes......pairs..	755,792	1,415,775	522,308	2,023,210
Sheep ....number..	9,301	39,185	13,782	72,198
Wool ....pounds..	155,482	66,358	466,182	254,721
Skins and furs	....	1,795,417	....	1,648,863
Wax ....pounds..	341,458	170,418	338,776	261,381
Apples ....barrels..	183,969	487,140	120,063	479,256
Potatoes ....bushels..	463,212	473,911	510,344	724,593
Onions	....	136,260	....	220,694
Breadstuffs:				
Indian corn.......bushels..	4,096,684	3,353,280	2,812,726	3,679,133
Indian meal.......barrels..	262,357	1,349,765	199,419	1,489,886
Wheat ....bushels..	23,681,712	31,432,133	9,937,152	19,397,197
Flour ....barrels..	3,557,347	25,588,249	2,604,542	27,222,031
Rye meal............do....	6,999	37,991	3,935	32,438
Rye and small grains.bushels.	893,809	957,394	691,152	846,444
Rice ....barrels..	5,442	84,217	2,395	63,430
Biscuit or ship bread........	....	660,324	....	771,952
Cables and cordage......cwt..	39,945	553,497	52,419	972,348
Cotton, Sea-island ....pounds..	132,521	127,783	330,584	296,179
other kinds .....do....	11,860,390	9,768,071	6,276,582	5,424,370
Cotton piece goods:				
Printed or colored..........	1,596,235	401,411	1,080,521	618,223
White, other than duck......	177,065	56,639	100,265	44,742
Duck	62,621	50,239	77,618	101,796
All other man'fact'r's of cotton.	....	948,612	....	2,566,821
Clover-seed ....bushels..	2,384,857	501,175	2,169,426	446,845
Flax-seed ....do....	1,708	5,808	39,369	120,091
Linseed oil............gallons..	143,301	81,751	64,913	110,156
Oil-cake	60,811	1,609,833	36,512	2,267,393
Hemp............tons..	1,751	246,257	2,111	259,393
all manufactures of	....	93,222	....	119,738
Ginseng ....pounds..	360,950	474,920	414,507	547,653
Hops ....do....	5,851,165	1,217,075	3,662,734	1,348,263
Spirits of turpentine...gallons..	32,548	87,988	42,518	95,747
Salt ....bushels..	635,519	296,088	582,803	355,469
Beer, ale, porter, and cider....	....	126,317	....	163,151

Products and manufactures.	1864.		1865.	
	Quantity.	Value.	Quantity.	Value.
Spirits from molasses..gallons..	1,180,641	$527,115	1,149,859	$708,134
Spirits from other material.do...	369,222	332,786	218,551	394,770
Molasses ....do...	47,455	23,239	28,221	16,308
Vinegar ....do...	216,991	41,825	136,414	46,100
Sugar, brown ....pounds..	525,151	65,368	116,240	20,617
Sugar refined...........do....	1,803,332	259,937	1,309,522	284,906
Tobacco	....	22,845,936	....	41,592,138
Tobacco, manufactured........	8,587,472	3,631,070	7,297,878	3,580,245
Snuff...............pounds..	28,277	16,813	93,159	39,129
Wood and its products:				
Staves and heading.thousand.	44,103	2,458,266	33,029	2,911,310
Shingles ....do....	30,344	137,222	33,034	173,760
Boards, plank and scantling, M feet..	132,298	3,064,264	158,774	4,340,664
Hewn timber ....tons..	6,742	87,289	4,133	69,699
Other lumber................	....	1,642,976	....	3,422,719
Oak bark and other dyewood.	....	194,575	....	158,495
Other manufactures of wood.	....	865,281	....	1,254,888
Ashes, pot and pearl .....cwt..	48,904	468,626	52,677	727,229
Tar and pitch ....barrels..	7,156	70,782	11,529	76,034
Rosin and turpentine....do....	2,418	55,551	11,232	157,662

TABLE U.—*Being a recapitulation of exports of the growth and agricultural products of the United States, and their immediate manufactures, from* 1856 *to* 1865, *inclusive.*

	1856.	1857.	1858.	1859.	1860.
Animal productions...	$21,411,900	$20,593,413	$19,946,411	$17,602,413	$24,666,798
Breadstuffs	59,010,219	57,915,232	35,569,068	23,562,169	26,989,709
Wood and its products.	9,566,037	13,525,339	12,279,597	13,073,850	12,909,585
Cotton and its manufactures	135,349,660	137,691,036	137,038,165	169,751,145	202,741,351
Miscellaneous	20,497,763	28,477,756	26,198,678	30,700,573	26,783,464
Total	245,835,579	258,202,776	231,031,919	254,690,150	294,090,907

	1861.	1862.	1863.	1864.	1865.
Animal productions...	$27,715,392	$42,288,916	$68,011,371	$56,182,453	$62,361,426
Breadstuffs	73,534,544	84,340,653	89,263,736	63,463,353	53,502,511
Wood and its products.	9,089,434	8,723,750	15,196,319	9,044,832	13,292,460
Cotton and its manufactures	51,008,521	4,117,577	9,558,816	11,352,755	9,052,131
Miscellaneous	26,687,135	19,788,756	34,756,128	34,710,779	54,913,137
Total	188,035,026	159,259,652	216,786,370	174,754,172	193,121,365

TABLE V.—*Recapitulation of exports of the growth and products of the United States, with their immediate manufactures, for forty years, from* 1826 *to* 1865, *inclusive, in periods of five years each, with the total annual average for each period.*

Products and manufactures.	Five years ending 1830.	Five years ending 1835.	Five years ending 1840.	Five years ending 1845.	Five years ending 1850.	Five years ending 1855.	Five years ending 1860.	Five years ending 1865.
	Value.	*Value.*	*Value.*	*Value.*	*Value.*	*Value.*	*Value.*	*Value.*
Animals and their products	$23, 011, 879	$24, 365, 223	$20, 309, 261	$33, 896, 486	$63, 473, 863	$67, 898, 685	$104,220,935	$256, 559, 258
Breadstuffs	42, 363, 119	48, 095, 362	47, 114, 914	51, 705, 513	142, 232, 388	134, 181, 567	203,046,397	364, 104, 797
Wood and its products	15, 632, 507	17, 403, 004	20, 043, 813	19, 331, 158	20, 383, 180	30, 248, 638	61,354,408	55, 346, 795
Cotton and its manufactures	139, 007, 584	217, 448, 062	336, 561, 729	273, 390, 047	319, 576, 828	526, 235, 464	782,571,357	85, 089, 800
Miscellaneous	32, 841, 875	37, 848, 758	52, 412, 149	52, 147, 603	48, 999, 940	77, 192, 944	132,658,234	170, 855, 935

Annual average for each period of five years.

Products and manufactures.	Five years ending 1830.	Five years ending 1835.	Five years ending 1840.	Five years ending 1845.	Five years ending 1850.	Five years ending 1855.	Five years ending 1860.	Five years ending 1865.
Animals and their products	$4, 602, 375	$4, 873, 044	$4, 061, 852	$6, 779, 297	$12, 694, 772	$13, 579, 737	$20, 844, 187	$51, 311, 851
Breadstuffs	8, 472, 623	9, 619, 072	9, 422, 982	10, 341, 102	28, 446, 477	26, 836, 313	40, 609, 279	72, 820, 959
Wood and its products	3, 126, 501	3, 490, 600	4, 008, 762	3, 866, 231	4, 076, 636	6, 049, 727	12, 270, 881	11, 069, 359
Cotton and its manufactures	27, 801, 516	43, 489, 612	67, 312, 345	54, 678, 009	63, 915, 365	105, 247, 092	156, 514, 271	17, 017, 960
Miscellaneous	6, 568, 375	7, 569, 751	10, 482, 429	10, 429, 520	9, 799, 988	15, 438, 588	26, 531, 647	34, 171, 187
Total annual average	50, 571, 390	69, 042, 079	95, 288, 370	86, 094, 159	118, 933, 238	167, 151, 457	256, 770, 265	186, 391, 316

These tables, taken in connexion with those showing the quantity and total value of agricultural products in the United States, reveal the relative paucity of our exports, and yet show conclusively their great absolute value. A very small percentage of annual production comprises the surplus for the foreign demand.

The cotton crop, though by no means the product of the greatest value, either at present or in the past, has attracted more attention than any other from the fact that it was mostly exported, and nearly all deported from the locality producing it. The export of raw and manufactured cotton is thus compared with other agricultural exports for ten years past.

Year.	Cotton and its manufactures.	Other products.	Year.	Cotton and its manufactures.	Other products.
1856	135,349,660	110,485,919	1861	51,008,521	137,026,505
1857	137,691,036	120,511,740	1862	4,117,577	155,142,075
1858	137,038,165	93,993,754	1863	9,558,816	207,227,554
1859	169,751,145	84,939,005	1864	11,352,755	163,401,417
1860	202,741,351	91,349,556	1865	9,052,131	184,069,234

While cotton has been the only article that is mainly exported, it is curious to observe that from 1826 to 1862, inclusive, its increase has been proportionately less than that of breadstuffs or animal productions—the increase in that period being as follows: Breadstuffs, 895 per cent.; animal productions, 818 per cent.; cotton and its manufactures (to 1860,) 629 per cent.; miscellaneous products, 199 per cent.; wood and its products, 178 per cent.

The animal productions for the five years ending in 1830, averaged only $4,602,375; for the five years ending in 1865, the average reached $51,311,851. Breadstuffs for the same period averaged, respectively, $8,472,623 and $72,820,959. The principal items of breadstuffs exhibit a wonderful increase during the last six years.

	1860.	1861.	1862.
Indian corn	2,399,808	6,890,865	10,387,383
Indian meal	912,075	692,003	778,344
Wheat	4,076,704	38,313,624	42,573,295
Flour	15,448,507	24,645,849	27,534,677

	1863.	1864.	1865.
Indian corn	10,592,704	3,353,280	3,679,133
Indian meal	1,013,272	1,349,765	1,489,886
Wheat	46,754,195	31,432,133	19,397,197
Flour	28,366,069	25,588,249	27,222,031

The total for five years, of breadstuffs of all kinds, $364,104,797, shows in a conspicuous light the marvellous resources of this country, in view of the withdrawal from the pursuits of agriculture of so many able-bodied men in the national and insurgent armies, and the shutting up of all the southern ports to the commerce of the world. Yet how small a percentage is this fifty millions per year of the total value of the bread crops of the entire country! And since the close of 1865 the almost total stoppage of this class of exports shows how utterly unreliable is a dependence upon a foreign market for a demand for any existing surplus. If crops in Europe are good, and plenty reigns in the ports of the Black sea, our wheat is not wanted in Great Britain; but if starvation stares in the face the English poor, we are permitted, in a limited degree, to fill their mouths and our own pockets.

NEW YORK CATTLE SUPPLY FOR 1865.

The following is the statement of the cattle supply of New York for the year 1865, as prepared by the cattle market reporter of the New York Tribune:

ANNUAL RECEIPTS, 1854–1865.

Year.	Beeves.	Cows.	Calves.	Sheep.	Swine.	An. totals.
1854	169, 864	13, 131	68, 534	555, 479	252, 326	1, 059, 386
1855	155, 564	12, 110	47, 969	588, 741	318, 107	1, 132, 491
1856	187, 057	12, 857	43, 081	452, 739	345, 911	1, 051, 645
1857	162, 243	12, 840	34, 218	444, 036	288, 984	942, 321
1858	191, 874	10, 128	37, 675	447, 445	551, 479	1, 238, 601
1859	205, 272	9, 492	43, 769	404, 894	399, 685	1, 068, 092
1860	226, 933	7, 144	39, 436	518, 750	323, 918	1, 116, 181
1861	222, 835	5, 749	32, 368	512, 366	559, 421	1, 333, 229
1862	239, 486	5, 378	30, 465	484, 342	1, 148, 209	1, 907, 880
1863	264, 091	6, 470	35, 709	519, 310	1, 101, 617	1, 027, 203
1864	267, 609	7, 603	75, 621	782, 462	660, 270	1, 789, 347
1865	273, 274	6, 161	77, 991	836, 733	573, 197	1, 761, 355

ESTIMATED AVERAGE PRICE OF BEEF CATTLE PER POUND EACH YEAR, 1854.1865.

1854	per lb. 9 c. full.	1860	per lb. 8 c. full.
1855	10 c.	1861	7¾ c.
1856	9½ c. nearly.	1862	7⅔ c.
1857	10½ c. nearly.	1863	9¼ c.
1858	8⅓ c. nearly.	1864	14⅑ c.
1859	9 c.	1865	16 c.

The prices are unprecedented, and the value of the beef alone is estimated at $31,296,720, at 700 pounds each, and 16 cents per pound.

WOOL PRODUCTS OF THE PACIFIC COAST*.

Year.	Pounds.	Year.	Pounds.
1854	175, 000	1860	3, 260, 000
1855	360, 000	1861	4, 600, 000
1856	600, 000	1862	5, 530, 000
1857	1, 100, 000	1863	6, 857, 000
1858	1, 428, 350	1864	6, 275, 855
1859	2, 378, 250	1865	5, 250, 000

*This estimate, with the exception of the figures for the last two years, is made upon the authority of James E. Perkins, secretary of the California Wool-growers' Association.

IMMIGRATION AT NEW YORK.

MONTHLY ARRIVALS.

January	5,319	July	21,290
February	2,466	August	22,011
March	6,171	September	23,204
April	10,818	October	20,069
May	24,451	November	24,995
June	27,119	December	12,118
		Total	200,031

CONCLUSION.

A review of the agricultural progress of the year warrants the exhibition, on the part of the farmer, of the utmost cheerfulness in the present and hopefulness for the future. Improvement has been rife, and skilled industry has secured its appropriate reward. Some of the crops were never, at any previous period, so large, and never were so high prices received, with one single exception.

For several years these statistics have been confined to the northern States. Arrangements are in progress for securing a full corps of reliable and intelligent correspondents in the hitherto unrepresented districts. Unfortunately this region would at present make a melancholy exhibition in agricultural statistics, the poverty of which may, perhaps, better be concealed. It is to be hoped that recuperation may be as rapid as deterioration and destruction have been; and that new life and energy may be infused into southern agriculture, new labor enlisted in agricultural production, new and improved machinery introduced, new processes learned, and a greater diversity attained in agricultural industries.

It is intended also to secure better facilities for recording the facts of agriculture in the Pacific States, and among the vast Territories between the Rocky mountains and the States of our western border. Such material will serve to give a completeness to future statistical presentations which has heretofore been wanting, and to perfect a system which has been necessarily imperfect in the beginning.

J. R. DODGE.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

ENTOMOLOGICAL EXHIBITION IN PARIS.

SIR: My visit, made under your orders, to the entomological convention, held in Paris in August and September, 1865, was productive of some interesting results which are herewith reported:

As European insects are liable at any time to be introduced into this country in roots, bark, wood, grasses, and seeds, their nature and habits cannot be too well studied or understood here. It is well known that several of the insects most destructive to our crops are of European origin, and I would suggest that all foreign seeds and plants imported by this department be subjected to a careful investigation, and, if found to be infested by any new or unknown insects, fumigation, or other thoroughly efficacious means of destroying them, should be used before distributing them through the country. One pair of new noxious insects will do more harm than hundreds of the well-known varieties, as the progeny might commit their ravages unsuspected till they multiplied past the possibility of extermination, while known and familiar ones would be watched and guarded against. An instance of this may be cited in the introduction of the orange scale insect into Florida a few years ago. The entire ruin of the orange crops of that State was said to be traceable to a single small mandarin orange tree which had been imported and planted in the midst of an old orange grove. Before the proprietor was aware of his danger his whole plantation was affected, and by means of cuttings, fruits, &c., the insects spread throughout the State, destroying not only the yearly orange crops, but, in many cases, sweeping off the groves themselves.

At the exhibition in Paris there were several insects shown as destructive to European crops, which are so similar in appearance to some of our common native species not suspected with us of injuring cereals or fruits, that I am inclined to think, when agricultural entomology shall be more thoroughly studied and developed, many of ours will be found nearly, if not quite, similar to theirs in food and habits; in other words, that some insects hitherto considered as predatory and beneficial may, upon examination, prove to be injurious.

Among the insects destructive to wheat there were two European rove beetles exhibited in the splendid collection of Mons. E. Mocquerys, of Evreux. This family of beetles has hitherto in this country been considered as beneficial to the farmer, almost all the carabidæ feeding upon other insects which are injurious to crops. The European "*Zabrus gibbus,*" on the contrary, is stated to be "very destructive, gnawing the stems of the cereals, attacking them in the larva state in the pith, and especially destructive to barley and rye." Another carabus, *Broscus cephalotes,* (Linn.,) has the same habits, but is particularly damaging to wheat. It would be well, therefore, to examine further into the habits of our native *Pangus caliginosus*, which the farmers of Maryland consider as exceedingly destructive to wheat in stacks, immense numbers of them being found under every grain stack in the field. As the carabidæ are beneficial in general, I have always supposed these insects sought the stacks for shelter, and to feed upon other insects frequenting such situations. It is true that on two occasions I have observed the *Pangus caliginosus* on the top of grass, apparently feeding on the newly-formed seed, though it is possible their food might have been minute insects invisible to the naked eye.

The larvæ of the long-horned beetles in America are considered to feed principally upon the wood and pith of trees and plants, but in Europe there is one, *Calamobius gracilis*, which is said to attack wheat. This insect is something like a small *saperda* or *oberea*, and Mr. Mocquerys states that it attacks the wheat when flowering, piercing the stem, and working downwards from the top; it bores through the joints, and passes the winter months in the lower part of the plant. It is stated that these insects sometimes destroy a fourth part of the wheat crop. Mr. Mocquerys, in his notes, refers to Mr. Guerin Meneville for fuller particulars. As we know of no similar long-horned beetle in this country possessing like habits, an inexperienced entomologist would not dream of looking for them in such situations, and possibly many of our dying wheat stalks, if examined, may be found inhabited by some similar insect.

The larvæ of another European longicorn beetle, *Phytœcea ephippium*, which resembles our *oberea*, is said to be very destructive in fields of carrots, mining channels in the roots. We have nothing of the kind described in this country.

The larvæ of *Agapanthus suturalis*, also a longicorn, lives in the interior of the great stems of lucerne. *Oberea linearis* (Linn.,) also destroys young branches of hazel and filbert by devouring the pith. Our *Oberea tripunctata* commits similar depredations here on blackberry and raspberry bushes.

The wood of the oak is injured by the larvæ of *Clytus arctuatus*, an insect which bears a striking resemblance in size, shape, color, and markings, to our *C. pictus*, or locust borer, which causes such destruction among locust groves.

The larvæ of various species of *Elateridæ*, or snapping bugs, so called here, under the name of wire-worms, cause much damage to the cereals, grasses, and vegetables in Europe, by devouring the collar from the plant, or boring into and destroying the roots themselves. Although our naturalists here have numberless species of these insects in their collections, I doubt whether the history and habits of half a dozen of them have ever been studied at all when in the larva and pupa state, excepting, perhaps, *Alaus oculatus*, and a few others, inhabiting decayed wood. Indeed, it is much to be regretted that entomologists have not paid more attention to the earlier stages of most of our *Coleopteræ*, and I may say of all our other orders also. The study of entomology, in most cases, in this country seems confined to the mere collecting of a certain order of insects, pinning them in cabinets, and classifying or subdividing into groups and species according to some slight variation in form or anatomical structure, without having the slightest knowledge of their natural history in any of the previous stages of larva or pupa. Much more credit is given to one who discovers any new or rare insect than to him who first traces the natural history and peculiar habits of any familiar species from the egg up to its perfect state. The collecting and classifying of insects is, indeed, indispensable to the proper study of entomology, and involves great labor and expense; still it is to be regretted that we have so few field naturalists who make the various transformations, habits, and food of insects their peculiar study.

The May bugs, (*Hanneton*, Fr.,) in both larva and perfect state, commit great ravages in certain districts in France. They differ in form and color from ours, but their habits are so precisely similar that they need not be described here.

I may mention, in passing, that I received a report from Maryland that the blossoms of the ailanthus tree were fatal to our much-dreaded rose bug, *Macrodactylus subspinosa*, thousands being found dead and dying under the blossoming trees, but whether the male or female tree the correspondent did not state, and I merely record it as a fact reported to the department.

The *Buprestidæ*, attacking wood, have much the same habits as our native American species.

The *Curculionidæ*, or snout beetles, were very numerous in the various European collections, and are exceedingly injurious to crops there.

Among the *Attelabidæ*, *Rhynchites betulæ* (Fab.,) or *Coupe bourgeon*, destroys the leaves of the grape-vine by rolling them into a cylindrical form after having weakened the petiole, causing them to fall and perish.

The opium poppy, in Germany, is attacked by a small curculio, *Ceutorynchus macula alba,* which lives and undergoes its transformations in the seed vessel or poppy head.

Another curculio, *Lixus angustatus,* (Fab.,) is said to be very destructive in fields of beans; the larvæ mining into the stalks devour the pith, thus causing the plant to wither and die. I have myself observed our American *Lixus concavus* burrowing into the footstalk of the rhubarb or pie plant, and then depositing a single egg in each hole. I endeavored to rear the young larvæ, but they died in a few days, as soon as the stalks became withered. I have no doubt, however, that if the yellow decaying leaves of the rhubarb were examined, many of them would be found to have been injured by this insect.

Two small curculios, *Anthonomus pomorum* and *pedicularius,* (Linn.,) pierce the flower buds of apples to deposit their eggs in them, which, after hatching into worms within the bud, devour the pistils and stamens, thus causing much injury to the crop. When grafting pears in the spring, and cutting open buds to see if they were alive, I have often found a single egg in the centre of a growing bud. These eggs being much too large for those of the small curculio, the question arises whether they may not have been deposited by some of the larger species whose habits are as yet unknown, especially as it is said that the European *Phyllobius oblongus* (Linn.,) gnaws and destroys the grafts of pears and plums in that country.

The larvæ of *Baridius chloris,* (Fab.,) a small steel-blue curculio, injures the colza, producing the little galls or excrescences which are often found near the roots of that vegetable. In these galls they live and undergo their transformations. The larva of our native *Baridius trinotatus* burrows into and consumes the substance of the stalk of the common potato plant, and has been incorrectly supposed to be one of the primary causes of the rot.

Rhynchites bacchus, (Becmare,) a small bright copper-red curculio, pierces the young fruit of the apple and deposits its eggs therein, causing the fruit to fall much in the same manner as is done here by our codling moth. *R. cupreus,* a small copper-brown weevil, destroys the plum in the same way, but also makes a small notch in the footstalk which hastens its fall. I saw, however, no insect which approximates our plum weevil, *Conotrachelus nenuphar,* in either numbers, manner of attack, or destructiveness. Europeans may be thankful that as yet they have escaped this dreadful pest. *R. conicus* is of a blue-steel color, and deposits its eggs in the young buds of fruit trees. *R. alliaria,* also steel-blue, is very destructive to nurseries of young fruit trees, and injures them by cutting off the twigs and buds after having deposited their eggs therein.

The larvæ of *Anthonomus druparum* (Hbst.,) pierces the fruit of the cultivated cherry, while *A. incurvus* (Steph.,) does the same to the fruit of the wild cherry, and the stocks of the strawberry are cut off by *A. rubra,* (Hbst.)

A small metallic green beetle, *Polydrosus sericeus,* or the *Charançon argente* of the French, devours the foliage and fruits of fruit trees, especially of grafts, and, when numerous, cause much injury; *Phyllobius pyri,* of a blacker copper color, but similar in form, and *P. argentatus,* of a bright metallic green, have the same habits; *P. betulæ* attacks pear trees especially; *Polydrosus micans,* of metallic copper lustre, attacks hazel and beech, while *P. planifrons,* or the *Charançon du grosselier,* destroys gooseberries.

The *Silphidæ* feed generally on carrion, snails, dead fish, &c., but Leunis states that the larvæ of *Silpha atrata* and others destroy the beets in Germany. In the Exposition it was also said that *Silpha atrata* and *lævigata* caused much injury by devouring the shoots and young leaves of the same plant. It would be well for us, therefore, to examine more carefully into the habits of the larvæ of our American species.

The more minute wood-eating insects, and those injuring forest trees, were very well represented in the exhibition; but as this report relates chiefly to those affecting cereals, vegetables and fruits, I shall only mention *Synoxylon sexdentatum*, which attacks the stems of unhealthy grape vines, and *Xylopertha sinuata* (Fab.,) which injures the branches.

The *Chrysomelidæ* devour the leaves of trees and shrubs in the same manner as ours. One of them, the *Crioceris asparagi* (Linn.,) which destroys asparagus in Europe, has of late been introduced into this country, and has already increased to such an extent as to become exceedingly destructive in some of the States. This is another warning to use care that foreign insects be not imported and acclimated here.

This year I had a *Colaspis*, very similar to the *Colaspis strigosa*, brought to me in Washington, and said to be very injurious to the foliage of the grape vine, in which the perfect insects eat innumerable small holes.

Among the European insects beneficial to farmers, I shall only enumerate a few of the principal species which were exhibited as destroying noxious insects.

The Cicindelidæ, or tiger beetles, feed entirely upon other insects, and were well represented. Among the *Carabidæ*, the following were especially noticed: *Procrustes*, *Carabus*, *Calosoma*, *Pœcilus* and *Omaseus*. Worms, slugs, snails, and caterpillars are destroyed in immense numbers by the *Staphilinidæ*. *Silpha quadripunctata*, in the larva state, devours caterpillars, while, as before noticed, its relatives *S. Atrata* and *lævigata* feed upon the shoots and leaves of the beet root. *Carpophilus sexpunctatus* lives under the bark of pines, and destroys great numbers of the *Bostrichidæ* which attack the wood. *Dasytes flavipes* and *Rhizophagus depressus* live exclusively upon the *Bostrichidæ*. *Trogosita mauritianica* (Linn.,) or *Cadelle*, was exhibited as being frequently found in wheat granaries, where they destroy the larvæ of the wheat weevil and other insects injuring grain. I have myself seen the larva of the *Trogosita dubia* in maize, where it had burrowed into a hole, and was apparently feeding on the interior of the grain. It is of some importance, therefore, to ascertain what they really do feed upon before destroying them.

Ditoma crenata (Fab.,) *Brontes planatus* (Linn.,) and *Silvanus tridentatus* (Fab.,) were shown as destroying the larvæ of *Scolytus* and *Bostrichus*, which are both wood-eating insects. *Drilus flavescens* (Fab.) lives entirely on snails and slugs, whilst the larvæ of *Telephorus fuscus*, and *lividus* (Linn.,) and *Rhagonycha melanura* (Oliv.,) are ever on the chase for soft larvæ, and the larvæ of the destructive saw fly. The larvæ of *Malachius æneus* feed upon other grubs which inhabit the stems of plants. *Tillus elongatus* (Linn.,) *Thanasimus formicarius* (Fab.,) *Opilus mollis* (Linn.,) and *Hypophlæus bicolor* (Fab.,) feed upon the larvæ of wood-eating insects. The larva of *Brachytarsus varius* (Fab.,) live especially on the *coccus*, or scale insect, infesting pine trees.

I may here remark that I have seen the perfect insect of our *Chilocorus bivulnerus* (a small black lady-bird, with two bright red spots on the wing cases) early in the spring busily employed in tearing open the cases of the white scale insect inhabiting our pines and devouring the eggs. I have also observed that if they were disturbed in their repast, many, if not all the remaining eggs fell to the ground through the orifice made by the *Chilocorus* whenever the wind agitated the leaves. In Florida the *Exochomus guexi*, a very small red coccinella, with black thorax and two black spots on each wing case, was observed to act in similar manner with the orange scale or coccus. Indeed, almost all our *Coccinellidæ*, or lady-birds, are exceedingly beneficial by destroying plant lice and scale insects, and I have even known them attack the newly-formed chrysalis of a butterfly before the outer envelope had hardened. There is one exception, however, which must be mentioned, and that is the *Epilachna borealis*, a large lady-bird, the larvæ of which are very injurious to the squash and other plants of that family.

Very few of the other orders of insects beneficial to the agriculturist, such as ichneumon flies, &c., were exhibited, the principal collections being mostly of the coleoptera or beetles, and lepidoptera or moths, the caterpillars of which are so injurious to vegetation. Mr. Mocquerys exhibited the finest collection, consisting of thirteen large glass covered cases, containing specimens of destructive European insects, with the root, wood or foliage as attacked, and a short written description of the injury, and the scientific and common names and habits of the insect. This plan might be adopted with advantage in our agricultural museums, and would be improved by adding references to the pages in Harris, Fitch, and other authors who have described the insects and proposed remedies for their destruction.

Although so many insects injurious to the farmer were shown, very little attention appeared to be paid to ascertaining remedies for them, except in the case of some specimens of the wood of forest trees destroyed by insects under the bark. These were exhibited by Dr. Eugene Robert, and a label was attached to them stating that "the diseased or infected trees can be cured, and restored to pristine vigor, by a process of decortication or stripping off the outer bark by means of certain instruments, such as scrapers, &c., at a particular season of the year." This he states he has done, and with the most beneficial results, and proves his statements correct by exhibiting in his collection woods which he has thus operated upon, the label attached to these specimens reading as follows:

"Dressing founded on vegetable physiology of the trees injured by *Xylophagus* (wood-eating insects,) by means of the method of superficial decortication, or taking off the old bark to the liber exclusively, &c." Considerable caution would be necessary in trying this experiment, as there might be great danger of killing the tree, and any farmer attempting it will do it at his own risk.

The Imperial Society of Horticulture of the Rhone suggest that, as insects which infest plants have a horror of vinegar, this article be used as a preventive of their ravages. It is alleged by M. Denis, director of the School of Arboriculture, of Lyons, that last year's experience showed that trees sprinkled with a solution of nine parts water to one of vinegar bore fruit abundantly, while those not so treated produced scarcely any. It may be applied to flower beds or fruit trees by means of a garden syringe or a watering-pot with a fine rose.

Many specimens of the various powders for destroying insects were exhibited, and are at present very popular in Paris. The basis of all is supposed to be the powdered flowers of the Pyrethrum, a plant very nearly allied to our wild cammomile, or feverfew. The almost impalpable powder is blown from a bellows, or other instruments made for the purpose, and, if perfectly fresh, and from the dried flowers alone, is reported to be very effective in destroying insect life. If powdered stalks and leaves be mixed with the flowers, it is not so good; and if the powder is exposed to the air, it loses its effect. Growing plants of the Caucasian Pyrethrum, *P. willemottii*, *P. roseum*, with smooth green leaves and pink flowers, and *P. rigidum* having leaves covered with short, cotton-like hairs, and bearing a white flower, like our common ox-eye daisy, were also in the exhibition; and as seeds of all these have been received by the department at Washington, it is expected that some practical experiments will be made to test their real value as insect exterminators.

Apiculture, or the raising and breeding of bees, being one of the main features of the Exposition, there was a large display of hives, but nothing especially new or interesting to us. The Italian bees were recommended as being more peaceable and industrious than the common hive bee. Those exhibited were of a lighter color than ours, and had two broad light brown bands across the base of the abdomen.

The centre of the building was devoted mainly to the various species of silk-worms, their culture and products. Among these the ailanthus silk-worm, *Attacus cynthia*, appeared to attract the most attention. According to the statements of M. Guerin Meneville, this insect is now acclimated in France, and promises great results, as the worms may be reared in the open air upon growing ailanthus trees. The cocoons being suspended to the branches by means of a silken web fastened to the foot-stalks, remain hanging on the tree, and can be gathered without trouble. The silk is also said to be very strong and durable. The culture of the ailanthus silk-worm has been made more necessary in that country on account of a fungoid growth which has attacked and destroyed immense numbers of the common or Chinese silk-worm, (*Bombyx mori,*) in several parts of Italy and France. The ailanthus worm seems more hardy, and, it is hoped, may take the place of the other, should the disease continue. In this country, however, it is to be feared that the culture of the *Attacus cynthia*, for silk-producing purposes, will prove a failure, as, owing to the attacks of parasitical insects and birds, comparatively few worms would complete their transformation without protection. This, added to the high price of labor and the great trouble and expense of attending a large plantation of worms, will prevent the business from being profitable.

While speaking of the ailanthus, I would call attention to the following statement, which seems to indicate that the tree may perhaps be found more useful than is generally supposed. This notice was attached to a large piece of wood in the exhibition:

Results of experiments made at the port of Toulon, in 1865, *by M. Roul, engineer of bridges and highways, upon the tenacity and density of the wood of the ailanthus, as compared with stronger wood:*

	Tenacity.	Density.
Ailanthus, three experiments, average	32.812	0.713
Elm, seven experiments, average	24.867	0.604
Oak, ten experiments, average	19.743	0.751

The wood is also said by some to make good fuel, and not to give out an unpleasant odor in burning. But this remains to be proved.

To this may be added the following facts, reported to the department by Mr. W. R. Grosh, of Elkton, Maryland:

"About ten years ago a wharf was built at Marietta, Pennsylvania, between the Susquehanna river and the canal, in which was a post of the ailanthus. It was subject to all the changes of dryness and moisture incident to canal banks. When the tow-path was changed to the river side of the canal, and the wharf removed, this post was found to be perfectly sound.

"On another occasion a neighbor had a lot of ailanthus posts. Some he set in the ground, immediately after they were cut; they proved to be no more durable than posts of pine. The remainder he set when they were seasoned, and they proved, after eight years of trial, about as good as locust. To see them now one would suppose they might last always.

"These cases seem to indicate that the ailanthus is equal to the best timber for posts, if properly seasoned. It is also pronounced equal to oak, or even hickory, for fuel, by those who have used it. As it is a rapid grower, and easily raised from seed, it would prove valuable for belts and groves on our western prairies, if far enough from residences to render the odor of its blossoms endurable."

Bombyx mori, or the common silk-worm, was represented in all its forms and products. The other new or imported silk-producing insects, *Bombyx yama mai*, from Japan, which feeds upon oak; *B. pernii*, from China, food also oak; and *B. Faidherbia*, or *Bauhiniæ*, so named from the plant upon which it feeds, were exhibited, and are now being experimented with by Monsieur Guerin Meneville and others, to test their qualities and capabilities of culture in Europe. Two of our native moths, *Attacus cecropia*, and *Polyphemus*, were also in the exhibition, and I believe them to be of equal value with the others. Mr. Trouvelot, of Medford, Massachusetts, has succeeded in raising *A. polyphemus* in numbers sufficient to test its value as a silk-producing insect.

As my instructions required me to examine the various museums and botanical gardens, in order to learn the best system or plan for forming an agricultural and economic museum, to be attached to the Department of Agriculture of the United States, much of my time was taken up in visiting the garden of plants, museum, gardens of acclimation, and other similar institutions in Paris. I found that the system of classification in the permanent exhibition of Algiers and the colonies, approaches nearer what we require than any other, and I shall therefore proceed to give a somewhat detailed account of it. The plan is such that the museum is not only rendered interesting, but useful to all classes—to the manufacturer, the druggist, and, indeed, to men of all trades and professions. Scarcely any one can visit such a collection, so arranged, without learning something new or useful, and will frequently be astonished at finding things before looked upon as mere weeds or cumberers of the ground, rendered, by science and industry, sources of both individual and national profit. Still, it lacks in one respect; although the name is attached to each object, there was no system of reference to books or works giving an account of the growth and habits of the seed or plant, or the methods of manufacture.

In the first place, the specimens are divided into series, and secondly into sections; so that any object may be found by referring to the number of the section and series, which is conspicuously printed in large letters on each case.

Series 1st contains vegetable substances and their products.
Series 2d contains mineral substances and their products.
Series 3d contains animals and substances manufactured from them
Series 4th contains productions taken from the water.

These series are then subdivided into sections, thus:

Series 1st, containing vegetable substances and their products, is divided into—
Section 1. Woods and bark, as cork, &c.
Section 2. All textile materials and their fabrics, excepting cotton.
Section 3. Cotton, cotton threads and tissues.
Section 4. Oils and saponaceous substances.
Section 5. Dyes and tanning substances.
Section 6. Gums, resins, and varnishes.
Section 7. Medicinal drugs, &c.
Section 8. Cereals, grains, forage plants, and legumes.
Section 9. Flour, meal, and pastes made from them, such as maccaroni, vermicelli, &c.
Section 10. Wines, alcohols, preserves, and confectionery.
Section 11. Essential oils, perfumes.
Section 12. Tobacco.
Section 13. Sundry industrial vegetable productions.

Herbarium, &c., fill up the other numbers, but as they are of comparatively little importance, I will close here. In these sections we want fruit, flowers, &c., between the woods and textile fabrics; cereals and grains might be put after, instead of where it now stands; and, indeed, the whole arrangement can be so modified as to be extremely simple and utilitarian.

Series 2d. Minerals:
Section 1. Substances metallic.
Section 2. Substances non-metallic.

Series 3d. Animals and their products.
Section 1. Wool, hair, and their products.
Section 2. Silks.
Section 3. Skins and leather.
Section 4. Wax and honey.
Section 5. Bone, horn, and turtle-shell.

Here we want separate sections for animals, birds, insects, &c., together with the contents of the birds' stomachs, what particular insects are destroyed by individual species of birds, and peculiar marks designating each specimen as injurious or otherwise. We should also want specimens of draining tiles, &c., under mineral substances, in order to show which are best for peculiar soils; and also several other useful agricultural articles.

Should the department ever succeed in forming such a museum, under the first series, section one, wood and bark, might contain longitudinal and cross sections, or triangular blocks, of all our native woods, with labels attached, giving the name, habits, density, tenacity, and peculiar uses of each, with references to the latest and most reliable works on the subject.

In the section of textile materials and fabrics, excepting cotton, there were fibres of the *Agave mexicana*, or aloe; the *Heliconea caribea*, or Brasilier; *Musa textilis*, or abaca; hemps of Saigon, a species of *Urtica*, or nettle, from Cochin China ; also, string made from the fibre ; *Coir*, or cocoanut fibre, of which a coarse rope is made; fibre of the *Ananas*, or pine-apple, apparently very good ; *Battenbang* and *Suntang*, hemp-like fibre from Cochin China—very fine and apparently strong; fibre made from the stalks of the *Hibiscus esculentus*, or the common okra of our gardens; also fibre made from the *Bromelia kanatos* (?) and banana. A curious kind of fibrous cloth is also made by beating the inner bark of the *Broussonitia papyrifera*, or paper mulberry, in Tahiti, as likewise from the Dawron bark and *Ficus prolixa*, from New Caledonia.

Among the oil-producing seeds and nuts was particularly noticed oil from the seeds of the *Melia azederach*, or Pride of China, a tree which grows most vigorously in our southern States. The oil, however, looked like a thin, yellow lard, and did not appear to remain in a liquid state.

The oil from our common peanut, or pindar, *Arachis hypogæa*, was extremely fine and clear, and might be made in the south with great advantage. In former years tons of peanuts were shipped from the southern States, especially from North Carolina, to France, where the oil was pressed and refined, and then returned to this country and sold as pure olive oil.

There were also many fine samples of oil from cotton seed, melon, cucumis sativa, palm, Indian hemp, cocoanut, &c.

A museum of this kind would be of the highest interest and utility, and might be made a perfect reference on almost any subject. Once commenced, it would grow yearly from the contributions of agriculturists, naturalists, and others. It would likewise serve as a record of the introduction of any new seed, root, fruit, or fibre into the country by means of the department; and as the name and address of the donors would be attached to each specimen, they might readily be referred to in case of any further information being required on the subject. Contributions would doubtless multiply to such an extent that duplicate specimens might be distributed to the different States, and in this way aid to form State agricultural and economic museums.

In the garden of acclimation I made brief notes of the various animals and birds which are very rare or may be acclimated and in a measure domesticated here. The following are the principal:

A pair of auerochs, or bisons of Europe, lately presented to the society by the Emperor of Russia, are very valuable, not only from their extreme rarity, but also as being the only living representatives in France of the true wild bison family—a species now extinct excepting in Lithuanian forests, where the Emperor of Russia carefully preserves a large herd. The specimens in the garden are not large, and look much like our wild bison, or, as it is generally but wrongly called, buffalo. Their color is brown or blackish, and the hair on the head and shoulders is rough and shaggy. The real buffalo (*Bos bubalus*) is an entirely different animal, which was originally introduced from the East Indies, and is now domesticated in Italy and elsewhere. This animal is almost semi-aquatic in its habits, and delights to wallow in swamps and muddy places; it swims well, and is exceedingly fond of being in the water, frequently submerging itself so that only the nose and part of the head are visible.

The yak, or grunting ox, *(Bos grunniens,)* or, as the French term it, horse-tailed ox, is originally from the cold regions of Asia and the Himalaya mountains. There are several specimens in the gardens of acclimation and the garden of plants; in the latter place, especially, may be seen a most magnificent white bull. These animals are covered with a very long, shaggy coating of hair, which reaches almost to the ground, and have long hairy tails, like the horse. The noise made by them resembles the grunt of a hog. The Tartars use the yak as a beast of burden, and in France it appears entirely domesticated. Crosses have been obtained between it and the common cow, and this cross is said likewise to be prolific.

The zebus, or hump-backed cattle of India, have also been acclimated in these gardens. They are really beautiful animals. Their mild, placid looks, large, intelligent eyes, sleek condition, and glossy, short, satin coat form a striking contrast with both the yak and the buffalo. Dr. Davis, of South Carolina, several years ago had a number of these Bramin cattle, and affirmed that he found them much better adapted to the intense heat of the south than common stock. He also claimed for them good milking qualities, and said that as working cattle they could not be excelled, their ordinary walking pace being nearly as fast as that of a horse. I have also seen very fine specimens of this breed in Demarara, and they would doubtless succeed very well in the warm climates of Georgia, Florida, and Louisiana. The zebu is reported to have been crossed with the yak; if so, no doubt it could be with our common cattle.

Among the sheep and goats were several varieties of merinoes and the ong-ti or ti-ang, Chinese sheep, which are celebrated for their prolific qualities, although I believe they have not answered the expectations of our farmers after two or three generations.

The sheep of Yemen have the body and legs pure white, while the head and part of the neck are of an intense black. They have no wool, but only a kind of nap or short hair. For use they would probably be no improvement on our most common kinds, but might be ornamental on a lawn or in a small park.

The Angora or Cashmere goats resemble those bred in our country. They are white, and similar to the breeds imported by Dr. Davis, of South Carolina, and Judge Peters, of Georgia. In the description of the Angora goat given in the catalogue of the society, I find it stated that at the last exposition of agricultural products magnificent tissues were exhibited by M. Davin, which had been manufactured from these fleeces; so we may yet hope for success with the Angora in the United States.

The llama inhabits the elevated regions of the Andes. Their flesh is good, and their fleece valuable for manufacturing purposes. There appear to be both dark-red, brown, and white varieties. The alpaca lives under the same conditions as the llama, but is smaller, and the fleece is longer and more silky. The vicuna and guanaco live in a wild state in the most elevated regions of the Andes, near the limits of perpetual snow. These four species can be crossed, and their progeny is fertile. The administration of the garden, in order to test these animals, have crossed the llama and alpaca, and the alpaca and guanaco. Their progeny has given satisfaction, the fleeces surpassing in quality those of their parents.

Among the horse tribe exhibited, the zebra holds the most conspicuous place on account of its beauty, the whole skin being regularly stripped or barred with black lines on a cream-colored ground, but the heavy head detracts from the general air of grace and lightness of the other parts of the animal. The dauw or Burchell's zebra is merely striped on the head, neck, and fore part of the body. They have bred and reproduced to the third generation at the Museum of Natural History, and are said to be very tractable.

The hemione or wild ass of Tartary, *(Equus hemionus,)* when in its wild state, is said to be one of the swiftest animals known. They are now acclimated, and breed perfectly well in a state of semi-domestication. They have been successfully crossed with the common donkey. From its reputed swiftness, perhaps, it might be advantageous to cross it with our common horse, in order to produce an extra swift race of mules. The hemione resembles a large, good-looking, fawn-colored donkey, and has nothing particularly attractive in its appearance.

A Siamese pony in the stables was well made, very small, of a cream color, with black mane and tail. The Shetland, in size and color, resembles a good-sized black Newfoundland dog, while the most pigmy pony in the collection is labelled "The Island Pony," but where the island is there is none to tell. This pony is really worth seeing—it is so very small, of a black color, and perfectly well formed.

I saw no true swine in the collection, the nearest approach to them being the collared peccary of Texas and South America. These animals have bred several times in confinement, but their size being small, their tempers rather uncertain, and their tusks unusually sharp, I do not think that, as a race of hogs, they are desirable.

The deer need not occupy space here, as we have enough of them in a wild state, and will merely remark that several of them might be introduced with advantage into the parks of our merchant princes, especially the fallow deer, *(Cervus dama,)* which is particularly adapted to this purpose. The antelopes, gnus, &c., are also very pretty and interesting, but more for ornament than for any real use.

In the poultry yard one of the most interesting objects was the wild cock of Sumatra. He was the most game-looking fowl in the whole collection, resembling our black-breasted red game, the back being red, while the neck and breast were of a rich dark metallic bronze. The tail was drooping and something pheasant-like, but shorter. This drooping might, however, be accounted for by the fright and agitation he evidently felt at being intruded upon by a stranger. He was excessively wild, and endeavored to hide himself behind a bush or in his house. The comb is single, very large and red. The wattles are pendant, large, and red, excepting near the lower part of the head, where they are of a most beautiful sulphur yellow. This gives the bird a very beautiful and singular appearance, the two colors contrasting so strongly with each other on the dark bronze of the neck.

Of the Sonnerat fowl, owing to his wildness, I am unable to give any description, excepting that in the cursory glance I had he appeared very much like a large reddish bantam without feathered legs and with a drooping tail.

Our domestic fowls are generally supposed to have been derived from the Bankiva jungle fowl, though it is possible that other varieties may have assisted in the production of the numerous breeds and varieties.

Among the other fowls I particularly observed the Houdan breed. These fowls are medium sized, of a white and black checkered color, and one of their peculiarities is that they have five toes, three of which are turned forward and two backward. The Creve Cœur are like our black top-knots. The La Fleche breed are tolerably large, and of a black color. The *Race Espagnole* is our black Spanish. The Dutch *Race de la Campine* resembles our Creoles, but are larger. The Breda breed have feathered feet and legs, and very small or no top-knots. The male has no comb, but large pendant wattles. Of this kind there are four varieties—the white, blue, black, and cuckoo or mottled. The breed of Padua resembles our spangled top-knot Hamburgs, having the same plume of top-knot feathers on the head. Of these there are five varieties—the fawn color, the gold, silver, white and spotted. The Holland Padua resembles our black fowls, with large white top-knots, sometimes called white top-knot Spanish.

The Brahma pootra fowls were introduced into France from Assam in about 1850, are very large, and have a simple dentated comb of medium size; their colors are white, checkered with black, and their legs and feet are heavily feathered. In the gardens are three varieties—the blue, the common, and "*la varieté inverse.*" The "*Race de Nankin,*" or Cochin China, are natives of the warm regions of China, and were introduced into France in 1846. They are splendid fowls, of a very large size, very clumsy in shape and gait, of a buff color, and with no tail to speak of; their feet are covered with feathers, and their comb is single and notched. Of these fowls there are four varieties on exhibition; the white, the cuckoo or mottled, the black, (the cock has a large single comb and wattles,) and the buff, this last being the original color found in China, the other colors having been bred in Europe.

The Russian fowl is large, the head and neck of the hens being curiously muffled with feathers of a cinnamon color, while the body is of a lighter tint. The Yokohama breed is originally from Japan; the male is distinguished by a long, drooping, plume-like tail. The color of this fowl is whitish, with some red on the wings. The Bruges breed is a game fowl of an iron gray color, with a short tail. The hens of this breed are celebrated as setters, while the males are said to make splendid fighting birds, and, to use a common expression, are "game to the backbone."

The Dorkings, imported from England, are fine fowls for the table; but the guide to the gardens describes them as delicate, and affected by severe frost and wet weather, though with how much truth I am unable to judge.

One of the most curious fowls in the collection is the Wallikiki (*Gallus ecaudatus*) from Turkey or Persia. This fowl has no tail whatever, not even the apology for one possessed by the Shanghai, but only long silky feathers falling over the place where the tail ought to be. There are also several very small fowls, or bantams, in the collection, the most singular of which is the "*Race Negre*" (*Gallus morio*) from India. They are covered with a fine silky down, instead of feathers, and present the appearance of a half-grown chicken. Their skin is said to be black, but this could not be discovered through the coating of long silken down which envelopes the entire body, neck, and head.

Some of the bantam chickens (*Gallus banticus*) originally, probably, from India, are remarkably pretty. One of the breeds is of a mottled gray color, like our Dominiques, with fine rose comb and wattles and unfeathered legs. There are two varieties of these, the yellow or buff, and the golden. The white Java bantams are the most graceful and beautifully formed little white bantams in the whole collection. They have a blood-red rose comb and wattles, and no feathers upon their legs and feet. There is also a black variety of these Java bantams which I did not observe. The Nangasaki bantams, originally from Japan, are of a whitish color, with some black feathers in the tail and wings. The cock had an immense single comb and wattles, the feet are very short, the head thrown back and almost touching the tail, wings nearly trailing on the ground, and short important gait.

The pheasants come next in order as being in a semi-domesticated state; of these, however, I shall merely mention a few of the most interesting. In the first place, the common pheasant, (*Phasianus colchicus,*) found in the wild state in the Caucasus and near the Caspian sea, is the most common species in Europe. It is a most beautiful bird, and has for a very long time been kept in a semi-domesticated state in the parks, woods, and pleasure grounds of wealthy persons, where it breeds almost as well as domesticated fowls. It roosts at night on elevated trees, and, like our domesticated Guinea fowls, loves to wander about the woods and fields. These birds ought by all means to be introduced into our ornamental parks and pleasure grounds, being at the same time useful as an article of food, as well as highly ornamental. There are five varieties here, viz: the common, the ring-necked, ash color, white, and parti-colored. The ring-necked pheasant is said to be originally from China. The male of the silver pheasant, (*Phasianus nycthemerus,*) originally from the north of China, is a most beautiful bird, of a silver white color, with regular, slender, lace-like black markings on the feathers of the back, while the under parts are of a black color; the long, drooping tail is also silver white, barred with black. This bird is said to be completely domesticated in France, where it is bred and reared with perfect ease. The female is by no means as beautiful as the male, being of a dull reddish color, and of a smaller size. The golden pheasant, *Phasianus* (*thaumalea*) *pictus,* is one of the most beautiful and bizarre birds, bred in a state of half-domestication, and is much smaller than either of the pheasants before mentioned. The under part of the male is of a red color, the head is ornamented with a splendid golden yellow crest, the neck is hidden or overhung by a somewhat projecting ruff of feathers of a bright yellow color, striped or barred with black. The wings are of a dull blue, the hind parts of the body are of a golden color, set off with red, and the tail is long and brown, barred with black. The female of this species is also very inconspicuous in color. These birds have bred well in some forests in Europe, and in a state of domestication have produced three varieties, viz: the ordinary golden and red color, the black, and the Isabella or fawn.

The *Euplocomus* (*Gallophasis prelatus*) or blue pheasant is one of the most splendidly metallic-colored birds in the gardens. It was introduced from Siam and Cochin China in 1862; it is of medium size, with crested head, and a back of the most brilliant metallic blue and gold, which, when reflected upon in the sunshine, gives forth almost all the colors of the rainbow.

The Impeyan pheasant, *Lophophorus impeyanus,* or *refulgens,* is a most splendid bird. The male is nearly as large as a Brama fowl. It is from the high montainous regions of Hindostan, and as it bears well the severe cold weather, it might be introduced into the United States. It breeds well in partial confinement, thirteen young ones having been raised in the gardens of the Zoological Society of London this season.

The *Song-ki (Crossoptilon auritum)* is from the mountains of the north of China and Thibet. This is also a most splendid bird; it is the size of a common fowl, of a blackish color, with a whitish tail formed of long hackle or barbed slender feathers. Some of the feathers of the neck are white and elongated so as to form two horn-like appendages which project on each side of the top of the head, giving this bird a most singular and grotesque appearance.

The Guinea fowls *(Numida meleagris,)* originally from the north of Africa, are represented by four varieties, viz: the common, parti-colored, lilac, and white. There is also a species with blue cheeks, *(Numida ptilorhyncha,)* from Egypt and Senegal, of similar color and marking as our common Guinea fowl, but distinguished by the blue color of the cheeks and wattles, and by the much less disagreeable cry which it makes when disturbed or on its wanderings. The crested or helmeted Guinea fowl *(N. tiarata)* from Madagascar is thus named from the rounded crest on the top of its head, which has been compared to a tiara. Of the common peacock, originally from India, Malabar, Ceylon, &c., there are the common, white, and parti-colored varieties. The Japanese peacock from India differs from the common species in the blue color and metallic reflections of the neck; whilst the green-necked peafowl, *(Paon speciferus,)* from Cochin China and Indian Archipelago, is distinguished by the neck being of a green color. Our native American wild turkey is also here, and six varieties of the domesticated kinds, namely: the black, white, gray, parti-colored, red, buff or fawn. Our bronze-backed turkeys are probably a cross between the common black and our wild turkey, as in the descriptive catalogue of the garden of acclimation we find it stated that "the common and wild turkeys cross readily, and that these crosses are much larger and more brilliant in colors than the common tame varieties." "Oviedo was the first to speak of the turkey," and according to some historians the turkey existed in France in 1518 or 1520; according to others it was first introduced in Spain, whence it was introduced into England in 1524; and it is somewhat strange that no mention is made in this pamphlet of its supposed Mexican origin.

The swans, geese, and ducks next claim attention. Of the swans there are the red-billed or domestic, the black-billed or wild swan, and the black swan from New Holland and Van Dieman's Land. This last bird is of a jet-black color, with a bright scarlet beak, and as it is a most magnificent and graceful bird, perfectly domesticated, and breeding well in confinement, it would be a most valuable acquisition to the lakes and waters of our large city parks. I am unable to say much about the geese, as one enclosure contained several species together, and I probably should make mistakes in the names, not being ornithologist enough to name varieties I have never either seen or heard of before. However, I recognized our common Canada and white-fronted goose, and the brent, as old American acquaintances. The ruddy-headed goose from the Falkland islands, the China goose, said to be very common in Russia, and the Egyptian goose, which is furnished with a small, sharp spur on the bend or elbow of the wing, would no doubt prove valuable to our farmers if introduced into America, as they are perfectly domesticated. The male of the upland goose, (*Clœphaga magellanica,*) or upland goose from the Falkland Islands, is a very large and fine bird; but one of the prettiest geese in the collection is the Sandwich Islands goose, (*Clœphaga sandwichensis,*) which may be more properly classed among the land than the water birds. It was introduced into Europe in 1832. The red-billed tree duck, (*Dendrocygna antumnalis,*) from Guinea and Brazil, appeared to be quite domesticated, and when I saw it was feeding upon the short turfy grass in its enclosure in a very goose-like manner. It is a very ornamental bird, the bright red bill and legs forming a striking contrast to the shaded gray and black color of its plumage. The white-faced tree duck from Brazil, in the same paddock, is also one of the perching ducks, but is of a smaller size, with bluish bill and legs, and instead of the usual quack given by our tame duck, this bird makes a kind of whistling sound. Our common wood or summer duck is also domesticated here. This species of duck ought to be more highly prized by our countrymen than it now is, and most probably it would be were it a foreigner and cost a very large sum of money to import. In these gardens it is as tame as our domestic mallards, and reproduces with as little trouble. The mandarin ducks from the north of China were all in very plain plumage, but, when in full summer dress, the male is said to be the most beautiful bird of the duck tribe. It somewhat resembles our summer duck in size, shape, and color, but is said to be infinitely more beautiful. These ducks were introduced into Holland about 1850, and reproduce very readily in a state of domestication. The Bahama duck, *Anas* (*dafila*) *bahamensis*, is very easily domesticated, and resembles a small mallard with a pointed tail, but the bright red color on the base of its bill renders it a most beautiful object when swimming.

In the collection of the Zoological Society of London were some animals and water-fowl which were not in the gardens of acclimation in Paris, and which deserve a passing notice, as they may be introduced and acclimated in this country.

Among the swans, the black-neck swan (*Cygnus nigricollis,*) from Chili, presented a remarkable appearance, the plumage of the body, wings, and tail being snow-white, while the head and neck are jet-black. The bill is ornamented with a red knob or protuberance. As they bred in England in 1858 and 1859, they may be considered as acclimated there.

The genus *Clœphaga*, as grass-eating geese, derive their name from their habit of feeding almost entirely upon grass, and are more terrestrial than aquatic in their habits. The ash-headed goose, *clæphaga poliocephala,* may be particularly noticed, as they have increased rapidly since their introduction in 1849. The Cereopsis goose (*Cereopsis novæ hollandiæ,*) or Cape Barren goose, from Australia, breeds almost every year in the gardens. This bird is large and of a gray color; its bill is very short, with the base of a yellow green tint; the legs are pinkish, and the feet dark. The bar-headed goose, (*Anser indicus,*) from Hindostan, is so called from the head, which is white, being barred with a black stripe running across it from the eyes, and another similar stripe below them. The red-breasted goose, *Bernicla ruficollis,* from northeastern Europe, and northern Asia, is very rare. The crown of the head is black with a white patch near the bill; on each cheek is a red patch bordered with white, and its neck at a distance appeared to be longitudinally striped with white and a dark color.

The beautiful Bahama duck has been bred very freely in a state of semi-domestication, and might be introduced here in our lakes and ornamental ponds.

Among the swine in the gardens of the Zoological Society of London may be seen the West Indian river hog, *Palamochœrus penicillatus,* which is remarkable for large protuberances on each side of its face; its color is reddish yellow, with a white line on the back, and a white stripe around the eyes and on the cheeks; its tail is long and straight, and the ears are upright, narrow, and tufted with hair at the end.

The white-whiskered pig, or Japanese wild swine, *Sus leucomystax,* resembles our peccary. The young of the European wild boar are of a dirty brown color, longitudinally striped with lines of a lighter color; these lines disappear with age. This fact is merely mentioned as the young of our semi-wild hogs in the south are sometimes striped in a similar manner.

The Andaman pig appeared to be the most susceptible of domestication, as it was very quiet, and showed a tendency to fatten; indeed it looked very much like a domesticated swine of the Chinese blood, and was of a blackish color, with erect short ears.

The wild sheep were represented by the Barbary sheep, *Ovis tragelaphus.* This animal approaches near the goat in many respects. The Punjaub wild sheep, *Ovis cycloceros,* from northern India, and the European moufflon, *Ovis musimon,* from Corsica and Sardinia, have both bred in confinement.

These notes in regard to the gardens of acclimatization, and the animals and birds therein, have been more extended and minute in detail than might appear necessary; but it was thought that many of the observations here made would be useful in this country to founders of the new parks and public grounds now becoming so popular in all our large cities. Also, the facts here made known may be of interest to the Department of Agriculture, should it decide to institute a similar establishment for breeding such useful animals and fowls as it might be found desirable to introduce and acclimatize.

It may be further added, that at the exposition of insects I was an exhibitor as well as an observer, having taken with me a colored copy of my insect plates, 130 in number, to which I had attached a catalogue of the vegetable substances fed upon by insects. By the aid of these plates and the catalogue I was able to explain the idea upon which the entomological division of our national agricultural museum is based. The French had nothing like it at the Exposition, and to prove the estimation in which the work and the plan were held by them, I have the honor to report to you that I received therefor the great gold medal of his Majesty the Emperor. Also, to this may be appended the following extract, translated from the official report of the exhibition, page 115, of the "Documents relating to the Exposition of Insects, held at the Palace of Industry, at Paris, in 1865:"

"The grand gold medal of the Emperor yet remained to be decreed, and the jury sought to ascertain to whom the high award was due; when, at a late hour, a stranger, an American, M. Townend Glover, attached to the Department of Agriculture, at Washington, presented himself with a work on practical entomology, applicable to agriculture; this work, comprising, on 130 copper plates, the useful and noxious insects of North America, belonging to all the orders established by naturalists, coleoptera, &c., is designed and executed by the exhibitor himself from nature, and presents them in their three forms of larva, pupa, and perfect insect.

"To these 130 plates is attached a table with numbers, which refer to the text, and indicate the plants, trees, or shrubs commonly inhabited by each larva or insect, mentioning the parts attacked, whether the roots, leaves, wood, fruits, grains, &c.; the nature of the damage done, the habits of the insects, the remedies, old and new, to prevent their ravages, and, as far as known, the efficacy of the remedies. These plates have been executed with the greatest care, the insects being represented with exact fidelity to nature. In brief, this work, which has cost the author ten years of research and observation, and for which he well merits the high position he occupies in the Department of Agriculture at Washington, was judged by an eminently scientific jury to be original in its style and character, and deserving to be copied by the entomologists of France as a *desideratum* in the application of their science to agriculture.

"This work, though not yet completed in the text, is remarkable for its plan. One division in it is especially full of interest to us; it is that which treats of the cotton plant, (now being cultivated in several of our provinces in Algeria,) with representations of the insects which attack the roots, the flower, and the capsule."

All of which is respectfully submitted.

TOWNEND GLOVER.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

RESOURCES AND INDUSTRIAL CONDITION OF THE SOUTHERN STATES.

BY DANIEL R. GOODLOE, OF NORTH CAROLINA.

THE SOCIAL AND POLITICAL REVOLUTION.

The attempt of the slaveholding States to throw off their allegiance to the Constitution of the Union has been properly designated a rebellion; while the failure of the effort has been attended by consequences which can only be characterized as a revolution, more complete and radical, as it affects themselves, than any of which history furnishes a record. This revolution is in every point of view unique. It was not intended or contemplated by the authors of the rebellion, but has resulted from their abortive enterprise. It is two-fold in its nature—political and social. The oligarchy which has so long ruled the country is, for the time being, stripped of all power, and its members are suing for pardon at the hands of the national Executive. As a powerful class, bound together by common interests, it is forever dissolved by the destruction of slavery. The passions which inspired it in the past will cling to the individuals composing it; but they must cease to have a great common bond of fellowship, and they can no longer be united in a common purpose.

But it is the radical and compulsory change in the social system which distinguishes the southern from all other revolutions, ancient and modern, and which has caused a temporary paralysis of industry.

The whole structure of southern society was founded on slavery. It was the one great controlling interest. The institution was a curse to the country. It retarded industry and enterprise by an unnecessary absorption of capital. It gave all to agriculture, and left nothing for commerce and manufactures; but in the actual condition of things, slaves constituted the most valuable property of the southern people. Land was always dull of sale; town lots and other property were never in great demand; manufacturing and mechanical investments were rarely safe; but negro property was always available. Slaves were portable, and could be sold at a large profit by their transfer from the old and worn-out plantations of Virginia and the Carolinas to the fertile cotton fields of the southwest. Generations had been educated in the employment of slave labor, with all its attendant circumstances; and the sudden destruction of the system produces a derangement and disorganization of industry not unlike that which would follow an instantaneous transfer of the population of the city to the country, or of the country to the city. The people must learn new methods of conducting their farms and households, and must become habituated to the idea that their late slaves are freemen, before the south can resume its former prosperity.

STATISTICS OF POPULATION, AREA, INTERNAL IMPROVEMENTS, AND WEALTH.

The great change which has taken place in the labor system of the south presents the opportunity for infusing new elements into southern life and new ideas of industrial enterprise. The desire for information in regard to the condition and resources of the southern States has been greatly stimulated since the overthrow of the rebellion and of slavery. The voluminous reports of the Census bureau, although abounding in such information, are not accessible to the public at large; and the knowledge to be obtained from them is diffused over a large space, and through several quarto volumes. There are also other sources of valuable facts in regard to the south, and it has been thought advisable to present the whole subject in a single article through the pages of this report. Before entering into a review of the nature and characteristics of slavery as a system of organized labor, and upon the consequences which result from its abolition, the following tables and statistical statements are presented, in order that the reader may have, so to speak, the whole case before him. It will be seen that the "border States" which remained in allegiance to the Union are distinguished, as far as was practicable, from those which engaged in the rebellion. The tables here presented are deduced from the census, but not without considerable labor. It has been of late years the practice with the compilers of the census returns to place the statistics of the several States in alphabetical order, thus confounding the slaveholding with the non-slaveholding. The inconveniences of this arrangement have often been experienced by writers and speakers, as well as by the students of American statistics. It has not been without considerable labor that I have rearranged them in the order in which they stand in this article, which shows at a glance the relative wealth, population, and resources of the south as compared with those of the north.

Territorial extent and population to the square mile.

BORDER STATES AND DISTRICT OF COLUMBIA.

States.	Square miles.	No. of acres.	Population to square mile.
District of Columbia	60	38,400	1,251.00
Delaware	2,120	1,356,800	52.93
Maryland	11,124	7,119,360	73.43
West Virginia	20,541	13,146,240	17.00
Kentucky	37,680	24,115,200	30.67
Missouri	67,380	43,123,200	17.54
Total	138,905	88,899,200	25.64

STATES LATELY IN REBELLION.

States.	Square miles.	No. of acres.	Population to square mile.
Virginia	40,811	26,119,040	30.54
North Carolina	50,704	32,450,560	19.58
South Carolina	29,385	18,806,400	23.93
Georgia	58,000	37,120,000	18.23
Florida	59,269	37,931,250	2.37
Alabama	50,722	32,462,080	19.01
Mississippi	47,156	30,179,840	16.78
Louisiana	46,431	29,715,840	15.25
Texas	237,504	152,002,560	2.55
Arkansas	52,198	33,406,720	8.34
Tennessee	45,600	29,184,000	24.34
Total	717,780	459,378,290	12.19
Add border States	138,905	88,899,200	25.64
Grand totals	856,685	548,277,490	14.37

Population of the southern States and District of Columbia in 1860.

BORDER STATES.

States.	Whites.	Free colored.	Slaves.	Total.
Delaware	90,589	19,829	1,798	112,216
Maryland	515,918	83,942	87,189	687,049
District of Columbia	60,764	11,131	3,185	75,080
*West Virginia	334,891	1,976	12,761	349,628
Kentucky	919,517	10,684	225,483	1,155,684
Missouri	1,063,509	3,572	114,931	1,182,012
Total	2,985,188	131,134	445,347	3,561,669

* The addition of Berkeley and Jefferson counties will add 27,060 to the total population.

REBELLIOUS STATES.

States.	Whites.	Free colored.	Slaves.	Total.
Virginia	712,520	56,066	478,104	1,246,690
North Carolina	631,100	30,463	331,059	992,622
South Carolina	291,388	9,914	402,406	703,708
Georgia	591,588	3,500	462,198	1,057,286
Florida	77,748	932	61,745	140,425
Alabama	526,431	2,690	435,080	964,201
Mississippi	353,901	773	436,631	791,305
Louisiana	357,629	18,647	331,726	708,002
Texas	421,294	355	182,566	604,215
Tennessee	826,782	7,300	275,719	1,109,801
Arkansas	324,191	144	111,115	435,450
Total	5,114,572	130,784	3,508,349	8,753,705
Total border States	2,985,188	131,134	445,347	3,561,669
Grand total	8,099,760	261,918	3,953,696	12,315,374

The following statistics, compiled chiefly from the census, will further set forth the wealth and resources of the south:

Assessed value of real and personal property.

Years.	Real estate.	Personal estate.	Total.	Estimated or true value.
DISTRICT OF COLUMBIA.				
1850	$14,409,413	$1,774,342	$16,183,755	
1860	33,097,542	7,987,403	41,084,945	
DELAWARE.				
1850	14,486,595	4,410,275	18,896,870	$21,062,556
1860	26,273,803	13,493,430	39,767,233	46,242,181
MARYLAND.				
1850	139,026,610	69,536,956	208,563,566	219,217,364
1860	231,793,800	65,341,438	297,135,238	376,919,944
WEST VIRGINIA.*				
KENTUCKY.				
1860	277,925,054	250,287,639	528,212,693	666,043,112
MISSOURI.				
1860	253,450,577	113,485,274	366,935,851	501,214,398
REBELLIOUS STATES.				
VIRGINIA. †				
1860	417,952,228	239,069,108	657,021,336	793,249,681
NORTH CAROLINA.				
1860	116,366,573	175,931,029	292,297,602	358,739,399
SOUTH CAROLINA.				
1860	129,772,684	359,546,444	489,319,128	548,138,754
GEORGIA.				
1860	179,801,441	438,430,946	618,232,387	645,895,237
FLORIDA.				
1860	21,722,810	47,206,875	68,929,685	73,101,500
ALABAMA.				
1860	155,034,089	277,164,673	432,198,762	495,237,078
MISSISSIPPI.				
1860	157,836,737	351,636,175	509,427,912	607,324,911
LOUISIANA.				
1860	280,704,988	155,082,277	435,787,265	602,118,568
TENNESSEE.				
1860	219,991,180	162,504,020	382,495,200	493,903,892
ARKANSAS.				
1860	63,254,740	116,956,590	180,211,330	219,256,473
TEXAS.				
1860	112,476,013	155,316,322	267,792,335	365,200,614

* In the census returns the value of real and personal estate is given in the aggregate for each State, and it is therefore impracticable to distinguish between East and West Virginia in this respect. The valuation of property for the State, as it existed in 1860, is stated in its proper place.

† For the reason stated above, the valuations include those of West Virginia.

CANALS, RAILWAYS, ETC.

The following table exhibits the number of miles of railroads in each of the southern States, the number of miles of canal, and the number of miles of slack-water navigation. The District of Columbia, as elsewhere in this article, is classed with the border States, for the reason that it was formerly a part of them, and constituted a portion of the south.

BORDER STATES.

States	Canals, miles of.	Railroads, miles of.	Slack-water navigation, miles of.
District of Columbia	8	6	....
Delaware	12.63	136.69	....
Maryland	184.50	380.30	....
*West Virginia	....	....	....
Kentucky	2.50	569.93	766
Missouri	....	817.45	....
Total	207.63	1,910.37	766

* For the reason already explained, the statistics of East and West Virginia are blended.

REBELLIOUS STATES.

States.	Canals, miles of.	Railroads, miles of	Slack-water navigation, miles of.
Virginia	196.98	1,771.16	....
North Carolina	19	889.42	....
South Carolina	51.32	987.97	....
Georgia	28	1,404.22	....
Florida	....	401.50	....
Alabama	51.76	743.16	....
Mississippi	....	872.30	....
Louisiana	4.25	334.75	63
Tennessee	....	1,197.92	....
Arkansas	....	38.50	....
Texas	....	306.00	....
Total	351.31	8,946.90	63
Border States	207.63	1,910.37	766
Grand total	558.94	10,857.27	829

The whole number of miles of canals in the United States in 1860 was 4,215.34, of which, as will be seen, the southern States (both loyal and disloyal) contained 558.94, or less than one-seventh. The whole number of miles of railroads in the Union at the same period was 30,793.67, of which the late slave-holding States contained, as above, 10,857.27, or a fraction more than one-third. This is exclusive of city passenger railways drawn by horses, of which there were 402.57 miles, which, with the exception of 26.30 miles in St. Louis, were in the cities of the non-slaveholding States. The whole number of miles of slack-water navigation in 1860 was 1,246.77, of which 829 miles, or two-thirds, were in the slaveholding States, chiefly in Kentucky.

SOIL, CLIMATE, AND PRODUCTION.

The southern States, extending from the 40th to the 24th degree of north latitude, and from the 75th to the 107th degree of west longitude, embrace a great variety of climate, and every variety of soil. Their productions include those of the temperate and tropical zones. The south produces all the cereals; but its soil and climate are best adapted to Indian corn, wheat, oats and rice. The latter grain is produced exclusively in the lowlands of the Carolinas, Georgia, and the Gulf States. The great staple, cotton, is also produced almost exclusively in the south. The crop of 1859, the last reported in the census, amounted to 5,335,354 bales, of 400 pounds each, clear of the seed; or to (2,154,141,600) two billion one hundred and fifty-four million one hundred and forty-one thousand six hundred pounds. This crop would now (March, 1866) be worth at current prices about $900,000,000, a sum equal to nearly one-third of the national debt. The south has no equal in the production of cotton, which is incomparably the greatest item in the commerce of nations, and is destined to confer upon this country, in connexion with the gold and silver products, the command of the commerce of the world. Next in importance to cotton, among southern exports, is tobacco. This, like cotton, rice, and cane-sugar, is peculiarly though not exclusively a southern production. The following statistics, culled from the census, embrace the leading articles of southern production. It is proper to say, however, that every article which grows in any northern State, will flourish, under proper culture, in every southern State.

It is an interesting fact that the south produced more of the great staple, Indian corn, than the north. Thus the aggregate crop of the Union in 1859 was 838,792,740 bushels, of which the southern share was 441,980,667 bushels. Illinois produced more than any other one State, and next in order came Ohio, Missouri, Indiana, Kentucky, and Tennessee.

The south produced about two-sevenths of the wheat crop, and nearly a fifth of the oat crop. It produced about one-ninth of the common potato crop, and nearly all of the sweet potatoes. Hay is grown in the south, especially in the mountain districts, and in Missouri and Kentucky. But this great crop is peculiarly northern.

There are many other valuable agricultural productions not here enumerated. It is sufficient to repeat that whatever grows in the northern States will, under an enlightened system of husbandry, flourish in all parts of the south.

Principal productions of the southern States as reported in the census of 1860.

States.	Tobacco.	Cane-sugar.	Hemp.	Peas and beans.	Cotton.
	Pounds.	*Hhds.*	*Tons.*	*Bushels.*	*Bales of* 400 *lbs.*
Alabama	232,914	175	....	1,482,036	989,955
Arkansas	989,980	....	447	440,472	367,393
Delaware	9,699	....	....	7,438	....
Florida	828,815	1,669	1	363,217	65,153
Georgia	919,318	1,166	31	1,765,214	701,840
Kentucky	108,126,840	....	39,409	288,346	....
Louisiana	39,940	221,726	1	431,148	777,738
Maryland	38,410,965	....	272	34,407	....
Mississippi	159,141	506	....	1,954,666	1,202,507
Missouri	25,086,196	402	19,267	107,999	41,188
North Carolina	32,853,250	38	3,016	1,932,204	145,514
South Carolina	104,412	198	1	1,728,074	353,412
Tennessee	43,448,097	2	2,243	547,803	296,464
Texas	97,914	5,099	179	341,961	431,463
Virginia	123,968,312	....	15	515,168	12,727
Dist. of Columbia	15,200	....	....	3,749	....
Total	375,290,993	230,981	64,882	11,943,902	5,385,354

The total tobacco crop of the Union in 1860 was 434,209,461 pounds, and the southern States, therefore, produced seven-eighths of the whole.

The cane-sugar crop was all produced in the south.

The hemp crop of the country was 74,493 tons, of which the south produced six-sevenths.

The pea and bean crops amounted to 15,061,995 bushels, four-fifths of which grew in the south.

The cotton crop was entirely southern, except 1,482 bales grown in Illinois.

LIVE STOCK.

Live stock in the southern States in 1860.

States.	Horses.	Asses and mules.	Milch cows.	Working oxen.	Other cattle.
Alabama	127,063	111,687	230,537	88,316	454,543
Arkansas	140,198	57,358	171,003	78,707	318,089
Delaware	16,562	2,294	22,595	9,530	25,596
Florida	13,446	10,910	92,974	7,361	287,725
Georgia	130,771	101,069	299,688	74,487	631,707
Kentucky	355,704	117,634	269,215	108,999	457,845
Louisiana	78,703	91,762	129,662	60,358	326,787
Maryland	93,406	9,829	99,463	34,524	119,254
Mississippi	117,571	110,723	207,646	105,603	416,660
Missouri	361,874	80,941	345,243	166,588	657,153
North Carolina	150,661	51,388	228,623	48,511	416,676
South Carolina	81,125	56,456	163,938	22,629	320,209
Tennessee	290,882	126,345	249,514	102,158	413,060
Texas	325,698	63,334	601,540	172,492	2,761,736
Virginia	287,579	41,015	330,713	97,872	615,882
Dist. of Columbia	641	122	639	69	198
Total	2,571,884	1,032,867	3,442,993	1,178,204	8,223,120

States.	Sheep.	Swine.	Value of live stock.
Alabama	370,156	1,748,321	$43,411,711
Arkansas	202,753	1,171,630	22,096,977
Delaware	18,857	47,848	3,144,706
Florida	30,158	271,742	5,553,356
Georgia	512,618	2,036,116	38,372,734
Kentucky	938,990	2,330,595	61,868,237
Louisiana	181,253	634,525	24,546,940
Maryland	155,765	387,756	14,667,853
Mississippi	352,632	1,532,768	41,891,692
Missouri	937,445	2,354,425	53,693,673
North Carolina	546,749	1,883,214	31,130,805
South Carolina	233,509	965,779	23,934,465
Tennessee	773,317	2,347,321	60,211,425
Texas	753,363	1,371,532	42,825,447
Virginia	1,043,269	1,599,919	47,803,049
District of Columbia	40	1,099	109,640
Total	7,050,874	20,684,590	515,262,710

The following statements exhibit the number and value of the live stock in the whole Union, in 1860, in comparison with that of the southern States:

	Horses.	Asses and mules.	Milch cows.	Working oxen.	Other cattle.
United States	6, 249, 174	1, 151, 148	8, 581, 735	2, 254, 911	14, 779, 373
Southern States	2, 571, 884	1, 032, 867	3, 442, 993	1, 178, 204	8, 223, 120
Northern States	3, 677, 290	118, 281	5, 138, 742	1, 076, 707	6, 556, 253

	Sheep.	Swine.	Value of live stock.
United States	22, 471, 275	33, 512, 867	$1, 089, 329, 915
Southern States	7, 050, 874	20, 684, 590	515, 262, 710
Northern States	15, 420, 401	12, 828, 277	574, 067, 205

It will be seen that the southern States possessed more asses and mules, more cattle, and more swine in 1860 than the northern; and that the value of live stock in the south was greater, according to the estimates of the census-takers. This latter fact will strike most minds with surprise, and, in view of the general superiority of northern animals, it can scarcely be credited. As it regards the greater numbers of southern live stock, however, there can be no doubt, and the fact is one of great interest, as illustrative of the resources of that section. The butter crop of the northern States excels that of the south in the proportion of five to one, while the cheese crop of the country, amounting to 103,663,927 pounds, is almost entirely northern.

MANUFACTURES.

The following table exhibits the total of manufactures in each of the southern States for the year ending June 1, 1860.

States and District of Columbia.	Number of establishments.	Capital invested.	Cost of raw material.	Number of hands employed.		Annual cost of labor.	Annual value of products.
				Male.	Female.		
Alabama	1, 459	$9, 698, 181	$5, 489, 963	6, 792	1, 097	$2, 132, 940	$10, 588, 566
Arkansas	518	1, 316, 610	1, 280, 503	1, 831	46	554, 240	2, 880, 578
Delaware	615	5, 452, 887	6, 028, 918	5, 465	956	1, 905, 754	9, 892, 902
Florida	185	1, 874, 125	874. 506	2, 297	157	619, 840	2, 447, 969
Georgia	1, 890	10, 890, 875	9, 986, 532	9, 492	2, 083	2, 925, 148	16, 925, 564
Kentucky	3, 450	20, 256, 579	22, 295, 759	19, 587	1, 671	6, 020, 082	37, 931, 240
Louisiana	1, 744	7, 151, 172	6, 738, 486	7, 873	916	3, 683, 679	15, 587, 473
Maryland	3, 083	23, 230, 608	25, 494, 007	21, 630	6, 773	7, 190, 672	41, 735, 157
Mississippi	976	4, 384, 492	3, 146, 636	4, 572	203	1, 618, 320	6, 590, 687
Missouri	3, 157	20, 034, 220	23, 849, 941	18, 628	1, 053	6, 669, 916	41, 782, 731
North Carolina	3, 689	9, 693, 703	10, 203, 228	12, 104	2, 113	2, 689, 441	16, 678, 698
South Carolina	1, 230	6, 931, 756	5, 198, 881	6, 096	898	1, 380, 027	8, 615, [illegible]95
Tennessee	2, 572	14, 426, 261	9, 416, 514	11, 582	946	3, 370, 687	17, 987, 225
Texas	983	3, 272, 450	3, 367. 372	3, 338	111	1, 162, 756	6, 577, 202
Virginia	5, 385	26, 935, 560	30, 840, 531	32, 606	3, 568	8, 544, 117	50, 652, 124
Dist. of Columbia	429	2, 905, 865	2, 884, 185	2, 653	495	1, 139, 154	5, 412, 102
Total	31, 365	167, 855, 344	167, 085, 962	166, 546	23, 086	51, 606, 773	292, 285, 413

The following statement exhibits the manufactures in the United States and Territories in comparison with those of the south:

	Number of establishments.	Capital invested.	Cost of raw material.	Number of hands employed.		Annual cost of labor.	Annual value of products.
				Males.	Females.		
Whole Union ..	140, 433	$1, 009, 855, 715	$1, 031, 605, 092	1, 040, 349	270, 897	$378, 878, 966	$1, 885, 861, 676
South..........	31, 365	167, 855, 344	167, 085, 962	166, 546	23, 086	51, 606, 773	292, 285, 413
North..........	109, 068	842, 000, 371	864, 519, 130	873, 803	247, 811	327, 272, 193	1, 593, 576, 263

It is seen that the southern share of capital invested in manufactures constitutes one-sixth of the whole. Compared with the western States, Indiana, Illinois, Michigan, Wisconsin, Iowa, and Kansas, the former slave States are not so far in the rear as is generally imagined. Illinois, for instance, with a population of 1,711,951 inhabitants in 1860, had a capital of $27,548,563 invested in manufactures. Virginia, with a population of 1,596,318 inhabitants, 490,865 of whom were slaves, and 58,042 free negroes, had a capital of $26,935,560 invested in manufactures. Kentucky and Missouri, also, had made larger investments in manufactures in proportion to population than either Illinois, Indiana, Wisconsin, or Iowa. On the other hand, each of the States of Pennsylvania and New York had invested more capital in manufactures than the fifteen southern States. The capital thus employed by the former in 1860 was $190,055,904, and that of the latter amounted to $172,895,652. Massachusetts, with a territory not larger than a Carolina congressional district, had invested in manufactures $132,792,327. The aggregate investment of the New England States was $257,477,783.

It is to be remarked that the manufacturing of the southern and western States consists in larger degree than that of the northeastern States in the mere preparation of the raw materials of agriculture for market. The same is, to some extent, true of the manufactures of Pennsylvania and New York, which embrace the extensive mining operations of the former, and the flour and meal manufactures of the latter. It is also worthy of notice that the manufactures of the southern States are, for the most part, located on their northern borders, where free labor has been predominant. Thus, in Delaware, of the $5,452,887 invested in manufactures, $4,863,472, or eight-ninths, belong to New Castle county, which contained but 254 slaves in a total population of 54,793. Maryland has $23,230,608 of manufacturing capital, nineteen-twentieths of which is to be found in the counties bordering on Mason's and Dixon's line, in which slavery had little more than a nominal existence. The manufacturing investments of Kentucky are chiefly at Louisville, and other places on the Ohio river; and three-fifths of the manufactures of Missouri are located at St. Louis. Wherever slavery is predominant, there no interest can flourish except agriculture.

SIZE OF FARMS.

As illustrative of the agricultural and social condition of the south, the following tables, showing the number of farms of various sizes, will be interesting:

Farms containing three acres and more.

States.	Acres, 3 and under 10.	Acres, 10 and under 20.	Acres, 20 and under 50.	Acres, 50 and under 100.	Acres, 100 and under 500.	Acres, 500 and under 1,000.	Acres, 1,000 and over.
Alabama	1,409	4,379	16,049	12,060	13,455	2,016	696
Arkansas	1,823	6,075	13,728	6,957	4,231	307	69
Delaware	63	215	1,226	2,208	2,862	14	......
Florida	430	945	2,139	1,162	1,432	211	77
Georgia	906	2,803	13,644	14,129	18,821	2,692	902
Kentucky	1,772	6,868	25,547	24,163	24,095	1,078	166
Louisiana	626	2,222	4,882	3,064	4,955	1,161	371
Maryland	457	1,210	4,346	6,825	12,068	303	35
Mississippi	563	2,516	10,967	9,204	11,408	1,868	481
Missouri	2,428	9,110	33,620	24,336	18,497	466	95
North Carolina	2,050	4,879	20,882	18,496	19,220	1,184	311
South Carolina	352	1,219	6,695	6,980	11,369	1,359	482
Tennessee	1,687	7,245	22,998	22,829	21,903	921	158
Texas	1,832	6,156	14,132	7,857	6,831	468	87
Virginia	2,351	5,565	19,584	21,145	34,300	2,882	641
District of Columbia	25	36	71	42	57	2	1
Total	18,774	61,443	210,510	181,457	205,504	16,932	4,572

The following tables, showing the average number of acres to each farm in all the States of the Union, at the same time marks the difference between the free and slave States, in this particular:

Free States.	Average number of acres to each farm.		Slave States.	Average number of acres to each farm.	
	1850.	1860.		1850.	1860.
California	4,466	466	Alabama	289	346
Connecticut	106	99	Arkansas	146	245
Illinois	158	146	Delaware	158	151
Indiana	138	124	Florida	371	444
Iowa	185	165	Georgia	444	430
Kansas	....	171	Kentucky	227	211
Maine	97	103	Louisiana	372	536
Massachusetts	99	94	Maryland	212	190
Michigan	129	113	Mississippi	309	370
Minnesota	184	149	Missouri	179	215
New Hampshire	116	123	North Carolina	369	316
New Jersey	115	108	South Carolina	541	488
New York	113	106	Tennessee	261	251
Ohio	125	114	Texas	942	591
Oregon	372	355	Virginia	339	337
Pennsylvania	117	109			
Rhode Island	103	96			
Vermont	139	135			
Wisconsin	148	114			

The reader will see at a glance that the average size of the southern farms is greater than those of the north. It is also to be remarked that in all the free States, except Maine and New Hampshire, the farms were smaller in 1860 than in 1850. This is a healthy tendency, as it implies better husbandry and a wider subdivision of the soil among the people. In the older southern States, comprising a majority of the whole, the same law is observable; while in the Gulf States, and in Arkansas and Missouri, the contrary is the case. As a general rule, where slavery was on the increase, the tendency was to the enlargement of the farms; while with the real or comparative diminution in the number of slaves, the farms were reduced in size.

The enormous magnitude of the farms in California, in 1850, is explained by the fact that the early settlers engaged extensively in sheep-raising before much attention was given to the cultivation of the earth; and the high average which still existed in 1860, notwithstanding the extensive introduction of agriculture, is doubtless owing to the continued existence of the same extensive grazing farms. The large averages in Texas and Oregon, in 1850, and their reduction in 1860, are to be accounted for in a similar way—cattle-raising in the latter cases being substituted for sheep-raising in California. If planting had been the chief occupation of the people, there can be no doubt that Texas, like the other new States of the southwest, would have exhibited an increase in the size of farms between the years 1850 and 1860.

The following tables tend to explain the foregoing, by showing the proclivity of the slaveholders to buy more land than they could cultivate:

SLAVE STATES.

States.	Number of farms.		Acres of land improved.		Acres of land unimproved.	
	1850.	1860.	1850.	1860.	1850.	1860.
Alabama	41, 964	55, 128	4, 435, 614	6, 385, 724	7, 702, 067	12, 718, 821
Arkansas	17, 758	39. 004	781, 530	1, 983, 313	1, 816, 684	7, 590, 393
Delaware	6, 063	6, 658	580, 862	637, 065	375, 282	367, 230
Florida	4, 304	6, 568	349, 049	654, 213	1, 246, 240	2, 266, 015
Georgia	51, 759	62, 003	6, 378, 479	8, 062, 758	16, 442, 900	18, 587, 732
Kentucky	74, 777	90, 814	5, 968, 270	7, 644, 208	10, 981, 478	11, 519, 053
Louisiana	13, 422	17, 328	1, 590, 025	2, 707, 108	3, 999, 018	6, 591, 468
Maryland	21, 860	25, 494	2, 797, 905	3, 002, 267	1, 836, 445	1, 833, 304
Mississippi	33, 960	42, 840	3, 444, 358	5, 065, 755	7, 046, 061	10, 773, 929
Missouri	54, 458	92, 792	2, 938, 425	6, 246, 871	6, 794, 245	13, 737, 939
North Carolina	56, 963	75, 203	5, 453, 975	6, 517, 284	15, 543, 008	17, 245, 685
South Carolina	29, 967	33, 171	4, 072, 551	4, 572, 060	12, 145, 049	11, 623, 859
Tennessee	72, 735	82, 368	5, 175, 173	6, 795, 337	13, 808, 849	13, 873, 828
Texas	12, 198	42, 891	643, 976	2, 650, 781	10, 852, 363	22, 693, 247
Virginia	77, 013	92, 605	10, 360, 135	11, 437, 821	15, 792, 176	19, 679, 215
Totals	569, 201	764, 867	54, 970, 327	74, 362, 565	126, 381, 865	171, 101, 718

It will be seen that in all the new States where there was public land to be had, the increase in the quantity of "unimproved" is, having reference to the number of farmers, out of all proportion to the addition of "improved" land.

FREE STATES.

States.	Number of farms.		Acres of land improved.		Acres of land unimproved.	
	1850.	1860.	1850.	1860.	1850.	1860.
California	872	18,716	32 454	2, 468, 034	3, 861, 531	6, 262, 000
Connecticut	22, 445	25,180	1, 768, 178	1. 830, 807	615, 701	673, 457
Illinois	76, 208	143.310	5, 039, 545	13, 096. 374	6, 997, 867	7, 815, 615
Indiana	93, 896	131.826	5, 046, 543	8, 242, 183	7, 746, 879	8, 146, 109
Iowa	14, 805	61,163	824, 682	3, 792, 792	1, 911, 382	6, 277, 115
Kansas	....	10.400	....	405, 468	....	1, 372, 932
Maine	46, 760	55,698	2, 039, 596	2, 704, 133	2, 515, 797	3, 023, 538
Massachusetts	34, 069	35,601	2, 133, 436	2, 155, 512	1, 222, 576	1, 183, 212
Michigan	34, 089	62,422	1, 929, 110	3, 476, 296	2, 454, 780	3, 554, 538
Minnesota	157	18,181	5, 035	556, 250	23, 846	2, 155, 718
New Hampshire	29, 229	30,501	2, 251, 488	2, 367, 034	1, 140, 926	1, 377, 591
New Jersey	23. 905	27.646	1, 767, 991	1, 944. 441	984, 955	1, 039, 984
New York	170, 621	196.990	12, 408, 964	14, 358, 403	6, 710, 120	6, 616. 555
Ohio	143, 807	179.889	9, 851, 493	12, 625, 394	8, 146, 000	7, 846, 747
Oregon	1, 164	5,806	132, 857	896, 414	299, 951	1, 164, 125
Pennsylvania	127, 577	156,357	8, 623, 619	10, 463, 296	6, 294, 728	6, 548, 844
Rhode Island	5, 385	5,406	356, 487	335, 128	197, 451	186, 096
Vermont	29, 763	31,556	2, 601, 409	2, 823, 157	1, 524, 413	1, 451, 257
Wisconsin	20, 177	69,270	1, 045, 499	3, 746, 167	1, 931, 159	4, 147, 420
Totals	874, 929	1,265,918	57, 858, 386	88, 287, 283	54, 580, 062	70, 841, 953

In order to make the comparisons palpable the following summary of the above tables is presented:

States.	Number of farms.		Acres of land improved.		Acres of land unimproved.	
	1850.	1860.	1850.	1860.	1850.	1860.
Northern	874, 929	1,265,918	57, 858, 386	88, 287, 283	54, 580, 062	70, 841, 953
Southern	569, 201	764,867	54, 970, 327	74, 362, 565	126, 381, 865	171, 101, 718
Differences	205, 728	501,051	2, 888, 059	13, 924, 718	71, 801, 803	100, 259, 765

The reader will remark that, both in the number of farms and in the number of acres of improved land at each of the periods, the northern States are largely in the ascendant. Also, that the ratio of increase in both these respects is generally on the side of the north. But in the columns containing the number of acres of unimproved lands the reverse is true. In 1850 the unimproved land appertaining to the southern farms was two and one-third times greater in quantity than similar lands belonging to the northern farms; and in 1860 the disparity was still greater. These facts illustrate the tendency of slavery to exhaust the soil by unskilful husbandry, and thus to make necessary new acquisitions. A large proportion of the "unimproved" lands in the south are, in fact, worn out fields which have been abandoned, as commons. This is particularly true of Virginia, the Carolinas, and Georgia.

A careful examination of the above tables will demonstrate that the smaller proportion of "unimproved" land belonging to northern farms, compared with those of the south, cannot be explained by the existence of a larger population in the one section than the other. For if States like Georgia, Alabama, Mississippi, Louisiana, and Arkansas, be compared with the States of the northwest, Illinois, Indiana, Michigan, Wisconsin, Iowa, and Minnesota, where land is equally abundant, the same characteristic difference will be found to exist; and it can alone be accounted for by the presence of slavery in one section, and its absence from the other.

EFFECTS OF SLAVERY ON POPULATION.

The foregoing facts suggest further inquiry into the nature of slavery, as a system of organized labor. It is apparent that the institution tends to retard the growth of population by immigration, if it has not the same effect upon the natural increase; that it obstructs the accumulation of wealth, and is especially incompatible with the development of commercial and manufacturing industry. The following tables, showing the populations, respectively, of the free and slave States, in 1790 and 1860, with their ratios of increase between those periods, are full of instruction on these points.

Population of free States in 1790 *and* 1860, *with the ratio of increase, in tenths and hundredths.*

States.	1790.	1860.	Ratio of increase.	Settled—
California				
Connecticut	238,141	460,147	93.22	
Illinois		1,711,951	13.838.70	1810.
Indiana		1,350,428	27.601.09	1800.
Iowa		674,913	1.465.56	1840.
Kansas				
Maine	96,540	628,279	550.80	
Massachusetts	378,717	1,231,066	225.06	
Michigan		749,113	15.631.06	1810.
Minnesota		172,023	2.730.72	1850.
New Hampshire	141,899	326,073	129.79	
New Jersey	184,139	672,035	264.96	
New York	340,120	3,880,735	1.040.99	
Ohio		2,339,511	5.057.08	1800.
Oregon		52,465	294.65	1850.
Pennsylvania	434,373	2,906,215	569.03	
Rhode Island	69,110	174,620	152.67	
Vermont	85,416	315,098	268.90	
Wisconsin		775,881	1.994.42	1840.
Total	1,968,455	18,420,553	935.78	

Population of slave States in 1790 *and* 1860, *with the ratio of increase.*

States.	1790.	1860.	Ratio of increase.	Ratio calculated from census—
Alabama		964,201	653.87	1820.
Arkansas		435,450	2.950.87	1820.
Delaware	59,096	112,216	89.88	
Florida		140,424	304.33	1830.
Georgia	82,548	1,057,286	1.180.81	
Kentucky	73,077	1,155,684	1.481.46	
Louisiana	319,728	708,002	824.82	1810.
Maryland		687,049	114.88	
Mississippi		791,305	8.841.30	1800.
Missouri		1,182,012	5.570.48	1810.
North Carolina	393,751	992,622	152.09	
South Carolina	249,073	703,708	182.53	
Tennessee	35,795	1,109,801	3.000.78	
Texas		604,215	184.22	1850.
Virginia	748,308	1,596,318	113.32	
Total	1,961,372	12,240,293	624.06	

COMMERCE.

The following tables, showing the trade between Great Britain and her American colonies from 1697 to 1775, are taken from Hazard's Commercial Register. They demonstrate the superior natural advantages of the southern over the northern colonies as producers of articles which command a price in European markets. But it is a great folly to suppose or pretend that they denote a superior degree of commerce on the part of the south at that period. The fact is, that the southern colonies had no shipping worth speaking of, while that of the north was distinguished in that particular.

NORTHERN COLONIES.

Years.	New England exports.	New England imports.	New York exports.	New York imports.	Pennsylvania exports.	Pennsylvania imports.
1697	£26,282	£68,468	£10,093	£4,579	£3,347	£2,997
1707	38,793	120,631	14,283	29,285	786	14,365
1717	58,898	132,001	24,534	44,140	4,499	22,505
1727	75,052	187,227	31,617	67,452	12,823	31,979
1737	63,347	223,923	16,833	125,838	15,198	56,690
1747	41,771	210,640	14,992	137,984	3,832	82,404
1757	27,556	363,404	19,168	353,311	14,190	168,426
1767	128,207	406,081	61,422	417,957	37,641	371,830
1775	116,588	71,625	187,018	1,228	175,962	1,366

The tables in Hazard's work, from which the foregoing figures are taken, are complete for the entire series of years; but these extracts will convey a sufficiently accurate idea of the whole.

The following is made up in like manner from the complete tables of Hazard:

SOUTHERN COLONIES.

Years.	Virginia and Maryland exports.	Virginia and Maryland imports.	Carolina exports.	Carolina imports.	Georgia exports.	Georgia imports.
1697	£227,756	£58,796	£12,374	£5,289	....	....
1707	207,625	237,901	23,311	10,492	....	....
1717	296,884	215,962	41,275	25,058	....	....
1727	421,588	192,965	96,055	23,254	....	....
1737	492,246	211,301	187,758	58,986	....	£5,701
1747	492,619	200,088	107,500	95,529	....	24
1757	418,881	426,667	130,889	213,949	....	2,571
1767	437,926	437,628	395,027	244,093	£35,856	23,334
1775	758,356	1,921	579,349	6,245	103,477	113,777

The reader will remark that the exports and imports of the southern colonies exceeded those of the northern during the greater part of the long period embraced in the tables. The following figures from Hazard's work, showing the shipping owned by the States north and south during the first thirty years under the Constitution, will leave no doubt of the fact already stated, that the commerce of the southern colonies was carried on by the mother country, or by their northern neighbors.

NORTHERN STATES.

Years.	Massachusetts.	N. Hampshire.	Connecticut.	Rhode Island.	New York.	New Jersey.	Pennsylvania.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1791......	95,000	10,496	18,140	17,003	41,866	1,171	53,898
1800......	223,000	14,120	31,260	18,841	97,791	806	95,632
1810......	352,000	24,534	22,671	28,574	188,566	17,336	109,629

SOUTHERN STATES.

Years.	Delaware.	Maryland.	Virginia.	North Carolina.	South Carolina.	Georgia.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1791..............	4,283	34,492	33,239	23,248	23,856	6,759
1800..............	2,066	81,446	41,838	20,949	43,731	7,937
1810..............	1,242	90,045	45,339	26,472	43,354	12,405

This remarkable disparity between northern and southern shipping, which has been growing wider and wider ever since, like the disparity in manufacturing enterprise, demonstrates the essentially colonial character of countries in which slavery prevails. The south has always produced the articles most in demand in foreign markets, and yet it has never had anything deserving the name of commerce. Its great staple furnishes the most important item of European and northern commerce and manufacture, while next to none of it is manufactured on the soil which produces it, and as small a proportion is shipped abroad in southern ships.

The following tables are taken from the report of the Secretary of the Treasury on commerce and navigation for the year 1860, and will further illustrate this truth:

Statement exhibiting the commerce of each of the slave States for the fiscal year ending June 30, 1860.

Slave States.	VALUE OF EXPORTS.		VALUE OF TOTAL EXPORTS.	Value of imports.
	American produce.	Foreign produce.	American and foreign.	
Delaware....................	$87,426	....	$87,426	$2,001
Maryland....................	8,804,606	$196,994	9,001,600	9,784,773
District of Columbia..........	4,413	....	4,413	8,278
Virginia....................	5,833,371	24,653	5,858,024	1,326,249
North Carolina..............	760,094	....	760,094	365,931
South Carolina..............	21,193,723	11,614	21,205,337	1,569,570
Georgia....................	18,483,038	....	18,483,038	782,061
Alabama....................	38,670,183	....	38,670,183	1,050,310
Florida....................	1,299,852	30,378	1,330,230	336,931
Louisiana..................	107,812,580	605,218	108,417,798	22,922,773
Texas......................	5,856,934	927,000	6,783,934	2,436,408
Totals..................	208,806,220	1,795,857	210,602,077	40,585,285
Total commerce of the U. States.	373,189,274	26,933,022	400,122,296	362,166,254
Deduct southern commerce.....	208,806,220	1,795,857	210,602,077	40,585,285
Northern commerce..........	164,383,054	25,137,165	189,520,219	321,580,969

It is seen that a majority of the domestic exports was sent out from the southern States, while nine-tenths of the foreign goods exported or reshipped were sent out from northern ports.

Of imports, the share of the south was as 40 to 321, or about one-ninth of the whole. This fact shows that a very small portion of southern commerce was in southern hands. The cotton, tobacco, and other raw products were necessarily shipped from the nearest southern ports, but the ships belonged to northern or foreign merchants. No better evidence could be desired of the unmercantile character of the southern people than is furnished by this table. A people with the slighest genius for commerce would, on the basis of such vast exports, import for the whole country; and the great mass of trade, instead of being far to the north, ought to be at Norfolk, Charleston, Savannah, Mobile, and New Orleans; but the maintenance of slavery doomed the south to a colonial condition, and it is as idle to talk of the commerce of the slaveholding States as of that of the West India islands. Like those islands, the south has been the great producer of the objects of commerce; but the commerce has at all times been in other hands.

This fact is more fully demonstrated by the following table from the same official report:

Statement of the tonnage of the several slave States on June 30, 1860.

	Tons and 95ths.
Delaware	23, 953.37
Maryland	255, 037.19
District of Columbia	45, 230.88
Virginia	92, 812.12
North Carolina	47, 964.83
South Carolina	66, 741.23
Georgia	43, 526.63
Florida	28, 800.50
Alabama	52, 757.72
Mississippi	3, 737.33
Louisiana	234, 988.66
Tennessee	12, 364.02
Kentucky	36, 801.84
Missouri	64, 683.66
Texas	12, 842.74
Total	1, 022, 242.72
Total tonnage of the United States	5, 353, 868.42
Deduct southern tonnage	1, 022, 242.72
Leaves northern tonnage	4, 331, 625.70

So the south, while producing a majority of the exports, owned less than a fifth of the shipping of the Union, and brought to the country only one-ninth of the imports. The shipping was in two-fold greater proportion than the foreign commerce of the south, which shows that the vessels owned by it were chiefly coasters or river steamers. This also appears from the report of the Secretary, which places a majority of southern tonnage under the head "Enrolled licensed."

OF FREE AND SLAVE LABOR.

It is a singular fact that the institution of slavery, which has been the most absorbing topic of discussion among politicians and moralists in two hemispheres during the greater part of the present century, has awakened so little inquiry among political economists. Of the hundreds of treatises on that science which the age has produced, there is, perhaps, not one which has devoted to slavery more than a brief chapter, in which, with rare unanimity, none but the most obvious evils of the system are pointed out. No attempt has been made by this class of authors to analyze and define the functions of capital invested in slavery, nor to show that there exists any difference between this and other modes of investment. Yet this is the great economical problem, aside from which slavery involves only a question of conscience and morals. Although slavery has been destroyed in this country, and there remains not a shadow of reason to apprehend that it can ever be revived, this problem is eminently worthy of solution. If it can be demonstrated that the whole capital invested in slaves was useless to the south as an agency of production, the southern people, if they will receive the truth, will the more readily acquiesce in what seems to have been a providential dispensation. Their prejudices and passions may continue to blind them to the moral wrong of slavery, but they may yield to the conviction that the institution is inconsistent and at war with the eternal laws of political economy. If they can be clearly convinced on this point they will eventually become reconciled to the irreversible decree which has destroyed their cherished social order.

If it be conceded by the laws that the men of property may buy and sell the poor as slaves, it may or may not be advantageous for the individual to invest his capital in that species of property. In all standard works upon political economy, the institution of slavery has been considered from this narrow point of view, and, for the most part, they concur in maintaining the negative, that under all circumstances it is less advantageous to employ slave than free labor. The folly of this notion is demonstrated by the fact that throughout the entire south there was no instance of a large plantation cultivated by hired free labor. Wherever agriculture was sufficiently profitable to induce large investments of capital the labor of slaves was preferred, and it was only the small farms in the south which were worked by free labor, generally by that of the owner and his sons. The universal preference given to slave labor in agricultural enterprises was due to several causes. In the first place, it was on hand, and from generation to generation the habit of cultivating the earth by servile labor had become invincible. The slaves could not be employed conveniently and extensively in other pursuits, which require more intelligence, and which make it necessary to collect them together in dangerously large numbers; and there was, besides, little demand for slave labor except on the plantations. The imperious manners of the slaveholders, who were the great capitalists of the south, were little suited to the direction of free labor. It was felt, and not without reason, that freemen would revolt and abandon the fields at the most critical periods of the crops rather than submit to the tyrannical driving process which was applied to slaves, and which was regarded as essential by those who had never witnessed anything else. The very existence of slavery had thus produced a condition of things, and generated manners and habits, which made it more profitable to employ slaves than free laborers. The few sickly manufacturing enterprises which had begun to spring up in the southern States, and to employ free labor, were, for the most part, under the management of northern men, or, at any rate, of men reared in those parts of the south where there were few slaves.

The habit of giving the preference to slave labor by the planters has in another way operated to the prejudice of free labor. It has caused the poor white population to grow up in idleness, to feel that labor is degrading, and to be incapable, from disuse, of continuous labor. Slave labor thus justified the preference given to it by its tendency to degrade free labor and to render the free laborer worthless. Reasoning from the premises accepted by the entire school of political economists, therefore, it is safe to say that the slaveholders had the advantage of the argument, at least so far as slaveholding countries are concerned. Admit the existence of slavery, once introduce the system, and it will generate an atmosphere in which free labor will not thrive. The whole experience of southern men is to the effect that slaves were at all times, up to the commencement of the rebellion, the most valuable property in the south. They were always in demand at increasing prices, and the demand was always growing greater. Lands were soon worn out and abandoned, railroads and other stocks might prove worthless, but it was always safe to invest in slaves. Pigs and cattle were worth only a few cents per pound, negroes readily commanded almost as many dollars. The mere mention of these notorious facts is sufficient to refute the assumption that the individual could always more safely employ free than slave labor.

THAT CAPITAL INVESTED IN SLAVES IS UNPRODUCTIVE.

The economical evil of slavery lies deeper. It is not that individuals or capitalists may not make money out of it, but that society, in the aggregate, cannot make money out of it. It permits and encourages an unnecessary investment of capital, and a diversion of capital from employments which would be gainful to the community at large, to one which is simply gainful to one class of society at the expense of another. At a moderate estimate, the value of the slaves of the south to their owners, in December, 1860, when South Carolina commenced the work of abolition by making war upon the general government, was $3,000,000,000. The title of the owners has been destroyed, and the negroes, formerly slaves, have come into possession of it. There has simply been a transfer of title from one class of owners to another, but nothing valuable has been destroyed. The strong arms and the skilled labor still exist, and new incitements to industry have been added to four millions of the southern population who, hitherto, were only impelled by the fear of punishment. It is as if a grand assize had been held, and a verdict and judgment had been given against the wrongful possessor. Only the title has been transferred; but no property has been destroyed. If the slave was worth a thousand dollars to his master, he is now worth a thousand dollars to himself. He may throw it away in dissipation and folly as his master often did; or he may employ it in the procurement of a home for himself and his family, in the education of his children, in surrounding them with comforts, and in raising himself and them in the scale of being. These are the ultimate uses of money, and they are worth as much to the negro as they were to his former master.

There has doubtless been a waste of property, and a loss of time and the fruits of industry, in the process of abolishing slavery by war; but this has nothing to do with the point at issue. In asserting that capital invested in slaves is unproductive, and that the liberation of the slaves is only a transfer of title, without a destruction of property, it is assumed that the change is made peaceably, and without disorganizing industry. The object is to show what the country lost by the admission of slavery, and what it will eventually gain by abolishing the institution; and not that the process of abolition has been unattended with loss. Besides the direct waste of war, in the destruction of houses, fences, and furniture, and the means of subsistence, there is also great loss in the disruption of society, in the failure to plant and cultivate, and to follow other industrial pursuits as usual in times of peace. All this is fully conceded; but it is still true that the three thousand millions of property invested in slaves has not been destroyed. There has been only a transfer of title, as there would be in consequence of the verdict of a jury in a suit at law for an estate.

Supposing, therefore, that the transition from slavery to freedom had been made peaceably and without any disorganization or paralysis of industry, and it is plain that the south would now possess every resource of wealth and production that it had while four hundred thousand white people claimed four millions of negroes as property. If the States or the general government desired to raise a direct tax upon real and personal property and polls, there would be the same resources on which to impose it. The emancipated negroes can pay as much tax for themselves as their former masters could have paid on them as property, and the land and other property would be no less valuable in consequence of an augmentation of the number of persons endowed with the capacity to hold property. In like manner the power of the States for defence or aggression would not be lessened by emancipation, as the late civil war has so fully demonstrated. It is well known, and came at length to be recognized by the whole south, that the existence of slavery, by making a third of the population enemies of their country was the great hindrance to success. If the negroes had been freemen, and had been inspired by the common desire for separation from the north, the conflict would undoubtedly have been far more stubborn, and it would be hazardous to say that the result would have been in that case what it is now. A nation, therefore, which has lost none of its resources of revenue, and which has increased by one-third the number of its arms-bearing population, cannot be said to have lost anything valuable in consequence of the abolition of slavery.

That slavery causes an unnecessary and therefore unproductive investment of capital may be made palpable by a familiar illustration: Suppose two farms, of one hundred acres of land each, are to be cultivated respectively with free and with slave labor, and that in each the soil and whatever is necessary to its cultivation is owned by the farmers, whom I suppose to be neighbors, and engaged in the same branch of agriculture; their lands adjoin, and are equally valuable; they employ the same number of cattle and horses, they must lay out equal sums for utensils, and they must lay in the same quantity of provisions. They also employ the same number of laborers—suppose ten, each. In all other respects their investments are equal, but as it regards labor a wide discrepancy exists. He who employs his poor neighbors to labor for him need have no capital for that purpose, as, at the worst, they will work for a share in the crop, on condition of being fed and clothed during the year, or they will wait till harvest for their pay, which can then be raised by the sale of the crop. If labor should be in considerable demand, and laborers should require monthly wages, the farmer owning the soil, and all that pertains to his farm, could borrow, from time to time, sums to pay wages; but, with the employer of slaves, the case is quite different. After keeping pace in investments with his free-labor hiring neighbor in all things else, he must have, *in addition*, a capital equal to the value of ten able-bodied slaves, which, at the beginning of the civil war, and for several years prior thereto, he must have paid for at the rate of fifteen hundred dollars each, or fifteen thousand dollars for the ten. The hundred acres of land, supposing it to have been of the best quality would have been worth perhaps twenty dollars per acre, or two thousand for the entire farm. His cattle and horses, and his utensils of husbandry, may have required an outlay of two thousand dollars. Food and clothing for himself and slaves, and provender for horses and cattle, one thousand. In all, his capital would amount to twenty thousand dollars, of which just three-fourths consists of the unnecessary and therefore unproductive investments in human beings as property. This fifteen thousand dollars of capital would be wholly dispensed with by the use of free labor, and with but a very trifling addition to the other items of expense. The cost of land, of horses and cattle, of farming utensils, and of food for the animals, would be the same. The food of the free laborers would cost as much as the food and clothing and the doctor's bills of the slaves. In all these items the expenses or capital invested in the two cases are parallel. As above stated, there is no absolute necessity for paying wages in advance; but to make the comparison perfectly fair and free from criticism, let it be supposed that the employer of free labor is under the necessity of having on hand a cash capital for this purpose sufficient to pay monthly wages during the nine or ten months in which the crop is planted, tilled, and gathered. One thousand dollars would be sufficient for this purpose, and the accounts of expenses incurred would stand thus:

Capital necessary to grow cotton with free and with slave labor.

	Free labor.	Slave labor.
100 acres of land, at $20 per acre	$2,000	$2,000
Value of cattle, horses, and farming tools	2,000	2,000
Food and clothing of farmer, food of free laborers, and provender for horses, cattle, &c.	1,000	
Food and clothing for farmer and his slaves, doctor's bills for latter, and provender for horses, cattle, &c.		1,000
Value of 10 slaves, at $1,500 each		15,000
Fund for paying wages to free laborers	1,000	
Total investments	6,000	20,000

The reader will reflect that the suppositions here made as to the several items of capital need not be strictly correct, in order to establish the principle involved. The cost of land and of other articles may be more or less, but the great fact is made palpable that the capital invested in slaves is not necessary to the production of the cotton crop, and that it has nothing to do with production.

It will be asked, if all this is true, why did not southern men cultivate cotton and tobacco with free labor? If, with a capital of six thousand dollars, a man could make as much cotton or tobacco by the employment of free labor as another could make with slave labor, on a capital of twenty thousand dollars, why was not free labor thus used in preference? The facts and considerations above stated will explain the motives of convenience which caused the preference to be given to slave over free labor, and the profit on the excess of capital employed by the slaveholder was made up to him by appropriating the wages due to the laborers. The free-labor farmer is under the necessity of dividing his profits with the men employed by him to make the crop. The slaveholder fed and clothed his slaves in the coarsest and cheapest way. Of this fact there is official evidence furnished in a report of the Secretary of the Treasury, made under the administration of President Polk, when every department of the general government was in pro-slavery hands. Circulars containing two series of questions were addressed to leading planters, as well as manufacturers and merchants, asking for statements of the amounts of capital invested by them respectively, their profits, the number of laborers employed, the cost of feeding and clothing slaves, and the wages paid to free laborers, &c. The response came from every part of the cotton and sugar regions that the cost of feeding and clothing a slave was thirty dollars per annum—fifteen dollars for food, and fifteen dollars for clothing per annum; children half price. The profits per hand to the master varied from $150 to near $500. In the free States wages for farm laborers ranged from $8 to $12 per month, with board in each case. Toward the close of the career of slavery, there was probably an increase in the cost of feeding and clothing slaves, and if the champions of the institution are tc be relied on, the disposition to feed and clothe better increased with the value of the slaves. The profits of the two farmers arising from the sale of the crop may be stated, taking the above suppositions, and further assuming that a bale of cotton is made for each acre of land, and that the cotton is worth ten cents per pound, as follows:

NET PROFITS OF FREE AND SLAVE LABOR CULTIVATION.

		Free labor.	Slave labor.
Product in each case, 100 bales, worth		$4,000	$4,000
Deduct annual expenses as follows: for food and clothing of farmer, food of ten free laborers, and provender for horses and cattle, &c	$1,000		
Deduct wages of ten free laborers, at $12 per month	1,440		
		2,440	
		1,560	
Deduct food and clothing of farmer and ten slaves, and doctors bills of latter			1,000
Net profits			3,000
Net profits, free labor			1,560
Difference			1,440

It will be remarked that the difference in the net profits of the two farmers is just equal to the wages paid by the free-labor farmer to his laborers. This sum $1,440 is 9$\frac{3}{5}$ per cent. upon the capital invested in the slaves. In each case the aggregate wealth of society is equally increased, while in the one case six thousand dollars make the product, and in the other twenty thousand.

It must be obvious, upon reflection, that what is here found to be true of single individuals, is true of the aggregate number of farmers and planters. There were about 5,000,000 bales of cotton produced in 1859, as reported in the census of 1860. In point of fact, there was much inferior soil in cultivation, and a large proportion of women and children were employed. But it is the universal testimony of planters that a good acre will make a bale of 400 pounds of picked cotton, and that a good "hand" will cultivate ten acres. It is, therefore, for the sake of illustration, safe to take the supposition above, and to assume that the 5,000,000 bales were grown upon 5,000,000 acres, by 500,000 able-bodied men, with corresponding investments as to land and other things, and it still remains clear that the investment in slaves is superfluous. The five hundred thousand laborers were worth $750,000,000, which sum is of itself nearly three times larger than was essential to the production of the cotton crop. We have seen above that $20,000, with slave labor, produced no more than $6,000 with free labor, and at the same ratios one thousand millions were employed to accomplish what three hundred millions would have done.

In like manner all the slaves of the south involved a corresponding amount of unproductive investment. They numbered nearly four millions, of all ages and both sexes, and were said by southern men to be worth from three to four thousand millions of dollars. This vast property was not a gift to the southern people; it was an accumulation, and constituted, in fact, nearly or quite half the wealth of the south. In the planting States slaves were greatly more valuable than all other property, real and personal, as will be seen by the following comparative tables:

Value of real and personal property.

States.	SOUTHERN.		States.	NORTHERN.	
	Real property in 1860.	Personal property in 1860.		Real property in 1860.	Personal property in 1860.
Alabama	$155, 034, 089	$277, 164, 673	Connecticut	$191,478,842	$149, 778, 134
Arkansas	63, 254, 740	116, 956, 590	Illinois	289,219,940	101, 987, 432
Florida	21, 722, 810	47, 206, 875	Indiana	291,829,992	119, 212, 432
Georgia	179, 801, 441	438, 430, 946	Massachusetts	475,413,165	301, 744, 651
Mississippi	157, 836, 737	351, 636, 175	Michigan	123,605,084	39, 927, 921
South Carolina	129, 772, 684	359, 546, 444	New York	1,069,658,080	320, 806, 558
Texas	112, 476, 013	155, 316, 322	Pennsylvania	561,192,980	158, 060, 355
			Ohio	687,518,121	272, 348, 980
Totals	819, 898, 514	1, 746, 258, 025	Totals	3,687,916,204	1, 463, 866, 463

It is quite apparent to any one familiar with the condition of the country at large, that these tables are not to be relied on as furnishing an accurate idea of the relative wealth of different States—for instance, Ohio is made to appear far more wealthy than her older, more populous, and larger neighbor Pennsylvania. The little State of Connecticut is placed ahead of Illinois, and Georgia is ranked higher than South Carolina in personal property, although the latter outnumbered the former in slaves by many thousands. These facts only show that the States have adopted different standards of valuation. Some assess property at its true value, others assess at one-half or two-thirds, and hence these incongruities. In another table of the census reports there is an effort made to equalize the principle of valuation, but upon what data is not stated. The tables above will answer my present purpose, which is to show the relative value of real and personal estate in the several States. It is seen that in the free States the real estate exceeds in value the personal in every instance—sometimes in the proportion of three to one, and that aggregately the former is two and a half times the latter. In the slave States the aggregate personal estate is more than two-fold greater than the real, while in some States it is two and a half times greater, thus reversing the proportions as they exist in free communities. This immense excess of personal over real estate consists of the property in slaves, which I have shown above to be utterly useless to the community at large as a productive agency.

SLAVERY AND MANUFACTURES.

I have already cited a report made by the Hon. Robert J. Walker, in 1845, while Secretary of the Treasury, upon the subject of capital employed in the various industrial pursuits. Having shown that capital invested in slaves is unproductive when the pursuit is agriculture, I will now undertake to demonstrate in like manner that it is equally so in manufactures; and as I am less familiar with such investments, and less capable of supplying illustrations by supposing cases, I will take the actual facts, with the names of parties as furnished by the official report.

In response to one of Mr. Walker's circulars Mr. Samuel Bachelor, on the part of the York Cotton Manufacturing Company at Saco, Maine, stated that the company (this was in 1845) had a capital invested in grounds, buildings, and machinery, amounting to $550,000. Their business capital annually invested in the purchase of raw material, &c., and in the payment of wages, amounted to $450,000 The whole, therefore, amounted to one million dollars ($1,000,000.) But this is rather an over-statement as it regards wages, if, as I suppose, it includes the whole amount paid during the year. In agriculture it is necessary to labor for three-fourths of the year before the laborer can be repaid out of the product of his toil. But in manufactures this is not the case, except, perhaps, in a few instances. In manufacturing establishments money is coming in daily, and it cannot be necessary to lay up a fund at the beginning of the year to pay wages until the close. The business capital, both to buy the material of manufacture and to pay wages, would be coming and going all the while; and perhaps of the $450,000 thus expended during the year not more than fifty thousand need be on hand at one time. So that, instead of a million, the York Manufacturing Company probably did not at any one time have more than seven or eight hundred thousand dollars engaged in every stage of the manufacture, from the raw material to the unsold fabric. The number of men employed in the establishment was 200; the number of women 900 to 1,200. Suppose the average number to have been, of both sexes, only 1,200. Now to carry on such an establishment with slave labor it would be necessary to own this number of slaves who were in the prime of life; and their average value, even at that day, could not have been less than $700, and their aggregate value $840,000. It is clear, therefore, that cotton manufacturing with slave labor would involve an investment two-fold greater than with free labor.

In the manufacture of tobacco, cigars, and snuff the proportion of labor to capital seems to be greater than in that of cotton. At least, such is true of the case furnished by Mr. Walker's report. Mr. Enoch Hughes was engaged in the manufacture of tobacco, snuff, and cigars. He stated his capital was $30,000, of which $20,000 was permanent, and $10,000 was used in the purchase of material and the payment of labor. He employed one hundred persons, mostly females. One hundred slaves of similar ages would be worth $700 each, or $70,000 in the aggregate. Add to this merely the $20,000 permanently invested by Mr. Hughes, and leaving nothing for the purchase of materials, and the sum total is $90,000, or just three times the capital employed where free labor is used.

In the manufacture of iron the same principle finds illustration. The Eagle Furnace at Buffalo, New York, according to the statement of Mr. Calvin J. Mill, the manager or proprietor, had a permanent capital of $50,000, of which $35,000 was invested in buildings and machinery, and $15,000 was business capital, though in the course of the year $30,000 was spent for materials, and $15,000 paid out as wages. This illustrates the correctness of my remarks above, that a small business capital on hand, together with the daily receipts of a manufacturing establishment, will dispense with the necessity of keeping on hand the whole disbursement of the year. The Eagle Furnace employed eighty men, skilled laborers, who in those times of low wages and gold received one dollar and a half per day. Slaves equally skilful, even then, would have been worth $1,200 each, or $96,000 for the eighty. Add this sum to the fifty thousand dollars of permanent capital invested by the Eagle Furnace Company, and the amount is $146,000, which would be necessary to carry on an iron furnace with slave labor, or three times more than is necessary with free labor.

I have all along assumed, in the above reasoning, that it would be practicable to employ slaves in manufacturing. This is not true, except in a very limited way. In the first place, it was always the policy of the upholders of slavery to keep the negroes in ignorance, and to offer them no incentive to labor, or to acquire skill. This policy would be a great hindrance to anything like excellence in the arts. But aside from this consideration, it would be dangerous to bring slaves together in great numbers; so that the idea of building up a great manufacturing city composed of slaves, would be repellant to every slaveholding instinct if it were practicable. Such an aggregation of slaves would be fruitful of plots and insurrections, and it would be necessary to maintain an army ready to suppress revolt. Such a thing might have been practicable in an age when the idea of personal liberty was unknown; but in our day, when it is the aspiration of every human being in christendom, it will not do to allow slaves to measure their power with that of their masters.

ANALOGOUS DOCTRINE OF J. STUART MILL.

Analogous to the foregoing doctrine, that capital invested in slaves, though a part of the wealth of individuals, is no part of the national wealth, I find the following passage in the "Preliminary Remarks" to J. Stuart Mill's Political Economy. He says:

"In the wealth of mankind nothing is included which does not of itself answer some purpose of utility or pleasure. To an individual anything is wealth which, though useless in itself, enables him to claim from others a part of their stock of things, useful or pleasant. Take, for instance, a mortgage of a thousand pounds on a landed estate; this is wealth to the person to whom it brings in a revenue, and who could perhaps sell it in the market for the full amount of the debt. But it is not wealth to the country; if the engagement were annulled the country would be neither poorer nor richer; the mortgagee would have lost a thousand pounds, and the owner of the land would have gained it. Speaking nationally, the mortgage was not itself wealth, but merely gave A a claim to a portion of the wealth of B. It was wealth to A, and wealth which he could transfer to a third person; but what he so transferred was in fact a joint ownership to the extent of a thousand pounds in the land of which B was nominally the sole proprieter. The position of fund-holders or owners of the public debt of a country is similar: they are mortgagees on the general wealth of the country. The cancelling of the debt would be no destruction of wealth, but a transfer of it; a wrongful abstraction of wealth from certain members of the community for the profit of the government, or of the tax-payers. Funded property, therefore, cannot be counted as part of the national wealth. This is not always borne in mind by the dealers in statistical calculations. For example, in estimates of the gross income of the country, founded on the proceeds of the income tax, incomes derived from the funds are not always excluded, though the tax-payers are assessed on their whole nominal income without being permitted to deduct from it the portion levied from them in taxation to form the income ot the fund-holder. In this calculation, therefore, one portion of the general income of the country is counted twice over, and the aggregate amount made to appear greater than it is by about thirty millions."

In like manner the title of a slaveholder is in the nature of a mortgage or lien upon the labor of the country taken by force, without consideration—not given for value received. The destruction of the title, to apply the language of Mr. Mill, "would be no destruction of wealth, but a transfer of it." In this instance, however, there is no "wrongful abstraction of wealth from certain members of the community for the profit of others. On the contrary, the abolition of slavery is the restoration of a *right* which has been unjustly withheld.

It may be shown how other articles which ordinarily cost nothing may be made, under peculiar circumstances, property to individuals, though they can never be counted as part of the national wealth. A man may live in a dark and close room, where artificial light would become necessary in broad day-time, and where a sufficient supply of air could only be obtained by an expensive machinery. In such a case, if there were any necessity for his residence in such a place, these poor substitutes for the clear light of the sun, and the pure air which surrounds his prison-house, would acquire value which he might transfer by sale to another man in like circumstances; but such property cannot have any general value, nor can it constitute any part of the national wealth. So, the slaveholder invests his capital in something which he could have the use of without owning it as property. He buys a rational being, whose incentives to labor for the sake of wages are stronger than the compulsory authority of a master. There exists a necessity for owning the domestic animals, in order to make their services available. They have no artificial wants, no aspirations or desires beyond those which nature has provided for in their instincts; they are never to wear clothing nor to acquire education; they would never be able to build them houses nor store them with provisions for winter, and it is only as the property of a rational being that they can be made more comfortable and happy. They cannot of themselves cultivate the earth, nor gather up its fruits for periods of scarcity; their only resource, and their only labor if left to themselves, would be to eat what the bounty of nature spreads before them. But with man in his lowest estate the reverse is true. His desires, and hopes, and aspirations for knowledge, for wealth and power, are illimitable. He is without the instincts which would enable him to live, but reason prompts him to labor and to save; and under favorable conditions the habits of laboring and saving become second nature, if, indeed, they may not be said to be natural. To own him as property is to stifle all the nobler impulses, and, as far as may be, to turn him into a mere beast of burden, without aspiration for higher life and without a stimulant to improvement. It is therefore worse than useless to enslave a human being, and the nation which tolerates the institution in its bosom is as unreasonable as the man who should consent to have a hand bound to his body, and thus to pass through life.

Capital invested in slaves could be considered no part of the national wealth, because it was unnecessary. It was three thousand millions laid out in the purchase of something which was at command without being called property. It was profitable to the slaveholders to the extent of the pecuniary injury inflicted upon the slaves. As the political economists would say, its function was to distribute wealth, not to produce it; and, as we have seen, the distribution, while it was unjust, could in no possible way add anything to the resources of the country.

WHAT HAS BEEN GAINED BY EMANCIPATION.

Thus far I have attempted to demonstrate the proposition that slavery involves a wholly unproductive investment of capital, and that its abolition was merely the destruction of title-deeds; while whatever there was of value in the south during the existence of slavery still remains, or at least would have remained if the institution had been put out of the way without war and bloodshed. I now propose to show what the south has gained with reference to its future progress.

Capital invested in slaves being unproductive, the introduction of slavery into a State diverts the energies of the people from its improvement. This peculiarity belongs to no other species of unproductive capital. Slavery dispenses with, and introduces a substitute for, free citizens by supplying the demand for labor; and yet it has been demonstrated above that the substitute requires several times more capital to furnish it than is necessary to obtain a supply of free labor. Thus, taking the supposition above, if the free-soil farmer wishes to double the area of his farm and the amount of his product, he can do so with an additional capital of six thousand dollars; whereas the slaveholder, whose cultivation and product are only equal to the other, must accumulate twenty thousand dollars in order to make an equal addition to his crop. Or, if the additional capital be brought in by emigration from the older States, six thousand with free labor would do the work of twenty thousand with slave labor; and if we suppose equal sums invested in each of these modes, say in a free and in a slave State, the free-labor investment would cultivate above three times the number of acres, and produce three times as much cotton as the slave-labor investment. In the latter case, also, the twenty thousand dollars would take with it above thirty freemen to till the three hundred acres, while the slave culture would bring to the State only ten more slaves. Here, then, is the secret of the rapid increase of northern population by immigration in comparison with southern. The accumulation of capital in the free States induces European labor to flock to our shores. The accumulation of capital in the south only stimulated slave-breeding.

The slave population of the south in 1860 amounted to 3,953,760. They have been acquired like other property—like the stocks of cattle and horses—by the joint operation of industry and capital. They were valued at three thousand million dollars. Had slavery never existed in the south, this value—and, as I have shown, a much greater value—would have taken a different shape. It would now appear in the form of improved lands, better and more numerous houses, fences, barns, workshops, railroads, and other internal improvements. Large and flourishing towns and cities would exist where small and poor ones, or none at all, exist now. There would have been ten-fold more commerce and manufactures; and in the place of four million slaves, there would have been three times as many intelligent, industrious, and patriotic freemen. Virginia, but for slavery, would be to-day, as she was in 1790, the most populous State in the Union, as well as the most wealthy and powerful.

The absorption of capital in this unproductive form of slavery was the great pecuniary curse of the south. It was not that the south had uselessly invested in the beginning half its wealth, for time would have overcome that loss; but the great evil consisted in the perpetually recurring and increasing misapplication of capital. Slavery had become the great interest of the south. It swallowed everything. Of every accumulation of capital, the majority was sure to assume that form. There was no recovery, no regeneration, but in the destruction of the system. It had been better if the institution had been peacefully abolished; but as that was not practicable, it is well for the south, in a pecuniary point of view, that it is overthrown by violence, and not without great destruction of other property. Henceforth there will be no more of the unproductive investment of capital in human beings, and every dollar from which a revenue is to be drawn will contribute something to the national wealth. The slaveholders have never been understood by the people of the north in one respect. They have been made to bear the economical reproach which properly belonged to slavery itself. They have been regarded as idle, prodigal, and thriftless; whereas they are, as a class, energetic, sagacious, and thrifty. They made money and grew rich, while their system of slavery was inflicting the deepest injury upon the country. Now that slavery is overthrown, they will exert their energies in methods promotive of the general as well as of their own particular welfare.

THE VALUE OF LAND.

In further illustration of the advantages which the abolition of slavery has conferred upon the south, I will endeavor to show the direct effect of that measure upon the value of land.

There is a special and peculiar value attaching to those southern lands which produce cotton, tobacco, rice, and sugar. The first of these articles, which is the greatest object of the commerce of nations, can nowhere else be grown so abundantly and of such good quality as in the south. The tobacco of that region enjoys, also, the preference in the markets of the world over the products of other countries; while rice and sugar are, as regards the United States, peculiar to the south. The lands of the northern States enjoy no such monopoly of productions. Whatever is grown in the free States, grows nearly as well in the south and quite as well in Europe. Here, then, is an advantage which southern lands enjoy, and which, under favorable circumstances, would make them the most valuable of any in the Union. Nothing but the presence of slavery has made them cheap in comparison with northern lands. How this effect is produced by slavery I proceed to show.

The value of a slave to his master is the difference between what he produces and what he consumes. If the slave could live without food and clothing, or if he could work as well for his master while finding himself in these necessaries, his value would be increased to the extent of their cost. As things are, the master must plant almost as many acres in corn and potatoes as in cotton, in order to provide for the wants of his slaves. The more the slave eats and drinks and wears, the less is the net value of his labor to his master. The supply of his wants affords no market for the products of his master's farm; but, on the contrary, those wants constitute a necessary burden, and it is just as much the interest of the master to economize the food and clothing of his slaves as of himself and family. The slave is a charge to the master and to the land he tills, to the extent of his food and clothing. This necessity of feeding and clothing that portion of the slave population which is engaged in agriculture, therefore, so far from enhancing, must diminish the value of land. But the reverse of this is true with reference to the free laborer. He is under the necessity of feeding and clothing himself, and consequently, so far from being a charge upon the landlord, he furnishes a market for the products of the soil, and enhances its value. It is universally true that slaves are a burden to their masters to the extent of their food and clothing, however much the value of their labor may exceed the expense of maintenance. But in the exceptional cases in which slaves are not engaged in agriculture, nor belong to planters and farmers, their wants, which must be supplied by purchase from the agriculturists, do enhance the value of the necessaries of life, and add to the value of land. But the aggregate number of such cases was small in comparison with the great body of the slave population; one in a hundred of the whole would probably cover the entire number of slaves who were thus owned and employed.

The proposition here laid down, that the necessity of feeding slaves is a burden to the soil, while the wants of the free laborer add to its value, will become evident by considering, first, that whatever the free laborer eats he pays for; and, secondly, that if he ate nothing, if he were a sort of machine, endowed with the power of labor, and with a desire for pecuniary wages, the farmer could pay no part of them in kind. Instead of paying one-half the wages in board, as is now the case, all must be settled up in money. There would be less demand on the soil for its products, and the land would be less valuable. If the merchant, the mechanic, and the professional man could live in society without food, it is evident that the farmer could not employ their services. It is their wants which make the market for the products of the soil, and if they had no wants but money the farmer could neither sell anything nor pay anything. Their wants hold out an inducement to the cultivation and improvement of the soil, and give it its salable value. But the free laborer pays no less than the merchant, the mechanic, or the lawyer for what he consumes of the farmer's crop. He receives not a peck of corn, a pig, nor a meal of victuals which he does not as fairly pay for with his labor as the doctor, the lawyer, the mechanic, or the merchant with their money. In fact they, too, are often paid, like the laborer, in the produce of the farmer, and the supply of their wants is no more conducive to agricultural improvement, nor no more calculated to enhance the value of land, than is the payment in kind of the free laborer. It is, of course, not the interest of the farmer to pay wages; but since he must pay them to the free laborer, it is to his advantage that the laborer, in common with the community at large, is a consumer of the products of the soil. This necessity of the laborer enables the farmer to pay him in kind to the extent of nearly or quite half his wages, and if the laborer has a family, in a greater proportion. In like manner it is against the farmer's interest to pay for the services of the physician or lawyer, but such expenses must be incurred. Physicians and lawyers are necessary, and they must be paid, and they are in that way a necessary evil, a drawback upon the resources of the farmer; but as consumers of the products of the soil their presence is beneficial to him, and raises the demand for, and the price of, everything he sends to market. The same is true of the merchant and the mechanic. The payment of their bills is contrary to the farmer's interest; but, as consumers, their presence adds to the value of his land by enhancing the price of its products. And in what particular differs the case of the common laborer? He is under no more necessity to work without wages than the lawyer or the physician, the merchant or the tradesman, and he equally pays for what he consumes. The only shadow of difference between his pay and that of others is the circumstance that it suits his convenience to be paid in kind, as to part of his wages, more uniformly than is the case of other consumers of the farmer's products. The slaveholder has paid for the labor of the slave in his purchase, and it is his interest to pay no more in the shape of provisions than will sustain life and strength; but with the employer of free labor the reverse is true. He wishes to pay as large a portion of the wages as possible directly out of the crop, and feels that he has found a market for his products to that extent. The slave lives at the expense of his master, and, of course, what he consumes can hold out no inducement to improve the soil, but, on the contrary, must retard improvement. The free laborer lives at his own expense, and, therefore, what he and his family consume must promote improvement.

SLAVE-BREEDING.

It may be proper to notice what may seem to be an exception to this principle in the case of slaves reared for market. Here the planter is remunerated for his outlay of food and clothing by the sale of the negro, as he is remunerated for the grain and hay he feeds to the hogs and cattle he raises for market; and it may be said with some plausibility that if raising hogs and cattle for market tends to enhance the value of lands, why may not the rearing of slaves? The inquiry only serves to bring out another radical incompatibility of slavery with the essential laws of political economy, which result from the nature of things. A community which raises hogs and cattle for market thereby acquires the means of supporting a larger population. It sells to distant communities commodities of which it has more than it can consume at home, and thus acquires the means of purchasing from them articles not produced within its own limits. This has been the chief occupation of the people of the northwestern States for thirty years past. They have grown rich, powerful, and populous by feeding grain to hogs and cattle. They have thus been able indirectly to find a market for the products of the soil, which the grain itself could not have found to the same extent, and the result has been a rapid increase in population, and a corresponding increase in the value of land. The facility of producing grain and grass in the northwest, and of raising stock for market, has been the real cause of the wonderful progress of those States. Emigrants have flocked to them from all the older States of the Union, from Ireland, from Germany, and from almost every part of Europe, in order to engage in their profitable agriculture and grazing, and to live on the fat of the land. Eastern Virginia, on the other hand, entered at about the same period of time upon rearing slaves for the southwestern market. Such may not have been the deliberate purpose of her people, but circumstances forced them into the practice, and with what result? The census tables show that there has scarcely been any increase of population for forty years, and the reason is obvious—she could only make money in the occupation of slave-breeding by depopulating her territory. In proportion to her exports of slaves has been her depopulation; and if she is not now reduced to half the number of people she contained at the beginning of the trade, it is because her white population was not wholly given up to this one pursuit, and because the market has not been greater than her means of supplying it. If there had been none but slaveholders among the white population, and if these had owned a good stock of slaves to begin with, and a market equal to the power of supply, the ruin of the State would have been complete. But the census shows that there were 86,468 farms in Virginia in 1860, and only 52,128 slaveholders. It is also shown by the census report that of the 52,128 slaveholders considerably more than half of them owned but five slaves each and under; many thousands owned but one slave each. The effect of slave-breeding upon a community, therefore, has not had a fair test in Virginia. The prices of tobacco and flour, which have made these articles profitable crops, have also tended to mitigate the consequences of negro-breeding. In 1859, for instance, Virginia produced 124,000,000 pounds of tobacco and 13,000,000 bushels of wheat, either of which crops was more valuable than the negro crop, so that the energies of the people were divided between these ordinary occupations of agriculture and the peculiar one of slave-breeding for the southern market.

As in other cases, the capital invested in slave-breeding has been a source of profit to the owner, while it has been worse than wasted to society at large. Virginia was depopulated and impoverished by the trade, while her slaveholders were growing rich.

In view, therefore, of these facts, I see no reason for modifying the proposition, that what the slave consumes can hold out no inducement to the improvement of the soil or increase its value. If he could live without eating and wearing, his value would be enhanced by the whole cost of keeping him.

HOW ABOLITION AFFECTS LAND.

If I have succeeded in making these propositions clear to the mind of the reader, it will be conceded that the abolition of slavery in the southern States has relieved the landed interest of the necessity of supporting four million people, the supply of whose wants was a burden to the soil; and at the same time it has enhanced the value of lands, by opening a market for the products of the soil in the wants of four million people, who must pay for what they consume. The necessity of feeding and clothing the slaves was a drawback upon the improvement of the land, and was to be deducted from the profits which their labor yielded to their masters. The abolition of the system, by bringing into existence an equal number of freemen, who are under the necessity of maintaining themselves, is an encouragement to improvement, and must cause an appreciation in the value of land. Thus, the free population of the south, in 1860, was, in round numbers, eight millions; the slave population four millions; and, consequently, the inducement to improve the soil was made up of these circumstances, viz: the profitableness of growing cotton, tobacco, and other articles for foreign and northern markets, together with the domestic market which the wants of eight millions of free people create, diminished by the necessary wants of four million slaves. The difference in favor of improvement was, therefore, only four millions, and the southern lands not engaged in the production of foreign exports would have been equally valuable if the entire population had been only four millions, instead of twelve. But the abolition of slavery has removed the necessity of feeding four millions of slaves, which was a burden upon the soil, and at the same time it has converted the emancipated blacks into profitable consumers of the products of the land. The abolition of slavery has had the same effect upon the value of southern lands, and will hold out the same encouragement to their improvement which would be produced by the introduction of eight millions of emigrants from Europe, or from the north. The effect of this change will become manifest whenever society and business in the southern States shall recover from the temporary paralysis which the terrible civil war has caused.

There must be another important benefit to the landed interest, arising from the transformation of four million slaves into freemen. It increases the number of buyers of land. During the existence of slavery there were but eight and one-third millions of people in the south capable of owning land. The overthrow of the institution has added four millions more; and thus, since the price or value of any article is dependent upon the number of bidders for it, there will necessarily be an appreciation of land, as the result of emancipation. That the value of land depends upon the number of its free population who consume its products, and who desire to become its owners, is illustrated in the example of England, as compared with one of our western States. That country is proverbial for its wealth. The accumulated wealth of the people in the shape of houses and personal property is vast; but the land itself, without reference to the buildings upon it, commands what appear to us fabulous prices. The yearly rental is generally greater than the fee-simple value of American lands; and it is within the bounds of moderation to say that the difference is ten to one in favor of English lands. The landed estate in Illinois, for instance, though greater in extent and more fertile than that of England, has not one-tenth the value of the latter. The reason is, that England has twenty millions of inhabitants, and Illinois but two millions. If the circumstances were reversed; if eighteen millions of the English people were to be transplanted to Illinois, with only the means of subsistence for a year, their presence and their wants would at once give something like a ten-fold value to land in that State, while the abandoned lands of the British island would at once fall in proportion to the demand for their products. This principle is illustrated, also, by the high price of even very poor lands in the vicinity of cities, in comparison with the fertile soils of the rural districts.

EFFECTS OF SLAVERY ON POPULATION.

One of the most obvious effects of slavery is the retardation of the increase of population. The tables already presented are full of instruction on this point. But the following comparative statements leave no grounds for cavil or controversy. I compare New England with Virginia, New York with North Carolina, Ohio with Kentucky, and Illinois with Missouri:

States.	Area in sq. miles.	Population in 1790.	Population to square mile.	Population in 1860.	Population to square mile.	Absolute increase of population to sq. mile.	
						1790 to 1860.	1850 to 1860.
Maine	30, 000	96, 540	3. 22	628, 279	20. 94	17. 72	1. 50
Massachusetts	7, 800	378, 717	48. 55	1, 231, 066	157. 83	109. 28	30. 33
Connecticut	4, 674	238, 141	50. 95	460, 147	98. 45	47. 50	19. 12
Rhode Island	1, 306	69, 110	52. 91	174, 620	133. 71	80. 79	20. 74
New Hampshire	9, 280	141, 899	15. 29	326, 073	35. 14	19. 85	. 88
Vermont	9, 056	85, 416	9. 43	315, 098	34. 79	25. 36	. 11
Total	62, 116	1, 009, 823	16. 25	3, 135, 283	....	....	....
Virginia	61, 352	748, 308	12. 19	1, 596, 318	26. 02	13. 83	2. 85
New York	46, 000	340, 120	7. 39	3, 880, 735	84. 36	76. 97	17. 03
North Carolina	50, 704	393, 751	7. 76	992, 622	19. 57	11. 81	2. 76
		Population in 1800.				1800 to 1860.	
Ohio	39, 964	45, 365	1. 13	2, 339, 502	58. 54	57. 40	8. 99
Kentucky	37, 680	220, 955	5. 86	1, 155, 684	30. 67	24. 81	4. 60
		Population in 1810.				1810 to 1860.	
Illinois	55, 405	12, 282	. 22	1, 711, 951	30. 90	30. 68	15. 54
Missouri	67, 380	20, 845	. 31	1, 182, 012	17. 54	17. 23	7. 43

It would have been fair to have omitted Maine from the comparison, as an offset to Western Virginia, since the latter has always partaken more of the character of a free than a slaveholding community. But the contrast is sufficiently striking as it stands. The remarkable fact is developed by the table that Massachusetts and Connecticut contained very nearly twice as many inhabitants to the square mile, in 1790, as Virginia contained in 1860, while Rhode Island was more than twice as populous at the former period as Virginia was at the latter. This important difference should always be kept in view in making comparisons between the free and the slave States. There should be something like equality in the conditions at the starting point. It is certainly remarkable that, with a dense population to begin with, in 1790, these free States have gained in far higher ratio to the square mile than Virginia, with its sparse population. Thus, Massachusetts gained 109.28 to the square mile in the 70 years following 1790, Rhode Island gained 80.79 during the same period, and Connecticut 45.50; while Virginia, with her ample domain, her fertile soil, her valuable mines, and her fine rivers and harbors, only gained 13.83.

In the other comparisons in the table, the slave States contained the larger populations at the beginning of the periods, with larger territories, (except as between Ohio and Kentucky, where the advantage is small in favor of the free State,) and equal fertility of soil. At the end of the period, these fresh and fertile slave States appear dwarfed by the side of their northern sisters, in all the elements of civilization. Between New York and North Carolina no one now would think of instituting comparisons, as it regards population, wealth, or any other indication of progress; yet, in 1790 the latter was the most populous State of the two. Between Ohio and Kentucky, and between Illinois and Missouri, the comparisons are particularly appropriate. The two former States lie contiguous, and are only separated by the Ohio river. Kentucky has the advantage of climate, and is quite equal to Ohio in soil, as well as in facilities for the transportation of commodities to market. Kentucky also had the start of Ohio in point of time, and contained, in the year 1800, *just five times* as many inhabitants, as can be seen by the tables. In 1860 Ohio contained more than twice as many inhabitants as Kentucky, all free and educated, while two hundred thousand inhabitants of the latter were ignorant negro slaves. Illinois, also, is contiguous to her slaveholding sister, Missouri, and is separated from her by the Mississippi river. In climate, soil, and productions they are very much alike, and in natural facilities of river navigation Missouri has the advantage. The latter State had, also, the advantages of an earlier settlement, and in 1810 contained nearly two-fold the population of Illinois. Yet, as in all the other comparisons, the race was overwhelmingly in favor of freedom. These illustrations can leave no doubt on any rational mind that slavery tends to retard the increase of population.

CONDITION OF THE FREE NEGROES.

WILL THE FREEDMEN WORK?

I have no occasion to enter into the discussion of the question whether the emancipated blacks will work as well as they did when slaves, or as well as white freemen. They may, or they may not; but the truth is indisputable that the capital invested in them while slaves was unproductive to society, and only tended to enrich one class of individuals at the expense of another. If it be true that the negroes will not work so well as formerly, the fact only goes to make the first introduction of slavery into the country the more deplorable; but it in no respect shakes the immutable truth that to make merchandise of human beings is to absorb the resources of the people in a manner wholly unnecessary, and therefore unproductive; and it would still follow, that if slavery had never existed, the places of the slaves would now be occupied by a three or four fold greater number of intelligent and industrious free laborers, while the three thousand millions of capital which was unprofitably invested in the slaves, three fold multiplied in amount, would have assumed the form of improved agriculture, more and better houses, more and larger towns and cities, more manufactories, and more commerce.

But I by no means assent to the truth of the proposition, that the freedmen will not work as well under the incitements of ambition and self-interest as they did under the fear of punishment. The free negroes of the free States in past years, though laboring under a mountain of unjust prejudice and proscription, though excluded by statute from the more honorable professions, and by mob violence from many of the humbler, have never been more a burden to society, in proportion to numbers, than have white people. Even in the south, where the tyranny of law and the tyranny of custom have been more severe than in the free States, the free negroes managed to live, and in many cases to accumulate property. I have for many years believed that a fallacy has existed in the reports of the census, by which it is made to appear that the free negroes, north and south, are increasing in numbers at a rate less than half that of other classes. The fallacy is not in the compilers of the census, but in the original collection of the statistics. In other words, there has been a strong temptation on the part of the nearly white mulattoes to pass themselves off for white persons. In all the southern, as well as the northern States, there was, either by statute, or by judicial decision, a limit beyond which a person of African descent ceased to be placed in that category. This was generally the third or fourth remove from the original black ancestor, so that if a man had less than that proportion of the African in him, he was in law regarded as a white man, and could sit on juries and vote; and there are many eminent instances among this class of families who have risen to social, as well as political distinction in the south. This fact is well understood in all the older southern States. When the mulatto family or individual has arrived at the doubtful confine which separates the two races by a mere shade of coloring, prudence dictates emigration to some distant part of the country, where the genealogy of the family is unknown. The enterprising *novus homo* has grown rich and taken social rank, it may be, with the best, and at length, when, after years of prosperity and honor, a breath of scandal, like the poisonous simoon, reaches the neighborhood, that the genealogical tree has been grafted upon an African stalk, it is too late to shake it from its firm base. It is dangerous even to allude to the sinister fact, and may involve a duel. The gossips may whisper in secret corners, but the rich and powerful man maintains his place in society. In the ten thousand instances where no great success attends the career of the new man, his origin is perhaps never discovered by the new friends and acquaintances he has made in his new place of abode. And after all, the prejudice against the blood of the African is more conventional than inherent in each individual composing society. No man will knowingly accept counterfeit money, by which he is to lose; but it is a discreditable fact that the world is not over scrupulous about accepting doubtful coin or bills, provided they are current. And so with the social world, as it regards genealogies. It is known at the south, and I suppose in the free States, that certain families have the taint of African blood in their veins; but they are rich and respectable, have married into good families, perhaps filled high offices in church or State, and have thus the stamp of current coin. They are accordingly received at par value, whether at the ballot-box or at the social board, and no questions asked.

There were other causes during the continuance of slavery for the slow increase of the free negro population of the south, during the last twenty years. These were, first, "unfriendly legislation," by which they were compelled or powerfully urged to leave that portion of the Union for the north, or for foreign countries; and, in the second place, it is a well-attested fact that many were reduced to slavery by fraud and violence. It became a branch of the negro trade to kidnap and run off free negroes from the older States, where they were numerous, to the southwest, where their labor was in demand. A brave and true-hearted Marylander assures me that he, with his father, had at various times rescued twenty-three free negroes from the clutches of the negro traders on the Chesapeake bay, and many well-attested cases of the kind are on record. It would be a miracle if any race should flourish under such oppressions.

The following facts from the census, showing the decline of the free negroes in Louisiana, can only be explained in one or all of the ways here described. The free negro population of that State reached its maximum of 25,502 in the year 1840; in 1850 there were but 17,462, and in 1860 the number was 18,547. Now it cannot be pretended that the climate of Louisiana is less congenial to the negro than to the white man, nor that the means of living are not as much within the reach of that class in that State as in other parts of the south. The rapid decline of the free negroes, therefore, can only be explained in one or all of the three ways I have pointed out. They must have been in part driven out by cruelty, and enslaved, while others were passing rapidly by the process of "miscegenation" into the ranks of the white people. From what is known of the state of society in Louisiana, and especially in New Orleans, where the majority of the free negroes resided, there is much reason to believe that the decline in their numbers is due rather to the bleaching process than to the stern cruelty which would expel, exterminate or enslave them; although these latter causes of the decline of that unfortunate class were in operation.

WORKING OF EMANCIPATION.

But there is tangible evidence of the fact that the freedmen will work, in the state of things now existing in the south. The monthly report of this Department, for February, has a table of the principal productions of agriculture in the loyal States during the past year. Included in it are the States of Maryland, Missouri, and Kentucky. The two former abolished slavery in the years 1864 and 1865, while in Kentucky the institution was practically broken up by the events of the war, by the enlistment of a large portion of the able-bodied slaves, and by the practical freedom granted them by the military authorities. Maryland, alone, presents anything like a fair test of what the negroes will do in a state of freedom. Her people were at peace among themselves throughout the year, and were free from invasion from the south. Still it is to be remembered that thousands of the laboring blacks and whites were in the military service of the United States, which circumstance will fully explain the slight falling off which took place in some of her productions, compared with the year 1859, as reported in the census, if it was not offset by the equivalent gain in others. The figures for the two years are as follows:

PRODUCTS OF MARYLAND.

	1865	1859.
Indian corn .... bushels..	14,308,739	13,444,922
Wheat .... do....	5,479,635	6,103,480
Rye .... do....	476,770	518,901
Oats .... do....	6,135,779	3,959,298
Barley .... do....	26,591	17,350
Buckwheat .... do....	164,048	212,338
Potatoes .... do....	1,274,393	1,264,429
Tobacco .... pounds..	29,963,672	38,410,965
Hay .... tons..	181,341	191,744

The reader will remark that nearly a million more bushels of Indian corn was produced in 1865 than in 1859; that there was a gain of above two million bushels of oats, and a small gain in the quantity of potatoes, (common.) These excesses of production with free labor will very nearly offset the loss on the crops of tobacco, wheat, and rye; and, taken in connexion with the fact above stated in regard to the enlistment of thousands of laborers in the military service, the crop in 1865 must be regarded as the larger of the two.

Kentucky and Missouri were during the past year in a state of civil commotion bordering at times upon civil war. Thousands of negroes and white men were under arms, and, as regards Kentucky, as many thousands of both races were fugitives, the whites in the more southern States, and the blacks in the northern States. These well-known facts fully account for the falling off in the crops.

PRODUCTS OF KENTUCKY.

	1865.	1859.
Indian corn ... bushels..	57, 512, 833	64, 043, 633
Wheat ... do....	2, 788, 184	7, 394, 809
Rye ... do....	476, 453	1, 055, 260
Oats ... do....	4, 824, 421	4, 617, 027
Barley ... do....	161, 778	270, 685
Buckwheat ... do....	13, 478	18, 928
Potatoes ... do....	1, 395, 468	1, 756, 531
Tobacco ... pounds..	54, 108, 646	108, 126, 840
Hay ... tons..	127, 301	158, 476

It is seen that the crops of grain, hay, and potatoes in 1865 are not far from full, in comparison with those of 1859. The tobacco crop is just half that produced before the war. This must be regarded as a very surprising result when the circumstances are taken into view, and it leaves no ground to doubt that the south will resume its former thrift and industry. The results in Missouri are similar:

	1865.	1859.
Indian corn ... bushels..	52, 021, 715	72. 892, 157
Wheat ... do....	2, 953, 363	4, 227, 586
Rye ... do....	218, 529	293, 262
Oats ... do....	2, 501, 013	3, 680, 870
Barley ... do....	148, 855	228, 502
Buckwheat ... do....	72, 461	182, 292
Potatoes ... do....	1, 139, 057	1, 990, 850
Tobacco ... pounds..	15, 237, 982	25, 086, 196
Hay ... tons..	519, 479	401, 070

It is apparent from the above table that the crop of 1865, raised amid civil strife, is more than two-thirds that of 1859. The corn crops are in the ratio of five to seven, while the hay crop produced last year excels the other by one-fourth in amount. The hay crop is next in value and importance in Missouri to Indian corn, and exceeds the tobacco crop three-fold.

There was much complaint throughout the south that the negroes would not work immediately upon the termination of the war and the enforcement of emancipation. But no fact can be clearer than that the indisposition to work on the part of the negroes was caused by the inability to pay on the part of the whites. They were not willing to work without wages, and in the general disruption of society which existed some months after the surrender of the rebel forces, there was, in fact, but little work to do. Only partial crops had been planted during the last throes of the confederacy, in March, April, and May, and when peace came it was too late to put in larger ones. That thousands should be idle under such circumstances was to be expected, and it is an undeniable fact that there was quite as much idleness among the whites as among the blacks. But in spite of much bad feeling and occasional disorders, there is a general disposition among all classes to resume habits of regular labor. There are still to be found groups of helpless women and children who need the support of the government. They have been driven from their homes, in many cases by their former owners, (as they say,) because their husbands and brothers have left; and they have been abandoned by their husbands, if they ever had any. That they are unable to support their children and themselves in the present disordered state of southern society is not to be wondered at, nor does the fact furnish a sufficient reason for condemning the whole race as idle and worthless. According to the reports of the Freedmen's Bureau, as many of the white people as blacks of the south need government aid, and receive daily or weekly grants of rations.

It would be a most surprising fact if four millions of people suddenly released from centuries of bondage should not indulge in a protracted holiday, and the wonder is that the negroes have demeaned themselves with so much moderation. The fact would not be creditable to them if they failed to show their appreciation of the boon of freedom by a degree of noisy demonstration, accompanied by idleness for a brief season. To remain at home and pursue ordinary occupations with stolid indifference at such a time, they must have been less or more than human. But the idleness exhibited by the negroes has, for the most part, been inevitable in consequence of the lack of remunerative employment. No rational man could expect them all to go to work quietly for their former masters without a prospect of fair wages, yet, in point of fact, thousands have done so, and there is abundant reason for believing that, as a class, the negroes will become an industrious, thrifty, and law-abiding people, eminently docile, and emulous of improvement.

AGRICULTURAL COLLEGES.

BY HENRY F. FRENCH, PRESIDENT OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Until the close of the past century we find no account of any school or college of agriculture. In 1799 Thaer, the celebrated German writer upon agriculture, founded at Celle, in Hanover, an agricultural school, and in 1806 the king of Prussia granted him a large tract of land, which he exchanged for another at Mœglin, where, in 1807, he founded a practical school of agriculture, which, in 1810, was constituted the royal school of agriculture.

This school is especially interesting, not only because it was the earliest on record, but also because it furnishes an excellent model, in many respects, for similar institutions. It is thus described by an English traveller who visited it in 1820: It comprised a model farm of 1,200 acres, and a college for instruction. The education was partly theoretical and partly of a practical description. The former was provided with three professors, who lived upon the premises: one for mathematics, chemistry, and geology; one for the veterinary art, and the third for botany and the use of the various vegetable productions of the *materia medica* as well as for entomology. The practical instruction was communicated by an experienced agriculturist, who pointed out the method of applying the principles of the several sciences to the daily routine of husbandry. The course commenced in September. During the winter months the time of the pupil was occupied in the study of mathematics, and the six books of Euclid were mastered by him, whilst in the summer the knowledge thus obtained was applied to the measurement of land, timber, buildings, and other practical purposes. The first principles of chemistry were also unfolded. By means of a good but economical apparatus various experiments either on a large or small scale were performed. For the larger ones, the brew-house and still-house, with their appendages, were found to be highly useful.

Much attention was directed to the analysis of the soils, and the different sorts met with, distinguished according to the relative proportion of their component parts, were arranged on the shelves with great order and regularity. There was an extensive botanic garden arranged according to the system of Linnæus, an herbarium containing a large collection of dried plants, a series of skeletons of different animals connected with husbandry, and models of agricultural implements—all open to the examination of students. The various implements used upon the farm were all made by smiths, wheelwrights, &c., residing around about the institution, and the pupils were allowed access to the workshops, and encouraged to make themselves masters by minutely inspecting the implements and the niceties of their construction.

This school is set down in Dr. Hitchcock's report in 1851 as still flourishing, with four professors, twenty students, and 2,480 acres of land.

In the same year, 1799, Fellenberg established upon his estate of Hofwyl, near Berne, Switzerland, his celebrated institution, where, in addition to a school for the poor, was also one for the sons of gentlemen of wealth who wished to study agricultural science and practice. This institution survived its founder about three years, and was discontinued about 1847. In the same year, 1799, the Prince Schwartzenberg founded a similar institution at Kruman, in Bohemia, on a domain of 300,000 acres. This school is still in successful operation, although we find no recent account of it. It is set down in Dr. Hitchcock's list, with its immense territory, its number of professors and pupils being blank. It is described in the new American Cyclopedia as having large collections, comprising models of agricultural implements, insects, fruits, plants, minerals, and a herbarium, with a botanic garden, conservatory, and astronomical observatory. The instruction is gratuitous, and the object of the institution is to render the sciences taught as practical as possible.

Next to these were established the institutions in Germany, to be mentioned in their place.

DEMAND FOR PRACTICAL EDUCATION.

Both in Europe and this country there is a growing impression that our colleges and schools give too much of their time to the classics and to abstract knowledge, and too little to what is practical.* There was good sense in the ancient philosopher who, when asked what is most proper for boys to learn, answered "that which they will want to practice when they are men."

If all men could learn everything, or if the major part of our youth, even, were training for a life of study and not of work; or, again, if we were not, in general, compelled to give up study at twenty or twenty-five, and attend to earning a living, we might well enough devote all our school and college days to mere discipline of the mind. The following statement by one of the visiting committee of Harvard University will help to illustrate our views:

"To be admitted into the freshman class, the candidate must pass an examination in Greek, Latin and mathematics, in which he must show himself to be well acquainted with all Virgil, Cæsar, Cicero's Select Orations, &c., with the Anabasis of Xenophon, three books of the Iliad, &c. But he is not required to be acquainted with any modern language, not even his own. He must be able to write Latin and Greek, but he need not be able to write English," &c. Again: "For the two ancient languages, Greek and Latin, the University provides six instructors. For the *four* modern languages, French, German, Spanish, Italian, it provides three instructors. The compensation paid to those teachers is so small that one of them has been compelled to resign his situation during the last year, and another very valuable teacher of German is scarcely retained." He says further, "Hitherto the study of modern languages in the University has been systematically discouraged by a lower scale of rank for good scholarship in this department than in the others. The best recitation in French and German only gave a mark of 6, while in Latin, Greek, and mathematics the highest mark was 8. Scholars, therefore, who studied for rank, and desired a part in commencement, could not afford to take modern languages as an elective in the senior year."

We are happy to learn that French is hereafter to be required, and not taken as an elective in the freshman and part of the sophomore years, though German is still an elective.

Here we find that in a republic, where German and French are the only languages spoken by a large proportion of the inhabitants of some of the States—in a country where the citizens of each State enjoy equal rights of citizenship in every other State—where the whole people are restless, and are drawn by self-interest to try their fortunes far away from their native homes, and so are constantly finding occasion and almost necessity to use both French and German—we find in this republic the leading university completing the education of her students without requiring them to understand a word of either language. And the same, substantially, is true of our other colleges, and of the great universities of England.

We can hardly find among our political men competent ministers to foreign courts, who can speak the court languages. Now, while, in the language of the act of Congress, we would not exclude classical studies, but would allow all who please to pursue them, we would insist that no young man should be pronounced educated at any college until he could speak and write readily the French and German languages.

The advocates for the classics claim that, in addition to these studies being best for the discipline of the intellect, taste, memory, and imagination, their students are enabled to study in the original Greek and Latin the works of the great master minds of antiquity. "Nor," says one of these advocates, "can translations avail anything for this purpose. The essential spirit and etherial beauty of the orignal vanish entirely with the version." If, however, it be true, as the report of her Majesty's commissioners upon the great schools and colleges of England, made to Parliament in 1864, seems to show, that graduates of the universities, after all their training, cannot read these originals, it would seem to be wise to resort to translations before, rather than after, some ten years' study of the dead languages. Mr. Neate, M. P. for Oxford, gives the following as his estimate of the grand result of education at Oxford: "I do not hesitate to say that the great majority of those who take a degree in Oxford, after having spent ten or twelve years of their life in the all but exclusive study of Latin and Greek, are unable to construe, off-hand, the easiest passages in either language if they have never seen them before." The commissioners themselves say, "Of the young men who go to the universities, a great number never acquire so much Latin and Greek as would enable them to read the best classical authors intelligently and with pleasure."

A careful investigation would no doubt lead to the same conclusion in reference to the graduates of American colleges.

While we do not undervalue the classics, and should hope that every boy would, if possible, possess some knowledge at least of Latin, as being the basis of modern languages, and while we would give to abstract mathematics all the time that the student can spare from such knowledge as we include among "the necessaries of life," we do believe that, for a large class of our people, a system of education should be framed which may combine more of the practical with the theoretical. Borrowing from the heathen mythology some reverence for that Titanic power with which all its deities and heroes are endowed, we would foster a more rigorous manhood, that shall not undervalue muscle and energy to perform the actual labors of life. The goddess of wisdom (as Pallas-Athene) was also the goddess of arts and of scientific war; and knowledge is always consistent with power to execute some practical work.

The establishment of scientific schools in connexion with most of our colleges, and the existence of such institutions as commercial colleges and institutes of technology in various States, indicate that there is a public sentiment demanding something different, at the present time, from the facilities for education given by our literary colleges. Even the old universities of Oxford and Cambridge, in England, have so far yielded to this popular sentiment that they have, within a few years past, established what are termed "middle class examinations" for the promotion of education, outside of their regular classes. Examinations of youth of the middle classes are held at stated times, by committees, and certificates given them, which may secure them situations to which their education may entitle them. The objects of the examinations are to encourage the middle classes in the pursuit of learning, and to guide them in their progress in their preparations for business in trade, manufactures, the arts, or agriculture. The foundation stones of republicanism are *equality, progress,* and *the dignity of labor.* We who are charged with the establishment of educational institutions should see to it that every element that savors of caste, of aristocracy, of distinctions against labor as such, should be carefully excluded. Labor is degrading only as it is associated with ignorance and vice. The skilful surgeon, the hospital physican, the great captains by sea and land, perform labors disagreeable, disgusting, arduous to the extreme of human endurance, and yet we reverence and applaud the laborers for the skill, the intellect, the high and noble motives which actuate them. By combining with all labor, intellect and skill, or, in other words, by educating the man who performs the labor, we may abolish these distinctions, and place the farmer and mechanic on the same plane with the learned professions.

THE ACT OF CONGRESS.

Congress by an act entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," approved July 2, 1862, granted to each State, for such purposes, an amount of public land equal to thirty thousand acres for each senator and representative in Congress, to which the States are respectively entitled by the apportionment under the census of 1860.

The subject of agricultural schools and colleges has long attracted the attention both of our people and legislators, and many attempts, most of which have proved failures, have been made to establish such institutions. The disposition to expend money in large and expensive buildings, and to indulge the American propensity to own all the lands that join us, induced Congress, in the act referred to, to fix judicious restraints upon the States accepting its grant. To the careless observer, a college is, chiefly, a group of magnificent buildings, with pleasant surroundings of lawns and trees, where students are expected some how to gain an education, however starved and pinched may be the internal organization, including the corps of professors and teachers.

Seeing how many institutions have been ruined or contracted in their usefulness by extravagance in the external management of their affairs, and especially by indulgence in architectural display, Congress wisely provides "that all the expenses of management, superintendence, and taxes, from the date of the selection of said lands previous to their sales, and all expenses incurred in the management and disbursement of the moneys which may be received therefrom, shall be paid by the States to which they may belong, out of the treasury of said States, so that the entire proceeds of the sale of said lands shall be applied, without any diminution whatever, to the purposes hereinafter mentioned;" and that "no portion of said fund, nor the interest thereon, shall be applied directly or indirectly, under any pretence whatever, to the purchase, erection, preservation or repair of any building or buildings."

To guard against loss of the fund by improvident investment, the act provides that all moneys derived from the lands granted shall be invested in stocks of the United States, or of the States, or some other safe stocks yielding not less than five per cent.; and that if any portion of the fund, or of the interest thereon, shall be lost or diminished, it shall be replaced by the State, so that the capital shall remain forever undiminished, except that a sum not exceeding ten per cent. upon the amount received by any State under the act may be applied to the purchase of lands for sites or experimental farms, whenever authorized by the legislature.

The general object and character of the colleges thus to be established is briefly stated in the fourth section of the act, which provides that the interest of the fund shall be inviolably appropriated by each State which may take and claim the benefit of the act, "to the endowment, support, and maintenance of at least one college, where the leading object shall be without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

Our object being to discuss the subject in such a way as to aid those who are engaged in organizing colleges under the grant of Congress, it is important to ascertain at the outset what limitations are prescribed by the act. The grant was made by Congress to all the States, and it was then, and still is, impossible to devise a defined plan to be adopted by all. The New England States, with their thoroughly organized system of common schools, require different colleges from the southern States, where no such system is known, or the new States of the west, where society has hardly begun to crystallize into towns or villages. Great latitude was therefore left to the several States in establishing their respective institutions under the act.

Certain marked features, however, remain prescribed by the act of Congress, which good faith, if not the power of the law, requires each State to incorporate into every institution benefited by its grant. "The leading object" of the college shall be, says the act, "to teach such branches of learning as are related to agricultural and mechanic arts;" and the title of the act expresses the same general object—to "provide colleges for the benefit of agriculture and the mechanic arts."

These fundamental provisions call for the establishment of institutions different from our ordinary colleges, which can in no fair sense be said to be maintained for the benefit of agriculture and the mechanic arts, or to teach especially such branches of learning as are related to agriculture and the mechanic arts. In a loose and general sense, all learning may be said to benefit agriculture and the mechanic arts, and to be related to them; but the colleges maintained by the grant of Congress are required to be distinctively and essentially of this character. It is therefore a fraud on the act for a State to transfer the bounty of Congress to existing literary institutions without requiring them, at least, to establish a regular course of study in such branches of learning as are distinctively related to agriculture and mechanic arts.

We find nothing in the act to limit the colleges established under it to the mere practical teachings of agriculture and mechanics; but, on the contrary, the idea, so far as developed, is of colleges of the grandest scope, where, "without excluding other scientific and classical studies," the branches of learning related to agriculture and the mechanic arts are to be taught "in such manner as the legislatures of the States may respectively require, in order to prosecute the liberal and practical education of the industrial classes, in the several pursuits and professions of life." Several points should be noted in the language of the act just quoted.

"Liberal" as well as "practical" education is provided for, and education in the several pursuits and "professions" of life.

The grand idea which seems to underlie the whole act, and which, no doubt, was prominent in the minds of the framers of it, is the elevation of the laboring classes. This is clearly expressed in the language already cited, giving the grand object, which is "to promote the liberal and practical education of the industrial classes," &c. The "industrial classes" are ordinarily those engaged in agriculture and the mechanic arts. To raise them to equality in education with the classes more favored by fortune, is the first care of a republican government. The rich may educate their own children, but the government should take care that the poor are not neglected. Already colleges exist in most of the States, where youth, a majority of whom are from the wealthier families, are educated for the professions. Colleges to teach the branches of learning relating to agriculture and the mechanic arts offer peculiar attractions to the industrial classes, and it is desirable to bear in mind, in their organization, the fact that these classes have not, usually, large means at their command, and that institutions for their benefit must furnish the means of education at moderate expense.

Again, it is clear that, although the primary object is the education of the industrial classes, it is not intended so to conduct their education as to confine them to any class, in their after life. The object is rather to offer to the industrial classes such facilities for education as they are most likely to use, to give them instruction in the branches relating to agriculture and mechanics, to offer them instruction in "scientific and classical studies," and finally to prepare them, by a "liberal and practical education," not only for farmers and mechanics, but for success "in the several pursuits and professions of life."

WHETHER INDEPENDENT OR CONNECTED WITH OTHER INSTITUTIONS.

Whether the college, to be established under the grant of Congress, shall be an institution independent, or whether it shall be, to greater or less extent, connected with existing colleges, is a question raised in every State where the subject has been discussed.

Assuming that a union with an existing institution is consistent with the act of Congress, let us consider the expediency of such a union. The question is attracting much attention in Europe, particularly in Germany, where, as in this country, scholars, and especially officers of universities and colleges, generally advocate such a connexion. The principal arguments in favor of a union, so far as relates to this country, may be arranged under a few heads:

1. The great cost of buildings for lecture and recitation rooms, halls, libraries, laboratories, and many other accommodations, may, for the most part, be saved, since in all our colleges there is accommodation for many more students than now attend.

2. Existing institutions, too, are already supplied with museums of natural history, geology, comparative anatomy, and the like, and with libraries for general reading and scientific works, all of which may be available to a larger number of students. It requires a long period of time as well as a large amount of money to form such collections, and without them an agricultural college could not be expected to maintain a position of dignity or usefulness.

3. Existing institutions have organized corps of professors, many of them (as of chemistry, physics, botany, physiology, mathematics, ethics) the same that would be necessary in the agricultural college, and those, with slight addition to their labors or numbers, could give instruction to the students in agriculture and mathematics.

4. The great leading minds of the country are already engaged and attached to existing institutions, and it will be found impossible to organize new colleges with competent professors.

5. The union of the highest education in the sciences, and in their application, is impracticable; and true education consists in the apprehension of principles and in general discipline, rather than in practical arts, which may be readily learned afterwards.

6. That knowledge is advanced by the devotion of thoroughly trained minds to special branches of science, whereby discoveries are made and actual additions to the sum of human knowledge are published to the world. The Smithsonian Institution at Washington and the Museum of Comparative Zoology at Cambridge, Massachusetts, are illustrations of this special mode of study, and all the higher universities and colleges, incidentally at least, to some extent, adopt the same method.

The reasons in favor of independent agricultural colleges, and the answers to the foregoing arguments in favor of a connexion, may be thus stated:

1. Admitting the great value of libraries and museums already formed, as well as the economy of using buildings already built, it is fair to suggest that funds for the erection of new buildings, and for libraries and collections, can usually be raised by local subscriptions or by contributions, in aid of an agricultural college, from persons who would give no aid to an existing institution.

There is a deep interest among farmers and mechanics in the success of colleges adapted to their practical wants, which is of more value than all that the older colleges can offer.

2. It is no disrespect to existing institutions to maintain that no one of them has within itself a corps of instructors competent to manage an agricultural college. Wedded to their own approved and time-honored theories, almost unanimously distrusting the possibility of a union of manual labor and study, accustomed to instruct mainly in theory, unfamiliar with practical agriculture, believing that Latin and Greek furnish the best discipline for the youthful mind, the regular professors in existing colleges are peculiarly unfit to develop or execute a new and peculiar plan of education. The agricultural college, thus controlled, would of necessity sink into a subordinate branch of the university, and fail of all its purposes. In an independent institution, under a government devoted to its peculiar objects, the professors of the other colleges might be procured to deliver courses of lectures in their several departments, and thus their learning may be made available to the new college. Nearly all college professors have periods of leisure which they devote to lectures abroad, and such interchange would be mutually beneficial.

3. The arguments in favor of a union, based upon the incompatibility of the study of abstract and applied science, and upon the idea that the advancement of knowledge rather than its diffusion is the chief object in view, are founded in a misapprehension of the intention of Congress as shown in the act.

The manifest object of the act is, as has been already shown, to furnish a more practical education for the industrial classes than other colleges afford; and if such education is incompatible with the theories of existing institutions, there can be no union between the two systems. Again, the new colleges are designed to educate boys, and not to advance the knowledge of learned professors. Their first object is to diffuse knowledge already existing, to teach their pupils what is already known to the best farmers, the best mechanics, and to the professors of the various sciences—boys between the ages of sixteen and twenty-one, incapable of receiving education beyond this. It is not expected of them that they should make discoveries in science, or enlarge the boundaries of human knowledge. Let us train them in body, in mind, in taste, in morals, developing each capacity harmoniously, to make them perfect men, robust and manly, with knowledge of men, of business, of practical affairs—observers and lovers of nature as well as students of books—and so prepare them for contact with the world "in the several pursuits and professions of life."

4. The essence of republicanism is equality and freedom from caste. They who advocate union do not, in general, propose to annex farms to the existing colleges, and so do not intend to make manual labor a part of their system. They thus avoid the division of their students into classes of scholars and laborers, by sacrificing the advantages which, in another place, we claim for manual labor. So far, they doubtless do well; for the harmonious operation of any system in which a part of the pupils should be required to perform farm labor, in the costume adapted to it, and another part should be exempt from labor, would be impossible; and the case would be even more manifestly hopeless were the attempt made to introduce a class of laboring boys into the ranks of an established institution, where the older classes had, by the natural course of their education, imbibed the common prejudice against manual labor.

The customs of students in old institutions seem fully as strong as the authority of the faculty. The attempts to abolish *fagging* in England, and *hazing* in America, in the universities, has taxed the utmost power of the authorities, with only partial success. This love of power and assumption of superiority seems to be one of the innate depravities of students, and the experiment of introducing a new class, to be known distinctly as agricultural or mechanical, even without the requirement of labor, would not be found without its embarassments.

If, again, the agricultural students are not distinguished from the rest, we have remaining only our old colleges, and our whole plan of agricultural colleges is destroyed.

The opinion of Dr. Hitchcock himself, president of Amherst College, was decidedly in favor of an independent institution. His reasons why mere agricultural professorships are insufficient, and in favor of independent agricultural colleges, are briefly as follows: 1. Because lectures upon such subjects attract but few of the students of colleges, most of whom are looking forward to professional life; 2. Because the two classes of students who would thus be brought together would have too little sympathy to act in concert and as equals in the same university; 3. Because, without such concert and sympathy, one or other of the classes of students would feel no pride in the institution, and without such *esprit de corps* it could not prosper; 4. Because the field is wide enough to require such establishments. The principles of agriculture are based upon a large part of the physical sciences. No man can understand the *principles* of farming who is not more or less acquainted with chemistry, anatomy, physiology, botany, mineralogy, geology, meteorology, and zoology; and then the practical part requires an extensive acquaintance with various branches of mathematics and natural philosophy. 5. Because it demands extensive collections of various kinds in order to elucidate the principles of husbandry; enough, indeed, to belong to any scientific institution, and too many to form a mere subordinate branch of some institution with a different object in view. 6. Because the number of instructors must be so large that they could not conveniently form an adjunct to some other institution.

MANUAL LABOR.

Whether students in agricultural colleges shall be required to perform manual labor, is a question which everywhere excites discussion, and which deserves most careful consideration. Learned professors, and indeed nearly all who have been engaged in education in our academies and colleges conducted on the ordinary principles, doubt the success of combining labor with study.

Manual labor schools were a few years ago much advocated. The idea upon which they were based was, that students by laboring a part of their time might defray the expenses of their own education. It was supposed that four or six hours' labor daily, well applied on the farm or in the workshop, might not only pay the board but the tuition of the pupil, and all his incidental expenses. The difficulty, however, was not in the theory, but in its development. A single faithful industrious young man in a farmer's family might, no doubt, by even four hours' daily labor, pay for more than his board; and perhaps a practical farmer might take into his family a small class of such youths, and teach them practical agriculture, and receive fair compensation for their support and his assistance to them, by their labor for a third or half the time. The farmer would invest in the enterprise only the supplies for his table and some additional house-room. His teachings would be given without loss of time from his business, and he would make no expenditures for apparatus, or for buildings for lecture and recitation rooms.

Suppose now that this same farmer undertakes to enlarge his plan of usefulness, and, instead of his small class, to educate two hundred boys in agriculture, not only practical but scientific; to teach them not only manual labor and commence farming by example, but to give them a regular course of education in chemistry, physics and engineering, natural history, comparative anatomy and physiology, including veterinary surgery; to instruct them in French and German, and, generally, to give them, in the language of the act of Congress, a "liberal and practical education in the several pursuits and professions of life." How can he do it? He must erect large and expensive buildings, with halls and lecture-rooms, and museums and laboratories; he must employ professors learned in the several departments, who must be paid enough at least to support them; he must provide his students with rooms for lodgings and for study, and make provision for their board; he must expect only the average amount of intelligence, industry, and fidelity in his pupils; and he must provide for the profitable employment of his two hundred boys, in all seasons—summer and winter, rain and sunshine. If he finds his own time occupied on the farm, he must employ some discreet educated person to take general charge of his establishment, to organize classes, conduct correspondence, listen to the complaints and requests of the students—in short, to *preside* over the enterprise, which it may be perceived has grown from a farmer's family into an agricultural college, with a president, professors, the usual expensive buildings, and our farmer himself as farm superintendent. The main object now being to educate two hundred boys, and not merely to farm profitably for the farmer's benefit, incidentally teaching a half dozen young men, the result of the scheme pecuniarily is entirely changed.

Thoughtful men might have foreseen what experiment proved, that manual labor schools as such—schools where the pupil's labor was to pay all his expenses and those of the school—must fail. It is difficult enough for the average of men to succeed in life when they devote themselves to one object, and give to it all their energies; but when they undertake a grand project like education, and expect that an incidental adjunct like a system of half-time labor shall maintain it, their disappointment is sure.

When we consider, further, that the men who have undertaken to establish manual labor schools have not been usually of the class called practical, but rather of the enthusiastic and philanthropic order—educated rather in theory than otherwise, it would seem strange, indeed, if they should be able even to conduct fairly experiments involving farms and workshops, buying and selling, and all the complicated machinery of education and self-support combined.

The failure of manual labor schools furnishes no argument against manual labor in agricultural colleges, but tends to prove only that such labor cannot be expected to be very profitable as a matter of dollars and cents, however profitable it may be as a part of a system of education.

It should be distinctly understood by the public, by legislators, and by all connected with these institutions, that the principal object is the education of the pupil, and that this object is kept in view in his hours of labor as well as in his hours of study. Profit and education may be quite inconsistent in many instances. The young man will earn more for the institution if placed in the employment which he best understands, and kept there regularly through his course. His education will be best promoted, on the other hand, by allowing him to engage in those branches of labor of which he has no knowledge.

It is frequently said by advocates for manual labor that three or four hours' labor a day ought to support the pupil. The same persons, if you ask them, will say that the pupils should be taught to perform with their own hands every process of farm labor. Let the farmer test this matter by applying the question to his own case. How much would it profit him, if he has a fine dairy stock of twenty cows, to have them milked for a fortnight by twenty boys who never had milked a cow before? How much richer would he be to set twenty boys, who never mowed a swath before, into grass fields to mow for him a week, and furnish them scythes? Ask similar questions as to all farm operations, fencing, cutting timber, planing, sawing, tending stock—as to gardening, pruning, grafting, budding, transplanting, and we shall see that unskilled labor of boys can be of little value; especially when they are employed in large numbers, so that they cannot be constantly superintended and watched as a farmer would do with his own family.

It is important to organize our colleges with the right idea upon this point. If legislators and trustees assume that student labor must be profitable and productive, and insist that it shall be made so, they compel their officers to sacrifice the prime object of their instructions, or to disappoint the expectations of the public. The writer visited the agricultural colleges of Pennsylvania and Michigan in June, 1865, and carefully investigated this subject at both institutions. He believes that the views already expressed will be fully confirmed by the testimony of the officers of those colleges. In another place we shall have occasion more particularly to refer to the systems there in operation. Manual labor should be required of every student, because in no other way than by actual practice can a man learn the proper use of implements. The processes of husbandry can no more be learned by study, than one can learn by study how to ride, or skate, or swim. A four years' course of lectures without practice would never teach a youth to mow or plough, or to plant trees, or graft or bud them. No man can safely go into the market to buy or sell live stock, seeds, manures, or any product of the farm, without practical and daily familiarity with such kinds of property.

Again: no person without a thorough knowledge of the processes of husbandry is fit to direct labor. The relations between proprietor and laborer are very delicate in this country. The laborer is intelligent, and knows when he is fairly treated, and will soon learn whether his employer is entitled to respect. Many gentlemen purchase farms, and entirely fail in their hopes of enjoyment of rural life because they do not know what a fair day's work is. They are unreasonable in their demands, and find fault with the poor fellow who has done a hard day's work, and the laborer feels that his best efforts are unappreciated, and ceases from his honest endeavors.

To encourage men of wealth of all pursuits and professions to create and occupy tasteful homes in the country is a legitimate object of agricultural education, and this can only be done by teaching the proprietors themselves the practical details of the farm, or by educating a class who shall correspond to the land stewards of England, who are competent to take full charge, for a fair salary, of large estates.

Almost every merchant, shipmaster, and manufacturer looks anxiously forward to the time when, bidding adieu to the peculiar cares of his own occupation, he may retire with a competence, perhaps to his paternal acres in the interior, perhaps to some elegant suburban residence, and devote his declining years to the peaceful pursuits of agriculture. The long-expected day arrives, and "with sweet dreams of peace" the rural home is secured. Field is added to field, and costly barns and stables are erected. Extravagant prices are paid for Short-horns, and Jersey's, and Devons, as caprice or the casual suggestion of friends may dictate; magnificent operations in draining and subsoiling, in planting orchards and vineyards, are commenced. Guano and phosphates, bone-dust and poudrette, are purchased and applied to hasten nature's tardy operations. Heneries and duck ponds are constructed, and stocked with fowls of wonderful names and pedigree. The dairy, with its never-failing spring, with the thousand appliances recommended in modern treatises, is elaborately furnished. Oxen and horses, ploughs and harrows, carts, harnesses, hay-cutters, root-cutters, mowers and reapers, with an endless variety of small tools, all of the most costly description, are added to the working capital, and cheerfully paid for, with the certainty that by and by the harvests will bring a rich return, and the proprietor will rejoice in his successful experiment in scientific farming.

A very few years, however, are sufficient to reverse this pleasing picture. The "hired men" are unfaithful and indolent; the fancy cows break into the cornfields or young clover, and are ruined; the drains are obstructed by the frosts of the first winter; the apple and peach orchards and vines yield no fruit; the poultry cannot keep enough feathers to cover their nakedness, and much less can they afford any eggs; the potatoes rot; the horses fall lame unaccountably, and, to cap the climax of misery, the kitchen help goes suddenly off, and the "angel in the house" either takes refuge in a fit of illness or finds relief in tears, with an occasional reminder of "I told you so." Scientific farming is pronounced a humbug, and our disappointed but worthy citizen suddenly sells out at a sacrifice, and returns to his city home "a sadder and a wiser man." Such cases are constantly occurring, and they not only bring disappointment to the parties themselves, but discouragement to all who would fain believe that agriculture may be made, at the same time, a rational amusement and a safe and profitable business. These men fail because they knew nothing of practical agriculture themselves, and because we have no class competent to take charge for them of their agricultural affairs. Manual labor should be required in agricultural colleges, because the cultivators of the soil are usually the owners of it, and because convenience, as well as the theory of our government, requires that the head and the hand shall be united in the same person; and a great proportion of students will have occasion to labor on their own farms. A course of study of several years without labor would unfit them for actual work, both physically and mentally. We deem it important, too, that labor at these colleges be compulsatory upon all. The idea has been suggested of leaving the matter optional with the student, and allowing those who work compensation. The objection to this is obvious. We desire, as a prominent object, to do away with caste, and especially with all distinctions founded upon an exemption from labor. Interest in the work of the farm can only be maintained by constant association of work and study, by constantly testing in the field the theories of the school-room. The idea that labor is degrading is already (though not designedly) fostered by setting apart, in our ordinary colleges, an educated class, who are not workers, and who from superior education occupy high positions. If we would dignify labor, we must combine and associate it with intellect and culture of the mind and taste, and in our agricultural colleges allow no divorce between what God has joined together—the mind and the body.

In the agricultural colleges of Michigan and Pennsylvania three hours' daily labor is required of each student. In the Michigan college, after detailing a sufficient number to take care of the stock and to attend to minor affairs, the students are divided into three equal classes, one of which works in the gardens, under the charge of the professor of botany and horticulture; while the other two work in the field, under the professor of physiology and practical agriculture. At the end of a certain term the class from the garden is put into the field, and one of the other classes is put into the gardens, new details being made for the care of stock.

At the agricultural college of Pennsylvania the time allotted to labor is the same. The students labor, however, under the farm superintendent, and not, as in Michigan, under the professors. It seems to us that this is the true system. It is objected that the professors cannot have time to spend with their pupils in the field; that they need their whole time in their studies and laboratories. This is the old reason urged in a new form against combining manual labor and study. The professors of practical agriculture and horticulture, and of botany, surely should be able to find useful topics of instruction in the field, and in our battles for the dignity of labor we cannot afford to yield the point so far as to set apart an aristocracy of intellect in our own professors, by position and education above manual labor. We need the eye of the master in the field. We should hardly expect young men to submit patiently to the direction and supervision of such a man as we are at present likely to employ as farm superintendent, and there are manifest advantages in having the labor of the pupils directed by their professors—illustrating in the field the lessons of the lecture-room, and, with the students, conducting to definite results experiments in the many vexed questions of practical agriculture.

The only objection to manual labor by students is in the supposed incompatibility of physical and mental labor. We admit that severe long-continued daily labor in the field is inconsistent with the close and absorbing pursuits of science and art, but we maintain that two or three hours of the light labor in which students of a college would participate may be heathful for body and mind.

Mr. Colman, in his reports upon the agriculture of Europe, in speaking of manual labor in such schools, says: "There can be no doubt that a man will perform more intellectual labor who devotes a portion, and not a small portion, of every day to healthful physical exertion, than the man who, neglecting such exertion, abandons himself in his study exclusively to his books. I am quite aware that many occupations of a mechanical or a commercial nature may so occupy the mind as to unfit it for scientific pursuits; but agricultural labors, quiet in their nature and carried on in the open air, when pursued with moderation, so far from fatiguing, refresh and invigorate the mind and prepare it for the more successful application to pursuits exclusively intellectual."

IS A FARM NECESSARY?

Whether a farm is a necessary adjunct of an agricultural college, depends very much upon whether manual labor by the students is an essential element of their education, and whether the college is to be connected with another institution or be independent. If we adopt the theory that practice and study cannot profitably be pursued at the same time, we have no occasion for a farm. Connecticut has granted her land script fund to Yale College, which has established a "course in agriculture" in the Sheffield scientific school, which will be given at large in this paper.

It is proposed in this place to call attention to two or three points, having a bearing upon the topic under consideration.

The circular says: "The details of farming cannot be learned advantageously in an agricultural school. They are only to be acquired during a long apprenticeship on the farm. No young man is well prepared to attend an agricultural school who is not practically familiar with most of the ordinary operations of farming."

To this it may be fairly objected, that it practically excludes from the course all but the sons of farmers, for "the comparatively high standard of admission" prescribed is such as would not be often attained by boys who should be sent from home into farmers' families to learn practical agriculture. More than one-half of all the pupils who have thus far attended the agricultural college of Pennsylvania are other than farmers' sons—the most of them from the cities and large towns. We apprehend that such will be the case in most of these colleges in the old States, and it is desirable that it should be so. The circulation from city to country, from merchandise and the professions to agriculture, and in the next generation back to the city, so in accordance with the spirit of our institutions, and healthful to the community, promotes harmony and equality, and checks all tendency to caste.

Each position in life seems hardest and least desirable to him who fills it. The city boy sees in agriculture only visions of bliss in the country such as he has enjoyed there in his holidays, while the farmer's son regards the farm only as a place for hard work, and envies the position of the merchant and the lawyer. The parents sympathize with these views, and the sons as often as otherwise seek a different business from that of the fathers. It will not be contended that these colleges are designed exclusively for the benefit of the sons of farmers, although this is sometimes thoughtlessly assumed.

A college in this country which should not open its doors as readily to the sons of the poorest mechanic, the wealthiest merchant, the lawyer, the doctor, and the minister, as to the sons of the farmer, would occupy a position at variance with our common school system and our fundamental principles of government.

Whether the details of farming can be advantageously learned in an agricultural school depends upon the appointments of the school, the capacity of the teachers, and the apparatus provided. With an extensive farm, stocked and furnished with specimens of the various breeds of cattle, horses, sheep, and swine, and with such other animals as may be newly introduced, and with the best variety of farm implements—a farm where the ordinary as well as experimental processes of husbandy were conducted, would certainly furnish every facility for learning the details of farming. Whether, as at Yale, the agricultural warehouses and neighboring gardens and farms can, to some extent, supply the place of a farm, must depend much on location. In Michigan and Pennsylvania the agricultural colleges are too far away from any such collections or examples of good husbandry to be aided by them, and we suppose this may be the case in other States. As was said of the labor of students, so it may be said of the farm—it should be regarded as part of the apparatus of the college, and not as a source of profit. The farm that should be chiefly for experiment and educational farming is never pecuniarily profitable, however profitable it may be for education. Experiments which fail, so far as money is concerned, may be as valuable as those which succeed. A beacon or a buoy is often as valuable to the mariner as a compass, and it is as important to the farmer to know what to avoid as what to pursue. A "model farm" is connected with most of the agricultural schools abroad, and the director is required to farm it to a profit; and this is for example to the surrounding farmers, to convince them, by actual observation, that good farming is profitable. This is more important in Ireland or France, where the occupants of land are less intelligent than with us, where each farmer knows pretty well the capacity of his own farm. The objections to it are, that by farming for profit merely we lay aside experiments and pursue the established course of the neighborhood, and we must employ the students in what they already best understand, instead of teaching them what they need learn. The idea of a *model* farm is such a farm as may serve for a model for surrounding farmers in its extent, its arrangement of buildings, its live stock, and its course and processes of husbandry. Inasmuch as in most of our States there is so great a variety of soil—wet and dry, clay, sand, and loam—it would be difficult to make any one farm a model for others. But an experimental farm should be of sufficient extent to embrace a variety of soils, and in its various products illustrate something for the benefit of all the farms of the State.

We have carefully examined the authorities upon the question of the expediency of having land connected with an agricultural college, and this question is closely connected, practically, as we have seen, with that of the independent organization of the college, or its connexion with a university.

Mr. Flint, in his report already cited, refers to the latter question, and says that volumes have been written upon it, and that in Germany it is still warmly discussed, the larger party taking ground in favor of a union, and he cites Liebig among the number.

This controversy is also referred to by Mr. Klippart, in his excellent address before the agricultural convention of Ohio, and he gives a conversation between himself and Baron Liebig, in which the baron says: "You want to teach agricultural *science* in the same manner that medical science is taught—that is, by series of lectures delivered by competent professors. You must not trouble yourself about teaching practical agriculture. The several lecturers on the several branches of agriculture can make excursions of one or two days every week, into different parts of the State, and can see and examine the operations on the best farms in the State. In this way they will learn what the present system and practice is with the best farmers; many improvements in the manual part of farming will thus suggest themselves to the students, which they can put into practice themselves. But you must teach the science of agriculture as purely, that is, with as little reference to application, as the science of geometry or trigonometry is taught. * * * But you do want 'experimental stations.' Let the object of these experiments be to obtain the greatest crops at the least expense, without impairing the fertility of the soil. * * One centrally located institution, to teach pure agricultural science, is as much as you need (in Ohio) until your population has at least doubled; but if you can afford it, you should have an experimental station in each county. * * You will not require a great amount of land—a few hundred acres is all-sufficient for all manner of experiments."

The argument of Liebig is evidently not against having experimental farms, but against a system of mere model farms, with schools of mere practical agriculture, where science is not taught, but where the processes of culture are learned by rote. Further on he is quoted thus: "The agricultural department to a college, without an experimental station, is simply nonsense. * * The object of an agricultural college is not simply to teach what is already known, but to teach a better system of farming. How will you do this? Certainly not by employing a practical farmer to manage a model farm for you; for he knows only what is practical generally, and his superior ability will consist simply in his better *management* over other ordinary farmers. This will be teaching financiering and not agriculture. The only method by which you can possibly advance and develop agriculture, is by experiments; that is the only plan, for there is no branch of industry so completely built up by experiments as agriculture. * * So far as cattle-breeding is concerned, *all* of that can be taught at the college proper. A few of each kind of cattle, horses, sheep, and swine will be sufficient. You must not calculate that the experimental farm will, in any sense, be a source of revenue to the finances of the institution, for while some experiments may show considerable net profit, others will show a corresponding loss."

It seems quite unnecessary that Americans should enter into the controversies which have grown up in Europe. However it may be abroad, there is no obstacle to establishing a college in each of the larger States in America, which shall, in due time, combine all the advantages claimed for both high and low schools in Europe. We assume that, in this country, our college is to be established for the admission, not of ignorant laborers or illiterate boys, but of youth who have had the early advantages of good schools, and who are advanced enough in common branches to enter intelligently upon courses of scientific study.

Although literary colleges already exist, they are not generally so rich in libraries, museums, buildings and funds, nor do they so engross the talent and time of scientific teachers that they may not soon be rivalled by our new agricultural colleges. To these new colleges may be attached experimental farms, where science may be illustrated and tested by practice, and where that familiar acquaintance with soils, implements and processes, and with animals, their habits, laws of breeding and uses, and that manual dexterity with tools may be attained, which cannot otherwise be acquired by those not bred upon a farm.

Nearly every agricultural institution in Europe, high or low, has connected with it, in some way, an experimental farm. Hohenheim, the most celebrated agricultural school in the world, has nearly 800 acres in a farm and about 5,000 acres in forest. Its three independent schools are on the same estate and under the same roof, but the different classes cannot meet in the same room or field. The institute is for "young gentlemen," and the school of practical farming for the sons of peasants. The latter work nearly all the time, while the former are not obliged to labor, though they are instructed (it is said) partly "by actual practice."

In France and Ireland, as will be seen, farms are attached to all the schools of agriculture, and so it is with nearly all those in the Germanic states.

Dr. Hitchcock gives a list of 352 agricultural schools existing in Europe in

1850, and he remarks "with very few exceptions, (I do not recollect any save the University of Edinburg,) a farm of at least a few acres of land is connected with the school." And it may be added, in conclusion, that the opinion of this eminent friend of agricultural education is decidedly in favor, not only of independent colleges, but of having connected with them farms of at least 100 or 200 acres.

PLAN FOR HALF-YEAR INSTITUTIONS.

The grant of Congress being proportioned to the number of senators and representatives from the respective States, gives to the smaller States but a small fund for the maintenance of a college, and such States may prudently inquire whether some modification of a plan adapted to the larger States may not, in their own case, be expedient. The annual expense of maintaining an institution of high rank as a college in this country is probably not well understood. To enable those who are considering the matter of establishing colleges to count the cost more accurately, we give a table by the late lamented president of the agricultural college of Pennsylvania, Dr. Pugh, which, although imperfect, is of great interest.

Table showing the educational resources of the more prominent American colleges.

Colleges.	No. of professors.	No. of students.	Amount paid professors and teachers.	Amount of endowment.	Annual expenses.	No. of volumes in library.
Bowdoin College	18	181	....	$182,000	....	30,595
Dartmouth College	20	307	$13,000	217,667	$17,907	35,402
Harvard University	56	833	68,000	1,613,884	153,431	149,000
Amherst College	17	229	....	590 000	18,500	30,000
Brown University	12	202	....	220,000	36,000	37,000
Yale College	40	617	....	....	78,000	75,000
Columbia College	43	689	52,000	1,650,666	79,269	18,000
University, city of New York	36	488	....	250,000	14,011	10,000
New York Free Academy	25	916	42,000	....	52,590	10,000
Union College	17	276	19,400	658,000	30,000	18,000
Rochester University	11	160	10,950	123,224	13,408	7,000
Vassar Female College	....	.....	....	408,000	....	....
Princeton College	13	221	....	....	....	22,000
University of Pennsylvania	28	642	....	306,654	26,844	8,000
Philadelphia High School	19	502	....	....	23,430	....
Girard College	13	400	....	2,000,000	85,000	....
University of Michigan	27	286	....	600,000	40,000	8,000
University of Illinois	38	.....	....	427,625	....	....
Georgetown College	26	225	....	....	36,000	22,000
St. Louis University	26	350	....	....	....	25,000

Georgetown College has around it 200 acres of ground in a high state of cultivation, this too, independently of a large vegetable and botanical garden, a greenhouse, and observatory containing many valuable astronomical instruments.

The grant to New Hampshire is but 150,000 acres, which, at the price at which the scrip has been sold during the last year in the market, (about eighty cents per acre,) would give but $120,000, the interest of which, at six per cent., would be $7,200, a sum entirely inadequate to pay a corps of professors, even if the farm, buildings, library, museums, apparatus and furniture were supplied by private subscription.

New Hampshire has in Dartmouth College, at Hanover, in a strictly rural district, an excellent literary college, with a scientific school. The amount of about $18,000 is now annually paid for expenses of all kinds in that institution, as appears in the above table. The idea has been suggested, and certainly deserves consideration, whether in that State, where a large majority of the people are engaged in agriculture, and where farmers' sons must form the greater part of the students, a half-year system of study for agricultural students may not be expedient and best. A majority of the literary students of the college are usually away, engaged in teaching the district schools in winter, leaving the professors in comparative leisure.

By connecting the agricultural college with Dartmouth, a few professors in the requisite agricultural departments might be added, and agricultural pupils might, during the winter months, attend to lectures and recitations, and in summer return to their homes, or find employment wherever they could best practice the theories learned in winter. "Study," (says an officer of Dartmouth, in a letter now before us discussing this plan,) "say, from November 1 to May 1; then send home the boys, each with half a dozen practical problems about soils, fertilizers, crops, &c., to be wrought out experimentally, and results noted and reported at the beginning of the next term. This would turn the whole State into an agricultural farm, and make all the farmers who had boys here, or whose neighbors were thus favored, both teachers and pupils. In the warm months our leading professors could lecture in different parts of the State, thus diffusing knowledge and awakening interest."

Verily, there is no new thing under the sun, and we find that the plan of half-year instruction is already in operation in Europe, although with what prospects of success we are unable to learn. From the report of Mr. Flint, already cited, we select the following account of a school upon this system.

GEISBERG.

The agricultural institute at Geisberg, near Wiesbaden, is the princial if not the only one of the kind in the Duchy of Nassau. This school differs from most others, in giving instruction only in winter. It is on the isolated and independent plan, and is designed for the instruction of practical farmers, without teaching practice on the place. Applicants must be sixteen years old, possess a good elementary education and a good character, and it is expected that they shall have spent one or more summers in work on the farm before they enter. "Each pupil is required to attend all the lectures; but they have a class of pupils who take only a partial course. The theoretical instruction is given in a regular course of two winters, the term beginning on the 15th of October of each year, and ending on the 31st of March. During the intervening summer the pupils are either at home, at work on the farm, or, if they desire it, the director of the institute procures them suitable places with skilful practical farmers.

"The instruction is by lectures and written and verbal questions on the studies. After the return of the students from their summer's work on the farm, they are required, within six weeks, to present a full written detail of operations, which, after suitable corrections, is returned to the writer. The institute possesses a library, which appeared to be tolerably well stocked, very good collections, and five lecture and study rooms. It was founded in 1835, and as may be inferred, from what has been said above, on the principle that it is of no use to try to teach theory and practice at the same school. There is a small farm connected with the school, but judging from the helter-skelter, or generally mixed up condition of everything about the premises, I should think they were quite right in not attempting to teach practice there. Old ploughs, drags, carts, harrows, and everything else lay around the building in no small confusion. The farm buildings are irregular and crowded, not large or imposing, but rather ordinary in every respect, though the building used by the students, and for the collections, was better. These collections consist of minerals, birds quadrupeds, seeds, grains and grasses, and a fine collection of wax fruits. The instruction embraces in the first or winter term the German language, arithmetic, botany, mineralogy, physics, general agriculture, cultivation of meadows, rural architecture, and veterinary science. In the second winter the boys take up zoology, physics, farm accounts, special agriculture, special zootechny, horticulture, technology, veterinary medicine, and composition. The director had left for Hamburg, so that I was obliged to find my way about without much assistance"

These colleges are, of course, to be organized to suit the great variety of climate and soil, and the different habits and systems of education prevailing in an extensive and diversified country.

In Michigan and Pennsylvania colleges, which have extensive farms attached, it is found convenient to have a vacation of about three months in winter, that being a leisure season on the farm, and practical agriculture being deemed the most essential element of the system.

Where no farm is attached, but pupils are expected to have resided on a farm before admission, and to return and labor on the farm in summer, there seems to be no objection to reversing this order, and devoting the winter half year entirely to study, and the summer to practice. And, again, it may be found convenient to combine the two systems to greater or less extent; to have a small experimental farm attached to the college, and to devote the winter chiefly to study in theoretical science, and allow pupils the choice to remain and devote themselves mainly to practical pursuits in summer upon the farm, or to go home or elsewhere, and earn by their labor the means of paying for their college education.

In the northern and eastern colleges many, perhaps the majority, of the students are in moderate circumstances, and are compelled to use strict economy to acquire education at all; many of them teach in winter, and some of them find labor to perform nights and mornings. We know one worthy young man who was a conductor of a street car between Cambridge and Boston certain hours of the day, during a year or more of his course in Harvard University, and lost no position with his class-mates by so doing; and many are glad of any employment to aid them to obtain a college degree.

This spirit is to be encouraged by every possible means, and if by the half-year system, or by furnishing compensated labor on the farm to students of small means, we can help them to acquire a good education, we shall do a substantial good to the country.

To make labor honorable, and to enable the industrial classes to gain by education the equality which is the birthright of Americans, is the special mission of those entrusted with the organization of agricultural colleges under the grant of Congress.

AGRICULTURAL COLLEGES IN EUROPE.

When we consider the differences between a republican and an aristocratic government, we should hardly expect to find in any European state a model for an agricultural college suited to our wants. We propose to organize colleges open to all classes alike, where the children of rich and poor, of laborers, mechanics, farmers, lawyers, doctors, merchants, and ministers, shall come up from our common schools, enter the same classes, labor side by side in the field, enjoy equal privileges, and know no distinctions on account of birth, or wealth, or rank in society. Such an institution could not exist in any aristocratic country. The very fundamental principle of their government is that of inequality or caste—that a few are born of higher rank, of better blood than the mass of the people, and that to these belong the powers of government, the wealth, the honors, the luxuries; while to the middle class belong trade and manufacture, the care of land as tenant farmers, with some restricted right of suffrage; and to the vastly more numerous third class of laborers is assigned hard work, ignorance and poverty, with no participation in the government, and no hope of rising above the humble position to which they were born. These divisions into classes are by no means merely theoretical; indeed, they exist more distinctly, if possible, in fact than in theory.

Not only is society in nearly all countries in Europe divided into grades or classes, ranged in the social scale one above another; but strict laws, or customs having the force of law, generally prevail, which limit and confine all citizens and mechanics to their own particular trades. Before being allowed to pursue a trade the youth must serve a five or seven years' apprenticeship; and having learned it, he is limited strictly to his labor in it, and must starve if he cannot find employment in his own special department, although another, in which his skill would enable him to work successfully, may offer abundant opportunity. With us, a man may be a farmer in summer, a shoemaker or blacksmith in winter, and change his trade as often as he pleases. A glance at our Congress and list of Presidents will show, indeed, that no employment, however humble, is too low for a stepping-stone for honest ambition, with persistent industry, to attain the loftiest positions of honor and power.

ENGLAND.

In England society may, so far as relates to agriculture, be divided into three classes: the landlord, who is usually a nobleman and owner of some thousands of acres of land, occupying himself but a small portion of it; the farmer, who is his tenant, hiring the land for a money rent; and the laborer, who is employed by the day or year, or by piece-work, and who performs all the actual hard work.

The nobleman, or land-owner, is a gentleman of fortune, living on his magnificent estate, a man of culture, of refined taste, of political position, born to his condition as a member of the aristocratic, governing class. The tenant farmer is usually much such a man as a substantial New England farmer. He has a good education for his business, which is to manage his farm of 500 or 1,000 acres in a regular system of rotation, with very little change; to buy the seeds, manure, cattle, sheep and implements for his farm, and sell his wheat, barley, wool and other products; keep regular and careful accounts, and pay his rent promptly. He lives well, labors but little with his own hands, oversees his laborers sharply, and pays them their small wages fairly, and is, on the whole, a tolerably comfortable, independent man. He manages to educate his children at private schools with others of his class, and his daughters are often teachers or governesses in the families of the nobility. The laborer is usually poor and uneducated. He lives in a mean cottage. His children generally hardly learn to read or write. His wages are from $2 25 to $3 50 a week, and on this amount he boards himself, and often goes two or three miles, and back, daily to his labor. His children are compelled to labor at a very early age. He has no hope of improving his condition, and the almshouse in the distance is the refuge of his old age.

The nobleman and the farmer never, in public or in private, associate on equal terms. They do not visit each other's families. They never sit at the same table. Their children do not attend the same schools. Between the farmer and laborer the chasm is still wider—almost, if not quite, as wide as between master and slave. Their children do not associate, and of course they have no schools where they are educated together; for, as has been said, the children of the laborer are without education.

We have taken England as an example, because England is the foremost nation in Europe in her agriculture, and the nation to which we naturally look for examples. It will be seen at once that such a college as we demand can have no place in England. A college there must be for one class or another, for the classes cannot and do not mingle. Indeed, so long as the different classes are maintained, they require different education, and of course different schools. An English nobleman has no occasion to learn to plough and sow, and mow and reap, with his own hands; because he will never have occasion to perform or even direct such labor. He has always a steward or bailiff, who superintends the estate, and personally directs its improvements and cultivation. The poor laborer, as we have seen, has no occasion for a college of any kind. He has no education to admit him to its classes, no time to attend, no money to maintain him there.

The only agricultural college existing in England at present is that at Cirencester. Professor Hitchcock visited it in 1850, and in his excellent report gives some account of it: "The buildings are substantial, ample and even elegant, the principal front being 190 feet. They include a dining-hall, library, museum, lecture-room, theatre, laboratories, class-rooms, private studies, kitchen and servants' rooms, and offices, with dormitories, one for each student. An elegant chapel has just been built; a forge, a carpenter's and wheelwright's shop are attached, as also a dairy and slaughter-house." The farm consists of 700 acres, and there are accommodations for 200 students.

The following language of Professor Hitchcock is worthy of special notice in connexion with our idea that aristocratic countries cannot furnish models for this country: "Formerly the school was open for the sons of the smaller farmers, but could not find support on that plan, and it was found that if these attended the wealthier classes would not send their sons. The price, accordingly, has been raised, and none but the sons of gentlemen, such as clergymen and wealthy laymen, now attend. None of the nobility send their children, although many give their money for its support"

Mr. Flint, secretary of the Massachusetts board of agriculture, visited the agricultural college of Cirencester in 1863, and his account serves to confirm the impression derived from Professor Hitchcock's report, that no scheme can be devised to adapt such an institution to the social and political condition of England. This institution, he says, does not appear to have commended itself very strongly to the confidence and good will of the people, and hence it has proved to be a partial, not to say a complete failure. It has now a debt of £30,000, or $150,000, which is a source of great embarrassment, in addition to the various other causes of ill success, which need not be stated in detail here. When I was in London, in 1862, all the professors resigned their positions, and most of them, I believe, left, one or two only having been persuaded to hold on, to save the institution from utter ruin."

At that time the institution was still in operation, with about sixty students, sons of the rich. Mr. Flint concludes his notice of this institution as follows: "The spirit of caste, so prevalent in England, has probably been the cause of the failure of this college to meet the expectations of the friends of agriculture, or to commend itself to any considerable portion of the people. I could not learn that it was popular with any class. They are waiting for something to 'turn up,' but in the mean time an enormous debt hangs like an incubus upon the college. Its future is therefore doubtful."

We see, then, that England has not, and probably never can have, an agricultural college such as we seek to establish. Yet we know that England is the best cultivated country in the world, unless, on the authority of Liebig, we except China. Her average crop of wheat is estimated at twenty-eight bushels to the acre, while that of France is less than fourteen bushels. Yet France is a better country for wheat, both in soil and climate, than England. So said

Arthur Young, the celebrated English agriculturist, in 1789, and so says Lavergne, the highest French authority, in 1855; and wheat is the great staple of both countries, and its cultivation is encouraged by both to the utmost.

How, without agricultural schools, does England so much excel in agriculture? and why may not other nations arrive at the same state of excellence by the same means?

These questions are pertinent and should be fairly met. In the first place, England is an old country, and her system of agriculture is limited (perhaps necessarily, from her cool, moist climate) to a few crops in a regular rotation, established by long experience. Her crops are wheat, turnips, grass, and barley, and her live stock sheep and cattle. Her system of husbandry is simple and well established, and therefore easily managed compared with our own, which is growing up over a continent of new land of the greatest diversity of soil, and great variety of products. The hot, dry, tropical summer of America, even of New England, admits of the culture of several important crops which cannot grow in England, of which Indian corn and tobacco are the chief.

Again—and this is essential—the soil of England is owned by but few persons, and it is leased in farms of from one hundred to one thousand acres to intelligent farmers. Although the laborers are degraded and ignorant, those who direct them are competent and well informed, and employ large capital in their business. Skill and capital are the secrets of British husbandry. A thousand-acre farm in Lincolnshire requires fifty thousand dollars capital to conduct it profitably. The farmer spends nothing for land, but everything to cultivate it. There can be no doubt that a thousand acres of arable land may be more profitably cultivated under the charge of one intelligent man, with steam engines and all other machinery adapted to his wants, who shall systematically drain, divide, and suitably crop in rotation the various fields—who shall buy his seed, stock, and manures at wholesale, and be able to hold his products for a fair price, than it would be if divided into a hundred ten-acre farms, each managed as a small owner must manage it.

The processes of English husbandry are more perfect than those of other nations. Their ploughing is better, because the same man holds the plough in one long furrow from the cradle to the grave, and knows how to do nothing else. This division of labor, which is possible only on large estates, tends to perfection in mere manual labor.

If the whole object of government were to produce the most food on a given area, perhaps the English system, which makes one man the head and many others the hands, is the best. We have high authority, however, for saying that man cannot "live by bread alone;" and there are higher objects of government than to produce corn, though that is essential. Hence, if an enjoyment of equal rights, under a republican government, makes our crops less per acre than under a monarchy, we should by no means be tempted to sell our birth-right. Let our ambition be to unite head and hand in the same labor; to give education and free scope to all to improve their condition; consign no millions to ignorance and hard work for the production of an abundance which they do not share, and let superior intelligence in the whole people compensate for the doubtful advantages, in aristocratic countries, derived from the concentration of capital and land in the hands of a few.

IRELAND.

By way of compensation, perhaps, to Ireland for holding her as a province, and depriving her of her nationality, England has undertaken to provide for that unhappy country a system of education far more complete than has ever been established in England itself. Whether the result of education in Ireland will be an increase of Fenianism, or a more prevailing spirit of humility and acquiescence in its subordinate position, is a question which chiefly concerns Great Britain.

The commissioners of national education have established in Ireland an excellent system, consisting of four classes of agricultural schools, under the name of model schools, ordinary schools, school-gardens, and work-house schools; the number of which existing at the close of the year 1857, when the writer visited Ireland, was, model, 38; ordinary, 48; school-gardens, 3; work-house, 76; making a total of 165. The number had not increased in 1859, and probably remains about the same.

The Albert National Agricultural Training Institution is situated at Glasnevin, about three miles from Dublin, in Ireland. It was established by the commissioners in 1838, and stands at the head of the agricultural schools of Ireland. It is designed to supply such instruction, both in the science and practice of agriculture, as will qualify young men for becoming farmers, land stewards, and teachers. The buildings, which are plain but substantial, comprise dormitories, dining-hall, lecture and school rooms for seventy-five resident pupils, with a museum, library, and laboratory, a comprehensive range of farm offices, and apartments for the superintendent, matron, land-steward, teachers, and servants.

At our visit in 1857 the library, museum, and apparatus for illustration in all branches of science were inferior to what we find in an ordinary high school in Massachusetts, and we learn that the same is practically true still. The literary instruction of the institution is all conducted by two teachers. Two classes of pupils attend: 1. Externs, or non-residents, board and lodge at their own expense, and are admitted on payment of a fee of two guineas. No regular time is set apart for the training of this class. They are engaged in all the practical operations of the farm, and their education is chiefly in strictly practical agriculture. The other class, called Interns, consists of two divisions; the first, of those who intend to be farmers and land stewards; the second, of those who are qualifying themselves for teachers of agricultural schools. Both divisions of this class are boarded and lodged at the public expense. They must be of sound health, good character, and seventeen years old.

Since 1860 the pupils are admitted on a competitive examination. They must be able to read correctly, write a legible hand with facility, possess such knowledge of grammar as to be able to parse short and easy sentences in prose, be able in geography to give the general outlines of the map of the world, the boundaries, countries, and chief towns and rivers of Ireland. They must know enough of arithmetic to work easy questions in fractions and simple proportion, and understand the first book of Euclid, and enough of book-keeping to know the nature and use of a cash account, and other simple forms. The period of training is two years for the land stewards and farmers, and one year only for the teachers. The institution is organized as follows: 1, a superintendent, Dr. Kirkpatrick, who has general charge; 2, a matron; 3, an agriculturist, who resides on the farm, and carries out the practical working of it, under the superintendent; 4, a gardener, who has charge of the horticultural department; 5, one or two literary teachers. There are, in addition, non-resident lecturers, who lecture on—1, animal physiology and pathology, and the treatment of diseases of domestic animals; 2, botany and vegetable physiology in their relations to agriculture; 3, chemistry and geology; 4, agriculture; 5, horticulture. Each lecturer gives two courses of lectures in the year, which is divided into two sessions. The course of instruction by the literary teachers embraces English grammar and composition, arithmetic, book-keeping, and mathematics, including land surveying, levelling, and mapping. All the students are required to take part in the performance of every kind of farm labor, including the feeding and management of live stock. They are made practically acquainted with the most recent application of steam power to agriculture, and with the uses of the best farm implements.

The farm consists of about 180 statute acres, of which about ten are in gardens and pleasure grounds, the rest being under farm cultivation. About fifty acres are set apart for a model farm, which is under the highest cultivation, and pays a profit beyond the rent. The following five-course rotation is carried out on this farm: 1st year, turnips, mangel wurzel, and carrots; 2d, potatoes, winter beans, and cabbages; 3d and 4th, Italian rye-grass; 5th, oats.

The remainder of the estate is in what is called "the large farm," of about 145 acres. On the large farm wheat and barley came into the rotations, which are arranged for three different courses of three, four, and five years. The order of succession of the crops in the three years' course is, first year, green crops, manured; second year, grain, with Italian rye, grass, and clover; third year, grass. In the four years' course, usually called the "Norfolk shift," the crops succeed in this order: first year, green crops, manured; second year, grain, with grass seed; third year, grass; fourth year, oats. The five years' course differs from the last only in leaving the grass unbroken another year, the third and fourth years being grass. All the crops on this estate indicate that practical agriculture is thoroughly understood. Their average crops in 1853, '54, and '55, were, of wheat, $32\frac{2}{3}$ bushels to the acre; of barley, $39\frac{1}{2}$ bushels; of oats, 70 bushels; of potatoes, 373 bushels. Their average product of mangel wurzel has usually been thirty tons (of 2,240 pounds) to the acre.

So remarkable seemed to us the crop of mangels upon the ground, at the time of our visit, that we requested the superintendent to send us a statement of the mode of cultivating it on their farm. A few months after, we were surprised to receive, in America, a printed treatise on the subject, by a pupil of the Albert Institution, with a statement appended, that a prize had been offered for the best treatise by a pupil in the school; that several had been prepared and submitted to competent judges, and the prize awarded to the one which was sent. It was published and largely circulated by the Chemico-Agricultural Society of Ulster, and in this country it was published in the Transactions of The Massachusetts Society for Promoting Agriculture, and also in pamphlet form for distribution. The judges were in doubt which of four competitors was entitled to the prize; and this fact, with the acknowledged value of the essay, speaks highly for the character of the Albert Training Institution.

The model agricultural schools of Ireland have small farms attached, and are usually under the charge of a schoolmaster and an agriculturist, who give the pupils instruction to fit them for farmers, land stewards, or teachers, giving them constantly practical instruction in all the operations of the farm. One pupil at each school is supported by the commission; the others pay a small sum for tuition and for their board. When the course of study in these schools is completed, those who have distinguished themselves are allowed to go to the Albert Training Institution, there to complete their course free of expense. About half these schools are under the exclusive management of the commissioners; the rest under local patrons.

The ordinary agricultural schools are ordinary schools with land attached, where the pupils are taught practical agriculture.

The workhouse schools are for the instruction of paupers; and although no doubt valuable in their way, neither they nor the ordinaries are within the scope of the present paper.

FRANCE.

By an act of the national assembly of France, in 1848, a system of agricultural schools was established throughout the kingdom. They were of three classes, or grades, and are clearly described by Dr. Hitchcock, from whose valuable report is condensed the following account. They are, beginning with the lowest, the Farm Schools, the Regional Schools, and the National Agronomic Institute.

1. *Farm schools.*—These are schools where children of laborers are received without charge, performing all the labor on the farm, and receiving, as a remuneration therefor, instruction in agriculture, essentially practical. They are established for two objects: first, to furnish good examples of tillage to the farmers of the district; secondly, to form agriculturists capable of intelligent cultivation, either upon their own property or that of others, as farmers, tenants, or managers, or to become good assistants, or farm servants, leaders of manual labor, or overseers of cattle and horses. They are established in most of the eighty-six departments of France, near the centre, and where the soil is similar to the general condition of the region. They have annexed to them gardens, nurseries, and collections of fruit trees. The buildings for the schools are constructed in a plain and substantial manner, conforming, in general, to the character of the buildings in the district. The director is chosen, of preference, from among the farmers or proprietors of the district whose farms are conducted in the best manner. The instruction is, as far as may be, practical, and given even in the field where the pupils labor, in the stables, and in the sheep-fold.

The officers and their salaries are—a director, salary $442; farmer, $184; overseer of accounts, who teaches the mode of keeping farm accounts, considered in Europe a most important part of agricultural education, $184; a nursery gardener, $184; a veterinary surgeon, $92; and some other leaders, according to locality, such as shepherds, silk-growers, irrigators, &c.

The school is open to young men from country families, sixteen years of age, who have received education in the primary school, and who have a good constitution. The numbers attending vary from twenty-four to thirty-two pupils. They all work, like laborers, for wages. Three in each school are confined to the gardens and nurseries, so as to become gardeners. The number should be sufficient to carry on all the operations of the farm, which is an essential feature of this sort of school. They receive board and instruction gratuitously in return. The farms vary in extent from 200 to 2,000 acres. The first year they attend to simple manual labor; the second year they have charge of the animals; the third year they have the oversight of various operations. The hours appropriated to study are devoted—1, to the arrangement of the notes the pupils have taken during the instruction from the different leaders; 2, to reading a manual or book of elementary agriculture; 3, to lessons given by the overseer of accounts on the elements of arithmetic, book-keeping, surveying, &c. The time devoted to study is less in summer than winter.

Besides paying the board of the pupil, the government allows each one $14 a year for clothing. Prizes are awarded for good conduct, and a single prize of about $100 is awarded to the pupil most deserving at the end of the three years' course. He who leaves the school, or is dismissed, loses all prizes.

The director works the farm at his own risk. He is obliged so to conduct it as to afford the best means of instruction to the pupils; to submit his books and accounts, at any time, to the examination of government; to send annually to the minister a full account of the state of the school, and to publish a full account, each year, of his operations, of his success, or his failure. If it appears that the farm is not conducted so as to afford a net produce, comparatively equal with other farms of the region, the patronage of the government is withdrawn.

2. *Regional schools.*—These have three objects: 1. To form enlightened agriculturists, by teaching them the principles of agriculture. 2. To offer an example or model of practical agriculture of a high and advancing order. 3. To make experiments for improving the cultivation of the soil. The instruction in these schools is of a much higher grade than in the farm schools, and is

adapted, not to prepare laborers on the farm so much as men to direct agricultural affairs.

The farm, containing from 750 to 2,000 acres, connected with the school, is expected to present an enlightened system of culture, and to adapt that culture to the wants and peculiarities of the district in which it is situated. The directory is not, as in the farm schools, a farmer or proprietor, laboring at his own risk, but an agent employed by the government, and accountable to it, and subject to its direction.

The instruction is both theoretical and practical, embracing the following six professorships :

1. Of rural economy and legislation. 2. Of agriculture. 3. Of zootechny, or the economy of animals. 4. Of sylviculture (cultivation of forest trees) and botany. 5. Of chemistry, physics, and geology applied to agriculture. 6. Of rural engineering, including irrigation, construction, and surveying.

Each school has its library, its philosophical and chemical cabinet, adapted especially to agriculture, its museum of geology, zoology, botany, and agricultural technology.

The pupils have an opportunity of witnessing, on the farms connected with those schools, all the important agricultural operations; also, of seeing specimens of the best breeds of animals, and the mode of using and taking care of them; and they engage personally in all the important operations of husbandry. The state furnishes several scholarships to each school. Half of them are given to the most deserving of the pupils from the farm schools, placed at the regional schools. The other half are divided among the scholars who are the most distinguished, after six months, for their labor and conduct. Towards the close of the third year examinations are held, and to those who sustain themselves diplomas are given, and the way is opened for their admittance to the national institute.

In addition to the farm, there is attached to these schools a manufactory of agricultural implements, a silk establishment, a distillery, oil-mill, saw-mill, dairy, and other departments.

In the report of Mr. Flint, in the Transactions of the Board of Agriculture of Massachusetts for 1863, may be found a very full account of one of these schools, which, the writer says, are now known by the name of imperial schools of agriculture, of which there were in France but three at that time; the one at Grignon, usually having about seventy-five students, being the most flourishing, and being the one visited and described by him.

3. *The National Agronomic Institute.*—This institution was located at Versailles by the act of 1848, and we find no later description of its organization than that given by Dr. Hitchcock. Three farms, a garden, and a forest, embracing about 3,452 acres, have been devoted to it. It presents itself in a threefold aspect: first, as having a faculty of the agronomic sciences; secondly, as a superior normal school of agriculture; thirdly, as a higher institute for agricultural education, open to the administrators and proprietors who have turned their attention to agriculture. To meet the wants of this class especially, a large farm is connected with the school. Here will be performed, at the expense of the state, all the experiments necessary to the progress of agronomic science, and to verify, practically, all the innovations and improvements proposed by others, before they are recommended to the public. This, says Dr. Hitchcock, is an object of great importance, and should enter into any plan for a school in the United States. This institute differs very little in its organization from the regional schools, except that it is on a more extended scale, and the course of study is more elevated.

GERMANY.

The German states furnish the oldest, and, no doubt, the best existing systems of agricultural education in Europe. We have already spoken of some of the most ancient of their schools, and are indebted to an excellent address by Mr. Klippart, secretary of the Ohio board of agriculture, for the following account of late institutions:

"In 1811 a private forestry school was established at Tharandt, in Saxony, which, in 1816, was transferred to the state authorities, and in 1830 was converted into an agricultural college. In 1818 the great agricultural college of Europe was established at Hohenheim, in the neighborhood of Stuttgard, in the kingdom of Wurtemberg. Then, in 1835, an agricultural college was established at Eldena, in Pomerania, in Prussia. * * * Its importance once appreciated, it is somewhat remarkable how rapidly agricultural education has grown into favor with the Germanic tribes. There are at present no less than 144 agricultural stations, institutes, schools and colleges in the Germanic states; and all of them, with the exception of the three already named, were established since Liebig published his first work on agricultural chemistry, in 1844, or during the past twenty years. These are located as follows: In Prussia 51; Wurtemberg 6; Bavaria 12; Saxony 4; Grand Duchy of Baden 6; several duchies 28."

Many of these are institutions for training laborers or teachers in special departments, as shepherds, foresters, gardeners; many of them specially to teach the culture of flax; some the care of meadows and irrigation; but the greater part are schools of practical agriculture, where the lower classes are educated to labor, and to fill the positions of land stewards or managers of estates for the higher classes.

As it is desirable to give in full a few examples of the best institutions at home and abroad, with the course of study and general scheme of organization, we will give, in the language of Mr. Klippart, with some omissions, an account of the institution at Hohenheim.

Hohenheim being not only the oldest institution of this kind now in existence, but the most famous one, I have deemed it proper to place it first on the list. It was established on the 26th of May, 1818, and had at that time an estate of two hundred and fifty acres of cleared lands, and was placed under the direction of Baron Nepomuk Schwerz, a very celebrated agronomist, and at that time in the 60th year of his age.

The institution was opened on the 20th of November, 1818, with eight students. The buildings were erected on the ruins of an old castle, by Duke Charles, in 1770–80, as a princely residence for himself and body-guard; and these structures were almost in ruins themselves, when King William determined to establish an agricultural college there. A portion of the royal stud and flock of sheep were placed under the direction of the institution in 1822. I have taken some pains to obtain these dates, in order to place upon record the fact, that only during the past fifty years have any steps been taken, whether in a right or wrong direction, to teach the science of agriculture in its various branches, so far as they were known, in the most populous, enlightened, and civilized portion of Europe.

The institution of Hohenheim consists of three separate schools, namely, that which may be termed the higher institution, the agricultural school, and the horticultural school, and to these may be added several special courses of study and instruction which, nevertheless, have an agricultural relation.

The higher institution was changed into an academy in 1847. Students were received in this academy who were not less than 18 years of age, that have made the requisite proficiency in preparatory studies, and who desire to obtain a knowledge of agriculture in all its branches and relations, so that at a future day they may manage their own estates, or undertake the management of large estates for others. Instruction is imparted by lectures and practical demonstrations, and the course embraces two years of time.

The agricultural school is independent of the academy, and was instituted for the purpose of creating a class of thoroughly practical stewards, or overseers of small estates, who will take the plough in their own hands. At present it is devoted more to teach young men, who own small estates, how to perform every necessary agricultural operation with their own hands. As their practical education is the main object, the greater portion of their time is spent in actual labor on the farm. They, however, receive instruction from professors during two hours each day in the lecture room. The number for any one term is limited to twenty-five, and they must be residents of Wurtemberg—no foreigners are, under any circumstances, admitted to this school. The course embraces three years; they must be at least sixteen years of age, and must have a preparatory education.

The third school was established in 1844, and is named the horticultural school. Six students are annually admitted for a year's theoretico-practical course of instruction. The requisites to enter the school are: To be seventeen years of age, to have served a three years' apprenticeship in gardening or in the vineyard, or, in lieu of that, to have gone through one course in the agricultural school. The object of this school is to complete both the theoretical and practical education of gardening and horticulture, which the students may have attained in the other schools.

In addition to these three schools, there is annually an educational course on fruit-growing, meadow culture and management, shepherding and school-teaching.

The fruit-growers' course has been held annually since 1850. The students are young men of eighteen (and upwards) years of age, who intend to make fruit-growing their occupation. The course is embraced in four or five weeks' study in the spring, and a few days in summer, to learn inoculation practically. Of late years, however, so many wish to attend this special course that it has been commenced about the middle of March and terminated at the end of May, thus giving an entire course to three successive classes. The meadow culture course of lectures was commenced in 1844, and suspended in 1852, but again restored in 1855. It is a five weeks' course in the spring time, and consists of lectures on practical drainage, surveying, &c., for those who wish to become engineers in agricultural operations, such as drainage, irrigation, &c. The number in attendance has averaged eight since the commencement. The shepherds' course was established in 1855, and has had a regular annual class of ten or twelve. The requisites to enter this class are: To be twenty years of age, and to have served an apprenticeship of at least four years in the shepherd occupation. This course commences in February and continues four weeks.

The school-teachers' course is somewhat similar to our normal school system, and the object of it is to introduce elementary agricultural knowledge in the common schools. The course is limited to three weeks, and is held during the autumn; the number of cadets is limited to twenty-five.

The instruction in these extraordinary courses is given either by professors of the institution or by experts in the respective specialties who are engaged by the directory to deliver the special lectures.

From 1840 to 1846 a course of lectures was annually delivered on the cultivation and preparation of flax, but was discontinued when an institution was opened in Stuttgard "for the promotion of flax industry." Since 1852 the various workshops, pattern and model depositories, and the various museums, are open to master mechanics, who are permitted to remain ten days in the institution, to observe, inquire, make notes, drawings, &c., of the models or other improvements there; seventy-seven master blacksmiths and fifty-eight master wagon-makers have given testimonials of the acquirements they made during their ten days' sojourn. In addition to all these, there are special courses for government officers, or those who will succeed in hereditary offices. A special course has also been adopted for instruction in bee and silk-worm culture and management.

THE MODEL FARM.

The model farm consists of about 1,000 morgen (778 acres.) The director disclaims the idea that it is a model farm, in the usually accepted sense of that term, but is intended to demonstrate improvements, such as a rational system of rotation of crops, careful and thorough culture of the soil, proper treatment of manures, under draining, irrigation, &c. Of these 1,000 morgen, 835 only are in an actual arable condition, as follows :

The Chaussefield rotation	99	morgen.
The Meierefield rotation	232	"
The Heidefield rotation	278	"
Free agriculture	19	"
Meadows	145	"
Permanent pastures	50	"
Hop field	3	"
Forest wood nursery	9	"
	835	morgen.

The live stock employed and kept upon this farm are: 10 farm horses; 90 cows and heifers ; 28 work oxen, and 1,000 sheep. The remaining 165 morgen are devoted to experiments, demonstrations, &c., such as a botanical garden, experimental plots, vegetable garden, vineyard, and a nursery for agricultural and horticultural purposes.

The experimental fields are composed of ninety-seven plots of ground, each containing one-fourth of a morgen. On these plots all manner of experiments are made—such as experiments in the different depths of ploughing; the effect of different manures; the effects of different systems of rotation of crops; the effects of a succession, for a series of years, of the same kind of crop, (as wheat, rape or potatoes, &c.;) the effects of excessive manuring, thick and thin seeding, drilling and broadcast sowing. Then, too, in these fields rare and valuable seeds are grown for distribution among the farmers. When I visited there these experimental fields were chiefly occupied with cereals—wheat, rye, barley and oats—although some were occupied with potatoes, rape, lupines, peas, beans, poppies, mangolds, swedes, sugar beets, carrots and sorgho.

The department for applied chemistry consists of a sugar-beet factory, brewery, distillery, starch factory, vinegar factory, a malting and fruit-drying establishment, roof and drain tile manufactory, &c.

The agricultural implement and machine manufactory was established, not only to supply the vicinity with the best implements and machines at the lowest possible rates, but as a school where young men might become practically finished workmen. It employs from thirty to forty workmen, of which, two or three are exclusively engaged in manufacturing models of agricultural machines and implements.

In the silk-worm department everything is taught that is known in this branch of industry, namely, how to rear and manage silk-worms; how to reel the cocoons, and prepare the silk for weaving or sewing.

The flax-preparing department is still continued, but is limited to water-retting the flax, breaking and scutching it during the winter; and its only object now is to introduce the Netherland system of preparing flax into Wurtemberg.

As a sort of addenda to this model farm, is an establishment for the dissemination of seeds to the farmers in the kingdom. There are annually distributed more than a thousand varieties. Then, too, there is an annual sale of bulls and bucks for the improvement of cattle and sheep. I have omitted to mention anything relative to the Forestry department. The forest consists of 6,290 morgens, embracing all the varieties of indigenous trees, shrubs and plants, and a plot of 25 morgens of exotic trees and shrubs.

PLAN OF TEACHING AND BRANCHES TAUGHT.

The instruction in the academy is imparted partly by lectures, partly by demonstrations and excursions, and partly by actual practice. The following is the plan and course of lectures:

I.—AGRICULTURE.

A.—Agricultural Products.

1. General agriculture and plant culture.
2. Special plant culture.
3. Meadow culture.
4. Grape, hop, and tobacco culture.
5. Fruit culture.
6. Culture of vegetables, (kitchen,) breeding of domestic animals.
7. Horse breeding.
8. Cattle breeding.
9. Sheep breeding.
10. Breeding small animals.
11. Silk-worm culture.
12. Bee culture.

B.—Professional.

13. Taxation.
14. Book-keeping.

C.—Agricultural Technology.

II.—FORESTRY.

Encyclopedia of forest science.

Agricultural Encyclopedia for foresters.

A.—Forest Productions.

1. Forest botany.
2. Growing woodlands.
3. Protection of forests.
4. Profits of technology of forests.

B.—Forest Economy.

5. Forestry.
6. Forest taxation.

C.—State Forestry.

7. Wurtemberg forest laws.
8. Practical forest business.

III.—COLLATERAL BRANCHES.

A.—Mathematical Collaterals.

1. Arithmetic.
2. Algebra.
3. Planeometry.
4. Stereometry.
5. Trigonometry.
6. Practical geometry.
7. Valuation of forests.

B.—Natural Science Collaterals.

8. Mechanics.
9. Physics.
10. General chemistry.
11. Agricultural chemistry.
12. Analytical chemistry.
13. Introduction of geognosy.
14. Geognosy.
15. Special botany.
16. Vegetable physiology.
17. General zoology.
18. Special zoology.
19. Veterinary science.

C.—Political Economy Collaterals.

20. National economy.
21. Principles of law.

D.—Technological Collaterals.

22. Economical architecture.
23. Draughting plans.

The above named general subjects may be considered as though each subject named were the title of a good sized volume. The captions or titles of the lectures themselves occupy about twenty-five large pages of finely printed matter. For instance, the subject of general agriculture and plant culture is divided into ten sections, as follows: 1. Introduction; 2. Climate and meteorology; 3. The soil; 4. Agricultural implements and machines; 5. Preparation of the soil; 6. The increase of plants; 7. Manures; 8. Protection of the seed when sown; 9. Harvesting; 10. Preservation of agricultural products.

Each one of these sections is divided into specific subjects, and each of these specific subjects into lectures. As an illustration, the second section (on climate and meteorology) is divided into the following specific subjects, each one of which may be the theme of a lecture, namely: 1. The atmosphere—its composition, height, or pressure; 2. Moisture, dew, fog, clouds, rain, snow, hail; 3. Winds; 4. Electricity and lightning; 6. Heat, or warmth—its horizontal, perpendicular, and curved distributions; 7. Light, and its influence upon vegetation; 8. The heavens, stars, moon, and comets; 9. Local climate; climate as affected by seas and continents; elevations above the level of the sea; influence of large streams, seas, sandy plains, prairies, forests, mountains, valleys; 10. Inherent warmth of the earth and terrestrial magnetism; 11. Distribution of the vegetable kingdom; 12. Effects of frost; 13. Duration of vegetation, and amount of heat during that period; 14. Acclimatization of plants.

Here there are fourteen lectures on one special subject. Taking this as a specimen, there would be 140 lectures upon the subject of general agriculture and plant culture, before the subject would be considered exhausted, and, perhaps, before a lecture would be delivered upon special plant culture, or meadow culture. And so on with the others.

The institution has a library of 4,000 standard volumes, and an annual fund of 500 florins ($200) to increase the library. There are cabinets and museums of everything pertaining to the branches taught; a collection of soils, minerals, plants, woods, wools, fibres; a museum of anatomy and physiology; a vast collection of models of implements, machinery, &c. This last collection embraces 1,250 articles; among them are models of 110 ploughs. In the museum of natural history I saw stuffed specimens of 400 different birds, and 100 mammals, besides many reptiles and fishes. In the veterinary department is a very extensive collection of pathological specimens and preparations.

The aggregate number of students inscribed on the books of the academy, from its commencement until the termination of the winter course for 1861–'2, was 2,944; of these 2,322 entered for purely agricultural studies, and 622 for forestry. Thirteen professors are employed.

AGRICULTURAL COLLEGES IN THE UNITED STATES.

MICHIGAN.

The State Agricultural College of Michigan was established by an act of the legislature of February 12, 1855, which authorized the president and executive committee of the State Agricultural Society to select, subject to the approval of the board of education, a site for an agricultural school within ten miles of Lansing. During the same year the farm of 676 acres, then covered with heavy forest, was selected, and a boarding-house 43 by 82 feet, three stories, with a basement; a college building 50 by 100 feet, of the same height; four houses for professors, all of brick, and a stable, were erected. On the 13th of May, 1857, the college went into operation, and has continued in operation to the present time.

As this is the oldest institution of the kind now in existence in this country, and possesses every apparent element of prosperity and usefulness, its progress must be watched with interest by all who are engaged in organizing agricultural colleges.

In a visit to this college, in the summer of 1865, we had the opportunity of examining the details of its operations, and we find in its present condition great encouragement for the friends of agricultural education. It seems that all institutions of this kind are ordained to a certain amount of trial and perplexity, before they attain a position of permanent prosperity, and the Michigan Agricultural College is by no means an exception. It has met and overcome the very obstacles with which the organization of such institutions meets in every other State.

The question of uniting the college with the State University was thoroughly discussed, and decided in the negative. The original grant for building purposes, of $56,000, and an additional appropriation of $40,000, were expended, and a debt of more than $13,000 incurred in the first two years. The farm was new and uncleared, and the original idea being that no charge should be made for tuition, and that the labor of the students should contribute largely to their support, only disappointment could result.

The board of education decided in December, 1859, that the course of education should be more purely professional, and cut down the course from four years to two, and recommended that a board of agriculture be created which should have charge of the college. The legislature in 1860 created a board of agriculture, to which the college was intrusted, and by the same act provided for a four years' course. We give the following extracts from the act reorganizing the institution:

"The design of the institution is to afford thorough instruction in agriculture and the natural sciences connected therewith; to effect that object most completely, the institution shall combine physical with intellectual education, and shall be a high seminary of learning, in which the graduate of the common school can commence, pursue, and finish a course of study, terminating in thorough theoretic and practical instruction in those sciences and arts which bear directly upon agriculture and kindred industrial pursuits.

"The course of instruction shall embrace the English language and literature, mathematics, civil engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology, and such other natural sciences as may be prescribed, technology, political, rural, and household economy, horticulture, moral philosophy, history, book-keeping, and especially the application of science and the mechanic arts to practical agriculture in the field."

The act requires students to be at least fifteen years of age, and that "three hours of each day shall be devoted by every student of the college to labor upon the farm, and no person shall be exempt except for physical disability. By a vote of the board of agriculture, at such seasons and such exigencies as demand it, the hours of labor may be increased to four hours, or diminished to two and one-half hours."

The act further provides that the president and professors be appointed by the board of agriculture, and that the president, professors, farm manager and tutors constitute the faculty; and the secretary of the board of agriculture is made the secretary of the faculty. The faculty are required to make an annual report to the board of agriculture, and members of the faculty may make a minority report; "but no communication at any other time from members of the faculty shall be entertained by the board, unless they have been submitted to a meeting of the faculty and sanctioned by a majority."

The general objects of the institution are briefly stated to be—1. To impart a knowledge of science and its application to the arts of life. 2. To afford its students the privilege of daily manual labor. 3. To prosecute experiments for the promotion of agriculture. 4. Instruction in military tactics, as required by the act of Congress. 5. To afford the means of a general education to the farming class.

The general course of instruction for the preparatory class is in arithmetic, descriptive geography, English grammar, algebra, natural philosophy, and composition. In the college course for freshmen, first half year, algebra, history, geometry; second half year, trigonometry, surveying, practical agriculture, principles of stock-breeding, geology. Sophomore class, first half year, English literature, structural botany, vegetable physiology, elementary chemistry; second half year, entomology, landscape gardening, analytical chemistry, systematic botany, horticulture. Junior class, first half year, physics, agricultural chemistry, inductive logic; second half year, physics, rhetoric, animal physiology. Senior class, first half year, zoology, practical agriculture, mental philosophy, astronomy; second half year, civil engineering, moral philosophy, political economy. Exercises in declamation and composition are also required.

The system of common school education in Michigan is, perhaps, as good as that of any western State, and perhaps not inferior to that of the New England States. In the new and sparsely settled States, however, whatever the system, it is impossible to impart its advantages to all, as may be done where the population is dense. Accordingly great difficulty has been found in the want of qualification by applicants for admission to the agricultural college, and the preparatory class has been necessary to fit pupils for the proper college course. This is felt by the faculty to be a misfortune, and they will gladly welcome the day when the preparatory class may be dispensed with, and the standard of admission to the college course fixed as high as that for admission to our best universities. It is best, no doubt, to educate all classes in our common schools together to as high a standard as possible, and not to separate them into special schools, until they require instruction of a peculiar character to fit them for their intended pursuits.

The buildings at this college are neither elegant nor commodious. They are crowded by their present number of eighty-eight students, and we are assured that if there were sufficient accommodation the number would at once be nearly doubled. With all these disadvantages, the institution presents every appearance of earnest, healthy vitality. The farm and gardens are models of neatness; the fields are fruitful; the out-buildings, though not expensive, are well arranged; the tools well selected and kept in order, and the live stock in such condition as to give pleasure to an amateur. It is a public benefit to collect and preserve for public inspection so good a variety of animals of pure blood as are shown here. The college already possesses Galloway, Ayrshire, Devon, and Short-horn cattle of the choicest pedigrees; Essex and Suffolk swine; Southdown, Cotswold, Spanish merino, and Black-faced Heath sheep; and it is intended to extend this department as rapidly as possible, until it includes cattle, sheep, swine, and other domestic animals of all the improved breeds.

A botanical garden, fruit garden, and orchards of apples and pears are already established, and a propagating house and conservatory are to be built immediately. An extensive herbarium has recently been added, and the museums contain valuable collections in the various departments of natural history. The laboratory is sufficient for present purposes, and so is the apparatus for illustration in physics. The library contains about 1,200 volumes, and a reading-room is open daily to students, where most of the agricultural publications of the day are found. There seems to exist a kind and friendly relation between teachers and pupils at this institution, quite different from that state of hostility which seems the normal condition at ordinary colleges. It is due mainly, no doubt, to the good judgment of the officers, and their kind, familiar intercourse with the students, and, perhaps, something may be claimed for their peculiar system of conducting the labor of the students under the charge of the professors, who thus are enabled to maintain a kindly sympathy with the young men, both in the study and the field.

Regret was expressed that the isolated position of the college compelled the officers to provide board and dormitories for the pupils, and deprived them of the advantages of female society to so great an extent during their college course. This is one of the evils of college education as usually conducted. The blessed influences of home, and the softening, civilizing effect of association with the pure and gentle of the other sex, are lost just at the period when the passionate, inconsiderate nature of youth most needs such restraints, and society, as expressed by the poet—

> "Not only to keep down the base in man,
> But teach high thought, and amiable words,
> And courtliness, and the desire of fame,
> And love of truth, and all that makes a man."

As the only example which we shall be able to present of the special rules for the conduct of such an institution in its details of farm operations, we give nearly entire the system here adopted:

RULES.

Rule 1. At least one week before the commencement of the term in each year the superintendent of the farm shall present to the president of the college, in writing, a plan of the system of cultivation and management of the farm proposed for the season, giving in detail the contemplated operations for each field and division. This plan shall embrace—

1. Proposed permanent improvements.
2. The crops to which each field is to be devoted, together with the variety and quantity of seed proposed.
3. The mode of culture, and the kind and quantity of fertilizers proposed for each crop; and
4. A detailed and accurate description of any new seed or mode of culture, if any such is proposed, together with a full account of the advantages likely to be derived therefrom.

Rule 2. The superintendent of the horticultural department shall, in like manner, present a plan of operations for his department, giving the details as minutely as possible for each section and subdivision of the gardens and grounds.

Rule 3. The faculty shall carefully consider the plans presented by the superintendents, and discuss as fully as possible the principles involved in the proposed methods, and offer such suggestions and amendments as may seem desirable for perfecting and maturing the same. The plans as perfected and adopted by the faculty shall be carried out in practice on the farm and in the gardens, unless modified by the board of agriculture when referred to them.

Rule 4. The plans for conducting the farm and gardens, as soon as determined, shall be recorded in full by the secretary in books kept in his office for that purpose.

Rule 5. The professor of agricultural chemistry shall present to the faculty a detailed statement of a proposed system for the management, manufacture, and proper preservation of manures, having reference to the best and most economical disposition of the same, and the adaptation of special manures for particular crops.

Rule 6. The faculty, after a full examination and discussion of the proposed system for the management of manures, shall determine the plan to be pursued, and make suitable provisions for putting into practical operation the plan adopted.

Rule 7. The superintendents of the farm and gardens shall keep a journal of all the work done in each field of their respective departments, and of all transactions connected with the same. This journal shall be transcribed by the secretary once a month into books kept in his office for that purpose. The journal shall embrace—

1. A general statement of the weather at the time of preparing the soil, of putting in the crop, of cultivating the same, during its growth and at the time of harvesting.

2. A detailed account of the crops raised in each field and in the garden, including a statement of the condition of the soil before cultivation, and during its preparation for the crop; the method of seeding, with variety and quantity of seed used, and its preparation for sowing or planting.

3. Details of the growth of the crops and any circumstances that may have influenced the development or maturing of it.

4. The time of harvesting the crop, the condition in which it is secured, the disposition made of the same, as, where stored, whether sold or not, with the yield and general results.

5. Purpose for which the crop has been cultivated—whether for profit, or to test some new variety of plant or method of cultivation.

Rule 8. A committee shall be appointed by the faculty at the commencement of the term in each year, to prepare and report a series of experiments for the next season, which report shall be presented to the faculty at its first meeting in October following.

Rule 9. The faculty shall decide upon the experiments to be made, and the manner of conducting the same, and shall appoint some one of their number to superintend such experiments. Each officer having in charge any experiment shall keep a full record of his proceedings in conducting the same.

Rule 10. Students, who have attained a suitable proficiency in their studies, may be appointed to assist in conducting experiments, and they shall, for that purpose, be under the direction of the officer having charge of the same.

Rule 11. The superintendent of the farm shall present to the faculty, at their first meeting in February, a report on the stock belonging to the college, giving a detailed account of its condition, mode of management, increase and results of the system of breeding, together with such suggestions as he may think fit to make. This report shall embrace—

1. The number and kind of horses, their management and condition.

2. The number and condition of each of the different breeds of neat cattle; the number of grade animals, and the breeds from which they have been derived and proposed disposition of the same.

3. The number and condition of each distinct breed of sheep, and the grades of the same, with a statement of the amount and quality of wool produced, their management, increase, &c.

4. Swine.

5. Poultry.

Rule 12. Each breed of domestic animals shall be so kept as to avoid any danger of crossing or mixing with any other breed. Cross-breeding shall not be permitted, except to accomplish a definite object, or for the purpose of experiment, and then only in accordance with a plan setting forth the object to be accomplished and adopted by the faculty, who shall prescribe such regulations as may be necessary for putting the same into practical operation.

Rule 13. An accurate record of the stock belonging to the college shall be kept in a book provided for that purpose. The details of the breeding and management of each breed shall be carefully and distinctly stated, together with the purpose for which each animal is kept, and the disposition made of the same.

Rule 14. For the purpose of imparting to the student an accurate knowledge of agriculture as an art, the instructors in the several departments of the college, in their class exercises, shall illustrate the sciences taught, as far as possible, by a thorough discussion of the principles involved in the details of the practical operations on the farm and in the garden.

Rule 15. The superintendents of the farm and gardens shall make an annual report on the implements used in their respective departments, giving the results of their experience in the use of each implement, and its adaptedness to the purpose for which it was designed, and its comparative value. Any new implement that has been tried during the year shall be particularly described and an accurate estimate of its merits given.

Rule 16. A committee on buildings shall be appointed each year, who shall report to the faculty the condition of the buildings, and recommend such additions and improvements as may seem desirable. The faculty shall carefully examine the report when presented, and shall make such recommendations to the board of agriculture as they may deem for the interest of the college.

Rule 17. The state board of agriculture shall determine what proportion of the whole number of students on the farm and in the garden shall be assigned to each. The list of students shall be examined each week to see that the proper proportion is employed in each department.

Rule 18. Students shall labor both on the farm and in the garden, and the alternations from the farm to the garden and from the garden to the farm shall be as frequent as the proportion of farm and garden labor, as determined by the State board of agriculture will permit, provided that such changes shall not occur oftener than once a week.

(*April* 6th, 1863. Rule 18 was amended by an addition that one class shall work an entire year on the garden, and another on the farm, for the same period.)

Rule 19. Students shall be employed with a view to their attaining the greatest proficiency in the art of farming, without reference to the greatest pecuniary gain to the college.

Rule 20. Work at the college shall be classified as follows: 1. Care of stock; 2. Care of tools, and repairing the same; 3. Care of grounds and shrubbery; 4. Preparation of ground for crops, ploughing, &c.; 5. Sowing or planting different kinds of seeds; 6. Weeding and hoeing; harvesting and securing crops; 8. Preparation of manures; 9. Gathering and preserving seeds; 10. Secretary duties, care of books, &c.

Rule 21. The faculty shall make such arrangements that each student shall perform a proper proportion of labor of the several kinds, as classified in rule 20.

Rule 22. The superintendents of the farm and gardens shall, once a month, deliver to the students lectures on topics connected with practical arrangement and management of farms and gardens.

Rule 23. The professor of agricultural chemistry, shall cause a daily meteorological journal to be kept, according to the system adopted by the Smithsonian Institution.

Rule 24. Any officer having in charge the development of any of these plans, who shall deem any change or modification of them advisable, shall submit to the faculty a written statement, setting forth in full the reasons for the desired change. Changes or modifications adopted by the Faculty shall be recorded by the secretary.

The legislature granted to the college at the outset, salt spring lands which sold for $56,320, and prior to 1865 had made various appropriations amounting to $112,500. It has also given to the college certain swamp lands, valued at $30,000, and the 240,000 acres of scrip granted by Congress, which has been located in the State, on lands valued at $600,000, thus giving this institution a magnificent endowment.

PENNSYLVANIA.

"The Farmers' High School of Pennsylvania" was opened in Centre county, on the 16th of February, 1859, and its first catalogue gives the names of 119 students. It was opened under very unfavorable circumstances, the buildings being unfinished and with no suitable accommodations. It has struggled along under a load of difficulties, (among which a large debt, contracted in part in constructing a huge and ill-arranged building of stone, six stories high and 334 feet front, is not the least,) until the present time, when it is hoped the grant of Congress may place it on a sure foundation.

In 1862 the institution took the name of "The Agricultural College of Pennsylvania."

Besides the common error of over-building, the officers of this college fell into another, which has much increased its embarrassments. They fixed the charge for board and tuition of students for the year at $100, probably expecting from the labor of the students and the increase of the farm a much larger contribution to their funds than experience justifies. The amount of this charge has recently doubled, and will probably now be found low enough.

We visited the institution in June, 1865, unfortunately in the absence of Dr. Allen, the president, who had then recently been inaugurated as the successor of the lamented Dr. Pugh, under whom the college course had been reconstructed. A farm of 400 acres of excellent land is attached to the college. The soil, though not so diversified as could be wished, is productive. They had on the ground 65 acres of wheat, 25 of oats and barley, 60 of corn, with a large amount of hay, some acres in a garden and nurseries. Their working stock consisted of five mules and two horses, and no attempt had yet been made to introduce blood stock of any kind. All the labor is performed by the superintendent, with one man and the students, who labor three hours a day, in four detachments, under the direction of the superintendent. All agree that much more labor is required on the estate to bring it up to a proper standard. The college is remote from any town or village, and is therefore compelled to provide board and rooms for all its students.

The fact is worth knowing that this college has had constantly a large number of students, and usually more applicants than could be received. We trust that the people and legislature of Pennsylvania will give this institution all necessary support, and that a career of prosperity and usefulness may be permanently secured.

The course of study, with such extracts from their programme as are deemed of interest, will be found below. The preparatory course, in many States, may be pursued in the common schools. The faculty and board of instruction consist of a president, who is professor of political economy and constitutional law; a vice-president, who is professor of botany, physiology and horticulture; a professor of surveying, mechanics, and engineering; a professor of chemistry and scientific agriculture; a professor of mathematics and astronomy, and lecturer on tactics; a professor of philosophy and English literature; a lecturer on veterinary surgery and medicine; a teacher of book-keeping, and a farm superintendent, with two teachers in the preparatory department.

REQUISITES FOR ADMISSION.

Preparatory department.—Certificates of good character and fair acquaintance with the rudiments of English grammar, geography, and arithmetic. Applicants for admission to the first preparatory class will be examined in the studies of the second class.

Collegiate department.—Candidates for admission to the fourth class will be examined on the studies of the preparatory course, or their equivalents. For admission to any of the higher classes, candidates will be examined on the studies which shall have been pursued by the classes they propose to enter, or their equivalents. In all cases, certificates of good character must be presented before an examination will be granted.

COURSE OF STUDY.

Second preparatory class.—Arithmetic, English grammar, geography, reading, writing, and orthography.

First preparatory class.—Elementary algebra, history of the United States, elementary physiology, book-keeping, English grammar and composition, reading and orthography.

COLLEGIATE COURSE.

Fourth class, first term.—Physiology, algebra, English grammar, and composition.

Second term.—Natural philosophy, plane geometry, universal history, grammar, and composition.

Third class, first term.—Structural botany, solid geometry, chemistry, universal history, elocution.

Second term.—Horticulture, entomology, trigonometry, surveying, navigation, chemistry, logic, elocution.

Second class, first term.—Political economy, systematic botany, analytical geometry, laboratory practice, rhetoric, selected exercises in speaking.

Second term.—Constitution of the United States, zoology, calculus, physical chemistry, and mineralogy (lectures,) laboratory practice, mental philosophy, selected exercises in speaking.

First class, first term.—Agricultural law (lectures,) geology, analytical mechanics, chemistry (lectures,) laboratory practice, moral philosophy, original exercises in speaking.

Second term.—History (lectures,) astronomy, agricultural chemistry (lectures,) scientific agriculture (lectures,) tactics (lectures,) evidences of Christianity, original exercises in speaking. Equivalent studies may be substituted for calculus and analytical mechanics; also for chemistry and laboratory practice in the first class.

Latin and Greek are not included in the regular course; but instruction in them is given to students who desire it.

PARTIAL AND ADDITIONAL COURSES OF STUDY.

To students who are not able to take so high a course in mathematics, permission will be given to substitute, in place of this study, a more extensive prosecution of the study of any of the natural sciences than is required in the full course. To those completing such a course of study suitable diplomas will be awarded.

For the benefit of any who wish to acquire general scientific knowledge, and special practical information, preparatory to the prosecution of farming, a practical course may be selected from the regular college studies. This course is designed for such as wish to remain for a limited period only, in order to become familiar with the various operations of the farm, garden and nursery, and at the same time attend some of the classes in the college. This course is not recommended to any but those who are unable, on account of ill-health or age, or for any other good reason, to take either the full or scientific courses; and no one under twenty-one years of age will be permitted to take it, without a written request to that effect, addressed to the faculty, by his parent or guardian. Practical instruction in tactics is given weekly during the whole course.

IOWA.

I give the following history of the enterprise in this State, in the words of its secretary, Peter Melendy, esq., and refer the reader to the frontispiece for a view of the college building, and to the statement of the architect for a description of the same:

At the session of the legislature of 1858 an act was passed providing for the establishment of a State agricultural college and farm, with a board of trustees, which shall be connected with the entire agricultural interests of the State. M. W. Robinson, Timothy Day, John Wright, G. W. F. Sherwin, William Duane Wilson, Richard Gaines, Suel Foster, J. W. Henderson, Clement Coffin, E. N. Williams and E. H. Day, were appointed the first trustees. Clement Coffin and E. H. Williams would not serve. Peter Melendy and John Pattee were appointed to fill their seats.

The institution is managed by a board of trustees, who are appointed by the legislature, one being taken from each judicial district in the State, and embracing the governor and president of the State Agricultural Society, being in all fourteen members. The board serves without pay for their services. Its officers are a president pro tem., a secretary and treasurer, and an executive committee of three to act during the interim of the meetings of the board.

In 1858 the legislature passed an act appropriating ten thousand dollars for the purchase of a farm on which to locate an agricultural college. A farm was purchased in 1859, in Story county, situated about midway between Nevada and Boonsboro, and about thirty miles directly north of Des Moines. The Cedar Rapids and Missouri railroad is now running directly through the farm, dividing it so as to leave about one hundred and sixty acres on the north side and about four hundred and eighty-eight acres on the south side of the railroad. The farm contains six hundred and forty-eight acres, and is admirably adapted to the purposes of the institution, embracing all the leading varieties of soil in the State. It is well watered by Squaw and Clear creeks running through the farm—Squaw creek on the east, Clear creek on the west sides, affording an inexhaustible supply of pure stock water.

Near the centre of the farm there are several fine springs, affording a good supply of water. The timber is principally black walnut, oak, elm, white maple, linn, cotton-wood, ash, hickory, and numerous other valuable varieties, covering about one hundred and fifty acres. The farm is about four hundred rods long from east to west, and about two hundred and fifty-nine rods wide from north to south. After deducting the one hundred and fifty acres above described, there remain four hundred and ninety-eight acres of prairie land suitable for grass and grain. There is probably not far from one hundred and eighty acres of low bottom land, about one hundred of which is covered with timber; the remainder is equally divided between wet and dry bottom.

The low land in the timber is a rich, deep, black, sandy loam, with clay subsoil, but not inclined to hold water on the surface. Next west adjoining the timber is a fine, smooth, level tract of low land, remarkably well adapted for grass, but could by a judicious system of drainage be converted into a most productive corn land, not excelled in the west. Beyond this to the northwest is a large tract, known in this State as second bottom land, being level, dry and very rich, and remarkably productive for almost every crop grown in this latitude. The soil is a mixture of black sand, fine gravel, and rich black alluvium and prairie soil proper, comprising perhaps the most desirable soil known to the agriculturist. West of this is a large tract of level prairie, the soil being dry, slightly intermixed with fine gravel in places, with clay subsoil, being a fair representative of the prevailing prairie soil of the State. On the northwest corner of the farm is a tract of perhaps forty acres of clay soil, most of which is covered with a heavy growth of oak, walnut, and hickory timber. Though called clay soil, this land is a fair specimen of what is known in this State as "barrens" and "timber land." The soil is a mixture of prairie and clay, with heavy clay subsoil, and is considered the best wheat and fruit land in the western States. On the south side of the farm is about ninety acres of high rolling prairie, intermixed with gravel, and well adapted for almost any grain crops, being warm and dry, the ravines which intersect it carrying off all surplus water in the wettest seasons. The gravel contained in the soil is mostly on the surface, and is turned under by the first ploughing, nearly disappearing after cultivation. There are five sand and gravel banks on the farm, furnishing an inexhaustible supply for building purposes, and for grading roads, walks and yards.

There is also on the farm good clay for making brick convenient to where the college is now being built.

The improvements consist of a good, substantial, brick farm-house, with a basement of stone, making a cellar under the whole building. The house is completed except painting, and when furnished will cost about four thousand dollars. The brick were manufactured on the farm. There is also a good barn on the place, well finished and painted, of good height, and is forty-two by sixty feet in size, capable of providing storage room for grain, and shelter for the necessary teams and stock connected with the farm. There is a good stone basement under the barn, and a large yard enclosed by a substantial fence; also a fine smoke and ash house, fourteen feet square, built of brick.

A great portion of the work and material used in the erection of these buildings was furnished in payment of voluntary subscriptions by citizens in the vicinity.

There is about four hundred acres of the farm, enclosed by a substantial fence, a part of which is built by boards and posts, five boards high, and the remainder of rails staked and ridered, eight rails high. The fences are built of good materials, and are put up in a very substantial manner. Of the land enclosed, about one hundred and fifty-one acres are under cultivation.

There is a fine young orchard of about four hundred thrifty trees near the house, enclosed by a good fence. This experiment has satisfied the people in the vicinity that the prevalent opinion that fruit cannot be raised upon our open prairies is entirely erroneous. Fine apples have been grown upon many of these trees, which had been planted out but *four years* on *level open prairie.* To be successful it only requires ordinary care, such as one would bestow upon a corn crop, and the farmers are profiting by this demonstration placed before their eyes. About seventy-five grape vines have been planted near the orchard, of several different varieties, among which are the Concord, Clinton, Isabella, and Catawba. They are doing well, making a fine growth, and producing some fruit.

Building material can be found in abundance on the farm and in the immediate vicinity. The necessary wood to burn the brick can be procured from down timber, which is fast going to waste, and the best kind of clay and sand for the manufacture of the brick is found in abundance on the farm. Stone can be had within three and a half miles, and lime within six miles of the farm.

The farm, which has been fully described, was purchased at a cost of $5,379 12. In consideration of having the college building located at that place, the citizens of Story and Boone counties made liberal donations of land, money, labor, and materials, to the amount of about seven thousand dollars, to assist in improving the farm and erecting the necessary farm buildings.

DONATIONS.—Story county donated ten thousand dollars in the bonds of the county, bearing seven per cent. interest. There is also appropriated the proceeds of the sale of five sections of land in Jasper county, known as the Capitol lands. The value of the lands is about $17,000.

It was expected that the legislature of 1860 would have made an appropriation sufficient to commence the erection of suitable college buildings, but as the financial condition of the State would not justify it, an appropriation was not asked. At the session of 1863 an appropriation was not expected, as the whole finances of the State were needed to meet the extraordinary expenditures incident to the suppression of the rebellion. Hence nothing had been done to add to its prospective revenue since the institution was organized, until the last session. We have done what we deemed prudent in opening a farm and erecting thereon buildings suitable for a dwelling for a farmer, and also shelter for the crops and animals.

Beyond the expenditures necessary to place the farm under a fair state of cultivation, the trustees did not feel justified in making appropriations from the limited amount in their hands, but preferred reserving the best of the assets for an endowment to meet the expenses of the institution when in operation, hoping that when it had the ability, the State would make the needed appropriation for college buildings. But during this time the people of the State generally supposed that the buildings were erected, and that the college would soon be open to the public, and many applications have been made to receive students. Had it not been for the extraordinary condition of the financial matters of the State, such would doubtless have been the condition of the institution on the opening of the present year. It is now about seven years since the purchase of the college farm. If all this could not have been done, a general expectation, or hope at least, was felt by its friends generally, that the farm would be open for experimental husbandry. Even this could not be accomplished, under the circumstances, without involving an expenditure which it was thought would not be justified by the people of the State, unless the college institution was fully provided for.

In July, 1862, Congress appropriated to the several loyal States in the Union, for agricultural colleges, 30,000 acres of land for each senator and representative in Congress. The amount under this grant to the State of Iowa was 240,000 acres. The State of Iowa, at the special session in September, 1862, accepted the grant with the conditions imposed therein. The lands have been selected by an agent every way competent, appointed by the governor and approved by the board of trustees of the college, as required by the acceptance law of the State, and they have been approved and certified to the State.

They embrace some of the best unentered lands in the State, and when prepared for sale, will command the attention of immigrants. As the interest on the proceeds of the sales of these lands is exclusively devoted to meet the annual expenditures of the institution, there will be a fund soon created to sustain the institution. This munificent grant having relieved the board from any anxiety in regard to the future endowment of the institution, they felt that a portion of the reserved assets might safely be used to place the farm in a condition to experiment upon crops, the purchase of several of the leading races of improved animals of all kinds, and testing their value by crossing on native breeds, best mode of feeding, shelter, &c., and in beautifying the farm with useful trees and shrubbery, and preparing fully for the work contemplated in the establishment of the institution.

Such is a brief history of the institution under the management of the board of trustees, which is almost exclusively confined to the farm and the operations thereon. The next point is the college proper, and the course of studies to be pursued therein, which are specified in the organic law as follows, with some other provisions in regard to students, &c.

The course of instruction shall include the following branches, to wit: natural philosophy, chemistry, botany, horticulture, fruit-growing, forestry, animal and vegetable anatomy, geology, mineralogy, meteorology, entomology, zoology, veterinary art, plane mensuration, levelling, surveying, book-keeping and such mechanical arts as are directly connected with agriculture. Also, such other studies as the trustees may from time to time prescribe, not inconsistent with the purposes of this act.

The board of trustees shall establish such professorships as they may deem best to carry into effect the provisions of this act. Tuition in the college herein established shall be forever free to pupils from this State over fourteen years of age, and who have been residents of the State six months previous to their admission. Applicants for admission must be of good moral character, able to read and write the English language with ease and correctness, and also pass a satisfactory examination in the fundamental rules of arithmetic.

The trustees, upon consultation with the professors and teachers, shall from time to time establish rules regulating the number of hours, to be not less than two in winter and three in summer, which shall be devoted to manual labor and the compensation therefor; and no student shall be exempt from such labor except in case of sickness or other infirmity.

Objects of the Institution.—The Iowa State Agricultural College has for its object, to associate a high state of intelligence with the practice of agriculture and the industrial or mechanic arts, and to seek to make use of this intelligence in developing the agricultural resources of the country and protecting its interests. It proposes to do this by several means:

1. As a purely educational institution, its course of instruction is to include the entire range of natural sciences, but will embrace more especially a practical bearing upon the every day duties of life, in order to make the student familiar with the things immediately around him, and with the powers of nature he employs, and with the material through the instrumentality of which, under the blessing of Providence, he lives and moves and has his being; and since agriculture does this, more than any other of the industrial arts, it follows that this should receive by far the highest degree of attention. The course of instruction is to be thorough, so that it will not only afford the student the *facts* of science, but will discipline his mind to habits of thought and enable him fully to comprehend the abstract principles involved in the practical operations of life. In doing this, it is not deemed possible to educate every agriculturist, artisan, mechanic, and business man in the State, but to send out a few students educated in the college course, that they, by the influence of precept and example, may infuse new life and intelligence into the several communities they may enter. A single individual who is thoroughly educated in the principles and practice of an art followed by a community, will often exert a more salutary influence upon the practice of this art by the community, than would result from sending the *whole community* to a school of lower order than that which he attended. A single practical school of the highest order in Paris, (the Ecole Polytechnique,) during the last generation, made France a nation celebrated alike for profound philosophers, great statesmen, able generals and military men, and civil engineers. If one high school of practical character is established, subordinate schools affording the elementary education of the latter will follow in due time.

2. *As a practical education*, the trustees of the Iowa Agricultural College have adopted the fundamental principle, that whatever is necessary for man to have done, it is honorable for man to do, and that the grades of honor attached to all labor are dependent upon the talent and fidelity exhibited in performing it. It is further considered essential as a part of the student's education that he be taught the practical application, in the field and laboratory, of the principles of his studies in the class-room; and manual labor is also necessary for the preservation of health, and the maintenance of the habits of industry. An incidental but not unimportant result of the operations of these principles is a reduction of the cost of tuition by the value of the labor, so that the college can take students at very low rates of admission.

All students, without regard to pecuniary circumstances, are, therefore, obliged to perform manual labor as an essential part of the college education, and discipline and training. In these respects consists a most essential difference between the idea associated with manual labor and that of all other attempts made heretofore to combine manual labor with study. Instead of the idea of poverty and want being associated with those who labor, that of laziness and worthlessness is associated with those who refuse to work efficiently, and the experience of established institutions has already, most assuredly, shown that no young man of whom there is any hope for future usefulness in life is insensible to the disgrace which thus attaches to the lazy, who will work only as they are watched, and cheat their fellow students by refusing to do their share of the labor assigned them; and nothing is more conclusively settled than that those students who are most studious and industrious in class, work the most efficiently, and are the most trustworthy, in the performance of their daily work.

3. *As an experimental institution*, our college has an unbounded field for labor. The principles of agricultural science, which shall ultimately constitute the subject of instruction in its class-rooms, will be a prominent and important branch of it. The development of no other department will yield richer and more lasting results, or confer more substantial benefit upon agricultural practice than this. Much time, however, is required to make thorough and reliable experiments—they will not pay at once. As well might the farmer expect to reap his crop the day he sows his grain. They will, however, ultimately pay a thousand-fold, as have the practical application of the sciences of electricity, heat and optics, in the present day, paid for the half century of apparently impractical, purely scientific investigations that led to the results now obtained through them.

The design of this institution is different from all other educational institutions in the country, excepting one in Pennsylvania and one in Michigan, now in successful operation. By the union of labor and study they are both placed in their proper position, and thus only are exhibited in their true dignity. Here they are taught to walk together, and that separation is degrading to both. The student's mind and hands are first prepared to promote skill and success in the important and honorable occupation of cultivating the soil, but he will be almost equally fitted to fill with honor any other position in life. There is thus supplied a practical and equal education, so much needed by the great body of our farmers, and cheap enough to be embraced by all. "The farmer who claims such an equal education for his son, feels an *imperative necessity* for an institution such as this. He sees that the son of a farmer who has been a four years' course at our old colleges returns with his eyes and his thoughts and the best of his mind directed *away* from the objects which worthily and usefully occupy his father and his brothers. He is useless and inferior in the sphere of his home; he cannot labor; he must go from home; he is *driven* from it; he can do nothing but enter a profession, and in any profession he may enter, if he cannot make a conspicuous mark, he is a miserable thing at best, and almost certain to fall into ruinous habits and to become their victim. And the unhappy and disappointed father loses not only the cost of his education, his own struggles and expended energy, but in three cases out of four *the son himself*. How different the case in circumstances which such an institution as ours is destined to establish! The boy, in great part, aids to work out his own education. Instead of dragging on his father, he aids him; instead of wasting his physical abilities, through want of exercise, he labors and develops them; while his mind is being stored with both practical and refining knowledge, his hands are educated to expertness in a thousand operations, and his body to grace and strength. How delightful will be the meeting between the graduate of our agricultural school and his father and brothers! He has stores of information for them, and there is a mutual interest and subjects of conversation in everything around. The proud and gratified father will bless the means by which his highest wishes have been accomplished." So plain is the need of this course of training even to the dullest mind, and so plain is the method of establishing it, it is wonderful up to this day that such schools are only commencing in this country.

The inquiry will naturally be made in regard to the cost of educating and sustaining a scholar in the college for one year. In the Farmers' High School of Pennsylvania the price for board, lodging, washing, fuel and lights is fixed at $200 per annum. The cost in our institution would not exceed this sum, from which would be deducted the amount credited for labor on the farm. The tuition is made free by law.

The financial condition of the institution is in a healthy state. The State has given to the farm proper $10,000, and she has property for this small outlay amounting to $59,834 39. The land is worth $10,000 more than the State gave for it, thus making the farm proper worth to-day $69,834 39, and with the munificent grant from the government, valued at $480,000, makes a grand total value of $567,834 39. At the last session of the legislature a sufficient amount was appropriated to complete the college building. At the last meeting of the board the contract was let to responsible parties to complete the building by September, 1867. The following is a description of the building, by the architect, Mr. C. A. Dunham, of Burlington, Iowa.

Description of the Iowa State Agricultural College building.—The outline of the ground plan is that of the letter E, one hundred and fifty-six feet in length by seventy feet in width, through wings which are so arranged that they can be extended at any future time as may be desired. The building is five stories in height—first story nine feet, second story fourteen feet, third and fourth stories twelve feet, attic story ten feet six inches. Forty-two feet of the central portion of principal front projects seven feet, with a veranda ten feet in width. At the ends of the principal front there are two towers twenty-one feet square, projecting four feet from face of main walls. The principal tower rises to the height of one hundred and thirty-six feet, and at the elevation of one hundred feet there is a bell-turret, with projecting balconies on the four sides, to accommodate those who wish to view one of the most beautiful prairie landscapes in the west. The principal story is gained by ascending a flight of stone steps of ample dimensions, landing upon the veranda heretofore mentioned. After passing through the entrance doors, which open into a hall eight feet in width, to the right is the reception room, sixteen feet by twenty-four feet; opposite is the president's suite of rooms—parlor, sixteen by twenty-four feet; chamber, sixteen by sixteen feet, with ample closet room. Opposite these rooms is the library, eighteen feet by forty, located in the central part of the building. There is a corridor of ample width running through the centre of the building and wings in each story. After leaving the library room, turning to the left, on the right side of the corridor, is located the museum, eighteen by fifty-two feet, which is fitted with cases and shelves for specimens. Returning back to the hall, to the right is the entrance to the lecture-room, which is in the north wing of the building, thirty-four by fifty feet, with seats around on the arcs of circles, radiating from the lecturer's stand. In the rear of the lecturer's stand is a doorway communicating with the museum, for the more ready introduction of anatomical and other specimens upon the lecturer's desk and stand. It is the design to have around the walls of this room a series of pictures, painted in oil, representing scenes in the life of the agriculturist and the arts and sciences. Retracing our steps, we return to the corridor, and approaching the library, to the right and on each end of the library room there will be found the two principal staircases, eight feet in width, circular in form, incased in two octagon towers leading from the basement to the attic story. Further on down the corridor is to be found the recitation rooms. At the ends of the veranda, on the principal front, stepping down four steps into an area of nearly the width of the veranda, the principal entrance to the basement story, is found halls and corridors running the same as those described in the principal story. After passing through the doorway to the left is the steward's room; to the right is the laboratory, and adjoining is the bath-room. At the end of the long corridor, entrance is to be had to the dining-room, which is thirty-three feet by forty feet. Passing on through the dining-room, to the left is to be found the kitchen, twenty by twenty-four feet, fitted with range, sink, pump, and boiler. Opening out of the kitchen is a doorway leading to cellar below, and another door leads to a pantry for dishes, with communication with dining-room. Further along is to be found a scullery and store room of ample size. There is a door from the kitchen communicating with steps in the area to exterior. Returning to the long corridor, and passing by one flight of principal stairs, and opening the door on the right hand, can be found the laboratory, a room eighteen by thirty-six, with closets and other fixtures. This is but a temporary location for the laboratory, as it is the intention to put up a building somewhat isolated from the main building for that purpose. Further along, passing the other staircase and turning to the right, are to be found the wash-rooms, sixteen by twenty-two feet. Opposite is the laundry, sixteen feet by twenty-two, and at one end of the laundry is the dry-room, fourteen by sixteen feet. In front of these rooms, and running parallel with the front, is to be found four large servants' rooms and one large room for the housekeeper. There are five external doors in this story, four leading out of the corridors, and one out of the kitchen.

Ascending either of the flights of stairs, and landing in the principal corridor of the third story, can be found in the rear of the central portion of the building and over the library room the armory, sixteen by eighteen feet, opposite the cabinet room, sixteen by eighteen feet. Returning and passing down the corridor either way can be found professors' and recitation rooms, fifteen by eighteen feet, and twenty-one students' rooms, fourteen by sixteen feet each.

The fourth and fifth stories are nearly the same as the third, each story containing thirty rooms, each ten feet by fourteen feet, and two recitation rooms, each fourteen feet by twenty. There is a cellar seven feet high under the dining-room, kitchen, laboratory, and corridors. Also fuel vaults in rear of cellar under laboratory. The building is heated with eight hot-air furnaces. Opposite to where the warm air is admitted into the rooms there is a register of the same capacity as that of the warm air register, to draw off the vitiated air downwards, by flues built in the hollow core of the walls. There is also a small register near the ceiling line, for summer ventilation, opening into flues which will conduct it to the summit of the roofs. The basement story is faced up with cut-stone seven feet above the ground. The walls above are built of brick. Cut-stone dressings to the doors and windows, with string and belt courses of the same. The roof is of the Mansard style, covered with slates in two patterns. The roof of the centre portion of the building is made to rise at a more acute angle, to give the principal entrance more prominence, and to give a more pleasing sky outline. All the openings have circular heads. The east, north, and south sides stand upon a terrace extending out 100 feet from the walls of the building. The outer edge of the terrace is some five feet above the natural formation of the earth. The terrace will have two fountains and other appropriate decorations.

MASSACHUSETTS.

The Massachusetts Agricultural College was incorporated in 1863, and, by subsequent acts, one-tenth of the land scrip granted by Congress to the State was assigned to the college as a fund with which to buy a farm. Two-thirds of the income of the remainder of the scrip was granted to the college for its maintenance, the other third being given to the Institute of Technology, situated in Boston. With the avails of the tenth, and some private aid, an excellent farm of nearly 400 acres has been purchased in Amherst, about 100 miles west of Boston, in the valley of the Connecticut. The cost of the farm was about $40,000. The sum of $75,000 has also been raised by the town of Amherst and private subscribers, for the purpose of erecting buildings. The legislature has appropriated $10,000 for contingent expenses, and advanced the like amount, to be refunded out of the income from the land scrip. A president has been elected, and plans for a college building have been procured, and preparations are made for its immediate erection. No definite course of study has yet been established, but the following extract from the annual report of the trustees indicates the general system in contemplation:

PLAN OF ORGANIZATION.

The estate, which comprises nearly four hundred acres of excellent land, affording great variety of surface and soil, is to be furnished with model farm buildings, to be erected from time to time, as the increasing productiveness of the farm shall require; to be supplied with farm implements of the most approved kinds, and stocked with a variety of the best thoroughbred and other animals that we may be able to procure; the farm to be conducted, primarily, for the education of the pupils, by way of illustration in agriculture, horticulture, botany, stock-growing and other rural affairs.

A college building, to be immediately erected for lecture and recitation rooms, library, museums of natural history and of farm implements and products, chemical laboratories, halls for exhibition and military drill, armory and chapel, and rooms for the president, librarian and other officers.

A president, who shall reside at the farm, and have general charge of its affairs under the trustees; a faculty, composed of the president and resident professors, who shall administer the government and execute the prescribed regulations; and a farm superintendent, who shall direct the ordinary labor, and manage the details of business on the farm.

The following departments, under such professors and assistants as may be necessary: A department of agriculture and horticulture; a department of physics, mathematics, and engineering; a department of natural history; a department of chemistry; a department of political economy, intellectual philosophy, and Christian morals; a department of comparative anatomy and animal physiology, including veterinary surgery and medicine; a department of modern languages and literature; and a department of physical education, including military tactics. The general course of study to be four years, with provisions for shorter elective courses.

For admission, students to be sixteen years of age, and to pass such examination as is required for admission to our normal schools, and such further examination as shall be prescribed. Manual labor to be required daily of every student, as may be arranged by the faculty, who may allow compensation for extra work. Tuition to be fixed by the trustees, with such free scholarships as may be established by public and private bounty.

CONNECTICUT.

In this State the avails of the grant of Congress have been given in charge to Yale College, and the school of agriculture has been connected with the Sheffield Scientific School.

From the high character of this ancient and well-endowed college, we may safely conclude that it will furnish the best possible illustration of the expediency of uniting an agricultural college with other institutions. In another place, some objections to such an arrangement are suggested. These objections are, in substance, discussed by the authorities of Yale in the paper which follows, and we gladly avail ourselves of their statement of their views on the subject.

We give below the full programme of this institution. The course of study is well considered, and being far more in detail than any other published in this country, will be of great value to those engaged in the work of organizing colleges under the recent act of Congress. The first or preparatory year is not devoted especially to agriculture, and might be omitted or modified.

SHEFFIELD SCIENTIFIC SCHOOL OF YALE COLLEGE.

Course of agriculture—Conditions of admission.—The full course of instruction for students in agriculture occupies three years. Applicants for admission must be sixteen years of age, and must bring satisfactory testimonials of good character. To profit by the instructions of this course, they should be familiar with rural affairs, as acquired by some years' residence on a farm. They must also sustain an examination in the following books or their equivalents: Arithmetic—Thompson's Higher Arithmetic; algebra—Day, or Davies; geometry—Davies's Legendre; plane trigonometry—Loomis, or Davies; the elements of natural philosophy—Loomis, or Olmsted; English grammar, geography, and the history of the United States.

To the shorter course of seven months persons are admitted on the same conditions as above, save that no examination is required.

PROGRAMME OF STUDIES.

First or preparatory year, first term.—English language—Rhetoric, exercises in composition. *French*—Fasquelle's Course, De Fivas' Reader. *Physics*—Silliman's Principles. *Chemistry*—Youman's. *Mathematics*—Davies' Analytical Geometry, spherical trigonometry, surveying.

Second term.—English—Rhetoric, exercises in composition, practical exercises in elocution. *French*—Fasquelle, De Fivas. *Physics*—Silliman's Principles, and lectures. *Chemistry*—Youman's. *Mathematics*—Descriptive geometry and geometrical drawing. *Botany*—Gray's First Lessons.

Third term.—French—Selections from Classical Authors. *Physics*—Silliman's Principles and Academical Lectures. *Chemistry*. *Mathematics*—Principles of perspective. *Botany*—Gray's Manual. *Drawing*—Free-hand practice.

Second year, first term.—Agriculture—Chemistry; structure and physiology of the plants; water, atmosphere, and soil, in their relations to vegetable production; improvement of the soil; tillage, drainage, amendments, and fertilizers; lectures. *Experimental and analytical chemistry*, in their agricultural applications; daily laboratory practice. *French*—continued. *German*—Woodbury's Method. *Meteorology*—Academical lectures.

Second year, second term.—Agriculture—Chemistry and physiology of domestic animals; digestion, respiration, assimilation, and excretion; composition, preparation, and value of the kinds of fodder, milk, butter, cheese, flesh and wool, as agricultural products; lectures. *Experimental Chemistry*—Laboratory practice. *French* and *German* continued. *Physical geography*—lectures. *Zoology*—lectures.

Third term.—Horticulture and kitchen gardening—Propagation, training, and culture of fruit trees, the vine, small fruits, and vegetables; lectures. *Mineralogy*—Lectures and practical exercises. *Experimental Chemistry*—Laboratory practice. *French* or *German*—continued. *Drawing*—Free-hand practice. *Excursions*—Botanical, zoological, &c.

Third year, first term.—Agriculture—The staple grain, forage, root and fibre crops of the northern States; their varieties; soils adapted for them; preparation of soil, seeding, cultivation, harvesting, and preparation for market;

lectures. *Agricultural zoology*—Origin and natural history of domestic animals; insects useful and injurious to vegetation; lectures. *Geology*—Dana's Manual. *French* or *German*—selections. *Excursions*—Agricultural, zoological, geological, &c.

Second term.—*Agriculture*—Raising and care of domestic animals, characteristics and adaptation of breeds; cattle for beef and draught; the dairy; sheep for wool and mutton; horses, swine; pasturing, soiling, stall-feeding; tobacco, hops, &c.; Lectures. *Forestry*—Preservation, culture, and uses of forests and forest trees; Lectures. *Human anatomy and physiology;* Lectures. *Agricultural botany*—Weeds and noxious plants; Lectures. French or German.

Third term.—*Rural economy*—History of agriculture and sketches of husbandry in foreign countries. Adaptation of farming to soil, climate, market, and other natural and economical conditions. Systems of husbandry, stock, sheep, grain, and mixed farming; Lectures. *Farm accounts*—Lectures and practical exercises. *Excursions*—Agricultural, geological, zoological, and botanical. *Examinations* in the studies of the course.

The students will be required to make full written reports of the lectures, and will be subjected to annual and final examinations. The instruction of the first year will be chiefly by recitation; that of the second and third years by lecture. The lectures will reflect as faithfully as possible the most recent state of science and the most improved practice. All the courses of lectures, &c., will be fully illustrated by specimens, experiments, and demonstrations. Collections of plants, seeds, woods, and vegetable products; of minerals, rocks, soils, and fertilizers; samples of wool; casts and drawings of improved stock; specimens of birds, and of injurious insects in all stages of development, will be provided in the agricultural museum. Many important topics in agricultural practice, not mentioned in the above brief programme—for example, the selection and care of implements, farm buildings, fencing, plan of work for the year as adapted to the season, &c., methods of conducting farm experiments, &c., &c.—will be suitably discussed. Weekly excursions in the neighborhood, and occasionally to a distance, under direction of the professors, will teach the modes of observing natural objects, especially plants and insects useful and injurious in agriculture, and will furnish illustrations of good stock, of farm buildings, of orchards, market gardens, use of implements, &c. The agricultural warehouses of New Haven are well-stocked museums of implements and machines, accessible to students. Like some of the best agricultural colleges of Europe, the school has at present no connexion with a farm. In considering what disadvantage this may prove to the student, it should be remembered that the details of farming cannot be learned advantageously in an agricultural school. They are only to be acquired during a long apprenticeship on the farm. No young man is well prepared to attend an agricultural school who is not practically familiar with most of the ordinary operations of farming. What he is to learn beyond this is mainly communicable by the teacher, with such aids as the lecture-room and museum can furnish. Their deficiencies may be almost wholly supplied by excursions to neighboring farms and gardens. A few hours' walk or ride will bring the classes to good illustrations of dairies, of improved stock of many varieties; will exhibit the culture of most kinds of crops under a variety of circumstances which no single farm can imitate, and which will greatly enhance the value of the instruction to be derived. A portion of time corresponding to what would be properly spent upon a college farm, were one connected with the school, will accordingly be devoted to excursions. A library and reading-room supplied with American and foreign agricultural books and periodicals will be provided at an early day. Features of the course to which attention is especially called are the following:

1. The comparatively high standard of admission has the advantage of securing such an amount of mental discipline as to fit the pupil for rapid

progress, and enables him in three years to go through a course equal to that occupying four years in most agricultural colleges. The earnest student will find no difficulty in preparation for admission, as the subjects he is required to know are taught in all the high schools.

2. Unusual attention is given to French and German. The agricultural literature of these languages is more abundant, and, in its scientific aspects, more advanced than that of English. The educated farmer should be able to read them with ease, in order to keep pace with the rapid progress now making in the theory and practice of his art. It is intended that the student shall read, during the latter part of his course, standard French or German agricultural works, in the place of the usual classics.

3. A feature deemed highly important is experimental chemistry, pursued in the laboratory for several hours daily during the second year. The student, after learning from lecture or text-book the characters which belong to sugar, starch, phosphoric acid, casein, gypsum, guano, and other substances of agricultural significance, takes them into his own hands, prepares, examines, or analyzes them under the teacher's guidance. He thus fixes and makes definite his knowledge, and, what is of the greatest value, he learns how to observe, exercises his vision to accuracy and delicacy, and trains his judgment to rely on proof, and to discover the fallacies and sources of mistake which embarrass the unaccustomed observer. He learns the precautions needful in planning and executing an experiment, acquires confidence in truth, and arrives at a just estimate of his powers of perceiving and appreciating facts. The discipline and culture attainable in this way repay a thousand-fold the time and labor expended in the laboratory, though the student might have but little actual use for his laboratory acquirements in after life. A person of ingenuity would, however, learn much directly beneficial to him; would fall into habits of experimenting that could not fail to make him useful in advancing practical knowledge; would become able, for instance, to study the problems of the manure-shed and feeding-trough with results of high value to himself and the world.

Shorter course.—To meet the wants of those who have not time to attend the full course, and especially to accommodate young farmers who cannot leave home occupations during the summer months, the instruction is so arranged that the more important practical topics, viz., practical agriculture, agricultural chemistry and physiology, agricultural zoology, physical geography, forestry, &c., are discussed during the fall and winter terms of each year, (September 13 to April 12, with vacation of two weeks, from December 19 to January 3.) Those who desire can thus attend, during seven months of the year, the shorter course, being such a selection of the most useful exercises from the studies of the full course as will occupy their time profitably.

State students.—Arrangements have been made by the State of Connecticut for admitting to the school a certain number of pupils gratuitously. According to the law, all candidates for this bounty must be citizens of the State, and preference will be given to such as are "fitting themselves for agricultural and mechanical or manufacturing occupations, who are or shall become orphans through the death of a parent in the naval or military service of the United States, and next to them to such as are most in need of pecuniary assistance." The appointments are to be distributed, as far as practicable, among the several counties of the State, in proportion to their population. The appointing board consists of the governor, lieutenant governor, and three senior senators, with the secretary of the school, Professor Brush, to whom applications may be addressed.

KENTUCKY.

The legislature has established the agricultural and mechanical college as one of the several colleges of Kentucky University, recently removed to Lexington.

We learn through private sources that by private enterprise a magnificent estate of about 430 acres, including Ashland, the home of Henry Clay, and an adjoining residence, with finely ornamented grounds, has been already purchased for the agricultural college, and that students will be received in the fall of 1866. The college, though connected with the university, will have a separate government, availing itself, however, of the aid of professors in other departments. Already about $250,000 has been procured for the college, and the State has granted its land scrip for 330,000 acres to the institution, on condition that three students from each of the one hundred representative districts be educated there free of tuition.

NEW YORK.

Mr. John Delafield and others, Ovid, New York, as early as 1853 procured a charter for an agricultural institution to be established at that place, by the name of the New York State Agricultural College. About 700 acres of land were purchased, and buildings erected sufficient to accommodate 150 students. In a report of January, 1860, it is said that a president had been elected, and earnest calls were made upon the public to subscribe the funds necessary for opening the college for students. It appears that the institution was in operation two terms, when, upon the breaking out of the rebellion, the president was called to the field, and the college was closed.

For some reason not publicly explained, the legislature of New York at first granted the avails of the grant of Congress, not to the State agricultural college, but to the people's college at Havana; but, by a subsequent act of 1865, granted the same to the Cornell University. to be received upon certain conditions, unless the people's college should comply with certain other conditions which, it appears, have not been complied with. The principal condition of the grant to the Cornell University was, that Mr. Ezra Cornell should fulfil his offer to give the university $500,000. This he has done, and the institution is to be established at Ithaca, the place of Mr. Cornell's residence, where 200 acres of land have been secured and preparations are making for building, and where, it is hoped, the agricultural college of New York may find a permanent abiding place.

NEW JERSEY.

The legislature of New Jersey has granted to the Rutgers Scientific School, connected with Rutgers College, the income of her land scrip, to be devoted to the uses specified in the act of Congress.

Although the income of the scrip sold was estimated at only $1,200 for the year 1865, eight pupils were received on the 20th of September, suitable rooms and instruction being provided at the college. A farm of 100 acres has been purchased for about $15,000, said to be conveniently located, though at what distance from the college does not appear. Provision is made for forty students, to be received on nomination by the respective counties, free of tuition fees, and an excellent course of study, which want of space compels us to omit, has been established. This experiment, as combining a union with another college and an experimental farm, will be watched with peculiar interest. It has at least the merit of economy and speedy organization.

VERMONT.

The legislature of Vermont has decided to unite her agricultural college with the University of Vermont, at Burlington. The plan of organization is substantially the same as that of Massachusetts, already given. It is proposed to have a farm of 150 acres or more, with stock and implements for illustration and experiment.

KANSAS.

The Kansas State Agricultural College, formerly the Bluemont College, "opened under the auspices of the State in September, 1863," (says the superintendent of public instruction,) "and has been doing a great and good work in the education of teachers, and in training young men and women for active business life, and also in fitting them to graduate from the highest course of a first-class collegiate institution." A president and four professors are employed, and the number of students was 113, as shown by the catalogue of 1865. The ages of the students range from 9 to 27 years, there being a large preparatory class. The college is at Manhattan, and has 80 acres of land, a college building, and the foundation of a library. The annual expenses are estimated at only $4,000 a year. A boarding-house is about to be erected, and the institution, now in its infancy, has large prospective means. It is believed to be the only agricultural college where females are instructed. We have not at hand any definite programme of its course of study.

MAINE.

After much discussion, the agricultural college of Maine has been located at Orono, and is to be conducted as an independent institution. No buildings have yet been erected, and no plan of organization has been published.

So far as can be learned, no other agricultural colleges than those above noticed have yet been established. The Maryland Agricultural College, established as early as 1857, and still in operation, has a farm attached, but is rather a school of general education than of agriculture distinctively.

THE MECHANIC ARTS.

The act of Congress provides that colleges maintained by its provisions shall teach, not only such branches of learning as are related to agriculture, but such as are related to the mechanic arts.

Massachusetts has granted the income of about one-third of her fund to the Institute of Technology, where the mechanic arts receive special attention, and her agricultural college is therefore regarded as released from obligation to teach the mechanic arts, further than they are essential to agriculture.

A good water-power, with shops of various kinds, or steam or caloric power for want of water, are greatly to be desired connected with every agricultural college. The act of Congress calls for earnest attention to the department for instruction in the branches related to the mechanic arts, which seem to have been nearly overlooked. It is hoped that the subject may receive due consideration in the organization and progress of these institutions.

We close our paper with the following conclusions:

1. Public sentiment and the public good require a more practical course of education than our literary colleges afford, with more attention to modern and less to ancient languages.
2. Colleges established under the act of Congress should "teach such branches of learning as are related to agriculture and the mechanic arts," both scientifically and practically, so as to prepare their students to labor and to teach in the highest branches of their respective pursuits.
3. If the means are sufficient, these colleges should be independent, and not united with existing colleges.
4. But one such college in a State should be established. Experimental farms or stations, or subordinate schools, may be organized in counties or districts.
5. Manual labor for practice and education is essential to education in agriculture, and should be required of all students in colleges which have farms attached.

6. Farms for experiment, illustration, and practice, with live stock and farm implements, are essential to strictly agricultural colleges.

7. Where means for independent institutions are wanting, a half-year system of study in winter, and labor at home or on an experimental farm in summer, is practicable.

8. The promotion of equality, and the dignity of labor, being principal objects in our government, we find no models for our agricultural colleges in the aristocratic communities of Europe.

POPULAR VARIETIES OF HARDY FRUITS.

BY F. R. ELLIOTT, CLEVELAND, OHIO.

The following is a continuation of articles descriptive of fruits, published in the reports of the Department of Agriculture for 1862, 1863, and 1864:

APRICOTS.

LARGE EARLY.

Synonyms.—Gros Precoce, De St. Jean, De St. Jean Rouge, Gros d'Alexandre, Gross Früh, Precoce d'Esperin.

Fruit.—Size—medium to large. Form—roundish, oblong, compressed, projecting considerably on the side of the suture. Suture—deep, and terminating in a projecting point towards the back or beyond the axis of the fruit. Skin—downy. Color—pale orange in the shade, fine bright orange red, and marblings or spots of deeper red in the sun. Flesh—pale orange, separating freely from the stone; juicy, rich. Stone—much flattened, oval, sharp on the front, perforated along the back, from base to apex. Kernel—bitter. Season—early in July.

Tree.—Of vigorous growth, with large, broad oval leaves, tapering towards the footstalks or petiole, and with little ear-like appendages in place of glands. An abundant bearer, an old variety from France, and one of the very best early sorts known.

APPLES.

DUCHESS OF OLDENBURGH.

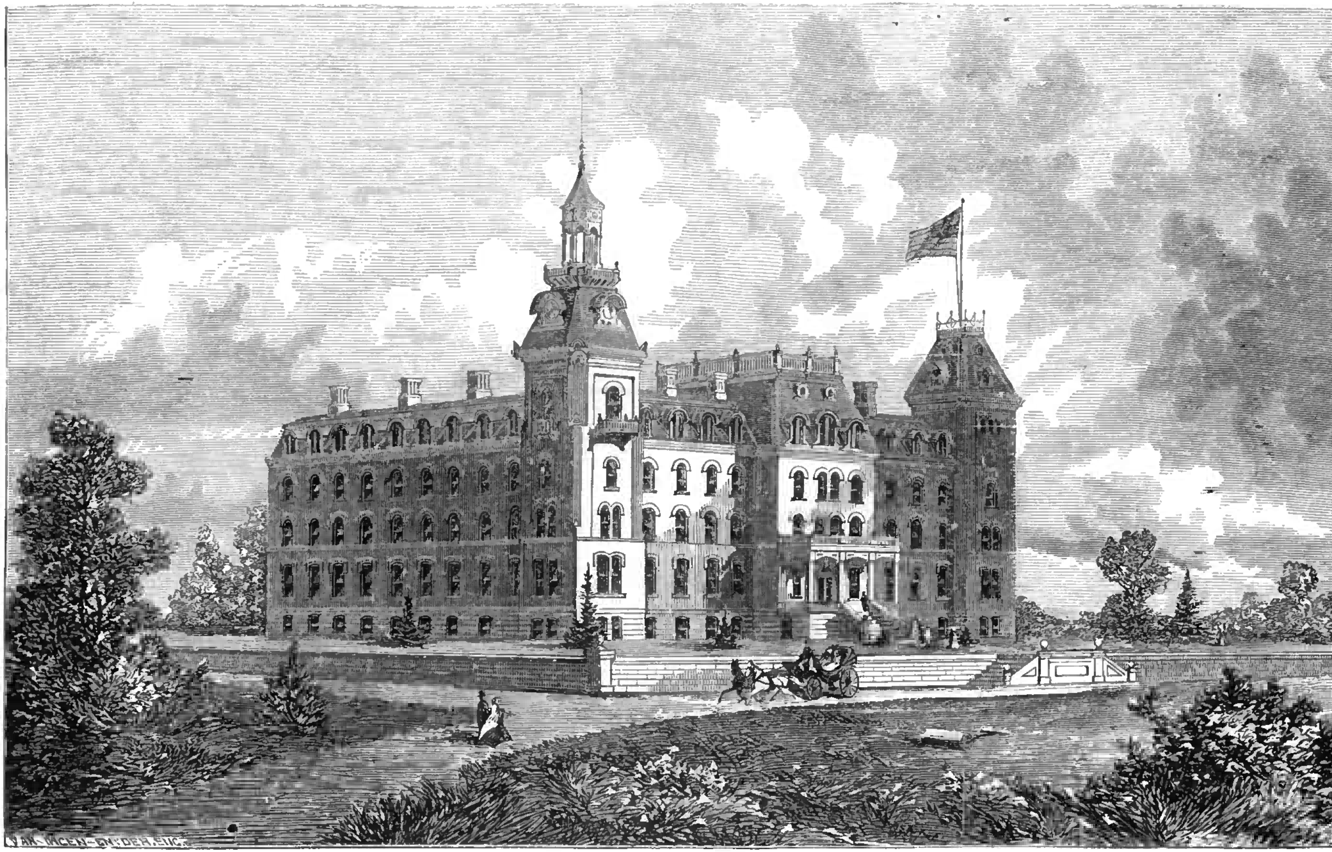
Fruit.—Size—medium to large. Form—roundish, flattened. Skin—smooth, with a light bluish bloom. Color—light and deep rich red, washed, striped and splashed on a yellow ground. Stem—short. Cavity—acuminate. Basin—deep, wide, even, regular. Calyx—large, nearly closed. Flesh—slightly yellowish white, sharp sub-acid, juicy, and, when well ripened, pretty rich. Season—September, and often keeping into October.

Tree.—An upright, vigorous, hardy and healthy grower, with dark-colored shoots and broad, dark-green, coarsely serrated leaves. A profuse bearer, apparently adapting itself to all soils and situations, and yielding a fruit of great value for marketing and for cooking purposes. It is of Russian origin.

FAMEUSE.

Synonyms.—Pomme de Heige, Sanguineus, Snow.

Fruit.—Size—medium. Form—roundish, somewhat flattened. Skin—smooth. Color—a greenish yellow ground, mostly overspread in the sun with a clean rich red; in the shade the red is pale, streaked, and blotched with the dark-red. Stem—slender. Cavity—narrow and funnel-shaped. Calyx—small. Basin—narrow and shallow. Flesh—remarkably white, tender, juicy, negative



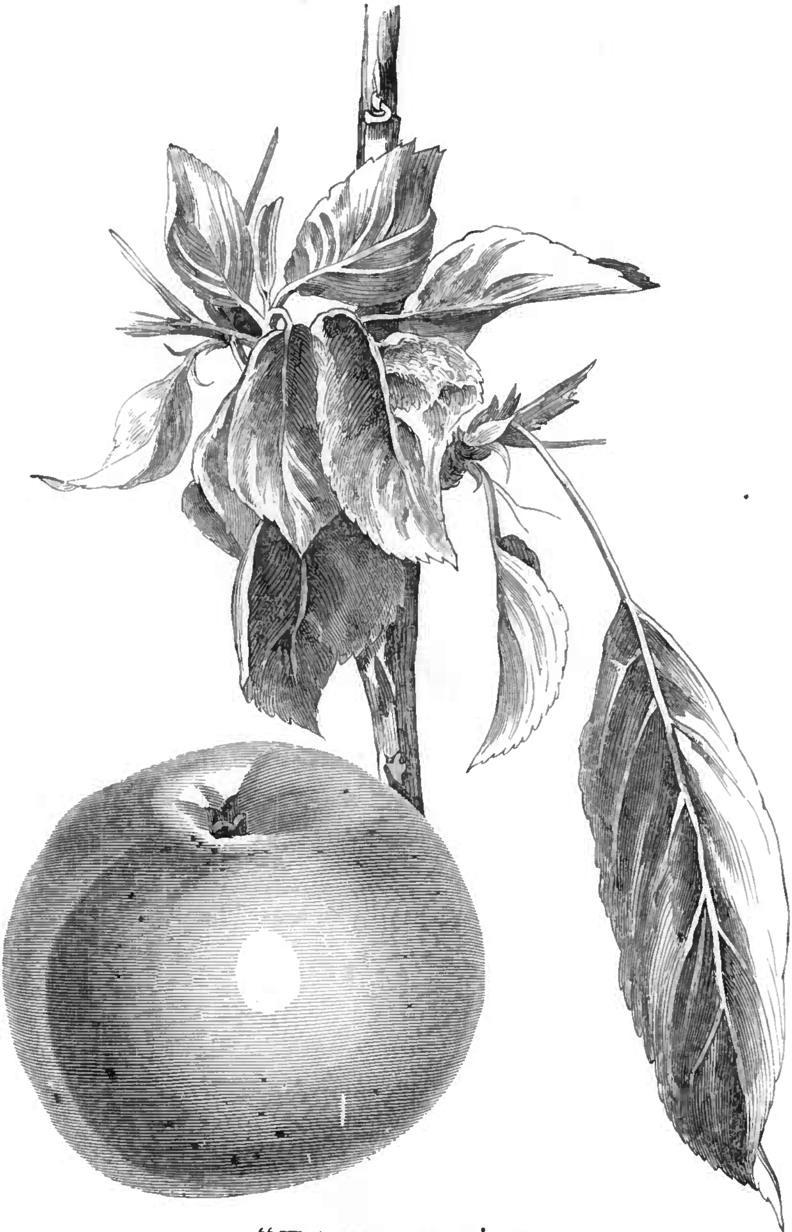
STATE AGRICULTURAL COLLEGE, STORY COUNTY, IOWA.

PLATE I.

LARGE EARLY APRICOT.

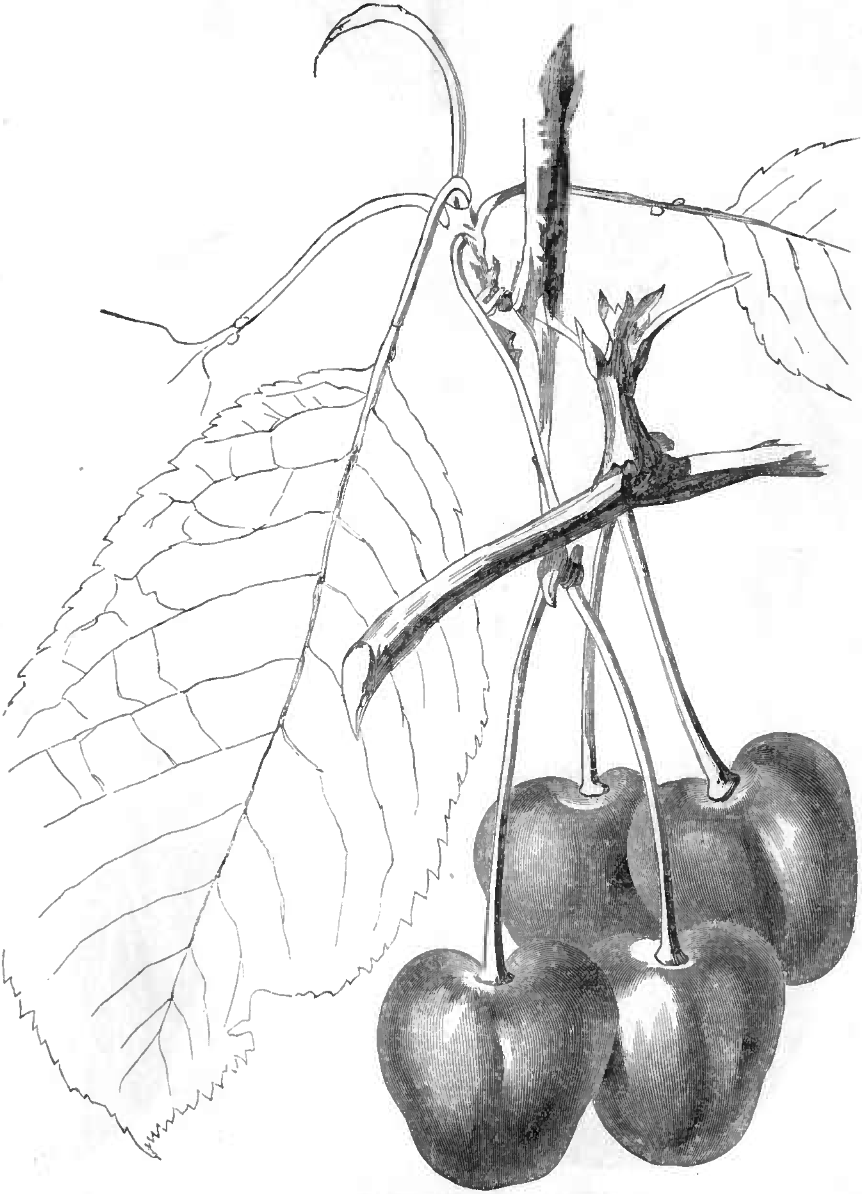
"DUCHESS OF OLDENBURGH."

PLATE IV.

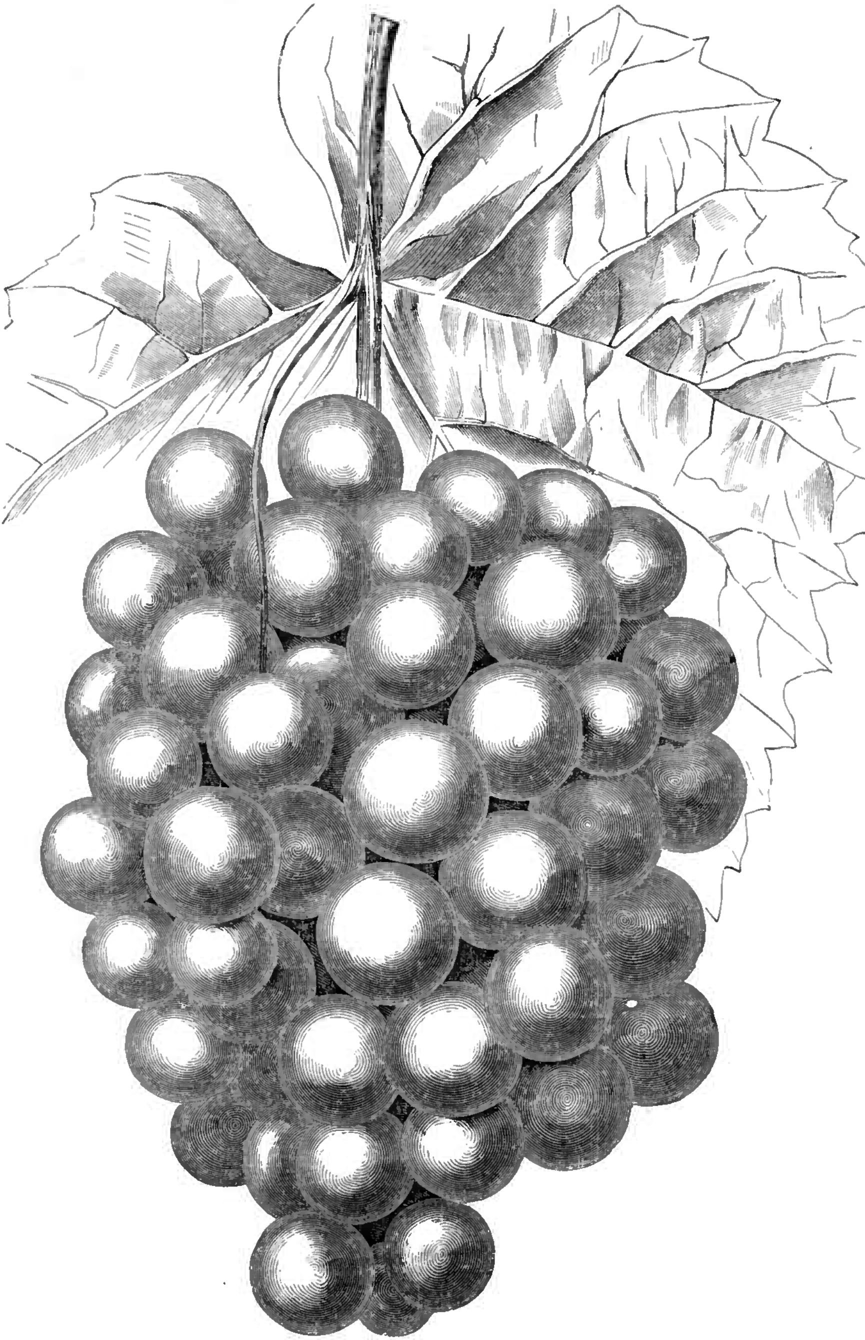


"FAMEUSE."

Plate V.



"GREAT BIGARREAU OF MEZEL."



"DIANA."

character, but deliciously pleasant, with a slight perfume. Core—close, small, compact. Seeds—light brown, long and pointed. Season—October and to December.

Tree.—Hardy, healthy, moderate grower, of a rather diverging habit, with dark-colored shoots and long narrow leaves, bearing annually a fair crop, with a profusion in alternate years. A rich but dry or well-drained soil seems to suit it best. No orchard in the north can be counted as complete without this variety; for while its fruit is not of the highest character, it is just so good that everybody likes to eat of it; and when cooked, it is white, puffy, and delicious. Of French origin.

CHERRIES.

LOUIS PHILLIPPE.

Fruit.—Size—medium. Form—roundish, slightly oval. Color—dark, rich red. Flesh—red, tender, juicy, sprightly, lively acid. Pit—small. Stem—short to medium. Season—rather late, say middle of July.

Tree.—Of the morello class, quite vigorous, and forming a good-sized tree, with sharply serrated, broad, oval-shaped leaves; an abundant bearer of a fruit that has no equal for canning purposes, and when fully ripe is very fine for the table. It is worthy a place in all collections, however small they may be. Of French origin.

GREAT BIGARREAU OF MEZEL.

Synonyms.—Monstreaux de Mezel, Bigarreau Gaubalis.

Fruit.—Size—very large. Form—obtuse, heart-shaped, flattened on sides. Surface—uneven. Color—dark reddish purple, becoming apparently quite black at maturity. Stem—long, rather slender, in a rather deep and regular cavity. Pit—large, oval. Flesh—purplish red, firm, a little coarse, juicy, sweet and good, but not of the highest flavor. Season—last of June and early in July.

Tree.—A strong, vigorous grower, rather crooked while young, becoming at mature age a broad, open, spreading tree, with large leaves, and producing abundantly a fruit that commands the highest price in market. It is possible the Great Bigarreau or Large Red Prool may be identical, but as there is some question of it, we have omitted the names in our synonyms. The tree is of French origin, and came to this country with a loud flourish of trumpets. While young it is not a great bearer, but when the trees have acquired some twelve or more years of age they are good and regular bearers.

GRAPES.

DIANA.

Fruit.—Bunches—medium, very compact, occasionally shouldered. Berries—above medium size, round, pale red. Skin—thick. Flesh—tender, with some pulp, very sweet, juicy, with a rich musk flavor that is very strong until the fruit is fully ripe, and then often offensive to some persons. It colors its fruit as early as the Concord, but, as a rule, does not really mature it much earlier than the Catawba. Its berries hold well, and its thick skin enables it to withstand changes of temperature better than thin-skinned; hence the Diana improves by being left upon the vine until after pretty severe frosts. As a variety for packing and keeping it has no superior. For wine purposes many claim it to be very valuable; our impression is that it has too much of the foxy character to ever make a very fine white wine. A dry and poor gravelly soil suits it best; on deep rich soils it inclines to make too much wood. It was grown from seed of the Catawba by Mrs. Diana Crehore, Milton, Massachusetts.

IONA.

Fruit.—Bunches—medium or above. Berries—above medium, yet not large, loosely and evenly distributed on the bunch, which may often be termed double-shouldered. Color—handsome pale red or wine-color, almost translucent. Flesh—melting to the centre, highly flavored, juicy, sweet, vinous. Skin—thin and tender, with little or no coloring matter, except in the outer corticle. Seeds—few and small. It ripens about with the Concord, while its quality more nearly compares with a fully ripened Catawba than any other sort. The vine is a healthy grower, with rather short-jointed wood, broad, three-lobed light green foliage, that in most sections at the north has not mildewed; but in Missouri it has not sustained a favorable character, and may prove valuable only for northern sections. It originated with C. W. Grant, of Iona island, New York, probably from a seed of Catawba.

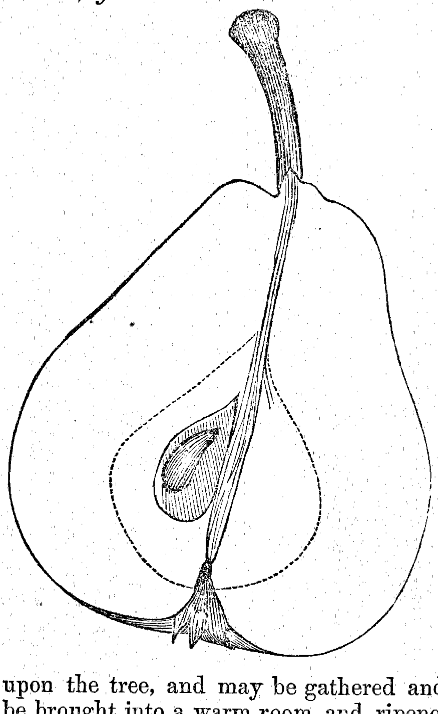
ROGERS NO. 4.

Fruit.—Bunches—large; very compact. Berries—very large, round, black, with a thick, blue bloom. Skin—rather thick. Flesh—with some pulp; melting, juicy, sweet, sprightly vinous, sub-acid. Ripens with the Concord, to which it is superior in quality. The vine is a vigorous, strong grower; an early and good bearer, and quite hardy and free from disease of mildew. This, with No. 15, which we figured in the Department Report for 1863, will undoubtedly prove the most valuable of many seedlings originating with Mr. E. S. Rogers, of Salem, Massachusetts. The leaves are broad and dark green, five-lobed, exhibiting strongly the native fox grape, claimed as its female parent.

PEARS.

BEURRE D'AREMBERG.

Synonyms.—Duc d'Aremberg, Colmar Deschamps, L'Orphelines, Deschamps, D'Aremberg Parfait, Beurre des Orphelines, Orpheline d'Engheim, Soldat Laborder, *of some.*

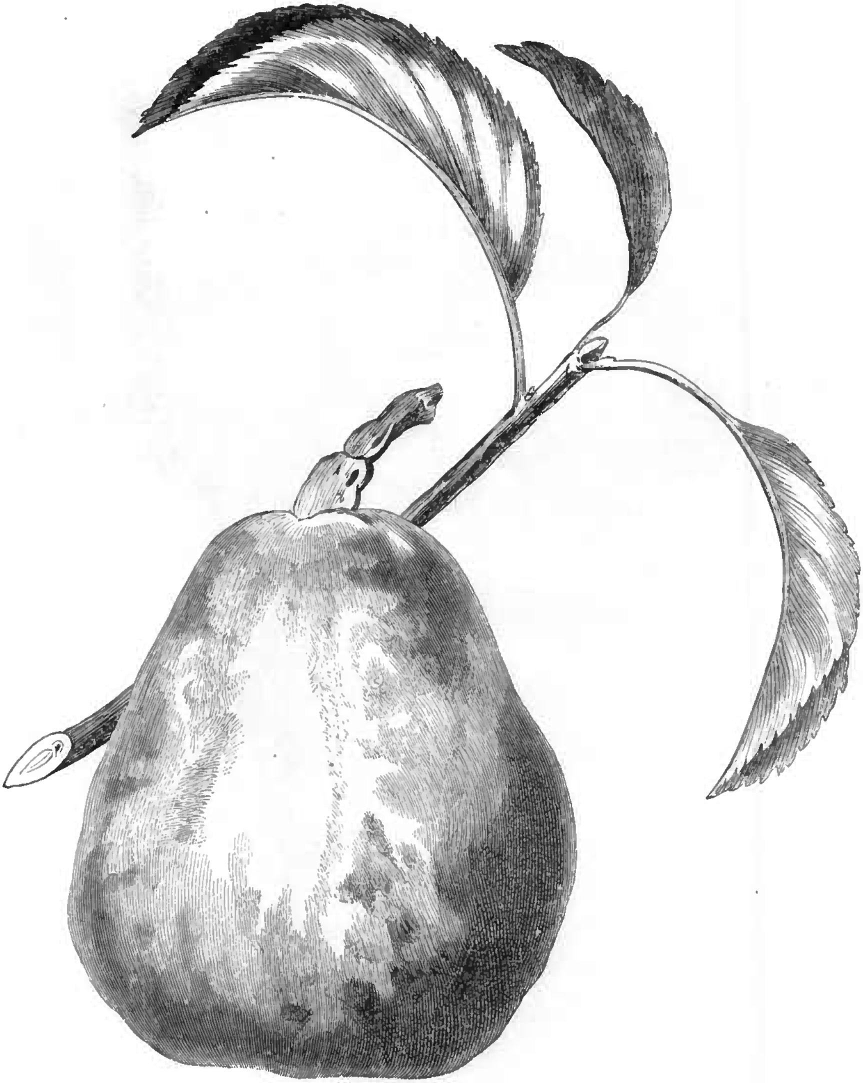


Fruit. — Size — above medium. Form—obovate, obtuse pyriform, tapering toward the stem, where it often terminates in a fleshy junction. Color—dull, pale green, becoming at maturity a light yellow, clouded with green, and with traces and patches of light cinnamon russet. Stem—short, stout; sometimes with, but oftener without, depression. Calyx—small, with short, closed segments. Basin—full medium depth. Flesh—white, juicy, melting, vinous. Core—medium. Seeds—light brown, acutely pointed. Season — December to March.

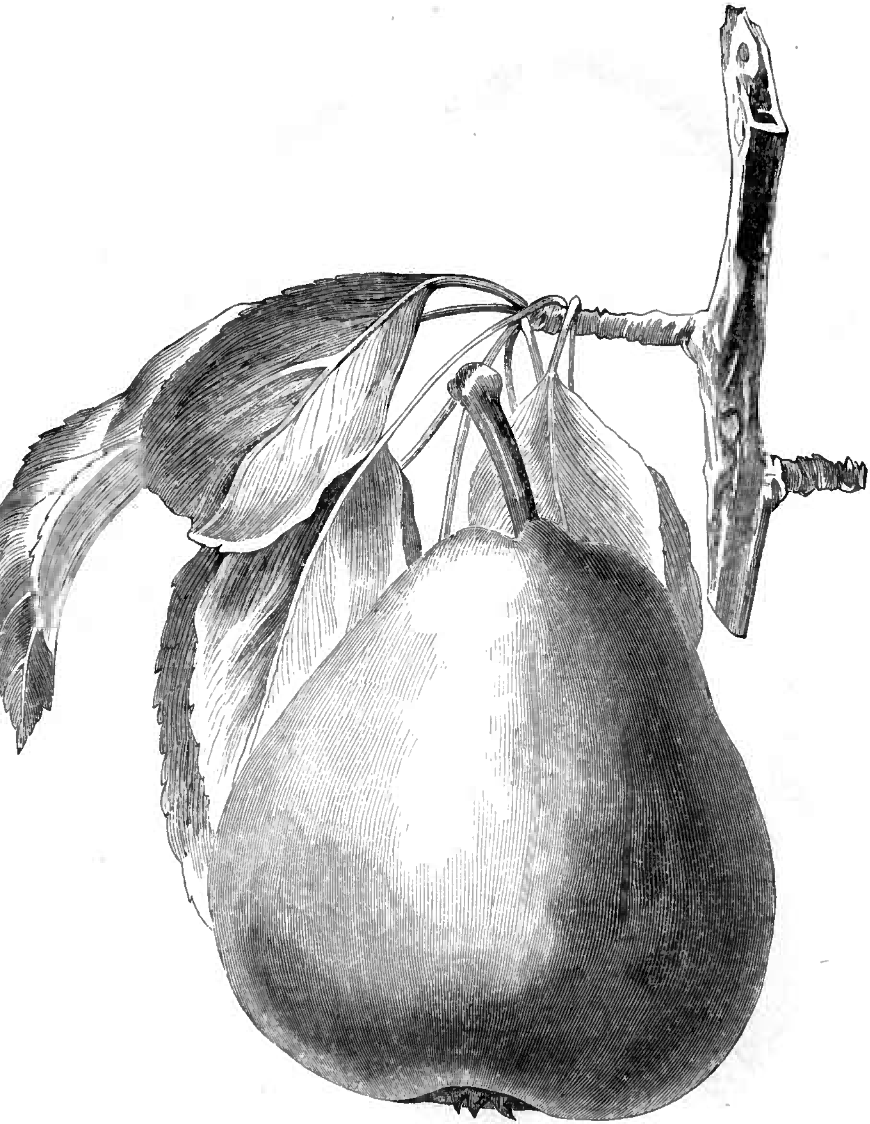
Trees.—Very hardy; commencing to bear early, even when grown on the pear root; a good, healthy grower, with long-jointed wood of yellowish brown color, dotted with pale gray specks. Leaves—narrow, sharply and finely serrated. A warm, rich, yet loose soil, seems to suit this variety better than heavy clays. It is a good bearer, the fruit hanging well upon the tree, and may be gathered and packed in barrels, as with apples, to be brought into a warm room and ripened as desired, from time to time. It is of Belgian origin, and has often been confounded with Glout Morceau.

"IONA."

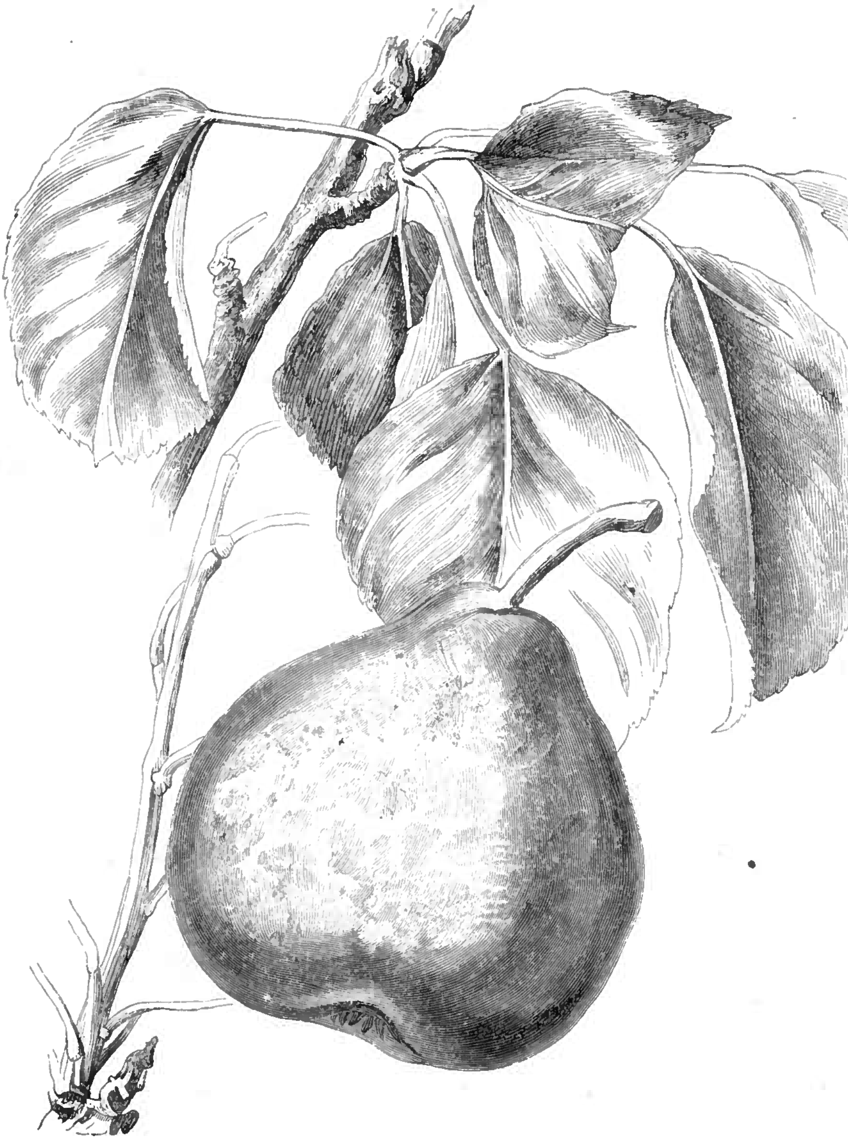
PLATE VIII.



"BEURRE D' AREMBERG."



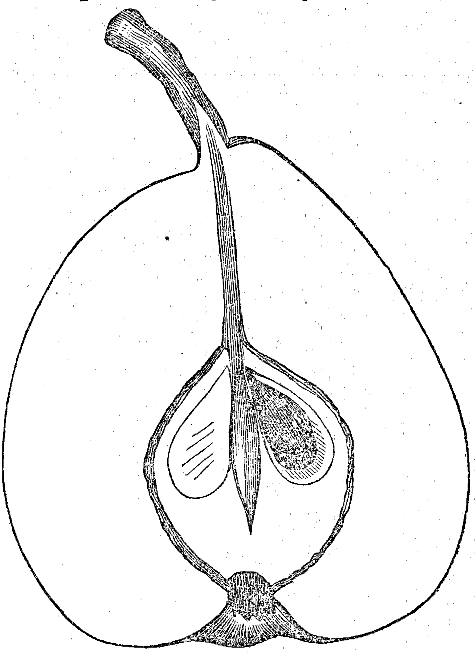
"BEURRE COIT."



"KIRTLAND."

BEURRE COIT.

Fruit.—Size—above medium. Form—obtuse pyriform; slightly angular. Color—rich brown russet, mostly overspreading a yellow ground, with a brownish red cheek in the sun. Stem—rather short, with an occasional lip-like at its junction with the fruit. Cavity—shallow, with unequal projections. Calyx—with segments nearly erect, surrounded by depressed, crescent-shaped furrows, in a shallow basin. Core—small. Seeds—blackish. Flesh—yellowish white, melting, buttery, juicy, sweet, vinous. Season—last of September and in October.



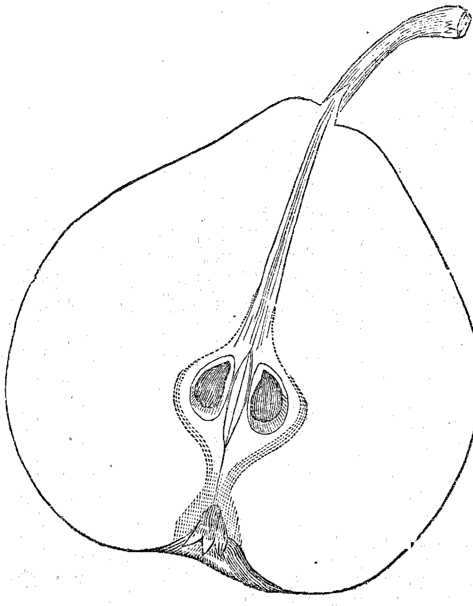
Tree.—Hardy, vigorous, upright grower, becoming spreading as it matures, with dark-brown shoots, and broad waved leaves, with rounded serratures. The tree is productive, and comes early into bearing on the pear roots. It originated with Colonel H. H. Coit, of Euclid, Cuyahoga county, Ohio, and is of such excellence as to deserve a place in all collections.

Our outline drawing was made from a small specimen, while our shaded drawing was from a full-sized fruit.

KIRTLAND.

Synonyms.—Seedling Seckel, Kirtland's Seedling, Kirtland's Beurre.

Fruit.—Size—medium, or a little above. Form—obovate, obtuse pyriform. Color—a rich, deep yellow, overspread with cinnamon russet; in the sun many of the russet spots become almost red. Stem—usually stout; of medium length; curved. Calyx—short, reflexed, persistent. Basin—shallow. Core—small. Seeds—short, ovate, blackish.



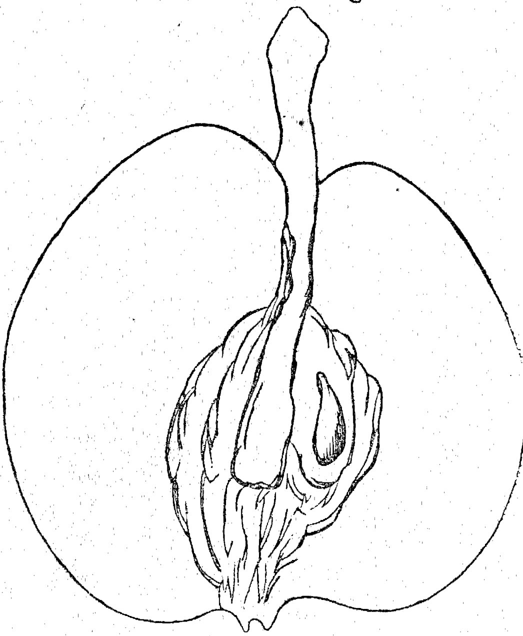
Flesh—white, melting, juicy, sweet, aromatic. Season—September.

Tree.—An upright grower, with short-jointed, stout, yellowish-brown shoots, and irregularly but sharply serrated leaves, with stout petioles; a hardy, healthy sort, partaking in its habits very much of its parent, the Seckel, from seed of which it was grown by H. T. Kirtland, of Mahoning county, Ohio. It is an early and productive bearer on the pear root, and succeeds admirably on the quince.

DOYENNE SIEULLE.

Synonyms.—Bergamotte Sieulle, Beurre Sieulle, Sieulle.

Fruit.—Size—medium to large. Form—roundish, a little irregularly depressed, and tapering slightly toward the stem. Color—dull, yellowish green, broadly shaded and marbled with bright red on the sunny side, and with many large reddish russet specks. Stem—stout, medium length, planted in a deep cavity, sometimes presenting appearance as of a swollen lip on one side. Calyx—with broad reflexed segments. Basin — shallow. Flesh — white, melting, juicy, vinous. Core—large. Seeds—large, dark brown. Season—November to January.



Tree.—A vigorous, upright, rather compact grower, with moderately stout, rather long-jointed wood, of a brownish olive color, and regularly speckled with large grayish white specks. Leaves with long slender petioles, light green, ovate acuminate, waved and finely serrated, of French origin, and although known, does not seem to have received the attention that it deserves, probably because its fruit at the usual time of exhibitions in the fall is unripe, and, again, is gone before midwinter shows. The tree on the quince root is one of the best growers and bearers in the whole collection, and it ripens just when the earlier varieties of fall pears are about gone.

PLUMS.

REINE CLAUDE DE BAVAY.

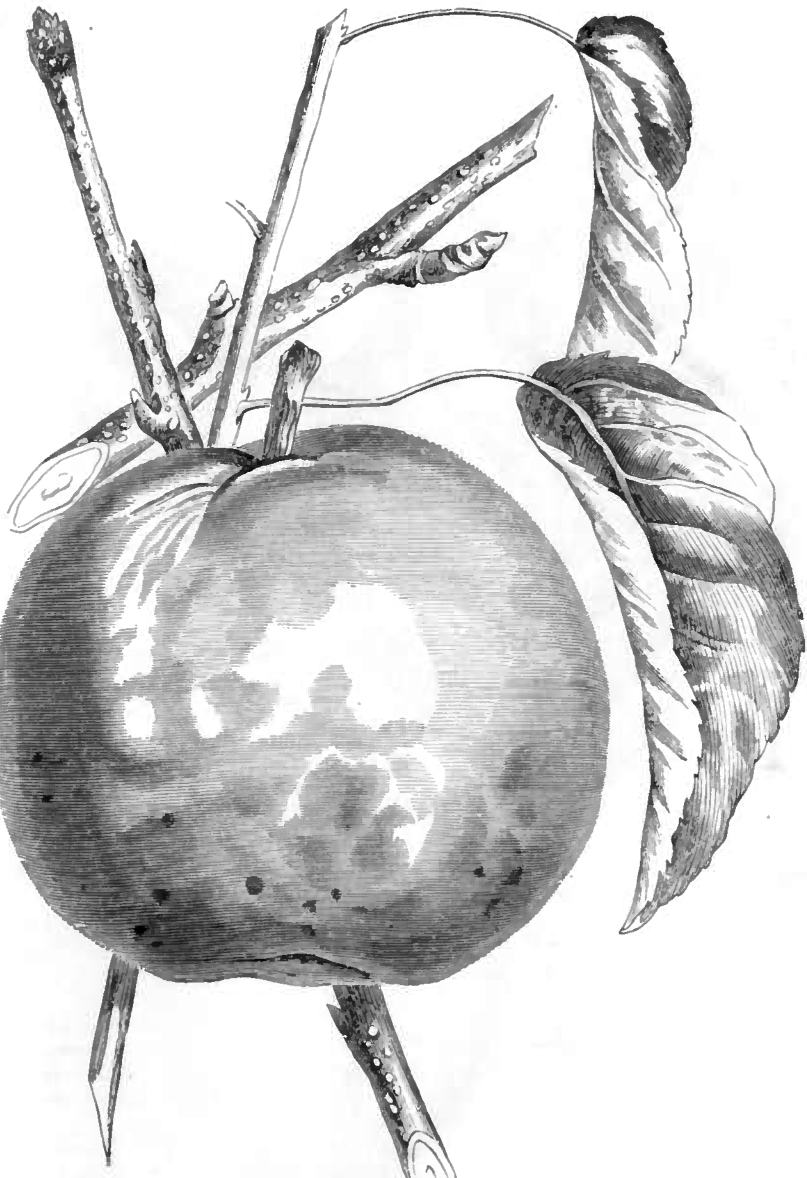
Fruit.—Size—large. Form—roundish, oval, oblong. Color—greenish yellow, with stripes and splashes of green, covered with a thin bloom. Suture—medium, apex dimpled. Stem—short and stout, planted in a rather deep cavity. Flesh—yellow, sugary, juicy, rich, excellent. Stone—small, from which the flesh separates freely. Season—early in October.

Tree.—A vigorous grower, with smooth branches, large, broad, ovate, rounded, pointed leaves, with rounded irregular serratures; very productive, of foreign origin, and a valuable acquisition to late ripening varieties.

PRINCE'S YELLOW GAGE.

Synonyms.—American Yellow Gage, White Gage, Harvest Gage.

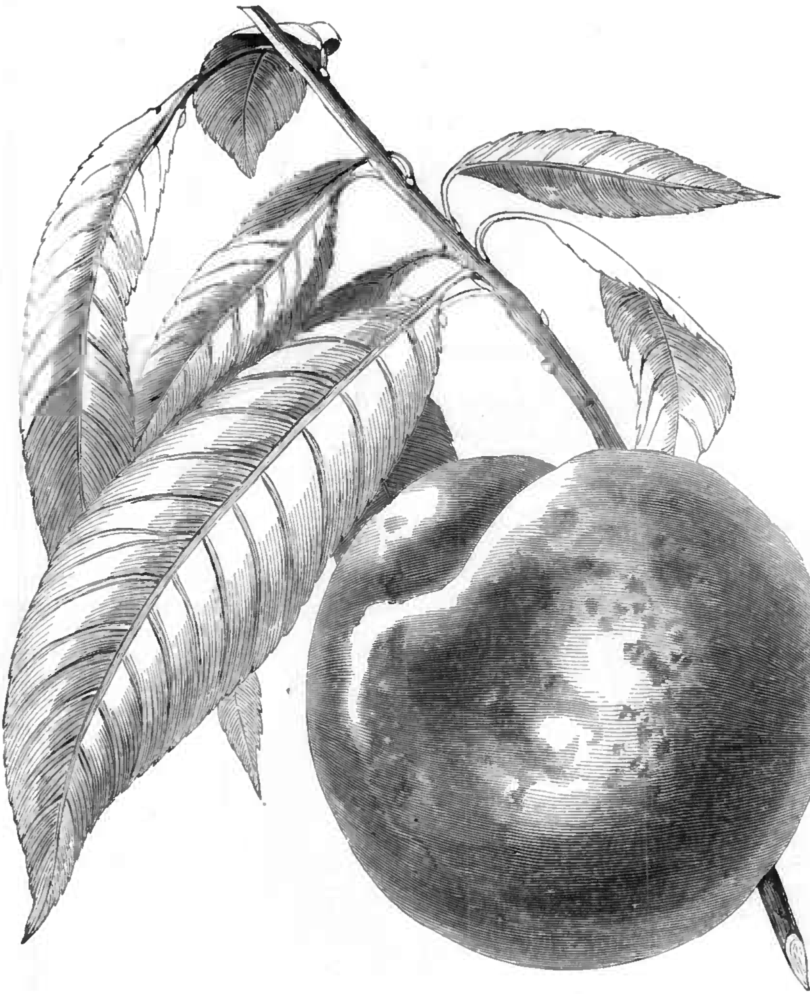
Fruit.—Size—above medium. Form—oval, broadest near the stalk. Suture—



"DOYENNE SIEULLE."

"REINE CLAUDE DE BAVAY."

"PRINCE'S YELLOW GAGE."



"HALE'S EARLY."

a mere line. Color—golden yellow, a little clouded. Bloom—white and abundant. Flesh—yellow, sugary, rich, sometimes a little dry, separates freely from the stone. Stem—about one inch long, set in a small round cavity. Ripens at the north early in August, at the south about middle of June, where it is said to become quite juicy and to ripen gradually, thus forming one of the most valuable varieties. At the north its hardiness and productiveness, together with its rich sugary character and fine show, make it indispensable in the market orchard.

Tree.—A healthy grower, with short-jointed, smooth branches, glossy leaves, and forming a large spreading head.

THE PEACH—ITS PROPAGATION, CULTIVATION, VARIETIES, ETC.

BY ISAAC PULLEN, HIGHTSTOWN, NEW JERSEY.

This delicious fruit justly claims a large share of attention, not only among those who are greatly benefited by its cultivation, but by those who have only a small plot of ground to devote to fruit. The ease with which it is raised, its generous return for the slightest attention, and its unequalled flavor, render it one of the most desirable fruits for the orchard or garden. It is proposed in this paper to state briefly a few facts, gathered from a long experience, as to its propagation, cultivation, varieties, &c.

PROPAGATION.

In the selection of seed it is desirable to procure it from localities where diseases have not made their appearance. For a number of years the best seed in market was procured from Accomac, Virginia, and other counties on the Peninsula, where almost all the trees were seedlings. In the preparation of the seed for planting, the usual custom with nurserymen is, in the month of October, to clear a space of ground, excavate to the depth of three inches, fill this excavation with the stones, and cover over with earth about two inches in depth. As a protection against too severe freezing in the winter, some boughs, or stalks, or straw may be thrown over the whole. In the spring, as early as the stones begin to open with the swelling kernel, the bed may be opened and the kernels carefully gathered and planted, in rows four and a half feet apart, and at a distance of about four inches from each other. The stones that have not opened may be cracked with a hammer, and the kernels planted in the same manner.

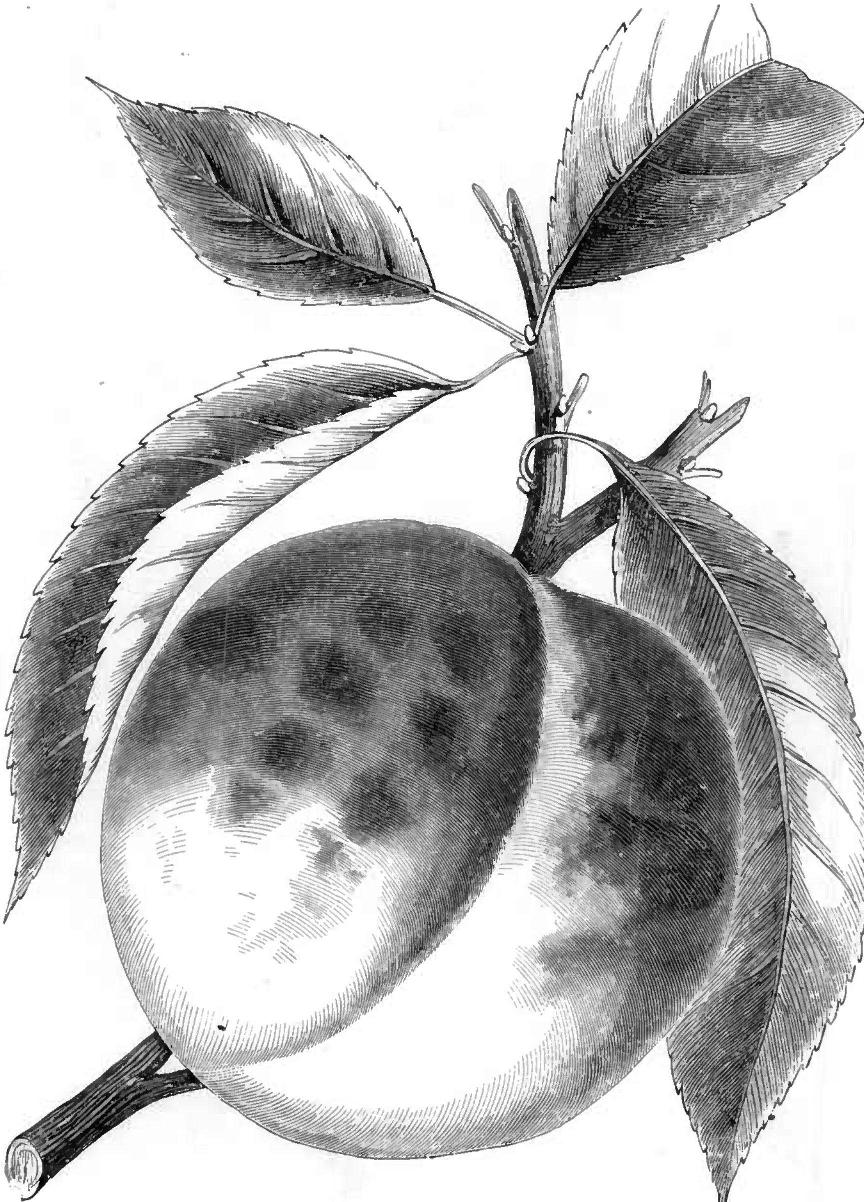
Plough and cultivate the young seedlings until they are of proper size for budding, which will be about the 10th of August or earlier, according to latitude. Buds are generally chosen from thrifty orchard trees of three or four years' growth, as being better matured than those taken from one-year-old trees in the nursery rows. The operation of budding is simple; an expert hand setting as many as two thousand in a single day. The bud is cut about one inch in length, the eye being in the middle. The bark will very readily cleave from the wood, and, in all cases where the bark of the budding limb is free, the plan of budding without the wood is preferable. A slit, corresponding in length with the bud, is made in the seedling, as near the ground as possible, and the bud inserted, where it is made secure by being wrapped about with strands of Russia mat, or other convenient wrapping material, care being taken to leave the eye of the bud exposed. In a few days the bud will have adhered to the wood of the tree, when the wrapping may be removed. Early the following spring the seedlings should be cut off as near to the bud as it can be done without injury—say one-half inch above it. Then, for the six weeks following, the stump which is left must be kept clean from suckers, so that the growing bud may have the benefit of the strength of the root. By the falling of the leaf the inoculation will have attained the height of four to six feet, according to the soil. It is not desirable that the trees should be grown in highly manured ground, or that they should attain a large size the first year.

PLANTING, CULTIVATION, PRUNING, ETC.

In all cases, peach trees should be planted when of one season's growth. The time of planting, whether fall or spring, is immaterial. In very severe climates, the spring would be preferable; but in all the peach-growing belt of the United States, the choice between fall and spring planting is of little account. For orchard planting, the ground should be marked out in furrows, about eighteen or twenty feet apart, and the trees planted to about the same depth as they stood in the nursery. The side limbs and tops should be cut off, leaving a straight stem of the desired height for forming a head. If the trees are planted in the fall this trimming and topping should be deferred till spring. Low heads are desirable. When the heads begin to form proper care should be taken to prune out all unnecessary limbs, leaving three or four limbs in proper position to form the future tree. Shortening in about one-half the growth for the second and third years after planting, and keeping the inside of the trees clear of useless growth, is all that is required in the way of pruning before the trees commence bearing. The borers, which enter the body of the tree at or a little below the ground, should be removed from year to year. Many remedies for their prevention have been recommended, but experience has demonstrated that the best preventive is personal inspection of each tree, and removing with a knife, or other suitable instrument, the borers. Peach trees will succeed in any soil that will grow corn or potatoes, and require about the same cultivation as those crops. No manures are required until the trees have borne their first crop. After the first crop one hundred bushels of wood-ashes, or three hundred pounds of Peruvian guano, or four hundred pounds of some standard super-phosphate, or four hundred pounds of bone-dust, to the acre, will restore the trees and prepare them for the next year.

VARIETIES.

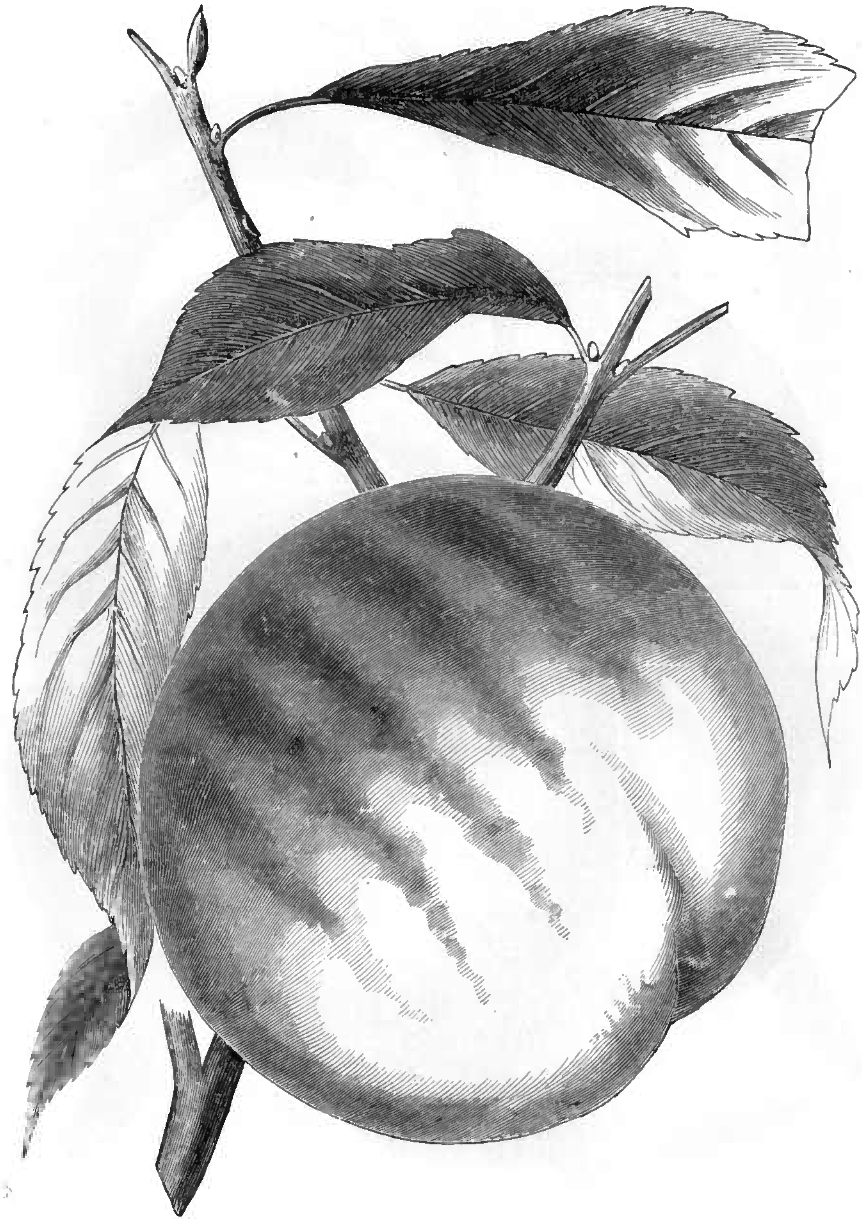
Among the hundreds of varieties which have been cultivated, and which swell the columns of nurserymen's catalogues, there are about twelve which amply suffice for general cultivation. Those varieties, which I shall recommend as possessing the qualities of fine flavor, succession in ripening, hardy growth of tree, and general fruitfulness, have been tested by me through a long and successful experience in the cultivation of the peach, with the exception of the Hale's Early, which is of recent origin. This latter variety has been fruited by me for three years, both in the orchard-house and in the open air. In each case it has been fruited side by side with the Troth's Early Red, which latter has for years held the position of the earliest market variety. The Hale's Early ripens at least two weeks in advance of the Troth's. It is larger, of fine flavor, and promises to be one of the most valuable and profitable additions to our peach list, since it increases the length of the peach season by two weeks. In order to fill up a gap between the Hale's Early and Troth's I am now engaged in producing a new variety by hybridizing.



"TROTH'S EARLY RED."

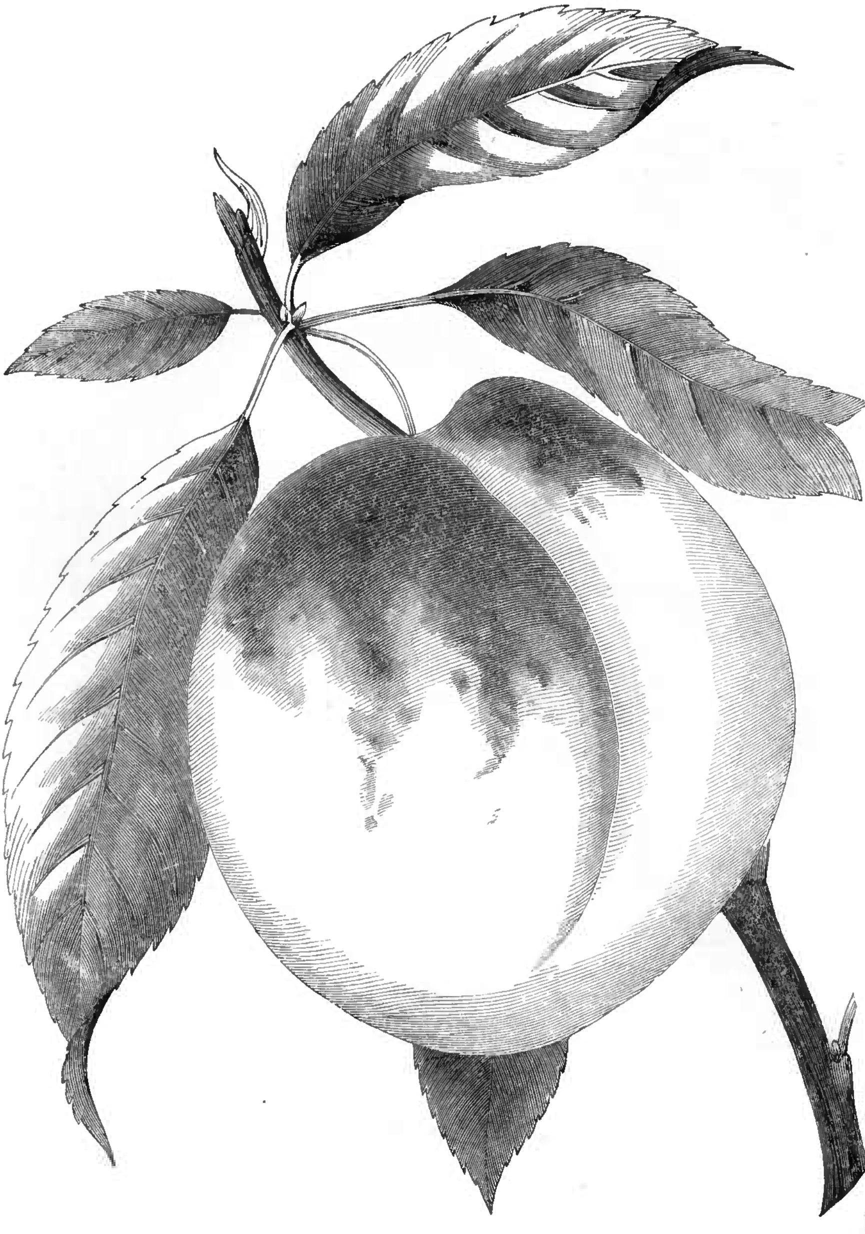
"LARGE EARLY YORK."

"YELLOW RARERIPE."



"STUMP THE WORLD."

"CRAWFORD'S LATE."



"HEATH'S CLING."

LIST OF VARIETIES FOR GENERAL CULTIVATION, GIVEN IN THEIR ORDER OF RIPENING.

Hale's Early.	Yellow Rareripe.	Crawford's Late.
Troth's Early Red.	Oldmixon Freestone.	Ward's Late Free.
Large Early York.	Reeves' Favorite.	Smock.
Crawford's Early.	Stump the World.	Heath, (cling.)

These varieties will afford a succession of fruit from the beginning to the end of the peach season. I attach descriptions of each:

HALE'S EARLY.—A new and valuable early peach; vigorous and healthy tree, and an abundant bearer. Fruit—medium size, nearly round. Skin—mottled red, with dark red cheek. Flesh—white, melting, juicy, and high-flavored. Glands—globose. Flowers—large. Season—last of July, and first of August. Freestone.

TROTH'S EARLY RED.—Fruit—small, round, uniformly red. Flesh—white, slightly red at the stone; not of first quality as to flavor, but one of the most valuable market varieties on account of its early ripening. Glands—globose. Flowers—small. Season—1st to 15th August. Freestone.

LARGE EARLY YORK.—This truly excellent peach is known by many names, such as Livingston's New York Rareripe, Honest John, New York Rareripe, Haine's Early Red, Walter's Early, &c. Fruit—above medium, roundish. Skin—whitish, dotted with red, with beautiful red cheek. Flesh—white, very juicy, and of excellent flavor. Season—middle of August. Flowers—small. Glands—globose. Freestone.

CRAWFORD'S EARLY.—A very popular, yellow-fleshed variety. Fruit—large, generally oblong, but variable as to shape. Skin—yellow, with red cheek. Flesh—yellow and juicy, and slightly acid. Flowers—small. Glands—globose. Season—last of August. Freestone.

YELLOW RARERIPE.—A variety ripening at nearly the same time as the Crawford's Early, and much esteemed on account of flavor. Fruit—large, roundish, the suture extending half-way round. Skin—orange-yellow, with rich red cheek. Flesh—yellow, but red at the stone. Flowers—small. Globose glands. Freestone.

OLDMIXON FREESTONE.—An old and highly esteemed variety. Fruit—large, roundish, a little swollen on one side. The skin is pale, dotted profusely, with a beautiful cheek. Flesh—white, tender, and very rich. Flowers—small. Glands—globose. Season—first of September.

REEVES' FAVORITE.—Fruit—large, roundish, slightly oval. Skin—yellow, rich red cheek. Flesh—deep yellow, red at the stone, rich and melting. Glands—globose. Flowers—small. Season—10th to 15th September.

STUMP THE WORLD.—Fruit—large, slightly oblong. Flesh—white, red cheek, of excellent flavor. Ripens about the middle of the peach season, just following the Oldmixon Freestone, which it closely resembles in size, appearance and flavor. Flowers—small. Glands—globose.

CRAWFORD'S LATE.—This has no rival as a yellow-fleshed variety. Its large size, beautiful appearance, and unapproachable flavor, make it a deserved favorite among growers. Fruit—large, roundish, with shallow suture. Skin—yellow, with dark red cheek. Flesh—deep yellow, and red at the stone. Glands—globose. Flowers—small. Ripens from middle to last of September.

WARD'S LATE FREE.—A fine, white-fleshed, productive variety. Skin—white, with crimson cheek. Flesh—white, slightly red at the stone, excellent flavor. Flowers—small. Glands—reniform. Season—last of September. Freestone.

SMOCK.—A well known late variety, very productive, and valuable as a market peach, on account of its bearing transportation. It is also a favorite for domestic purposes for pickling, preserving, &c. Fruit—large, oblong. Skin—light-yellow, mottled with red, with red cheek when ripened in exposed places. Flesh—yellow, but red at the stone. Glands—reniform. Season—last of September and 1st of October. Freestone.

HEATH.—A clingstone variety, of most delicious flavor. Fruit—large, oblong, narrowing to both ends, with distinct suture on one side. Skin—whitish, but slightly tinged when grown in exposed places. Flowers—small. Glands—reniform. Season—from 1st to 10th October.

Another list, combining, in many respects, qualities common to the above, might be made; but on the whole I consider the list given as possessing more qualities for commendation than any other.

Peach-growing, as an industrial pursuit, is steadily increasing. With the opening by expresses and otherwise of such markets as Boston, Albany, Troy, Portland, New Haven, Buffalo, and all considerable towns and cities north of New York, the demand has been so much increased that when peaches are received in fair condition in New York, no such gluts as distinguished that market some years ago, when this fruit was thrown into the dock by boat-loads, are known. At present the eastern market receives the main supply from the Peninsula, bounded by the Chesapeake bay on the west, and the Delaware bay on the east. This comprises the State of Delaware, and a portion of the States of Maryland and Virginia; but the greater part of the supply comes from the State of Delaware. The extension of the Delaware railroad from Wilmington south, through the whole length of the State, and through some counties of Maryland south of Delaware, and the running of a through train during the peach season to Jersey City, has opened up one of the finest peach-growing districts in the United States, to one of the best markets. In the summer of 1864 there were received at Jersey City, by the Delaware peach train, three hundred and thirty-five thousand (335,000) baskets of peaches. Add to this about one hundred thousand (100,000) by Adams's express, and three hundred and sixty-eight thousand one hundred and eighty (368,180) by the Camden and Amboy railroad, (the greater part of which were Delaware peaches re-shipped at Philadelphia,) making the amount received in New York city from the Peninsula eight hundred and three thousand one hundred and eighty (803,180) baskets. The receipts during 1865, from the same source, amount to over that number. New Jersey, during the above year, furnished about half as many baskets as the Peninsula for the New York market. In the west, the great markets of Cincinnati, Louisville, Chicago, St. Louis, &c., have stimulated peach-growing to a great extent, so that in certain portions of Ohio, Indiana, and Illinois, this pursuit has become a great source of wealth.

NEW VARIETIES OF GRAPES.

BY S. J. PARKER, M. D., ITHACA, N. Y.

In this brief article I wish to notice a few grapes either entirely new, or now receiving public approbation, but hitherto neglected; and even yet comparatively unknown. Perhaps no new grape is, at the present moment, more largely cultivated, or better proven, than—

IVES'S SEEDLING. It was found a chance seedling growing in the garden of H. Ives, esq., of Cincinnati, Ohio; and he being at that time secretary of the Cincinnati Horticultural Society, introduced it to its members and gave cuttings to them. These fell, among others, into the hands of Mr. Waring, George Graham, esq., and Dr. Kittredge, who are, if my information is correct, with Mr.

Ives, to be accredited for the proving of this valuable grape, and announcing it to the public.

Various conjectures have been made as to the parentage of this new and excellent vine. At one time Mr. Ives attributed it to the Madeira, just as too many give foreign-birth blood to every good fruit. But its wonderful resistance to the rot and mildew of Cincinnati proves it to be eminently native. Others, of whom the intelligent George Graham, esq., is one, see the characteristics of the Hartford Prolific in it. But the fact that "it so closely resembles the Hartford Prolific as not to be distinguishable from it, except by its clusters," as says Mr. Washburne, of Illinois, is no reliable proof on this point, in my opinion. Mr. Graham says, in almost the identical language just given, it "is probably a seedling from the Hartford Prolific, as the vine bears a strong resemblance to that variety, and can be scarcely distinguished from it, except in time of ripening and coloring, which, in the Ives, is much earlier than the other."

It has also been attributed to the Concord and other seed. Its parentage can never be certainly known, and hence we must take it as it is. Its history (since its discovery and the distribution of cuttings to the gentlemen named) is this: Mr. Waring, "who is a cultivator of grapes," first made wine of it, but was, on the first trial, not very successful. So vigorous was its growth, so excellent its habits, that he multiplied his vines. "Dr. Kittredge, his neighbor, also, about the same time, made wine of it; his grapes being fully ripe." Eminent success attended the Dr.'s experiment, as his wine proved to be a red wine, similar to a fine Burgundy. This seems to have confirmed our Cincinnati grape friends, so given to wine-making, in their estimate of the value of this grape.

Mr. Waring, in 1863, had two acres in fruitage, and Mr. Graham informs me that "the two acres, in 1863, 1864, and 1865, suffered very little from rot or mildew, and produced 450 gallons of wine to the acre, *in those seasons when the Catawba and other grapes were a failure.*" Here I take occasion to say, that I would not have the American or European reader of these pages suppose, because certain writers at Washington, Philadelphia, Cincinnati, and elsewhere, constantly make *mildew* and *rot* the *test of value* in a grape, that therefore all our citizens necessarily have the same rule. I live in the Cayuga valley, where *rot* in *red* grapes does occur to some, and at times to serious, extent. But mildew is never to be complained of. Such are most grape regions in this country, so entirely free, that wherever mildew is named, the *bias* of the writer's locality must be taken into consideration as an exception to the general rule. But the resistance of Ives's Seedling to the evils of the Cincinnati locality is high praise of it, as it promises to become, at no distant day, *their wine grape.* The wine made of Ives's Seedling "in 1864 sold for $4 50 per gallon." The vintage of 1865 was worth more. "Wines of Catawba and other natives were not worth more than $2 per gallon" at the same time.

Description.—Ives's Seedling is a large, dark purple or black grape, growing in a medium to a large bunch, beautifully compact and neat in its appearance. It contains much sugar and a fine, high aroma. The vine is very vigorous, "the stock strong, and producing canes of one-year's growth sometimes twenty feet long." The leaf is hardy and resists the attacks of insects and disease. General appearance resembles the Hartford Prolific, but is more free in its growth, and earlier, prolific, and more profitable.

George Graham, esq., whose words I have quoted so often, says: "I have analyzed this wine, which is a very popular wine with the Germans of our city, and consider it one of our best native wines. The wine of 1864 contains 13½ degrees of alcohol. The must in the press-room averaged about 86 degrees. The wine is a beautiful claret color, delicate in flavor, and by many considered equal to fine Burgundy." Such being its character, by the testimony of such gentlemen as I have quoted, this vine will be widely diffused and proven. A permanent red or claret wine is not a common American wine. Our northern wines, whatever their color, easily lose it in the second fermentation. A real claret grape will fill a wide gap in our grape demand.

MILLER'S SEEDLINGS.

Next we name the seedlings of Samuel Miller, esq., of Camdale, near Avon, Pennsylvania. I had supposed the mountain-protected lands of Lebanon county, Pennsylvania, peculiarly favorable to the grape. But in writing to Mr. Miller of the entire freedom of vines in central New York from mildew, I said that a vine in the Cayuga, Crooked lake, or other valleys of New York, seriously injured or entirely ruined by this disease, would be a curiosity; he replied, "I have it by the cart-load." Such being the unfortunate locality of Mr. Miller, on the latitude of mildew, the seedlings he has raised deserve the more notice by every one; and he the credit of perseverance, as well as of being one of our best seed planters of the vine.

One of the seedlings raised by him, less generally valued, but quite diffused everywhere, is

THE LOUISA.—This was grown from seed sent to Mr. Miller by Mr. Longworth, of Cincinnati, Ohio. It is considered by most as a mere common Isabella. It certainly *is an* Isabella. Its value is realized only in those places where the common Isabella fails to ripen to the delicious excellence which it attains where the writer lives. Where no Isabella will ripen, it is, of course, a failure. Where the common Isabella is in its prime, it is not specially needed. But in that midway region I am pointing out, it is an acquisition, and good everywhere.

Description.—Louisa is a large grape, on a quite large bunch, more shouldered than the common Isabella, and its pulp less and sweeter. Well ripened and cared for, it is a choice grape. The vine grows far more freely than its parent, the Isabella, with larger and stouter roots.

MARTHA.—This is probably the best of Mr. Miller's seedlings. It was obtained from Concord seed in the following manner: Soon after eating the Concord, for the first time, Mr. Miller found himself reasoning in his own mind, "if such a grape could be got, as Mr. Bull says, 'in the second generation' of a wild fox-grape, will it not go on and improve still more?" He saved and planted seed. Five plants survived the second year; were transplanted into good but unprepared ground, set about six feet apart, staked, and numbered I, II, III, IV, and V. In a few years numbers I and II bore a few berries, which "tasted good." The next season number I bore a crop that was admired by all who saw it. Number II bore a few berries, as it has since continued to do, but no sufficient crop; and on that account I fear it is not worth propagating. Number IV also bore that year, and was a large, excellent black grape. Since that time numbers III and V have fruited. Number III is a white grape which promises well; number V a black, late grape, resembling, in color and shape, the Concord, but three weeks later than its parent, and of course not as valuable. They have been named—No. 1, *Martha;* No. 2, *Eva;* No. 3, *Macedonia;* No. 4, *Black Hawk;* No. 5, *Young America.*

MARTHA, I named after Mrs. Miller, of Camdale, Pennsylvania. It is large in its berry and bunch, more shouldered than the Concord; pale yellow, with a delicate bloom; few seeds, and these small, no pulp worth the name, and, as many exclaim on eating it, "sweet as honey," with a fine spicy aroma; perfectly hardy and healthy. It is, in a word, a white Concord, with all the excellencies of that grape, with merits of its own. Such being the case, its diffusion must be very extensive. It has, as yet, been proven in but few places, but those have further confirmed its value. No white grape on the whole list of American grapes stands as high in its reputation as this. If in the vineyard and garden, east and west, it sustains its reputation, then at last we have a white grape worthy the name; for the Rebecca, good as it is, is a mere dwarf in its growth; the Lydia, vigorous but comparatively tasteless; the Cuyahoga, one of the finest imaginable clusters, but late and insipid; the Spencer, small and flavorless; and others with equal faults. But Martha seems a tough, hardy, vigorous, sweet, early grape, just suited to the broadest domain of our grape lands. Its wine is also praised; for at the east, though the Concord makes a fair wine, we have yet to see a bottle of the highest wine excellence. Martha makes a delicate white wine, with aroma enough to be called by its admirers "superb." The vine loads itself with its fruit.

EVA.—This is No. 2 of Mr. Miller's five Concord seedlings. It is a white grape, admirable in quality. If Miss Eva will only become prolific, and decorate herself with fair and full clusters, she will have a name; if not, she is lost irrevocably.

MACEDONIA.—This is No. 3 of Mr. Miller's collection. It is said to be a large, early, fine white grape, less vigorous in its growth than the Martha, but promises well. This completes the white grapes of Mr. Miller.

Ephraim Bull, esq., of Concord, Massachusetts, and several other gentlemen, have also white Concord seedlings. They will confer a favor if they also let them be known.

BLACK HAWK.—This is Mr. Miller's No. 4. It is a large, black grape, fully equal in size to the Concord, its parent, and "a week earlier, and much sweeter." Its bunch is large, berry nearly round, vine perfectly hardy, remarkably vigorous, habits unexceptionable. It has the remarkable peculiarity that its leaf is so dark a green as to appear almost black. So far it has proved to be a Concord, with the Concord leaf intensified, a Concord grape slightly enlarged, and much improved.

If this latter sentence be true, then no more need be said. The Concord is one of the very best, if not the best, of all our grapes; and a grape larger, earlier, and sweeter cannot be praised—it can only be had, eaten, and enjoyed.

CUYAHOGA.—This grape is perhaps better known than some of those I have just named. It comes to us from Cleveland, Ohio; it has received, perhaps, too much praise. It is a medium-sized white grape, on a medium bunch. It is, when fairly grown, one of the most beautiful clusters of any of our grapes. I cannot call it either early, very hardy, or sweet. It is moderate in growth. For latitudes where No. 2 of Rogers's, Young America of Mr. Miller's, and other later grapes, will ripen, it will ever be a favorite for its graceful bunch and delicate berry. As I have seen it, it is very prolific. I have seen canes perfectly loaded with its charming fruit.

NORTON'S VIRGINIA.—This is an old grape, too old to be properly placed in this list, were it not that, accidentally, it has been recalled from the tomb of discarded grapes into which it was, for some reason, cast. It is reputed, probably without good reason, to be a seedling of Dr. Norton, of Richmond, Virginia, introduced about 1840, and hence, if it had value, should have had its merits tested long ago. Not until it fell by some means into the hands of the German vineyardists at Herman, Missouri, did its true value come to be appreciated. The results of its culture there have been extensively announced by George Husman, esq., residing in that place. He considers it one of our best grapes for the value of its wine, as his statistics show. If any objection is to be made to his conclusions, it is in the fact that these Germans are slow to test new grapes, and some of our other valuable wine grapes they never have tried to any reasonable extent, in comparison with it. His figures are such as to show that none of their vines compare in quality, or productiveness and economic value, with this one. He says he received it by a few cuttings sent him by Samuel Miller, esq., whose name I have mentioned so often in this article; that he grafted it on a Catawba, and that he and a neighbor grew, each, one cutting on its own roots. This was his commencement; that it proved so valuable, that at the present time, no grape has such "immense" loads of fruit, or equals it in flavor, sweetness, and wine aroma.

The true history, doubtless, is, that Dr. F. A. Lemosy, of Richmond, Virginia, about 1836, while on a duck hunt on Cedar island, of the James river, (a rocky isle, four miles above Richmond,) found a wild grape, sweet and pleasant to eat His son and himself for several years picked its fruit. They told Mr. John Carter and Dr. Norton of it. Mr. Carter cut off the top for propagation. Dr. Norton transplanted the root of the vine. Proving valuable, it became known. Founded on facts like these, Norton's Virginia is now being eagerly sought for, largely planted, and much wine made of it.

Description.—It is a small black grape, round, on a long stemlet. Bunch long, straggling, and very graceful, sometimes shouldered. Pulp feeble, too harsh in most places for the best table grape. When well ripened in a good soil it has a finer bunch, much sugar, and an aroma that is pleasing in its wine. It is hardy, rapid in its growth, full and constant in its loads of fruit, excellent foliage, and its vineyard qualities give it its reputation; and extensive tracts of vine-lands may be found where it will be the most valuable grape that can be grown. It is worth trial and testing everywhere, in those places in which it will ripen.

OTHER NEW GRAPES.

In the hands of several gentlemen are the Diana-Hamburg, crosses of the foreign Black Hamburg on the Diana, and with the marks of both parents in the offspring. At least three independent parties are reputed to have made this hybrid. It is said to be a far sweeter and larger grape than the Diana, though retaining its compact bunch, and much of its flavor. Like Rogers's excellent and valued hybrids, its seeds give both red and black grapes.

Several gentlemen have also made the hybrid of Concord-Hamburg in like manner. At least two such have promise of large size and fine aroma, with the hardiness of the Concord.

Several seedlings also are arising that are yet little known, but whose value will, without doubt, be greater than some kinds now well known.

Did time and space permit, it would be a pleasure to me to state what I believe is the level at which some older grapes now stand, as proven by the experience of a few years past. For example, Rebecca. This, I believe, is demonstrated to be a grape that, in fair, unstimulated growth, in places where mildew never prevails, by fair, honest vineyard treatment, is a fine yellowish white grape, growing in a loose and not very perfect bunch; and on a vine so little disposed to vigorous growth, that it needs to be set three or four feet apart in the row, and rows six feet from each other, and rarely covers a trellis over three feet high. It is a sweet, delicious grape where I reside, and with such culture may be profitably made a vineyard vine. It is in this manner—and not by excessive praise, or culture in beds of manure trenched deep in the soil, in a style wholly impossible to be had or done everywhere—that the true value of any grape is to be known. A grape or a vine that will not grow in good, moderately strong soil, on which vines have never been raised, and bear remunerative loads of fruit wholly without manure, is hardly worth classing among the best grapes to be grown in that locality.

Speaking of excessive praise, I have no doubt that the best American grape ever produced may be so commended that no intelligent mind can otherwise than receive it suspiciously. When a writer ignores good grapes, and misuses his competitors, he casts grave doubts on his own favorites. We believe that while the grapes we have named may perhaps not prove the best we have, their claims should be fully and fairly tested; and they *may* prove to be the very best we have on our lists. What we need more than all else is, not excessive and exclusive praise of any one grape, but fair, lucid, honest statements of the qualities of every grape. He who proves and impartially states his results is ever to be commended.

So, too, we need that those who have grapes little known should plant a few acres and fairly test them, both for the table and for wine. We cannot safely buy or trust the fruitage of one, two, or half a dozen vines, petted in their care, grown on the south side of a house or barn, and in the richest compost the owner can command. But field culture, without shade or favor, with little or no manure, in pure air and sunlight, and with a thousand vines, will develop what is in a grape.

In conclusion, let no one think the selection I have made for description is to their neglect. I have no favorites. I would gladly describe any other really good vine. It is the fault of the owners or of the grapes that they are not known. I hope, if life is continued, to extend this list of grapes whose dawning or proven merits are so great that they call for examination by every one interested in grapes. Letters of inquiry unanswered, vines hidden under their own bushel, is my reason for not naming three or four others which I have reason to consider very well worth culture.

FRUITS AND FRUIT TREES OF THE MIDDLE STATES:

THEIR

PROPAGATION, INFLUENCE OF STOCKS, DISEASES, AND ENEMIES.

BY WILLIAM C. LODGE, CLAYMONT, DELAWARE.

The experiments of centuries have failed to establish any rules by which varieties of our standard fruits, the apple, pear, peach, cherry, and plum, may be perpetuated with certainty from the seed. Seedlings often reproduce themselves for two or more successive crops, particularly when the seed is of the wild stock, or possesses its chief characteristics. Or, in case the tree is completely isolated from the pollen of other varieties, its kind may be perpetuated from the seed; but the inclination to vary or "sport" from the parent is so decided, that all who plant with the expectation of good fruit use grafted or budded trees. It is well known that seedlings from our best and most highly improved varieties depart more widely from the original than those from inferior grades, while the young trees evince less vigor, and decline at an earlier age.

The French and Germans have, of late years, repeated an almost exhaustive series of experiments toward determining a system by which excellence may be obtained with certainty from fruit seeds. Their experiments, though failures as to the object proposed, have proved the fact that some one or more seeds in every perfect fruit have a stronger tendency towards perfection than other seeds in the same specimen, and that, while such seeds as produce in their first crops inferior fruit to their parents continue to deteriorate with every successive planting, the others continue in the same ratio in the improving course. It has also been proved that trees grown from the improving seeds bear fruit at an earlier age, with every successive crop of trees, while those grown from the deteriorating seeds require, with every crop, a longer period of growth before showing fruit. The natural inference from this fact is, that the better kinds endure a shorter period proportioned to their age before fruiting. Such, however, has not been shown with certainty to be the case.

The experiments of the celebrated Belgian pomologist, Van Mons, with the pear, prove the different tendencies of seeds from the same specimen fruit. He, however, instead of carefully selecting only the few improving seedlings from improving parents, planted *all* the seeds of such varieties as exhibited the improving tendency, and continued planting thus through eight successive generations. He found that in the eighth generation his best kinds fruited at the age of four years, while those of an opposite tendency required a much more extended period to bring them into bearing.

The results of these experiments established the fact that the better kinds are more likely to produce good fruit from the seeds than the wildings. Indeed we have never known good fruit to spring at once from wildings with crab tendencies. Excellence is progressive, while in some cases the opposite, from good to worthless, is accomplished in a single generation. This, however, is more particularly the case in budded or grafted fruits, the seedlings seeming to follow the type of the original stock rather than that worked upon it. It is true that many of our best varieties are accidental seedlings; yet, for all we know to the contrary, they may have attained their excellence by a course of gradual improvement, going on unnoticed for an indefinite time.

Change of *locality*, in case the soil or climate, or both, be different from those in which the parent grew, produces great changes in the seedlings. Trees of the same variety, planted in different localities, often produce fruit quite dissimilar.

Fruit will deteriorate in quality, and the trees become less enduring and more uncertain bearers, from being grown successively in the same ground. Many of the finest varieties have become, in the early settled districts, so worthless through this cause, that their culture has been wholly abandoned. Removed to a new locality they flourish as finely as ever. In the year 1848, the father of the writer sent some Rambo apple trees from his residence in Delaware, to a farm just cleared from the woods in Indiana. He has since received specimens of their produce, so perfect in size, color, and flavor, as scarcely to be recognizable as the same variety with those grown here, from trees planted at the same time, and procured from the same nursery.

BUDDING AND GRAFTING

are now universally resorted to when varieties of highest excellence only are required for planting. Budding is performed with most ease, greatest certainty, and least injury to the stock and future tree, when it is but one year from the seed or slip, or so soon after as it becomes of sufficient size for the operation. As a general rule, budded trees attain a greater size, live longer, and grow more symmetrically than grafted trees, unless the graft be inserted in the root, when it will grow about the same as a bud, other conditions being equal. The insertion of a bud does not check the growth of the stock, nor is the tree cut or bruised in the operation so as to leave a scar that may ultimately become diseased and interfere with its thrift. Budding is performed in the latter part of summer or early autumn; grafting, in the early spring; therefore, should the bud fail, we may resort to the graft without loss of time.

Stone fruits are generally budded, and seed fruits grafted; though cherries are often grafted and do well. The peach, plum, nectarine, and apricot rarely succeed when grafted, though they grow readily from the bud. The apple and pear grow and flourish equally well from bud or graft. A graft will grow more vigorously than a bud, and come earlier into bearing. Large trees are grafted, both because the process is more expeditious, and less time will be lost in fruiting. On trees that have been some time in bearing, a graft will sometimes fruit the next season after insertion, often the second season, though such early bearing is injurious to the future growth and vigor of the tree.

STOCKS FOR FRUIT-BEARING.

When the natural stocks of the apple, cherry, peach, or pear cannot be easily procured, or where the soil is unsuitable, or when it is desirable to dwarf the tree so that it may occupy less space, or to bring the tree into bearing sooner than it would fruit upon its own roots, other stocks, or roots of a different character, are used with advantage. For the apple, paradise roots and the white thorn may be used; for the cherry, the mahaleb; for the peach, the red plum; and for the pear, either quince, thorn, or apple.

THE INFLUENCE OF STOCK

upon the fruits of budded or grafted trees is not yet fully understood by our first scientific pomologists. Many fruit-growers do not take the stock into account further than as a passive vehicle, through which the sap is drawn by the leaves, giving it no share otherwise in the elaboration of the fruit. While we admit the general rule, that fruits are produced most perfectly on their natural roots, we know there are modifying circumstances which render different stocks preferable. We have observed that, with successive plantings, some quality of the soil essential to the well being of either fruit or tree, or both, becomes exhausted; that frequently the first generation of trees endures longer, bears more abundant crops, and fruit of better quality, than succeeding generations planted in the same ground, under the same circumstances. The peach may be succeeded by the apple, and the apple by the pear, and each kind produce healthy fruit upon healthy and vigorous trees. But plant either peach, apple, or pear, for three generations successively, and the result will be a great deterioration in the quality of the fruit, a decrease in quantity, and a shortening of the life of the trees. It therefore becomes necessary to substitute, so far as practicable, other roots different from the natural one, if we wish to continue to grow good fruit upon the same ground.

On the principle that the vigorous growth of the tree is at the expense of its fruitfulness, and, on the other hand, that prolificacy interferes with a vigorous growth, we understand that to work a strong growing scion upon a weakly stock will bring the tree into fruiting at an early age. But why the stocks should hasten or retard the period of ripening, or how it changes the color, flavor, or size of the fruit, is not so easily shown. We know that a few of our best native varieties of the pear, when grown upon the quince, are more perfect than upon their own roots, and that most of the superb foreign varieties can only be successfully grown by us on quince stocks. All we know about the cause is, that the quince roots give out a more meagre supply of sap, so affecting the growth of the tree that it becomes and remains a dwarf. It is also thus brought into bearing at an earlier age, producing larger and more certain crops of perfect fruit, while the want of complete harmony between stock and scion has a tendency to shorten the existence of the tree. All our standard fruits can be grown with more or less success upon other than their own roots.

THE APPLE,

our hardiest, most useful, and most enduring fruit succeeds better on its own roots than any that can be substituted for them, in most localities. The white thorn has been used with advantage for the codling and a few other varieties, and beautiful dwarfs can be formed by working the apple upon paradise stocks. But for orchard culture we prefer the natural roots, which may be more easily and cheaply obtained than any others. Such, however, is not the case with the favorite fruit of the middle and northern States—the rich, delicious

PEAR,

whose grace of form, beauty of color, and high flavor, render it only second to the peach, while the hardiness and great endurance of the tree, and the little care it requires to perfect its annual tribute of fruit, as well as the high market value of the same, make it the most profitable. It will adapt itself to every variety of climate, and although it delights in a heavy or clay soil, it will do well in any soil where its roots do not come in contact with too much water.

The pear is, however, difficult to propagate from seed, and requires a longer period before bearing than any other fruit; hence the scarcity of young trees, and the comparative high prices they command at the nurseries. For this reason, chiefly, different stocks are so commonly used on which to grow the pear, though many other advantages result from the use of stocks of a different character from its own.

In the early settlement of the country very few pear stocks could be obtained, and various experiments were tried on the haw, apple, and thorn with partial success. The thorn proved to be the best adapted to the purpose, and several old moss-grown trees planted about the year 1710, on the farm of the writer, have borne fruit until within a short time. The thorn here used is the large variety known as the "apple thorn," which bears a berry about the size of a small red plum, and is quite palatable. The thorn gives longevity to the tree, while it detracts from the flavor of the fruit. It has generally been abandoned since the quince has been introduced in its stead.

The apple is rarely used to give roots to the pear. In a few instances, however, the effect of the apple roots upon the pear has been astonishing. Mr. Perkins, of New Jersey, in experimenting with various stocks, used the scion of a superior variety of the hedge pear, thick-skinned and late in ripening. On apple roots he found the pear grown to more than twice its largest size on its own roots, and when carefully picked and house-ripened, proved to be the finest winter pear, being a fine orange color, with tender flesh, exceedingly rich and juicy. We have seen specimens weighing over a pound, perfectly free from blemish or fault; and being so pleased with the fruit, we worked it upon some old standard trees, from which we now gather large annual crops of hedge pears! We have since worked it upon both apple and quince, and await their fruiting with interest.

Since the introduction of the quince for pear stocks, all others different from the standard roots have gone out of general use. The variety of quince proved most suitable is the Angers, a foreigner, now so perfectly naturalized that pears are grown upon it in the highest state of perfection. It is readily propagated from the slip, which may be laid in the spring, and inoculated with the pear in the autumn succeeding. It becomes a dwarf tree, and commences bearing in its third or fourth year from the slip. By a system of pruning it may be grown into almost any shape or size desirable, fitting into corners or angles, or flower plat, or any out-of-the-way spot on which the sun occasionally shines, always proving both useful and ornamental.

THE CHERRY

delights in a heavy soil and a high and dry locality. For many years after the first settlement of the country the favored home of the cherry was the "Delaware Highlands"—a tract between Wilmington and Chester, where the hills sweep down gently to the river's edge, and catch the first warm rays of the morning sun. The markets of Philadelphia and New York were, for more than half a century, supplied with cherries from this locality; and well-grown trees of improved varieties have been known to represent a capital of from one to two hundred dollars each, in the transfer of real estate, the produce of the trees averaging thirty to forty dollars each, annually. John Brown established his nursery and fruit farm here about the year 1780, and the noblest cherry, pear, and apple trees now standing in the neighborhood are of his planting. Generations of trees have since been planted and have passed away, while these veterans still flourish in their pride and beauty, and yield annually large crops of superior fruit. While the old trees preserve a uniformly healthy habit, young trees of the same variety, even when budded from these, become diseased—the bark of the branches cracking and leaving great black ruptures, which affect the growth and finally destroy the tree. This we now remedy by working the cherry on the mahaleb stock, which brings it earlier into bearing, and, like the quince, has a tendency to dwarf the tree. By judicious pruning, the mahaleb may be equally adapted to dwarfs or standards. When pruned from the roots upwards, good-sized trees may be formed, almost rivalling the cherry on its own roots; while pressed from the top downward, it may be shaped into a dwarf of any requisite size or form. The cherry is now on the decline with us.

THE PEACH

has become the most important as well as the most profitable fruit of Delaware. For many years we enjoyed the monopoly of the best markets in the middle or eastern States. The Messrs. Reybold planted thousands of acres, and their fruit was justly considered superior, and accordingly commanded everywhere the highest prices. They freighted steam and sailing vessels for every important market within reach, embracing even those of Canada, on the St. Lawrence. The size attained by the trees, and their enormous crops, astonished all who visited them. It was supposed by many that the cultivators possessed some secret which enabled them to grow both better trees and superior fruit. Their secret was suitable soil and climate, and thorough cultivation. Failures were unknown in the orchards first planted, and it was not until the second orchards were in bearing that any deterioration was noticed in the quality of the fruit, or failure in the health and vigor of the trees. The second planting produced uncertain crops of inferior fruit, and the trees endured only half the period of those of the first planting. After the second crop of trees the decline was so rapid that peaches were rarely grown in the locality, except on plum stocks.

The orchards of Messrs. Reybold were located near the centre of New Castle county. Peaches were previously grown quite extensively in the northern part of the State, and the adjacent districts of Pennsylvania; but they had run out, while the Reybold orchards were in their prime. At the present time the finest peaches taken to the New York and Philadelphia markets are grown in the vicinity of Dover, (which occupies a central portion in the State,) and in the extreme northern section of the State, where for many years their cultivation was wholly abandoned.

What is known as the "peach district" is not confined to any one locality or neighborhood for more than a single generation of trees. It is progressive, moving from the north toward the south at the rate of about fifty miles in twenty years, when it again returns by a single leap to the place of starting. In other words, peaches are grown with complete success only after the ground has rested for a period of about twenty years; it having been found that intervals of such length are necessary, in order that the soil may become perfectly disinfected from all injurious qualities imparted to it by diseased trees, or that it may fully recover those peculiar constituents exhausted by the growth of previous trees.

The peach, when it fails upon its own roots, may be grown to a limited extent on the roots of the plum. We have heard of large crops being gathered from such orchards; but our own experiments with the plum stocks have not proved satisfactory. They may answer in a more northern locality, where the plum flourishes and the peach fails; but in our congenial climate and suitable soil for the peach, we have not found such substitution of general advantage. The peach will outgrow the plum stock, and, when in full foliage, the high winds are apt to break it off at the place of junction. This may be avoided by budding below the surface of the ground; but in that case the borer will select the tender bark of the peach, where it unites with the plum, and at once girdle the tree. The plum stock gives the peach a deeper color, while it detracts somewhat from the flavor and renders the flesh more coarse. This may be accounted for from the fact that the sap of the plum starts later in the spring, and ceases to flow earlier in the autumn, than that of the peach, thus shortening its natural season and giving the fruit less time for the perfect elaboration of its juices.

THE APRICOT AND THE NECTARINE

are budded both on peach and plum stocks; but owing to the destructive attacks of the curculio, we seldom obtain a perfect crop of either fruit, unless when grown under glass. We have noticed that, like peaches, the plum stock gives the fruit a deeper color than when grown on peach roots, though the flavor is not perceptibly changed by its influence. The apricot is liable to injury from late frosts, as it blooms so early in the season. We have found it a good plan to set the trees on the north side of a wall or building, so that they may be shielded from the rays of the sun while the frost is upon them.

THE GRAPE

may be grafted either in the root or the extremities, though success is uncertain, owing to the thin bark and porous quality of the wood. Large vines are sometimes grafted by cutting them off at the ground and boring holes in the stump, in which are fitted the scions with the bark on them. The soil is then drawn up and pressed about them, leaving only the top bud uncovered. The other buds, if any, can strike root and assist in the growth of the vine. Seedlings make the best stocks for grafting, as they are furnished with better roots than slips or layers.

It may be here remarked that grafting is most successfully accomplished when the stock and scion nearly approach each other in general character, as the Catawba and Diana, the Isabella and Concord; while there is little sympathy between the more highly improved varieties and the common chicken or frost grape, and none whatever between the best kinds and the ordinary wild, sour grape.

THE INSECTS

injurious to fruit and fruit trees are not numerous in variety, but so destructive as to render fruit growing a precarious business in many parts of the country, and even to cause the cultivation of many kinds to be wholly abandoned.

The *caterpillar* is hatched in the early spring from a collar of eggs deposited around a branch the preceding summer by the mother butterfly. It begins to feed upon the tender leaves of the apple and some other trees as soon as they appear, and increases in size and capacity for destruction with the growth of the foliage, destroying it as fast as it grows. When numerous, it has been known to strip whole orchards of their leaves, thus destroying the fruit crop for the season, and sometimes proving fatal to the trees.

The *remedy*, however, is efficient and easily applied. In the early morning, while the dew is on the foliage, sprinkle fine air-slaked lime freely over the tree. The caterpillar will drop almost as soon as touched by the subtile dust, or perish while holding to the leaf. The same remedy is equally efficient in regard to the *thrip* of the grape leaf, and the *slug* that depastures upon the foliage of the cherry.

While the caterpillar is depredating on the leaves of the tree, the *borer*, a more subtle and dangerous enemy, is often at work at the roots.

The *borer* is the larva of a brown beetle, striped with white, which, like a thief, seldom shows itself in the day-time, but flies about at night in the early summer, and covertly attacks the tree near the surface of the ground, where it makes a small hole in the bark, deposits its eggs, and trusts to nature to hatch them into life. The young worm feeds at first upon the tender bark, until, growing larger and stronger, it strikes into the "pith of the matter," eating away the wood of the apple tree, so that it may fall before the first puff of wind, or die standing on its mutilated roots. This pest is also particularly fond of the quince, which can only be saved from it by closely watching. When the pear is worked upon quince stocks, it is necessary to set the roots below the surface of the ground for the security of the tree; otherwise, it will be sure to girdle the stock where the two woods meet.

The *remedy*—the only *sure* remedy we know—is the knife, and a pointed instrument to impale it in its holes. An application of ashes has been recommended as a cure; but we have tried it, and found that it destroyed both borer and tree. Coal ashes or lime, applied judiciously, may be a preventive; but so also is the earth drawn up around the trunk and pressed hard, so that the butterfly cannot penetrate it. Better than either is a small piece of oil-cloth tied tightly to the trunk of the tree, and drawn down to the ground where the lower parts are covered with earth, to prevent the insect reaching the bark.

The *bark-louse* is a less formidable enemy than either caterpillar or borer. It attaches to the young and smooth barks of the apple and pear, sucking their juices and retarding their growth, until, finally, it destroys the tree altogether if not removed. A single washing with strong soap-suds will generally clear the tree of them, and restore its vigor, if attended to in time.

The *apple-worm* and the *curculio*, or plum-wevil, affect the fruit only. The first enters at the blossom, and feeds at the core of the apple, causing it to fall prematurely from the tree. The curculio is a small brown insect that stings the young and tender fruit, depositing its egg in the flesh of the plum, nectarine, or apricot, where it soon hatches and commences, in the larva state, to feed upon the fruit. It is so destructive that a tree loaded with young fruit will sometimes not have a single specimen left to arrive at maturity.

Remedies and preventives, in great numbers, have been tried with only partial success. Bottles, half-filled with sweetened water, are sometimes hung in the tree, and captivate a few. Spreading a cloth on the ground under the tree, and then jarring the tree while the insect is partly torpid with the cold, in the early morning, will cause many to fall, when they may be easily destroyed. Strong-smelling herbs, such as tansy and elder-leaves and blossoms, or other nauseous matters not agreeable to the olfactory nerves of the insect, are hung among the branches, in hopes the insect will give them a wide berth. But the best preventive is to dust the trees with sulphur or lime when wet with dew. This method will sometimes keep the insect from the fruit if applied in proper season, taking care to renew the application whenever the rain washes the dust from the leaves and fruit.

DISEASES.

Both fruit and fruit trees are subject to so many diseases that, frequently on this account, and in consequence of destructive insects, a good and full crop is not gathered during the whole life of the tree. We will mention a few of the most fatal, and give such remedies and preventives as have been found beneficial.

The apple is such a hardy fruit, and the habit of the tree so uniformly healthy, that we know of but few diseases to which it is subject, and those are not of a fatal character. The most serious is that known by the general name of *blight*, which affects the terminal branches and destroys the crop for the year. The cause is attributed by some to the sting of an insect—by others to frost; but being involved in uncertainty, the remedy is likewise uncertain.

The pear is also subject to the *blight*, which assumes a more dangerous form than in the apple. The disease begins with the early summer, and first appears in the extremities of the branches, from which it extends rapidly toward the trunk, causing often the speedy death of the tree. Sometimes its strength is expended before the destruction of the tree is completed, and it may partly recover. It is indicated by a shrivelling of the bark upon the branches, and withering of the leaves which still adhere to the affected branches. Such trees as continue a vigorous growth late in the autumn are most subject to the disease, and, consequently, fertile soils and thorough tillage have a tendency to encourage the malady. The disease is contagious, and young trees in the immediate vicinity are liable to be affected if not attended to in time.

Remedies have been tried, though not always with complete success—such as washing the parts affected with ley; also, Downing recommends a solution of copperas and diluted muriatic acid. But the *sure* remedy is to cut off the branches at once below the part affected, and burn them. This will be a certain cure, provided the cut is made at a sufficient distance below all external signs of the disease. Sometimes the sap is vitiated below the part in which the effect is apparent, and the disease breaks out again.

Black knot.—Except in a few favored localities, the plum is, of all stone fruit trees, the most liable to disease. Its peculiar malady is the black knot, which is an eruption of the branches, causing an excrescence like great, unsightly warts, and so interferes with the flow of the sap as to cause the death of the branches beyond the place affected. The black knot, like the pear blight, is attributed to various causes, the most probable of which is a disease of the sap imparted from either the soil or atmosphere; as healthy trees, removed to a neighborhood where the disease is unknown, are not affected. The disease seems to pervade every part of the tree, and shows itself as virulent in the young trees which spring from the stump of the affected tree as it was in the parent. Of all the remedies yet recommended, we have not found any one effectual, though we believe a proper application of a solution of salt would preserve the health of the tree, and prevent the destructive attacks of the curculio on the fruit. The difficulty is in the application without injury to the tree.

The cherry is also subject to a disease which shows in the rupture of the bark, though the wartlike excrescences are not formed as on the plum. Like the sap blight of the pear and the black knot of the plum, the certain cause and remedy have not yet been determined. Some varieties, as the Black Morello and the English Morello, are subject to the black knot similar to that on the plum, and, as in regard to the plum, we candidly admit both cause and remedy are to us unknown.

The yellows.—In the middle States, where the peach arrives at the highest perfection, it is subject to but a single disease, and that, when fully developed, is of a fatal character. It is known as the *yellows*, and when young trees are grown from the seeds of diseased fruit, it sometimes shows itself in seedlings one year old. In most cases it is not noticeable until the tree has borne one or two crops of fruit, when it is indicated by slender, erect branches starting up from the larger limbs, a general sickly appearance of the tree, and a dull color of the foliage. The fruit also becomes discolored, and so changes from the natural taste and appearance of the variety as not to be recognizable as the same. When first attacked, a single branch only is sometimes affected; but by the following season it spreads over the whole tree, which struggles feebly for life for a season or two, producing small, immature, and flavorless fruit. The yellows is a contagious disease, and is imparted to other trees by contact or propinquity, as well as by a knife used in pruning trees affected, from buds taken from infected trees, and from the soil in which such trees have grown.

Remedy.—As a remedy, we have known iron filings and scales from around a blacksmith's anvil, placed about the roots, at the rate of a good shovelful or more to the tree, to have a good effect. An application of hot wood-ashes about the roots, so that the ashes come in direct contact with them, will prolong the life of the tree; but the best preventive and cure is an application of Peruvian guano, sowed around the ground and harrowed in. We have seen old orchards, apparently worn out, revived by this application, which have borne fruit for many years after. One of my neighbors has adopted the plan of throwing fell (air-slaked) lime over his trees about the time the curculio deposits its eggs, and of sowing guano in his orchard every spring, with most satisfactory results. His crops are unfailing, and the life of his trees extended to more than double the age of others in his immediate neighborhood.

We believe we have discovered a sovereign remedy for nearly all diseases of our fruit trees, as well as for the destructive insects, which so frequently destroy our fruit after it has given promise of satisfactory crops. It is nothing more than common salt. We have experimented with it on bushes and young trees, with admirable effect in many instances, though sometimes with injury, owing rather to the manner of application than the agent employed. Its application was first suggested to us as an insect destroyer, from the success of an experiment made upon the tree-moth. We found it altogether effectual in preventing injury from this troublesome pest, and so we extended our experiments, with almost equal success, to the fruit-destroying family of pests. The difficulty is in the proper application of the remedy or preventive, as salt is so injurious to tender vegetation that, frequently, we cannot reach the insect without also touching a bud, blossom, or tender leaf. Where the atmosphere is impregnated with saline particles, nearly all our troublesome insects and most of our diseases of fruit trees are unknown. The most perfect fruit of the peach, plum, nectarine, and apricot, and the most enduring trees, are found in the neighborhood of salt water. On the higher lands, along the Delaware and Chesapeake bays, all stone fruit trees bear plentiful crops, and endure much longer than in the interior. On the islands of the bays where the shores are washed by salt water, we have found peach and plum trees with their loads of fruit in such perfect condition as we have never seen elsewhere. Of the many plum trees we have examined in those localities we have yet seen no trace of black knot, nor any sign of the curculio on the fruit. Peach trees flourish and bear annual crops at the age of fifty, and in some cases seventy years, and on the islands of the Chesapeake the figs produce two or three successive crops of perfect fruit in the same season.

THE NATIVE FRUITS OF THE FAR WEST.

BY R. O. THOMPSON, NURSERY HILL, NEBRASKA.

While producing many varieties of fruits by hybridization of those already in cultivation, and the importation of others that seem suited to our soil and climate from abroad, the wild fruits of the far west should receive the attention of those who feel an interest in the horticulture of our country. There are many varieties which, when cultivated, will occupy a prominent place in the pomology of North America.

The wild plum, *Prunus americana, P. umbellata, P. chicasa,* and some twenty-five other varieties, are found upon the banks of the several Nemahas in this Territory. In early spring the eye can wander over hundreds of acres of these plums, one sheen of white flowers covering the entire landscape; and the air is laden with their sweet fragrance. They are found with leaves pinnate, doubly serrate, smooth, long, round; smooth above, downy beneath. Trees of straight, trim growth, ten to twenty feet high; others three to four feet, mere shrubs, but each year bearing their loads of delicious fruit. Fruit of all colors and all forms that the prune family assumes—deep red, purple, pink, deep yellow, orange, salmon, blue, green, and others almost white; the green and white varieties are almost invariably shaped like Coe's Golden Drop; and some of them are much larger in size. The yellow have more the form of Columbia and Washington; the other colors are formed like Purple Gage. All the varieties, except the red and one or two others, part readily from the stone. Where there are such immense groves of these plum trees, and millions of the young fruit set each spring, it must not be supposed that the eternal enemy of the plum, the curculio, is not to be found; here it is that their numbers may be called legion.

Something over four years ago my attention was directed to a thrifty group of these trees, by finding the branches literally loaded with very large fruit, while all others were pretty effectually thinned out by the "little Turk." The fruit of these same trees has each year, since that time, withstood the attacks of this insect, and the bearing has been equal to many of the cultivated varieties. The skin is tough, not very thick, and may be pared like an apple. The flesh is firm unless very ripe, then melting and juicy. The tree, foliage, and fruit, all show a wide difference from the other native plums of Nebraska, Iowa, or Illinois. Pruning and cultivation improve size and flavor. Scions have been sent to several experienced nurserymen in the eastern States to test their qualities. When grafted upon their own stocks they require very close working, as the bark is quite thin.

As a stock, to bud or graft the plum, apricot, or peach upon, there is no better; as is evidenced by the fact that eastern cultivators, who have tested them, have sent here for their stock for the past two years. Their extreme hardihood, and their free union with the cultivated plums, will make them valuable to the fruit-grower. When grafted upon the root of this plum in winter, by setting time there is a perfectly smooth callous formed at the junction, as in apple-root grafting. A tree on my grounds, three years from the seed, bore eight hundred perfect blossoms; the same tree was pruned to an even round head, 3½ feet high from the ground.

A variety with greenish white fruit has never ripened but one year in four, the fruit being green and hard when the severest cold of October came on. When picked in the fall, after the hardest frost, before the ground freezes, and put away like pears, they ripen readily. One tree that bears a round red plum, a little larger than a cherry, has invariably borne double fruit.

There are three varieties of the gooseberry indigenous to Nebraska. One, the *Ribes cynosbati*, a variety with prickly fruit, is of no value whatever as a fruit for man; when ripe, even birds seldom disturb it. Two other varieties are found. One bears a berry long, large, and of a deep green color, quality not first-rate. The other has been named the Nebraska prolific gooseberry. It stands two to four feet high; canes thickly set with long thin or slim thorns of a purple color; leaf very much resembling the Lancashire varieties; fruit larger than the Houghton, veined, and of a clear transparent green; nearly round, flattened very little at the ends, and possessing a rich, vinous flavor. Single specimens have been found nearly an inch in diameter. In the past four years I have examined thousands of bushes, and never found mildew upon any of them.

A form of the *Rubus occidentalis*, called here the Western Black raspberry, grows along our streams and in woodlands; fruit one-third larger than the American Black Cap, where it is cultivated, the canes making a much stronger growth. Specimens sent to Pennsylvania three years ago have borne fruit, and fully sustain its superiority. *Rubus strigosus*, found in but one locality in northern

Iowa, and called the Elisdale raspberry, is a valuable acquisition; fruit very large, bright red, with light bloom, very sweet and rich; canes grow ten to twenty feet in a season; is quite hardy. This was first introduced to my notice by H. A. Terry, of Crescent City, Iowa.

Ribesia.—There are three varieties of the currant found wild in Nebraska, none of them being of any size or flavor; but I have four varieties, found in Utah, which will compare in quality with any of the kinds in cultivation. The black and red kinds from there have borne fruit with me one inch in diameter. The white or yellow and the blue are not so large or of as good quality as the former. A lot of seedlings are showing some peculiar forms of hybridization. I received cuttings of the Utah currants from some half dozen sources; only one lot was of any value, and they were improved seedlings selected from about ten thousand plants. All of these mountain currants possess the peculiarity of being adapted to very dry soils, and make heavy crops where our cultivated kinds would scarcely fruit at all.

GRAPES.—*Vitis labrusca, V. æstivalis, V. cordifolia,* and many curious forms of hybridization, are found here in plenty. One or two varieties have been taken from their wild state and cultivated. They possess good wine qualities. The wine, at two years of age, is much the flavor and color of Oporto. All of these grapes are perfectly hardy. There are no varieties here that possess enough good qualities to be called "table grapes." Some seasons many hundred gallons of the above-named wine are made from the native grape growing wild along all the water-courses. Such wine sells readily at from $2 50 to $3 per gallon.

The leaf and flower of the various forms of our native grapes are a study for the botanist. A few years ago I received a letter from a gentleman of New York, much interested in fruit-growing, concerning a "tree grape," of which he had been informed by parties who had seen them on the arid plains or in the passes. It would not be out of place to state here that this grape was said to be of enormous size, and to grow upon a small shrub. I have found, by careful search, that no such grape exists there, and that what was probably taken for such, and is equally strange, is a cherry of the size of a well-grown May Duke, very sweet, melting, of rich delicious flavor, nearly oblong, and of a changeable brown purple. This fruit is set in heavy clusters, on long stems, beneath the leaves, and upon a tree never more than one to two feet high! At two years from seed it produces a most bounteous crop of these rich and luscious cherries. It is so hardy here, in N. latitude 40° 39′ 43″, that the tips of the branches were not even killed last winter in our coldest weather. It layers as readily as the grape; will grow from cuttings and single eyes. It ripens in September. The fruit, foliage, and growing shoots, all have a waxy or varnished appearance. I have a number of these miniature cherry trees that bore fruit the past season. Had they no other qualities to recommend them than as ornamental shrubs, there would be few finer ones; but add to this a most rich and luscious cherry, and we have a shrub of rare excellence and beauty. Plants of this dwarf mountain cherry will be sent the Department of Agriculture, to test its quality and adaptability to that soil and climate.

AMERICAN FORESTS;

THEIR DESTRUCTION AND PRESERVATION.

BY REV. FREDERICK STARR, JR., ST. LOUIS, MISSOURI.

THERE are few subjects so closely connected with the wants of society, the general health of the people, the salubrity of our climate, the production of our soils, and the increase of our national wealth, as our forests; and yet no considerable interest of our country has received so little attention at the hands of the people, and enjoyed so little of fostering protection from the government.

It is my intention in this article, by a simple array of important facts and a few passing suggestions, to call the attention especially of our landholders, farmers, and mechanics to an impending national danger, beyond the power of figures to estimate, and beyond the province of words to express. If I can influence these classes but a little; if but a few facts shall be added to the present knowledge possessed by each; and if, therefore, but a slight effort be put forth by every one of them, the aggregate of interest, intelligence, and action thus obtained will be immense. There were in the United States in 1860, 2,044,077 farms under cultivation. Could each farmer, having timber on his own land, be led by the facts presented to so husband his trees, or improve their quality, or replace judiciously and speedily those removed, as to equal one-half acre of common forest each year, and if those whose lands are destitute of timber could be led to plant the equivalent of one-half acre per annum, we should either save or produce, annually, 1,022,038 acres, which would be something towards offsetting the destruction, and warding off the coming desolation.

It is feared it will be long, perhaps a full century, before the results at which we ought to aim as a nation, will be realized by our whole country, to wit: that we shall raise an adequate supply of wood and timber for all our wants. The evils which are anticipated will probably increase upon us for thirty years to come, with tenfold the rapidity with which restoring or ameliorating measures shall be adopted. Every hour, therefore, is precious. We have, as a nation, far too long disregarded this interest. Growth is slow and restoration tedious, while destruction is rapid and injury instantaneous. Delay, therefore, is both cruel and disastrous to ourselves. Attention is, therefore, respectfully invited to the following statements:

EVILS OF PAST DESTRUCTION.

1. *A great increase in the cost of fuel.*—In all our cities and large towns the consumption of fuel exceeds the production of the neighboring country. It is brought from a distance, and its transportation makes its value enormous and onerous.

The railroads consume great quantities of wood, and exhaust the supply along their lines. Steam-engines, for manufacturing purposes, are not erected in hundreds of places, simply because of the high price of fuel. The expenses of every class in the community are thus increased, but it especially oppresses the industrious poor. It diminishes their comforts, gives them imperfect cooking, injuriously exposes their health, holds them back from a competence, and, in mere defence of life, consumes a large fraction of their earnings which else could have been used for education, purchasing personal effects, or securing for their families a home.

When the proprietors of mines will sell coal only to certain favored dealers in cities and towns, and when great railroad companies refuse to carry coal for any persons except these same dealers, their monopoly reigns supreme, and then only the presence of wood in considerable quantities can save the people from extortion, or from absolute suffering.

In any region, hamlet, or city where fuel is dear, the scarcity proves itself a detriment to happiness and an injury to business.

2. *A great increase in the price of lumber and timber.*—This hinders the erection of dwellings. A poor man now labors years longer to obtain the means to build a house than he did ten years ago to erect one equally convenient, valuable, and spacious. Years of his life and toil are thrown away simply to meet the enhanced price of lumber. The growth of our cities is retarded by it; small and often uncomfortable tenements are built where larger, more substantial and costly ones would have been erected. Landlords not only charge high rents, but make the expensiveness of building an excuse for unjustifiable exactions. Tens of thousands are thus discouraged from becoming freeholders. The costliness of lumber also makes furniture very expensive, so that our countrymen must purchase poorer and less elegant articles than the same money would otherwise provide, or consume means they need for other permanent uses.

3. *High rates of fares and freight charges on our lines of travel and transportation result from the increased cost of building and equipping steamboats and railroads.*—Ships now cost, as regards their main material, fully double the expense a few years since. The increased price of lumber used in the superstructure of a railroad for its depots and for freight and passenger cars has added much to the capital upon which they must make dividends, or the bonds upon which they pay interest. The enhanced value of fuel also increases the expenses of running the road, while, worse than any of these, the force and time required to move coal for the consumption of the people along the line of the road, and to convey fuel for the use of the road itself, diminishes the capacity of the road for other business, consumes machinery and labor, and interferes with more legitimate commerce. In the winter of 1864 and 1865, on the line of some of the New York railroads, the people in the villages and cities were without fire in their houses awaiting the transportation of coal, while the perishable products of farms by hundreds of car loads were lying in the depots for weeks and months awaiting transportation, and shut out from market at the most eventful times. On all the great carrying lines of our country, whether by steam-car or steamboat, this question of fuel has become one most important and vexatious as regards quantity, ease of obtainment, and price.

Among the things which are most fundamental to a nation's material growth and prosperity, we name these four—cheap bread, cheap houses, cheap fuel and cheap transportation for passengers and freights. A nation which produces the raw material for every species of manufactures and commerce, and that at low cost—whose people provide their own houses, and raise all they consume—which can move its people, its products and manufactures, quickly and cheaply, is in a condition to establish the most complete division of labor, and to give to every man the results of his abilities, energy, and skill. Such a nation must prosper. Its people will save and accumulate immense sums from their respective earnings; and this question of wood enters largely and constantly into each one of these four great departments of industry and living.

INCREASE OF DESTRUCTION.

The older portions of our country are, even now, drawing their supplies of lumber from the newer States. For black walnut, and some other woods used in cabinet manufactures and in carriage-building, the eastern States are already sending to Michigan and Wisconsin, while tens of millions of dollars' worth of pine are brought about two thousand miles from our upper lakes and the head-waters of the Mississippi to our Atlantic and Gulf seaboard. Foreign nations, also, are consumers of our forests. Oak and pine are exported by us to other countries for purposes of house and ship carpentry. A single gun factory in Europe, during the first two years of the rebellion, consumed 28,000 walnut trees to supply gun-stocks for the American market. This fact will give some indistinct idea of the consumption of lumber in great factories of cabinet ware, where the amount of wood required for the smallest articles exceeds that required for the stocking of a musket.

In the State of New York alone, within the ten years from 1850 to 1860, there were brought under cultivation 1,967,433 acres of land hitherto unimproved. As there are scarcely any lands in the State of New York naturally untimbered, it is probable that during those two years more than 1,500,000 acres of what had been (or was then) timbered land, was cleared for purposes of lumber and agriculture. Thus, 500 acres of land were changed from wood-bearing and timber-growing, each day, for 300 days each year, through that period of ten years, into farming lands.

During the same ten years more than 50,000,000 of acres in our whole country were brought under cultivation. But these improvements were especially made in Iowa, Kansas, Minnesota, Wisconsin, Illinois, Indiana, Ohio, and Texas. These States, to a greater or less extent, are dotted with prairies, or suffer from a scarcity of timber; many prairie farms were, therefore, taken up. But bear in mind, that every man seeking a prairie farm desires, in his selection, to secure small streams and as much timber as possible upon his farm, or near to it; so that, while the reckless waste which attends new clearings in forest districts has not existed in the case of these prairie farms, their owners have wonderfully diminished the very scanty supply, even while they have dealt with it with an economy almost penurious. We will allow, then, for unwooded country brought into cultivation two-fifths of the whole, (which is probably more than twice as much as was the fact;) this will leave three-fifths of the 50,000,000 of acres brought into cultivation, or thirty millions of acres, which were lands either previously or during those years heavily timbered. Assuming, as before, 300 working days in each year, 3,000,000 of acres were thus, each year, lost to tree-growing, or 10,000 acres each day.

In all regions remote from a market, and where logs and lumber cannot be readily exported, no matter how grand the forests, how excellent the timber, the trees are killed by girdling, and left to stand until overthrown by their own weight or by storms, and are then consumed by fire, yielding in return for their displacement only ashes to act chemically upon the soil, the fire often injuring the earth itself far more than the value of the ashes returned.

The land thus stripped of forests is permanently alienated from timber-growing. In many places in the eastern States, where the mountains are too precipitous and rocky to allow of cultivation, a second growth of timber is permitted and even cherished for firewood and the making of charcoal; but arable lands, once cleared, are scarcely ever permitted to be overrun a second time with forests. In fact, destructive man so utterly robs and impoverishes his lands of timber that he destroys the beauty of the landscape, and beyond the fence of his "wood-lot" leaves no shade for man or beast.

Increasing population swells these evils. Between 1850 and 1860 our population increased 8,080,785. It is now advancing at the probable rate of over one million souls per annum. The consumption and exportation of lumber in the United States, in 1860, was $37,390,310 more than in 1850. The ratio in this increase in population was but 35.59 per cent., while the increase in lumber was 63.09 per cent. This shows that the demand for wood for agricultural, mechanical and domestic purposes (notwithstanding all the use of iron in manufacturing useful implements, and the use of iron, stone and brick for bridge and house building) increases each year with the advance of the nation in age and wealth.

If for twenty years to come the demand for lumber shall advance in the same ratio to the population as in the past twenty, more than two hundred millions of dollars' worth of *American sawed lumber* will be needed each year, and the same ratio in increase of population, which has called the fifty millions of acres into use in ten years, will then be calling it in the rate of more 100,000,000 of acres each ten years. Our native-born and foreign population will have farms, lots and houses, fences, furniture, vehicles and agricultural implements; but every year they will impoverish the United States more and more of her lumber, and all these things will demand a higher price.

The great State of New York still holds pre-eminence as furnishing more lumber than any other State; but as long ago as 1850 it reached the maximum of its ability to furnish lumber. With the enhanced price of 1860, as compared with 1850, that State produced about one million of dollars less of lumber in 1860 than in 1850; while the State during those ten years increased her population 783,341, she diminished her supply of lumber almost one million of dollars each year. Five other States in this Union also diminished their supplies of lumber during those ten years. Some of the newer States are developing their lumber interests; but our whole country (aided by foreign nations) is using up the products of their forests very rapidly.

Speaking of New York, the completion of the new railroad from Saratoga springs northwestward, called the Adirondac railroad, and traversing the vast wooded region known as the "John Brown Tract," will, a few years hence, bring a great amount of lumber into market, which has hitherto been inaccessible. But it is doubtful whether even this will equal the amount of destruction which will, in the mean time, take place in other sections of the State. The black walnut has almost wholly disappeared from the State. The wild cherry and cucumber tree are great strangers, the hard maple and hickory in some sections are nearly gone, while entire counties, formerly heavy with hemlock and pine, can with difficulty supply now and then a farmer with a knotty sill for a small barn; and the opening of the mountainous Adirondac region, it is feared by many, will so let down the cold and storms of the northeast upon central and western New York, that, in the effect of the bleakness upon human health and the destruction of grain crops by intense cold, every foot of lumber secured therefrom for commerce and industry will cost double its value in the injury to other interests.

CONSUMPTION BY BUILDING RAILROADS.

The average cost of sleepers for one mile of railroad is one-eighth the cost of the iron, with these points of difference: the iron, if of the best quality, will last from twenty to twenty-five years, while the sleepers will last but from five to seven years, unless chemically prepared at a great increase of cost. Decayed sleepers are worthless, and are thrown away or given to the hands on the road for firewood. But, on the other hand, bruised, broken or split rails can be rewrought, and come a second time from the rolling-mill with little waste, and even of better quality than when first made. The mere cost of rough timber for sleepers will probably, in time, prove to many of our railroads an expense greater than the first cost of the rails, even including the keeping of the iron rails in repair.

Between 1850 and 1860 there was built in the United States 22,204 miles of new railroads. New timber was required for all these. But for nearly 8,589 miles of previously existing roads there was needed, during this period, for the replacement of old timbers, more than the amount necessary for their first construction. So that there was used in that time 65,897,020 pieces of timber, costing, at the low average of thirty-five cents a piece, $23,063,957. But, besides all this, there were building and not yet brought into use, on January 1, 1862, about 17,827 miles of new road, for all of which new sleepers were needed. When it is remembered that these sleepers are generally sound hemlock, chestnut, and especially oak; that trees are selected to make them of a size just sufficient to furnish one or two sleepers only, (the tree being simply hewn on two sides, and having the heart entire,) the destruction of choice timber just approaching a size suitable for sawing is immense.

The lumber used in fencing their lines of railroads, (more than 60,000 miles,) and in erecting bridges, depots, station-houses and cars, is also a great item, to which we have but limited means of approximating; and leaving it we will notice—

CONSUMPTION FOR RAILROAD FUEL.

It is estimated that one and three-quarters cords of wood are equivalent to one ton of coal, and on an ordinary train will drive the engine twenty-five miles. Let us call the New York Central railroad three hundred miles long, (the length of its direct trunk,) and let us assume that an equivalent of only ten trains, passengers and freight, pass over it every twenty-four hours. This will give us a total of twenty trains each day. Let us now account for only three hundred days in each year, which will allow for floods, accidents, snows and Sabbaths, and we have the distance travelled by the trains 1,800,000 miles. For each twenty-five miles there is consumed, at the ordinary estimation, one and three-quarters cords of wood, making 126,000 cords per annum, which is supposed to be by one-third less than the amount actually burned by them. In the fall and early winter of 1864 and 1865 the runs on this great road became very irregular, as the supply of fuel fell short, owing to the high prices demanded by the farmers. The engines of this road were made for burning wood; unable to obtain it, or compelled to burn it green, the company were forced to burn coal in their engines, and for many weeks the trains were irregular, freight accumulated, and many splendid engines were badly injured. Energetic agents were sent back into the country, and by offering high prices, and making great exertions to supply the road, in mid-winter the trains began to resume their regularity. When the devastations of the forests have continued another generation, the New York Central railroad, now just about twenty-five years old, will be obliged to buy its fuel and have it brought to it, or else own its own mines, and build a branch road to them, and distribute coal for its own use through its entire length. Already the "Onondaga Salt Company," with the Erie canal and all its branches to bring its fuel, cannot depend upon the wood of the State, but has purchased its own mines in Pennsylvania, and carries all the fuel for its immense works more than one hundred and fifty miles.

If we should average all the roads of the United States, and assume that only ten trains each day pass over each road, (including passenger, freight, extra-repair, wood and paymaster's trains,) we should have in the whole United States 307,930 miles travelled daily, demanding a daily consumption of 21,555 cords, or, in 300 days, 6,465,500 cords.

Many great steamships, steamboats, founderies, rolling-mills, and factories of every description, also many families, use coal entirely for their fuel, and the coal interest is becoming one of the most important in our land.

The census of 1860 gives full statistics of coal, while in the compendium for 1860 wood is mentioned only in a table of sawed lumber. In the compendium of 1850 the only mention of wood is as follows: "Cord-wood on the bases of 1840, $20,000,000." It is thought, with the increase of navigation, manufactures and population between 1850 and 1860, that the cord-wood actually sold by producers to actual consumers and railroads could not have amounted in 1860 to less than $50,000,000, while the total of all the coal mined in the United States in 1860 was but $19,365,765.

GENERAL CONSUMPTION OF WOOD FOR FUEL.

We are to remember that, in the occupations of men, the farmers furnish their own fuel. The farmers number in this country 2,423,895; while the next most numerous class is but one-tenth as many, to wit, *carpenters*, men who live by working upon forests—these number 242,958. The blacksmiths number 112,357, clerks 184,485, merchants 123,378, miners 147,750, shoemakers 164,608, tailors 101,866, teachers 110,469. When we come to count what are denominated laborers, there are but 969,301 "common laborers," while, besides the 2,423,895 farmers proper, there are 795,679, farm laborers. Remembering that farmers produce their own fuel, and often use it with great freedom, it is probable that the total consumption of wood for fuel in the United States will cost at the lowest estimate upwards of seventy-five millions of dollars per annum.

CONSUMPTION BY MECHANICAL INDUSTRY.

There are sixty-six occupations enumerated in the census which depend, in whole or in part, upon lumber or wood as their raw material for manufacture and commerce, employing a total of artisans of 476,623 souls, representing in their families, probably, more than 2,000,000 persons. We will enumerate a few of them: Carpenters, 242,959; coffin-makers, 7,000; cabinet-makers, 29,223; chair-makers, 6,341; sawyers, 15,000; millwrights, 9,063; ship-carpenters, 13,379; coopers, 43,624; wheelwrights, 32,693; piano-makers, 2,378; coach-makers, 19,180; and thus proceeding until sixty-six classes are specifically named. But there are others whose callings are very intimately connected with the use of wood and depending upon it, not at first sight occurring to the mind as their occupations are named. There are charcoal burners, 203; lime burners, 1,456; brick-makers, 13,736. How intimately are these trades connected with the entire destruction, the use, and the manufacture of wood. All the occupations to which we have alluded are such that as our population increases, and the national wealth becomes greater, more persons will be demanded to labor in each, and the necessity for wood will become hourly more pressing. But we must not tarry.

DESTRUCTION BY WAR.

The destruction of forests and timber during the war of the rebellion has been immense. Both armies, the Union and the rebel, have destroyed it. Much has been ruined by accidents; it has been removed for military purposes, both by the axe and fire; it has been taken to supply fuel for the armies, to erect fortifications, to hinder the movements of the enemy, and to open the country for military movements. Timber, whose value had been enhanced by labor bestowed upon it, was also destroyed—as the sleepers from torn-up railroads, large and costly bridges, and dwellings and outhouses consumed by fire. Then the relaying of railroads, and rebuilding of bridges and dwellings, wherever this has been done, demands a new supply. We are told that native Virginians, in some sections of that State, are removing, because the war has swept away the timber; and, for the same reason, emigrants decline to go into some of the finest parts of the State as regards the soil.

The general government, in its grand and sudden expansion of our navy, has almost stripped some of the best sections of the whole country of its very best timber—the white oak—which has gone to the navy yards and contractors' docks in untold quantities.

IMPROVIDENT WASTE.

Men, in their haste to get their land under cultivation, girdle and burn vast tracts of the most magnificent forest, while they could, with the greatest advantage to the crops, and the general health and the beauty of the country, leave every field with a fine belt of timber, from two to eight rods in width, surrounding it on every side. The disadvantages which men imagine to result from the shading of their fields are, by most beautiful compensations of nature, both in summer and winter, more than twofold made up to them in blessings and profit. So thoughtless and reckless are men in opening up their farms, they do not even have forethought to select the knoll and save the forest where nature indicated should be set the future house. That very spot is bared of its trees, and at length he sets his house upon it, large, imposing and costly, and twenty years later he finds himself beginning to enjoy a meagre artificial shade, prepared with long toil and heavy expense.

DESTRUCTION FOR LIQUIDATION OF FARM DEBTS.

When wood commands a high price, and farmers can sell it, and, by removing it, can put in a larger breadth of grain, also commanding a high price, their covetousness leads them to cut and sell as long as one stick remains on the farm more than just enough to keep up the fences poorly. This course also degrades the quality of our forests. First, the trees suitable for sawing fall; then those which can be hewn; then those choicest for firewood are culled out, and the forest becomes crooked, gnarled, and composed of comparatively worthless trees, the grander and more valuable species having been utterly extirpated

REPRODUCTION PREVENTED.

Many, with great labor, have cleared out the underbrush, and have seeded down their woods, to make noble parks, or to procure range and pasturage for their cattle. They do look beautiful, smooth, and pleasant to the proprietor himself and every passing stranger. But is it well? Others, in time of drought, or to save a little pasturage or fodder, turn their cattle into their woods. Thousands of young trees are eaten, or torn up by the roots, while other thousands are broken down and trampled to death; and in a few years the new forest is nearly destroyed. In some of the European countries this practice is forbidden by stringent laws, and punished by severe penalties.

The fruits of the best nut-bearing trees, as the population increases, are more in demand by the squirrels and the children, for their own uses, or by those who supply the demands of commerce. So that some noble trees that would do all in their power to propagate themselves, annually shower upon the earth bushels of nuts; and yet, at the end of a generation, cannot show one plant in vigorous growth as the result of all their generosity and labor. The coopers' trade, meanwhile, beyond any other, penetrates the most thrifty forests, and gathers the choicest saplings by millions. It is a common sight at St. Louis to see the freight trains on the Pacific railroad enter the city with from one to four platform cars loaded with hoop-poles, to the top of stakes six feet above the platform of the car. This is a new road, but a few months completed, and the woods furnish a fresh field for this devastation, to last, however, but a very few years ere all will be exhausted. But the farmers, as if determined to make the destruction of the woods complete, in many instances turn their swine into their woods, not only to root up and trample what plants were left by the cattle, but also to devour the last stray kernel of mast that remains.

PREVENTIVE MEASURES PROPOSED.

Can anything be done to check this destruction? and how? Call the attention of all owning forests to the methods of economizing their timber. Encourage them to permit none of the more valuable kinds of timber to be removed until it has reached a fair maturity, remembering that each year's growth is greater than any preceding year's accretion. A sapling ten feet in height and two inches diameter may add in one year a ring of wood one-third of an inch in thickness, and may increase its slender top by four feet of additional height; the amount of wood actually grown for that year will be equivalent to a strip of board one inch thick and two inches wide at the butt, and one inch square at the top, and fifteen feet long. But thirty-five years later, when it shall have acquired a diameter of two feet, when it shall stand eighty feet in height, let us see the speed with which it makes lumber. Assume the diameter of the coat of wood deposited to be one-quarter of an inch, and we have for a single year's growth, by averaging the height and diameters, the equivalent of a solid plank *ten inches wide, two inches thick, and forty feet in length.* Timber which stands well located in the forest, with suitable room, and which is making vigorous growth, should, by all means, be spared as long as possible. The timber which is evidently worthless for purposes of usefulness and manufacture should be removed and used for fuel.

A vast mistake exists in the minds of men as to the relative values of different woods, as to their ability to produce heat. Certain kinds of wood are preferred by the purchaser because, when he has to pay for preparing and handling wood to burn, he wishes it as solid and as lasting as he can obtain it. But the lower rates at which he may obtain other wood than hickory and hard maple may, on examination, prove to him that it is economy even to buy, prepare, and use a greater quantity of other kinds. I therefore introduce a few facts from the carefully and exactly compiled tables made by Marcus Bull in his experiments upon American woods. His ninth table shows "the value of specified quantities of each wood, as compared with shell-bark hickory as the standard, and marked 100." Out of forty-six different woods of trees and bushes experimented on, only *five* stood under *fifty*, or were of less than half the value of shell-bark hickory; these were Lombardy poplar, white pine, pitch pine, Jersey pine, and white birch, which stood respectively as follows: 40, 42, 43, 48, 48. Hard maple, generally considered as next in quality to hickory as fuel, was found to have a value of *only sixty.* There were eighteen of the varieties of wood experimented on which were more valuable, foot by foot, than hard maple, ranging from 60 to 80, while white oak and red-heart hickory marked 81, chestnut and white oak 86, and pig-nut hickory 95. Many of the small growing trees, oftentimes cut and burned in the clearings, were found among the best heat-producing woods.

In removing trees let a view be had to the protection of the remaining forest, taking those decaying and liable to fall, and those that have become insecure and are liable to be uprooted by violent storms. And care should be exercised in felling trees, not only to facilitate the removal of the logs and wood, but also to save the breakage of the remaining trees. And by all means entirely exclude domestic animals from the woods. Encourage the farmers of our land also to study the cherishing and reproduction of their timber. Let the trees of the least value be cut out for wood, and thin out the poorest of the trees where they stand too thickly. Take away large branching and yet indifferent trees where the woods are sparse, and set young trees and plant nuts of valuable varieties in the area thus opened, and let the sunshine and the air *start them together*, that they may grow thriftily and advantageously. As a nation, great ignorance and stupor exist among our farmers respecting this subject. If the 2,240,000 farmers would each give but one hour of real thought to this subject, and then practice upon their own thoughts, the result would profit this nation tens of millions of dollars.

Our farmers should consider the ultimate pecuniary benefit of such a course for themselves, and their children after them, both in the better incomes from their farms and their greater value to their families if in time they should be sold. We are cutting down too much of the timber and removing the extended and grand instrument which God uses in nature for greatly controlling the extremes of temperature and moderating the violence of ærial disturbances and inequalities of all kinds. Cutting off timber to raise grain will, when carried *far enough*, change those rich grain fields to moderate grass lands. The lesson of the goose that laid the golden egg should check our thoughtlessness and lead us to save our timber, and even produce more, and cultivate with greater care and thoroughness the present fields.

NATIONAL SCIENTIFIC EXPERIMENTS NEEDED.

Let extensive, protracted and scientific experiments in the propagation and cultivation of forest trees be established. In European countries vast sums have been expended, and years—yes, *lives* of eminent men have been spent in observation and experiment upon this subject. Laws have been passed protecting the forests from injury by cattle and from depredations by wood thieves, limiting the amount of wood which may be cut, and requiring men to plant trees. But this knowledge is of comparatively little advantage to us. The books are mostly written in foreign languages; they are, to a great extent, scientific works, and would not be suited for general use and instruction, even were they translated in the most scholarly manner. The climate, soil and trees of Great Britain are dissimilar to ours, to so great an extent that the works written there would be inapplicable to our vast area, with its great extremes of latitude and its great changes of temperature. Our country, in the general excellence and variety of its timber, exceeds Europe and demands that we should study and learn for ourselves what our country can do for its native trees, and what our trees can do for our country. The pursuit of thorough knowledge involves the use of so much time, and the expenditure of so much money, that when a nation is as ambitious of material progress, and as eager for gain as ours, study on this subject, as an individual pursuit, will be wholly neglected. This subject should receive the immediate attention of our government, and enjoy its fostering care. No private efforts, however expensive or extensive, would so much impress the great mass of the people with the immediate and pressing importance of action as to have Congress make some movement worthy of a subject so grand, and an interest so vast. There are certain objections against the government attempting such experiments itself, and directly under its own authority and inspection. It would need to be added to some department already existing, and overloaded now with the oversight of other great and varied interests. The experiments ought to be carried on in sections remote from the seat of the general government, and would need the appointment of agents and overseers, who would serve simply as appointees, and not because they were drawn to the work by their natural tastes and their high estimates of its importance. The experiments, to be of any value, must be continued through several presidential terms; and in the continual changes occurring in the various departments of government, no one person would be permitted to control these experiments, to carry out to completeness thoroughly digested theories and test them in actual practice, and to avail himself of his own experiences, knowing which to truly condemn and which to approve. The liability would be a defeat, through incompetence or lack of interest in the men appointed to the work, from the short periods with which they would be connected with it, and the fact that they had no personal interest at stake in it except their salaries.

On the other hand, no company of men can, in the present state of ignorance, afford to buy lands, and then propagate trees at an expense of twenty to thirty times the value of the land per acre, and wait twenty years for the return of the money in fire-wood and lumber. Men must live—they need present money; they wish immediate income from their labor and investments. If in any manner the government could aid any competent corporation of able and scientific men, either by grants of money or grants of public lands, to assume a faithful and thorough fulfilment of certain definite and important experiments, made extensive enough and continued long enough to settle certain great facts—to determine certain sure methods of culture, and to place in the United States, within fifteen years, the art of sylviculture (or tree-growing) on the same basis as wheat-growing—to bring it to a forward and certain position, which it will not otherwise attain in forty years—then it ought to be done. The great objection to this plan is, that the government is dependent, to a certain extent, on the faithfulness, capacity or honesty of those to whom it intrusts this great work. If, then, the government, in the furnishing of means to such parties, could keep such a control only as should secure the faithful performance of the agreements made, and also make it for the ultimate personal benefit of those conducting the experiments to carry them to completion in the most perfect mode, the object would be probably obtained in the best, most satisfactory, and most economical manner.

Whatever course may be adopted in this matter, it is hourly assuming an importance with thinking men that will not permit it to rest. Action, for which in twenty years sixty millions of citizens will return devout thanks, is demanded, and it should be taken without an hour of unnecessary delay.

BEGINNINGS ALREADY IN OPERATION.

Every word that has been written, printed, or spoken in our country on this subject has been a blessing, and the author deserves public thanks. Every man who has experimented, to however small an extent, whether led thereto by his own necessities for trees, or by love for the employment, has been a public benefactor. Like the "cloud no bigger than a man's hand, just rising from the sea," an awakening interest begins to come in sight on this subject, which, as a question of political economy, will place the interests of cotton, wool, coal, iron, meat, and even grain, beneath its feet. Some of these, according to the demand, can be produced in a few days, others in a few months, wool itself in a few years, but timber in not less than one generation, and such as we are daily destroying in not less than five to fifteen generations. The nation has slept because the gnawing of want has not awakened her. She has had plenty and to spare; but within thirty years she will be conscious that not only individual want is present, but that it comes to each from permanent national *famine* of wood.

We should hail every movement in this direction of increasing interest. The State Agricultural Society of New York has offered last year, for the first time, a premium for the best acre of forest orchard. I have not seen the proposal, but think the amount is $200; and the only thing specified as required is that a given number of trees should be set out. All honor to that society in its noble beginning! Mr. Douglass, of Wisconsin, will long deserve the thanks of this nation for his patient and successful experiments in domesticating and successfully propagating in this country the European larch. Close by the region of native pine, so rapidly melting away, he is seeking to introduce and encourage the cultivation of the larch in all that region of country. May success attend him, and an abundant reward! In connexion with some of our colleges, and contemplated in the future by some of the agricultural colleges, and in some few instances owned by men of great wealth, are found arboreta, or gardens, or grounds in which are collected all varieties of trees which can be made to endure the climate; and sometimes the collections are extended so as to include many shrubs and trees which can be grown only under glass and with constant protection. For the advancement of science, for the use of the naturalist, the philosopher and the student, such collections are of great value, bringing the practical examination of these productions of nature within the reach of many whose time, circumstances, or means would not permit them to visit foreign countries. One of the largest and finest collections of this kind in the United States constitutes one department of the Missouri Botanical Garden, which is the property of a wealthy citizen of St. Louis, and is situated some two miles southwest of Lafayette Park in that city. These grounds are probably unsurpassed by any in the United States, either public or private, in their extent, their beauty, the completeness of the collection of plants, shrubs and trees, or the skilful cultivation and the lavish expense bestowed upon them. Although private grounds, they are thrown open to the public by their proprietor, Mr. Henry Shaw. Tens of thousands have enjoyed their beauty, many students have spent happy and useful hours there, and the effect upon the landscape gardening and the beautifying of yards and private grounds from this example has been immense. But the arboretum, which contains *one* tree of each known variety, does not meet the particular want of which we are speaking, though, as we have stated, their presence helps to arouse and instruct the nation. It is such governmental action as has been recommended, with such action as I am told has just been taken by the legislature of Kansas, which is to bring us relief, if it ever comes. The State of Kansas, to encourage the planting of trees, not only remits the taxes upon all planted forest, but pays annually, through a period of some twenty years, a bonus of one dollar an acre to the planter. To persons who think there are in our country trees enough this may seem a strange expenditure of money; but it will do more than any other expenditure to replenish the State treasury in all future time. The facts I have mentioned show that light is beginning to struggle through the darkness. Let the people, then, have immediate true, and reliable information, such as only such courses of experiments as have been spoken of above can give. They are ready now to receive it. Let them also have an opportunity to see what has been, and is, from year to year, being done at such propagating grounds and plantings. If this is done, there is no reason why arboriculture may not become throughout all our land as distinct a department of our agriculture, as well understood, and as certainly managed, as breeding, herding, wool-growing, dairying, or raising grain.

An effort is now being made with the government to obtain and diffuse intelligence on this subject. In the spring of 1865 a company, of which the writer is a member, was incorporated by the legislature of New York, under the name and title of the "American Forest Tree Propagation and Land Company." The said company, having duly and legally organized, have applied to Congress, asking a grant of public lands, the far greatest part of whose proceeds are to be expended in making the experiments; the remainder of the land, with the plantings thereon, to be the reward of the company. It may properly be questioned, why should they ask the government for such assistance? Why not carry forward the enterprise by individual energy and at private expense?

Let us then inquire, why government should aid such efforts? *The work is national.* Every part of the land suffers together. In the pineries themselves a man cannot now build for double what it cost a few years ago, because the demand for lumber, its increasing scarcity, and the price of labor control the price. It will take the man no longer to chop the logs, nor the mill longer to saw them; but all things have gone up in price; and (leaving out the fluctuations in currency and prices caused by war) there is no one thing in our land which has more certainly caused the present high rates of labor than the high price of fuel for all domestic and manufacturing purposes, the high rents for the industrial classes, and the high price of the raw material upon which nearly one-half million of our industrious, intelligent mechanics labor for their bread. Every citizen in this country is interested in this question, both directly and indirectly. Every one must have his house to dwell in, either his own or some other man's; every one needs his victuals cooked and his tea and coffee warmed; every one, for health of body, needs a genial fire in the inclement days of inhospitable seasons of the year.

Bernard Pallissy, the famous "Potter of the Tuilleries," who died in the Bastile for his religion in 1589, was one of the most profound men ever produced in Europe. He then plead for the wood in France as follows, (see G. P. Marsh, "Man and Nature," page 296:) "Having expressed his indignation at the folly of men in destroying the woods, his interlocutor defends the policy of felling them by citing the example of divers bishops, cardinals, priors, abbots, monkeries and chapters, which, by cutting their woods, have made three profits—the sale of the timber, the rent of the ground, and the good portion they received of the grain grown by the peasants upon it." To this argument Pallissy replies: "I cannot enough *detest* this thing, and I call it not *an error, but a curse and a calamity to all France;* for when forests shall be cut, all arts shall cease, and they who practice them shall be driven out to eat grass with Nebuchadnezzar and the beasts of the field. I have divers times thought to set down in writing the arts which shall perish when there shall be no more wood; but when I had written down a great number, I did perceive that there could be no end of my writing, and having diligently considered, I found there *was not any* which could be followed without wood." * * * * * "And truly I could well allege to thee a thousand reasons, but 'tis so cheap a philosophy that the very chamber wenches, if they do but think, may see that without wood it is not possible to exercise any manner of human art or cunning."

But there are many persons who, living in the near vicinity of coal, undervaluing the infinite uses to which wood is serviceable especially, smile at the idea that the coal can ever be exhausted, or that it cannot readily take the place of wood as an article of fuel. Now, there are certain simple and evident truths well to be considered. The more dependent the nation becomes upon the mines for its fuel, the more liable will be both the owners of the mines and the community at large to be oppressed by combinations and strikes among the miners. Already scarcely a year passes without such occurrences in the leading mines, producing anxiety and suffering to tens of thousands, and exacting unjust charges from all who are consumers. But again, the larger the regions denuded of lumber, and also destitute of coal, the greater the distances over which coal has to be transported. This enhances its price and increases the uncertainty of receiving a supply. Again, as the mines are worked longer and are sunk deeper, or are drifted further into the mountains, the cost of getting out the coal increases, while other mines will prove unprofitable and will be abandoned, and others will be utterly exhausted. An article in the London Times, as late as April 19, 1866, speaking of the duty of England to pay her national debt now, while in the zenith of her power, talks thus on the short supply of coal in that nation: "But we must look beyond this century. In THREE GENERATIONS—that is, in the days of our children's children—we are told that *all the coal of these islands that lies within four thousand feet of the surface will be exhausted if we go on increasing our consumption* at the present rate. Coal is everything to us. Without coal our furnaces will become idle, our factories and workshops will be as still as the grave, the locomotive will rust in the shed, and the rail be buried in weeds. Our streets will be dark, our houses uninhabitable, our rivers will forget the paddle-wheel, and we shall be again separated by days from France, months from the United States. The past will lengthen its periods and protract its dates. A thousand special arts and manufactures, one by one, then in a crowd, will fly the empty soil, as boon companions are said to disappear when the cask is dry. We shall miss our grand dependence, as a man misses his companion, his fortune, or a limb, *every hour* and at every turn reminded of the irreparable loss. *Wise England* will then be the *silly virgin* without oil in her lamp. We shall be surrounded and overwhelmed by the unprofitable lumber of buildings and machinery that we cannot use, and with cities we cannot occupy; for who will care to live in Manchester? Who will be able to live in the metropolis? It is not so difficult to imagine the state we shall return to, for it takes only a middle-aged man to remember it. They would be sorry to be called *old* who can remember large towns lighted with oil lamps, the first steam vessel timidly creeping along our shores or up our rivers, and the hardly credited rumor of a steam engine on a 'tramway.' But the process of learning will be slow, and neither easy nor pleasant. To be sure, as coal becomes scarce and dearer we shall learn economy. We shall warm our houses more scientifically and improve our machinery. But meanwhile our descendants will witness another process equally exhaustive; the *population* will follow coal wherever it is to be found, whether on foreign or on colonial soil. Our manufacturers will be beaten by those who then have this advantage over us, and the working classes will accept the invitation of the master that bids the highest. That is what they must do, for it is the law of existence. It is not easy or at all possible to forecast any point at which the various conflicting causes may fix the future of English labor, but we may as well expect a large population in Salisbury Plain, as a Manchester, a Liverpool, a Sheffield, or a Birmingham *without coal*, and *cheap coal, too!*" Such are the views so recently set forth by the London Times, asserting that the coal will be exhausted, that it will result in the prostration of British commerce and manufactures, and the ultimate depopulation of the British isles; and hence it urges the nation to pay its debt while this source of wealth and strength is still theirs.

Should not such words as these arouse Americans to the value of wood, which has a value in our nation of probably *four times* its value as mere fuel, and which, in the mere department of fuel, can do for all purposes except those of foundery and steamships upon their long voyages on the ocean, all that either anthracite or bituminous coal can do? Already the United States in its short period of existence has acquired a population equal to that of Great Britain, and all things would indicate that the nation, as regards population, is still in its infancy. We say, then, that government should regard this interest, because every person will be pecuniarily interested in it—it is national.

2. *Government should aid* in the development of this knowledge and science, because it is not remunerative to those who would do it privately. It will pay every man who owns a farm which has a scarcity of timber to begin, upon some systematic plan, the planting of trees, each year to invest some money and give a few days' labor, thus steadily, persistently, but with small expense and little derangement to his other agricultural arrangements, supplying this want. But if he will undertake to plant trees as an experiment for the good of others, and make this his first and main occupation, he will both fail in business and starve in person. While he could raise one tree to a size suitable for any manufacturing purpose, he could, from the same ground, have sent into market twenty crops of corn, wheat, grass, or hemp, or twenty shearings from his flock, cutting from the tenth generation of bucks and ewes raised by himself, or could have sent eight generations of fat beeves into the market. Not

only will those who undertake such a work as ought for the nation to be done be compelled to make a vast outlay of money, but they will also expend their time, and lose not only the interest of their money, but also the means of living from year to year. The time when farmers are most busy will be the very time when these persons will also be the most engaged.

The knowledge obtained, and impulse given to tree-growing, will be realized by future generations more than this; and as nations have lives extending over centuries, while individuals live but for years, the nation should reward its real benefactors while they live.

The waste portions of the republic will in time thus be reclaimed, a larger area be subjected to cultivation, a greater population maintained, and thus the nation in coming ages be increased in happiness, in numbers, in strength and wealth.

EXPERIMENTS SHOULD BE PROTRACTED, THOROUGH, AND VARIOUS.

There should be selected, with great care, suitable grounds, in various localities in the bounds of the United States, to be tilled and used as nurseries, in order that the best, surest, and quickest methods of propagation may be certainly learned; that all the debated questions, whether to propagate and transplant, or to plant and till where the trees are ultimately to stand, may be finally and truthfully determined; that the proper time in the season, and the best manner and the best age of the trees for transplanting, may be learned; that the kind and composition of the soils used in propagating, and the most promising soils into which to plant, may be all proved. The influence exerted by trees upon each other, as to their health and thriftiness, a subject of immense importance, and of which scarce anything is known, should be thoroughly investigated, and not respecting a few kinds of trees, but of all those whose size and peculiar qualities will make them valuable either as fuel or lumber. The state of the atmosphere, the temperature, the amount of rains, the presence and direction of winds, should all be accurately observed and registered, and their effects upon the propagating or upon the young trees should be noted. The quantities of seed planted, its previous preparation, the location and preparation of the beds, and the various methods of planting, together with all results, successful or unsuccessful, should be recorded.

When the trees are planted the experiments should be many and often repeated, at what distances they shall be set, whether in lines equidistant or in lines wide apart, but the trees standing close in the line or in lines arranged so as to cause the trees to stand quincuncially; also, to determine the effects of shade upon the growth of trees, and to study the arrangement of small and short-growing trees in artificial forests, to learn the effects and secure the power of sunlight and heat to all. Trees also should be planted in various forms, as wind-breaks, orchards, lines to defend fields or fruit orchards; also with the smallest species to the windward, and the rankest growing varieties on the leeward; also in long parallels, especially to test their effects upon important meteorological points, sought to be established thereby. These trees should be measured from year to year, and an exact record kept both of height and circumference, the extremes of each species being noted, and then the general average for the season determined for each kind.

Not only should the experiments embrace the trees of America, but some experiments should be made upon the domestication and propagation of some of the best European and other trees; and not only should our forests of America be planted as we find them standing in nature, in various latitudes and longitudes, but these should be mixed, and foreign trees intermingled with them.

An account should also be kept of the number of trees of each species annually injured by animals, insects, accident, storm, heat, cold and disease, specifying by which destroyed; also a full account of the cost of propagating, setting, and cultivating, not only in the gross amount, but by particular items, so that the knowledge may be reliable and exact for others.

A full annual report should be made of all the things tested by the experiments and sent to the Department of Agriculture, and, so far as may by it be deemed desirable, be spread through the country in the monthly annual issues of the department.

The writer, and others most conversant with the subject, think that the experiments should continue through not less than ten years of active labor, nor less than forty varieties of trees indigenous to this country be tested, nor the experiments be limited to less than 1,000,000 trees. Less than this would leave the work so feebly and slightly explored and accomplished that it ought to be done again. This, therefore, is the *very least* that the magnitude of the object can ask.

The cost, perplexities, risk, labor and study demanded for this enterprise is not conceived of by one person in 100,000 of our citizens; but a moment's consideration will set them on a correct train of thought. While the number of American trees worthy to be tested is about forty, but few of these, and those the most readily grown, are found in our ordinary nurseries. Trees such as should be grown to make these experiments of any value wholesale at from ten to twenty-five dollars per hundred, and retail at prices from twenty-five cents to one dollar each. Being almost wholly demanded for ornament, the call for them is very limited, and they are raised in the nursery in the same manner as other trees, in closely standing rows, and thick in the row. The soil is of the finest quality, and worked with great ease. No extra fencing is required, and when the nurseryman digs them up he transfers all further care of them to other parties. He receives his money for the work performed, to be again invested in the same manner.

In the case of such experiments as have been mentioned above the circumstances are wholly different. With the first moment's work commences an outlay of expense which will make no return under fifteen years, and then only as firewood. All the expense of making the experiments must be laid out before any income can begin to return. A railroad or a telegraph, or a ship company, almost from the beginning of their work commences receiving income; in such a work as this there is none. When the nursery work is far advanced, and the trees are ready to be removed, then the labor is but begun. New soil must be broken up to receive the trees, and it will require great breadths for this purpose. It is a great and costly labor to mark out and set 100,000 trees in a season. The new lands thus planted must be fenced either with wooden or live fencing, or the trees will be destroyed.

The trees must not stand, as in an ordinary nursery, crowded upon a small space and thickly in rows, but each needs a location where it can be singly cultivated. Neither should the experiments be made on one piece or tract of land—this would be economical—but the experiments on varieties and adaptations of soil, and on all thermometrical, hygrometrical, and pneumatical points, would be defeated thereby. In sections destitute of trees, one dense and large forest is not so much needed as many and scattered ones of much smaller size. If the plantings should thus be scattered, men and teams must be sent to great distances, and in various directions from a selected centre. The force of men and teams required for this work, it is supposed, after careful estimates, will be from five to six times as great as would be required to treat the same number of trees to seven years' growth in a common nursery; while the expense attending the completion of a tree plantation will probably be five times as great as the cost of raising and disposing of an equal number of trees from a nursery. Such experiments ought to be commenced without delay. The annual taking away of 3,000,000 of acres of our wood-growing lands is cutting down and sweeping off our forests with frightful rapidity. Kansas, Nebraska in part, the whole of Utah, New Mexico, much of Texas and California, have not one sapling to spare. As population rolls into these regions, and the railroads are built through them, the one destitution, and the great drawback to every kind of business and to all prosperity, will be the lack of timber.

East of the Mississippi river, excepting the prairies, the territory of the United States is all timber-growing land. West of the Mississippi, the plains, the bad lands, and the sandy deserts, occupy probably two-thirds of all our domain. Soon those distant States will begin to draw upon the more favored sections, and those States now impoverishing themselves will have to share their remnant with others. This country still enjoys the blessed ignorance of not knowing what it is to purchase her common timber abroad. As yet we have imported only ornamental woods from other countries; but when we cannot supply our own artisans with our own wood, then, indeed, will it be a day of sorrow. Is it not time to change some of our soil, either bare of trees by nature, or denuded by the violence of man, into tree-bearing land?

Millions of dollars are yearly paid for wood fuel, and the demand increases annually. Fully ten millions of dollars' worth of railroad sleepers are now annually called for by the railroads. More than one hundred millions of dollars' worth of sawed lumber is now consumed yearly, while the addition of timber for building and naval purposes, for home manufactures and cooperage, will probably swell the aggregate to $250,000,000 per annum. Such is the yearly destruction. Already the nation begins to feel the drain and the scarcity; and to counterbalance even in the least degree this waste, such experiments as we have urged should be set on foot without a day's delay.

It will take at least ten years to arouse the people to any considerable extent. Were man to begin to-day, it would take twenty years to produce one good oak or chestnut railroad sleeper. Before it would be ready for market the railroads will have paid for sleepers alone more than $300,000,000.

The Department of Agriculture, better than any other agency, can communicate such valuable information as these experiments would develop to the citizens at large. The publications of this department reach the very men upon whom all depends, the owners of the soil. But mere writing and printing are not enough to produce the desired impression and movement upon the masses. They want experimental demonstration; and merely individual, limited, and local experiments will not satisfy them. One person may write about planting a few acorns, a few butternuts or black walnuts, or a few chestnuts; another about sowing a little locust seed, and another about setting cottonwood cuttings. They are all well enough in their way, but they are meagre, imperfect, unsystematic and transient, as well as private. It should, then, to command public confidence and wide adoption, be known that such experiments were being made on an extensive scale by the government itself, or with its aid, and that all are free to visit the nurseries and plantations to see the work performed, and to make inquiries into the minutest particulars.

Then the information given by the government would be sought with greater interest, year after year, as the developments became more certain and confirmed; and such information would be considered authority on the subject. And thousands would even go great distances to see the actual working of the plan who would sleep reading over the theory and description.

WARNINGS FROM HISTORY.

We ought to learn from the experience of other nations great and terrible lessons, without madly insisting upon suffering the same disasters ourselves. The history of the world presents to us a fearful record respecting the destruction of the forests. Palestine and Syria, Egypt and Italy, France and Spain, have seen some of their most populous regions turned into forsaken wilderness, and their most fertile lands into arid, sandy deserts. The danger to our land is near at hand, NEARER BY FULL THIRTY YEARS than the most intelligent suppose; we need immediate action both for prevention and restoration.

Hon. G. P. Marsh, than whom no man living is more competent to speak on this subject, thus warns his countrymen. His extensive travel, his high scholarship, his official position as United States minister to several foreign nations, his wonderful powers of observation and deduction, give to his words, verified by his own personal observation of the subject on four continents, the greatest authority and power:

"There are parts of Asia Minor, of northern Africa, of Greece, and even of Alpine Europe, where the operâtion of causes set in action by man has brought the face of the earth to a desolation almost as complete as that of the moon; and though, within that brief space of time men call the "historical period," they are known to have been covered with luxuriant woods, verdant pastures, and fertile meadows, they are now too far deteriorated to be reclaimable by man; nor can they become again fitted for human use except through great geological changes, or other mysterious influences or agencies of which we have no present knowledge, and over which we have no prospective control.

"The earth is fast becoming an unfit home for its noblest inhabitant, and another era of equal human crime and human improvidence, and of like duration with that through which traces of that crime and improvidence extend, would reduce it to such a condition of impoverished productiveness, of shattered surface, of climatic excess, as to threaten the depravation, barbarism, and, perhaps, even extinction of the species.

"The destructive changes occasioned by the agency of man upon the flanks of the Alps, the Appenines, the Pyrenees, and other mountain ranges in central and southern Europe, and the progress of physical deterioration, have become so rapid that, in some localities, A SINGLE GENERATION HAS WITNESSED THE BEGINNING AND THE END of the melancholy revolution.

"It is certain that a desolation like that which has overwhelmed many once beautiful and fertile regions of Europe, awaits an important part of the territory of the United States, unless prompt measures are taken to check the action of destructive causes already in operation. It is in vain to expect that legislation can do anything effectual to arrest the progress of the evil, except so far as the State is still the proprietor of extensive forests. Both Clavê and Dunoyer agree that the preservation of the forests in France is practicable only by their transfer to the state, which alone can protect them and secure their proper treatment. It is much to be feared that even this measure would be inadequate to save the forests of our American Union.

"There is little respect for public property in America, and the federal government certainly would not be the proper agent for this purpose. It proved itself unable to protect the live-oak woods of Florida, which were intended to be preserved for the use of the navy; and it more than once paid contractors a high price for timber stolen from its own forests.

"The only legal provisions from which anything can be hoped are such as shall make it matter of private advantage to the landholder to spare the trees upon his ground, and promote the growth of the young wood. Something may be done by exempting standing forests from taxation, and by imposing taxes on wood felled for fuel or timber; something by premiums or honorary distinctions for judicious management of the woods. It would be difficult to induce governments, general or local, to make the necessary appropriations for such purposes. But there can be no doubt that it would be sound economy in the end."

Such are some of the thoughts and words of this eminent scholar, statesman, and observer, published after this company had been fully organized, and for years in contemplation. His whole book, "Man and Nature," bears testimony on every page to the existing wants and evils already upon us, and which make the action of government an instant and imperative necessity.

WHAT CAN BE EFFECTED BY SUCH EXPERIMENTS.

How much could be accomplished of absolute tree-planting as the results of such experiments and information?

No exact and positive answer can be given to this question. We can, however, upon very low and probably safe data, show what could be accomplished were those data adopted practically, and thus made facts. There is a possibility that from such experiments, whether by the government or by a company, it might become proven that a great forest nursery, under scientific and skilful management, might supply farmers with trees to set for forest better and cheaper than they could themselves propagate them. And thus a trade might arise, if sufficient interest could be awakened in it, which would furnish every farmer with such and so many trees as his time and inclination might from year to year lead him to plant. But whether he shall propagate them himself or purchase them is immaterial to our estimate, which is as follows:

There were in 1860 in the State of Illinois 143,210 farms in cultivation. Let us suppose that only *one-third* of these farms were prairie lands; and again suppose that only one-third of those having farms bare of timber take any interest in the subject, and that these take so little interest in it that in ten years they shall plant but five acres to each farm. Then one farm in nine through Illinois would plant one-half an acre of forest orchard each year; and yet, in the aggregate, it would amount to 90,000 acres of forest, equal to 270,000 acres of common forest, or 156 square miles, or four and a half townships. It should be remembered that it is estimated that one acre of scientifically and mathematically selected and planted forest is equivalent, in ultimate amount, to at least two acres, and in value to three or four acres of ordinary forest; so that the acres planted and grown in replacement are entitled to count far higher than simply acre against acre. Does any one exclaim, "This seems but a drop in the sea?" A beginning certainly must be made, or nothing will ever be done. If the timber of this nation is saved or restored, it is to be accomplished by labor and planting, and the sooner all are aroused and commence the better.

INDIVIDUAL EFFORTS ON TOO SMALL A SCALE.

Some few persons of large means in this country, with a simple view to beauty, or to meet their particular plans in conducting the various branches of the farmer's profession, have laid off their farms with great care and excellent judgment for the ends sought to be secured. But such persons often purchase the farms they own and thus beautify; when these come into their possession, the roads and lanes, the shape and location of the woods, and the general plan of fields, are all settled, some of them in a manner which cannot be changed or modified. But to find farms that have been laid off with a view to future years, or on any general and carefully considered plan, which could be repeated indefinitely on every side, one will look in vain.

Farms are generally so small, and the persons who open and improve them are so poor, that they have neither time, room, nor money to commence their farms aright, and for their own future interests. It would require combination among many neighbors, a well matured and faithfully followed plan, and a high intelligence, to so alternate and arrange forests and arable lands as to accord with certain great principles in nature, which, if regarded, would enrich and benefit all who come within their influence.

As it is now, each farmer by his own notion, often with no sound reason, clears one part and leaves forest on another portion. No one studies his neighbor's farm, or questions him as to what he intends to cut away or leave, and thus he is wholly ignorant of what the surroundings of his own farm will be. Each farm ignores the existence of any other on the whole continent. No *two*, much less *five, ten, twenty*, or *fifty* neighbors come together and enter into an intelligent agreement, fixing upon plans seeking to control or modify the severity of winds, droughts, frosts and winters, and to secure frequent, abundant and perennial springs of water.

There are in our country some extensive tracts of forests still unbroken, or but just penetrated by the pioneer, where it is possible that some system might be adopted by the settlers, *however poor*, which shall show to the country and the world how beautiful, healthy and productive a country man can make by preserving the forest in its full proportion to the cleared land, and in the proper forms.

And should the government, or any company, ever execute experiments on a scale such as this interest demands, then, certainly, upon those portions already by nature ready for the plough, there should be given a specimen of what can be done by study, science and forethought to make agriculture, and rural scenery, and farm homesteads what they ought to be.

THE MAKE OF OUR COUNTRY DEMANDS LARGE FORESTS.

Geographers, by an averaging of the coasts and boundary lines of the United States, have fixed its geographical centre in the State of Kansas, about twenty-five miles west by six miles south of the city of Leavenworth. This is the real centre, though far too much to the west for the probable centre of population. The thermometrical observations taken for many years at Cantonment Leavenworth (while that was still "Indian" and then "Nebraska" Territory) showed "that Fort Leavenworth was subjected, beyond any other part of the United States where similar observations were made, to sudden and extreme changes, both of heat and cold, of moisture and drought." (Authority of Major E. D. Ogden, U. S. A., 1854.) Since the settlement of Kansas the terrible droughts experienced, and the many men who have perished with the cold on the plains between Leavenworth and Salt Lake, bear evidence to the truth of the observations.

And this is to be expected in the nature of things. There is no body of water in the central part of the North American continent, west of the Mississippi river, which is able to exert any controlling influence upon the temperature of all that region. When we go north from Fort Leavenworth five degrees we are in a cold and frozen climate, closed early in the fall and locked in frost until late in the spring. Pass five degrees southward, and you have almost forsaken the region where ice may be said to form; hence this middle ground is wholly controlled by the prevailing type of the season, interspersed with the sudden and ofttimes violent interjection of short periods of temperature from the opposite points of the compass. Thus the general winter may be mild, without snow, with scarcely frost enough to prevent ploughing a single week through the entire winter, and there may come one, two, or five days, when the thermometer shall stand anywhere from zero to 26° below zero. On the other hand, in a long, cold, snowy winter, a period of very spring or early summer, as regards its balminess and comfort, may break in with equal suddenness. The same latitude upon either the Atlantic or Pacific coast is no criterion by which to judge of the temperature of the plains. The presence of a great ocean, with its broad, open bosom continually exposing to the biting air the fresh warm currents of her inmost being, gives a stability and produces a control over the temperature which is unknown when we reach a point almost two thousand miles from each ocean, and one thousand from the Gulf of Mexico. No portion of the world more needs the presence of great and numerous forests to preserve an equilibrium of temperature than the central parts of North America, and especially upon this latitude, which, as it approaches either ocean, is so admirable and so much sought for.

The same causes which produce such instability of temperature have an almost equal and direct effect upon the amount of moisture in the atmosphere. The depth of the Missouri and Mississippi are insufficient to produce much effect upon temperature by their simple, positive presence; the results which are obtained come rather from the processes of evaporation. I suppose that were the Missouri river, from its mouth to the headwaters of the Yellowstone, to be laid out in a straight line, and its tributaries to be laid on each side of it, side by side, that the surface of that mighty river would average a mile in width by three thousand in length, giving an evaporating surface of 3,000 square miles. When we remember that the Missouri river discharges all the water east of the Rocky mountains north of the Arkansas headwaters, except what is carried by the St. Peter's and the Des Moines into the Mississippi, it will be seen that a little lake, sixty miles long and fifty wide, is not a large surface from which to *evaporate* water in so vast a territory.

Hear G. P. Marsh, fortified by the ablest European writers, respecting the appropriate proportions between wooded and tilled lands, in order to secure the highest agricultural and healthful returns.

In 1750 Mirabeau estimated that there should be retained in France *thirty-two per cent.* of the land in wood. The forest was destroyed, with most disastrous effects upon the general prosperity, far faster than his estimate allowed, and the percentage was reduced far below that proportion. Marsh says: "It is evident that the proportion of forest in 1750, taking even Mirabeau's large estimate, was not very much too great for permanent maintenance, though doubtless the distribution was so unequal that it would have been sound policy *to fell* the woods *and clear land in some provinces,* while *large forests should have been planted in others.* During the period in question France neither exported manufactured wood or rough timber, nor derived important collateral advantages of any sort from the destruction of her forests. She is consequently impoverished and crippled to the extent of the difference between what she actually possesses of wooded surface, and what she ought to have retained.

"Since writing the above paragraph, I found the view I have taken of this point confirmed by the careful investigations of Reutzsch, who estimates the proper proportion of woodland to entire surface of *twenty-three* per cent. for the interior of Germany, and supposes that near the coast, where the air is supplied with humidity by evaporation from the sea, it might safely be reduced to *twenty* per cent. The due proportion in France would considerably exceed that for the German states."

Now, if the German states require 23 per cent. midway between the North sea, the Baltic, and the Mediterranean, what is demanded for the great area between the Mississippi and Rocky Mountains, almost without water from the Gulf of California to the Polar sea!

My mind has been often impressed with the wisdom and goodness of God in the peculiar configuration He has given to this great region, and the consequences resulting from it. Had the main Missouri river *come eastward,* in the line of the great Platte or the Kansas river, there would have been lost to all the immense valleys of the Missouri and Mississippi rivers one great blessing. The Missouri river from its sources runs *northward* into British America, there making an immense curve, while, running eastward, it comes to take a southerly course, until it turns with another great curve, and southeasterly cuts the State of Missouri asunder and pours into the Mississippi eighteen miles north of St. Louis. The providential depression to the northward, eastward, and southward, successively causing the waters to flow by that strange route *to the northward,* to reach at last the Gulf of Mexico, making the distance from the mouth of the

Missouri to the headwaters of the Yellowstone about 2,000 miles longer by the channel than by a straight line drawn between the two points. When one thinks on the obstructions by sand-bars, drift heaps, snags, and the crookings of the river itself, he will understand that the water drained from the eastern slope of the Rocky mountains and all the northwestern side of the divide between the Upper Missouri and the Upper Big Platte has 2,000 miles more to travel to reach St. Louis than had it come, like the Platte, by a direct eastern or southeastern line, and that it will therefore come many days or even weeks later on that account. If we assume that the current runs five miles an hour, then that is about one hundred miles a day, and twenty days or three weeks must be allowed for the distance in traversing the great northern curve. But rapid as the river is—and it is a most majestic one when it puts on its power—the current is not equally swift in all places, sometimes being widely spread out or running in several channels. We shall assume two and a half miles per hour as its uniform motion, and then *forty days*, or about six weeks, must be allowed to elapse in calculating the coming of the mountain waters. *But this arrangement has another peculiar providence.* Had this immense curve run southward and then northward, emptying at the same point as now, another blessing would have been lost. As it now is, the spring rains and melting snows on the mountains are all garnered up in the valley of the Yellowstone and other tributaries, increasing in volume as the heats of spring slowly creep north, unlocking the ice-bound rivers. The last point that breaks under the heat and accumulating flood is the northernmost point of this great arch, and there more than 1,200 miles of rivers and melted snows are waiting with their contribution of waters; and at last on they come, sometimes earlier, sometimes later, but always as certain as the year returns; on they come, and when? The spring rains that swelled the Red, Tennessee, Cumberland, Arkansas, Ohio, Illinois, and Upper Mississippi have been over many weeks. Some of the rivers are growing low, and navigation is difficult. What shall the great valley of the Mississippi do for water, to be changed hourly into vapor by the sun, whose fierceness is becoming every hour more intolerable? Where shall they obtain water for the rain? Every rain which comes is welcomed by the boatmen, for it floats their steamers, barges and flatboats. Every rain is hailed by the husbandman because it saves and revives his crops. Spring and its rains have gone, and summer comes; and *now*, sometimes far on in June, comes the "June rise," a name of grandeur, of joy, of activity, of wealth, of harvests to all the dwellers on the stream, from the Gulf of Mexico to the far-off British line of the northwest! The river rises with the "June rise," sometimes six feet in twenty-four hours, until it stands for days at twelve to sixteen feet above low water. And sometimes, when heavy snows in the mountains are followed by a sudden, warm and rainy spring, so that the waters of the spring have not escaped before the mountain tides come riding down over them and commingling with them, come the terrific floods and overflows like that of 1844.

Is not that a most manifest and merciful provision of Providence, for all that central region of which we have been speaking, to retain that great body of waters so long for purposes of evaporation, and then, when the whole Lower Mississippi would be straitened for water for navigation, to pour this abundance through June, July, and sometimes into August, till its effects are scarcely lost before the fall rains begin to replenish the rivers? Were it not for this grand river, it is my opinion that much of that region would be utterly uninhabitable by man. And ought we because forests are wanting in all that region—shall we leave the lands to neglect and comparative barrenness, when, by adding forests as great modifiers and controllers of temperature and precipitation, they may probably become as desirable as any lands we possess, considering their locations as connected with our mineral wealth? No civilized nation should regard this subject with profounder interest, or prosecute it with an intenser energy, than our own.

WOOD PAYS MORE THAN ONE-HALF OF THE ENTIRE INTERNAL REVENUE OF THE UNITED SATES.

All wood that has been so used as to make it a part of man's real estate, or which is the staple of the man's business as a manufacturer, is taxed as real estate or manufactured products. But all wood thus invested in any manner, where it pays to the owner an income, whether it is in movable or fixed form, is obliged, if he has any income over six hundred dollars, to pay a second time on all that it has clearly produced him, except what he before paid as taxes. It is thus true that, in one form or the other, all standing timber, all lumber and wood used in houses, steamboats, or permanent instruments of any kind, and all that is used in industry or manufacturing, pays a tribute to the United States.

Let us take, then, the real estate of the United States:

In the erection of ordinary buildings of brick and stone—not cut-stone walls—and with wooden floors and joists, it is estimated that the cost of timbering, flooring, roofing, wainscoting, the finishing of entrances, cornices, cupolas, doors, window-sashes and blinds, makes an expense for wood-work equal to at least that for all the brick and stone work. The wood-work, then, which represents not only the raw material, but the labor necessary to put it in its complete form and appropriate use, pays one-half of the tax accruing upon that improved property. And taxes are very light upon the same land, wherever situated, when without buildings, in comparison to what they are when improved. But we must go further back.

It required, if the building is one of brick, wood with which to burn the clay, making about one-third the expense of making the brick. In like manner the lime is burned with wood, and half its value arose from that expense. But the clay is in the bank, the rock is in the quarry, and wagons, made greatly of wood, must carry the one to the kiln and the other to the pug-mill; and, when burned, the same wagon is needed to draw them from the kilns to the place of using. But then we have not gone far enough back. The brickmaker, the limeburner, the stonemason, the bricklayer, the plasterer, the painter, the carpenter, have all needed wood in their houses for fuel, in their dwellings to shelter them, in their stables to protect their animals. But come to the building itself. Hogsheads and lime box, a hod and a scraper, a mortar board and a pail, tressels and scaffolds, inclined planes and ladders, a plumb and a trowel—wood, wood, incessantly wood! Even for the mason, the same for the plasterer, the painter, the carpenter, everything he grasps to work with is, first of all, wood. Far more than one-half of all the value of ordinary brick and stone buildings in the United States has come from wood, and pays one-half of the taxes. But we come to other buildings. There were in the United States in 1860 3,362,337 dwelling-houses, besides all public buildings, churches, educational institutions, stores, manufactories, depots, warehouses, &c. How large a proportion of these were brick we cannot tell; but by far the great majority were of wood. And what proportion of their cost came from manufactured wood? A little hardware, a little paint, a little masonry, the plastering, and all else was wood. But let us estimate a little on farm-houses. When these are built of brick, the lime and brick are often burned with fuel cut on the very farm where the house is erected. The barns and outhouses, and the fences, are also generally constructed of wood, Now, if we assume that the houses, barns, and fences give but one-half the value to the farm at which it is assessed, (which estimates the land unimproved as worth half as much as when thus improved,) then this astounding fact comes to our notice—the value of farms in the United States in 1860 was $6,654,045,007, and the value of the lumber improvements would be $3,322,522,000. This has been cut from our soil and put into these permanent improvements, and pays taxes.

Now, the vast majority of these improvements have been made within the last thirty years, (probably twenty;) and as within that time, probably, old houses, barns and fences have been replaced sufficient to make the whole amount new; during that period, on farms alone, there has been cut and used annually, and changed into permanent tax-paying property, $101,070,000 worth of forest. These improvements continually are growing old and falling to decay. But this is a single item. "A good barn will build a good house," is an adage that thousands of farmers have proved true; the protection of crops, the defence of stock, the shelter of vehicles and implements, have saved thousands of dollars to many a farmer. How much of the income tax paid by the farmers of the nation represents the wood in their utensils, vehicles, barns, stables and fences, outside of the value assessed directly upon them.

But pass a moment to manufactures. The cotton manufactures are the second in the United States, as reported in the census for 1860, the products being $115,137,926; the value of flour and grist mill products being the first, and amounting to $223,144,369. Let us now take lumber, and contrast it with these. There was of sawed and planed lumber in 1860, $96,000,000 worth. The products of the grist-mills furnished occupation to 19,000 bakers, besides being used in every household supplied by the baker. The products from the cotton-mills, besides the private use in families, in part, gave employment to 90,000 seamstresses and 102,000 tailors and tailoresses. But as one-half the labor of these was expended on woollen, silk, or linen fabrics, it gave direct employment to about 96,000 men and women. Now, the direct tax on the produced timber was almost as great as on the cotton goods, while in the line of furnishing employment to others in the simple trade of carpentry alone, employing only men, it gave business to 242,958, or nearly three times as many as worked in cotton, and thirteen times as many as worked in flour and meal.

The iron interest and the machinery interest (often requiring much lumber) are immense, but the pig iron in 1860 amounted to only $19,487,790, and the bar and other rolled iron to $22,248,796, making a total of $41,736,586. The machinery made in this country in 1860 amounted in value to $47,118,550, and of sewing machines to $5,605,345, making a total of iron produced and machinery manufactured in 1860 of $94,460,481—a million and a half dollars less than the raw lumber of the country which had passed through the saw-mill.

I have before said that there are sixty-six trades in whole or in part dependent upon wood as their material for manufacturing. What they can earn or do earn cannot be known; but two points will help us approximate. There were 29,223 cabinet-makers, who produced $22,701,304 worth of ware; also 3,510 piano-makers, musical-instrument makers and organ-builders, who made $5,791,807 worth of musical instruments. If we should average these two trades, we should certainly set our mark too high, as one is low, and the other unusually high, demanding skilled labor. The production *per capita* above was, in the first $771, in the other $1,651. Should we estimate the production of those 476,623 artisans in wood at $1,000 each, we should have nearly $500,000,000 per annum, of which scarcely a trifle, excepting the two items above of about $28,000,000, appears in any column of the census. This is additional to the making of the lumber itself. From all incomes over $600 the United States exacts a tax.

United States buildings, capitols and public buildings belonging to the respective States, and all educational institutions and county property, and generally churches, are exempted from taxation, and therefore are of no value under this particular point of revenue, although, if they are of such vast importance, subserve such necessary and useful purposes, and are paid for by the money of the people generally, their wood pays its tribute to the maintenance of government, the dispensing of justice, and the diffusion of religious truth and influence through the nation.

We are told that the manufacturers of the United States, together with the mines and fisheries, produced in the United States in 1860, $1,900,000,000.

Of all the cotton and woollen factories, of furnaces, rolling mills, flour and grist mills, machine shops, furniture, implement and cooper-shops, of all the manufacturing establishments of every description, what proportion of the value invested and helping to produce this vast amount was wood, and paid its tax, first as real estate, then in incomes of proprietors?

We have spoken of dwellings, then of manufacturing establishments. We come now to commercial and mercantile houses. Of all the buildings used for banking and insurance purposes, for offices, for public halls, for theatres and museums, for all kinds of business, and for all kinds of storage, what per cent. of all the values of these buildings is wood, and, as asked before, pays a double tax?

But when we come to one other point, we meet timber under a new aspect. In 1860 the ships of the United States had an aggregate tonnage of 5,539,812 tons, and were worth, at $40 per ton, $221,592,480. In 1860 there were a few iron steamers, but the great mass of American vessels were built wholly of wood. When we remember that it is through their instrumentality that those articles are brought which yield such a national income to the government, surely wood stands forth, demanding again the acknowledgment of its value and power which thoughtless men have never given to it.

But there is an interest growing up among us which is destined, in time, to control every other of a mere pecuniary kind; it is the railroad power and railroad contributions; and from a few facts connected with these (I have early alluded to one or two in part) may be seen how here, as well as elsewhere, wood pays its tribute to the United States treasury.

The report of the engineer of the State of New York on the railroads of that State, for 1864, is in my hand, with the latest and most reliable information. By it I find that to fence forty-nine miles of the Atlantic railroad in the lumber portion of that State cost $35,680 70, or $728 a mile. At the same rate the fences for the 51,114 miles, either operating or being constructed in 1862, would amount to $37,208,992, a value greater than the entire value of the New York Central railroad. Thirty-four railroads in the State of New York paid $2,311,213 for bridges, on an aggregate of 2,798 miles of roads, which is equivalent to $826 for each mile of road. Assuming one-half of that amount for wooden bridges, there would be required in the United States $42,817,144 for wooden railroad bridges.

The superstructure of the 2,798 miles of New York railroads cost $22,253 72; taking one-eighth for the cost of sleepers, gives about $1,000 per mile; for the railroads of 1862, it makes about $50,000,000 in this item.

Passenger and freight stations and buildings cost $1,519 for each mile of road; assume one-half for wood, $760 per mile; for the United States, $38,846,000.

The wood value in the engine and car houses, &c., in the United States is $8,961,607. The wood value in the freight and passenger cars in 1862 was, in like manner, $67,810,480. We thus see, upon a very low estimation, that the probable amount of wood in the railroads built and building in the United States in 1862, was $215,664,223, amounting to nearly one-fifth of all the expense—earth, stone, brick, and iron.

When we come to estimate the cost of keeping up these roads, we see again how much the income derived from this great interest is dependent upon wood.

The repairing for 1864 of roadway and superstructure of the New York railways cost, not including iron, $4,747,523. What part of this was, strictly speaking, wood itself, it is difficult to answer. A vast amount was doubtless expended in ballasting the road; but when a sleeper is broken and decayed, the more complete and perfect the roadway, the more time, labor and expense required to dig out a new bed to insert the sleeper, and to properly adjust, fasten, and ram it. If we assign one-third of the expense above for sleepers, and placing them properly, then this item for New York alone, in 1864, was $1,582,301, and for the United States $30,063,719. We also, in brief, make other estimates from the same table:

Repairs of railroad buildings for New York $750,000, for United States $14,250,000; repairs of railroad fences for New York $93,236, for United States $1,771,485; repairs of railroad cars for New York $2,000,000, for United States $38,000,000; fuel (wood) of railroad for New York $3,000,000, for United States $57,000,000.

If, then, these estimates hold true, and they are based upon all the railroads of New York, (thirty-four in number,) long and short, rich and poor, crowded and empty, we see that in the United States the lumber, timber, and wood used for railroad purposes alone (not to build a foot of new road, but only to keep up the road, stocks, and fires) require of wood $141,085,104. But we should never, as Palaissy declared, come to the end of the enumeration, and we will stop.

But I would ask, most respectfully, that every farmer and every intelligent man should ask his congressional senator and representative why we should not have, from this day forth, full tables respecting the timber, lumber, and wood of our country, compiled for the public benefit in the census? This is, I believe, the greatest interest of a pecuniary kind connected with our government; and all the facts connected with it should be sought out and set before the public.

Now is the time to act; we should regard and forestall the future. God has given us a great and goodly heritage—a grand and broad and luxuriant country; but it is our forests that have made this country so salubrious, so fertile. Shall we not preserve and cherish with care what remains, and plant on every quarter section destitute of trees, in all our land, its proper complement of forest, until from sea to sea it shall seem to all men "like the garden of the Lord?"

I append a copy of the new law of Kansas, to which I have alluded, and which, I think, is the greatest step towards the production of American forests ever taken in this country, and one which places the entire nation under a debt of gratitude to that State and its legislature:

"SECTION 1. *Be it enacted by the legislature of the State of Kansas*, That any person planting one acre or more of prairie land, within ten years after the passage of this act, with any kind of forest trees, and successfully growing and cultivating the same for three years, and every person planting, protecting, and cultivating for three years one-half mile or more of forest trees along any public highway, said trees to be planted so as to stand at the end of said three years not more than one rod apart, shall be entitled to receive for twenty-five years, commencing three years after said grove or line of trees has been planted, an annual bounty of two dollars per acre for each acre so planted, and two dollars for one-half mile for each mile so planted, to be paid out of the county treasury of the county in which said grove or line of trees may be situated; *Provided*, the bounty hereby given shall not be paid any longer than said grove or trees are cultivated and kept alive and in a growing condition.

"SEC. 2. That any person wishing to avail himself or herself of the provisions of section one of this act, shall, within three years after planting said grove or line of trees, file with the clerk of the county a correct plat of said grove or line of trees, showing on what section or sections of land said grove or line of trees is situated, attested by his oath, and the affidavit of at least one resident householder, setting forth all the facts in relation to the growth and cultivation of said grove or line of trees; whereupon the county clerk shall, if he find from all the evidence that section one of this act has been fully complied with, on or before the first Monday in October in each year, cause warrants to be issued upon the county treasurer of the proper county for the bounty above provided for, which order shall be received by the treasurer in payment of all county taxes.

"SEC. 3. This act to take effect and be in force from and after its publication once in the Leavenworth Conservative.

"Approved February 16, 1866."

As remarked in the body of this article, I consider such an appropriation of money as the most productive of any that that State will ever spend, in increasing population, reclaiming waste lands, and raising all real estate in value by controlling climatic extremes and favoring the growth of all cultivated crops.

THE ONION;

ITS HISTORY, CULTURE, AND PRESERVATION.

BY ELISHA SLADE, SOMERSET, MASSACHUSETTS.*

FROM time immemorial the onion has been cultivated by man, and still grows wild in many portions of the world. For more than 4,000 years it has been used as an article of food by "all classes and conditions of men;" and there are few that have not some savory remembrances of it as a constituent of those dishes that "none can cook as well as mother." The Israelites, 1,490 years before the Saviour's advent, murmured in the wilderness: "We remembered the fish we did eat in Egypt freely, the cucumbers, and the melons, and the leeks, and the *onions*, and the garlics."—Numbers xi, 5. Hasselquist says that "whoever has tasted the onions of Egypt must allow that none can be had better in any part of the universe. Here they are sweet; in other countries they are nauseous and strong. Here they are soft; whereas, in northern parts they are hard, and their coats are so compact that they are difficult of digestion. Hence they cannot in any place be eaten with less prejudice and more satisfaction than in Egypt."

It is unknown where, precisely, our cultivated onion originated. Some writers say that no species of the *allium* now found growing wild will produce the vegetable called the onion, even though cultivated ever so carefully. Others inform us that the species with fistular stalks and swelling bulbs, now found in Persia, would, if cultivated, produce this vegetable, and firmly assert that it is the original of all the varieties of onion now grown. Some declare that the onion was given to Adam as we now have it, and that it has not degenerated, and *cannot* degenerate in the least; while others say that if left to itself for a few years it would "fall from grace," and become like the wild species described. Be these theories as they may, the wild species of Persia is so nearly allied to our cultivated onion that some travellers cannot tell the difference.

In India the onion is highly esteemed for food, and used as an antidote to many diseases, even to a greater extent than in Europe; and most dwellers in our own country can remember it as an article of medicine, administered for their youthful ailments by a skillful mother or maiden aunt.

The ancient Greeks and Romans cultivated it in large quantities, and at one time the Roman armies almost wholly subsisted on it. They also imported onions from abroad in great quantities. The island Cimolus was named Onion on account of the peculiar quality and the immense numbers raised there; and it is said that the Roman provinces of Spain, in the days of Scipio the Younger, produced annually $200,000 worth of this esculent.

Hannibal, who swore "eternal hate to Rome," and led the Carthaginian hosts through sultry Spain and across the snowy Alps, well knew that the health of his army demanded the onion, ever present, amid all the changes of heat and cold. And Aurelian, who led his armies across the burning sands of Arabia, conquering Palmyra, and leading its queen, Zenobia, captive to Rome, found that his army suffered terribly from scurvy, and was restored to health

* With additions from other sources, by A. B. Grosh of the Department of Agriculture

only when he found in the captured city well-watered gardens containing abundance of garlic and onions.

So great a quantity of this bulb was raised at the Alibi, in France, that the *tithe* of them is said to have yielded an annual revenue of one thousand crowns for its bishop.

Thus might we glean notice after notice from the pages of history of the high esteem and value accorded this vegetable down to the present day, when Spain, Portugal, and Tripoli yet keep up their ancient reputations for the quantities and qualities of their onions; while in this new world their culture seems everywhere increasing from Canada to Patagonia, and especially in these United States, since our soldiers proved their value in camp, in hospital, and on the march, all through our late civil war. Each one of our brave boys would indorse the statement of its worth made by a late writer, who estimates the amount of nourishing gluten contained in the onion at 25 or 30 per cent., and says: "It is not merely as a *relish*, therefore, that the Spaniard eats his onion with his humble crust of bread as he sits by the refreshing spring; it is because experience has long proved that, like the cheese of the English laborer, it helps to sustain his strength also, and adds (beyond what its bulk would suggest) to the amount of nourishment which his simple meal supplies."

But few will deny the importance of the onion as an article of diet, or in a sanitary point of view. Nor is it without commercial importance. An utter failure of the onion crop would create considerable panic in the vegetable market. It is rapidly increasing as an article of export, and will figure largely in the tables which show "how we feed the nations." It is stated on good authority that in the year 1860 the value of onions exported exceeded the value of exports of apples by more than $250,000. It is also estimated that in 1865 there were planted one-fourth more acres of onions than in any previous year, and that the average product per acre was 500 bushels. And yet the market seems by no means glutted; the appetite "grows with what it feeds upon," and, like a certain famous Oliver, asks for "more!" Let us, then, consider the ways and means to meet the demand, and make the supplying of it profitable.

GOOD SEED.

If compelled to purchase from unknown or unreliable dealers, test the germinating power of the seed before buying. After onion seed is two years old much of it is worthless. The following tests may be of service: 1, new seed is soft, and has a strong taste; 2, good seed sinks in water; 3, placed on cotton, kept soaking wet and in a warm place, good seed will germinate in a few days; 4, pour hot water on two sods, place seed between them, and put the whole under a stove or other warm position, and it will germinate in a few days; and, lastly, (as a test which will also hasten the preparation for planting, and cause an early springing of the crop,) pour boiling water on a mass of seed so as to cover it, pouring it off in a few seconds, when, if good, minute, hair-like sprouts will start from the heated mass, which may then be mixed with plaster or ashes, and immediately planted.

But it is better always to buy your seed from a reliable dealer, even at double price, if necessary, than to get poor or wrong seed as a gift, for the seeds of an inferior kind of onions may be fresh and good as mere seed. And it is best of all to raise your own seed thus:

Select a sufficient number of smooth, hard, ripe onions, of medium size, and of the kinds you desire. Keep them in a cool, dry place, where they will not freeze, though some planters say that freezing does not injure them. As soon as the soil can be worked in the spring, set them out in a rich, deeply-tilled, mellow soil, in rows two feet apart, and the bulbs one foot apart in the rows. Cover them nearly to the stalk, hoe frequently, and keep them free from weeds.

In no case allow more than two stalks of a bulb to bear seed, if you desire good, heavy seed. Tie the stalks to stakes or trellises when they become heavy and drooping. When the heads begin to open and the stalks to turn to a straw-color, cut off the seed heads, and spread them on a loft floor or other warm and dry place, until the seed shells out easily—say in four to six weeks. Then shell and winnow it clean, and put it away in paper bags, closed with gum or paste, so as to exclude the air, and keep it in a dry place, secure from mice, until needed.

THE GROUND.

Any soil that can be made mellow, and will grow corn, will produce onions. It must be enriched with fine manure, and be deeply stirred, and kept clear of weeds. The best manures are the excrements of fowls and pigs; next, well-rotted or composted stable manure. But in all cases avoid manures containing seeds of weeds and grasses, as they are the great enemies of the crop. Hence some prefer liquid manure, and continue to raise onions year after year on the same plot or field. Apply the manure at the fall ploughing, if possible; if not, in the spring, after the deep ploughing; spread it and plough it in lightly, and mix it well with the soil, which should be thoroughly and finely pulverized, and the field or onion bed made as level as possible. Complete the preparation by breaking up all the clods, and removing the stones, if any, if you would have the full benefit of your labors. Some roll the land previous to planting, (and sandy or spongy soils may be benefited by it,) but it should be done very lightly, so as to leave all beneath the mere surface easily to be penetrated by the tender roots.

Warm soils will be benefited by sowing a few bushels of salt, or many of ashes, or both, to the acre, over the surface before planting.

PLANTING.

This is done by a machine where a large breadth is cultivated. It is unnecessary to describe these labor-savers, save to remark that the one most generally used in Massachusetts plants two rows at a time, and has small rollers attached for pressing down the seed. Those used in Connecticut are said to cost about four dollars each, and the seed is planted in rows about twelve inches apart, (and about six inches in the row, if the machine plants in hills, which is deemed better than in drills,) and covered with a hand rake, carefully drawn parallel with the rows, covering two rows at a time. The seed should be covered about half an inch deep, and from five to eight seeds put in a hill, if for home market, or for sale by the bushel; but ten to twelve seeds to a hill, if designed for a foreign market, or bunching on straw. From four to six pounds of seed are usually planted to the acre. Plant as early as the condition of the ground will allow.

N. B.—South of the State of New York onions are generally cultivated as a biennial. The seed is sown in drills from nine to twelve inches apart, three seeds to an inch in the drill, in beds conveniently wide, and carefully prepared by manuring and pulverization for the purpose. The small bulbs thus produced the first year are called "sets" in the middle States, and "buttons" further south. The second year these "sets" are set out in rows one foot apart, and five or six inches in the row. The "button" held between the fingers and the thumb is gently pressed into its place, so that it sets firmly in the ground, merely deep enough to allow the small fibrous roots to descend into the soil, and yet not cover the bulb above them. The "sets" should not, then, be disturbed until firmly rooted, and in all after cultivation care should be taken not to loosen them. Hence all weeding near the bulbs should be performed by hand.

The harvesting of the "buttons" or "sets" the first year, and their cultivation the second year, is the same as for onions cultivated as annuals.

Full-sized onions are sometimes raised from the seed in one year, even in the middle States, by selecting a site that dries off early in the spring, well sheltered from cold winds, and properly exposed to the sun; and then planting very early, so as to secure a large growth before summer's drought and heat stop the circulation of sap in the tops. But frequent failures to attain a full growth induce most persons to prefer the two-years' culture.

HOEING.

As soon as the rows become visible lines of green, go through with a light hoe, and stir the ground between the rows, carefully extirpating every weed. When the onions are fairly up, take out the weeds which this first hoeing may have left near and in the rows. To do this well requires great care and frequent use of the fingers. Take in one hand a very light hoe, (the blade about one to two inches wide, and three or four inches long, and the handle a foot or eighteen inches long,) and with the fingers of the other hand ever ready to pull the grass and weeds, (it would be dangerous to cut with the hoe,) *on your knees* apply yourself to the task. A handy, willing boy will do this work better and faster than a man.

The wheel-hoe is a valuable implement for field culture, to cut up the weeds between the rows. But weeding *in* the rows, and around the bulbs, must be done by the small hand-hoe and the fingers, at least until some ingenious Yankee invents a machine capable of discerning onions from weeds.

From the first appearance of the tops, until the bulbs are as large as pullets' eggs, the ground should be frequently hoed to keep it mellow, and every weed be carefully cut up or rooted out to give the onions the sole occupancy of the soil and the full benefit of the culture. But when the bulbs attain that size, the hoe should be laid aside, at least not be allowed near the finest root, and finger weeding only be used to keep the crop *perfectly* free from weeds.

DISEASES, ETC.

The most common disease is *smut* or *blight*. It shows its presence by turning the tops to a straw-color, when, on examination, the inside of the leaves will be found smutty or black. In some cases the stalk cracks open; but at other times it takes the same form as in wheat or other cereals. This disease is more common in old fields than in new. The causes are imperfectly known, and no effectual remedy has yet been found. Probably a sprinkling of sulphur would be beneficial.

If onions show a disposition to "grow too much to top," or to form seed bulbs, bend down the tops, giving them a twist at the same time that shall bruise them, but be careful not to break them off.

If the plants persistently run to thick necks, or "scallions," pull them up as soon as of sufficient size for marketing or home use, and thus give the others more room.

THE ONION FLY—(*Anthomyia Ceparum.*)

Soon after the plants come up a small greenish white fly, about half the size of the common house fly, with very transparent wings of rainbow hues, punctures the young stalks near the ground, and deposits from one to six eggs, closing the wound with wax, which the insect secretes. In from one week to twelve days (according to the weather) the eggs are hatched, and the maggots gnaw their way out and go down into the little bulb. Here they remain long enough to destroy the plant, when they emigrate to another for a fresh supply.

They generally finish the work of destruction about the beginning of July. They do not always confine their work to the young plants, but attack advanced bulbs and the seed onion. When the maggots have attained the age of six or eight weeks, they bury themselves in the ground, roll themselves up like the chrysalis of the canker worm, and remain through the winter. In the spring, after the ground is sufficiently warm, they emerge from their resting place as perfect insects.

PREVENTIVES AND REMEDIES.

Spare the birds! I *know* that they destroy a vast number of the flies and their maggots. Especially does the robin (*Turdus migratorius*) and the chipping sparrow (*Spizella socialis*) devour an innumerable quantity of them. And I have seen the white-bellied swallow (*Hirundo bicolor*) flying within a few inches of the onions during the season when the fly was busy laying her eggs. As the swallow feeds mostly on the wing, there can be no doubt that it devours many of this pest. The common yellow bird (*Dendroica æstiva*) will eat several times its weight of insects every week, and I have seen them busy for hours in succession on an onion bed picking away at the flies and maggots. Other preventives and remedies commonly used with success are the following:

1. Soak the seed in water a little above blood heat for half an hour to hatch out the maggot; then in a strong solution of copperas or saltpetre to kill those that remain; and finish by rolling the seed in dry air-slaked lime, and sow it.

2. Soak the seed for 24 hours in chamber lye, (urine,) or in brine made as strong as possible, then roll in ashes and sow.

3. Mix every pound of seed with half a pound of sulphur, and sow them together.

4. The dust from coal pits and forges, (mixed with ashes, if the ground is not a heavy clay,) well spread and lightly ploughed or cultivated in before planting.

5. Sow soot, or charcoal dust, or common salt, thickly over three-fourths or four-fifths of the rows at planting, (leaving the other rows as "cities of refuge;") renew the application as soon as the onions are well up; and *again* (say) about the middle of June.

6. As soon as the plants appear, (and again, at intervals of from a week to ten days, until the middle of June,) sprinkle dry, unleached ashes on (and not merely around) the plants while they are wet with rain or dew. Some water the plants, and then sprinkle.

7. Others prefer a mixture of equal parts of charcoal dust, (or soot,) air-slaked lime, ashes, and plaster, applied while the onions are wet.

8. Cover the ground around the plants with fresh pine sawdust, and when the plants are about four inches high, wet the sawdust with gas water, diluted with twice its bulk of soft water.

9. Where gas water cannot be had, some substitute a strong decoction of tobacco.

10. Great success has attended the pouring of boiling water from a tea-kettle spout along the drills, close to the bulbs. There is no danger in this, as a living vegetable will resist a brief heat sufficient to destroy the tender cold-blooded maggot.

THE CUT-WORM—(*Agrotis.*)

This is sometimes very destructive. It belongs to the same family as the cabbage worm, and cuts off the stalk just above the ground. It generally works during the night, and at daybreak covers itself with earth, which it resembles in color, so that it is difficult to discover it. It is about an inch long when fully grown.

As with the maggots, so with the cut-worm; the same general applications cause him to "change his base;" but the principal remedy is, "spare the birds." They are "up in the morning early," before the worms retire for the day; and "the early bird catches the worm." How beneficial, then, are these "denizens of the upper deep" to the onion grower! They are diligent in providing daily and hourly food "from early dawn to dewy eve;" and if they do sandwich their worms and flies with an occasional cherry or strawberry, it is for their health, and really leaves us in their debt on the whole account.

Having kept down the weeds throughout the season, and, with the help of the birds, done what we could to lessen the scourge of the insects, the next event in order is

THE HARVEST.

When the tops turn yellow or brown and fall over, the onions are fit for harvesting. (The "scallions" or thick-necked plants, with others not matured, can be passed by for later disposal.) Pull, hoe, or rake out the bulbs carefully, so as not to wound or bruise them, and expose the bottoms or roots to the air as much as possible. Leave them to dry, turning them once or twice to secure perfect drying. If you desire to secure them in their greatest beauty, after a few days stack them, about a barrel to a heap, for sweating. After remaining in heaps about two weeks, open the stack, spread it, and dry again for two or three bright sunny days. They are then ready for marketing or storing. If intended for early marketing, cut the tops off about an inch above the bulb and pack in barrels. If they are to be put in ropes, or bunched, cut off the tops about three inches above; but if they are to be stored, leave the tops and dried husks (to absorb any moisture caused by after-heating and sweating) until ready to market them. A sheep shears will be found a good instrument for topping them. For storing, they should be perfectly dry and free from dirt. The loft, store-room, or cellar, should be of even temperature, cool, dry, and airy. Spread them out in bins or on floors, not over a foot deep, unless by putting an open floor of slats under them, elevated a few inches above the tight floor, you provide for a free circulation of air under, up, through, and on all sides of the pile. In such case they may be spread three, four, or even five feet deep. Watch diligently, however, and carefully keep them from heating; and should they heat, or gather moisture, open the heap immediately and dry and cool them. If liable to freeze at the approach of cold weather, cover them well with hay, straw, carpeting, &c., at top and sides, so that if they do freeze, they may remain undisturbed and free from thawing until spring, and then thaw them gradually, as thus the freezing will not injure them. See, therefore, that the coverings at the sides and on top are not removed until all are thawed out.

The "scallions" and later gathering should be kept by themselves, and marketed early.

VARIETIES.

These are numerous, but a few only of the best and most approved kinds will be described:

Weathersfield—the most prolific and most commonly cultivated—is a large, red variety, from which three sub-varieties have been produced by careful and long-continued culture—the first Early and the second Early Red ripening from three weeks to a fortnight earlier than the Late Red, and smaller than it in size. The Large Late Red sometimes grows to six inches in diameter, and is hardier than the earlier reds. Some cultivators suppose that these three varieties are wholly determined by the shape of the bulbs employed for raising seed—the flat producing the late, and the rounder bulbs producing the earlier varieties.

Early Red Globe—a very fine and delicate onion—much sought after, and highly esteemed by epicures.

The red varieties are generally better growers and keepers than the white and yellow, but do not sell as readily, nor bring as high a price in the markets.

The Yellow Danvers—round, solid, a good keeper, and the next in production, if not the equal of the Weathersfield. It ripens about the beginning of September; is very compact and heavy, weighing more per bushel than any other; is more uniform in shape and size, and will yield "a greater proportion of handsome, well-developed seed onions" than any other, according to Mr. Gregory, of Marblehead, Massachusetts.

The Early Cracker—so called from its resemblance to the water-cracker—also a yellow onion, is thin, compact, honey-color, "in fineness of structure and delicacy of flavor is unsurpassed," and accordingly commands a higher price than other early sorts. It bruises easily, and, therefore, requires careful handling. Its diameter varies from two to three inches, and its thickness is about one inch from neck to root.

White Portugal or *Silver Skin*—an early variety, frequently planted for "sets." It is rather a poor keeper, but has a mild, sweet, delicious flavor. It is the principal variety grown in Buenos Ayres, where it grows much larger than here.

The Potato onion grows from bulbs planted deep in the ground, the planted bulb growing to a large size, and producing from five to seven small bulbs around it for next year's planting. It is the earliest of the onion tribe, being fit for the table several weeks earlier than any grown from seed. And as it is planted deeper in the earth than common "sets" or "buttons," it may be put in place in the fall, (as it is easier to shelter from freezing by extra covering than the common onion,) so as to start at the first warmth of spring. The potato onion is mild in flavor, hard in flesh, and the small bulbs excellent for pickling. It is a poor keeper. Plant in rows 18 inches apart, and the bulbs from 6 to 8 inches apart in the row. The planted bulb will grow to about three inches in diameter.

There is no doubt that the potato onion originated in some freak of the common kinds, as frequently a seed will produce several little onions instead of a large one; and sometimes a potato onion will send up a large single shoot and try to head, but seldom produces seed.

The Tree or *Top onion* produces sets instead of seed, like the garlic; but it is little esteemed except for pickles, and seldom grown. Planted and cultivated like the common onion when the latter is set out for seed.

Of the above kinds, the Weathersfield large red is the most prolific, in some instances over 900 bushels having been produced to the acre. Next, if not equal to it in productiveness, is the Yellow Danvers. In pecuniary profit the two are probably equal, except in particular localities, where market preferences may make a difference.

The Department of Agriculture has imported and distributed widely seeds of several approved foreign varieties, which it is hoped may prove valuable accessions when properly cultivated and duly acclimated. Among these we will name the following, copying the descriptions given of them from Thompson's "Gardener's Assistant," a valuable and costly British work.

White Spanish or *White Portugal.*—"Very large, flat; skin loose, pale brown, falling off spontaneously, exhibiting the next coating, which i greenish white; flavor particularly mild. This sort is not a long keeper, bu is much esteemed for its quality, and is one of the best for early winter use."

White Lisbon or *White Florence.*—"Large, globular, neck rather thick; the skin thin, smooth, clear, and white. A late, but hardy sort."

Strasburg, Flanders, or *Dutch*—"Large, varying in shape from flat to globular or oval; outside coating brown, of firm texture; divested of this the color is reddish brown tinged with green; flavor strong. Being a hardy sort and a good keeper, it is very generally cultivated."

White Globe.—"A sub-variety of the Strasburg, much approved of by the growers near London. It is rather large and firm; general form roundish, but inclining to taper abruptly towards the neck, and also to the root, which is an advantage, as the hard portion in connexion with the root is somewhat prominent, and can be cut off without entering deeply into the softer substance of the bulb. It is of excellent quality, and a good keeper."

French, or *Dutch Blood Red.*—"Middle-sized or large, rather flattish; skin dull red, the coating next below it glossy, and very dark red. The internal layers are palest at the base, and, except at the top, they are only colored on their outsides; each layer is paler than the one that surrounds it till the centre is reached, which is white. Of all others this is the strongest flavored; it keeps remarkably well."

Tripoli or *Besagnina.*—"Very large, tapering sometimes abruptly from the middle to the neck, and almost equally so to the root; color light reddish brown, beneath the skin pale brownish red tinged with green. It is of a soft texture, and does not keep long, but while it lasts it is much esteemed on account of its mild quality."

Welsh or *Cyboule.*—"This is the *Allium fistulosum*, L., an herbaceous perennial, a native of Siberia, and consequently very hardy. The French have two varieties—the white and the red. It is quite distinct from the common onion, inasmuch as it never forms a bulb; its roots are long and tapering, with strong fibres, and its stems and leaves are hollow. Its principal use is for sowing in the end of July or beginning of August, to furnish young onions for salads early in the spring. Being very hardy, some of it should be grown for a supply in case the common onion should be cut off by a severe winter."

COST AND PROFIT OF A CROP.

Both depend, of course, on many circumstances—kind of culture, success, prices of materials, labor, onions, &c. But that the inexperienced may form some estimate of probabilities the prominent items of expense per acre are named: 1st, interest on value of land; 2d, twenty loads of manure; 3d, hauling, spreading, and ploughing, or cultivating in the same, so as to mix it thoroughly with the soil; 4th, fall and spring ploughing and harrowing; 5th, raking off clods and stones, and levelling the ground for planting; 6th, 100 bushels of ashes, or their equivalent in lime, plaster, or other fertilizers and remedies; 7th, four to six pounds of seed; 8th, planting; 9th, hoeing not less than four or five times—say six days; 10th, weeding not less than four or five times—say thirty days of boy labor; 11th, pulling and piling ten to twelve days; 12th, topping, drawing home with team, and putting up crop for market. The total of these expenses in Connecticut and Massachusetts (where the cost is probably greatest) would be covered by from $130 to $150. The market price of onions in the large cities, at the proper selling season, rarely is less than fifty cents per bushel, or more than $2. Estimating an average yield to be 500 bushels, it will readily be seen that with but moderate care and success onion-raising is a *paying* crop, and in some sections may be made a *profitable* one.

MISCELLANEOUS.

The new beginner should remember that *skill* is only acquired by *experience*, combined with persistent industry, close observation, and all the knowledge he can obtain from others. A beginning should, therefore, be made on a moderate scale. The second requisite is a deeply-cultivated, rich, friable soil, as free from weeds as possible. The third is good and abundant manuring. The fourth is good seed of the best kinds of onions. And the fifth (which is fully as important as any) is, never allow the weeds to get the start of you. The land also should be as nearly level as possible, and fully exposed to the sun.

Guano, superphosphates, and bone-dust or bone-flour, are all recommended for special manures to stimulate the growth, and the first named to keep off the fly; and where manure of hogs or fowls is scarce or dear, they answer an excellent purpose. The mixture of soot, fresh air-slaked lime, plaster, charcoal dust, ashes, salt, (omitting the last two if the land is heavy clay or too wet,) will be found a good preventive, and a stimulant also, and is highly recommended for the latter purpose. They should always be sowed when the plants are wet. If the soil is very sandy, and has been well limed, the lime may be omitted.

Some tramp the soil around the bulbs, or run a very light roller (or a barrel) over the rows, when the plants show no disposition to "bottom" or form bulbs. The effect is the same as in bending down and twisting the tops, as already mentioned.

Earlier crops can be secured of this plant, as of others, by careful selection of the finest early ripening onions, and of the earliest ripening seed from them. But some growers deem it necessary to "change seed" frequently; in which case, correspondents should be selected who can be relied on to pursue the same measures for improvement, with whom to exchange seed. A free exchange of "experience," to accompany exchanges of seed, will add to the profits of both parties.

And in this, as in the culture of all other products, the grower must enrich his soil not only with "the sweat of his brow," but with the best use of his brains, if he would attain the greatest success in his vocation.

MARKET GARDENING IN THE VICINITY OF NEW YORK.

BY PETER HENDERSON, SOUTH BERGEN, NEW JERSEY.

To supply a population of a million inhabitants daily, throughout the year, with fresh vegetables would, it might be supposed, require an immense tract of land. Such, however, is not the case. I doubt if there are more than 4,000 acres devoted to the raising of green vegetables, three-fourths of that extent being occupied with the bulkier articles of corn, peas, and beans. The finer crops of early vegetables—such as asparagus, beet, cabbage, cauliflower, cucumber, lettuce, onion, radish, rhubarb, tomato, and turnip—being confined to an extent of possibly not more than 1,000 acres. This area is occupied by the market gardeners in portions of from five to fifty acres, the average being about ten acres to each. I will briefly detail our manner of cultivating the above as practiced in this vicinity, premising that, for the cultivation of all kinds of vegetables for profit, the soil should be of the best quality—loam of at least ten inches deep, with a porous subsoil.

Asparagus being a crop that will produce for twenty years without renewal, extra preparation is given to the bed in which it is planted. This is done by thoroughly pulverizing the soil, trenching it two feet deep, incorporating it throughout with at least six inches of well-rotted manure. When thus prepared, the beds are lined out six feet wide, four rows being planted in each bed, and in length to suit the convenience of the planter. The plants are set nine inches apart in the rows. We usually take a full crop the second year after planting. The market value of asparagus is much varied, ranging from $500 to $1,000 per acre. But when once planted, it is profitable even at the minimum rate, as there is no expense attending it, except giving it a top-dressing of manure each fall, which is dug in in the spring, and in keeping the crop clear of weeds.

The *beet* used for the first crop is the "bassano," which is followed by the "short-top round." These are sown about the first week in April, in rows eighteen inches apart, and are thinned out, as soon as they get about an inch high, to five or six inches apart, and thoroughly hoed with the prong hoe twice, or until the leaves cover the soil. This crop is marketable with this treatment about the middle of June, and is sold clear off in two or three weeks at a price varying from $400 to $800 per acre. This, it will be understood, is a *first* crop, to be followed by celery or other vegetables as a *second* crop, as will be described hereafter.

Early cabbage or *cauliflower* are our most profitable, and hence most important, of all crops. The seed for these (for their culture is the same in all respects) is sown in the open ground from the 15th to the 20th of September, and a month later the plants are planted out in "cold frames," at a distance of about two to three inches apart. These frames are covered with sashes as the cold weather advances; not usually, however, before the middle of November. Care must be taken to expose them to the air on all occasions in mild days all throughout the winter. We plant them out where they are to head, usually from the middle to the end of March, in rows two feet apart, by sixteen inches between the plants. Between the rows of cabbage or cauliflower we plant lettuce plants, which have been sown and wintered over in the same manner as the plants of cauliflower and cabbage. The lettuce is ready for market by the middle of May, and is cut out and sold before the plants of cabbage or cauliflower have grown to injure it. Thus two crops grow on the same ground at the same time. The crop of cabbage and cauliflower is sold from the middle of June until the middle of July, never later. This, also, is succeeded by the second or fall crop. The value of this double crop is rarely less than $650: thus, 15,000 lettuce at $10 per 1,000 is $150, and 12,000 cabbage at $50 per 1,000 is $500=$650.

This may be taken as a low average, for, by extra manuring and cultivation, it is not at all unusual to double these amounts.

Cauliflower commands a much higher price than cabbage, usually $25 per one hundred, but the crop is by no means so certain, as we rarely make good crops two years in succession. The variety of cabbage used is the early Wakefield exclusively. It somewhat resembles the Winnigstadt, but is at least two weeks earlier. The varieties of cauliflower, are the dwarf Erfurt and Early Paris.

Onions are raised from "sets" or small bulbs that have been grown from seed sown thickly the previous year on very poor soil, so as to render them as small as possible. These are planted out as early as the ground is fit to work in spring, in beds, rows nine inches apart, the sets two inches apart in the rows. Great care is required in this crop to have the ground hoed, just as soon as the onions start to grow, and to have the soil broken between the plants with the fingers, so as to destroy the embryo weeds before they start, as the crop may be stifled if the weeds get headway.

The amount sold per acre has always been with me greater than any other, although requiring more labor to produce it. It has never sold for less than $500 per acre, and on one occasion as high as $2,100. The onions are sold in bunches (of eight or ten in each) in the green state. If dried they come in competition with those raised from the seed, and thus do not sell at anything like so high a rate. This, also, is a first crop, cleared off in July, and followed by celery, &c., as second crops.

Early radishes—the first of all vegetables from the open ground—are of very simple culture. The ground being thoroughly pulverized by ploughing and harrowing, the seed is sown regularly "broadcast," then lightly run over again with the harrow, which completes the labor until the crop is fit to gather, usually by the middle of May, or in six weeks after sowing. But although the labor of preparing the ground is very little, the preparation of the radishes for market is very expensive, all requiring to be tied in bunches, and cleanly washed before they can be sold. The prices in the New York market average about $10 per 1,000 bunches. An experienced tier averages only about that number per day; another hand is required to gather, and still another to wash. So it will be seen that the great labor in this crop leaves but a small margin of profit; the gross receipts not being more than $300 per acre. The radish crop is usually succeeded by carrots, parsnips, or long blood beets for winter use.

Rhubarb, like asparagus, being a perennial plant, requires special preparation of the soil to produce profitable crops. The variety we find most profitable is the Victoria, though by no means so high flavored as the Linnæus; but the quality of vegetables, as regards flavor, seems to be of only secondary importance in a large market like that of New York; size being everything in an article like rhubarb. It is increased by division of the roots, planted in rows four feet apart by two and a half or three feet between the plants, and is fit to be gathered the second year after planting. The preparation of the soil is similar to that used for asparagus beds, copious dressings of well-rotted manure should be dug in close around the roots in early spring. It is a clean, convenient, and safe crop, averaging a sale of $600 per acre.

The tomato is a vegetable requiring a peculiar soil and location to be produced early. I have often seen a difference of two weeks in the ripening of this fruit from the same sized plants, planted the same day, in situations only half a mile apart, but on entirely different soils; those on the light sandy soil, selling, by their earliness, at $4 per bushel; those on the stiff clayey soil, two weeks later, a drug at one-fourth of that price. The tomato, in a country like ours, will only be profitable in warm, southerly portions of the country, where there are rapid facilities to get them to the northern markets.

Thus the crop raised in the vicinity of Baltimore will always be supplanted by that, at least ten days earlier, raised in the vicinity of Norfolk. The Baltimore crop again, in turn, supplanting that of New York. It would be difficult to determine the value of the tomato crop per acre, owing to its condition of earliness and productiveness being so varied. I have discontinued growing it for some years, being convinced that it was far from profitable in this section, although there is no doubt that, in warmer latitudes, within transporting distance (say sixty hours) of our large cities, it must be highly so.

Turnip.—"Early purple top strap-leaved" is the variety most valued for market here. Its cultivation and returns are very similar to that of early turnip or Bassano beet, already described. The ground is usually cleared of this crop by the middle of June, enabling it to be followed by a second crop of sweet corn, bush beans, or celery, as may be desired. These varieties are the leading sorts that are used as a first crop. Our second consists of spinach, horseradish, celery, thyme, and other sweet herbs.

Spinach.—The only variety we use is the winter or prickly, sown from the 1st to the 15th of September, in rows one foot apart, hoed and kept clear of weeds until the growth ceases in the fall. It is best preserved during winter by a coating of two or three inches of straw or salt meadow hay. It begins to be sold often as early as March, and is usually cut off entirely in time to be followed by a summer crop of cabbage, onion, or beet. It usually sells for about $500 per acre, but it is only a moderately profitable crop, as it entails great expense in the labor of picking and preparing for market.

Horseradish.—The culture is very simple, and, so far, very profitable.

The plants or sets used are the pieces broken off from the main root in its preparation for market. These are cut into lengths of about six inches long, and are from one-quarter to half an inch in diameter. They are planted *between the rows* of cabbage or cauliflower as soon as these crops are planted in the spring, and about the same distance apart between the plants. The set or root is planted perpendicularly three inches under the surface. There is no danger in planting the sets thus deep, for horseradish is particularly tenacious of life, and will start and push through the soil even if planted much deeper. The motive in planting it under the surface is to delay its starting, so as not to interfere with the cabbage crop, which may close over it without any injury whatever to the horseradish. It sometimes happens, however, either from planting too near the surface, or by the sets being very strong, that the horseradish grows so strongly as to seriously interfere with the cabbage crop. In such cases it must be cut off by the hoe, and this will not injure it in the slightest degree. We have often had to hoe it off twice before the cabbage crop was ready. It will be borne in mind that it is the root only of this crop that is wanted, and that being grown mostly in the late summer and fall months, the removal of the leaves in June, or July even, does not in any way affect the crop.

As soon as the cabbages have been cut off, the stumps are dug up and the ground deeply hoed so as to encourage the growth of the horseradish crop. This rarely requires to be done more than once, the rapid growth of the leaves smothering all weeds. It attains its full growth of root by the end of October, when it may be dug up; but being an entirely hardy plant, we usually defer lifting it until all our more tender vegetables are secured, so that the time of digging it up is usually in November and December. It is then placed in pits adjacent to the vegetable-house, so that it can be got at conveniently and trimmed during leisure time in winter. Its preparation for market is very simple, being merely trimming off the small roots, (which are kept for next season's planting;) washing, by rinsing them around in a large tub; weighing—for it is all sold by weight—and packing in barrels. The average weight per acre is four tons, and for the past five years it has sold at $200 per ton, or $800 per acre. During March of last year it sold as high as $250 per ton. I have always considered it as the most safe and profitable crop of our gardens.

Celery.—As the cultivation of celery is but very indifferently understood, and an immense amount of useless labor given to its cultivation in many parts of the country, I will describe our practice of it at more length than other vegetables. This system is suitable either for private use or for market garden culture.

The ground best suited for celery is a heavy loam, although it will grow freely on any soil, provided it is rich enough. It is a mistaken notion that it does best on wet soil. No doubt it requires abundance of moisture; but at the same time it is quite as impatient of a soil where water stagnates as any vegetable we grow.

The system we now adopt is much more simple than that in general use. We entirely dispense with the trenches, thereby saving a great deal of extra labor. The crop is planted on the flat surface, in the same manner as any other vegetable, in rows (for the dwarf varieties) three feet apart, by six inches between the plants. In planting, great care should be taken that the roots are properly formed. The safest plan, after planting, is to press by the side of each plant gently with the foot, so as to compact the earth around the root until the new rootlets are formed. This practice should be rigidly observed in planting of every description, as much disappointment is caused by the omission of this very simple precaution.

After planting, nothing more is required for six or seven weeks but hoeing between the rows to keep down the weeds. By the end of August the cool and moist atmosphere quickly induces a rapid growth, and when the plants attain the height of ten or twelve inches the earth may be drawn up against them, so as to cause an upright growth and keep the plants from spreading. To that wanted for fall use, a further addition of soil may be added. This time it had better be done by the spade, and raised to at least half the height of the plants. The final earthing-up may be delayed for a few days, so as to allow an increase of growth. In two or three weeks after the last earthing-up, it will be blanched sufficiently for use. This is the process required for what is to be used until the middle of December. That which is wanted for *late* winter use requires but little labor, as it should never be banked up. All that is required is simply to hoe the soil towards it, so as to induce an upright growth; then further tighten the soil to it with the hands, and hoe up against it soil enough to keep the plant in its upright position, which is all that is necessary until it is dug up to be put away in the trenches, wherein it is to be kept during winter. This is performed in the following manner: Dig a trench or drain in a dry spot as narrow as the spade will allow, say ten or twelve inches wide, and of the depth of the length of the celery—that is, if the celery is two feet long, the trench must be two feet deep, so that the top leaves will be level with the surface of the ground. It will be understood that the celery is packed in this trench or drain perpendicularly, so as to fill it completely; no earth being put between the plants, nor even to the roots, as there is always moisture enough at the bottom of the trench to keep the plants from wilting. The time at which this operation is performed has a great deal to do with its success. In growing this crop on a large scale in our market gardens, we begin to put the first lot away in the trenches by the 25th of October, which is blanched fit for use by the middle of December. Our second lot is put away about the 10th of November, which is that used in January and February. The last lot we delay putting away as long as it is safe to risk it—say the 20th of November. This lot almost invariably keeps in fine order until March. Attention to dates in this matter is of the utmost importance, as by putting it away too early the warm weather would cause it to blanch too quickly, while by delaying too long it might get caught by frost, which usually comes severe enough to hurt it by the end of November. By the middle of December the trenches containing the celery must begin to be covered up with straw or leaves, which must overlap the trench a foot at least on each side. The covering must be done at intervals as the season advances to severe weather, which is rarely before the first of January. By this time it should have a covering of eight or ten inches. Covered to this depth it will safely resist the severest frosts, and the roots can be taken out with little trouble during the winter.

For private use.—Where there is a plenty of cellar-room the celery may be packed in narrow boxes, having a layer of soil at the bottom, exactly in the same manner as is done in the trench. The only precaution necessary is, that the boxes be narrow, so that too much of it may not be packed together to heat.

The *dwarf* varieties, red and white, should be grown to the exclusion of all others. They are much better flavored, more solid, take up only two-thirds of the space, cost only half as much in labor, and, above all, being of firmer texture, they keep much better during the winter. We have grown over ten acres of these varieties for the last six years, and have found it vastly to our interest to discard all others.

By using the new dwarf variety, we grow, for fall use, 30,000 roots per acre—rows three feet apart—which have averaged, even in the New York markets, $3 per hundred roots. For winter use, 40,000 roots per acre are planted—rows two feet apart—which averages $2 per hundred roots. There is considerable labor in growing this crop, and, occasionally, loss from peculiarities of the season; and the immense quantity grown and thrown into our market (for it is not easily transportable) lowers the price, at some parts of the season, below the paying level. For the past few years, however, our market here has been relieved by shipments to Philadelphia, Baltimore, Boston, and other cities. There is no doubt that, in many parts of the Union, it can be grown by our method at a handsome profit.

Sweet herbs.—The cultivation of *thyme, sage, &c.*, for market purposes is but little known in this country except in the vegetable gardens in the vicinity of New York. There it is practiced to an extent of perhaps sixty or seventy acres, a fair average product of which would be about $500 per acre. Like the crops of celery, spinach, or horseradish, it is grown only as a second crop—that is, it is planted in July after an early crop of peas, cabbages, beets, or onions has been sold off. The varieties used are thyme, sage, summer savory, and sweet marjoram, the former two being grown in the ratio of ten acres to one of the latter. The seed is sown in April in rich mellow soil, carefully kept clean from weeds until the plants are fit to plant out, which may be done any time that the ground is ready, from the middle of June until the end of July. As the plants are usually small and delicate, it is necessary that the ground be well fined down by harrowing and raking before planting. The distance apart, for all the varieties, is about the same, namely, twelve inches between the rows, and eight or ten inches between the plants. The lines are marked out by what is termed a "marker," which is simply a mammoth wooden rake with the teeth twelve inches from centres; having six or eight teeth, this number of lines is marked at once. This "marker" is used for many other purposes; in lining out the rows for early cabbages, for instance, every alternate line is planted, thus leaving them two feet apart, their proper distance.

In eight or ten days after the herb crop has been planted, the ground is "hoed" lightly over by a steel rake, which disturbs the surface sufficiently to destroy the crop of weeds that are just beginning to germinate; it is done in one-third of the time that it could be done with a hoe, and answers the purpose quite as well; as deep hoeing, at this early stage of planting, is perfectly useless. In ten or twelve days more the same operation is repeated with the steel rake, which usually effectually destroys all weeds, the seeds of which are near enough the surface of the ground to germinate. (We use the steel rake instead of a hoe on all our crops immediately after planting; for, as before said, deep hoeing on plants of any kind, *when newly planted*, is quite unnecessary; and by the steady application of this rake weeds are easily kept down, and it is great economy of labor *never to allow them to get established*.)

The herb crop usually covers the ground completely by the middle of September. Then every alternate line is cut out, each plant making about two "bunches." The object in cutting out the lines alternately is to give room for the remaining lines to grow. In this way, nearly twice as much is taken off the ground as if every line had been cut; and it frequently happens, on particularly rich soils, that at a second cutting every alternate line is *again* taken, when the remaining lines, now standing about four feet apart, will again meet. I had about an acre of thyme treated by this process, in the fall of 1864, that sold for over $2,000. But this was an exceptional case; the crop was unusually heavy, and prices, at that time, were more than double the average. As before stated, the average yield is about $500 per acre. Herbs are always a safe crop for the market gardener. They are less perishable than anything else grown; for, if there be any interruption to their sale in a green state, they can be dried, boxed, or barreled up, and sold in a dry state a year after if necessary. The usual price is from $10 to $15 per 1,000 bunches, and we have always preferred to dry rather than sell for less than $10 per 1,000—experience telling us that the market will always so regulate itself as to handsomely pay for holding back the sale. The cost of getting the crop raised and marketed will average about $150 per acre, the principal expense being in tying it in bunches. But with many of our industrious German gardeners it does not cost half that, as the tying is usually done by their wives and children in the evenings, and is a pleasant as well as profitable occupation.

It may be supposed by some that these large receipts per acre, from market gardening, are exaggerations. I can simply say, they are not. The condition of the soil, however, in which our vegetables are grown, is such as few farmers have any conception of. One leading condition of this high state of cultivation is (where required) thorough drainage; most of my land is drained with four-inch horseshoe tile, three feet deep, the drains being only eighteen feet apart.

We use, every spring, at least seventy-five tons of well rotted manure per acre, or alternate it with 1,200 pounds of best Peruvian guano, or 2,000 pounds of crushed bone. The manuring is done only in the spring for the first crop; sufficient remains in the soil to carry through the second crop of celery, &c., successfully.

It takes about three years to bring ordinary farm land into the high state of cultivation necessary for successful market gardening.

MARKET PRODUCTS OF WEST NEW JERSEY.

BY J. S. LIPPINCOTT, HADDONFIELD, N. J.

LABOR, either of muscle or of mind, is the true source of wealth. It is not by the gains of trade, or successful speculation, that the resources of a nation are increased; but by the harmonious, unimpeded labor of every member in the business for which he is fitted, and the equitable interchange of the products of manual skill, of inventive genius, and of mental toil. Mental labor is properly included among the sources of national wealth, because, though often deemed "unproductive," it is the agency by which unskilled labor is directed aright and rendered valuable. The moral and intellectual growth of a people is also a source of wealth, adding to material gains, while it increases the ability to derive legitimate pleasure from the possession of abundance.

The foundations of our national wealth are laid upon agriculture, manufactures, commerce, and mining. Of these, agriculture is of first importance. It is that which feeds and clothes all other labor, which supplies the material to be transformed by the skill of the artist, and freights our commerce, foreign and domestic. Agricultural labor is, then, the leading and most important direct source of wealth. The skill of the mechanic may improve, the enterprise of the merchant may exchange, but the source of wealth is in the earth, and the cost and profit are alike determined by the results of agriculture. No other branch of human industry has stronger claims upon the fostering care of legislation; for not only upon its prosperity does that of the State now depend, but the future of the nation is closely bound up with its healthy and sustained progress. Upon the conservation, by the present generation, of those forces in the soil to which we owe our wealth of vegetable and animal products—upon our ability to continue, without deterioration, to produce material for food and clothing sufficient for the growing wants of a rapidly increasing people, depends, in a great measure, the future of the nation. What question of material interests is more momentous, or demands more earnest consideration, by those who would legislate for the living as well as for their posterity?

To the prosperity of agriculture we owe most of the increase in wealth, and the consequent civilization and refinement of the present age. This is so obvious, that agricultural statistics are considered by every statesman as a thermometer, indicating, most unerringly, the advance or decline of a nation's prosperity.

Hence the care taken to register these statistics by those States in which the true principles that regulate trade and productive industry are best understood. Monetary crises have originated and spread rather from ignorance of the actual state of productive industry throughout the earth than from any other cause. The value of agricultural statistics can hardly be overestimated. They form, as has been well said, "the key which is to unlock the hidden treasures of maturing nature; the chart which reveals to the husbandman and merchant the great laws of demand and supply, enabling each to work out a safe and healthy prosperity."

Though the following is mainly descriptive of the progress and products, with extended notices, of the market-gardening of Camden county, the region with which we are most familiar, the character of the agriculture of the western and southern counties of New Jersey, is therein approximately described.

All that the county of Camden (and a wide district of New Jersey) claims in superiority over the primeval forest, has been the result of unremitting labor and the teachings of recent times. Nature supplied but the crude materials of sands, and clay, and muck; the industrious and skillful farmer has wrought out the problem of existence by aid of foreign material which the neighboring city and the exhaustless "marl" beds have supplied. The soil of the district does not appear to possess the self-recuperative powers enjoyed by many regions whose loams have resulted from the decomposition of hornblende and limestone rocks. These latter, by their decay, give up to the softened material which man, by his labors and the growth of vegetation, converts into soil, a larger share of those soluble mineral ingredients which, though needful to the successful production of human food, are not largely present in the soil of lower New Jersey. Nowhere can more convincing evidence of the immense superiority of the recent improved system of farming, over that pursued by the fathers and grandfathers of the present generation, be found, than in this section of the Union. The success already attained should stimulate to renewed efforts; for it is by no means certain that the limit of improvement has been reached. A very large portion of the eastern counties of New Jersey is, moreover, in a state of nature—wild land, scarcely inferior to much of that which the energy of the West New Jersey farmer has redeemed. The same means, so successful in his hands, must render productive these now unproductive tracts; and it is a leading object of this paper to exhibit the gratifying results of thorough improved culture upon exhausted soils, that the example may be imitated by the despairing or doubting tenant of similar lands yet unimproved. In the midst of the wilderness of East New Jersey, some enterprising agriculturists have already made farms which would be pronounced models in any part of the country, and the cultivation of small fruits and garden vegetables has there been extensively and successfully prosecuted. The low swamp-lands, hitherto esteemed valuable only for their product of white cedar or cypress, (*Cypressus thyoides*,) the common material for fence rails, are also found capable of redemption, and, when planted with the cranberry, have proved highly remunerative. Capital and labor are now tending largely towards this branch of cultivation.

The success which has attended sundry attempts to redeem this hitherto neglected part of the Union has been so gratifying, that it bids fair to turn the tide of emigration. Many, dissatisfied with the border semi-civilization of the west, and its privations, its extreme climate, and their general unsatisfactory experience, have returned to the east, to find in New Jersey all the advantages of a kind soil, (needing much improvement, it is true, but with fertilizing resources of ready access,) near an unsurpassed market, with a climate unequaled for mildness and salubrity anywhere in the north. To those who contemplate removal from the northeast or the northwest in search of a more genial air—to all who would learn what gratifying results may be attained on a seemingly unpropitious soil, this record of the experience of the New Jersey farmer cannot fail to prove interesting. Its lessons may be read with advantage by farmers, whether in the east or in the west, whether contemplating removal, or content to rest upon their paternal acres depleted by the generations that have grown thereupon.

THE "PEA-SHORE" REGION.

The production of vegetables for the markets of Philadelphia and New York is a leading branch of New Jersey agriculture. The business is locally denominated "trucking," and those who pursue it, "truck farmers" or "truck men." These terms, though not found in "Webster unabridged," are of long-standing use; but whence their origin we have not discovered. "To truck" is an obsolete and now vulgar term for bartering, but for that kind of trade common between the early settlers and the Indians, by which articles of trifling cost were exchanged for others of greater value—as trinkets, for skins and furs. As the term "garden-truck" is often used by farmers who regard the cultivation of the garden as contemptible, the word may have had kindred origin with that which describes the barter of trifles for valuable commodities. The comparison may still appear to hold good; for, from a moderate extent of well-tilled land, the skillful and early producer of market-garden vegetables, or "truck," receives large returns in substantial sums of gold or greenbacks.

The peculiar advantages, local and general, enjoyed by the eastern bank of the Delaware river to furnish to the epicurean tables of the adjoining city those delicate, early vegetables, unsurpassed in quality in any other region, as well as those heavy supplies of more common produce indispensable to the health and comfort of the masses, render this district peculiarly worthy of notice. The more favored portion of this region is located immediately upon the river bank, extending northeast to Pensaukin creek, about five miles beyond the city of Camden. From the very early opening of spring in this locality, and the success which attends the early pea culture, it is known as "Pea-Shore." On this narrow strip, vegetables have been raised, with almost uniform success, several days or a week earlier than on adjoining lands more remote from the river, and larger sums have been realized from their sale than have been made by the growers located at Norfolk, Virginia, noted for its extremely early products. Here the soil is loose, warm, friable, easily drained, readily penetrated by the rays of the early spring sun, and especially protected by the influence which humidity affords in preventing the escape, by night, of the warmth received by day. The protecting agency of moisture appears to extend from one-half to three-quarters of a mile from the river, and to be modified by the wind prevailing at the time. When the wind is from the west, the later frosts of spring do not affect the river farms, while those a half mile distant may have their early vegetables seriously injured. Again, in autumn it has been observed that as long as the winds prevail from the west, passing over the river, the late crops of tomatoes do not suffer, while the entire crop half a mile distant, beyond the low hills, may be entirely destroyed. As if confirmatory of the belief that the protecting influence resides in the presence of humidity, the residents observe that nights which are perceptibly damp give promise of freedom from frost. This region is washed by the Delaware on its northwest side, and has the benefit of a spread of water from one to one and a half mile in breadth, including the low island which may be properly regarded as merely an extension of the water, as it is, in a great measure, a bog. It is thus favored by proximity to a wider expanse of water than the region above or below for many miles. The presence of considerable humidity in the atmosphere immediately over a region, by night, is now known to impede the escape of radiant heat.

This early and productive district is part of that through which the Camden and Amboy railroad passes, and which many observers regard with no very favorable impressions of New Jersey soil for agricultural purposes. An exhibit of the products of a farm lying in this desolate region, so given over to sands and barrenness, (in the opinion of many,) may impress an agricultural mind with its value as a spot whereon to grow profitable crops of early vegetables—the very vegetables for which Philadelphians so extol their markets, and which, indeed, contribute in no small degree to render it a most desirable city for residence.

The following are some of the returns from a farm of about eighty acres, situated thus favorably—a farm which it may be well to say is valued at upwards of $25,000. We will say nothing of the crops of corn, wheat, oats, and hay, which were considerable—adequate, or nearly so, to maintain the stock of horses and cows kept upon the farm—but note only that about 5,000 baskets of tomatoes were raised thereon in one season, which returned upwards of $3,000; more than 1,000 baskets of white potatoes, producing $1,200; 1,000 baskets of peas, which sold for more than $800; and 1,000 baskets of other "truck" of various kinds, which returned $1,000—making an aggregate, independent of farm crops, of upwards of $6,000. To produce these large returns demanded energy, skill and untiring industry, upon a soil admirably adapted to these crops, and most favorably located, as we have remarked, combined with the application of a large amount of manures from the city stables, and a heavy expenditure for fertilizers of several kinds.

STATISTICS OF CAMDEN AND BURLINGTON COUNTIES, N. J.

The success which attends good farming is the best evidence that can be adduced in support of the claims of New Jersey to the possession of great agricultural advantages. Facts furnish the best reply to the many attacks that have, from time to time, been made upon the State. We have been furnished with the agricultural statistics of the counties of Camden and Burlington, by courtesy of the chief of the Census Bureau, which we append for the satisfaction of our readers who may be interested therein. The details of products, and the value of products of each township, will render these tables of greater interest to their residents, respectively.

Agricultural statistics of Camden county, New Jersey.

Townships.	Acres of land.		Cash value of farm.	Value of farming implements and machinery.	Live stock, June 1, 1860.								Produce during the year ending June 1, 1860.				
	Improved.	Unimproved.			Horses.	Asses and mules.	Milch cows.	Working oxen.	Other cattle.	Sheep.	Swine.	Value of live stock.	Wheat, bushels of.	Rye, bushels of.	Indian corn, bushels of.	Oats, bushels of.	Wool, pounds of.
Stockton	5, 586	596	$844, 500	$18, 575	257	19	285	......	51	70	730	$35, 925	4, 973	5, 040	20, 385	530	162
Camden city	165	......	230, 500	350	8	......	15	......	......	......	29	1, 350	200	172	1, 400	275	......
Newton	7, 260	265	1, 275, 735	24, 700	314	37	748	5	105	203	1, 093	47, 350	13, 416	1, 465	44, 785	4, 214	466
Delaware	11, 873	2, 191	1, 225, 610	37, 975	478	43	1, 180	......	381	619	1, 975	91, 575	18, 648	4, 707	68, 457	6, 972	1, 904
Union	320	83	70, 100	750	18	......	33	......	1	......	47	1, 900	......	180	425	......	......
Centre	5, 481	1, 589	645, 960	17, 245	242	14	477	......	109	231	790	31, 403	9, 748	1, 490	34, 700	1, 931	542
Gloucester	7, 601	3, 475	498, 600	20, 755	241	31	460	2	219	283	1, 010	43, 200	9, 415	5, 455	35, 205	2, 705	461
Waterford	4, 565	3, 228	359, 000	8, 300	160	28	312	......	109	53	658	24, 375	3, 468	4, 079	21, 390	2, 645	......
Washington	7, 001	1, 913	505, 600	16, 805	222	40	339	13	316	129	945	44, 450	5, 926	6, 818	40, 450	2, 935	160
Winslow	2, 412	1, 252	120, 800	3, 625	50	21	108	......	75	6	248	10, 350	798	2, 407	7, 375	440	......
Monroe	3, 470	3, 245	215, 700	8, 925	129	20	172	......	159	21	355	19, 425	2, 884	3, 786	16, 950	2, 173	......
Total	55, 734	17, 837	5, 992, 105	158, 005	2, 119	253	4, 129	20	1, 525	1, 615	7, 880	351, 303	69, 476	35, 599	291, 522	24, 820	3, 695
Camden county in 1850	53, 968	77, 416	4, 651, 048	153, 622	1, 924	377	3, 669	57	1, 330	2, 133	9, 107	344, 363	66, 440	22, 138	259, 684	22, 139	2, 777
Increase	1, 766	59, 579	1, 341, 057	4, 383	195	......	460	......	195	......	......	6, 940	3, 036	13, 461	31, 838	2, 681	918
Decrease	......	......	......	......	......	124	......	37	......	518	1, 227	......	......	......	......	......	......

Agricultural statistics of Camden county, New Jersey—Continued.

Townships.	Produce during the year ending June 1, 1860.																	
	Peas and beans, bushels of.	White potatoes, bushels of.	Sweet potatoes, bushels of.	Barley, bushels of.	Buckwheat, bushels of.	Value of orchard produce.	Wine, gallons of.	Value of produce of market gardens.	Butter, pounds of.	Cheese, pounds of.	Hay, tons of.	Clover-seed, bushels of.	Hops, pounds of.	Molasses, gallons.	Beeswax, pounds of.	Honey, pounds of.	Value of home manufactures.	Value of animals slaughtered.
Stockton	1, 687	15, 190	26, 782	....	480	$1, 450	....	$120, 450	28, 665	....	733	....	......	......	......	......	$30	$14, 152
Camden city	....	700	100	....	160	50	10	200	1, 000	....	36	....	......	......	......	......	....	200
Newton	97	51, 225	12, 220	60	298	2, 030	....	36, 603	114, 850	....	3, 166	....	......	......	......	......	....	21, 155
Delaware	22	75, 930	12, 135	....	761	4, 753	5	16, 965	132, 982	4, 950	4, 360	27	......	......	33	366	15	37, 976
Union	44	1, 650	1, 175	....	60	....	....	7, 650	1, 095	....	72	....	......	......	......	......	....	996
Centre	47	30, 970	17, 215	....	546	1, 505	....	11, 020	54, 280	18	2, 166	....	32	36	......	......	8	12, 899
Gloucester	730	54, 375	9, 355	....	2, 208	150	2	250	24, 925	3, 318	1, 290	12	......	......	......	......	....	16, 363
Waterford	....	21, 315	1, 754	....	830	....	....	100	16, 100	100	932	....	......	......	......	100	....	7, 704
Washington	....	73, 850	4, 723	....	1, 187	250	....	....	26, 450	400	1, 309	52	......	......	......	200	200	15, 990
Winslow	....	7, 675	755	....	478	....	....	....	6, 250	....	283	....	......	......	......	50	....	2, 794
Monroe	....	21, 705	885	....	1, 352	....	....	500	11, 620	....	257	10	......	......	......	100	....	6, 170
Total	2, 627	354, 585	87, 099	60	8, 360	10, 188	17	193, 738	418, 217	8, 786	14, 604	101	32	36	33	816	253	136, 399
															849			
Camden county in 1850	27	307, 869	65, 191	....	10, 620	20, 805	....	42, 301	299, 856	20, 882	12, 946	25	297	30	2, 554		216	72, 382
Increase	2, 600	46, 716	21, 908	60	....	....	17	151, 437	118, 361	....	1, 658	76	......	6	....		37	64, 017
Decrease	....	....	....	....	2, 260	10, 617	....	....	....	12, 096	....	....	265	......	1, 705		....	....

Agricultural statistics of Burlington county, New Jersey.

Townships.	Acres of land.		Cash value of farms.	Value of farming implements and machinery.	Live stock, June 1, 1860.								Produce during the year ending June 1, 1860.					
	Improved.	Unimproved.			Horses.	Asses and mules.	Milch cows.	Working oxen.	Other cattle.	Sheep.	Swine.	Value of live stock.	Wheat, bushels of.	Rye, bushels of.	Indian corn, bushels of.	Oats, bushels of.	Tobacco, pounds of.	Wool, pounds of.
Bordentown	5,062	275	$501,185	$13,050	267	26	46	8	163	429	926	$56,575	8,782	2,799	19,650	17,103	8,500	699
Chesterfield	16,728	1,281	1,241,538	29,685	460	60	857	4	439	2,299	3,343	1,111,925	14,752	8,143	71,260	31,990	....	5,959
Mansfield	17,301	930	1,583,641	48,417	633	54	1,557	15	803	3,736	4,155	163,985	24,024	8,319	93,270	44,925	....	5,614
Burlington city	1,258	176	156,200	5,420	11	6	76	....	32	21	157	10,500	931	430	3,310	750	....	....
Burlington town	56,100	807	706,200	15,700	218	18	450	2	129	300	668	40,984	6,596	3,557	22,635	6,656	....	921
Springfield	15,982	906	1,620,800	51,215	544	57	1,713	26	925	2,877	4,793	181,739	16,036	17,806	101,028	28,638	....	8,517
Hanover	16,514	8,185	1,677,000	39,935	645	101	1,270	....	671	3,517	6,032	162,638	13,629	22,253	123,280	23,549	300	11,372
Northampton	585½	13	120,900	1,780	31	....	68	....	7	21	121	8,205	1,185	350	4,200	595	....	....
Beverly	2,116	505	784,000	6,875	96	7	114	2	51	....	275	13,250	2,352	1,344	7,970	160	....	....
Willingborough	3,271	538	326,000	11,800	140	2	257	....	104	84	393	26,840	4,346	1,462	12,470	4,800	....	....
West Hampton	8,658	895	1,013,600	26,620	325	14	863	2	333	752	1,775	95,292	14,913	5,690	49,838	20,062	....	2,083
Cinnaminson	7,146	2,055	744,090	29,715	286	55	496	....	189	154	755	55,587	10,665	4,343	30,335	2,163	....	169
Chester	8,647	1,188	1,002,100	44,320	435	45	856	2	250	239	1,145	86,801	17,919	2,053	45,185	12,360	....	430
Lumberton	9,580	1,515	968,200	41,185	418	31	867	20	428	1,219	2,152	103,321	10,907	11,973	71,835	9,715	....	2,883
Pemberton	9,926	505	284,000	6,875	96	7	114	2	51	....	275	13,250	2,352	1,344	7,970	160	....	....
Evesham	16,821	2,565	1,589,105	70,150	799	106	1,722	18	571	2,101	2,305	176,307	14,736	15,247	1,112,035	13,044	....	4,356
Medford	7,960	1,467	820,950	33,675	358	47	783	4	318	1,904	1,381	95,172	2,130	15,242	55,400	3,463	....	4,047
Southampton	12,685	20,616	1,406,430	39,312	519	29	1,208	40	708	1,918	4,412	159,674	8,607	24,572	105,525	6,952	....	5,382
Shamong	4,778	3,600	297,250	13,865	174	37	358	....	194	112	968	42,675	896	7,964	25,686	2,517	....	329
Washington	1,248	34,860	180,700	3,200	41	42	127	10	129	....	312	14,980	126	1,418	6,115	288	....	....
Egg Harbor	3,801	25,934	287,450	7,552	127	12	364	52	400	201	623	29,502	2,824	2,677	13,392	1,938	....	347
Total	226,167½	108,816	17,311,339	540,346	6,623	756	14,166	207	6,895	21,884	36,966	2,649,202	178,708	158,986	1,982,389	231,828	8,800	53,108
Burlington county in 1850	132,017	40,670	11,666,550	316,217	5,203	413	12,545	572	8,004	20,981	35,376	1,063,412	152,369	118,920	883,011	159,398	....	43,781
Increase	94,150½	68,146	5,644,789	224,129	1,420	343	1,621	....	....	903	1,590	1,585,790	26,339	40,066	1,099,378	72,430	8,800	9,327
Decrease	....	....	....	....	....	....	....	365	1,109	....	....	....	....	....	....	....	....	....

Agricultural statistics of Burlington county, New Jersey—Continued.

Townships.	Produce during the year ending June 1, 1860.																			
	Peas and beans, bushels of.	White potatoes, bushels of.	Sweet potatoes, bushels of.	Barley, bushels of.	Buckwheat, bushels of.	Value of orchard products.	Wine, gallons of.	Value of products of market gardens.	Butter, pounds of.	Cheese, pounds of.	Hay, tons of.	Clover-seed, bushels of.	Grass-seed, bushels of.	Hops, pounds of.	Molasses, gallons of.	Beeswax, pounds of.	Honey, pounds of.	Value of home manufactures.	Value of animals slaughtered.
Bordentown	47	8, 550	8, 435	210	780	$5, 295		$9, 425	17, 960	300	1, 572					22	280		$9, 651
Chesterfield		18, 510	1, 791	90	582	2, 437	25	1, 000	38, 563	1, 540	3, 176	13	4			8	465		58, 301
Mansfield	1, 092	33, 254	3, 736	85	2, 511	4, 110	6, 018	18, 425	98, 148	3, 120	4, 931	48	583	76	*284	36	1, 122	$25	59, 942
Burlington city	473	3, 325	1, 625		130	325		12, 490	4, 430		250		10	5			220		2, 483
Burlington town	658	12, 026	3, 360	300	1, 181	2, 095	5	27, 006	23, 600		1, 326		8			21	281		11, 219
Springfield	141	31, 152	2, 664		2, 668	2, 157	26	1, 540	55, 931	1, 579	6, 310	3	24		†35		515	50	55, 797
Hanover	13	27, 644	1, 544		2, 230	2, 416			70, 304	8, 343	3, 906	68	71			85	1, 037		119, 796
Northampton	8	1, 650	170		120	65	5	975	4, 350		204		200						1, 354
Beverly	267	5, 205	5, 825		501	1, 305		25, 075	5, 820		268								3, 155
Willingborough	82	9, 155	4, 205		674	1, 270		11, 175	18, 145	300	1, 084	12	34						7, 585
West Hampton		19, 595	1, 472		886	1, 215	90	1, 215	30, 060	10, 050	3, 231	65	29		†20				21, 853
Cinnaminson	679	24, 544	39, 332		1, 046	4, 748	15	85, 132	29, 103	110	1, 733	18	31	152		51	835		16, 546
Chester	123	42, 010	8, 494		1, 299	10, 085	136	33, 051	59, 176	3, 460	4, 148	43	12	96		24	670		29, 083
Lumberton	72	44, 425	3, 843		1, 944	2, 475	94	3, 970	30, 713	2, 600	3, 829		46	55			400		46, 555
Pemberton	81	28, 850	2, 417	10	3, 447	455	45	300	32, 084	1, 410	3, 411	1	123		*40	52	700	300	32, 130
Evesham	26	86, 656	13, 936		3, 375	7, 402	98	30, 230	68, 853	38, 113	8, 059	52	2	168		1	863		59, 162
Medford	1	30, 110	9, 662		2, 880	2, 323	112	2, 920	29, 488	17, 931	3, 714			150			773		34, 396
Southampton		36, 856	2, 536		7, 131	1, 993		100	44, 870	7, 750	4, 762	2	68	50		7	1, 550		73, 287
Shamong		12, 249	870		1, 750	811	3	2, 188	16, 862	552	1, 490			60			693		15, 591
Washington	10	2, 350	402		173			1, 000	4, 310		414						61		3, 259
Egg Harbor	4	7, 144	1, 500		1, 536	115			11, 705		2, 447					14	150		7, 981
Total	3, 777	485, 260	117, 819	695	36, 844	53, 097	6, 672	267, 217	694, 475	97, 158	60, 265	325	1, 245	812	379	321	10, 615	375	669, 126
																10, 936			
Burlington county in 1850	2, 048	364, 461	47, 682	10	29, 744	53, 433	255	51, 639	688, 869	238, 940	41, 783	115	582			3, 050		433	394, 380
Increase	1, 729	120, 799	70, 137	685	7, 100		6, 417	215, 578	5, 606		18, 482	210	663	812	379	7, 886			274, 746
Decrease						336				141, 782								58	

* Maple. † Sorghum.

From the Census Report of 1850 we learn that there was in Camden county, New Jersey, 731 farms, comprising 53,968 acres of improved land, and 77,416 acres of land unimproved. The latter included all such as was in occupancy and necessary to the enjoyment of the improved portions, though not itself reclaimed. These 731 farms, therefore, embraced an area of 131,384 acres. The distinction between improved and unimproved land is not very clearly drawn, as it is plain, from the result attained, by dividing the total number of acres by the number of farms, the quotient, 180 acres, as the average extent of the farms of Camden county, being quite too great. Much land which is neither meadow nor wood land attached to the farm has been included in the contents erroneously. If one-half the unimproved be considered as forming part of the farm, the average of each will be found to be 126 acres, and the value per acre $52, according to the Census Report of 1850. The total value of farms (implements included) was $4,804,670. According to the census of 1860 the farms of said county embraced 55,734 acres of improved, and 17,837 of unimproved land. The amount unimproved is thus greatly reduced by the latter census, and more just distinction made between that occupied and useful, and that unoccupied and unproductive. (Seventy-seven, in the report of 1850, is probably an error for seventeen, easily made by a copyist.) The total number of acres, properly considered farm land, becomes, therefore, in 1860, 73,571; and if the farms have not increased in number, the average number of acres in each becomes 100, which appears to be very nearly correct. The total value of farms and implements being nearly six millions of dollars, gives to each acre an average value of 83 $\frac{50}{100}$ dollars. As the area of the county of Camden is 173,000 acres, there remain nearly 100,000 acres unoccupied, and unreported by the census of 1860. This is mainly comprised in extensive tracts of unreclaimed brush lands and cedar swamps. A detailed comparison of the census tables for 1850 and 1860 will indicate a general advance, and, in some products, an extraordinary increase during the ten years which intervened. Thus the land and implements in the county of Camden were valued at $1,345,440 higher in 1860; the wheat showed a small decline of about 3,000 bushels; rye and oats a considerable falling off; white and sweet potatoes an increase together of about 70,000 bushels; butter exhibits an increased product of about 18,000 pounds, while cheese declined 12,000 pounds; hay an increase of 1,658 tons; sheep declined 518, and swine 1,227; neat cattle increased but 618; horses increased 195, and asses and mules declined 124; while the value of animals slaughtered was nearly doubled. The returns of orchard products were, in 1860, but half those of 1850, having declined upwards of $10,000. The market garden products had advanced from $42,301 to $193,738, an increase of $151,437, or nearly 360 per cent. The last census inquiry was made five years ago, and cannot exhibit the aggregate products of the county at this time. These are no doubt much in excess of those of 1860, the crops of many kinds gathered in 1864 having been of extraordinary yield, and above the average of some years previous.

The county of Burlington, adjoining Camden on the northeast, is much more extensive, and exhibits, according to the last census, much greater aggregates of products and value, having nearly 900 more plantations, and an extent of improved and unimproved territory of 324,983 acres, or nearly three times that of Camden. Here, also, is exhibited a general advance in value and production which is very gratifying. If we may believe the report, of improved lands nearly 85,000 acres have been taken into cultivation during the ten years prior to 1860; the farms improved in value to the extent of five and a half millions of dollars; the wheat increased 26,000 bushels; rye and oats together increased about 112,000; corn 1,100,000; white and sweet potatoes together upwards of 190,000; buckwheat 7,000; wine 640 gallons; butter increased 5,606, while cheese declined 141,782 pounds; hay showed an increased product of nearly 20,000 tons; sheep 903; swine 1,590 more; cattle of all kinds 3,076 increase;

and horses and mules were, together, in 1860, more numerous by 1,763 than in 1850; while the value of animals slaughtered increased $275,000. The orchard product was almost identical in value with that of 1850, while the market garden product advanced from 51,639 dollars in 1850, to 267,217 dollars in 1860, a gain of 215,578 dollars, or about 418 per cent. increase in ten years.

Burlington county was divided, according to the Census Report of 1850, into 1,638 farms, which were valued in 1860 at seventeen and a half millions of dollars. The farms averaged 112 acres each, and were estimated worth $63 75 per acre, or about $20 per acre less than the farm lands of Camden. Upwards of 300 square miles of Burlington, near the Delaware, extending twelve miles therefrom, is a fine fertile loam; the rest of the county is sand, or a sandy loam. About 100 square miles of Camden contains the same superior soil as that in the western part of Burlington; the remainder, 173 square miles, is sandy, and cannot be so readily improved. One-half of Burlington is thus of excellent quality, while only about one-third of Camden is highly productive. This difference in the relative extent of the improved soils may account for the more rapid development of the larger county.

PRODUCTS OF SEVERAL CAMDEN FARMS IN 1864.

From a large number of returns to queries distributed among the farmers of Camden county, and responded to by many intelligent, public-spirited gentlemen, we select the following interesting details. Many of the returns cannot be used because imperfect and irregular. Sixty contain details sufficiently clear and full to serve our purpose, for though they represent but one-twelfth of the number of farms in the county, they vary in size from 8 to 500 acres, and in productiveness from very best, perhaps, to very worst, and may be considered representatives of the county, or more properly of the northwestern or cultivated portion:

Number of acres in farms	6, 132.75
Number of acres arable	4, 852.00
Number of acres woodland, &c	1, 280.75
Average acres in each farm	102.21
Average acres arable	80.82
Average acres woodland, &c	21.34
Average acres in each farm in 1860	100.62
Value of farms	$747, 130 00
Value of implements	22, 526 00
Value of products	271, 128 00
Average value of farms	12, 452 16
Average value of implements	523 81
Average product of each farm	4, 518 80
Average value per acre	121 82
Average value in 1860	83 50

On sixty farms reported, there were in January, 1865:

Horses, 236, valued at	$26, 432
Mules, 34, valued at	6, 290
Milch cows, 446, valued at	16, 948
	49, 670

Calves, 315, valued at	$5, 300
Fatling cattle, 102, valued at	8, 325
Sheep and lambs, 191, valued at	1, 295
Swine, 512, valued at	16, 671
Chickens, &c., valued at	2, 800
	34, 391

Avera~e horses to a farm	3.68
Average mules on 14 farms	2.42
Average cows on 58 farms	5.10
Average value of horses	$112 00
Average value of mules	185 00
Average value of cows	38 00
Average value of fatting cattle	81 61
Average value of sheep and lambs	6 75
Average value of swine	32 56

From the above 60 farms the following products were obtained in 1864;

Wheat, bushels	8, 188	Valued at	$20, 499
Rye, bushels	664	Valued at	1, 237
Indian corn, bushels	27, 194	Valued at	44, 505
Oats, bushels	3, 498	Valued at	2, 635
Barley, bushels	240	Valued at	456
Buckwheat, bushels	159	Valued at	190
Turnips, bushels	4, 636	Valued at	2, 364
Carrots, bushels	1, 877	Valued at	1, 450
Mangolds, bushels	50	Valued at	20
White potatoes, bushels	36, 185	Valued at	46, 848
Sweet potatoes, bushels	15, 772	Valued at	16, 738
Hay, tons	1, 797	Valued at	43, 842
Sorghum, gallons	307	Valued at	400
			181, 184

Market garden products, growth of 1864:

Cabbages	151,812	Value of cabbages	$16,581
Tomatoes, baskets	18,025	Value of tomatoes	10,555
Egg plants, baskets	856	Value of egg plants	234
Watermelons	7,230	Value of watermelons	696
Citron, baskets	5,631	Value of citron	2,068
Squashes, baskets	281	Value of squashes	131
Peas, baskets	3,566	Value of peas	3,195
Beans, baskets	926	Value of beans	150
Cucumbers, baskets	885	Value of cucumbers	200
Peppers, baskets	442	Value of peppers	300
Sugar corn, baskets	1,794	Value of sugar corn	1,088
Rhubarb		Value of rhubarb	500
Asparagus		Value of asparagus	1,051
Small fruits		Value of small fruits	1,116
			37,865

ORCHARD PRODUCTS.

Apples, baskets	9,791	Value of apples	$7,381
Pears, baskets	659	Value of pears	386
Peaches, baskets	322	Value of peaches	477
			8,244

DAIRY PRODUCTS.

Butter, milk, and cheese		$9,454
Farm products, excluding horses, mules, and cows		$34,391
Vegetable products		181,184
Market garden products		37,855
Orchard products		8,244
Dairy products		9,454
Total products of sixty farms		271,128
Value of horses, mules, and cows		49,670
		320,798
Value of farms	$747,130	
Value of implements	22,526	
		769,656
		1,090,454

The average product, per acre, of the sixty farms above referred to, was as follows: Wheat, 15 bushels; rye, 10; corn, 40; oats, 33½; buckwheat, 10; hay, 1.52 tons; white potatoes, 85½; and sweet potatoes, 94 bushels per acre.

By tables prepared for the Department of Agriculture it appears that in 1864 the average yield of wheat in New Jersey was greater than that of any other State except Massachusetts, Rhode Island, and Connecticut--Rhode Island having exhibited a return of 15 bushels, which was identical with that of New Jersey, while Massachusetts exceeded by one, and Connecticut by but one and a half bushel. New Jersey thus still continues to be one of the leading States in wheat production, though not in absolute product, but in yield per acre.

In the production of corn in 1864, during which this crop suffered greatly from drought in some sections of the State, New Jersey was excelled by Vermont, Illinois, Iowa, and Minnesota. New Jersey produced 31⅔, Vermont 38⅘, Illinois 33, Iowa 36⅔, and Minnesota 33 bushels per acre. The average product of the sixty farms under notice, which exhibit a fair sample of the productiveness of West Jersey in the better cultivated districts, is thus, even in a season of drought, greatly in excess of that of any of the most favored western States in the yield of corn. This yield, it will be seen, was forty bushels to the acre.

The product of hay per acre in New Jersey, in 1864, equalled or exceeded that of every other State, Iowa and Kansas excepted, and fell below these States by but a small fraction of a ton. New Jersey was estimated to have yielded 1.57 ton per acre. The above sixty farms produced 1.52 per acre—a close approximation to the estimated return.

The yield of oats, in 1864, per acre, in New Jersey, was exceeded by that of Vermont and Rhode Island only, and but by half a bushel per acre. Most of the States were surpassed by New Jersey in the production of oats, by from four to ten bushels per acre. Thirty-two and one-third bushels was the estimated yield throughout the State; in our district, as deduced from reports of the farms before referred to, the average yield was 33½ bushels.

A table exhibiting the number of farms among the sixty from which full returns were received, in which leading crops are cultivated, with acres occupied by each crop, product per acre, &c., in 1864.

	No. of farms.	Acres occupied by each crop.	Total product in bushels.	Average product of each farm in bushels.	Average product of each acre in bushels.	Average number of acres in each farm in each crop.
Wheat	57	547	8,205	144	15	9.59
Rye	.....	.....	.....	.....	10	.....
Corn	58	693	27,720	478	40	12
Oats	33	104	3,498	106	33.63	3.15
Barley	1	6	240	.....	40	6
Buckwheat	10	16.5	159.5	15.95	9.66	1.625
Hay	58	1,176	1,787	31	1.52	20.28
White potatoes	63	423	36,185	574.33	85.54	6.71
Sweet potatoes	44	108	10,152	236.30	94	2.45

The foregoing tables of farm crops, averages and values, need no further elucidation, except the remark that there is necessarily an overestimate therein; because the produce, such as grain and hay, which have been transformed into beef, butter, calves, milk, cheese, and chickens, has been already valued and included in the aggregate. This is necessary in order for comparison with the report of the Census Bureau, where no distinction is made between vegetable products sold directly and those transformed into animal and again enumerated as such.

The above statistics, derived from less than one-twelfth of our Camden county farms, clearly show what energy, combined with skill and capital, can produce upon the soil of New Jersey. From the reports received we will extract a few detailed examples, which may serve to incite the owner of a poorly worked and indifferently paying farm to emulate the enterprise of his more successful fellow-farmer.

We may premise that there are few such farms as that whose products we are about to name, and that fewer farmers can bring to the active duties of their profession greater skill or intelligence than can the owner of these acres. He is not only a business man, but he is also intelligent, and by education cultivated. But such farms might be seen almost everywhere did their owners but make them what they might become; such men might abound did our young farmers who now seek to dabble in some "respectable" profession, but receive that higher order of education of which they are lamentably deficient, and apply their improved abilities to the redemption of their State from agricultural and political contempt.

On this superior farm there were produced in 1864—

225 bushels of wheat on 9 acres, average 25 bushels per acre	$693
550 bushels of corn on 10 acres, average 55 bushels per acre	935
65 tons of hay on 40 acres, average 1.67 ton per acre	2,080
10 tons of straw on 9 acres, average	225
2,000 bushels of white potatoes on 10½ acres, average 112½ bushels per acre	1,600
Cabbages on 9 acres, average	2,150
Various market-garden products on 8 acres	1,700
Sundry other crops	575
To which may be added for swine $370, and calves $325; the first consumed a portion of the corn, and may not be properly included. Add the latter, with half the value of swine	400
We find a total aggregate product of	10,358

If swine should not be included, we find about $10,000 total product of this fine farm of 100 acres, which doubtless is still much beneath its capacity for production, estimated at the rates for produce which ruled during the year past.

The expense of conducting a farm producing thus largely was correspondingly heavy, and the net returns to the owner were not of so surprising an amount as to tempt any one in good paying oil business to leave his wells to turn farmer, or any gold gambler, who is rolling up thousands by a happy turn, to envy the successful Jerseyman, unless they could at the same time appreciate his untroubled conscience and his peaceful repose. But they are certain gains, and though slowly made at the expense of thought and diligence, have not among them "one dirty shilling."

There are many farmers in Camden county who cannot rest satisfied with indifferent cultivation and meagre crops, whose high farming is attended with corresponding results. Witness one among several well authenticated returns before us, freely given by the public-spirited and enlightened cultivators, who are superior to petty selfish interest, and have reported their crops in full for the benefit of the Agricultural Department and their fellow-workers.

The following is the product of a farm of about 107 *acres of arable land in* 1864

236 bushels of wheat grown on 9 acres, at the rate of 26¼ per acre	$626 36
1,460 bushels of corn grown on 17½ acres, at the rate of 83.42 per acre	2,190 00
102 tons of hay grown on 46 acres, at the rate of 2.21 per acre	3,060 00
1,680 bushels of white potatoes grown on 11 acres, at the rate of 152 per acre	1,600 00
592 bushels of carrots grown on 1¼ acre, at the rate of 473 per acre	460 00
2,000 cabbages grown on ½ acre	160 00
200 bushels of turnips	132 00
950 pounds of butter	515 40
3,598 quarts milk and cream	328 72
Calves, swine, beef	382 00
Chickens and eggs	221 00
	9,675 48
30 loads of straw	380 00
Value of aggregate products	10,055 48

The sales from the foregoing during the year were as follows:

Wheat		$626 36
Corn, 400 bushels, brought		660 00
Corn, (300 bushels remain for sale)		450 00
Hay—60 tons will be sold		1,800 00
Potatoes, 1,630 bushels		1,550 00
Cabbages, 2,000		160 00
Butter, milk and cream		665 12
Calves		81 00
Eggs, chickens, &c		140 00
		6,132 48
Leaving for consumption—		
Corn, 760 bushels, worth	$1,080 00	
Hay, 42 tons, worth	1,260 00	
Straw, 30 loads, worth	380 00	
Potatoes, 50 bushels, worth	50 00	
Carrots, 592 bushels, worth	460 00	
Turnips, 200 bushels, worth	132 00	
Butter, &c., 250 pounds, worth	200 00	
Pork, $156, beef, $155, worth	311 00	
Chickens, eggs, &c., worth	70 00	
		3,943 00
Total		10,075 48

To produce the above crops there were purchased and applied 220 one-horse cart-loads of horse-stable manure, four tons of superphosphate of lime, 1,200 bushels of lime, and forty bushels of ground gypsum or plaster. A herd of dairy cows was kept, and a strong force of horses and mules, which swelled, with the straw and corn-stalks, the products of the cow and stable yards. The soil of this farm is a very strong loam, tillable only by heavy labor in dry weather, and incapable of cultivation in wet. Heavy drainage is demanded and has been applied, and is continued yearly. The course of cultivation may be partially illustrated by the following outline. It has been the practice to lime the sod one year (or immediately) preceding the plowing, with about eighty bushels of quick-lime per acre. The plowing for corn is done in the fall, as deeply as possible, that by freezing and thawing the clay may be ameliorated. The only manure applied was a compost consisting of 150 pounds of superphosphate of lime, (or 200 pounds of poudrette, and fifty pounds of fine bone-dust,) one bushel of gypsum, and five to ten bushels of charcoal-dust to an acre. This compost was strewed along the drills, which were four and a half feet apart, and the seeds dropped in the drill by hand, one foot distant from each other. The ground was kept constantly stirred and every weed eradicated.

The rotation observed is that usual in the district. First, corn on a turned pasture sod; second, white potatoes, which prepare the ground thoroughly for wheat, which follows; third, grass-seed is sown on the wheat in the autumn and clover-seed in the spring following; fourth, after this the grass is mown for three years, and pastured for one year, when it is again ready for turning under by the plough to feed, by its decay, the crop of corn to be therein planted in its turn. The success attained is the result of abundant drainage, deep plowing, ample fertilizing, and close attention to the eradication of weeds by constant and thorough culture.

Another farm thoroughly tilled by its intelligent and progressive owner, but larger than the preceding by a few acres, produced, in 1864, the following respectable array of crops:

300 bushels wheat, on 10 acres, at the rate of 30 bushels per acre	$750 00
800 bushels corn, on 10 acres, at the rate of 80 bushels per acre	1,200 00
84 tons hay, on 33 acres, at the rate of 2½ tons per acre	2,520 00
1,615 bushels white potatoes, on 10 acres, at the rate of 161½ bushels per acre	2,500 00
312 bushels sweet potatoes, on 2 acres, at the rate of 156 bushels per acre	700 00
100 bushels turnips	40 00
200 bushels carrots, on 1 acre	160 00
2,000 cabbages	120 00
Sundry small crops	362 56
	8,352 56

Cattle slaughtered	$150 00	
Lambs	110 00	
Swine 24, weight 4,900 pounds, at 16 cents	800 00	
Calves 6, weight 1,200 pounds, at 10 cents	120 00	
		1,180 00
Aggregate product of farm		9,532 56

Two hundred cart-loads of manure were purchased and applied, 55 loads of street dirt, and 100 tons of green sand "marl." A dairy of superior cows is kept, and six horses and mules, and a flock of sheep.

The following was the product of a farm in Stockton township, in that desolate region so little admired by the passing agriculturist, on his way to or from New York or Philadelphia. This farm comprises eighty acres, and is valued at $25,000, or more than $300 per acre. To its worth its products will testify:

92 bushels of wheat, on 8 acres, at the rate of 12* bushels per acre	$248 40
10 bushels of rye, on 1 acre, at the rate of 10 bushels per acre	17 00
200 bushels corn, on 5 acres, at the rate of 40 bushels per acre	350 00
11 tons hay, on 6 acres, at the rate of 1¾ ton per acre	220 00
1,136 baskets white potatoes	1,238 00
18,000 cabbages, on 5 acres, at the rate of 3,600 per acre	720 00
4,876 baskets tomatoes	3,155 32
469 baskets citrons	187 60
88 baskets squashes	37 60
1,092 baskets peas	834 40
58 baskets beans	29 00
136 baskets cucumbers	102 00
350 baskets peppers	210 00
75 baskets sugar corn	45 00
102 baskets apples and pears	94 50
	7,488 82

* This is about the average yield of wheat for the county in 1864.

There were applied of purchased manure 450 cart-loads, 2 tons of guano, 1 ton of bone-dust, and 2 barrels of superphosphate of lime.

The large products of a few acres confirm the maxim that a small farm well tilled will produce the largest returns per acre. The exhibit is here, as elsewhere, the gross results; with cost of production we do not concern ourselves; every farmer may judge of the expense attending high farming for himself, always bearing in mind that it is, if judiciously conducted, abundantly more remunerative than the ordinary indifferent scratching called farming.

On less than eight acres there were raised in 1864 the following crops:

350 baskets of white potatoes, which were sold for	$400
444 baskets of sweet potatoes, which were sold for	413
100 baskets of turnips, worth	60
200 baskets of carrots, worth,	160
158 baskets of sugar corn, worth	135
65 baskets early peas, worth	35
900 heads of cabbage	54
	1,257

An extraordinary yield of tomatoes was destroyed by an unusually early frost. Notwithstanding the gross results exhibit a return of $143 68 per acre, this small farm lot, it is unnecessary to say, was already in high condition, having received heavy dressings of manure, street dirt and marl, for many years past, and as heavily cropped and thoroughly worked by its skillful and industrious owner. To the crop of 1864 there were applied 75 cart loads of manure, 125 loads of street dirt, and 40 tons of marl.

We have returns of products of farms of 90 acres and upwards which do not exhibit crops of the gross value of $2,000, though favored by the help of a herd of cows. The reason is obvious—no manures were purchased by the careful cultivator, no return was made of phosphoric acid and potash to supply the waste from continual cropping.

On eleven acres the product in cabbages in 1864, which was an extraordinarily favorable season, both as respects the perfection of crops and prices, 41,000 cabbages were grown, which sold for the large sum of $3,274 53. This is nearly $300 per acre. A wagon load of these cabbages, containing 800 heads, sold for $100.

On two acres, which of course had received the benefit of the applications to many previous crops, there were grown, in 1864, 300 baskets, each $\frac{5}{8}$ of a bushel, of early potatoes, which sold for $1 25 each, and returned $375; 7,500 cabbages, which sold for $10 per hundred, $750; making a total gross return of $1,125—an average gross product per acre, scarcely exceeded by any yield of which we are cognizant, a large return for egg-plants only excepted.

The above yield of cabbages is exceeded by that given by another skillful farmer, whose aggregate of sales from fourteen acres exceeded $5,500—an average product per acre of quite $392 Some of these cabbages brought $15 per hundred, and the best load sold for $115.

The largest product of cabbages was that given upon 30 acres, which reached the large amount of 175,000, and sold for about $9,000; but in productiveness per acre this must yield to the second above noted, which is certainly extraordinary. The farm upon which the cabbage crop was given, which sold for $9,000, produced also, in 1864, upwards of 100 tons of hay, besides other farm crops. The hay was probably worth $2,500 to $3,000, and swells the total of products to $11,500 or $12,000 for these two items alone. Upon the same farm, now in the hands of a citizen, the former owner was unable to maintain his family, but eked out a precarious existence by cutting wood, &c.

Sweet potatoes were remarkably productive in the season of 1864. From returns perfectly reliable we learn that on $6\frac{1}{2}$ acres there were grown 1,700 baskets, or at the rate of 261 baskets (or 163 bushels) per acre, which sold for $1,700, or at the rate of $261 per acre. By the same grower there were produced 22,000 cabbages on 10 acres, which sold for $2,000. A crop of early potatoes was raised by the same energetic farmer, which returned, from 3 acres, upwards of $500. Turnips were sowed on the drills without ploughing, and a crop of 1,400 bushels raised therefrom, which brought $420. This sum, with the proceeds of the early potato crop, amounted to upwards of $900, or quite $300 per acre.

Farming and vegetable growing are not conducted on small plots only with success. We have had returns of potato growing on a scale of considerable magnitude. On thirty-two acres there were raised, in 1864, 3,274 bushels of white potatoes, which sold for $4,800. On the same farm, upwards of 40 acres produced nearly 50 bushels of corn to the acre, though the season was quite unpropitious, or more than 2,000 bushels, which, at present rates, are worth quite $3,500. On the same farm, cattle to the value of $6,000 were fatted.

It must not be supposed, nor is there any probability that the above recitals of large crops and heavy returns per acre, under high manuring, and large expenditure for fertilizers, will induce the reader to imagine that these are very common cases, or that the farmers of Camden county are rapidly becoming rich. There remains the per contra—the debit side—where poor farming without capital, small spendings by timid, old-fashioned men, who decry all the innovations which the agricultural press is continually urging upon their attention, result, as it should, in poor returns, which have kept, and ever will keep, such farmers poor. Some of these men are scarcely making their expenses. They are deriving no advantage from the present high rates of farm produce, because they have no surplus to sell; while they are oppressed by the increased cost of every article entering into the list of domestic expenditure. These not having moved with the tide, will be left stranded when it retires.

The record is before me of a farm of 100 acres, nearly all arable, from which less than $2,000 gross product was taken. Nor is this a solitary case. This poor exhibit is made for a farm of good quality, capable of largely increased product, as is proved by the returns of that adjoining it of similar soil, &c. The latter, about 90 acres arable, presented a gross return of more than $7,000. The yield of hay of the latter was $2\frac{1}{2}$ times greater; that of corn, nearly twice as great; of potatoes, $2\frac{1}{2}$ times; turnips, 4 times larger in the well-tilled farm than on that poorly managed. Both farms are occupied by tenants, but of very different character, education, and capacity.

From another farm of thirty-six acres the gross returns were made of but $375, which may be placed on the scale against another of twenty-five acres, which showed an aggregate value of crops of about $2,500. Finally, we have received returns of total products of a farm of one hundred acres in Camden county, whose aggregate yield for 1864 amounted to $15,000, the sales of vegetable products alone having exceeded $12,000, a yield and gross product unsurpassed by any other cultivator with whose success we have become acquainted.

The following statement was made to the Burlington County Agricultural Society, by J. and S. Butterworth, extensive farmers of that county, and will show the products and profits of their farm during the year 1863. There are 248 acres in this farm, exclusive of 20 acres of woodland pasture·

Statement of products.

220 tons of hay, at $14	$3,085 00
900 bushels white Kentucky wheat, at $1 75	1,575 00
300 bushels potatoes, at 50 cents	150 00
1,800 bushels corn, at 75 cents	1,350 00
Apples	50 00
60 head of beef cattle, at $70	4,200 00
75 sheep, at $4 50	337 50
75 lambs, at $4 50	337 50
280 pounds of wool, at 70 cents	196 00
12,000 pounds of pork, at $6	720 00
Poultry	480 00
1 yoke of fat cattle	250 00
Total	12,731 00

Statement of net receipts.

Advance in 80 head of fat cattle	$2,180 00
Advance in 75 lambs, at $4 50	337 50
Advance in 75 sheep	75 00
280 pounds of wool, at 70 cents	196 00
1 yoke of fat oxen	100 00
Apples	50 00
300 bushels of potatoes, at 50 cents	150 00
12,000 pounds of pork, at $6	720 00
Poultry	480 00
50 tons of hay, sold at $14	700 00
4 tons of straw, at $10	40 00
600 bushels corn, at 75 cents	450 00
840 bushels white wheat, at $1 75	1,470 00
	6,948 50

Statement of expense attending the conduct of the above farm, net profit, and interest on the investment.

Value of the farm of 268 acres, at $125 per acre	$33,500 00
4 horses, at $125 each	500 00
1 pair of oxen	140 00
60 neat cattle, at $32 each	1,920 00
75 sheep, at $3 50 each	262 00
50 swine, at $5 each	250 00
Labor employed and board of men	1,150 00
Farm implements	600 00
Seeds (seed wheat deducted from net profits)	60 00
Wear and tear of buildings, fences, and implements	500 00
Fertilizers purchased, (500 bushels of lime, at 14 cents)	70 00
Taxes	160 00
Capital invested in farm and working material	39,112 00

Net profit, as stated above, $6,948 50; being 17 7-10 per cent. on the investment.

The above farm is located in the "green sand marl" region, and 300 tons of this fertilizer are annually applied; but as this is digged on the farm, the cost of digging only is included in the above account.

MARKET GARDENING IN NEW JERSEY.

While New Jersey is unsurpassed in the excellence of her market-garden products, in the aggregate she is exceeded by New York alone.

According to the census of 1850, the product of New Jersey was valued at $475,242, and in 1860 at $1,542,155—an increase of quite 210 per cent. Delaware and Virginia exhibited the same growth; Maryland increased 150 per cent.; Pennsylvania 100 per cent.; but all the seaboard States, except South Carolina and New York, were equalled or surpassed by New Jersey in their gain in the ten years from 1850 to 1860. In South Carolina garden products were quadrupled, and nearly the same growth appears in the State of New York. New York and New Jersey produce most of the vast supplies of green vegetables consumed in the great cities on their borders. As the population of the city of New York increased but 56.27 per cent., Brooklyn 175.37 per cent., Philadelphia 65.43 per cent. in the ten years under notice, and the market-garden products of the States which supply the vegetables in demand in these cities have, during the same time, known a growth of from 210 to 370 per cent., we may conclude that either a much larger quantity was consumed by each family than formerly, or that the price had proportionably advanced. As there does not appear to have been any material advance in prices before or during 1860, the first conclusion is sustained. Whether this increased consumption of vegetables has arisen from the increased attention to early production, to the cheapened supply of small fruits, to greater demand for winter preservation in air-tight cans, to superior horticultural knowledge, or to greater regard for health, we cannot determine. All these influences have, perhaps, combined in producing a greatly increased consumption of a variety of food which cannot but be advantageous to both producer and consumer.

By examination of the way bills of produce received at Camden, (which is one of sixteen platforms where market-garden vegetables are received for transportation to New York,) we learn the following interesting statistics:

There were received at the Camden depot, and shipped to New York—

From May 18 to June 6, 1,877 barrels of peas.

From June 19 to July 2, 3,298 barrels of beans.

From June 28 to August 10, 9,831 baskets of tomatoes.

From July 9 to August 19, 2,281 barrels of cucumbers.

From August 2 to August 17, 1,016 barrels of citrons.

From August 3 to December 31, 15,660 barrels of sweet potatoes.

From July 20 to September 23, an enormous freight of peaches.

The above peaches and sweet potatoes were not all the product of this State. A very heavy freight business was done in produce by the line of steamboats, the bills of which we have not examined. Peaches are grown in Monmouth county, New Jersey, to a very large extent. So great is the supply from that region, that it has been estimated that there has been sent thence to New York alone, an amount equal in bulk to all the fruits consumed in Great Britain, and at a cost less than ten per cent. of the European prices.

Were we able to obtain returns of produce received at the way-side platforms which line the road, the aggregate would appear enormous—sufficient, indeed, to stagger belief, and exhibit in strong colors the dependence of New York upon the productions of "poor Jersey."

MARKET GARDENING IN CAMDEN COUNTY.

The growers of early market vegetables enjoy but short respite from active labor during the winter. Their attendance on the markets for the sale of late-keeping produce has not ceased before they open the spring campaign with preparation of hot-beds and ploughing for the crop of early peas. Their teams, also, have been busy during the winter in hauling stable manure from the wharves or landings on the creeks where it has been deposited, unloaded from the sloops and flat-boats which navigate these streams. The sloops, carrying from 125 to 200 one-horse cart-loads of manure, are floated up on the tide and return by the current. Their services are invaluable to the farmers of the interior, bearing, as they do, a burden of heavy and bulky material which could not be economically conveyed by wagons to the same distance from the city. Districts situated in the vicinity of such streams and landings are, in consequence, more readily cultivated than those more distant, and agriculture in general declines in proportion to the remoteness from the facilities commanding a cheap supply of manure. The lands in the interior of New Jersey have not been in demand, mainly because they are distant from the source of supply of enriching agents, and can never compete with those more favored by proximity to creeks or the Delaware. The farmers who reside within a moderate distance of the "green-sand marl" pits employ their teams during the winter in hauling immense quantities of this fertilizer. Many deem it worth hauling upwards of five miles, and apply many tons of the heavy material annually to their land. The "marl" thus carted has been bought by the rod in the ground, reaching to the depth it is found possible to dig without interference by water, which is from 8 to 12 feet. A square rod will sometimes furnish upwards of 100 to 120 tons, and must be dug and thrown out at one operation by a strong gang of men, many of whom are professional diggers, and expert at handling their peculiar long-bladed semi-cylindrical spades. The rich dark-green material, quite moist, is easily cut like new cheese, and a full gang will throw out half a rod readily in a day. Large quantities of this "marl" are conveyed on the Camden and Atlantic railway to various points between Camden on the west, and into the interior eastward, at rates varying in 1865 from eighty cents to one dollar per ton. An ordinary four-wheeled gravel or dirt car will hold about 14 tons.

TOMATOES, EGG-PLANT, AND EARLY PEAS.

The earliest preparation of hot-beds in Camden takes place among the "Pea-Shore" truck men, who, about the 20th of February, generally bestir themselves. These beds are of the usual kind—depth of about 14 inches of good fresh horse manure, well shaken up, and then slightly compressed, being deemed sufficient. On this about four inches of mellow, dark soil is spread, and the seeds of early tomatoes, egg-plant, &c., sown in drills. In the choice of seed the growers are especially careful, well knowing that their success depends in great measure upon the early ripening quality of the plants. Some successful raisers of early tomatoes carefully select the earliest, smoothest, fairest, and largest for seed, year after year, and thus secure a variety which can compete with any to be had at the seed stores, not always so carefully selected. The best seed of early tomatoes is generally scarce, and, at times, commands as much as six dollars a pint. The seeds are sown rather thickly in the hot-bed, and the plants are carefully watched, aired on proper occasions at mid-day, and covered with old hay during stormy or cold weather. When the plants have attained the height of four or five inches, and are proportionally strong, they are carefully drawn and transferred to a cold frame, also covered with glass, and having a few inches of rich old soil and old manure beneath.

In this they are "spotted out" about four or five inches apart each way. Under glass, again carefully watched, ventilated, covered with hay in windy, stormy, or cold spells, they grow and develop abundant roots, acquire a stocky habit, and, as soon as all danger from frost is past, (generally about the first week of May,) they are ready, after a slight exposure without glass by day, to endure the trials of the outer world. Tomatoes and egg-plants having been placed under favorable conditions in the hot-beds, the early peas next require attention, should the earth have become dry and ready for the plough. This is often, on the light, warm soils, in sheltered fields, (where this vegetable is most successfully grown,) as early as the middle of February, or, at the latest, the 1st of March, but has been delayed some years to so late as the 25th of March. The preparation of this crop is a simple ploughing and furrowing in drills 2½ feet distant. Stable manure, well rotted, is lightly strewn along the drills from one-horse carts at the rate of about 12 loads per acre, a very light portion only being needed, as the product is removed before ripening, and demands but a small amount of nutriment. The peas are sown by hand, (thrown by the handful along the drills rather thickly,) or by seed drills by some, and covered by a one-horse plough. The culture demanded is a scratch harrowing to loosen the crust as they are appearing above the ground. This is followed, when the peas are a few inches high, by a horse cultivator, the back teeth of which should throw the earth towards the young plants. The process is repeated when the vines have grown to 6 or 12 inches high, after which they will take care of themselves until they are ready for picking for sale. The practice of ploughing towards the plants is less in vogue than formerly. The kind of seed sown is the growth of the district, carefully selected, and of long understood qualities for earliness and productiveness. Such seed has sold as high as $20 per bushel. Dan O'Rourkes have been planted, but were not so early the first year, growing too rank; but the growth of the second season was as early as the ordinary varieties. An early pea grown in Canada is planted by some with good success, northern-grown seed having generally an early-growing quality. The peas formerly grown in Virginia for our markets were raised from seed the product of Camden county. Peas are planted by the best growers expressly for seed, no pods being taken therefrom for market, experience having proved that those selected for seed from the earliest ripening pods will prove the earliest to mature the following year. The early pea may be planted or sown in the autumn, and is sometimes thus early committed to the earth in the more southern counties of this State, but we are not aware that any advantages result therefrom which are not counterbalanced by the loss caused by mice and decay in the ground. They are said to appear ten or fifteen days earlier, but they are thin in the rows, and the practice of fall planting is not encouraged by the results. From the 1st to the middle of May the early pea will be in bloom, and the earliest pickings made have been from the 16th of May to the 18th of June, or about three weeks from the date of blooming. The demand for early peas to supply the Philadelphia and New York markets is very large. The high prices paid on their first appearance attest the craving of the good citizens of the latter city for this delicious esculent. Nearly 5,000 barrels of early peas have been carried to New York from Camden in one season, most of which were the product of this district. The first picking was received in 1864, at Camden, on the 18th of May, and amounted to three barrels only; on the following day fifty-six barrels were received, and the daily receipt and shipment ranged from twenty to thirty barrels until the 26th, when seventy barrels were despatched; after which they reached, on some days, to upwards of 325 barrels, or nearly 1,200 baskets per day, but rapidly declined until the 6th of June, when the demand from this region ceased. In 1864 there were forwarded to New York from the Camden depot alone about 2,000 barrels, or nearly 7,000 baskets of early peas. More than 1,000 barrels daily have been taken to New York from the way stations in this district. The first picking has commanded at Camden for several years past, from $1 to $1 50 per basket, containing five-eighths of a bushel. Three and a half baskets will fill a barrel, and the early growers have received from $3 50 to $6 per barrel. The latter highest price has been paid only since the competition from Norfolk has been destroyed. The price rapidly declines, sometimes at the rate of a dollar a barrel daily, until they soon are not worth the cost of picking, which is from fifteen to eighteen cents per basket. The value of shelter by belts of evergreen trees is well known to growers of early peas. Plots, of which we have knowledge, thus protected from the northwest and northeast, have returned to the grower more than others of five times the same extent, similarly treated and planted at the same time, because of their early ripening by but two or three days in advance. The second crop of peas is obtained from the "Marrow-Fat." These are planted in very sandy ground from the middle of March to the 1st of April, and are ready for picking when the early peas have disappeared from the market. If very early they may bring the grower $1 per basket, but generally not more than 75 cents, and decline soon to 40 cents or lower. They are, of course, sold only in Philadelphia. The early peas are often planted in drills five feet asunder, and the intermediate space reserved for cucumbers. By this course of cultivation and reservation for a succession, four crops may be taken from the ground in one season. Thus when the peas have grown to the height of four or more inches, and need no further working, cucumber drills are made intermediate, and seed planted as usual. When the peas have been removed, the cucumber vines occupy the space thus made vacant. After the last cultivation of the cucumbers the drills formerly occupied by peas are planted with sugar corn, which will have attained some growth by the time the cucumbers have ceased to repay gathering and conveying to market. The vines are then immediately removed, the corn cultivated, and when this has been done for the last time, the space made vacant is sowed with turnip seed broadcast, (generally with the purple top flat white variety,) which continues to grow until late in the season. A few years of such treatment may prove exhausting despite the heavy manuring practiced, and it is esteemed both restorative and economical to sow clover seed upon such land, cut one crop, and again plough under, either for early potatoes, corn, or the round of trucking as above, or for tomatoes alone. Superior crops of rye are sometimes grown on land thus "trucked," or on which sweet potatoes have been grown for several years.

ASPARAGUS.

While the peas are growing, the asparagus has made its appearance, sometimes as early as the first of April, but generally about the 20th, in this district. This plant is a fixture, occupying the entire ground for many years, and producing, under judicious cultivation on soil well adapted to it, very large crops for a long succession of seasons. It, however, eventually declines in productiveness, and becomes an undesirable tenant, (not "at will," but an "entailed" possessor,) so difficult is it of eradication. A successful grower of asparagus in Camden county has described his process as follows, which appears to be satisfactory for field culture: Late in March select a light sandy loam, free from weeds and grass, for the site of the plantation. With a one-horse plough draw furrows four feet apart, and follow with the largest two-horse plough, repeatedly returning in the same furrows. Follow this with shovels, and remove the loose earth to the depth of sixteen inches, throwing it into ridges between the furrows. Spread the best stable manure in the furrows to the depth of three inches, and thereon place the roots, which should have grown two years in the seed bed. If placed twenty inches apart upon the manure in the trenches, they will continue to yield longer than if more closely planted, as the roots in time become, by the formation of offsets and new crowns, inextricably complicated and interlaced. The plants are lightly covered with a hoe by drawing the top soil upon them. The half-filled trenches should be kept free from weeds, and the next season, if the plants have well grown, it may be filled even with the former surface. In the spring of the third year the young shoots may be partially cut for market, care being observed to retain a portion of them for the healthy growth and due vitalizing of the roots. To obtain the strongest and earliest growth, stimulating applications are useful; and for this purpose night-soil with a proportion of salt is a specific manure. This, however, is seldom applied by the market-gardener on a large scale. The roots from old beds about to be destroyed have been very profitably used to obtain a forced growth. The very high prices which asparagus commands in the New York market, in January, February, and March, render this a profitable mode of disposing of the old roots. By planting a succession every six years, and using the old roots when worn out, a constant supply of plants for this purpose may be had, while the newer beds will furnish the crop in its season. The tenderness of this vegetable depends much upon high manuring and its rapid growth in a warm soil. In many parts of the north of Europe asparagus is forced in the beds themselves without disturbing the roots. Trenches are dug beside the asparagus and filled with hot manure, and the beds covered with the same material to the depth of six inches. In very cold weather the beds are covered with frames. Asparagus thus treated is neither stringy nor tough, but tender and succulent as in its proper season. Such treatment, however, enfeebles the plants, and to restore them to their former strength they must be permitted to grow, without cutting, as freely as possible during the succeeding summer. Some localities produce better results in asparagus growing, despite the manure used, though no giant growth can be obtained without profuse enrichment. On Coney Island, on the south side of Long Island, near New York, asparagus is grown of extraordinary size and delicacy, and epicures have resorted to this locality to partake of the luxury of spears of over an inch in diameter, and so tender as to be edible a foot in length. The presence of salt in the soil is of importance—indeed, indispensable to mammoth growth, and may be spontaneously supplied at Coney Island. Asparagus raised on the sea-shore in northern Spain greatly surpasses our product, as also does that of the London market-gardeners, who produce heads three of which will weigh a pound. The Spanish asparagus is stimulated by the drainage of sewers flooded over the salt sea sands whereon it is grown.

The large growers of asparagus cut it daily for the Philadelphia market, using a knife adapted to the purpose, chisel like, with a long shank or handle. The young shoots, which have just protruded their green or purple heads above ground, are removed from the crown of the root by cutting several inches beneath the surface, to obtain the delicate blanched and succulent growth. These are prepared for sale by arranging them into bunches of about one pound each. The shoots, having been cleansed by washing, are placed before the operator on a table having a front ledge of six inches in height, and a series of pins, arranged by fours, for the reception of the piles of shoots. Between these pins is arranged a semi-cylindrical iron plate, with the concavity upwards, into which the shoots are laid, their ends in contact with the front ledge. Over each bunch, as piled to the proper height, a strap is placed, which, passing through the table, is tightened by a spindle or ratchet turned by a crank. Several of these cylinders, strapped, &c., are arranged upon the table, adapted to bunches of different lengths. When tightened, the strings, which had previously been placed beneath, are tied, the strap is relaxed, the buts cut smoothly, and the bunches are ready for market.

In March grass-seed and clover-seed are sown; timothy (*Phleum pratense*)—the herds grass of New England and New York—is, however, generally sown in the autumn on the wheat. Planting the early peas may continue for a week or more as the weather and the ground will permit, as both are at this season very variable. About the last of March or first of April ploughing has commenced for oats by the few farmers who grow them; their place in a rotation in Camden county is commonly supplied by white potatoes.

EARLY POTATOES.

Ploughing has, however, commenced about the middle of March, or earlier if the season will permit, on ground sufficiently dry. The more sandy ground intended for sweet potatoes is sometimes turned in February; that for white potatoes is not generally fit for the plough until later, though the earliest varieties are sometimes planted by the 17th of March, or the day dedicated to "Saint Patrick." The corn stubs are knocked over by careful farmers while the ground is frozen, and are then easily buried by the plough. Others grub them out and cast them to their cow-yards, or waste them in filling gulleys. The ground is ploughed thoroughly but not deeply for white potatoes, (six inches being the average,) and furrows opened for drills two and a half to three feet apart, according to the strength of the variety to be grown. One of the most judicious and successful growers of white potatoes in Haddon township cultivates sundry varieties which ripen in succession. Each kind may thus be committed to the ground and digged in its turn, without encroaching one upon another, or too much hurrying the labor required by each. The manure applied to potatoes is that of the horse-stable and the cow-yard, composted with "green sand marl" in the proportion of four loads of the former to one of the latter. This compost is applied at the rate of thirty one-horse cart-loads to the acre. A small portion of fallen lime has sometimes been thrown upon the heaps immediately before applying the compost, with advantage, it is believed, to the potato; being immediately covered, its otherwise injurious effects may be avoided.

The mode of planting found most convenient to insure a proper succession of ripening and digging is as follows: The earliest variety, the Michigan White Sprouts, are dropped upon the manure in the furrows, about two and a half feet apart and fourteen inches in the drill, the sections being of good size, having one or more eyes. Larger cuttings are deemed desirable for the production of a strong, early growth, and earlier maturity. Next is planted the Buckeye, which receives the same treatment. The Dykemans are next in order, followed by a variety which has received the popular name of "Monitor." This is a very productive kind; under good treatment 30 bushels of seed having returned 507 bushels, 185 of which grew on three-fourths of an acre, (or at the rate of 250 bushels per acre,) in 1864.* These "Monitors" were grown in drills two feet nine inches apart, and fourteen inches in the row. The fifth in the series are the Peach-blows, which, from their strong growing habit, require drills three feet apart and from fourteen to sixteen inches in the row. The last variety completes the series, and is committed to the earth about the last of April or early in May, and may continue to grow until frost has destroyed the leaves. The cuttings planted for a late crop are placed in the furrow and the compost thrown upon them; for early crops it is deemed advisable to place the cuttings upon the manure, that it may earlier receive the influences of the spring sun. A short time before the sprouts of the potato should appear the ground receives a harrowing, to level the tops of the ridges formed by the closing furrows which have covered the drills. When grown sufficiently to bear cultivation, they sometimes receive a ploughing, by which the earth is thrown towards the row, but generally level

* Another grower of early potatoes has produced from sixteen baskets of seed, of the White Sprout variety, 600 baskets of merchantable potatoes, which were sold early in July at $1 25 per basket, or $725.

cultivation is deemed better, and a horse-hoeing, when weedy or the soil is baked, is all-sufficient. The field of ten acres on which the above named varieties of white potatoes were grown, had produced a good crop of corn in 1863, the year previous. This corn had been treated with a compost of unleached ashes and hen manure, a handful to two hills, and was planted on ground which had been in sod for three years. The product of the ten acres was 2,584 baskets, or 1,615 bushels, (or 161½ bushels per acre,) which sold for upwards of $2,500. The average yield per acre of white potatoes was in 1864 but 85 bushels. The prices per basket of five-eighths of a bushel, which were received early in the season, ranged from $2, $1.70, to $1.40. For the late potatoes $1 per basket was obtained.

The experience of the above successful grower is unfavorable to the continued use of guano as a fertilizer for the potato. Though the first crop may be benefited, and perhaps hastened thereby, those following are not so favorably influenced. On lands which have received heavy dressings of green-sand marl, guano does not prove of much value; the ingredients useful to vegetation existing in the more cheaply obtained green-sand. Immediately after the removal of the crop of potatoes from each plot of two or more acres, it is ploughed twice, six inches deep. The ground is then manured broadcast with cow-yard manure and street dirt, except the plot which produced the earliest variety—that not having been taxed so heavily by the crop of short season and diminished growth. This dressing of manure is moderate, at about the rate of twenty-five cart-loads per acre. It then receives a rolling, and the wheat is sown broadcast at the rate of rather more than two bushels per acre. The Mediterranean is exclusively cultivated. The seed is then ploughed in, a one-horse plough being used, and the field is again thoroughly rolled.

The crop of wheat raised by the careful cultivator whose process we have described, is generally unsurpassed in his district. The young growth of wheat thus early sown has made its appearance before his neighbors have sowed their fields. No growths of wheat have appeared to us as forward as those of our friend; none more promising were seen by the writer during journeys made in the autumns of several years past, throughout the length and breadth of the wheat region of southeastern, middle, and northern Pennsylvania. His success is the result of thorough culture and early seeding, upon a soil not naturally adapted to the growth of heavy crops of wheat. His crop for 1864 returned 300 bushels, or fully 30 bushels per acre; that of his neighbors generally did not produce one-half this average, that for the entire county having been but thirteen bushels. An instructive lesson may be found in the above recital of successful wheat culture that should stimulate others to greater care in the preparation of the ground and to early seeding for this important staple.

RHUBARB.

Early after frost has left the ground and a moderate warmth has penetrated it, the rhubarb makes its appearance; its leaves unfolding as if by magic. In this latitude its first appearance may be from the first week in March to the middle, or later. By the 10th of April the leaf stems are oftentimes sufficiently grown to be fit for market. These stems should be about ten inches long below the leaf before the pulling should commence, and, as the season advances may be permitted to extend in length. To remove the leaves properly they should be grasped separately, as near the root as possible, so as to secure the entire length in perfect condition. The leaves, as they are gathered, should be placed in small piles, and, as soon as may be, removed from the sunshine to shelter, to be "bunched" and put into merchantable shape. This is a very simple process, but may be described as follows: Place the leaves upon a high and large table, before which stands the "buncher," who collects the leaves of uniform length to form one bunch, (less regard being paid to thickness,) to the number of four to seven, as size or custom may indicate. Holding this in his left hand, the ends made even by a slight tap against his body, it is placed in a rack on a small table, where it is kept in position by pegs or pins three inches high, before and behind which strings had been previously placed by boys, who at once tie it as tight as possible, and then cast it over to a fourth assistant, who washes and trims it, and places it in a pile ready for the market.

In this manner four persons can pull and bunch five hundred bunches in a day. That which is gathered in the afternoon should be taken to market the next morning, thus securing its freshness, and avoiding injury by heating, to which it is liable when closely packed. Early in the season but a small portion or none of the leaf should be removed: but later, as the stems become longer, they must be more closely cropped, which may be done by one or two quick strokes with a sharp knife. The stem-ends should not be cut unless broken or ragged. The varieties of rhubarb under cultivation are numerous, and various in quality and early fitness for market. That known as Myatt's Linnæus is at present most esteemed, and is grown from sections of the roots having one eye or bud.

The process followed on a large scale in this section may be thus described: A deep rich loam is the best soil for the growth of rhubarb, though it will grow in any kind of soil if drained and properly manured. The ground selected should be mellowed deeply with a two-horse plough, and if the sub-soil be hard it must be also broken up. Divide the plot by furrows accurately, four feet each way, and at each intersection remove the earth, making a square hole a foot or more wide and fourteen inches deep. After two rows are thus prepared, into each hole throw a forkful of good stable manure. If the manuring be delayed until all the holes are made, a cart cannot pass over the ground. The manuring thus accomplished, drop a section of the roots to be planted near to each hole. One assistant should hold the root in the proper range of the rows, the crown being at the depth of two inches beneath the level of the surrounding soil, while another throws in sufficient earth to hold it in its proper position. The hole should then be filled up and the earth trodden solid about the plant. No leaves should be removed from the rhubarb until it has attained one year's growth. If planted in the autumn a stronger growth may be obtained than if put out the following spring, and may prove more remunerative.

After the crop is established, manure broadcast every fall or winter with at least a one-horse cart-load of stable manure to every hundred hills. Peruvian guano may also be profitably sown over the ground in early spring. The cultivation deemed necessary is performed in early spring, as soon as the weather will permit, by passing a cabbage plough along the rows as near as possible, throwing the furrow away from the plants, running as deep as the roots will admit. This should be done in both directions, and the ridges smoothed down by the hoe-harrow, and repeated when requisite. After the leaves have expanded, the hoe-harrow or cultivator will alone be needed for keeping the ground clean and mellow.

Rhubarb, planted at the distance of four feet each way, may be expected to yield fairly for four or five years without resetting, which is necessary when the plants appear to decline. To obtain a succession of prime growths it is best to have a portion of new ground planted yearly, and as much cleared of roots as may have become unproductive. The old ground may, however, be replanted; and old beds may be partially renovated by dividing the crowns with a spade, and removing one-half and permitting the other to remain for one or two years longer. The blossom stalks which appear from time to time should be industriously broken out, for if left to perfect themselves they will shorten the life and diminish the productiveness of the parent plants. The leaves should never be entirely removed from a rhubarb plant, as it would be injured by total stripping. Commence on one side of the "patch," and gather from a portion only of the rows each day. A better article will thus be secured, and the plants from which leaves were removed on the first day will have an opportunity to recover in readiness for a second contribution. After the middle or end of May no more leaves should be taken from the plants, that their summer growth may prepare them to endure the gatherings of the next year. If planted at the distance of four feet, an acre will contain 2,722 plants, and, if well managed and near to a good market, should produce an average clear profit of $200 per annum during the five years it is in high producing condition. But so variable are the demand and price that no definite profit is certain, and so prolific is the nature of the rhubarb plant that any market may be easily overstocked with its product. Late in March or early in April the tomato plants are removed from their seed-beds and "spotted" out under extensive glass structures or "cold frames," where they are planted about five inches apart upon a good soil enriched with old manure. Here they require careful nursing and sheltering from the cold and changing skies and rains until they become large and stocky, and the weather has become warm and settled, which is generally about the 1st of May. The plants are then carefully removed and planted in a light loamy soil, in hills about six feet by four feet apart. In each hill a small shovelful of well decomposed stable manure, or a compost of four-fifths manure and one-fifth street-dirt, has been placed. If spread in drills the entire length the results are by some deemed better at the rate of fifteen or more one-horse cart loads per acre. The tomato plants are easily inserted deeply either by a dibble made of an old fork handle sharpened to a point, or by thrusting the hand forcibly into the soil. Very deep planting is approved, as new roots are thrown out nearer the surface, and the plant becomes more robust. Clean cultivation with the horse-hoe or cultivator only is needed until the vines have become so large as to impede the work. A very early ripening may be hastened by removing the upper part of the plant after the first and lowest tomatoes have set and obtained half their size. The lower half-grown fruits soon enlarge rapidly, and ripen earlier than if the whole crop had been retained. From 200 to 500 baskets of tomatoes may be readily raised on one acre, on soil adapted to their early growth, and in sheltered localities, or where shielded from late frosts by the influence of water. They are brought into market as early as the last of June or first of July, and are readily sold at very high prices. A skillful farmer in Gloucester county, New Jersey, received in the summer of 1863 sixty-six dollars for seven baskets, or four and three-quarters bushels. In the summer of 1864 the same grower obtained twenty dollars for two baskets, the earliest in the market; others, resident on "Pea Shore," received five dollars per basket for their tomatoes. In the same district of Stockton this vegetable is extensively grown, and from the favored location and early ripening large sums are realized therefor. Nearly 5,000 baskets, raised by one of these successful "truck-men," returned, in 1864, more than $3,000. That season was, however, unusually favorable as respects product, demand, and high prices. Another skillful cultivator of tomatoes grew about 8,000 plants on less than four and a half acres, for the product of which he received upwards of $1,000. His earliest gathering was made on the 2d of July, and for these he received $5 per basket, and for the first hundred baskets, which were gathered in about ten days from the first ripening, $4 25. The second crop of tomatoes is grown from plants obtained from seed sown in drills in the open air. The large smooth red and the Feejee are popular. The season is oftentimes cut short by frosts early in or near the middle of October, and vast quantities of the fruit destroyed. If gathered in anticipation of frost, and placed beneath glass on straw, a large proportion of those half ripened may be secured and partially matured for market.

Egg-plants receive a treatment resembling that given to the tomato, but more careful nursing is demanded while in the seed-bed. Some growers have found them highly profitable, one of the most successful in Camden county having sold 600 baskets, the product of three-quarters of an acre, for $400. For the earliest product he received $3 per basket, and the entire return was at the round rate of $567 per acre.

THE SWEET POTATO.

About the middle of April the preparation of the hot-beds for starting the sweet potato, for the production of sprouts, is commenced. Much of the soil of the district of New Jersey is adapted to the growth of this admirable root. No other northern State produces the sweet potato so abundantly or in as great perfection. Her product in 1860 was more than one million bushels, which nearly equalled that of all other northern and western States combined. In 1862 the Agricultural Department estimated the growth of the sweet potato in New Jersey at 1,634,832 bushels, valued at $1,226,126. The crop of 1862, thus estimated, surpassed all other northern and western States in aggregate product. Most of the southern States greatly surpass New Jersey in the amount of product, North Carolina and Georgia having produced in 1859 more than 6,000,000 bushels each, Alabama 5,000,000, sundry others from two to four millions of bushels, where it appears to be the great staple vegetable product. Though adapted to a warmer climate, it attains in our State, in favorable seasons, a degree of perfection which leaves nothing to be desired. Such a season was that of 1864, which was remarkable for its product, both in quantity and quality, and for remunerative prices. The return of this crop varies from 100 to 200 baskets and upwards per acre, the latter being an exceedingly favorable yield. From six and a half acres there were taken in 1864 1,700 baskets, which sold for $1,700. Upon three acres 800 baskets (or 500 bushels) were raised, which sold for $1,000. On two acres 600 baskets (or 185 bushels per acre) were produced in 1864, which yielded per acre about $300 gross revenue. The above is not, however, a fair exhibit of regular annual returns for the anxious care, the labor and expense, which is sometimes poorly remunerated by an indifferent crop and diminished prices.

A successful grower has favored us with his method of culture, which we cannot do better than give entire for the instruction of those who may wish to cultivate this choicest of esculent roots. Moderately good sweet potatoes may be raised further north than New Jersey, on a warm soil, and large crops have been grown in northern Pennsylvania, where we would not have deemed success could be obtained. The product was not, however, commended to our taste by that flavor and dryness which result from growth upon a properly selected soil, under a warmer sky. The sweet potato requires a sandy soil or a sandy loam. Land is generally chosen which has been in corn or a vegetable crop the previous year, though it is a common practice to plant the same ground with sweet potatoes season after season. In the latter they seem to grow as well as they do in freshly chosen ground. Having been ploughed as for any ordinary crop, but not deeply, the ground is furrowed out with a one-horse plough three feet each way if to be planted in hills, over three and a half feet apart if in rows, the plough running twice in the furrow. A forkful of horse-stable manure is then, if for hills, placed at each intersection of the furrows, and well covered by hand with a hoe. If to be grown in rows, the manure is scattered evenly along the row and covered by turning two good furrows directly upon it. The field is then ready to receive the plants. The manure should be applied freely, and be of good quality. It should have been well forked over until fine and mellow, to avoid as much as possible increasing the evil effects of drought by presenting to the plants their food in lumps, which readily become dry and unavailable, and which, if once in that condition, will certainly remain so throughout the season. When grown in rows a larger number of plants are required than when grown in hills. Both methods have their advocates, but if the sprouts are placed from twenty inches to two feet apart in the row a better crop is generally obtained for the same amount of labor and money expended. The young sprouts or plants are grown from "seed potatoes," selected from the previous year's crop, which should be of middle size, and of short, compact shape. These are placed in hot-beds, made up from about the first to the middle of April, in the ordinary way. The manure, fresh from the horse stable, having been evenly shaken into the bed or frame to the depth of twelve or eighteen inches, is pressed down by the weight of the laborer upon a board laid thereon. The board is removed, and the whole evenly covered with about three inches of rather dry sand. Upon this the "seed potatoes" are carefully placed, close together, though not actually touching, and are then covered with about three inches of good sand or loam. Great care is observed that the right degrees of heat and moisture shall be maintained. If the heat become too great it may be checked by piercing through the bed into the manure with a rake-handle, thus allowing the excess of heat to escape. Moisture must be regulated by the watering-pot, which should be used on clear days only, and about noon. If the heat or moisture become excessive, the potatoes will rot; deficient heat with moisture may cause the "black-rot." If the plants become infected with the latter, it will prove worse than useless to endeavor to use them. Heat and dryness kill the sprouts, or prevent their growth; and even when moderate dryness is combined with other influences favorable to growth, though sprouts apparently good may be produced, they will not possess well developed fibrous roots. Experience alone can teach that wisdom in minutiæ which will command certain success. The bed should be exposed to the sunshine on every clear day, and covered with hay or straw at night, and in rainy weather protected from excess of moisture by a covering of boards. The sprouts will be ready for transplanting in about a month, and planting commences from the 15th to the 22d of May, and continues from two to four weeks. When the time for removal has nearly arrived, the plants should be exposed to the open air, to harden them for the field. The sprouts are drawn by taking hold of but one at a time, and gently extracting it in order to avoid disturbing the mother potato, from which, if undisturbed, a second crop may be obtained. A bushel of good seed properly managed will produce 1,200 or 1,500 sprouts at the first pulling, and three-fourths as many at the second. Those obtained later are often as good as the earlier growth.

Good, strong, stocky plants having been obtained, they are rapidly and expertly transferred to the soil, the operator using no implement but his bare hand. Dashing aside the crown of the hill or ridge, he thrusts his open hand into the yielding sand, and with the other inserts the plant, covers and compresses it, and if the ground is too dry, waters it. In a week or two the field must be examined and replanted wherever cut-worms or other insect larvæ may have destroyed the first setting. Clean culture, with the hand-hoe or iron garden rake and horse cultivator, is now required until the vines have covered the ground. About the middle of August the ground should be "tended" for the last time, by ploughing to the rows or ridges, and cleaning up the balks. To perform this thoroughly, the vines must be loosened from the soil to which they have attached themselves by small roots along the main stem, and turned over or out of the way by means of sticks or by the hand. Before gathering the crop, the vines are cut off close to the hill with a sharp hoe. The potatoes are then ploughed out and thrown into rows to dry, when they are readily sorted for market.

To fit them for preservation they must be lifted before the weather indicates a degree of cold sufficient to freeze the ground, or, in this latitude, before the

25th of October. Those intended for winter storage should be gathered before the middle of October, put up in barrels or shallow boxes, and placed in a dry, warm situation. When placed in barrels in the open field, and carefully handled, they will be more readily preserved during winter, other circumstances being favorable—slight bruising from rough carriage proving injurious to them, if designed for winter use. When large quantities are reserved for spring sales, houses are erected expressly for their preservation. These are generally two stories high, built of wood, and so arranged that the potatoes may be stored therein in boxes about two feet deep, placed in tiers, with spaces of a few inches between for ventilation, and extending from side to side of the house to within a foot of the weather-boarding. The source of heat is a fire in the cellar, from which the warmth is caused to circulate equally and freely throughout the building. Thus arranged and carefully tended, maintaining a nearly uniform moderate heat, sweet potatoes may be preserved until late in the following spring. No chaff, shavings, or other material is needed; careful packing and handling, and uniform moderate heat, being the only requisites for the attainment of perfect success in the preservation, for the entire season, of this admirable root.

CUCUMBERS

Are sometimes successfully grown in cold frames, covered in cold weather by sash, and exposed at all times in warm or fair weather. Seeds are placed in a piece of inverted sod about four inches square, and arranged side by side in a low frame, having a back of but four inches, to prevent excessive growth from reflected heat. Seed sown in this manner about the 20th of April, and duly sheltered and exposed to the air at proper times, will be ready to set out by the 15th of May, after which they will require shelter from late frosts. Cucumbers are now grown in drills or rows about five and a half feet apart, the plants being three feet asunder in the row. The manure, which should be well rotted, is sprinkled along the furrows, in preference to more condensed manuring in hills or beneath each plant only. A most successful grower of early cucumbers, whose practice of early forcing the plant, or rather of protecting it in its infancy, is that described above, has thus picked fine full-sized fruit, to the amount of many baskets, as early as the 28th of June, for which he received, in 1864, seven dollars per basket. The ground upon which these early cucumbers were grown was exposed, having no shelter from the north or northeast.

LATE CABBAGE.

The cabbage crop is a very important one in Camden county, where it receives the cultivation it requires to command success. The past season was unusually favorable to its growth, heavy crops, at compensating prices, having been obtained. Upwards of 20,000, by one grower, were raised on four acres, which sold for about $1,500. More than 40,000 were obtained by another most successful grower from about eleven acres, which returned a gross sum of nearly $3,300; and a third produced, on thirty acres, 175,000, which were sold for $9,000. The season of 1864 was exceptional in the product and profits of this crop. Whole fields sometimes refuse to head, and the care and expenditure for labor and fertilizers, which are heavy, are, in great measure, lost. The ill success of many who would grow this important vegetable may be oftentimes found to arise from their indifference to choice of seed and injudicious culture, rather than from the season. This may appear more clear by a description of the method followed, with almost uniform good results, furnished by one of our most intelligent and enterprising young farmers. His paper we will give nearly entire, the result of experience on a large scale.

"Having experimented in cabbage-growing, on soils varying from a light sand to a heavy loam, we find that a medium rather sandy loam will give the best success. But whether the soil be light or heavy, the indispensable elements of success are, carefully grown seed, a high enrichment, and thorough cultivation. We have been in the practice of sowing the seed about the 5th of May; have delayed it until the 20th; but the sooner the seed can be started and grown to sufficient size to escape the ravages of the cabbage flea, (*Haltica striolata,*) the better. There are two methods of preparing the seed-beds, in each of which we have been successful in growing good plants. The variety most esteemed for winter consumption is the drum-head. Select a piece of dry, sandy ground, spread thereon guano at the rate of five hundred pounds per acre, and plough or spade it in shallow, then harrow and rake smooth, producing a fine mellow soil before planting. Take a board eight inches wide and about twelve feet long, having straight edges on each side. Standing on this board, draw a straight drill along each edge with a spade or trowel, and sow the seed along it as thickly as may be deemed judicious, erring rather in excess than otherwise. Shift this board along the seed-bed, repeating the process of drill-making and sowing, as described. We have planted cabbage seed with good results by manuring the ground in drills three feet apart, ridging with a plough, smoothing the surface nearly level with the surrounding soil, and then planting in a broad band thereon, and covering lightly with earth. This latter method permits horse cultivation, but in neither case must the earth be suffered to become hard or weeds be allowed to grow among the plants.

"The great difficulty to be overcome by the grower of cabbage plants arises from the ravages of the flea beetle. This pest sometimes sweeps whole beds, attacking the tender plants as they break through the ground, and continuing to feed on them till the second leaf is well developed. To prevent this evil, and destroy the pest, we have tried soot, sulphur, guano, ashes, a coop with hen and chickens among the plants; but the remedy has, in most instances, proved worse than the disease. The last has, however, in some instances been successful; though, as the chickens became large, the cabbage plants became, in turn, a prey to their insatiable cravings. With all the care taken the seed-beds will at times present a sorry appearance, and afford but an indifferent supply. It is safer to make two plantings, even if side by side, ten days or two weeks apart, the latter planting frequently proving the only source of supply. By the 10th of June the plants should be growing rapidly, and stand three or four inches high, with strong stems, ready to pull and set out. Meanwhile the ground selected for the crop has been thoroughly ploughed and furrowed into drills three feet apart, with a one-horse plough, going twice in each furrow. If the soil is not already in "excellent heart," a liberal supply of well-rotted manure is spread along the rows and covered at once. If the soil be in good condition guano is applied in preference, and is spread along the drills at the rate of from 200 to 300 pounds per acre, and covered. Guano stimulates to early and rapid growth, and appears to be the specific manure for this vegetable. The entire field having been prepared in this way, poles are set up, and a marker (made of five half-inch slats placed edgewise and parallel, 2½ feet apart) is drawn by hand to and fro across the ridges covering the furrows, making five lines at each traverse over the breadth of the field. After the first tracing has been made the poles are dispensed with, one runner of the marker returning in one of the lines previously made. The tracing across is sometimes made by lines three feet asunder, which throws the field into squares of three feet, requiring 4,840 plants to the acre. If marked or laid out as described, 2½ feet by 3 feet, 5,808 will be needed for planting each acre. The latter mode is rather preferable, as the distance is sufficient, though the plants finally entirely cover the ground, while nearly 1,000 more heads may be taken therefrom.

"When ready for planting, and the ground in proper condition, just after a rain, the plants are pulled and carefully packed in baskets. A boy precedes two men, his basket strapped by his side, and can readily drop for them, one to each furrow. Taking the plant in the left hand, and dashing aside the crown of the ridge with the right, which is then plunged into the soil, the young cabbage is inserted nearly up to the leaves, and the earth lightly pressed around it. Plants drawn from a sandy seed-bed are furnished with a mass of fibrous roots, which contribute greatly to growth and ability to withstand the sunshine while taking fresh root in the soil. If the weather be dry, and no rain in prospect, a pint of water poured around four hills will prove sufficient, in most instances, to sustain life and induce growth. It is desirable that the leaves of the plant should start as near to the ground as possible, and that they be regularly planted to secure cultivation on all sides. The after treatment is very simple; a horse hoe, or cultivator being used to keep down the weeds, and render the ground mellow. Cabbages must be kept growing from the time they are set out until perfect heads are formed. If they receive a check from weeds, or a hard surface-soil around them, they never recover therefrom. Constant vigilance is, therefore, demanded to keep in action their growing energies. By the first of October the leaves should be closing in rapidly and forming heads. The more forward will continue to grow, will burst and "go to seed" if care is not taken to pull each one so advanced sufficiently to break its roots slightly. A slight crack on the top of the head indicates over-ripeness, and further advances may be thus prevented.

"Before any cabbages have been cut for market the field should be searched thoroughly, and a selection made of plants for the production of seed, which should be marked by a stake inserted beside them. This selection must be made with great care, and the parents of the future generations of cabbages should stand upon short but not too thick stems, with dense, hard, and well-developed heads, having fine soft veins, and but few spare leaves around them. Those intended for seed should be pulled up just previous to burying the main crop, taken to a dry spot and laid on the ground, their roots upwards and towards one another, forming a semicircular pile, the heads pointing outwards. This pile is completely covered with earth to the depth of eighteen inches, a little heavier on the northern side, which will preserve them unharmed in this latitude throughout the winter. The crop may be cut and carted to market any time previous to December, as they are injured by freezing and thawing, but will withstand a continuous frost without much apparent injury. By the last of November, or first of the succeeding month, preparations should be made for burying those intended to be sold during the winter or following spring.

"Three rows of cabbages are pulled up the entire length of the field and placed in one continuous line, lying on their sides, the roots pointing towards the furrow about to be opened. With a two-horse plough open a drill, returning in the same to widen and deepen it. The workman standing astride the furrow, with his left hand draws the cabbage into the furrow, head down and roots out, and tucks the leaves under and around each one before passing to the next. The entire field is thus planted, while the covering is quickly performed with a one-horse plough by throwing a furrow just sufficient to cover the cabbage on each side, leaving the roots exposed. A covering of but two inches affords ample protection, and permits their ready extraction as well as thawing during an "open spell."

"Those who would command success in cabbage-growing on a large scale, should select the heads and grow the seed for themselves. If compelled to buy, they cannot inquire too closely into the integrity of the parties selling, and their method of raising seed. Seed grown from stalks after the removal of the head, or from cabbage which did not (and perhaps never would) form a head, will disappoint the grower of this crop. Unscrupulous seedsmen will sell such seed, knowing it to have been thus raised; though plants grown therefrom must be degenerate, and will surely cause vexation and loss to their cultivator. Complaints from this cause alone are heard every season, and the dishonest practices of dealers who would palm off such worthless trash, called seed of their own growing, should be severely exposed."

STRAWBERRIES, RASPBERRIES, AND BLACKBERRIES.

If we would believe the reports that are so sedulously put forth by enthusiastic, imaginative, or interested writers for the agricultural journals, we should suppose that fruit-growing is uniformly a productive business in the district of which we treat. But this is far from the truth. So far from being uniformly profitable, the product is on the decline, and the business has been abandoned by many farmers. Entire orchards have been rooted up, not because, as some would have us believe, the owners did not give their trees judicious treatment, pruning, &c., but because the crop is too precarious. A heavy crop of apples, occurring once in eight or ten years, will not satisfy the owner of broad orchards, spreading their shade over everything beneath, and unfitting the soil for any other crop. The farmers of Camden county cannot afford to raise winter-keeping apples, as the shade of the trees costs more than the crop is worth. So long as western New York, a region adapted to fruit-growing, can supply apples in unlimited quantities, we will not occupy with orchards land worth from $200 to $400, and which will pay exceedingly well if cropped with market-garden vegetables and small fruits. Our own orchard of twelve acres of prime trees has not borne a fair crop of fruit for eight years past, nor have we had from long rows of winter varieties one apple that could be esteemed excellent. The early summer kinds appear to be productive in some instances, and are worthy of more attention in sheltered locations.

Enthusiastic writers, who judge of the fitness of a district for fruit-raising by the returns for one season, which is exceptional, have praised our district as of high excellence in this respect. Such, however, is not the case. Western New Jersey is not well adapted to the growth of winter apples or pears, though occasionally large crops of good fruit are raised. We are satisfied that much injury may be done by this indiscriminate praise of the district, and that some may be induced thereby to expend means and labor upon a business that must prove, as it has again and again proved, unremunerative.

In the production of small fruits, such as strawberries, raspberries, and blackberries, we doubt whether the river townships of Burlington county have been surpassed. The following reliable returns and statistics will exhibit the extent, productiveness, and profits derived from this business, which will probably add to the surprise that some readers may already have felt in scanning the vegetable wealth of "poor Jersey."

In the immediate vicinity of Moorestown, Burlington county, New Jersey, there were grown in 1862 more than 6,000 bushels of strawberries, which, at the moderate rate of $3 50 per bushel, produced a return to the farmers of that vicinity of at least $20,000. On ten days an average of 600 bushels a day, and on one day 700 bushels, were carried to Philadelphia, from this neighborhood alone, by one avenue to market. Large amounts are taken to the same city from this district over other roads and by water conveyance, and to New York by rail. The quantity thus seeking a market probably quite equals that above named in amount and productive returns; and we doubt not that from this small district of a few square miles 12,000 bushels were produced, and realized to the skillful growers upwards of $40,000 in the year 1862. One farmer, whose strawberries are sent to New York, devotes forty acres to this crop; and another received for one day's picking, sent to that city, $300. Two hundred and ten bushels of strawberries have been raised on one acre, which sold at nine cents per quart, realizing $600.

By the reports made to the West Jersey Fruit-growers' Association, in 1864, from the townships of Burlington, Chester, and Cinnaminson, all in Burlington county, there were under cultivation and producing fruit, during the preceding season in said townships, 272 acres of strawberries, 40 acres of raspberries, and 99 acres of blackberries. Of the above 272 acres of strawberries, 200 were comprised in Burlington, 47 in Chester, and 25 in Cinnaminson. The aggregate product was 12,596 bushels, or 403,072 quarts, and the amount received therefor $45,345. The general average yield per acre was 55 bushels, viz: in Burlington 40, Chester 68, and in Cinnaminson 56 bushels. The average price obtained was $3 60 per bushel, or 11¼ cents per quart, which is 50 per cent. greater than for five years previous.

The above is much below the possibilities of strawberry production. One unusually large crop of Hovey's Seedling and Lady Fingers was reported from Chester, which returned from 1.46 acres 8,000 quarts, or at the rate of 166 bushels per acre.

The second annual report of this useful association, which should be more generously patronized by the horticulturists of the district, whose interests it must greatly advance if but properly aided and encouraged, contains more details of the progress of small-fruit cultivation in our midst. But four townships reported in 1865 an area under cultivation in strawberries amounting to 488 acres, of which 220 were in Burlington, 200 in Beverly, 40 in Chester, and 28 in Cinnaminson. The total product of these 488 acres in bearing was 27,924 bushels of fruit, yielding the sum of $164,633. The general average product per acre was 58½ bushels, and that for Burlington 40, Beverly 75, Chester 65, and Cinnaminson 54 bushels. The average gross sum obtained per bushel was about $5 90, which is a very large increase over that for 1863.

A general progress is apparent in the extent of cultivation and productiveness. But occasionally crops have been raised three times as large as the general average reported above. Seventy bushels have been raised in the township of Cinnaminson upon one-third of an acre, or 210 bushels to the acre. The premium crop of 1855 yielded 1,052 quarts on twenty rods of land, being at the rate of 263 bushels, and yielding more than $1,200 per acre, after deducting every expense for manure, hoeing, picking, sale of fruit, and interest on the land. Cannot such crops be frequently or regularly raised? And what was that combination of favorable influences? And can they not be again commanded, and that upon a large scale?

Such extraordinary returns should serve to stimulate fruit-growers to inquiry into the causes which have conspired to produce these magnificent results, which can doubtless be again obtained. That moderate crops continue to be grown indicates that some radical error exists in the common mode of cultivation. The committee on fruits, reporting to this association, asserts that thorough preparation of the soil before transplanting is of the first importance; that the ground should be deeply ploughed in the fall, and liberally enriched with a well prepared compost; that much closer attention should be paid to the adaptation of varieties to the peculiar soil to be planted; and finally recommends more thorough cultivation in the beds, to admit of which a more systematic distribution of the plants and removal of a large proportion of the minor growths should be practiced. The mode of cultivation almost universally adopted is to plant in rows five feet apart, and one foot in the row. The vines are trained across the beds, and set in as they are ready for forming roots. Beds three and a half feet wide are thus made, and a path eighteen inches wide is formed between them. Thus trained, on ground deeply ploughed and manured, a crop may be insured the first fruiting year. As they are planted early in April, the following year generally finds them productive. They soon become infested by grass and clover, and some growers deem it more profitable to renew the beds than to prepare the old by laborious weeding for a second crop.

The varieties cultivated are Wilson's Albany, Lady Finger, Hovey, French's Seedling, Downer's Prolific, and Cutter's Seedling. Of the older varieties, Bartlett, Austin, and Triomphe de Gand, and many others, have been generally discarded, not having proved reliable. On light or sandy soil it is labor lost to plant the latter-named kind, as it, in common with many others, among them the Lady Finger, Scarlet Magnate, &c., demands a good, strong loam. The Early Scarlet, May Queen, Iowa, and Downer's Prolific, and some others, will succeed on a light, sandy soil; but land of this character should not be chosen for the production of the finer strong-growing varieties. Russell's Prolific upon small plots of strong, gravelly loam, has produced a very fine crop of the finest fruit, and it is, in the esteem of the fruit committee of the W. J. F. G. Association, one of the largest and most productive strawberries; but larger experience is needed to establish its claims to preference.

The cultivation of the raspberry is deemed of considerable importance in the townships of Burlington, Chester, and Cinnaminson. Forty acres were devoted to this fruit in 1864, which yielded from 20 to 60 bushels per acre, which, at 30 cents per quart, a probable average price received, produced a gross sum of $15,360. The varieties grown are the Philadelphia, Doolittle Black, the old Purple Cane, and the two kinds of Allens. Nearly all others have been rejected as tender or unproductive. At present the Philadelphia stands unrivalled as a market berry, being hardy, of large size, and exceedingly productive. It has yielded over 200 bushels per acre, and the fruit during last summer found ready sale at from 40 to 60 cents per quart at wholesale. It never fails to produce an enormous crop, and has been thoroughly tested as regards endurance of heat and cold. The variety is not new, though but recently disseminated, having been found wild in a wood near Philadelphia twenty-five years ago, but so highly prized that no plants were spared to the public for fifteen years. The demand now exceeds the supply. Four thousand plants were sold by one nurseryman in Burlington county, for $500. In 1863 there were nearly one hundred acres in the aforenamed townships devoted to the cultivation of the blackberry—Burlington reporting 75, Chester 11, and Cinnaminson 13, which yielded 5,264 bushels of fruit. This was an average product of 53 bushels per acre—Burlington producing 50, Chester 68, and Cinnaminson 66 per acre. The price per quart averaged $10\frac{3}{8}$ cents, or $3 30 per bushel, and for the entire product $17,915 were received. The New Rochelle or Lawton and the Dorchester were the only varieties found adapted to field culture. In 1864 reports were received from five townships, in which one hundred and eighty-nine and a half acres were devoted to the growth of the blackberry; and of these Burlington occupied 100, Beverly 50, Chester $18\frac{1}{2}$, Cinnaminson 13, and Centre (in Camden county) 8 acres. The entire product was 9,189 bushels of fruit, which sold in market at about $4 80 per bushel, and realized $44,107. This crop was much reduced by drought in one township, but the net returns were larger on the whole than in 1863. The prices obtained for small fruit in 1864, it has been shown, were much in advance of those for 1863. Unusually large profits were the consequence, if estimated in the inflated currency of the day. An exhibit of a few crops raised by individuals, and gross returns received, may prove of interest to many readers, who prefer bald facts to theories or generalizations.

One of the most successful growers of small fruits produced, on $3\frac{1}{2}$ acres, 4,575 quarts of strawberries, for which he received $975; on $2\frac{1}{4}$ acres, 6,675 quarts of blackberries, which sold for $900 52; on $2\frac{1}{2}$ acres, 2,226 quarts of raspberries, which returned the gross sum of $747 50; a total by one grower, on but $8\frac{1}{4}$ acres, of 13,476 quarts, which produced a gross return of $2,623 02, or at the rate of $307 per acre.

Another very skilful grower of small fruits produced, on $2\frac{1}{2}$ acres, 4,608 quarts of strawberries, which are equal to 144 bushels, and sold the same for $867 84. His blackberries, on one acre, produced him 1,600 quarts, or 50 bushels, and sold for $240; an aggregate of $1,107 84 from $3\frac{1}{2}$ acres, or $316 per acre.

A third grower, evidently an expert, raised on $2\frac{3}{4}$ acres, strawberries which sold for $1,200, or at the rate of $436 per acre. One of the above gentlemen sold strawberry plants, which increased the income from his small plat to the sum of $504 per acre.

The following crops of Lawton blackberries were reported, raised in Camden county, in 1864:

1,143 quarts on $1\frac{1}{8}$ acre, at the rate of 1,016 per acre	$172 50
12,304 quarts on 8 acres, at the rate of 1,538 per acre	1,436 00
365 quarts on $\frac{1}{8}$ acre, at the rate of 2,920 per acre	49 00
1,000 quarts on $\frac{1}{5}$ acre, at the rate of 5,000 per acre	110 00

The largest plantation of eight acres thus produced 384 bushels, at the rate of 48 bushels per acre, and sold at $3 74 per bushel, or nearly $180 per acre. Large crops of blackberries have been raised on the same ground from which, one month previous, an excellent crop of strawberries had been gathered. The blackberry tied closely to wires, headed back during summer, and pruned in the spring, does not materially interfere with the strawberry plants around it, and a succession of fruits may thus be obtained from the same ground.

In Burlington county, on ten acres of thin land, from which the sand formerly drifted like clouds before the wind, six hundred and fifty bushels of Lawton blackberries were gathered in 1862. The same plantation yielded seven hundred in 1863, and in 1864 eight hundred bushels. A résumé of the report made to the West Jersey Fruit Growers' Association, which does not include the entire area devoted to small fruits in the counties of Burlington and Camden, affords the following gratifying exhibit:

	Acres.	Yielding in bushels.	Which sold for—
In strawberries	488	27,924	$164,633 60
In raspberries	40	1,600	15,360 00
In blackberries	$189\frac{1}{2}$	9,189	44,107 20

Affording an aggregate yield, on $717\frac{1}{2}$ acres, of 38,713 bushels, bringing $224,100 80.

CRANBERRIES.

The cranberries grown in New Jersey are, it is well known, of superior quality. Under proper cultivation they prove very productive and attain a size and quality unsurpassed elsewhere. As an example of their productiveness, we may state that a part of the plantation of W. T. Bates, of Cape May county, has produced at the rate of 1,300 bushels to the acre, or one bushel to a space of three square feet. This must not, however, be regarded as the ordinary yield. Favorable seasons have exhibited a product of upwards of 400 bushels of superior cranberries, which command the highest market rates. The product of cranberries, as reported to us in 1864, was much less per acre than the above. One grower in Burlington county raised, on 25 acres, 1,000 bushels, for which he received $8 per bushel, doubtless a net profit of at least $6,000.

Let not the shopkeeper or the mechanic, who has read "our farm of two acres," or "four acres," or even of "ten acres," and deemed it "enough" for him if he could grow such crops thereon—who has pored over the fascinating pages of such writers who have the faculty of making the reader utterly oblivious of the toil by which the crops were raised—imagine for a moment that compensation for *hard work* does not form much the greater part of this seemingly large amount of returns per acre. Let him not for a moment suppose these products are the spontaneous growth of the Jersey soil, and that he will there find "another lubber land where the houses are tiled with pancakes, and chickens ready roasted cry, 'come eat me.'" Labor—continuous labor, early hours, broken rest, wearing watchfulness, are the price; and this oftentimes but indifferently paid. High remunerations are found only on soils and in locations specially adapted to produce early and abundantly. The results enumerated in this paper cannot be attained everywhere, even with high manuring and all the expenditures of toil and care and skill.

THE GREEN-SAND MARL OF NEW JERSEY.

The district to which the foregoing observations have mainly applied belongs to the cretaceous division of the geologist, and corresponds to the chalk of Europe. It comprises beds of clays, of sand, of gravel, and of green-sand or "marl." The section of the county of Camden to which the attention of the agriculturist has been chiefly directed lies in the western half, and is of quality much superior to the southeastern portion. The latter is included in the tertiary, and is mainly covered with sand and sandy loam, sometimes capable of producing crops under good culture, more frequently unfitted to endure any other burden but scrub oaks and dwarf pines. Wherever the sandy soil is underlaid by several feet in thickness of clay, cultivation might be conducted with promises of compensation; but where sand follows sand to the depth of many feet, perpetual drought must wear out the efforts of any useful plant to maintain an existence, and scrub oaks and stunted growths generally are but evidence of this lack of continued supplies of moisture during the growing season. Any person desirous of learning the capability of any part of this region may satisfy his inquiries by examining the growth of the crop already on the ground, (the bushes and trees,) or by boring with a common auger having a long shank, and thus determining the depth of the sand and the underlying clay. A sandy loam upon an impervious clay subsoil is often the most valuable for the growth of market-garden vegetables; but where we do not find an underlying clay of five or more feet in thickness, no useful result can follow the efforts of the cultivator. There are wide tracts of such sandy loams, or even of stronger texture, which are capable of improvement, because thus underlaid by a more retentive subsoil, and within reach of the marl deposits. Without resources from outside, they cannot probably be rendered productive. It is an error to suppose that these deposits of sand are worth but little. On the whitest of sands, resembling a sea beach, we have seen excellent crops of Catawba and Isabella grapes grown, even surpassing many we have observed on what would seem to have been much more congenial soil, and in districts esteemed for their fertility. In some parts of the southwest coast of France, vineyards are planted on the sand dunes or low hills of the coast, and the grapes produced thereon are among the best grown in France. Vineyards are planted on this sea sand, and fresh sands from the salt shore regularly applied, alternated every other season with ordinary manure. The vines being cut down, and the soil raised rapidly, covers the old stocks, which, as fast as buried, throw out new roots, and thus the vineyard is constantly renewed. This practice has been followed for two centuries with success, we may well presume. Nothing is needed in such sands but a due supply of organic matter and alkaline earth. At Truro, on Cape Cod, where the traveller would imagine himself almost beyond the region of agriculture—where he sees little else but drifting white sand, and scarcely any vegetation except a few stunted pines and poverty grass—Professor Edward Hitchcock was shown a piece of ground on which there were annually grown fifty bushels of Indian corn to the acre. The soil did not differ from the white sand around it, except in containing abundance of fragments of clam shells and enough organic matter to give it a dark color. Having extracted these shells, that is, all the carbonate and phosphate of lime, and burned off the organic matter, his analysis proved that nothing remained but the pure white sand of the cape. If thus the seemingly most irreclaimable and unpromising wastes may by art be rendered productive, how much better results must await the hand of skill and enterprise when applied to our far more hopeful stretches of unoccupied lands. Over much of this hitherto neglected region the beneficial effects of our "green-sand marl" are yet to be widely exhibited. Some remarks on the composition, value, and accessibility of this extraordinary deposit of fertilizing material, almost unique in character and extent, may here be deemed appropriate.

The rapid improvement in agriculture in a large part of lower New Jersey is to be ascribed, in a great measure, to the intelligent employment of this so-called marl, which is found in the central and south-western region in immense deposits. The belt or strip of land under which it is found extends obliquely across the State, from Sandy Hook southwest to Salem; its length is about ninety miles, and its breadth fourteen at its eastern, and six miles at its western extremity; and its area nine hundred square miles, or five hundred and seventy-six thousand acres. This deposit of fertilizing material has been worth millions of dollars to the State, through the increased productiveness of the district to which it has been applied, as well as the influence it has exerted in awakening and fostering a livelier interest in agricultural improvement.

The region of country in which it is found has been redeemed from desolation by its use. Before its application much of the neighboring land had become nearly worthless through exhaustive cropping. Some of these lands, even in Camden county, which, in 1830, were not worth five dollars an acre, are now valued at upwards of one hundred dollars; and others could be named which have gained more than pristine fertility, and would readily sell at two hundred dollars. On most of these latter farms marl is abundant and largely applied. Others, removed from five to fifteen miles from the marl beds, have been equally benefited by its liberal application.

Green-sand marl continues to be used in increasing quantities in all parts of the State of New Jersey to which it can be cheaply transported, and is rapidly aiding in bringing the most unpromising soils to a high degree of fertility. Lines of railroad have been constructed expressly for conveying it to distant points more cheaply and expeditiously. The business of transporting marl to distant points is yet in its infancy. There were carried on the Jamesburg railroad, in 1864, upwards of 14,000 tons of Squankum marl, which was distributed over a country from seven to twenty miles distant from the pits. The Burlington railroad carried from Pemberton, in eight months, 15,000 tons, which were distributed along the line of that road, the Camden and Amboy, the Delaware and Raritan canal, and into Pennsylvania. The demand upon these lines will fall but little short of, if any less than, 50,000 tons per annum. The Camden and Atlantic railroad conveyed, in one year, upwards of 10,000 tons, and the West Jersey railroad has commenced the transportation of marl to the country along that line of road, and of the Millville and Cape May roads, where the demand is such as to warrant preparations for an annual sale of 100,000 tons. The enlightened policy of conveying fertilizers at the lowest possible rates sufficient to cover cost, is alone needed along this road to render the business very large, and to amply repay, by the improvement of the district and increased productiveness and consequent enlarged traffic, for the far-seeing liberality.

The above exhibit of the burden of marl transported upon rail and by water forms but a small proportion of the amount distributed from the pits in a year. The great consumption still is in the vicinity of the "diggings," whence it can be hauled by teams. By this means 10,000 tons have been taken from a single pit in one year, and distributed over the region, from one to six miles distant. Numerous pits are opened along the line of outcrop, and almost every farm favorably situated has a "marl hole," as it is locally termed, thereon.

It may be said that the region under notice is peculiarly situated as respects a market and a supply of cheap fertilizers, enjoying, in these respects, unusual advantages. This is in a measure true, but a wide region of New Jersey, and the adjacent States of Pennsylvania and Delaware, is of almost equally ready access to the great agent which has regenerated West New Jersey. The vast beds of green-sand marl are but partially developed and but imperfectly worked, and are capable of supplying a much wider district with the elements of fertility. The foregoing record of the results of the application of this remarkable deposit will, we trust, aid in disseminating a knowledge of its value, and extending its application into States which border on New Jersey, to which it may be readily conveyed by rail or by water. The business of shipping this material is but in its infancy, and the demand must increase with a knowledge of its economic value. Having power equally valuable on soils remote from its region, it will probably yet overflow the country in every direction as rapidly as the facilities for transportation shall be increased and the expense diminished.

The following analysis of marl from the second and third beds will be found especially interesting to the farmers of Camden county, where the first-named are largely applied. The first table will fairly represent that at White Horse; the second, that obtained from the pits of David Marshall, near Blackwoodtown, the analysis of which was made by George J. Scattergood, of Philadelphia; the third represents the Clementon marl, from the pits of George Adams.

For the first and third of the above analyses we are indebted to the very valable reports of William Kitchell and Professor George H. Cook, superintendents of the State geological survey. This survey was most unwisely suspended in its incipiency, and much of its valuable fruits lost, because of incompleteness. Seven years later, in 1864, it was resumed under the supervision of Professor Cook, who brings a hearty application of the value of the results to be obtained by a thorough scientific inquiry into the undeveloped resources of the State. His second annual report for 1864, just published, is an outline of labors for the past year, and a prelude to many others to follow, ere a final report shall make known to us the yet unexplored stores of mineral wealth hidden in our rocks and soils, and which scientific research, under liberal State patronage, can alone render available.

	White Horse.	Blackwood T.	Clementon.
Phosphoric acid	2.657	4.821	2.640
Potash	5.637	5.010	5.375
Soda	....	1.080	
Lime	1.557	1.975	1.985
Magnesia	1.476	1.375	1.615
Prot. oxide of iron or green vitriol	....	22.740	14.930
Alumina, or pure clay	23.875	6.610	6.000
Silica, or pure sand	54.430	48.500	56.200
Sulphuric acid	.649	....	.439
Water	9.963	7.500	....
	100.244	99.611	89.184

From the report of Professor Cook we extract the following table of analyses of sundry "marls," spurious and genuine. The first is that of a spurious variety digged by Messrs. Ten Eyck, in Middlesex county; a similar bed is found on the farm of J. Stokes Coles, on the Atlantic railroad, four miles from Camden, and has been applied to a moderate extent with as moderate results.

The second is an analysis of a characteristic specimen from the first marl bed, or the lowest well-marked stratum, from the pits of J. B. Crawford, Monmouth county. This first bed is not as valuable in the district southwest of the middle portion of Burlington as in Monmouth, where it is much esteemed. The third is an analysis of that from the second marl bed. This is an average of the green-sand which traverses the marl region from the Atlantic to the Delaware bay. It is from the marl pit of R. Dickson, Woodstown, Salem county.

The fourth represents the composition of the third bed, or upper stratum, lying southeast of those before named. It is from the pits of Hugh Hurley, Shark river, Monmouth county, and is an average of the stratum seen from Deal to Clementon, in Camden county.

These analyses will exhibit to the reader the remarkable fertilizing value of the "green-sand marl," in which potash and phosphoric acid form so large a proportion.

	(1.)	(2.)	(3.)	(4.)
Phosphoric acid	1.15	1.12	2.65	3.73
Potash	1.54	5.80	6.81	4.98
Lime	2.52	11.67	1.04	4.15
Magnesia	2.15	1.97	1.81	.47
Oxide of iron	31.50	16.93	19.80	18.70
Alumina	6.00	7.18	8.04	8.18
Silica	34.50	40.61	49.73	49.68
Sulphuric acid	1.27	.70	.11	2.44
Water	18.80	8.10	8.34	7.37
Carbonic acid and loss	....	5.92	....	....
	99.43	100.00	98.33	99.70

THE CLIMATE OF SOUTHERN NEW JERSEY.

An increasing tide of immigration is tending toward the uncultivated lands of southern New Jersey, and those who purpose to remove thereto should be informed of the healthiness of the region, as well as its capacity for the production of the necessities of life. Much has been written by parties more or less interested in the sale of lands; how reliable we will not pretend to determine. One of the peculiar advantages possessed by the lower counties of New Jersey is the mildness of the climate in winter. This is a feature of extreme value to many northern men who may desire to change their habitation. To those whose families have suffered from the rigors of northern winters near the seaboard, and have drooped under frequent colds and rheumatism, or are threatened with pulmonary disease, the climate of southern New Jersey may prove of inestimable value. In one settlement more than one-half the families fled to the South to save the life of one or more members, who have, in many instances, been restored by the change.

The study of the comparative climate of lower New Jersey, as of the Atlantic States further south, and the western States in the same latitudes, will illustrate the facts that the summer mean temperature of the peninsula of New Jersey is the same or higher than the same mean throughout the breadth of Virginia, from northeast to southwest, along the foot of her main ranges of mountains—as warm as the same district in middle North Carolina and northwestern South Carolina, middle Kentucky, southern Indiana, middle Illinois, and northern Missouri. Its summer mean is therefore greater than that of any part of Pennsylvania, Western Virginia, Ohio, northern Indiana and northern Illinois, or the States north of all these. Its winter mean temperature is the same as that of middle Virginia at the foot of her mountains, as middle Kentucky and southern Indiana and Illinois, and southern Missouri. She has not fastened upon her those climatic features which are termed fickle, by which she is subject to great diurnal ranges of temperature, and great and sudden changes in the seasons.

Such changes from one extreme to another are well known in the west, but though sometimes extreme, are experienced less frequently and less severely in lower New Jersey. Her winters are therefore much less extreme than those places in the same latitude in the western States, while her summers are about as warm.

According to the census of 1850, the deaths from consumption were in the following proportions to the whole mortality, viz: In Maine $22\frac{1}{2}$ per cent.; New Hampshire, 22; Vermont, 24; Massachusetts, $17\frac{2}{3}$; Connecticut, $16\frac{2}{3}$; Rhode Island, 21. In 1853, the percentage in Massachusetts reached $23\frac{1}{2}$. In the middle States, New York, in 1855, exhibited a percentage of 17; New Jersey, in 1850, $14\frac{1}{6}$; Pennsylvania and Philadelphia, $12\frac{1}{2}$; Maryland, $11\frac{1}{2}$; and Delaware about 10 per cent.

By the census of 1860, the percentage of deaths from consumption, though generally higher for all the States named, was again much greater in the eastern New England States than in Delaware, Maryland and southern New Jersey. Deaths from all diseases of the lungs bore nearly the same proportion, ranging in Maine from 35 per cent. to 33 in New Hampshire and Rhode Island; 30 in Vermont and Massachusetts; 28 in Connecticut; 25 in New York; 22 in Pennsylvania and Maryland; 24 in New Jersey, and 21 per cent. in Delaware.

Thus in New England, generally, the deaths from consumption alone were, in 1850, twice as great as in Maryland, Delaware and Philadelphia; which districts correspond, in climatic peculiarities, more closely with the peninsula of lower New Jersey than would the entire State for which the percentage is given. For all diseases of the lungs, the percentages of deaths in New England are from 10 to 14 per cent. higher than in Delaware, Maryland and New Jersey; and the chances of freedom from consumption are doubled, and the probabilities of escape from fatal pulmonary complaints increased upwards of 75 per cent., in the more southern locality.

Great variations of temperature and humidity in a climate generally cool and damp, afford conditions extremely favorable to the production of various forms of diseases of the respiratory organs, as is well known. These diseases appear to increase as the temperature decreases with like conditions of humidity; at least such appears to be the case along the seaboard of the eastern States. Diseases of the respiratory organs, of which consumption is chief, appear to have their maximum in New England, on the seaboard of Maine, New Hampshire and Massachusetts, and to diminish towards the south and west in a rapid rate of decrease. The mild winters of Philadelphia are well known to many northern sufferers from weak or diseased lungs, who make an annual pilgrimage to this shrine of Hygeia to escape the rude, raw northeaster, and the fogs and cold of the eastern seaboard, or the scarcely less unpropitious region of western New York.

The following table will exhibit the mean temperature and the extreme heat and cold of sundry places north and west, which may serve to exhibit the relative mildness and equability of the climate of lower New Jersey.

The records for Camden county and for Cumberland county have been carefully compiled and reduced, and though made at points forty miles separate, have much in common, and may be accepted as the best exhibit of lower New Jersey climate accessible.

The resident of Maine, New Hampshire, Vermont, or middle New York, may, by a glance at this table, perceive how much he would gain in ameliorated temperature by removing from a district where, in January, the low degrees of 20 to 22 below zero are the common minimum, to one where the mercury seldom descends below zero, and where the low temperature of New England or Wisconsin and Illinois have not been known within the memory of the oldest inhabitant. The extremes of heat are not higher than in Maine and in Illinois, while the range or variation of the thermometer is much smaller than at many of the localities named.

Table illustrating the comparative mean temperature of sundry places in New England, New York, and the west, with those observed in New Jersey, during the year 1864.

Month.	MAINE.			NEW HAMPSHIRE.			VERMONT.		
	York county.			Grafton and Coos counties.			Chittenden co.		
	Highest degree.	Lowest degree.	Mean temperature.	Highest degree.	Lowest degree.	Mean temperature.	Highest degree.	Lowest degree.	Mean temperature.
	°	°	°	°	°	°	°	°	°
January	42	— 9	21.7	36	—26	13	42	—20	21.4
February	41	—11	24.6	38	—27	15.3	46	—13	23.9
March	51	10	30.4	43	— 4	23.2	53	8	30.0
April	60	26	37.9	56	24	35.4	61	30	40.0
May	82	36	54.9	74	32	51.3	78	34	56.1
June	92	45	66.7	82	35	58.5	85	41	63.2
July	93	55	72	87	47	64.5	85	53	68.3
August	97	56	70.7	90	51	65.3	87	50	66.8
September	72	39	56.5	72	32	51.3	69	38	54.0
October	66	31	45.4	69	26	45.5	64	25	42.5
November	62	18	36.2	60	12	32.3	65	19	38.9
December	44	—11	23.8	44	—19	19.5	54	—14	26.6

Month.	MASSACHUSETTS.			NEW YORK.			ILLINOIS.		
	Hampden county.			Onondaga county.			Peoria county.		
	Highest degree.	Lowest degree.	Mean temperature.	Highest degree.	Lowest degree.	Mean temperature.	Highest degree.	Lowest degree.	Mean temperature.
	°	°	°	°	°	°	°	°	°
January	52	— 4	24.7	58	— 5	25.3	66	—22	23.4
February	52	— 6	28.4	49	— 5	28.9	59	— 5	33
March	53	15	34.5	54	3	29.9	68	14	38.8
April	65	31	42.1	60	27	41.1	74	38	49.5
May	86	39	59.6	82	35	57.8	92	39	66.4
June	91	46	65.3	90	42	66.8	95	52	73.9
July	90	53	71.4	93	51	71.3	98	59	78.0
August	95	56	70.1	91	51	68.6	97	55	75.2
September	77	40	57.8	76	40	57.0	98	43	67.3
October	72	28	46.9	66	31	44.4	72	34	50.1
November	65	15	38.4	64	20	36.5	74	11	40.1
December	51	— 2	28.0	51	3	26.4	67	— 6	25.6

Month.	WISCONSIN.			NEW JERSEY.					
	Milwaukee co.			Camden co.			Cumberland co.		
	Highest degree.	Lowest degree.	Mean temperature.	Highest degree.	Lowest degree.	Mean temperature.	Highest degree.	Lowest degree.	Mean temperature.
	°	°	°	°	°	°	°	°	°
January	49	—30	18.8	65	7	32	?	?	32.13
February	48	—18	?	56	5	33.8	?	?	35.71
March	52	— 1	30.7	61	22	39.3	60	22	39.4
April	61	30	?	77	36	49.6	77	36	50.7
May	68	46	55.2	85	48	65.8	87	46	66.6
June	97	39	65.2	96	53	69.2	98	54	69.8
July	94	52	71.3	91	58	74.4	92	55	75.1
August	92	49	69.8	91	58	75.4	92	59	76.6
September	84	40	61.0	79	50	63.4	79	51	64.6
October	60	28	45.7	75	35	51.3	73	38	53.2
November	60	3	32.1	71	19	43.6	65	21	43.8
December	53	—15	20.1	62	14	35.0	60	16	35.7

The spring opens so early in this district as to be a matter of astonishment to visitors from the remote northeast. In 1858, on the 26th of January, gardening commenced in Cumberland county, and the last week of February the labors in the field may begin with the planting of peas. This is often succeeded by a series of cold days, which prevent further operations on the soil. From the middle to the last of March early potatoes are generally planted, oats is sometimes sowed, and by the 5th of April asparagus is sometimes brought to the table.

Snow disappears early in March—seldom lies many days; thunder with lightning and warm weather follow, and the spring opens; an occasional frost may appear until about the end of April. Many readers, who are not familiar with the terms and the measures of mean temperature, range of thermometer, &c., may desire a more definite idea and comprehension of climate, from the enumeration of the above data of gardening and farming operations, which they can compare with those known in their own districts. The dates of leafing of early spring plants indicate the early stirring influences of the sun's rays in this section, betokening the advent of spring in an unmistakable manner. The shad bush *(Amelancheir canadensis)* put forth its leaves in Burlington county, New Jersey, in 1852, on the 20th of April, five days before it opened in the upper Shenandoah valley, and two weeks before the same appearance at Gettysburg, Pennsylvania.

The Virginian locality is two degrees further south, but more elevated; the Pennsylvanian one-third of a degree lower than the New Jersey station. The leafing noted was also three and a half weeks prior to that of the same plant at Richmond, Massachusetts, and at Manchester, New Hampshire.

The blooming of the strawberry took place at Burlington city, New Jersey, in 1852, on April 26, and at Gettysburg and upper Darby, near Philadelphia, on May 6, or ten days later. At West Point, New York, it occurred on the 18th of May, three weeks later, and one week before blooming at Flatbush, Long Island, one of the most favored northern localities. In 1852 the strawberry ripened in Burlington, New Jersey, June 2; at West Point, New York, June 10; North Attleborough, Massachusetts, June 12; Londonderry, New Hampshire, June 15; Steuben, Maine, June 20; and at Manchester, New Hampshire, June 25—a difference of three weeks in favor of the New Jersey locality. In 1859 at Haddonfield, New Jersey, the strawberry ripened on May 23, and in 1860 on May 29, the earliest dates noted for many years past.

In 1855 the lilac *(Syringa vulgaris)* bloomed at Moorestown, Burlington county, New Jersey, on the 1st of May; at Lima, Delaware county, Pennsylvania, in the same latitude, on the 12th; at Flatbush, Long Island, on the 17th; at Rochester, New York, on the 18th; Spencertown, New York, on the 20th; and at Steuben, Maine, on the 13th of *June*. This excellent index of opening bloom, blossoms in west New Jersey ten days before it appears in Pennsylvania in the same latitude; three weeks before the most favored parts of Long Island; more than three weeks before its appearance at Boston, Massachusetts, and five weeks earlier than at Steuben and on the coast of Maine generally.

At points further south in the peninsula of southern New Jersey, the activity of vegetation in the spring commences from two days to a week earlier than is indicated by the above dates. In Cape May county, at the southern extremity of the State, early vegetables are ready for the market as soon as if grown in the favored districts of Virginia.

The following table is the result of careful observations made during the year 1864 at Haddonfield, New Jersey, and is the most reliable and complete detail of extremes and mean temperatures and atmospheric humidity to which we have access. Very few extended series of observations have been made in this district, but the following is worthy of credence, and may be consulted with advantage by those who comprehend its teachings.

Summary of meteorological observations made at Cole's Landing, near Haddonfield, New Jersey, 1864.

Month.	Mean monthly temperature.	Rain and melted snow, in inches.	Snow, in inches.	Highest temperature.				Lowest temperature.				Humidity.							
				Highest degree.*		Warmest day.		Lowest degree.*		Coldest day.		Grains of vapor in one cubic foot of air.				Percentage of saturation, 100 = saturat.			
				Date.	Temp.	Date.	Temp.	Date.	Temp.	Date.	Temp.	7 a. m.	2 p. m.	9 p. m.	Mean.	7 a. m.	2 p. m.	9 p. m.	Mean.
	°				°		°		°		°								
January	32	2.46	6	28	65	28	48½	7	7	2	12.33	†1.57	1.70	1.64	1.63	†81	69	77	76.00
February	33.83	.02	....	28	58½	28	48.16	18	4	17	7.16	1.97	1.67	1.67	1.77	68.8	54.5	68.6	63.96
March	39.34	6.03	7.5	13	61	5	50.83	21 & 22	16	22	26.33	1.85	1.97	2.07	1.96	80.9	54.8	73.2	69.63
April	49.56	2.99	....	24	78	24	68	4	28	5	38.50	2.66	2.77	2.77	2.73	73.9	55.53	73.2	67.54
May	65.83	7.09	....	10	87	31	75	2	35	3	49.66	4.76	5.29	5.00	5.02	78.1	57.0	75.6	70.23
June	69.23	2.39	....	26	96	26	84.67	11	43	11	57.16	5.20	5.40	5.20	5.27	73.5	51.3	69.6	64.80
July	74.40	3.12	....	12 & 13	92	31	82.83	23	46	22	63.83	5.77	6.14	6.12	6.01	75.6	48.9	72.0	65.50
August	75.39	2.52	....	1	93½	1 & 11	83.33	31	52	31	63.50	7.90	7.64	7.10	7.55	84.3	63.6	82.0	76.60
September	63.36	6.55	....	24	78½	23	69	26	42	25	50	5.12	5.30	5.03	5.15	83.34	66.05	83.6	77.67
October	51.27	1.85	....	6	75	6	69.17	10	35	9 & 22	46.66	3.40	3.60	3.50	3.50	87.23	58.49	86.27	77.33
November	43.63	3.53	....	9	71	9	67.17	24	19	24	26.33	2.66	3.10	3.00	2.92	87.87	64.56	83.59	78.67
December	35.00	5.24	12.5	3	57	3	53	23	8	12 & 23	19.87	1.91	2.05	2.00	2.99	87.40	70.8	78.10	78.80
Total	52.73	43.79	26	....	....	....	....	....	....	....	....	....	....	....	3.87	80.16	59.54	85.23	72.22

* From maxima and minima thermometers.

† Mean for six years in Philadelphia.

An examination of the above table will show to those who are familiar with the indications of the thermometer, the relative temperature shown by monthly means, as well as by those which exhibit the highest and lowest degrees, that the average or mean temperature for the year 1864, in Camden county, New Jersey, was about $53\frac{3}{4}°$ of Fahrenheit—that there fell, during that year, sufficient rain and melted snow to have covered the ground (if it had not evaporated, sunken into or ran off from the surface) to the depth of $43\frac{3}{4}$ inches, or about 3 feet 8 inches; that there fell 26 inches of snow, which was divided over three months; and that at no time, in any month, more than $12\frac{1}{2}$ inches fell; and of this $12\frac{1}{2}$ inches, but 6 inches fell on any one day.

The highest temperature was 96°, and the warmest day 84°.67. The coldest extreme was 4° above zero, and the coldest day 12°.33. The range of the thermometer was thus 92°. The average temperature of the months during which vegetation is most active was 70°.59. The mean of spring, 51°.88; of summer, 73°; of autumn, 52°.75; of winter, including the temperature of January and February, 1865, was 30°.67. If the winter of 1863–'64 be included, its mean would be found to be 33°.24. February of 1865 has been unusually severe, and lower temperature observed than for eight years previous; and on no day did the mercury descend below zero at the usual 7 a. m. observation; though, during the nights of two days a minimum of a few degrees lower was noted.

Some rain or snow fell on 119 days during 1864; of the clear days, less than $\frac{3}{10}$ cloudy, there were 101; of cloudy days, more than $\frac{3}{10}$ cloudy, there were 265. The latest injurious frost, or fall of temperature to 32° or lower, was on April 29; and the earliest frost in autumn, sufficient to destroy vegetation, occurred on the 10th of October.

The period during which no frost occurred was 163 days, (or nearly five months,) which enjoyed a mean temperature of 67°.88. The average relative humidity of the season free from frost was 67.48 per cent. of saturation, or of the amount of humidity which the atmosphere was capable of sustaining, indicating a comparatively dry air. The amount of humidity or moisture in the air is a very important meteorological element. This with the amount and distribution of heat are those most essential to the agriculturist, since they principally determine the capacity of different districts for the production of vegetable food. There is no reason why the indications of humidity, as measured by instruments, should not be as readily understood by the instructed agriculturist as are those of the thermometer, except the impossibility of obtaining access to reliable data for determining the amount of this most important element in our local atmosphere. We have, therefore, given the results of close observation during the past year, by which the varying proportions of vapor in the air may be readily learned. In June and July it will be observed that the relative humidity fell to a very low degree; that for July, at 2 p. m., being but 48.9 per cent., or less than one-half the amount that could have been sustained in the air, and is present immediately before and during a rain.

The summary and means for each month does not fully illustrate the extremes of dryness and humidity by which, as well as the mean amount, the district under consideration is greatly influenced. This branch of our subject is worthy of more extended discussion than our space will here admit.

The district of country of which Vineland forms a part enjoys a climate intermediate between that of Camden and Cumberland counties, whose peculiarities may be learned by inspection of the tables of comparative temperature. The lines of equal summer temperature, instead of ranging in a general eastwardly and westwardly direction, as they commonly do, are here deflected until they extend nearly from north to south. The same summer temperature known at Progress, on the Delaware, above Philadelphia; at Haddonfield, Camden county; and at Greenwich, Cumberland county, is the measure of the summer heat for Vineland and its vicinity.

The equalizing influence of the ocean winds has caused the lines of equal summer temperature to approximate to the head of the coast, almost from Cape May to Sandy Hook. As these lines approach the higher hilly or mountainous regions of upper New Jersey, they are rapidly deflected towards the west and southwest, extending parallel to the Delaware river in its southwest course from Trenton to the head of the bay of the same name. The isotherms of summer heat of 70°, 71°, 72°, and 73°, thus form long close loops, whose summits are in the upper and middle counties of New Jersey, while their lower extensions are in the southern counties of Pennsylvania and New Jersey respectively. This is a curious and very interesting feature of these districts. The interior and more western parts of the lower peninsula are, therefore, warmer, in the same latitude, than on the Atlantic side. This is owing to the influence of the cold currents of water which come down from the arctic regions, between the coast and the Gulf Stream, and deflect towards the south the lines of equal heat which tend to rise higher as they approach the coast from the inland regions. There is no point on the coast at which the temperature of the summer is greater, because of the existence of the Gulf Stream, the influences of the land or of the arctic current predominating. The average summer temperature for Vineland is believed to be about 73°, which is the same as that of Philadelphia and Haddonfield, thirty miles north. Its spring mean temperature is about 51°, or that of Philadelphia; its autumn, nearly 55°, or one to two degrees warmer, and its winter about one degree warmer, than at Philadelphia. The temperature for the year is almost identical with that of the latter place. The above data have been derived from tables of observations made at Greenwich, and correspond closely to the deductions of Lorin Blodget, the able and experienced climatologist, and leading authority on this subject. If the prevailing winds were not from the land towards the sea, the climate of the Atlantic coast would be much softened by the proximity of waters of so high a temperature as those of the Gulf Stream, or of those at a moderate distance from the coast. Off the coast of Norfolk, the winter observations, for a breadth of one degree of longitude, show a mean temperature of the ocean water of 46°. The next degree of longitude was 61° and 65°, 69°, 68°, and 67°, successively. These temperatures greatly modify the heat at their respective localities, but their heats are borne towards Europe, and but slightly affect the winter temperature of our coast.

POTATO CULTURE IN LAKE COUNTY, OHIO.

SOIL REQUIRED—CHOICE OF SEED—CULTIVATION—CARE

BY L. S. ABBOTT, PAINESVILLE, OHIO.

THE design of this article is not to present the subject in a scientific manner, but to consider it, as the producer should, in the light of observation and personal experience.

The general reader, at least, is aware that the potato, at the time of the appearance of the potato disease, was the almost sole dependence of the common people of Ireland for food. What this vegetable was, and still is there, it is sure to be in all countries in the temperate zone, when population becomes crowded. We have also seen that in the northern States of this country the potato is the third of the three staple articles of food. As such, it has come to be regarded as nearly indispensable. This fact is sufficient to render a thorough knowledge of the best varieties for use, the soil adapted to their growth in the highest perfection, their cultivation and after care, matters of the highest importance to the farmers of the United States.

The statements which follow in the elucidation of these topics are based upon actual personal observation and experience in the potato-growing locality of almost national reputation—Lake county, Ohio. The county is the smallest in the State, only embracing eight townships, and of these only five, which reach the lake, contain potato lands. These lands are the ridges running parallel with Lake Erie, which, according to geological indications, have each, at different periods, defined its boundaries.

With some degree of care the calculation has been made, that in these five townships only one-eighth of the cultivated ground is potato ground; and while it is true that never, in any one season, is all this potato ground planted with the potato, yet it is the concurrent judgment of men of close observation that one-half million bushels of potatoes are annually grown and transported from this locality to the south, southeast, and east, to market.

The average price one year, with another, never, even in common times, falls below a half dollar per bushel, and hence it will be seen that this is the best, the money-making crop of the locality.

SOIL.

The potato, to be of the highest quality, must have a soil exactly adapted to its growth. It may be said to be, in this regard, like the onion, "notional." In no argillaceous soil can the potato be grown to perfection, as regards quality. It requires, to attain this, a dry, warm, sandy soil of moderate fertility. Quality depends upon a soil which will produce tubers mainly of a medium size. In such case the yield must not be over one hundred to one hundred and fifty bushels per acre. To obtain a greater yield the ground must be richer, so that while the number may be increased, the tubers will also be larger; and just in proportion as the above number of bushels per acre is increased, the quality is deteriorated, and the liability of the crop to rot is augmented. As to size, for quality, the Peach Blow, for instance, should not have an average diameter of more than two and one-half inches. Indeed, I would never have one larger, if it could be avoided. This potato when grown in a strong productive soil will assert its natural tendencies to be large, coarse-fleshed and ill-flavored; but when restrained by right culture it is among the best of the potato family.

The rule for soil and culture applied to the Peach Blow, applies to all the other varieties of general cultivation. The producer should aim to obtain a medium growth only of all varieties, and then, with sandy soil, he will have the highest quality of potatoes. The potato lands of Lake county are yellow sand.

MANURING.

It not unfrequently happens that the soil is too poor even for potatoes. In such case manuring in the hill should be avoided if possible, as it is rarely ever attended with satisfactory results. If the season is not very favorable, the manure will go through with the second heating process, burning up its substance, and leaving a dry, unrotted residue in the hill, and if there be any potatoes they will scarcely exceed the size of a quail's egg. If, however, the manure properly decays, the growing potatoes from its proximity to them may receive too great a stimulant, and therefore be predisposed to rot. As a general rule, it is better not to manure those in the hill. Manure the ground broadcast, and, if possible, one season before potato-planting, occupying the ground with some other crop.

PLANTING.

The preparation of the ground for the planting of the early varieties commences as soon as the frost is fully out of the ground. Sand becomes dry as soon as the water is allowed to percolate without obstruction through the soil. Two or three days from a very wet condition is sufficient to render such ground fit for the plough.

VARIETIES.

Every grower's observation has established the fact that, for quality, the late varieties excel the early ones. The English Stamp (locally it is more commonly known as the Rust potato, taking the name of the man who introduced it) is claimed to be, by its friends, the earliest of all the early varieties, is of excellent quality, and is not very liable to rot. The Early June is very early, and it is grown only on account of its earliness. In quality it is very inferior. The Cherry Blow is early, grows large and yields well, but its quality is quite indifferent. The White Neshannock, better known as the White Mexican, is a very fine potato for quality, but yields very poorly. The Early Kidney and the Cowhorn are perhaps as early as any grown in this locality, but in quantity they make a poor return to the husbandman for his labor. In quality they are very good. The old time-honored Neshannock (or Mercer) is among the latest of the early varieties. No testimony is needed in regard to its quality. For the first few months after maturity it is very excellent, but as the time for planting approaches, its quality is deteriorated somewhat. It is grown yet to some extent as a late potato, but its liability to rot discourages its cultivation.

The late varieties now cultivated are reduced to a less number than the early. The Carter is one of excellent quality, but its liability to rot has been a good reason for discontinuing its cultivation almost entirely. Probably the old style of long Pinkeye, in the matter of quality, is not excelled by any potato ever grown; but under circumstances favorable for its healthy growth its size is very small and its product unremunerative. It is rarely cultivated now. The numerous other varieties cultivated in past years are now discarded, and we have really but one late marketable potato, and that is the Peach Blow, originated in New Jersey. It was introduced in Lake county in 1859—Mr. R. Marshall being the principal grower that year.

This potato has so many striking peculiarities and so many excellent traits that an extended notice of it is warrantable. If planted in a rich argillaceous soil it grows large, is hollow in the centre, is coarse in flesh, is very inferior in quality, and, under these circumstances, has a tendency to rot somewhat. Under favorable circumstances there is no potato known to this locality that is so secure as this against this disease. A more satisfactory crop of the Peach Blow can be grown on poor soil than of any other variety known. It will grow successfully on the same ground, year after year, which no other variety will do. Planted ever so early, it remains green through the hot, dry weather of the summer, and never forms tubers and matures them until the fall rains come, and then there is no potato which does this so quickly. There is no other potato which may be dug before maturity, when the skin may be slipped off by pressure with the hand, that will have so much of that dryness and mealiness when prepared for eating, characteristic of the mature vegetable. Neither is there one which retains its character and excellence from maturity to maturity again to the same degree It is, in fine, with all of its qualities, considered the most perfect potato.

CUT AND UNCUT SEED.

It is the custom, generally, with growers to cut their seed potatoes. Economy, unquestionably, first suggested the idea, and made the practice general. An acre of ground will require of medium-sized potatoes planted whole, full twelve bushels. As the seed is cut by many, from five to six bushels will plant an acre. When the growers plant, as is customary, from five to thirty acres, and when potatoes are worth from seventy-five cents to one dollar per bushel, the saving of from four to six bushels per acre appeals strongly to their parsimony, and hence, singular enough, the community generally have come to the conclusion that cutting the seed is most judicious and most profitable. This conclusion is not based on accurate tests, and, therefore, no class of men were ever more mistaken in regard to the correctness of a practice pertaining exclusively to their own avocation than are these potato-growers. Ordinarily but two eyes are left in a piece, and two pieces make a hill. Sometimes the pieces are cut so small as to leave the most of the potato for eating. Cut seed never will produce as good nor as many bushels of potatoes to any given quantity of ground as whole seed. To prove this, let any grower commence his field, for example, with a row of whole seed, and then plant every alternate row with cut seed, so that the soil and the cultivation shall be the same; make such a record, either by stakes set to each row properly inscribed or otherwise, as will prevent any mistake as to which rows were planted with the cut, and which with the uncut seed; and when the growing season is over, dig each, and measure by itself, and he will find that the uncut seed will produce the largest number of bushels on the same ground.

But suppose another experiment be tried. Let any grower select large potatoes for seed and plant them whole. From this product do as before, and thus continue to do year after year, and he will find that the potatoes will increase in size, and that, just in proportion as they grow or increase in size above a fair medium, he will find his potatoes deteriorated in quality.

The experiments which established the above facts in relation to cut and uncut seed established another fact—that small but matured uncut potatoes should always be used. These planted in observance of conditions above stated, and the grower, with a fair season and fair cultivation, will always produce potatoes which, in all respects, will be of the highest attainable perfection.

HOW TO PLANT.

Unquestionably a greater yield of good potatoes may be obtained from an acre of ground by drilling the seed than by planting it in hills, as is usually done; but the labor with the hoe is greatly augmented thereby. The ground, after being well ploughed, should be deeply furrowed both ways if planted in hills. If the seed is put down deep, the hills are easier made, and the dry weather does not so readily affect the plant. The practice of crowding the rows to within three feet of each other is a bad one. The potato should not be dug up, almost literally speaking, in hoeing it. A large, flat-top hill is necessary to catch the rain, and afford plenty of room in loose dirt for the potatoes to grow in. The covering of the dropped seed may be done very rapidly and very well with the small plough.

CULTIVATION.

The first act of cultivation should be with a light drag, just as the potatoes are ready to come out of the ground. This disturbs the weeds which are already growing, and kills them. The after cultivation should be with the cultivator and hoe, keeping the ground level until the tops are grown up as high as they will grow and stand up, when the plough should be put in to assist to form the hills, and thus end the cultivation.

THE POTATO DISEASE.

The potato disease is still a mystery. There are a hundred theories, more or less, in regard to the cause of it; but not one of them can establish a real claim to reliability. But this does not matter. He who will plant whole, sound, and small potatoes, in a sandy soil, with a fertility as above stated, that will produce per acre a hundred bushels of Neshannocks, or not to exceed one hundred and fifty bushels of Peachblows, will never be troubled with potato disease.

DIGGING.

Digging and storing is full half of the labor of growing and securing a crop of potatoes. The digging is a long, tedious, laborious task. The ploughing, planting and cultivation is the easiest half of producing and caring for the crop.

Potato-diggers have been invented; but none have found their way into this potato region, which will do the work well only under the most favorable circumstances. A small plough to turn a furrow away from each side of the row, and a good hoe, and a man with a strong, active, muscular system to work it, is the most reliable arrangement as a digger yet found.

CARE OF THE CROP.

The care of the potatoes should begin with the digging. They should be picked up as fast as they are dug, not allowing them to lie on the ground several hours in the sun, as is customary. Light is very detrimental to potatoes, and strong sunlight pouring down on them will soon make its effect seriously apparent. The finest potatoes ever grown may be spoiled in a few days by exposure to the light; they may be spoiled substantially in taking them to market by the exposure incident to the present inconsiderate method of transportation. Hence the marketman who makes a sign of his potatoes in baskets about his shop-door, prepares a worthless article for his customers. Light changes the complexion of potatoes, as the observation of almost everybody will bear witness, from its normal one to green, and renders them strong to the taste and unrelishable. As soon after digging as convenient the potatoes should be stored in a dark place, and, if it be in a cellar bin, during the entire time that they lie there for the family use, or awaiting the market, they should be covered with a thin coating of sand to make the absence of light as perfect as possible.

The denizens of our cities know nothing of the excellence of the potato. As has been shown above, the character of the seed, the soil, size, and care during storage, are absolutely essential to excellence of quality. It will be seen, therefore, that the real difference in the value of different lots of potatoes is as great as in any other article of food—as much as it is between different lots of wheat, or as it is between different specimens of any other kind of vegetables. This comparative difference in the value of potatoes is recognized now by only a few people—those grown in certain localities command a higher price than others, and soon there will be an acknowledged difference in the quality and price even in the potatoes of the same locality; and when the necessary conditions are observed in the growth of the potato in all the potato-growing localities, and the facilities of transportation are so improved that they may be taken to market without impairing their quality, our city folks will relish and estimate the potato as an article of food as never before.

BOTANICAL HISTORY OF SORGHUM.

BY F. PECH, DEPARTMENT OF AGRICULTURE.

UNDER the name of Sorgo, several congenerous plants from the East Indies have been described from remote antiquity. Their agricultural value, fully appreciated in husbandry for the benefit of their seeds and juices, attracted the attention of the farmer and naturalist.

Pliny the elder, who flourished in the first century, describes, in his 18th book, chap. 7, a Sorgo plant under the name of *milium quod ex India in Italiam invectum nigro colore,* (millet, of black color, imported from the East Indies to Italy.) That name, *milium,* or millet, signifies thousands, alluding to the numberless seeds produced by these plants.

Fuchius, of Belgium, describes, in his History of Plants, in 1542, a plant under the name of Shorghi, which is precisely the true popular name of the Sorgo in the East Indies.

Jerome Fragus, in describing the plants of Germany, in the year 1552, gives the description of the same plants under the name of *Panicum Dioscorides et Plinii*, (bread millet of Dioscorides and Pliny.) Then the plant of Pliny was that of Dioscorides, the Greek, and already cultivated in Germany. Conrad Gesner, in his *Hortus Germania*, (German garden,) in 1591, names the same plant Sorghum. Matthioli, an Italian, in his Commentaries on Dioscorides, in 1595, describes it under the name of *Milium Indicum*, (Indian millet.) Lobel, a Belgian, in 1576, describes that plant as the *Sorgo melica Italorum*, (Sorgo, or honey of the Italians;) and, followed by Dodon, a Belgian, who, seven years later, 1583, in his Pemptades, names it *melica, sive sorgum*, (honey, otherwise sorgo.) This Latin name, *melica*, means pertaining to honey, which is the *mele* of the Italians, from which is derived *melligo*, (honeyish.) The synonyms of the last two authors are of great importance, to show that there was in Italy, besides the Indian millet, (Durra corn, *sorghum vulgare*,) another species which has been confounded with it, and which corresponds exactly with the Chinese sugar-cane; and if any doubt still exists, the following line from Lucian, a Roman writer, will entirely establish the fact: "*Quique bibunt tenera dulces ab arundine succos*," (those who drink in sucking the tender sweet stalks of canes.) See also Dod. Pemp., 4, 1, 27, and Matthioli, book 2, chap. 9. Lonicer, a German, 1589, and Gerarde, English, 1597, describe several varieties of these plants. Bester, a German, 1613, also describes it as the *Milium Plinii*, which plainly shows that this plant from Italy has been cultivated in Germany, Belgium, and England from the time of Pliny to the seventeenth century.

In 1623, the botanical reformer, Gasper Bauhin, in his Pinax, a work of forty years' labor, includes all the above names as synonyms, under the descriptive phrase of *milium arundinaceum subrotundo semine sorgo nominatum*, (millet cane, with nearly round seeds, called sorgo.) With the observations that the seed varies in color, from rufous to black, and from white to yellow, these names represent one or more species. In reading the above authors we found that the uses of these plants were various; under the name of millet they were used for making bread and feeding poultry; in some other instances, but in the middle centuries principally, when the Romans, conquerors of the world, came to change their classical language into the present Italian, that same plant, the millet, preserving its Indian name, sorgo, was also called *melica*, from the sweet taste of its juice. As the true Indian millet, (*sorghum vulgare*,) which is our Durra corn, does not possess the same sweetness as the present Chinese cane, it proves that the ancient botanists have confounded together the Indian millet and the Chinese cane.

Through Asia, by Egyptian and Syrian commerce, and from Italy to the coast of north Africa, the Indian sugar-cane has spread on African soil, where it has created the imphee races, so very different in appearance from the Chinese plants; and these varieties will, by the new impetus of cultivation, still further increase their polymorphous tendencies in the same manner as our wheat, apples, cabbage, &c.

From Bauhin to the present day the botanists have been more definite in the determination of these plants. Linnæus ranges them, in his genus *Holcus*, under the specification of *H. sorghum* for the Indian millet, and *H. saccharatum* for the Chinese cane.

Persoon, after a careful study of these plants, has divided the Linnæan genus *Holcus* to form a new one, which he calls *Sorghum*.

CLASSIFICATION AND DESCRIPTION OF THE INDIAN SUGAR-CANE AND ITS VARIETIES.

The sorgo sugar-cane belongs to the gramineous family, and is included in the genus

SORGHUM:

HOLCI species, Lin.;
ANDROPOGONIS, Kuntz;
SORGHUM, Pers.

Etymology.—Name from shorghi, the popular appellation for the plants of this genus in the East Indies.

Generic characters.—Spikelets, (flowers with their husks at the end of the small branches,) two or three together on the slender ramifications of the panicles, (bunches,) the lateral ones abortive or reduced to a mere pedicel, the middle or terminal ones fertile. Glumes, (husk, hull,) coriaceous, closely bearded or downy, becoming indurated after the anthesis, (blooming,) with or without awn. Palea, (inner husk,) membranous; stamens, three; styles, two, with bearded stigmas. Stout, tall grasses, with solid stocks with pith.

Specific name.—SORGHUM SACCHARATUM.

Botanical names.	Milium quod ex India, in Italiam invectum nigro colore	Pliny.
	Sorgo, melica Italorum	Lobel.
	Melica, sive sorgum	Dodon.
	Melica forte a melica sagina, aliis saginanda calamagrostis Dioscoridis	Cœsalpin.
	Milium arundinaceum subrotundo semine, sorgo nominatum	G. Bauhin.
	Sorghum	Rumphi.
	Milium Indicum arundinaceo caule, granis flavescentibus	Herman.
	Holcus saccharatus	Linnæus.
	Milium Indicum sacchariferum altissimum seminibus ferrugineo	Breynius.
	Holcus dochna	Forskal.
	Holcus caffrarum	St. Clair.
	Andropogon saccharatum	Kuntz.
	Sorghum saccharatum	Persoon.

Popular names.
- Sorgo.
- Chinese sugar-cane.
- Indian cane.
- Imphee.
- Caffer's bread.
- Pain des anges, (angel's bread.)

Description.—Root, fibrous; culm, (stock,) thick, stout, solid, with pith, from six to twelve feet high; leaves, lanceolate, acuminate, downy at the base; flowers, forming a large, more or less diffusely spreading panicle, with the branches more or less verticillate, often nodding when in fruit; glumes, (husk,) of the perfect flower, hairy, downy, and persistent. From the East Indies. Cultivated.

This species offers numerous varieties, which form two races, the Chinese and the Imphee. The Chinese race is represented only by a single plant, which has preserved all the above specific characters. The Imphees are numerous, and their variations are mostly distinguished by their compact panicle, and by the length of their seeds relatively to the glumes, (husk.)

Artificial synoptical table of the varieties of sorgo.

- RIPE SEED . . .
  - longer than the glumes . . . . LIBERIAN . . . . . .
    - E-koth-la.
    - Koom-hana.
    - Boom-vwa-na.
    - E-en-gha.
    - Boo-e-a-na.
    - E-ed-no-moodoa.
  - equalling or shorter than the glumes. GLUMES . . . .
    - equalling the length of the seed. GLUMES.
      - closed, hiding the seed . . . . RED IMPHEE . . . . . . Shla-goo-va.
      - open, showing the seed. GLUMES .
        - greenish white or ash color . . . . WHITE IMPHEE . . . Nee-a-za-na.
        - Black, or purple black. BRANCHES OF THE PANICLE . . . .
          - thin. Panicle long, widely spreading. TRUE CHINESE SORGO.
          - compact. Panicle short, erect, more or less appressed to the axis. GLUMES MOSTLY . . . . .
            - downy . . . . EARLY SORGO . . . . San-go-ka-haa.
            - smooth . . . . OOM-SE-A-NA . . .
              - Shla-goon-da.
              - Otaheitan.
    - longer than the seed . . . . BLACK IMPHEE.

How to use this synopsis table.—Compare a fully ripe branch of sorgo with the descriptions placed at each end of the braces, commencing with the words "Ripe seed," placed behind and at the middle of the first brace; then applying the phrases at the ends of the brace, the reader will retain and follow the one which agrees with the seeds of the bunches leading to another brace, and so on until the name of the variety of sorgo in examination is reached; then, with that name, refer to the description given in its proper place.

NATURAL CLASSIFICATION AND DESCRIPTION OF THE VARIETIES OF SORGO.

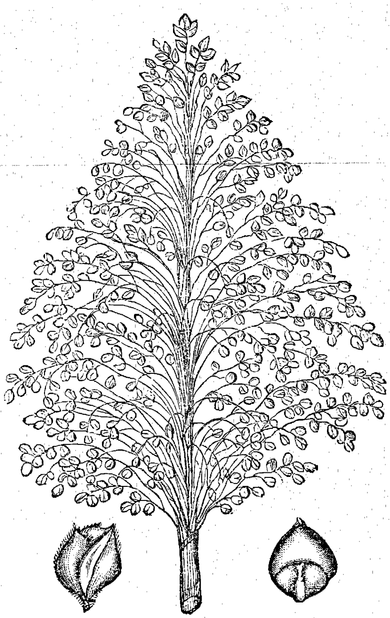
1 Race. EUSORGHUM. TRUE CHINESE CANE.

Paniculis sparsis, patentissimis.
Panicle thin, widely spreading.

VARIETY A.—*Chinensis.*

CHINESE SORGO.

Panicle compound, rhombic-ovate in outline, thin, loose, about a foot long, with the branches long, widely spreading and nodding at maturity. The glumes open, roundish ovate, acute, the outer one concave-convex, the inner somewhat smaller and keeled; seeds large, roundish-ovate, dingy yellow, plano-convex, crowned with the remains of the persistent styles, presenting at the base, on the flattish side, a small cavity in which is seen a small black spot.



This plant appears to be the original Holcus saccharatum of Linnæus, from which were produced all the African varieties.

2 Race. (1)IMPHEE. AFRICAN RACES.

Paniculis confertis, ramis erectis subappressis.
Panicles compact, the branches erect, but more or less appressed.

* Glumis semine æquantibus vel longioribus.
Glumes equal or longer than the seeds.

† Glumis hiantibus.
Glumes open.

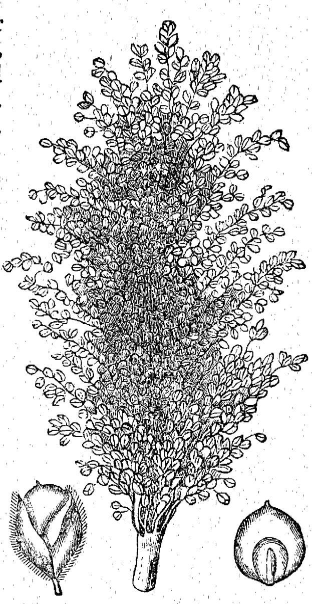
---

(1) The amount of seed obtained by the acre equals fifty bushels.
Doctor Sicard, of Marseilles, France, has obtained a fine red and permanent color from the glumes.

VARIETY B.—*Præcocia.*

EARLY SORGO.

Panicle compound, compact, rather cylindrical, about nine inches long, with the branches ascending and loosely appressed to the axis. Glumes black, mostly downy, principally towards the apex, oblong, acute, concave-convex, the inner one slightly shorter and more round; from the base to the middle they are smooth and shining, open at the top, showing the seed, which is oblong-ovate, pointed at both ends, rufous or yellowish, as long as the glumes, plano-convex, crowned at the summit by the remains of the style, presenting at the base, on the flattened side, a small cavity, in which is seen a small black spot.

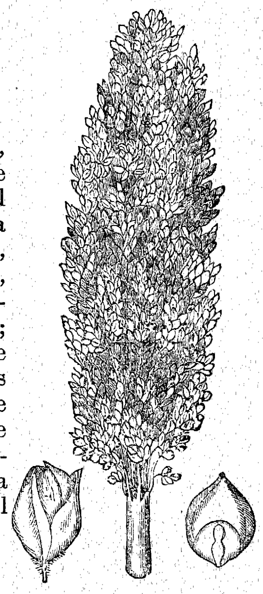


VARIETY C.—*Pinna.*—POMPOON.

OOM-SE-A-NA.

Otaheitan.

Panicle compound, compact, cylindrical, about nine inches long, with the branches strictly erect and appressed to the axis. Glumes black, with a slight purplish tinge, mostly smooth, oblong, ovate, pointed at both ends, and very acute at the apex, concave-convex, open and showing the seed; the inner one slightly smaller, and the outer one keeled on the back. Seeds rufous or sandy color, as long as the glumes, plano-convex, crowned at the summit by the remains of the persistent style, and presenting at its base a small cavity, in which is seen a small black spot.



Here several sub-varieties, with the seeds longer than the glumes, take place after the last two type varieties; the shape and the color of their panicle is nearly identical, but white; the branches are erect at their base, their summits are more or less recurved in fruit, and their glumes more or less smooth; they appear to be hybridizations forms between the early sorgo, Oom-se-a-na, white imphee, and the Liberian.

The San-go-ka-hea, by its downy glumes, appears to be a modification of the early sorgo and the Oom-se-a-na.

The	Slagonda........ Koom-ha-na..... E-hoth-la....... Ee-a-moo-da .... Lim-moo-ma-na. E-en-gha........ Boo-e-a-na.......	Are modifications between the Liberian and oom-se-a-na.

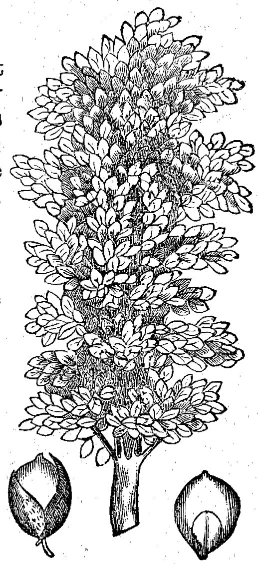
The Boom-va-na is a modification of the last sub-varieties and the white sorgo, which has inherited from it the color of its panicles.

Variety D.—*Albescens*, (whitish.)

White Imphee.

Nee-a-ga-na.

Panicle decompound, very compact, about nine inches long, the branches very loosely appressed to the axis. Glumes ovate, acute, concave-convex, smooth; the outer one purplish and keeled, the inner one always whitish and shorter, both widely open. Seed large, round, ovate, dingy white, plano-convex, crowned with the remains of the persistent styles, and presenting at the base a small cavity, in which is seen a small black spot.

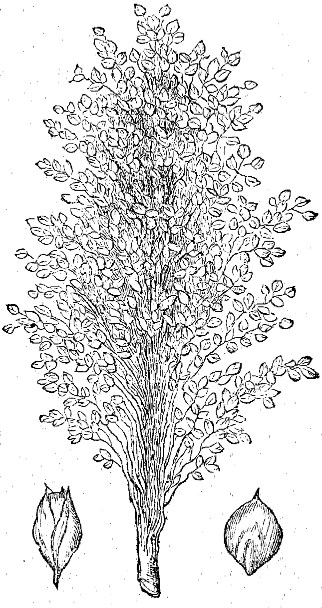


† † Glumis clausis.
Glumes closed.

Variety E.—*Nigerrima*, (deep black.)

Black Imphee.

Panicle compound, flattish, wedge-shaped, about six inches long, the branches thread-like, and more or less appressed to the axis. Glumes purple-black, smooth and shining from the base to the top, and downy along the edges, rather large, ovate, concave-convex, acute, longer than the seed, and closed; the inner one slightly smaller and keeled on the back. Seeds mostly hidden in the closed glumes, oblong, ovate, plano-convex, crowned by the base of the persistent styles, and presenting at the base of the flattened side a small cavity, in which is seen a small black spot.

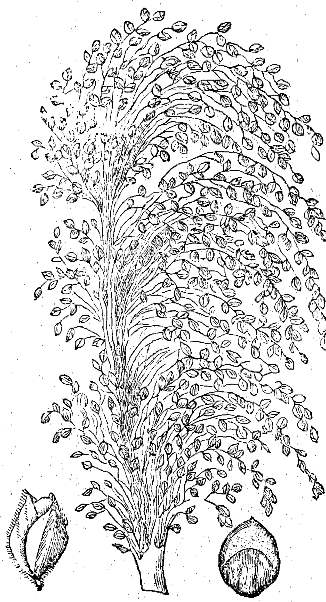


Variety F.—*Cerasina*, (cherry color.)

Red Imphee.

Shla-goo-va.

Panicle compound, rather slender, about fifteen inches long, the branches erect from the base, moderately spreading and drooping at the top in fruit. These branches are regularly whorled, leaving long intervals along the rachis between each whorl. Glumes as long as the seed, reddish yellow or cherry color, mostly downy; they are closed, round, ovate, acute, convex-concave, the outer one even, and the inner one keeled on the back. Seed round, ovate, dingy yellow toward the base, and clear purplish above, crowned at the top with the remains of the persistent style, presenting at the base a small cavity, in which is seen a small black spot.



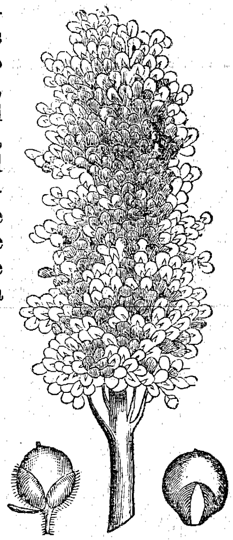
* * Glumis semine brevioribus.

Glumes shorter than the seed.

VARIETY G.—*Liberia*, (Liberia.)

LIBERIAN.

Panicle supra-decompound, angular cylindric, obtuse, very compact, about six inches long, the branches short and appressed to the rachis; glumes shorter than the seed, mostly smooth, shining, orbicular and open. Seeds longer than the glumes, round, obovate, tapering at the base, and much obtuse at the summit, reddish yellow toward the base, cherry color on the upper part, and slightly crowned by the vestiges of the styles, presenting at the base a small cavity, in which is seen a small black spot.



PRODUCTION OF SUGAR FROM SORGHUM OR NORTHERN SUGAR-CANE.

BY WILLIAM CLOUGH, CINCINNATI, OHIO, (EDITOR OF SORGO JOURNAL.)

THE term sugar is applied, in a general sense, to the sweet principle of plants, fruits, and trees. There are several different kinds of sugar. Three kinds exist in or are produced from sugar-cane, called, respectively, *cane* sugar, *fruit* sugar, and *grape* sugar. The last two rarely occur separately or apart from some portion of cane sugar, together with impurities and vegetable substances derived from the cane, and forming together an amorphous compound, variously termed uncrystallizable sugar, glucose, molasses, or sirup.

CANE SUGAR.

This substance crystallizes readily from a pure solution, forming bold, transparent, colorless crystals, having the form of a modified, oblique, rhombic prism, as exhibited in rock candy. It has a pure sweet taste, is quite devoid of odor, very soluble in water, and nearly insoluble in absolute alcohol. The formula of its composition is, 12 equivalents carbon, 11 equivalents hydrogen, and 11 equivalents oxygen. Its sweetening property is greatly superior to that of grape sugar or glucose. Cane sugar is believed to be exclusively the product of nature. All attempts to produce it by artificial means have failed. It is, however, easily transformed or degraded to fruit or grape sugar, and in all the ordinary methods of producing sugar from its natural sources, a large per centage is converted to uncrystallizable sugar in the process. This reduces the commercial and intrinsic value of the product, and imposes a heavy discount upon the business. No part of the process of sugar-making demands more attention than the means of preventing the conversion of cane sugar, when present, to uncrystallizable sugar.

FRUIT SUGAR.

The elements which enter into the composition of this substance are the same as appear in cane sugar, differing only in the proportions of hydrogen and oxygen, or the elements of water, to the carbon, and only to the extent of one equivalent of each in this respect. Fruit sugar is composed of 12 equivalents carbon, 12 equivalents hydrogen, and 12 equivalents oxygen. It is uncrystallizable, and when pure has an intensely sweet taste. It occurs in fresh grapes, and many other fruits, particularly in such as contain considerable natural acid. It constitutes the sweet of new honey, and is probably the first product of cane sugar, starch, and lignine, when operated upon artificially, to effect their conversion. It differs from both cane sugar and grape sugar in rotating the plane of polarization to the left, and is for this termed, scientifically, *lævo-glucose.*

GRAPE SUGAR.

This body is composed of 12 equivalents carbon, 14 equivalents hydrogen, and 14 equivalents oxygen. The nodulous masses of sugar which appear in old dry raisins and the solid portion of candied honey afford the best natural illustrations of this substance. Cane sugar, starch, lignine, and some other substances, are susceptible of conversion into grape sugar. It is probable that grape sugar never occurs originally in nature, but is always the result of changes either natural or artificial imposed upon other bodies. Professor Anthon, of Prague, having devoted much time to the study of this substance, has succeeded in producing it, artificially, in almost a pure state, in which condition it affords regular, palpable, crystalline forms, unlike the warty and needle-like grains by which it was formerly distinguished. His researches afford new and important light upon this subject, revealing the fact that but little was formerly known with reference to the so-called grape sugar. This substance, like cane sugar, rotates the plane of polarization to the right, and is hence called *dextro-glucose.*

CONVERSION OF CANE SUGAR TO GLUCOSE.

Dense solutions of pure cane sugar in closed vessels, at ordinary temperatures, undergo no change. Dilute solutions in closed vessels are but slightly altered after long periods, but exposed to the air speedily change, being first converted to fruit sugar, afterwards to grape sugar, and subsequently fermenting. A solution of pure cane sugar, of the density of 25° Beaumé, boiled in an open vessel for two hours, becomes partly converted. At greater densities the conversion occurs sooner and more rapidly, about in proportion to the increased temperature of ebullition. Cane sugar is changed more rapidly by boiling if agitated so as to expose it to the air, or if a current of air be passed through the boiling liquid. Acids effect the complete conversion of cane sugar to glucose; strong mineral acids more rapidly than weak vegetable acids, and both much more rapidly with boiling them with cold solutions, the changes being in proportion to the strength of the acid and the temperature employed.

Alkalies promote conversion much less than acids. Some of them, such as lime, the chlorides of alkaline earths, the normal sulphates and carbonates, when added to solutions of pure sugar, or when boiled with them, do not increase or accelerate conversion. Their presence, however, hinders or wholly prevents crystallization. Two parts of common salt, or of chloride of calcium, in one hundred parts of cane sugar dissolved, will prevent recrystallization. Solutions of pure sugar with lime, when boiled, suffer conversion less than without lime, and when long kept they exhibit greater stability than when lime is absent; but with impure solutions, at temperatures favorable to fermentation, lime promotes conversion.

Deastase, an active principle existing in the buds of plants and germs of grain, causes rapid conversion of cane sugar at ordinary temperatures. At boiling heat it is coagulated and rendered inert. This is an insidious agent, and its presence may be apprehended in the juice of cane which exhibited, before being harvested, a tendency to sprout at the joints.

Sugar-cane exposed to a temperature as low as 30° or 31° while standing in the field freezes, causing a rupture of the juice cells, and allowing the pure sugar-water which they contain to mix with the crude sap. This excites the first step in the fermenting process, and in a very few hours, if the canes remain exposed to a warm sun, complete conversion of all the crystallizable sugar they contain takes place. If stored in large unventilated shooks, or closely packed in sheds, or put up when wet so that any part of the mass heats to even a moderate degree, conversion of sugar and subsequent fermentation occurs at the point affected, attended with the development of all the inexplicable agencies by which fermentation is communicated. In a short time the whole mass partakes of the infection. The first step in the changes which thus occur is the conversion of crystallizable to uncrystallizable sugar, and this may take place before active fermentation is indicated, and without being even suspected.

Cane sugar contained in the expressed juice of sorghum, if the temperature is above 60°, begins to undergo conversion almost as soon as pressed from the stalks, more rapidly as the temperature is higher. In close humid weather, or when warm rains prevail, particularly if accompanied with lightning, complete conversion occurs in a short time, followed or attended with the development of lactic acid, and exhibiting a condition of the juice entirely different from that which results from ordinary vinous fermentation. Small portions of juice left over in pipes or vessels, or minute fragments of saturated bagasse remaining in the mill, soon become changed, and when mixed with fresh juice excite the state or condition which they have acquired, the vinous state exciting the vinous fermentation; the acetic, the lactic, the mucous or viscid, and the putrid, each exciting in juice, first, conversion of cane sugar to glucose, followed by further changes to the particular state of the excitant, respectively.

In the operation of boiling cane juice, particularly the juice of sorghum canes, which contain a large proportion of earthy salts and azotized matter, conversion of sugar to glucose occurs extensively. If large quantities of juice are operated upon at one time, involving a long exposure of the solution to boiling heat, the conversion becomes total, and this result is inevitable. Other effects of an injurious character are produced by protracted exposure of the juice, or rather of the dense and nearly concentrated solution to heat, which will be referred to hereafter.

VARIETIES OF CANE WITH REFERENCE TO SUGAR.

The Imphee or African canes have been found more productive of sugar than the Chinese; although all varieties have afforded crystallizable sugar, and its production or occurrence, unexpectedly to the operator, is frequent, and is becoming more common every year.

The Imphee canes, the variety known as *Oomseeana*, by some called *Otaheitan*, is most distinguished as a sugar-producing cane. The stalks of this variety are tall, the panicle close, seeds nearly enclosed in the hulls, which are a dark purple, nearly black; color of the seeds orange, or a dingy brown. The joints of the stalk are short at the base, and increase in length towards the top, as do nearly all the imphees. This cane does not resist winds well, but is frequently blown down flat, forming a tangled mass, very difficult to harvest.

The peculiar imphee odor is very prominent in the Oomseeana. It reveals itself to the passer-by while growing in the field, and very decidedly in the vapor while boiling. The sirup partakes of the same, and on this account the variety is rejected by many cultivators, notwithstanding its superior sugar-producing qualities.

Nee-ā-za-na or white imphee produces sugar frequently. The panicle of this variety is short and compact, the upper part generally drooping. Seeds large and very abundant, projecting beyond the hulls, and presenting a lighter appearance than any other variety. The seeds are in fact white, except the portions which project beyond the hull, which acquire a light brown tinge. The stalks are short and heavy, joints of graduated lengths. This cane stands erect with much stability. It should be worked early, before the seeds begin to harden. The imphee odor is less marked in this variety than in the Oomseeana, and it affords a light colored, pleasant sirup. The sugar from it appears in large well-defined crystals, and it is drained or "purged" with more facility, perhaps, than any other variety. The product of Oomseeana per acre is generally less than that of other varieties.

A variety known as *Shla-goo-va* or red imphee, not largely cultivated, has been little tested with reference to its sugar-producing qualities, though the occurrence of sugar in its sirups has been reported in a few instances. The panicle of this variety is long and somewhat bushy, the foot stalks slender, inclined to droop, in some cases very long, and presenting the appearance of broom-corn. The seeds are closely encased in the hulls or glumes, and these of a dark red color when fully ripe, approaching a purple hue. Stalks tall and slender, joints in graduated lengths, liable to fall or be blown down by winds.

Black imphee is an early variety, not very productive and not generally popular, though a few operators report well of it. Panicle short, compact, seeds closely encased, glumes glossy black, stalk short, color of sirup dark and flavor generally rank.

Liberian, a variety of imphee but recently introduced to notice in the northern States, and not yet extensively cultivated. This is a very promising cane, and the indications are that it will afford sugar. It is very distinctly marked by its seeds, which are small, very round, and of a rich cranberry color. The panicle is large, compact, the seeds being closely compressed except at the top, where a clump of more flexible foot stalks appear, which bend over and droop a little. The stalk is large, but shorter by one or two feet than the Oomseeana; distance between the joints graduated, sometimes very short at the base, but increasing to a good length above; affords a great quantity of juice of average saccharine richness, and of a very pure sweet taste; color of sirup light, flavor mild, betraying but little of the peculiar imphee quality. This cane stools out abundantly from the seed, affording, in good ground, a heavy stand from two or three grains in a hill. It stands up rigidly against all winds; in this respect being greatly superior to any other variety. The Liberian appears to retain its identity, refusing to amalgamate with other canes even when grown in close proximity to them. It is, however, suspected that other canes, particularly the Oomseeana, become impregnated by the Liberian, displaying in the color and shape of the seeds evidences of the admixture.

The sorgo or Chinese cane is more generally distributed and much more extensively grown in the northern States than the imphees. It is most highly esteemed for productiveness, and for the quality of its sirup, being usually more mild and pleasant. It rarely affords crystallizable sugar, and until recently was considered incapable of producing it. Considerable sugar was, however, made from sorgo in the season of 1865. A barrel of sugar, made by Walter Edgerton, Henry county, Indiana, from Chinese cane, was exhibited to the

Cincinnati Horticultural Society in the spring of 1866, and found to be of very superior quality, having large, bold grains, and quite free from the gummy principle which is commonly present in these sugars. It is, however, entirely certain that the sorgo or Chinese cane has been less productive of crystallized sugar than the imphees, and, from what is at present known, it affords less promise for the sugar-making enterprise. The results of another year may, however, change or invert the popular notion upon this subject and give sorgo the priority. Inversions of prevailing opinions upon similar questions have been frequent in the experience of cane-growers, and it would be unwise to abandon the idea of producing sugar from the sorgo cane until much more carefully tested.

The sorgo cane is tall and slender, distances between nodes nearly uniform; panicle branching, showing a cone-shaped outline; seeds nearly enclosed in hulls, but when fully ripe expanding the hulls and revealing the yellow or brownish tinge of the exposed part of the seed; juice rich, tolerably abundant; quality of sirup more mild and pleasant than that of the imphees generally. This cane is very liable to fall down of its own weight, and a strong wind upon a heavy growth prostrates it, reducing the whole to a tangled and impenetrable thicket. This is a common and a very important objection to the Chinese variety.

Early sorgo, a variety or rather a class of canes designated by this name, has been cultivated to a small extent. The only respectable cane of this class is one which was developed from the regular sorgo by careful selection. A gain of two or three weeks in time of maturity was obtained, and this quality has remained permanent; but it was secured at some sacrifice of length and size of stalk. It is distinguished from the regular sorgo by the increased size and greater prominence of the seed, and by a downy growth near the margin of the glumes, particularly toward the points, imparting a grayish cast to the panicle when seen from a little distance. Its capacities as a sugar-bearing cane, if it have any, remain undiscovered. Several canes of this same class have appeared under various names, coined or imported, for the purpose of giving effect to schemes of speculation. They appear to be derived from an amalgamation of the sorgo, perhaps the early sorgo above referred to, and the black imphee. The yield of sugar from these *fancy* canes is prodigious, if advertisements can be relied upon, but, unfortunately, the newspaper traditions have not been realized in practice.

SOIL AND CULTIVATION.

The subject of soil for cane, particularly when sugar is contemplated, is important. Roots of plants take up fluids from the soil; these contain soluble matters of various kinds, some of which are required for the growth of the plant and are appropriated to that purpose, but by far the larger portion taken up is not required, and is either excreted, or, at the time the cane is harvested and severed from the roots, remains in the crude sap. When the cane is ground, the crude sap with all the soluble earthy matters which it contains is pressed out, and forms a portion of the juice. Rank soils, containing a large portion of soluble salts, particularly those of a saline nature, are highly unfavorable; they oppose the production of sugar in three ways: first, by preventing its development in the cane; secondly, by promoting the conversion of crystallizable sugar during the process of boiling; and thirdly, by obstructing the crystallization of that which remains. Badly-drained lands, even if not rich, by retaining their moisture for long periods, losing it only by the slow process of evaporation, contain a large percentage of deleterious salts. Fresh undigested manures, or those containing a large percentage of ammoniacal salts, (as stable manure, hog manure, and some of the guanos,) are injurious, particularly when applied to undrained or highly retentive land. Professor

James F. Johnston, referring to the presence of earthy salts in the juice of the sugar beet, and the effects of manures in the same connexion, writes: "Certain sirups remained behind, which, though they certainly contained cane sugar, refused stubbornly to crystallize; and the reason of this was traced to the presence of saline matter, chiefly common salt, in the sap. This salt forms a compound with the sugar and prevents it from crystallizing. And so powerful is this influence that one per cent. of salt in the sap will render three per cent. of the sugar uncrystallizable. To overcome this difficulty, new chemical inquiries were necessary. As results of these inquiries it was ascertained, first, that the portion of sugar was larger and of salt less in beets not weighing more than five pounds. The first practical step, therefore, was, that the sugar manufacturer announced to the cultivators, who raised the beets, that in future they would give a less price for roots weighing more than five pounds. Next, that a crop raised by means of the direct application of manure, contained more salt and gave more uncrystallizable sugar than when raised without direct manuring. A larger price, therefore, was offered for roots grown upon land which had been manured during the previous winter; a still higher price for such as were raised after a manured crop of corn; and a still higher price when, after the manuring, two crops of corn were taken off before the beet was sown."

Few plants are so deep-rooted as the sorghum. The roots have been traced to the depth of more than four feet; hence it would be inferred that the quality of the cane must be affected by the nature of the subsoil. This is found to be the case. Sandy or gravelly subsoils are most favorable for developing the pure saccharine properties of the cane. This, of course, results mainly from their affording drainage, carrying off the stagnant fluids which would otherwise remain in the soil surrounding the roots. This suggests the idea of underdraining, and in soils which are not naturally drained, underdraining is almost indispensable. It is very much more necessary with cane than any other crop. Professor B. Silliman, jr., in concluding a course of lectures upon cane culture in Louisiana, enforced the subject of draining in the strongest terms. He said that, "if called upon to give three rules which he regarded as most important for success in cane husbandry, the first would be drainage; the second, *drainage;* and the third, DRAINAGE." The conditions which affect tropical cane doubtless produce a corresponding effect upon ours, and the *rules* above given may be confidently commended to all who contemplate producing sugar from sorghum. It is hardly necessary to add, in this connexion, that deep ploughing, or, if convenient, subsoiling, is in order, and extremely appropriate for cane.

Cultivation should be thorough and frequent in the early stages of growth, but deep ploughing, or even working with the cultivator, should be suspended after the plants have acquired a height of three or four feet. The roots permeate the soil, extending quite across the rows, and when severed by the plough or cultivator the growth is arrested, and the cane acquires a premature and a dwarfed maturity.

TIME OF HARVESTING CANE.

Until recently the opinion has prevailed that cane for making sugar should be thoroughly ripe; that it could not remain standing in the field too long, provided it escaped the frost; but lately, this notion has been somewhat modified. The frequent occurrence of sugar in sirup of immature or unripe cane recently attracted attention, and was published. This called to mind numerous similar instances which had escaped notice until the subject was suggested, and these were multiplied in number until something like a case for early or premature harvesting was made out. The matter cannot, however, be considered as definitely settled until the results of the season of 1866 shall have been determined. Many will carefully test the cane at different periods or stages of maturity, so that, after the next year, it will be fully understood. The precise stage of maturity most favorable for the production of crystallizable sugar, according to the new theory, is just after the seeds are formed, and before they begin to harden. As cane matures quite unevenly, it will be necessary, in making accurate tests, to select stalks of uniform maturity, rejecting such as are not sufficiently or too much advanced.

In all cases, when working for crystallizable sugar, the two joints of cane next to the ground, and two joints from the top, (besides the arrow,) should be rejected. The cane should be cut close to the ground without removing the blades or the top; these, together with the two joints at the butt, to be removed as the cane is worked. It would be best to allow but little time between harvesting and working the cane, and on no account should it be stored and allowed to remain long in large shooks. It is almost demonstrable that no cane sugar is developed under any circumstances after the cane is harvested. The changes that occur after the cane is cut, if any, must be in their nature depreciative, consisting in the transformation of crystallizable to uncrystallizable sugar. The rind of the cane and the sheath surrounding the stalk will, of course, dry, if grinding is delayed, and give off less crude sap; but if the purpose is to produce sugar, the main point must be kept constantly in view, and all considerations which relate merely to the quantity of the uncrystallizable product must be disregarded. Sugar alone crystallizes, and this can be easily separated from or purged of any impurities or offensive matters. So far as the crude matters oppose crystallization they are to be avoided, but the "curing process" is attended with more loss of crystallizable sugar than their presence in the juice would occasion.

GRINDING.

But little need be said upon this point. The mill should be absolutely clean, no fragments of old bagasse left adhering to parts reached by the juice. If the cane is newly harvested and not thoroughly ripe, it will part with most of its juice without very close pressing, and that which remains in the bagasse can well be spared. Bagasse of green cane repressed affords a juice, which is not very sweet, but which is very green and offensive.

TANKS AND VESSELS.

These should be scrupulously clean, particularly with reference to any trace of acidity. If filters are used, the arrangement of them should be such as to keep the straw or other filtering medium covered with juice while employed; and if emptied at any time, leaving the surface of wet material exposed to the air, the contents of the filter should be renewed. No ordinary condition is more favorable for exciting vinous and acetous fermentation in cane juice than that afforded by the contents of a filtering vessel when emptied of juice and exposed to air.

NEUTRALIZING AGENTS.

The use of alkaline agents in the juice of our sorghum canes is attended with results which do not follow when they are used in the juice of tropical canes. Neutralizing with lime is an immemorial custom in the tropics, and no sugar-boiler would think of dispensing with it, or some full equivalent. The cause of the difference referred to is not well understood. Our canes contain a greater percentage of glucose, and this has been named as a reason. It is true that lime forms a compound with grape sugar, but it combines only a little less readily with cane sugar. This explanation is not satisfactory to any intelligent observer of the phenomenon. Lime applied to sorghum juice in quantity sufficient to neutralize the free acid produces invariably a dark inky complexion in the sirup, and a strong, and, to many, an extremely offensive taste.

Chalk or pulverized carbonate of lime is but slowly acted upon. Filtering hot juice through a mass of finely broken limestone decomposes the carbonate slowly, but the quantity of lime appropriated is not sufficient to produce any perceptible effect upon the acid of the juice. Calcareous clays have been used with but little benefit. Carbonate and bicarbonate of soda and potash affect the color and taste of the sirup like lime, while they are less appropriate in other respects.

Bisulphate of lime is an acid. It decolorizes, assists in defecation, and serves in a remarkable manner to prevent every kind of fermentation. The quantity appropriate to be used is very small—so insignificant that no injurious effect can follow. One pint to a hundred gallons of juice is enough. The sulphurous acid which it contains is supposed to assimilate free oxygen from the juice, removing thereby the active agent of fermentation, the sulphurous being converted into sulphuric acid, the latter combining with lime, forming the insoluble sulphate of lime which comes off with the scum. Probably but a small portion of the sulphurous acid is thus converted, while the remainder being volatile escapes in boiling, leaving a small quantity of free lime in the juice in excess of that required by the sulphuric acid. The objection urged against the use of bi-sulphate of lime is, that it renders sugar deliquescent. When first introduced and employed in Louisiana, it was doubtless used in immoderate quantities. There can hardly be an objection to using the small portions named above, and from very careful observation of its effects the writer is inclined to recommend it, particularly in operations conducted with reference to granulated sugar. Notwithstanding all that is said and all that is realized from the use of quick-lime in sorghum juice, there seems to be a necessity for employing it in sugar-making operations. The presence of acid in the boiling juice and sirup must tend to increase conversion of cane sugar to glucose, and there appears to be no adequate remedy but by the employment of a moderate quantity of lime.

It is, therefore, recommended, and, in combination with bisulphate of lime, to be used in the following manner:

The bisulphate should be introduced into the juice as soon as possible after it leaves the mill, and before it passes through the filter. One mode is to allow it to drop from a vessel, holding a measured quantity, into the stream of juice as it flows from the mill. If this cannot be conveniently arranged, it may be poured into and thoroughly mixed with the juice in appropriate quantities.

The quick-lime, having been slaked by immersion in boiling water, and having been thoroughly mixed with water to the consistency of milk, may be carefully added to the juice, the last thing before it goes to the pan. On no account should tempering with lime be undertaken without litmus paper to determine the effect as lime is added. After adding a portion of lime and thoroughly incorporating it with the juice, apply the litmus paper, and if the original color produced by the juice has been modified from a scarlet to a pink, approaching a purple, probably enough has been used. Complete neutralization of the acid should not be attempted. Clear lime water, in place of milk of lime, is sometimes recommended. Larger quantities are required to produce a perceptible modification of the acid, and if used in quantities sufficient to effect the object, the result is the same in all respects as if milk of lime were used.

GENERAL REMARKS UPON EVAPORATING.

The art of producing sugar from sorghum, while it depends upon every step in the progress of the work, from the selection and planting of the seed to the final operation of draining the crystallized sugar, may be said to hinge upon the process of evaporating; as it is in this that all the prudence and skill of the operator are required. This subject embraces, first, the means of separating the sugar from the impurities with which it comes associated; and, secondly, the means of expelling the excess of water without developing a dark color in the concentrated sirup, or causing conversion of crystallizable to uncrystallizable sugar. Processes for accomplishing both of these are known and in successful use in large sugar-making operations, both with the beet and the tropical cane; but they are expensive, complicated, and entirely beyond the reach of the northern farmer, who produces his crop of sorghum as an incidental and generally a subordinate farm crop. The question for practical consideration in this connexion is, how shall the work of evaporating sorghum juice for the production of sugar be accomplished by *simple and inexpensive means,* accessible to the ordinary farmer?

If cane juice containing crystallizable sugar could be *instantly* deprived of its excess of water and the impurities which it originally contains, no appreciable conversion of sugar would occur, the solution would be colorless, and the cane sugar would immediately crystallize out, in clear, bold grains, from which the uncrystallizable portion would readily drain. But the work of evaporating requires time, and when performed in an open evaporator under ordinary atmospheric pressure, it requires a high degree of heat, the effect of which is, as has been stated, to develop color and convert crystallizable sugar. A dense viscid condition of the sirup is also produced by the same cause, which retards or totally prevents the crystallization of any cane sugar which may remain unconverted; or if the molecular attraction is powerful enough to overcome the obstructions and a tardy crystallization is displayed, the viscid or gummy medium refuses to separate or drain from the sugar. The difficulties here referred to are encountered in all sugar-making operations. They constitute the great and universal impediment to the production of pure sugar from its various sources in nature. It is to avoid or counteract these that vacuum pans, bone coal filters, the desiccating, the refrigerating, and numerous other processes have been devised. While these difficulties pertain to the juices of all plants worked for sugar, they are most formidable in the juice of the beet and sorghum. The beet sugar enterprise came near being abandoned on account of difficulties of the nature here referred to, and its success was only established after the employment of extraordinary means, suggested by long experience and the highest scientific aids, and these included with the abundant use of animal carbon and evaporating in vacuo. It should not, therefore, be surprising to any one acquainted with the nature of our sorghum juice and its similarity to the juice of the beet, that the production of sugar by the simple, and in many cases inappropriate, means has not been more frequent. By similarity, it is not meant that the juice of the beet and sorghum are identical. The saccharine substance of the beet consists more generally and more exclusively of cane sugar, while it contains a greater proportion of earthy salts and other impurities. These are so abundant that a sirup of beet produced by the simple process employed with sorghum would be extremely offensive.

A description of the apparatus and processes employed in beet sugar factories, or in the sugar houses of the tropics, would afford hardly a suggestion of practical use in domestic operations with sorghum.

The bone coal filter and the vacuum pan are the most appropriate means known to man for producing sugar from its solutions; but they are not appropriate, and cannot be considered as having any place in this connexion, as they do not meet the popular purpose which is intended to be subserved in this paper.

Conversion of sugar occurs, as has been shown, from *prolonged exposure of the solution to intense heat.* Brief exposure to intense heat, or prolonged exposure to moderate heat, is not attended with much loss or injury. The vacuum pan operates upon the latter principle. Under a vacuum, boiling may be carried on at temperatures much below that of boiling water; and this permits the boiling of cane juice in large charges, requiring several hours for its concentration. But the vacuum pan, which affords the means of boiling upon this principle, not being attainable by the sorghum operator, he must, if possible, accomplish the same end by the other method—that of brief exposure to intense heat. If the excess of water in cane juice could be instantaneously expelled, the results would be as satisfactory as they are with the vacuum pan. But as time must be employed, it is obvious that the shorter the time the better will be the results. In considering the subject of evaporating cane juice in open pans, then, the following may be given as a maxim of universal application: Other things being equal, *that process which concentrates with the briefest exposure to heat is the best process.*

STEAM EVAPORATORS.

These are used but by few operators in sorghum. They are no more economical than properly constructed apparatus worked by direct fire, and afford no advantage whatever except convenience and facility in controlling the heat. These are overbalanced by the great expense of apparatus; by the necessity of working in large batches enough to cover the pipes; and by the difficulty of discharging the finished sirup clean from the evaporator, a portion being necessarily left adhering to the pipes, which becomes candied by the heat of the metal, and must be cleaned off at some trouble and loss, or be left to impart a dark color and an offensive taste to the next batch.

"Steam-jacket" evaporators have been used. Kettle-shaped evaporators, surrounded by a steam chamber, can be conveniently and securely made, and for many purposes these steam-heated kettles answer very well, but not for sorghum. They must necessarily be made to contain a considerable quantity of juice; then, the heating surface is insufficient, and the solution is exposed to a long, sluggish process of boiling, than which nothing could be more fatal to crystallizable sugar.

Steam has been applied to the bottoms of flat pans. This permits the heat to be applied to a shallow body of juice, and secures the rapid concentration of the quantity acted upon, but the difficulty of constructing the apparatus renders it expensive and almost impracticable. A pressure of steam sufficient to evaporate rapidly, when applied to the under surface of a flat metal plate, tends to produce an upheaval which must be counteracted by numerous stay bolts, so nicely and securely fitted as to remain steam-tight. Pans of this description have been constructed and found to operate well when perfectly made. They afford the only known mode of evaporating by steam adapted to making sugar from sorghum.

FIRE EVAPORATORS.

From the repeated reference which has already been made to the destructive effects of heat upon sugar juices, it might seem that the subject had received sufficient attention. It is, however, impossible to give undue prominence to this point in operations with sorghum, particularly in working for sugar. It is a matter of first and greatest importance. In considering the claims of evaporators, then, the most important question has reference to the capacity afforded for reducing juice suddenly to sirup. Pre-eminent capacity in this respect compensates for inferiority in any and all others. Extra labor and attention, waste of fuel, inconvenience of all sorts in an apparatus, may be endured. It may fail to afford means of good defecation—even this may be submitted to; for if the juice is reduced to sirup so suddenly that the sugar is left intact, or unchanged by heat, it will readily crystallize out of the solution, and can then be separated from the uncrystallized portion which will retain the impurities. But if, on the other hand, the apparatus be faultless in all respects except that it provides for working upon considerable quantities of juice at a time, or from any other cause involves longer exposure of juice to heat and the consequent conversion of crystallizable to uncrystallizable sugar, the enterprise, so far as sugar is concerned, is a total failure. The result may be a very clear, nice sirup, but it will be uncrystallizable; or if not all converted, and a crop of puny crystals appear, they will be inseparable from the dense and gummy medium in which they are contained.

The importance of rapid boiling in small batches is recognized by all experienced operators in sorghum.. All know that protracted, sluggish boiling imparts an inky hue and a rank disagreeable taste to the sirup. It is not, however, so generally understood, or admitted, that the gummy, viscid condition of the sirup, and conversion of cane sugar, is produced by the same cause. Some even suppose that the yellow, waxy scum, which appears in the last stages of boiling, is original in the juice, and by prolonging the boiling this may be, in a great measure, brought to the surface and eradicated from the sirup. Yet no one has ever found this adhesive substance to diminish in quantity as the boiling and the operation of expelling it is continued; on the other hand, the careful observer must notice that, in place of disappearing, it accumulates more rapidly than it is removed, and that this gummy principle is, in fact, a product of the very means employed to expel it.

When sorghum was first introduced, operators took counsel from the only sources which they could consult—the familiar modes employed in concentrating the sap of the sugar maple, and the practice of the sugar-planter of the south. Cast iron sugar kettles, of the largest attainable dimensions, were put to use, and these being deemed insufficient, many procured cauldrons made for the purpose, which would hold several hundred gallons. The sirup resulting from these formidable boilers disappointed expectation. It was dark, strong, offensive, and by universal consent christened "*cane*-olina tar." Sorghum was regarded as a failure by many, and the enterprise came near being abandoned. But experiments with juice boiled in tin cups and basins on kitchen stoves had been incidentally tried by a few persons, and the results of these were so entirely different, and the sirup so greatly superior to that which had been obtained by boiling in large batches, that the theory of rapid boiling in shallow pans was suggested from many quarters, and universally adopted. The new revelation which was thus made opened a hitherto unoccupied field for invention, and a great multitude of "new and useful improvements" in sorghum evaporators immediately appeared; and these, *propagating*, have continued to multiply with a sort of generative ratio of increase to the present time, the original key of shallow evaporation being preserved in nearly all. Two different and distinct modes of shallow evaporation are employed. One consists in operating upon a batch or charge of juice, which is received into the evaporator either in the original green state, or after being first defecated by a previous process, and is finished and struck off in one body. The other consists in receiving either the green or defecated juice continuously, in a small stream, into one end of the evaporator, and discharging the finished sirup continuously from the other end, the juice being concentrated to a proper degree during its passage, and while in motion through the pan. The first is called the "intermittent process," and the other is called the "continuous process." Numerous plans have been invented and used for evaporating by the intermittent method. They all relate to economy in construction and in the use of fuel, or to convenience in management. Some of them provide for receiving the green juice into large evaporators, where it is defecated, thence transferred to tanks or vessels, in which suspended impurities are allowed to settle, and thence to small evaporators, where it is finished. The success of this mode of evaporating, when the operation is conducted for sugar, depends mainly upon the quantity operated upon in the last stage. If very small, and the boiling quickly performed, the conversion of crystallizable sugar may be inconsiderable. The finishing pans should be thoroughly cleansed at the end of each strike. The settling process must receive particular attention, as the juice, if allowed to remain in the tanks long after the temperature is somewhat reduced, is liable to ferment, or to undergo an incipient change, which, although it might not be perceptible in the quality of a sirup, might be fatal to the production of sugar. A more simple process, but much less perfect in its results, is where the green juice in a considerable body is taken into the evaporator, and directly boiled down to sirup. If the operation is conducted upon small charges, the conversion of sugar will be trifling, but in order to accomplish much work, large evaporators and large charges must be used.

The plan of boiling in a series of four or five small pans upon one furnace is used to some extent. They are each charged with a few gallons of juice, and placed crosswise upon the furnace, over the fire, and for some distance back over the flue. When the juice in the first pan over the fire is sufficiently concentrated, the whole series is moved or slid forward the width of a pan, which removes the front one from over the fire upon supports arranged to receive it, and leaves a space in the rear, which is covered by a newly charged pan. The pan of finished sirup is then emptied, cleaned, and charged with fresh juice, ready to take its place in the rear when another pan is removed from the front. Between the "intermittent process," according to any plan that may be adopted, and the "continuous," there is this specific difference: In the former the quantity of juice operated upon at one time must be sufficient to cover the bottom of the pan so deep that, even in the last stages, when the sirup becomes dense and sluggish, it will have sufficient volume to give it mobility, and cause it to circulate freely from one part of the pan to another; for if so shallow as to refuse to circulate, the parts exposed to the greatest heat, remaining undisturbed, will suddenly become unduly concentrated and burn upon the pan. By the continuous process the heat is applied, not to a body of juice at rest, but to a moving current or stream—each part being displaced or pushed forward by that which follows. The portion of the pan occupied by sirup in the last stages is very small compared with the whole surface of the pan, and in this the sirup is kept in motion or carried along towards the exit by the less dense sirup in the rear, so that the depth of sirup may be very shallow, and the whole time during which any portion of it, in its critical stage, is exposed to heat may be but a few seconds, or, at the most, but one or two minutes. Practically, the quantity of sirup acted upon at any one time, in the last or finishing stages, would be appropriately stated in gills, while by the "intermittent process" it would be stated in gallons, and the difference in time of exposure of dense solution to heat by the two modes is necessarily and inevitably about in a corresponding ratio.

Evaporators constructed to operate upon the continuous principle are of two kinds. One provides for the *direct* flow of the juice from the entrance to the exit end of the pan; and the other provides for an *indirect* flow, or the passage of the juice through narrow transverse channels back and forth, until by successive steps it reaches the exit end. In the first the whole width of the pan is the width of the channel through which the juice flows, and this plan does not provide adequately for the successive displacement and advancement of all portions of the juice. The less concentrated portions may find their way along, and appear in advance of, the more concentrated portions, mixing therewith, and occasionally producing a complete mixture of green juice and nearly finished sirup. Cross-bars or ledges with gates, or provided with openings for an underflow, are generally used. These hold back the green scum, and prevent it from flowing down, but do not wholly restrain the green juice from advancing prematurely.

By the transverse or indirect flow the juice is confined to channels but a few inches wide, and all must pass through the same channels, each portion being exposed to the same heat, each being displaced by the portion which follows, at the same time displacing that which is in advance. At the side of the pan it leaves the channel which it has traversed, and enters the next in advance, through which it returns to the other side, thus flowing back and forth through the whole series, until it reaches the last channel, where, if the flow has been properly regulated, the juice will have been fully concentrated, and may escape from the pan through the exit spout. At the centre of the pan, in each channel, the juice is exposed to the greatest heat, and will there boil violently; at the sides the boiling will subside, to be renewed again at its next transit. The juice is thereby subjected to an alternate boiling and subsiding operation, which is most favorable for the separation of impurities, these being cast up more abundantly, in all cases, at the moment fluids pass from a state of rest or subsidence into ebullition.

The continuous transverse current process of evaporating was discovered by Mr. D. M. Cook, of Mansfield, Ohio, and it is believed to be the best plan for evaporating sorghum juice that has yet been devised. It meets all the requirements of the business; that is, it affords the means of obtaining perfect defecation, and enables the juice to be concentrated with the briefest exposure to heat, being at the same time economical and convenient. The occurrence of sugar from sorghum has been almost exclusively in cases where the Cook sugar evaporator has been used. A very large proportion of all the sugar made from sorghum has been made by the use of this apparatus.

With regard to the facilities for defecation afforded by the different evaporators in use nothing need be said. All provide for removing the scum, and the different modes provided are commended more by fancy than any intrinsic difference, though the process of Mr. Cook is believed to produce a better separation of impurities than when the boiling occurs without the interruptions which he provides. But, when working for sugar, the defecation of the juice is, as has been said, of less importance than rapid concentration.

It is not considered necessary to refer to the modes of working the different evaporators, as all information required is furnished by the circulars of manufacturers. An attempt has been made to explain only the leading features of the different systems of evaporating, with particular reference to their adaptation to the work of producing sugar from sorghum. The reader, if satisfied that the difficulties to be encountered in the operation have been correctly represented, will have little difficulty in determining from a general description of the different systems of evaporating, which is most appropriate to the work.

CLARIFYING SIRUP.

This term properly applies to an auxiliary process employed upon the semi-sirup while in progress, or upon sirup which, being once concentrated, is afterward reduced with water and treated anew. For making sugar the shortest and most direct process from juice to sirup is the best, and will result in the greatest quantity, and in the best quality of sugar. Reducing sirup with water, and subjecting it to treatment in connexion with, or followed by reboiling, involves, of course, a new exposure to heat, and is obnoxious to all the objections which have been so often referred to in connexion with boiling. There are no means at present known by which sorghum sirup can be made more readily crystallizable than it is when boiled down direct with proper defecation, except by filtering with bone coal, which, not being practicable on a small scale, cannot be considered as an appropriate subject in this connexion. Numerous processes have been invented, patented, and sold for effecting the crystallization of sorghum sirup, and hundreds of thousands of dollars have been paid for them by sanguine and over-credulous operators; but not one of the many which have come to the knowledge of the writer contains a single new and useful suggestion, while most of them betray the most profound ignorance of the art upon which the patentees profess to have made improvements. Nine-tenths, and probably more, of all the sugar which has ever been produced from sorghum has occurred through the direct and ordinary means employed for making sirup, and generally without any purpose or expectation on the part of the operator that the sirup would granulate, or, in ordinary language, "turn to sugar." The result occurred from the accidental and unpremeditated compliance with all the conditions necessary for the production of sugar. These conditions are all that are required in making sugar from sorghum, and *none of them are patented*, and no patented invention will supply their place, or compensate for non-compliance with them.

FINISHING POINT.

It is difficult to give particular directions upon this subject. The sugar boiler very readily acquires familiarity with the appearance of sirup in its last stages, and can determine the density it has attained by the manner of boiling, usually by the peculiar appearance and sound emitted by the steam as it escapes from the boiling mass. As it approaches the finishing point, the steam is liberated in lively puffs, with a slight noise; gradually the sirup becomes more sluggish, and the steam seems to break away with more difficulty; still later, the foam subsides somewhat, and the steam escapes with a more sharp and angry puff; at the same time the sirup assumes a glistening, some say a "sugary" appearance. This is generally regarded the finishing point for sugar. With sorghum sirup it is better not to be too dense. The stage before the last above described is more appropriate. The sirup, after being removed from the fire, is discharged into coolers, and should then be reduced in temperature, by any appropriate means, as rapidly as possible, at least as low as to the temperature of 200°. Some practise stirring or agitating the sirup violently in the last stages of boiling, and for some time after being removed from the fire. The first facilitates the escape of steam, and preserves a lower temperature by several degrees in the boiling sirup, which is an important advantage. A plan of evaporating, at what is called "low temperature," is effected by rotating a series of disks, partly submerged in the sirup, which brings up and exposes a large amount of surface to the air. This is a systematic plan of "agitating" boiling sirup, and the process is regarded as an improvement. When working by the intermittent or "batch" system it is an advantage to stir from the bottom of the evaporator, as it assists the naturally sluggish circulation, and prevents portions of sirup from remaining too long in contact with the heated bottom plate. Agitation long continued, after the sirup is removed from the pan, produces a foamy state of the whole mass, which is probably a mechanical condition favorable for granulation, though this condition is generally sought to be avoided in tropical sugar-making.

GRAINING.

If a special effort has been made for sugar, it should not terminate when the sirup has reached the cooler, but be continued to the end. When it is not convenient to establish a room for graining, the sirup may be put into barrels and placed in a cellar, or room, where the temperature will be even, and as warm as can be secured. Granulation *may* occur in a few weeks or months. Occasional stirring or disturbing the barrels will be of advantage. Many sirups will, however, fail to show any signs of granulation under these circumstances, which would, if otherwise treated, afford a large display of sugar. The impulse to grain must be very strong when it manifests itself, as it often does, in sorghum sirups tightly barrelled, and taking all the chances of temperature which may befall it.

A properly constructed room for graining is an important part of the operation of sugar-making, and no operator in sorghum should complain of failure to produce sugar who has not employed a graining room, or specific means equivalent thereto, to secure granulation. The room may be of any convenient dimensions and arrangement, provided with places to bestow the sirup, and the means of *heating and preserving a uniform temperature.* The following plan will be found convenient, or it will at least afford the main features or elements required, and enable the operator to construct understandingly, with such changes or variations as his own ingenuity may suggest. It may be constructed as a "lean-to" against the side of some other building, or it may be partitioned off from the inside of the sugar-house or other building. For a room to contain twelve or fifteen barrels of sirup, let the dimensions be eight by twelve feet on the inside; make it as close and impervious to air as possible. Arrange all along on the two sides, stands for drawers, which are to be forty inches long, twenty-four inches wide, and three inches deep on the inside; the drawers to have their places in the stands one above another as high as convenient, say six feet, and to have a space of two inches between each. This will give for each drawer a space of six inches, and each stand will accommodate twelve drawers. Allow for three stands on each side of the room, six in all, and the room will accommodate seventy-two drawers. Each drawer can be filled with sirup to the depth of two inches, when it will contain about eight gallons, or for seventy-two drawers, five hundred and seventy-six gallons. Place in the room a good air-tight stove, which, upon being supplied with large wood, will give off a regular heat, without renewal, for twelve hours. If the room is made very tight with plastering or paper, an auger hole may be made near the floor, and another near the top of the room for ventilation; but it is rare that any special provision for ventilation will be required. There is much more danger that the room will not be made sufficiently close, and will be allowed to cool off frequently in the intervals of replenishing the fire. The sirup, as soon as cooled down to a temperature of 100°, may be conveyed to the graining room, and deposited in the drawers, either a full supply to each, or a small quantity to be added afterwards. While the drawers are being filled, and as often as convenient afterwards, the sirup may be stirred. For this purpose use a wooden instrument, formed by a rod of sufficient length, say thirty inches, with a wooden blade nailed across the outer end, forming a T. It can be worked conveniently without moving the drawers, as the two inches of space provided between them affords room. The temperature of the room should be raised, and kept as near as possible between 90 and 100°. It will do no harm if the temperature falls for a few minutes—while the door is open, or the operator working in the room—as the temperature of the sirup will not be sensibly affected by a temporary change.

By the time the last drawers are filled, *it is hoped* the sirup in the first will have become well granulated, or resolved into "mush sugar," when the drawers can be emptied and again filled with sirup; but if granulation is not supposed to be complete, and it is thought best to give more time, store the sirup which may be made while the drawers remain thus occupied, in any convenient place, but without any attempt to effect its granulation until it can be transferred to the graining room, as nothing would be gained.

DRAINING OR PURGING.

This is the last and not the least difficult operation to be performed. The facility with which the uncrystallized portion of the mush or "rough" sugar can be separated from the solid grains will depend much upon the success which has attended all the previous operations. If the cane was good, if the evaporation was conducted without the development of an undue quantity of that tenacious, gummy principle which is the great obstacle to the work of draining, and if the granulation occurred without too much time in the hot room, then the draining will be attended with little trouble. The more quickly sugar grains, the more easily and perfectly it can be purged. If considerable time is required, particularly when the mass is exposed in open vessels to warm temperature, the uncrystallizable portion becomes condensed by desiccation, and may be rendered almost solid; in which case it is impracticable to separate the sugar without reducing the mass with warm water, and this is necessarily attended with the dissolving of a portion of the solid sugar.

Many different modes of draining sorghum sugar have been suggested, and several have been patented and extensively sold through the country. In connexion with these, a great number of (so-called) processes for "making sugar from sorghum" have been introduced. Enormous sums have been paid by producers for these so-styled "processes." Space will not permit them to be referred to separately, but this paper would be incomplete if it failed to warn sorghum-growers, and all who are interested in the subject, against the absurd pretences and fraudulent practices of these peddlers of "rights" for making sorghum sugar. Not one of the processes for making sugar from sorghum, or for draining sorghum sugar, which has been patented and sold since the introduction of the plant, contains a single essential element of novelty. All, without exception, consist of either slight and immaterial variations from processes which formerly existed and belonged to the public; or, if they present elements of novelty in the form of agents and substances not formerly used, they are, in all cases, not only non-essential and useless, but often absurd, and not unfrequently positively injurious. And yet for these miserable pretences sorghum-growers of the country have paid, at a moderate estimate, not less than *four hundred thousand dollars*. This is not the place to explain how it is that patents are obtained for trivial and useless inventions. It may, however, be remarked that a large proportion of all the patents issued are for really worthless inventions, or for trifling and unimportant modifications of that which was formerly known. But a patent covers only that which is found by the office to be *new*, and this may be an immaterial part of all that the applicant describes in his specification. An old and well-known process may be changed by adding another element, or slightly modifying those which formerly existed, so as to produce a new process, but the change may be no improvement—it may produce no difference whatever in the effect; still it is a new process, and the applicant, if he swears that he believes his alleged invention to be "useful," is entitled to and can claim letters patent for it. The letters patent, however, cover, as has been said, only that which was new. They cannot deprive the public of that which was formerly public, and cannot give to a patentee anything more than he has *invented*. This brief explanation seems to be required in this connexion, as the opinion prevails somewhat that the broad seal of the Patent Office granted to an inventor implies that the august head of that department, and the entire government through him, certifies to the great value of any patented invention, and to the truth of all the patentee has been pleased to say about it. This popular superstition is of great service to dealers in worthless patents, for it predetermines a thing patented to be new and valuable, and this causes purchasers to neglect to examine and scrutinize the merits of an invention.

The operation of draining should always be performed in a warm room, and the temperature of the sugar to be drained should be about blood heat, if it can be brought to that temperature slowly without the application of fire directly to the mass. If sorghum sugar crystallizes out of a solution not very dense and waxy, it may be transferred to moulds for draining. These may consist of vessels of any convenient size and shape. Cone-shaped vessels are most commonly used. The arrangement of them should be such as to allow them to be filled, and, after standing a few hours (perhaps days) until the sugar "sets," a plug can be withdrawn from the bottom to allow the molasses to come off. It will frequently happen that molasses refuses to separate from the sugar. When the plug is withdrawn, both come off together. This mode of draining can only be applied to sorghum sugar under the most favorable circumstances. It will rarely present itself in a condition to be thus treated, and other means must be resorted to. Among the many which have been used are the following:

Place the mush sugar in a coarse cloth or bag, and suspend it until the molasses drips away. After the dripping ceases, the sugar may be thoroughly mixed with a very small quantity of water and again hung up to drain; and this may be repeated, if desired, until the sugar becomes nearly white, though the operation will be attended with some loss of sugar by dissolving. Another mode consists in enclosing the mush sugar in bags and subjecting it to pressure. After once pressing, the sugar may be mixed thoroughly with a small quantity of water and re-pressed, repeating as many times as may be necessary or desirable. This is a very old process, but, like many other old processes, has been *re-invented*, and "rights" to employ it have been extensively sold. The most appropriate and effectual means of draining sorghum sugar is by the centrifugal process. This has been used in the tropics for many years, and is an old process, although it has been made the subject of several new patents for so-called improvements, and an attempt is made to establish a monopoly of the right to drain sugar by centrifugal means. It is a public right, and any ordinary mechanic can construct a machine, on a small scale, adapted to the work. The machine consists of a cylindrical screen, carried usually by a vertical shaft revolving at a high velocity. The speed should be nearly as great as would be appropriate for a circular saw of corresponding diameter. An outer case surrounds the screen. The mush sugar is placed in the screen, either when in motion or at rest, care being taken to distribute it evenly around upon all sides. The sirup or liquid portion is caused to force itself out through the meshes of the screen by the centrifugal action, and is caught in the outer case, from which it should be conducted away by a spout. A small machine, with a screen twelve inches in diameter and six inches deep, can be made to run by hand, though the speed must be high, and the work of draining by hand is necessarily laborious. The quantity which a hand machine is capable of draining in an hour depends upon the condition of the sugar. Two or three times as much power is required with sugar in one state as in another; and sometimes it is found impossible to produce any separation by the centrifugal, without adding considerable water and greatly reducing the viscid, adhesive medium in which the sugar is contained. It is perhaps safe to say that with a light-running hand machine and a fair quantity of mush sugar, from fifteen to twenty pounds of dry sugar per hour may be produced.

CONCLUSION.

The production of sugar from sorghum has been much retarded by a false notion on the part of many, that it is to be accomplished by some sovereign specific, which is to *make* the sirup crystallize. This has led producers away after pretentious patent processes, to the neglect of a careful attention to every step in the operation, which is the only certain means of success, and without which nothing else is of any avail. It should be understood that sirup frequently contains no crystallizable sugar whatever, and to produce a single grain of true sugar from such sirup transcends all arts of man's device. Carbon has been made to crystallize and afford artificial diamonds, but no man has ever yet succeeded in making a grain of artificial cane sugar. It is developed alone in the great laboratory of nature, and all that art or science can do is to preserve it unimpaired, and separate it from excess of water and the impurities which obstruct granulation. It will then crystallize, when reduced to the proper temperature, without the employment of any "process" or extraneous aids whatever. Sirup often contains so small a portion of crystallizable sugar—that is, the minute atoms of sugar are so far separated, that they are not attracted to each other; in which case crystallization cannot occur. Sorghum sirup generally contains a dense, viscid substance which obstructs granulation. This can be removed; but the only effectual means of removing it is by filtering it through a liberal quantity of freshly burned bone-coal—a means which cannot be considered practicable with the mass of farmers. But it can be, in a great measure, avoided or prevented from occurring; and this, together with the means to be employed for promoting the development of cane sugar in the plant and preserving it unimpaired constitutes the whole art of "making sugar from sorghum." It all consists in strict compliance with the conditions imposed at each step in the operation, from the selection of the seed to the final act of purging or draining the crystallized product. It is not to be accomplished by any magical or sleight-of-hand process. There is absolutely no "royal road" to sugar.

THE GRAPE DISEASE IN EUROPE;

ITS

ORIGIN, HISTORY, PHENOMENA AND CURE.

BY HENRI ERNI, M. D., DEPARTMENT OF AGRICULTURE.

The grape disease being with us a growing evil, threatening the total destruction of some of our native American varieties of vines, like the Catawba, I have deemed it important to give a brief history of the destructive malady which has prevailed of late in European vineyards, hoping it may to some extent aid in understanding the character of diseases of the grape which are beginning to prevail in this country.

The literature upon the subject of grape disease is meagre. The books consulted in writing the following article were, principally: *Louis Leclerc, Les vignes maladé*, report to the minister of the interior, Paris, 1853. The plates annexed were copied from this report. Dr. H. Schwartz, Chemie und Industrie unserer Zeit; Breslau, 1862. Dr. W. Hamm's Weinbuch, Leipzig, 1865. Marès diseases of the wine stock, in "Memoires de la Société Impériale et Centrale d'Agriculture." An extract of the above, in Journal de Pharmacie et de Chemie, Mai, 1857, p. 355; also, in Dingler's Polytechnisches Journal, Bd cl., 1858, pp. 148–153. J. T. A. Barral: Cure of the vine disease, with instructions how to apply sulphur, and figures of the apparatus, from "Extrait du Journal d'Agriculture Pratique," No. du 20 Juin, 1857. Paris, Librarie Agricole de la Maison Rustique rue Jacob, 26.

The year 1845 will ever be a painfully memorable one, by giving birth to two new diseases which threatened the entire destruction of the potato and wine crop, and which caused suffering, devastation, and pecuniary ruin to an incredible extent on the continent of Europe.

It would require a great deal of space even to allude to the different theories and opinions advanced as to the cause of these diseases. Suffice it to state, that time has proved the majority of them to be fallacious. All such as imputed to peculiar electric conditions, a wet season, or other meteorological influences, and in seasons remarkable for dryness, are manifestly refuted, whilst the gradual accumulation of scientific facts has established, almost beyond dispute, that the potato and wine diseases are not only accompanied by, but result from, fungus or mouldy growths. Limiting our remarks here more particularly to the wine disease, we begin with its

HISTORY.

In the spring of 1845 this disease was observed for the first time in Kent, England, on vines raised in the hothouse of Mr. Tucker. The termination of the young shoots assumed, first, a crispy look, began to wither, and then dried up. The unripe grapes were next attacked, becoming covered with a grayish white bloom, destroying the skin of the berries, and causing them to rot and dry up. This fearful disease spread itself speedily over other English grape hothouses; was observed almost simultaneously in like establishments at Paris, and passed thence over France, Italy, Greece, Tyrol and Hungary, affecting somewhat later and more feebly the vineyards on the Rhine. Rev. M. J. Berkeley, of Bristol, an eminent naturalist, who has devoted his life to the study of these minute organisms, was consulted, and diseased grapes submitted to his examination. He at once ascribed the cause of this injury to a new species of the botanical genus *Oïdium*, a vegetable fungus or parasite which, in honor of the horticulturist at Margate, he termed Oïdium Tuckeri. The genus Oïdium established by Link, belongs to the agamous plants, and is included in the Mucedineous family, (moulds.) It is described as a vegetable parasite preying upon living plants, like lice and other animal parasites upon animal species. At first this mould forms webby creeping filaments known in botanical language as Mycelium. These root-like fibres then branch out, sending up straight or decumbent articulated stems. These bead-like joints fill up successively with seeds or spores which are discharged at the proper time to multiply the species.

EFFECTS OF THE PARASITE UPON THE VINES.

The first effect is generally perceived upon the leaves, which, at their vernal growth in vineyards, turn whitish, owing to the development of mycelium, (see Plate I, Fig. 4*a*.) creeping first over the superior leaf-surface, constituting a felt-like mass, visible plainly under the microscope alone, then invading the whole leaf with rapidity. Sometimes the diseased leaves remain green and smooth, but appear spotted. The spots differ much in appearance, and may be dirty brown and scarcely circumscribed or confluent; sometimes they are black, covering here and there the natural white down of the lower surface of the leaves, according to the variety of the vine. At other times the leaves crisp and curl up under the effect of the parasite, then fade and dry up, or turn black from the centre to the circumference, and, lastly, drop off, from the latter part of July to the beginning of August.

At this stage the vine is in a state of consumption—for the leaves are to plants what the lungs are to animals—and the functions of life are being suspended at the most important period of growth. The mycelium developing upon leaves produces relatively but few branches with seed capsules (spores,) whereas, when growing upon the berries of the grape, these are very numerous. When the shoots are attacked by the disease they are covered with spots of a variable diameter, or with large, irregular, often confluent blotches of a reddish-brown or even black color. (See Plate IV, Figs. 1 and 2.) Generally the spots preserve their primitive color, even after the August sap.

In the most affected vineyards the shoots look as if burned in different places, or as if a red-hot iron had been applied to their herbaceous surface. In several instances the same effect took place on the petioles (stems) of the leaves, and on the peduncles (stems) of the bunches of grapes. At times the shoots may be observed to secrete a clammy inodorous fluid all over their surface. The living parasite has also the power to penetrate into the young wood to the medullary canal, when the summit of the woody texture turns black and dry, and withers from the top down to half its length.

The symptoms presented by the affected grape are more variable. During the first invasion of the oïdium, sometimes before, sometimes after its appearance on the leaves or shoots, a single whitish spot may be seen on a single berry, enlarging itself by radiating in irregular directions. The mycelium, with its fructifying stems, is limited or arrested, at times, in its growth, from some unknown cause; whilst, at others, it is seen spreading with great rapidity, covering the entire surface of the berries. If in a bunch there is but one abortive berry, it will bear marks of the disease. The creeping branches of the mycelium are fixed upon the skin of the berry by rootlets which do not penetrate into the juicy pulp. The mycelium sends up vertical fructiferous branches nearly of the same height, and densely pressed against each other, velvet-like. These branches are composed of, or subdivided into, transverse cells, (see Plate I, Figs. 1 and 6.) The top cell increases in volume, becomes ellipsoidal, and detaches itself at maturity, or is carried off by the slightest motion of the air. If the conditions (*i. e.*, the temperature and dampness of the atmosphere) are favorable, a second and third cell will follow the same course, (see Plate I, Fig. 2.) These cells, called spores by botanists, correspond to the germs, buds or seeds of the higher orders of plants. The more or less elongated spores of the oïdium mould form capsules, consisting of two transparent integuments or skins. The spores are almost devoid of weight, and so small that their length only amounts to the $\frac{1}{300}$ or $\frac{1}{500}$ of a millimetre, or $\frac{3}{10000}$ to $\frac{7}{10000}$ of an inch, English measure. As soon as the deposited spore is favored by circumstances (*i. e.*, a moist atmosphere and a temperature not less than 15° C. or 59° F.) it germinates. A sort of irregular bud (Plate III, Fig. 2, *c*) bursts forth at one of the ends or poles of the ellipsoid, elongating itself into creeping, webby fibres, which, at length, developing themselves into a net work of branches, form the *mycelium*. But the oïdium has yet another way of propagation, or revivifying as it were. If the mycelium is reduced to dry, inert, and almost imperceptible fragments, it constitutes, when placed under proper conditions of warmth and moisture, a true *cutting*, which soon sends forth two or three creeping rootlets, (see Plate III, Fig. 2, *d*.) These will produce vertical fruit branches, discharging successively the ripe spores, as has been already described.

The first effect observed of the *mycelium*, when adhering to the surface of the berries, consists in producing elevated, brown, (rarely red or black) points, unless they be certain varieties of grapes attacked toward maturity. Louis Leclerc, in his report to Monsieur le Ministre Persigny, remarks: "Certain learned physiologists, for whom I have perfect deference, entertain the opinion that these elevated points on the berries appear before the formation of the *mycelium*. Constant observations, extended for over three months, have failed to reveal to me a single example of such a phenomenon." Suppose this to be so, are these slight elevations the result of a developing internal sporule, or of the removal of the mycelium? Such apparently trifling facts are of great importance. The appearance of these elevated points before the oïdium proves that it is a pre-existing disease—a kind of eruption. These excrescences or round swellings (Plate III, Fig. 1, *a*) seem not to penetrate the pellicle, and consequently do not extend into the cellular tissue constituting the pulp of the berries. The excrescences, at first very indistinct, proceed, nevertheless, in irregular lines, according to the direction taken by the sterile base network of the mycelium. The elevated points are readily seen by the naked eye, by wiping off the oïdium with the finger, or when the latter is removed by some unknown cause, (Plate IV, Fig. 5.) These points are indelibly traced, whether they cover the whole berry, or are distributed in isolated patches; and it is always upon one of these punctuated lines, and longitudinally, that the pellicle of the berries opens. The berries themselves afterwards burst, owing to the weakness of the skin, or the great accumulation of the nutritive juice within. (Plate IV, Fig. 5.) The cellular tissue forming the pulp is next torn, leaving the seeds naked.

The berry dries up or rots, according to the state of the atmosphere and the more or less advanced stage of the fruit. The berry does not always open in straight lines, sometimes not at all. In the latter case, the fissure in the skin sinks in, forming a furrow, at the bottom of which is sometimes found a bluish or greenish blue fungus, which is not the Oïdium Tuckeri.

The berries infected with Oïdium Tuckeri do not necessarily split or burst open. Louis Leclerc has witnessed them in five other conditions: 1. Simply withering, with transient softening and final dryness. 2. When the berry is only half developed the growth is arrested. 3. In spite of the enemy the growth continues until one-half to even three-fourths of the normal final volume is reached, when the berries wither and putrefy. 4. The berry down to the pedicle or stem is completely covered by a dense, thick, brownish or reddish layer, composed of the accumulated webby threads of the desiccated *mycelium*, somewhat of a woody appearance, with none or but few fructifying branches. In this case the coating may be removed by a sharp instrument, and still the pellicle beneath look perfectly green, and the interior of the berry be in good condition. 5. Finally, and most strangely, the berries from their formation are covered one-half, two-thirds, or even wholly, with mycelium and numerous fertile stems; still they grow, soften, attain the normal size, and mature perfectly.

CIRCUMSTANCES FAVORABLE TO THE INVASION OF THE DISEASE.

From England the disease passed, in 1847, over the English Channel, and became visible in hothouses near Paris. Thence it spread over the vineyards in neighboring districts, and travelled with increased violence over the south of France, Italy, and Hungary.

In 1853 spores of the oïdium crossed the Mediterranean to invade Algeria, Syria, Asia Minor, &c., destroying a most important article of commerce and ruining the cultivators. Happily the disease seems to have yielded to science and human labor combined; when the oïdium had been submitted to the scrutiny of science, which investigated, named, and classified it, the question was earnestly asked whether this disease was the effect or cause. It is still disputed. Likewise, whether the vegetable fungus or mould, called yeast, is the primary agent in starting alcoholic fermentation, as in the manufacture of wine or beer from sugary liquids, or whether these vegetable cells, or yeast, are a secondary production, collecting, (owing to the decomposition of organic materials,) as higher order of fungi collect, on dead leaves and decaying substances generally.

To return to the grape disease. Was the oïdium parasite a new plant previously unknown, which installed itself on a higher order of plant, as the grapevine when it is in full vigor and in a normal condition, there to germinate, propagate, and live, by preying upon the tissues and sap of the vine; or was this terrible evil brought about by an artificial, forced culture, causing deep-seated alteration or disease in the vine, the oïdium fungus or mould prospering while disease or decomposition invaded the vine living under entirely unnatural conditions? These two opinions advanced by naturalists do not appear entirely settled. In searching with due care for the circumstances which favor the invasion of the disease, it has been remarked, in many different localities, that it is developed principally in rich, low, and moist soils. These are generally infected first, and favored by a warm and damp atmosphere, the multiplication of the oïdium spores is indeed enormous and may be counted by millions. The wind raises them up in clouds and distributes them everywhere, even over elevated vineyards. This dissemination of seed spores occurs at a period the most dangerous to the vine, the stem and fruit being in a transition state, and very delicate and susceptible.

A few remarks in regard to the tendency of forced or hothouse culture, as well as of the domesticity of animals, may not be out of place. The mass of mankind are apt to find nothing good in nature but what conforms to their interest. Thus we resolutely assume that animals or plants are ameliorated and improved in consequence of an artificial life inflicted upon them, termed culture or domesticity, which must contribute to our wants, tastes, and even fancy. But thes animals, whose muscles and fat ingenious man steadily increases at the expense of the bony tissue; these plants, whose fruit by the care of man increases in size, softness, juice, and flavor, are they truly perfected for their good?—these unnatural, perverted beings, so to speak, whose certain organs enlarge themselves enormously, while others growing more and more delicate and impressible, either perish or become abortive, and are exposed to disease which their wild congeners never contract. Plants do not grow spontaneously and multiply themselves in all soils. It is only under favorable circumstances that particular species can flourish. The *Vitis vinifera*, or European grape, will grow on this continent (so varied in soil, climate, temperature, &c.) in California alone. And I am informed by my distinguished countryman, the California pioneer, General Sutter, that he successfully raised upon his farm a great variety of trees, shrubs, and flowers peculiar to Europe.

The geographical distribution of plants (*i. e.*, the locality of their proper existence) seems to be determined not so much by the variety of soil as by the intensity of the solar forces, light and heat, and the degree of moisture, all of which are imitated in our greenhouses, where we are wont to grow plants of all zones.

An impressive illustration of the almost marvellous results gained by a successful artificial imitation of the conditions required by different species of plants for their maturity may be seen at Zwickau, in Saxony. Upon a spontaneously burning subterranean coal strata an intelligent gardener built extensive greenhouses, in which the air is saturated with moisture, and wherein reigns, in all respects, a truly tropical climate. Here the sugar-cane and coffee plant can reach their full development. It is said that the owner sells his large crop of pineapples, alone, for 3,000 Prussian dollars annually. Cucumbers, beans and melons ripen within this magic circle at all seasons of the year*.

When the plant is placed in circumstances not of its own selection, and left to itself, it disappears, and wonderful artificial contrivances only can maintain it. Then it acquires new qualities at the expense of conservative forces, which the genius of cultivation can never supply. The altered plant can no longer surmount the obstacles offered by the immutable physiological laws of geographical limitation, and the slightest occasion may suffice to induce the destruction of this artificial being. Comparisons are generally bad evidence, but certain connexions presenting themselves may, nevertheless, throw some light on a questionable matter. Count de Gasparin states that the silkworm is now only found in the protecting hands of man, who has altered, if he has improved it. The fact is, says Boissier de Sauvages, the domesticated silkworm has become so stupid that, when placed upon a mulberry tree, it will often gnaw off the stem of the leaf upon which it crawls, and then fall from the tree, up which it is never able to climb. A common caterpillar will never act in this silly way, and if the wind should blow it down to the ground it climbs up rapidly again to its selected home. The silkworm, as modified by art, will reach its fifth period of transmutation, be lively, healthy, and so great a glutton, that, relatively to its bulk and weight, it devours as much food as thirty-six horses, when, alas! our fine silkworm quivers, twists itself in painful convulsions and dies. What is the cause of this sudden disease? It is occasioned by an agamous parasitical plant—a fungus or mould called by scientific men *Botrytis bassiana*, and by the cultivators of the silkworm "muscardine" and "gættino." Any one can verify this fact by rubbing a silkworm with a camel's hair brush previously brought in contact with the spores of this cryptogamic

---

*Die Schœpfung, by Hugo Reinsch, Erlangen, 1856, p. 32.

plant. It is estimated that in France, alone, the loss occasioned by this disease amounts to twenty million of francs, or 3,960,000 dollars. When, where, and how it first originated, no one knows; but it seems very probable that circumstances similar to Tucker's hot-bed culture gave rise to it. The people first attributed the phenomenon to witchcraft.

In this connexion I will mention circumstances that came under my personal observation, showing how, sometimes, unexpected causes contribute to the rapid and unexplained formation of fungi or mould. In a village near Zurich, some twenty years ago, great excitement was caused in a farmer's house, where every article of food containing much starch, such as potatoes, flour dumplings, and rice, turned red in spots when brought to the table, as if sprinkled with blood. A neighboring family was charged with wickedly causing this trouble. So great became the excitement and popular prejudice against the accused, that the police had the matter investigated. Experiments confirmed the truth of the supposed blood-stains appearing upon cooked starchy vegetables, and the cause was traced to a sewer passing under the kitchen. It was probably the parasite known as the "bloody wonder," *Prodigium farinæ*, on account of which many, in a superstitious age, lost their lives. According to Ehrenberg—who lately succeeded in infecting in like manner boiled potatoes, dumplings, cheese, and bread—these red spots are not the result of a fungus or mould, but are microscopic animalculæ, having voluntary motion, and are termed by him *Monas prodigiosa*. In 1821 this phenomenon was quite general in the Rhenish provinces. We should not be surprised if the potato mould, *Botrytis (peronospora) infestans*, which made its first appearance as far back as 1842–'43, both on the continent of Europe and in North America; the parasite *Oïdium Tuckeri*, which, from 1847 to 1860, infested the grape vine, and the *Brotrytis bassiana*, a plant of the same family, which threatened to ruin sericulture, by boring itself in the living silkworm, proved to be the same parasite, modified by characteristics depending upon circumstances and the difference of organisms upon which they prey.

To return to our proper subject: M. Gontier, of Montrouge, France, a distinguished horticulturist, stated before the National Central Agricultural Society that the "*Frankenthal*" (gross-race or Trollinger) wine stock seemed to be primarily selected by the oïdium to feed upon. It has always been first observed on this variety by Tucker and others, which shows that no other would more likely degenerate by forced culture.

Count Babo, a German wine-grower of great authority, declares that the Germans have committed the blunder of planting the "Frankenthal" grape in situations not appropriate for it, such as moist grounds, &c. But what is such a mistake, after all, when compared with a house heated by stoves, and filled with a suffocating damp atmosphere—a condition fulfilled in the art of horticulture in order to yield fruit in winter, and termed *forced culture?* Does not the cultivation of the grape from shoots raised in hot-houses point out the road followed by the grape disease? The oïdium was not traced first upon the wild grape, or on vigorous American varieties, on table-land, or on dry steep declivities. No; it first established itself in an English hot-house; from thence it penetrated like establishments in the neighborhood, and, acclimating itself thoroughly, next attacked the artificial vine arbors in the open air. Thence it found its way into the vineyards, and was spread by the wind in every direction. In this country the Catawba grape seems to be the only variety that has suffered by the disease, and is threatened with ruin at no distant day. The horticulturist has a striking difference indicated to him in the longevity of peach trees raised from seedlings and from buds. The ancient way of propagation furnished healthy and vigorous trees, which (although coming to maturity more slowly) often reached the respectable age of fifty years; while according to the second method, trees barely reach their tenth year without being attacked by disease and decay. Before finally speaking of the remedial agents employed successfully against the grape disease, we will give briefly a few statements of the ruinous extent to which it prevailed The following prayer, ordered by the bishop of Montpelier, France, to be read in all the churches in the diocese, may convey an idea of the terrible ravages of the disease. The following is the translation:

"We pray Thee, O Lord our God, that Thou wouldst deign to regard the vines with kindly eye and propitious countenance; and that Thou bestow upon them Thy blessing, that neither the terrible consequences of Thy wrath, nor any noxious disease devour them, but that unharmed and full of delight the fruit be conducted to a perfect maturity, and happily preserved for our use."

Its prevalence in Madeira, where, probably in consequence of the isolation of the country, it did more damage than anywhere else, is thus described in the report of Dr. H. Schacht.* The oïdium first appeared in Madeira in 1852, soon after the flowering season in June, attacking both leaves and the young grapes, and destroying the first year nearly the total crop. In the following year it was scarcely less injurious in its effects, and, with the exception of the summer of 1856, no wine was produced on the island from 1852 to 1857. As late as 1850 the wine crop, according to the tax levied upon it, amounted to 12,964¼ pipes, though in the judgment of those best informed it was double this quantity, yet in 1856 only 200 pipes were raised. No kind of grape escaped in Madeira, even the American grape, *Vitis vulpina*, which before 1856 did not suffer, likewise became affected. From an oral statement of Mr. Acevede, major of the engineer corps at Funchal, the disease had shown signs of its presence long before this time in Madeira, since old leases from the west of the island Ponta do Sol contain this article of agreement: that if the grape should become diseased with a white bloom, the contract should be considered annulled. In Portugal, also, some evidence of the grape disease has been perceived, but to a less extent. The vine is raised in the southwest of Madeira upon espalier frames, formed with canes fastened horizontally, four or five feet above the ground, to wooden beams or wall posts. Under the shadow of this vine roof sweet potatoes and other useful vegetables are planted. Before 1852 the largest portion of the country around Funchal, as well as the western portion of the island, is said to have been covered with vine espaliers. In 1857 these were seen only here and there. Still later, the wine stock has been entirely neglected, and in its stead sugar-cane and cochineal have been planted. In the northern portions of the island, producing an inferior kind of wine, and where, consequently, less labor was bestowed upon its culture, the vine climbs upon trees, mainly chestnut. Vine espaliers were never seen here, and although the disease affected some isolated leaves, it never attacked the grape. The 200 pipes mentioned as the product of 1856 were derived exclusively from this portion. It will thus be seen that the consumption of Madeira wine has rapidly diminished, and that that which is now sold as such is not genuine.

In 1831, Great Britain imported 209,127 gallons or 3.57 per cent. of her total wine consumption from Madeira, while in 1861 it amounted to only 28,749 gallons or 0.27 per cent. Schacht calculated the annual loss of the island from the oïdium to be 1,137,990 dollars. The Madeira is replaced in part by the various wines of the South Canary islands, or the proper Canaries, viz: Teneriffe, Canary, Lanzerote, Fuerteventura, Palma, Gomera, and Ferro. These are situated nearer to the tropics and the African continent than the North Canary group, and all cultivate wine. In the middle ages Canary wine was already celebrated. We need only allude to the inn at Eastcheap, and Sir John Falstaff, to show that even at that time the wine of the Atlantic islands was known and prized. The total crop of the seven islands formerly amounted to over 25,000 pipes. The grape disease has diminished the wine product of the Canaries one-tenth. The same is the case with the Western or Azoric islands, which the writer of this article vis-

* Dr. Wm. Hamm's Weinbuch, Leipzig, 1865, p. 321.

ited in 1849–'50. The soil, like that of the Canaries, is entirely volcanic, and probably but a few inches deep; to prevent it from being blown off by the wind, the vineyards are divided by stone walls into small squares, and produce enormously, a bottle of fine wine selling for about four cents. The island of Pico alone yielded annually from 15,000 to 30,000 pipes of wine. Also the other islands, Terceira, St. Miguel, Fayal, St. George, and Graciosa, produced splendid wines principally exported to North America and Brazil. Vigorous efforts have of late been made to again increase the wine culture in these western islands.

REMEDIES FOR THE GRAPE DISEASE.

In the face of the wholesale destruction of so important a plant as the vine, numerous means were resorted to, purporting to be effectual in arresting the ravages of the disease. Two of these were successfully employed. The use of the first, viz., pulverized sulphur, is attributed to an English gardener at Leyton, named Kyle. M. Gontier, near Paris, has improved the efficacy of the remedy by inventing a small hand-bellows, by means of which the powder is forcibly ejected. When signs of the disease show themselves, sulphurization is resorted to at once. It is a good plan to apply the sulphur when the leaves and fruit have previously been covered with dew, or sprinkled with water. The berries which are already affected at this time remain stationary, while the remainder attain maturity without any further trouble. Microscopical examinations have revealed the highly interesting fact, that in the vicinity of every sulphur granule the cellular texture of the oïdium withers and dries up; further, that spores already ripe are destroyed, and that others are no longer developed. In what way the sulphur acts it is difficult to explain, considering its insolubility in water. Whether a gradual oxidation and formation of sulphurous or sulphuric acid ensues, or whether simply a slight volatilization of sulphur (sulphur gas) takes place, is not proved. The latter assumption gains ground from the fact that hothouse gardeners observe highly favorable results from simply strewing sulphur powder upon the heating pipes, having a temperature of 60° to 70° C.= 140° to 158° Fahrenheit. Furthermore, experience has shown that during hot weather, and under the influence of the sun's rays, a quicker destruction of the oïdium takes place. There is no good reason why solid sulphur should not, like water in the form of ice, volatilize in a small measure. However this may be, a single sulphurization is rarely sufficient to arrest the disease. Some spores escape its action, and their rapid development must be prevented by a new application within three to four weeks' time, until the growth of the grape is perfected. This proceeding is practiced now, almost without exception, in the south of France and in Italy. The use of sulphur has become so great that the French government was induced to lessen the duty considerably on its importation. Although sixteen pounds of sulphur may suffice for nearly two acres of grape-vines, yet its consumption in this way almost equals the quantity employed in the manufacture of sulphuric acid and of gunpowder. By the systematic use of sulphur for years past, the oïdium has been almost entirely annihilated; and it is asserted, besides, that sulphurization promotes essentially the increase in fruit, (as also in the case of fruit trees,) but in this respect the effect may be equalled by substitutes in powder form, as, for example, the dust from the roads. Experience long since taught that fruit trees and vineyards bear most plentifully when situated on much-frequented and dusty roads.

TREATMENT OF THE VINES WITH HYDRO-SULPHIDE OF LIME.

Doctor Turrel, during the first days of the month of June, 1852, noticed the appearance of the oïdium Tuckeri on his own farm, comprising about thirty acres, in the district of Toulon, France, and resorted at once to the use of hydro-sulphide of lime. The first trial proved successful. The leaves turned green once more, and the berries resumed their former brightness. The sprinkling was then resumed; the weather at the time was calm, and the atmosphere warm and sultry. The method of proceeding was as follows: Two men carried, by means of two long poles, a wooden vessel containing about twenty-five quarts of hydro-sulphide of lime; the liquid was poured into buckets, and passing along each row of vines, the leaves and grapes were sprinkled by means of a broom dipped into the mixture. Those branches which were prostrated on the ground were raised and brushed over with the broom. Cypress brooms proved the best.

Recipe for preparing hydro-sulphide of lime.—Flowers of sulphur, 68 ounces; lime nearly slacked, same quantity; mix and knead together thoroughly; add three to four quarts water. Boil the whole in an iron kettle for about ten minutes; allow it to settle, and decant the liquor. Preserved in well-corked bottles it will keep several months. In using, one quart of this preparation is poured into one hundred quarts of clear water, stirring the mixture meanwhile. With one hundred quarts, one hundred and fifty yards of espalier may be moistened. It will be found necessary to repeat the operation two or three times before the blooming of the vines, and a last time when the berries begin to form. There is good reason to believe that the compound formed in gas-works, by the purifying of the gas from sulphur, could be advantageously employed in the place of that mentioned above.

According to Dr. Engelmann,* a reliable botanist, there are two species of fungi destructive to our American vineyards, both of which he regards as different from the European parasite, *Oïdium Tuckeri.* The first species, *Botrytis viticula,* of Berkley, is very similar to, if not identical with, Oïdium Tuckeri. It makes its appearance in the latter part of June on the lower downy surface of the leaves. About the same time it appears on the pedicles, and afterwards on the young berries when they are about the size of peas, or smaller. Dr. Engelmann never saw it on full-grown berries. Those attacked on their surface, or on the pedicles, soon fall off; but the most material damage is done by this "mildew" infesting the leaves, whereupon the greater part of the berries gradually turn a yellowish brown color at their base, shrivel from that point, assume a club-shape, and at last dry up entirely, still remaining adherent to the withered racemes. This is the *brown rot,* so well known to cultivators of grapes. The second kind, the *black rot,* is brought on by a very different fungus, which Dr. Engelmann thinks is undescribed as yet, that is, that it is a new species. He says it belongs near Ehrenberg's genus, *næmaspora,* and ought to bear the name of ampelicida. It makes its appearance only on nearly full-grown berries, exhibiting in the first stage a discolored spot on the side, (but never at the base of the berry,) about two lines in diameter, with a dark spot in the centre. This spot soon becomes light brown, and remains so, while the surrounding part of the berry gets darker, and exhibits under the microscope a rough or pustulous surface. Gradually the berry shrivels up and becomes black. The individual fungi are little spherical bodies (from 0.07 to 0.10 of a line in diameter) formed beneath the surface in great numbers, which, developing, elevate and at last burst the epidermis. They then open at the apex by a small jagged hole, and, shrivelling with the berry, eject a more or less curled or twisted thread which, when moistened, becomes gelatinous, and shows the innumerable oval sporules, (from 0.004 to 0.005 of a line long,) each imbedded in mucilage.

Whether different species of grapes contain also different species of parasites, or whether the same fungi, under different circumstances, relating to food and meteorological alterations, assume a different form, the writer must leave undecided. It is true, that in the animal kingdom the different species foster different

* Transactions of the Academy of Science, at St. Louis, vol. II, 1863. Extract by Professor Silliman, in the Horticulturist, vol. XVIII, p. 304.

parasites, so much so, that the examination of these animal parasites often aids in the determination of the species.

To return to the grape disease. We guard against its attacks on this continent by precisely the same means as suggested for a cure in Europe—that is, by the use of sulphur.

In Dingler's Polytechnic Journal, vol. CL, Ed. 1858, p. 146, is the following extract from M. Marès in regard to experiments upon the grape disease:

"The following advice in the treatment of diseased vines will prove of great advantage:

"1. The diseased vine needs special care, the ground well cultivated, loose, and porous, no weeds. Everything that impedes the growth favors the development of the disease, as bad pruning, insufficient hoeing, &c., &c.

"The appearance of the fungi destroys the growth. This must, through fostering care, be restored, and sulphur applied against the oïdium.

"2. It is better to apply sulphur too early than too late.

"3. Sulphurization of the plant at the flowering season proves the most effective. At this stage it seems to have a salutary effect upon the growth also. I thought that I observed in 1854–'55 that vine stocks that had been sulphurized bore better than others not so treated.

"4. The sulphur must be applied carefully and thoroughly to all parts—the wood, the leaves, flowers, and fruit, and must not be sparingly applied. The powder is blown upon the plant from two opposite directions while passing entirely around it. The application has been effective when the leaf or fruit held towards the light appears covered with the sulphur-dust. We must not overlook the fact that sulphur destroys the oïdium *only* by being brought in contact with it.

"5. A vineyard that has been recently sulphurized must remain at least several days before hoeing. The flour of sulphur falling to the ground in part volatilizes by the hot rays of the sun and condenses on the shady parts of the vine stock. In this way the sulphur may reach many points that have escaped the blowing process, and this advantage would be lost in burying the sulphur by too soon hoeing.

"6. If the sulphur is dissolved or dissipated by the wind and rain on the same day it is applied, we may wait several days before a second sulphurization; for the first supply, in spite of the rain, is effective, provided the temperature is 16° to 20° R. = 68° to 77° Fahrenheit. If the vine stock is well supplied with leaves, as in July, a strong heavy rain does not prevent the effect of the sulphur, for it adheres so firmly to the surfaces diseased with the oïdium that water can only carry it off together with the fungi or mildew. In this respect a rain does no harm after the 1st of July.

"7. The requisite sulphurization should not be postponed on account of the wind, but more sulphur should be applied than in calmer weather. I have sulphurized vine stocks that were but little developed in the month of June, and they did well.

"8. The effect of the sulphur may be judged of in the course of ten days after the operation, (for we must allow time for the growth to assume a normal condition and develop itself.)

"9. Sulphur is no absolute protection against the disease, for it does not prevent its formation, and the process has to be repeated at regular intervals. It acts more as a remedial agent than as a preventive, and we must, therefore, wait for the first signs of the disease before we resort to sulphur, so as not to apply the remedy uselessly.

"10. After the tenth of August, in the climate of Montpelier, France, the effect of sulphur upon the blue grape that has been seriously affected with the disease is no longer perceptible. If the disease is absent until the formation of the fruit, there is less liability to its occurrence; but if it happens to attack the plant and fruit at this stage, the remedy is less effective.

"From the preceding instructions it will be seen that the timely application of sulphur before and after July 15 (taking this date as the mean) will protect the vine from the oïdium until the ripening season. Experience has annually established this fact since the appearance of the grape disease.

"In the department of Herault, France, the formation and development of the fruit takes place from the fifth to the twenty-fifth of August. Any time of the day will answer to apply the sulphur, in case it does not rain, but it produces the same effect upon either a dry or moist surface; and if the temperature is not below 20° R. = 77° Fahrenheit, it will destroy the oïdium when brought in contact with it. The most favorable circumstances for applying the sulphur, to act quickly and effectively, are a warm sunny day and a gentle breeze, aiding the distribution of the sulphur, and enabling the surfaces to receive it. It adheres firmly where the oïdium develops itself, for the latter presents a velvet-like surface that receives and tenaciously holds the flour thrown upon it.

"My annual use of sulphur per hectare, (2½ English acres,) was in the month of May, 15 kilograms, (= 30 pounds;) June, 50 kilograms, (= 100 pounds;) July, 70 kilograms, (= 140 pounds;) costing me, together with the labor, (performed by women,) 50 francs and 45 centimes, (= to less than ten dollars.)

"If the sulphur used is fine, (like flour of sulphur,) it spreads better and less is required."

EXPLANATION OF THE PLATES AND FIGURES.

PLATE I.

Figure 1.—*a a*, webby, sterile filaments, or mycelium; *b b*, fertile, erect, and articulated filaments; *c c*, spores, or seeds, in a condition of vigorous vegetation.

Figure 2.—Three spores having reached their maturity simultaneously.

Figure 3.—*a a*, mycelium at different stages; *b b*, erect branches.

Figure 4.—*a a*, sterile filaments of mycelium at the left hand; *c c*, spores adherent and detached, according to Dr. Montagnie.

PLATE II.

Figure 1.—Small grape of retarded growth and infested by the oïdium.

Figure 2.—Fragments of this grape as it looked when inspected, October 10, 1852; *a a*, mycelium; *b b*, erect filaments; *c c*, spores. The oïdium appears weakened; the filaments are drooping. Temperature rather cool.

Figure 3.—*d d*, fragments of dried up filaments.

PLATE III.

Figure 1.—*a a*, fragments of the pellicle of an infected berry, but free or disentangled from the oïdium. The thin slice of the berry exhibits the elevated points described in the text; *b b*, cells of the pulp below the pellicle.

Figure 2.—*d d d*, fragments of the dried up mycelium. When placed in a moist atmosphere, below 59° Fahrenheit, they throw out radiating filaments, *a a a*.

PLATE IV.

Figure 1.—Herbaceous fragment covered at *a a* with black spots.

Figure 2.—Woody fragment in August, showing reddish spots, having remained stationary since the invasion of the oïdium.

Figure 3.—Fragment of a growing berry, appearing punctured when freed from the mycelium.

Figure 4.—Small portion of a bunch of grapes partially infected at the beginning of the disease—the first of July.

Figure 5. Two berries, the pellicle of which bursted longitudinally; a third exhibits the radiating points; the mycelium has disappeared.

The observations and drawings of Plates 2, 3, and 4 were made by Guérin Méneville. The first three plates represent the objects magnified 400 diameters.

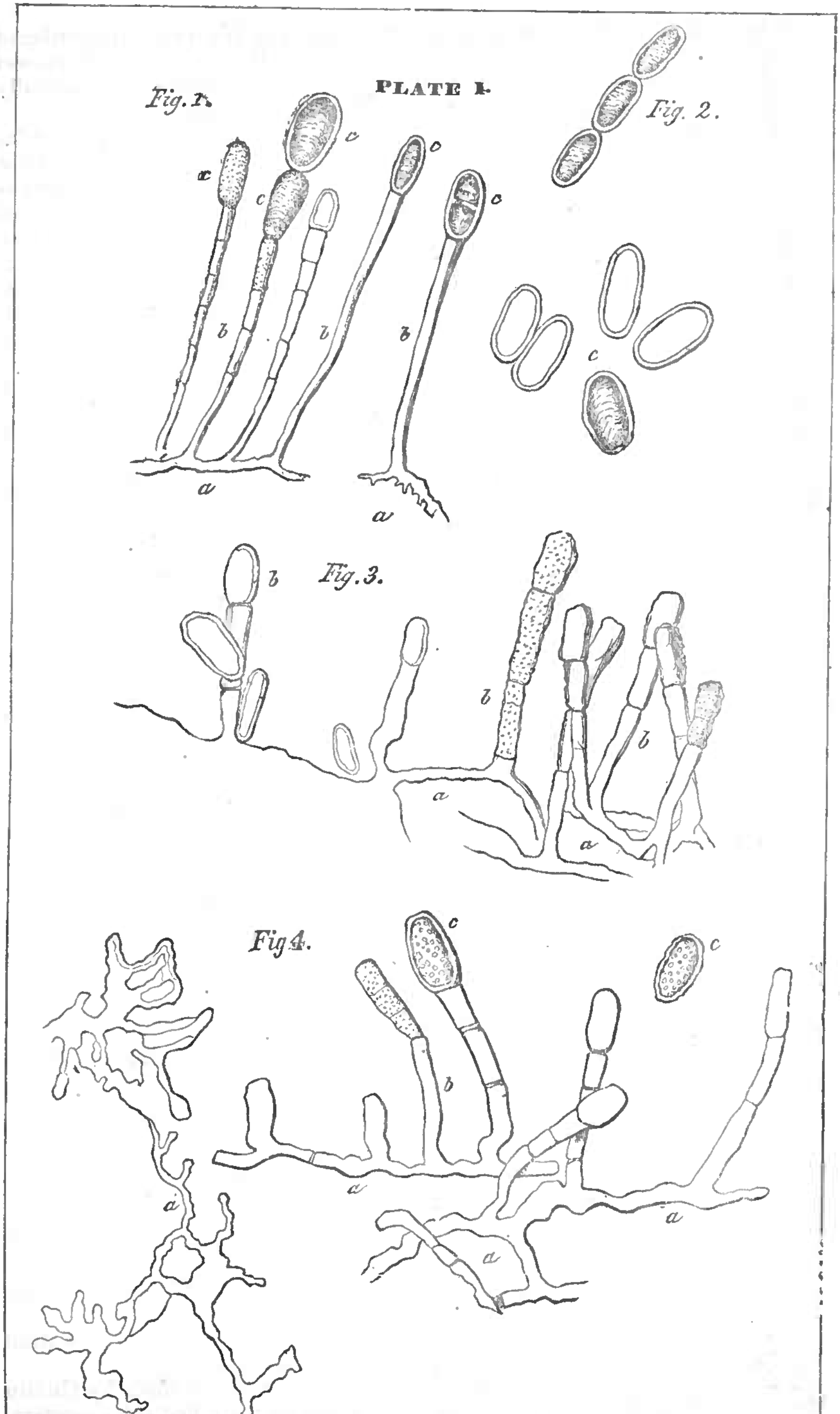
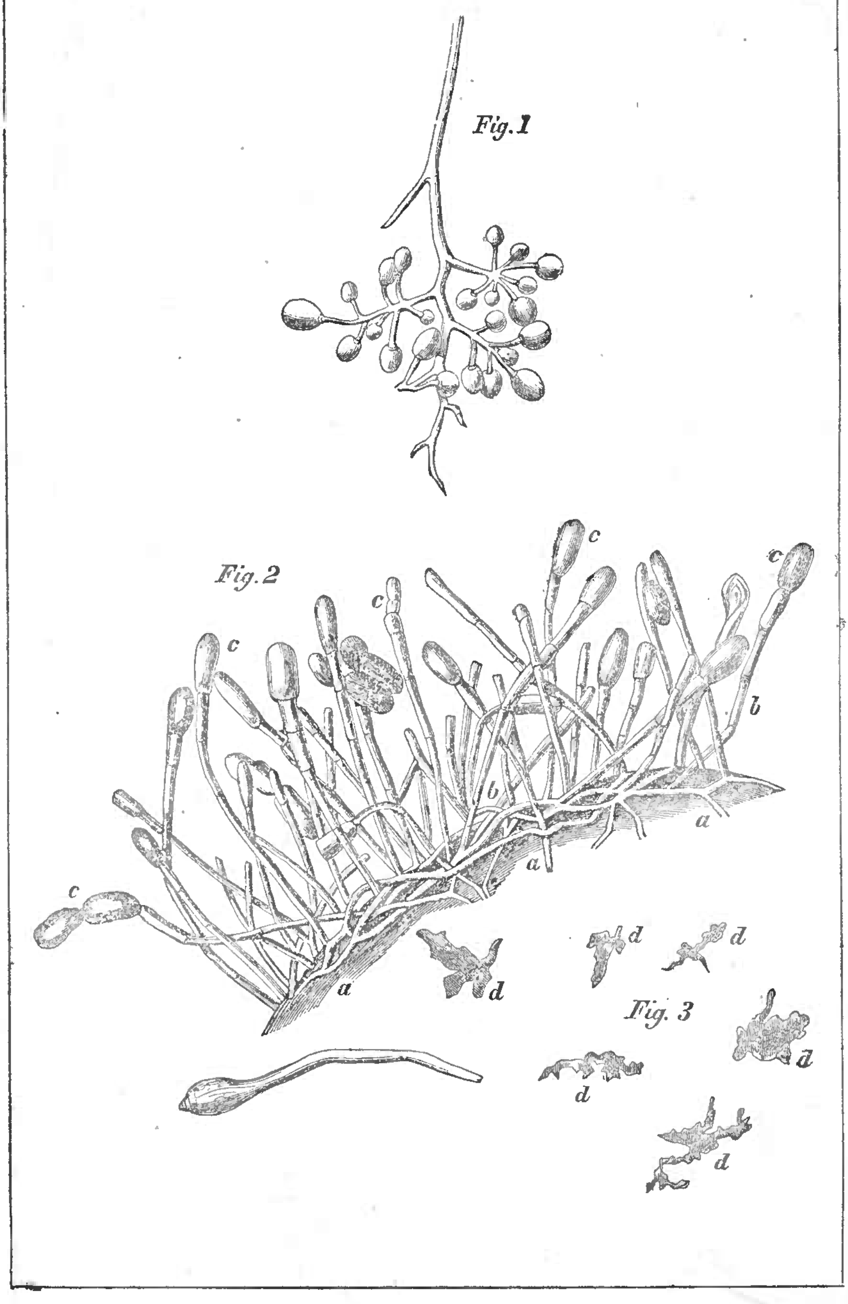


PLATE I.
Fig. 1.
Fig. 2.
Fig. 3.
Fig 4.
a
b
c

PLATE II.



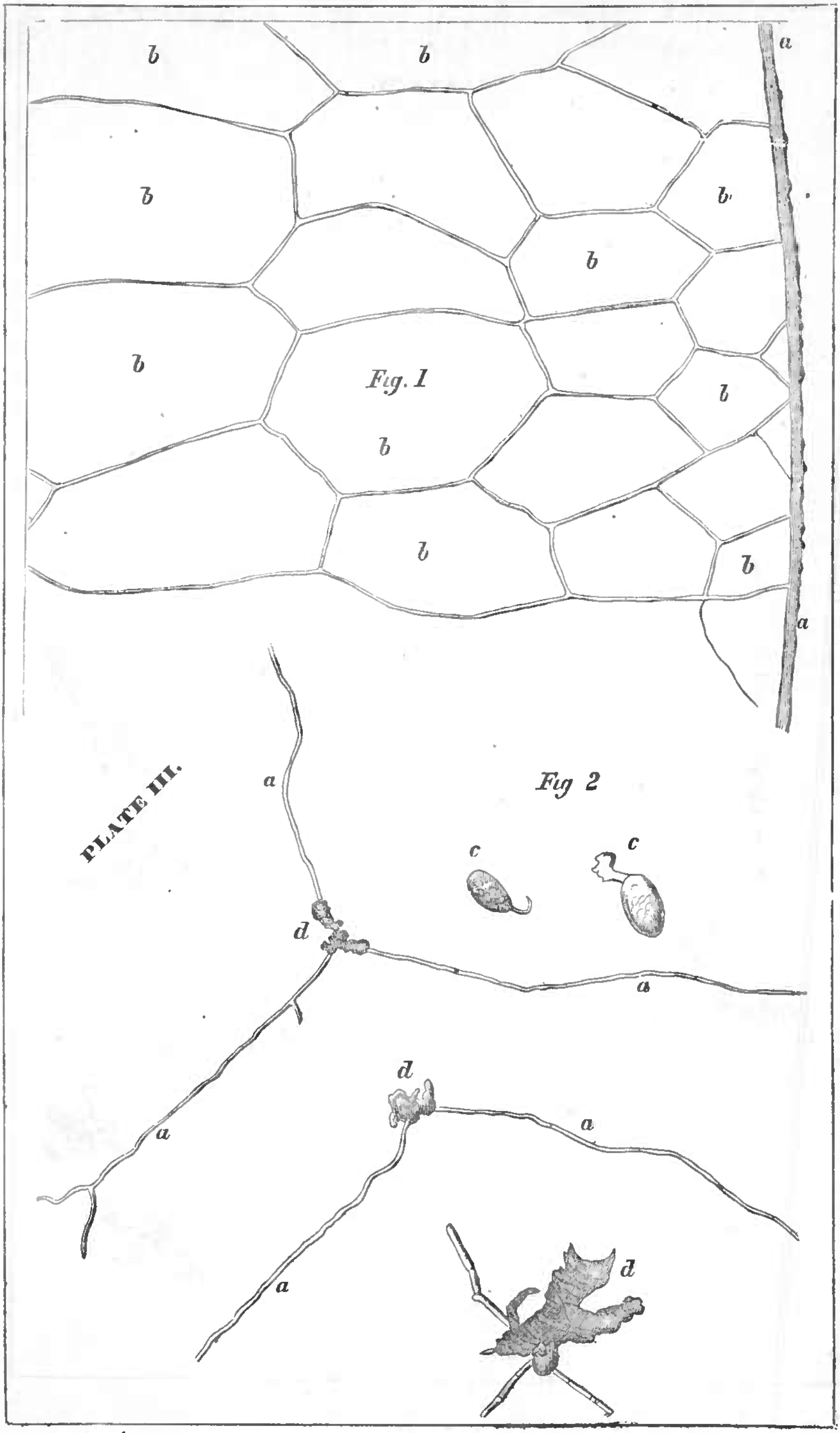
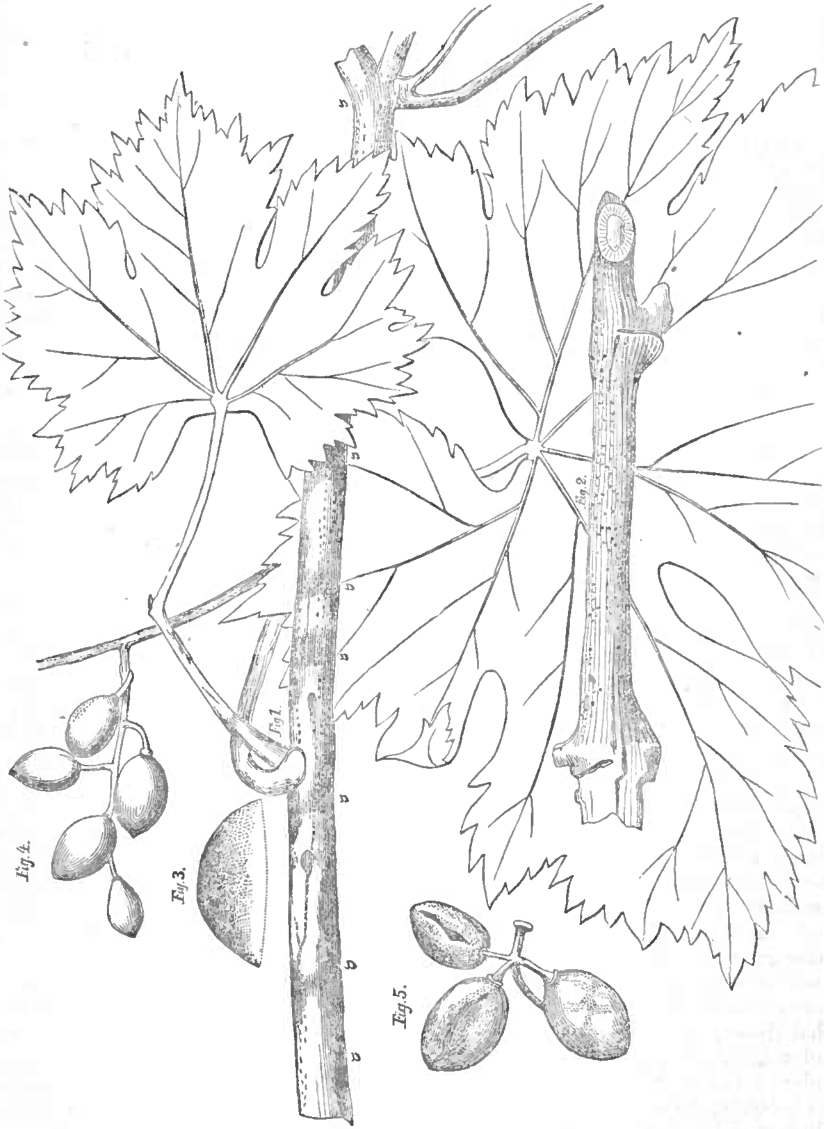

b
b
a
b
b
b
b
Fig. 1
b
b
b
b
b
a
PLATE III.
Fig 2
a
c
c
d
a
a
d
a
a
d

PLATE IV.



MADDER.

BY J. R. DODGE, DEPARTMENT OF AGRICULTURE.

INQUIRY has been made in different sections of the country for practical information concerning madder, its qualities, habits of growth, culture, and preparation for market. Petitions to Congress have been submitted upon the same subject, and congressional inquiry has been directed to it. While it is not deemed a very promising crop for American farmers generally, at present prices of labor, it is thought worthy of a brief treatise, for it is quite possible, in central or southern States, near towns having available supplies of labor at the precise time required, that the crop may be cultivated to advantage, especially with the use of improved economic modes of culture and labor-saving machines.

PROPERTIES AND USES.

Madder (*Rubia tinctoria*) has long been cultivated for the dye extracted from its roots. The Greeks and Romans used it two thousand years ago. It was called *rubia* by the Romans, and by several different names by the Greeks, one of which, *værantia,* has given the French word *garance,* by which the plant is distinguished in France. One of its extracts, peculiar to that country, is largely imported into this country, and called garancine.

There is a difference in the intensity of the coloring principle in madders from different localities; and, as generally stated, there are two distinct principles—*alizarine,* red, and *xanthine,* a yellow color. Some have recognized still another, *purpurine,* insoluble in water, obtained by treating the powdered root, when exhausted of its alizarine, for some hours in a hot solution of alum, with a little sulphuric or hydrochloric acid, by which a precipitate is obtained soluble in alcohol, and yielding purpurine by distillation. The primary coloring principle, *alizarine,* is obtained by mixing madder in fine powder with an equal weight of sulphuric acid, and allowing it to remain a few days until all the vegetable elements but alizarine are carbonized, when the acid is washed out with water, the residue digested with cold alcohol to dissolve fatty matters, then dissolved in boiling alcohol, from which the coloring matter is obtained by distillation. It is without smell, insipid to the taste, neutral to test papers, slightly soluble in cold water, but soluble in ether or alcohol in all proportions. The aqueous solution is of a pure rose-red color; the etherial, a golden yellow. Sulphuric acid gives a solution of a blood-red color. Xanthine, the yellow coloring matter, is soluble in water and alcohol, and sulphuric acid produces a green. It is probable, after all, that these products are all modifications of one coloring principle. It is used for coloring cotton goods mainly. It does not answer well for silks, not affording a color of sufficient brilliancy. It is very useful and convenient in calico printing, on account of the different tints obtained by the use of different mordants, including red, purple, yellow, orange yellow, and brown.

It has been shown, by analyses made by Mr. Carnes, in Lowell, Massachusetts, that the ashes of the French madder of Avignon contained 32 per cent. of carbonate of lime, while Turkey madder yielded but 18, and a Massachusetts product 23 per cent. To this fact he attributed the superiority of the Avignon madder, believing that a portion of the mineral had been mixed with the root in grinding, and holding that a similar admixture would make ours the best madder in the world, from the fact that the introduction of five per cent. of chalk into the home product had produced a result equalling the best French madder dyeing.

IMPORTS.

Twenty years ago the imports of madder were so considerable as to induce experiments in its culture and preparation. From a statement made in 1848 there was imported into New York in eighteen months from January 1, 1845, and into Boston, Philadelphia, and Baltimore, in twenty-one months from the same date, an aggregate of 16,804,715 pounds, costing $1,620,415, or about ten cents per pound.

In the statistics of the commerce and navigation division of the treasury, from which the following table is compiled, the quantity given for the first three years (though the class is not specified) is presumed to be "ground or prepared."

Statement of imports of madder into the United States from 1855 to 1864, inclusive.

Years.	Root.		Ground or prepared.		Extract.		Total.
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Dollars.
1855	....	....	10,652,548	851,979	....	....	851,979
1856	....	....	20,847,472	1,671,805	....	....	1,671,805
1857	....	....	14,113,425	1,375,472	....	....	1,375,472
1858	....	78,144	643,642	....	....	40,567	762,353
1859	....	44,138	....	2,156,403	....	152,808	2,353,349
1860	....	35,911	....	784,671	....	585,698	1,370,280
1861	9,911	806	1,543,741	174,645	392,256	96,926	*280,280
1862	248,533	17,955	6,283,822	615,713	590,992	118,451	752,119
1863	....	....	5,752,822	525,419	1,236,317	†249,867	777,802
1864	531,370	46,313	7,491,931	542,174	....	242,385	830,872
Total	....	....	....	....	....	....	11,026,311

* Including India madder. † Including extract of logwood also.

The largest portion of this importation comes from France. Holland, Belgium, and Turkey furnish much of the remainder. These prices are those of the countries from which the import comes, and represent gold values. The present quotations in New York are: Dutch, 7¼ to 8½ cents; French, 7½ to 8½ cents, in gold.

It is stated that the demand for madder is less than formerly, in proportion to the amount of manufacturing done, in consequence of the substitution of analine dyes extracted from coal-oil or petroleum; and the price has been somewhat reduced at the same time. Twenty years ago the price was about ten cents per pound. In 1864 the root was bought abroad, in gold, for eight cents seven mills, and the prepared for seven cents two mills per pound. In currency, however, in our ports it must have commanded at that time little short of twenty cents. The same fact must be taken into consideration, to some extent, in estimates of probable prices and profits in the future.

In 1865 the imports were nearly all from France, in the form of extract and garancine. Our French correspondent gives the process of making garancine at Avignon. It is first washed to separate the yellow coloring or xanthine. It is then boiled with fifty per centum of sulphuric acid at 66°, to render the fibre soluble. Again the acid is washed out, and it is pressed, dried, and ground. The water of the first washing, by fermentation and distillation, produces a very strong alcohol used in the arts.

CLIMATE AND SOIL.

A mild climate is essential to the best growth and highest development of its peculiar properties; yet it is cultivated throughout a wide range of climate—on the East India coasts, the shores of the Mediterranean, and upon the northern German coasts. All of our middle, southern, and western States afford a climate suitable for the culture.

A rich and deep dry soil is required, with a good proportion of humus; and if a decayed grass-sward is selected, it is all the better. If rich and deep, so that the roots may readily develop and spread, a soil inclining to sand may be better than stiffer soils. In France it is grown in all kinds of land, but in soils too dry or sandy it is said that "the root remains small, produces little, and after trituration has a very light color."

The roots, which are long and crawling, ligneous, and divided into branches, are yellowish in color and of an astringent taste. In light soils they are small and of a red orange color when dried in the air. In soft, light, rich lands they are grayish in color, but dusky red when powdered. In France the root is extensively cultivated, especially in the department of Vaucluse, where an extensive area, formerly swamps, and lightly esteemed by the proprietors, has been drained, and now commands a high price, and produces an excellent quality of madder. These lands contain a very large proportion of chalk. Undrained or badly drained soils are entirely unsuitable to its growth; and, therefore, heavy uplands, tenacious with a stiff clay, are found to be unprofitable for such a crop. River bottoms, not clayey, and especially "second bottoms," which contain a rich, light loam abounding in humus, are employed to advantage.

CULTURE IN ZEALAND.

In Zealand it is grown upon alluvial bottoms deposited by the sea, which are highly alkaline and silicious, and produce a root of yellowish color. It is propagated there by shoots or sets planted in May, in rows two feet apart. Clean culture by weeding and covering in autumn is pursued, and the roots are taken up and dried by means of stoves, and are a second time dried before being ground.

The yield in Zealand averages 2,350 pounds of powdered madder. The winter being severe, the roots are oftentimes taken up at eighteen months' old. The product is less in such case, but the risk and trouble of a second wintering is avoided.

CULTURE IN FRANCE.

In the French department of Vaucluse it is grown from seed in a chalky alluvial deposit, and is sown in beds five or six feet wide, with a space of eighteen inches between the beds. In November of the first year, the young plants are covered two or three inches with earth taken from between the beds. In the second and third years the beds are carefully weeded, and the foliage cut for forage when in flower. The roots are dug in August or September of the third year, and simply cleaned if the earth is dry, but washed if so damp as to adhere. In digging, the earth is loosened by a spade or fork, and the roots are drawn, piled, dried in the open air, and packed in bales.

The Department of Agriculture has received, through the courtesy of the Secretary of State, several communications relative to the French mode of culture, forwarded by Consul Geo. W. Van Horne, from Marseilles, prepared by practical operators of that vicinity.

From one of these communications—that of Mons. A. de Speyr, of Avignon—the following extracts are made, detailing the experience of many years in the cultivation of madder in the department of Vaucluse:

"Composition of the best soils:

Sand	40.8
Lime	2.3
Clay	53.5
Humus	3.4
	100

"Of an inferior quality:

Sand	22
Lime	3.5
Clay	73
Humus	1.5
	100

"*Seed.*—The seed should be perfectly dry and free from fermentation. The seed of the paluds is much better than that of the roses. One may preserve it in a good state for two years by keeping it in a dry place and subjecting it to a thorough ventilation.

"*Sowing.*—A ridge of eight or nine inches wide and one and a half inch deep is made with a spade and sowed. At a distance of two inches another ridge, of the same size, is run, having care to cover the seed of the first ridge with the earth taken from the second, and so on to the completion of the third ridge. These three ridges form a platband about three feet wide, separated from each other by a space one and a half feet in width, left as a path for the laborer in weeding. From this path also is taken the earth to cover the plants in autumn, when the leaves are dead. For the sake of economy these paths are sometimes planted with potatoes, beets, &c., but each extra plant should be put far apart.

"If the earth is well pulverized, instead of the seed being sown, one had better plant roots of the preceding year's growth, as crops obtained from the plants display much finer roots than when raised directly from the seed. But if the ground is not friable, but hard and clayey, the plants would not grow well, and possibly would not take at all. In this case seed must be sown. An acre of madder produces seed sufficient for three or four acres of sowing.

"*Transplanting.*—For the transplanting of roots, as indicated above, ridges, about three feet wide and three inches deep, are made, and the roots laid therein just free from each other; and between these ridges an uncultivated space is left, as in sowing.

"*Weeding.*—The seed is sown, or the roots transplanted, in March, and great care must be observed in keeping the land free from weeds; the paths, also, being attended to in this respect.

"*Irrigation.*—When the land is dry, from drought, it will be necessary to water it by irrigating the intermediate paths, if possible. Slimy water is preferable to clear water for this purpose.

"*Covering.*—In autumn, when the plants lose their verdure and turn to a grayish tint, they must be covered with one and a half or two inches of earth taken from the paths. In the following spring the clods must be broken with a rake.

"*Digging.*—The madder cultivated in strong, dry soils may be removed in three years, and from wet lands in eighteen months. Thus the madder of the mountain requires three years to mature well, while the paluds may be dug in from one and a half to three years. The roots should not be extracted until the seed has been produced. Some cultivators, who are pressed for the moneyed results of their labors, do not wait for the seed; but the madder thus prematurely gathered is of an inferior quality.

"The ramifications of the stalk are first cut, dried, and threshed for the seed; the straw, or refuse, is saved as fodder for cattle. The roots are then dug with the spade or fork, and as their length will average one and a half feet, it can be seen that their removal leaves the land in a prepared state for some other crop.

"*Drying.*—When dug they are spread on the aire, (usually a level spot of ground paved with brick,) where they are dried by the action of the sun and air. When the larger roots may be easily broken, they should be heaped up, so that the smaller tips *(pettis couts)* may become thoroughly dry. Care must be taken that this place be free from dampness.

"*Trituration.*—When the roots are sufficiently dry they are embaled and sent to the manufacturers, where they are stored in a well-ventilated granary. It is taken from the granary in proportion to each day's demand, and, having caused it to lose 15 to 16 per cent. of water in a drying oven, it is passed under a large mill-stone and ground to powder. The bolters keep the coarser portion for a second grinding."

The following are extracts from the statement (recently received) of Messrs. Imer Brothers and Leenhardt, relative to the expenses of cultivation in the district about Marseilles:

Expenses per hectare (two and a half acres) by manual labor.

FIRST YEAR.

	Soft soil, (paluds.)	Compact soil.
Days in winter for breaking or ploughing	44 at frs. 2 = 88.00	90 at frs. 2 = 180.00
Manure, (dung,) wagons of	22 at frs. 20 = 440.00	22 at frs. 20 = 440.00
Carting	22 at frs. 6 = 132.00	22 at frs. 6 = 132.00
Seed, kils	85 at frs. 4 = 34.00	34.00
Sowing, days' work of men and women	8 at frs. 3 = 24.00	24.00
Weeding, days' work of women	66 at frs. 1 = 66.00	66.00
Covering in summer three times	34.00	34.00
Covering in winter, fixed price	24.75	24.75
Rent of land	165.00	132.00
	1,031.75	1,090.75
Interest at 10 per cent	103.17	109.00
	1,134.92	1,199.75

SECOND YEAR.

Weeding	Frs. 22.00	Frs. 22.00
Covering, one in summer	12.00	12.00
Covering for winter	24.75	24.75
Rent of land	165.00	132.00
	223.75	190.75
Interest	22.37	19.07
Interest first year	101.62	104.75
	347.74	314.57

THIRD YEAR.

Harvest, days' work	165 at frs. 5 = 645.00	244 at frs. 3 = 732.00
Drying and packing, quintals, 110 lbs	77 at frs. 1.58 = 121.66	55 at frs. = 86.90
Rent of land	165.00	132.00
	781.66	950.90
Int. of capital of first year for six months	51.58	54.50
Interest of capital of second year	11.18	9.53
	844.42	1,014.93

RECAPITULATION.

	Soft soil, (paluds.)		Compact soil.	
	Francs.	*Dollars.*	*Francs.*	*Dollars.*
First year	1,134.92	217 90	1,199.75	230 35
Second year	347.74	66 75	314.57	60 39
Third year	844.42	162 12	1,014.93	194 08
	2,327.08	446 78	2,529.25	485 62
Cost per quintal, (110 lbs)	30.32	5 82	45.99	8 83

"It is found, in taking a piece of ground of great firmness and of a productiveness of 33 quintaux of root per hectare, that the expense will amount to only 30.40 francs per quintal, (110 pounds;) whilst in lands of less tenacity there will be a yield, say, of 55 quintaux, which would reduce the cost of the first crop to 15 francs the quintal."

ITS CULTURE IN THIS COUNTRY.

The plant is found to be very hardy in this country, is entirely exempt from injury by insects, and not liable to suffer from drought in deep soils after the first season. Twenty years ago it was produced to some extent in some portions of the country, especially in Ohio. Some of the most successful cultivators reported a product of 2,000 pounds per acre. A Mr. Joseph Swift, of Birmingham, Erie county, Ohio, for several years engaged in its production, with profitable results for a time at least. The following is a statement of one of his crops, as reported originally by Mr. M. B. Bateham:

By 2,000 pounds of madder, at 15 cents per pound		$300 00
Contra.—To 100 days' work, at 75 cents	$75 00	
To use of land four years, at $4 per acre	16 00	
To grinding, packing, &c	9 00	
		100 00
Leaving a profit of		200 00

Its cultivators have sometimes met with loss from drought soon after planting. The great length of time required for maturing the crop has been a great drawback to its cultivation, especially if coupled with ill success through drought in starting a plantation.

The soil in which the Ohio experiments were made was in most cases river bottom, not wet or liable to overflow. Good strong upland, not clayey enough to bake hard, was thought to be almost as good, and a soil impregnated with lime was found to produce the best quality.

The land was ridged up in the autumn, and in the spring received a dressing of barn-yard manure, sometimes with leaf mould or decomposed muck in the case of uplands, previous to ploughing and harrowing. For planting, light, straight furrows were made, eight feet apart, and the roots were laid lengthwise one foot apart and covered to the depth of two inches. Ten bushels of sets were sufficient for one acre.

A cultivator was employed between the rows, with hoes along the rows as soon as the plants made their appearance, and such cultivation was continued at such intervals as to keep the surface free from weeds. The more thorough in this respect, the less labor was needed the next season.

Vacancies were filled up by lifting and dividing some of the stronger roots, when the plants were well rooted, in May or June. When twelve or fifteen inches high, the tops were bent down on each side and covered with earth, excepting the tip. This operation was continued whenever the new shoots had attained the same height as before, until the entire space between the rows was filled, with the exception of a space of two feet in the middle, which was kept clean and mellow by a single plough. This process of layering filled the whole space with roots, and left no necessity for culture the second year, with the exception of weeding and ploughing the middles. But the tops were bent down and covered to fill closely the remaining space, until it became difficult to get dirt in the ditches with which to cover. Care was exercised to keep the edges of the bed as high as the centre, to prevent the too rapid drainage of water and the danger from drought.

Washing and drying.—The roots were washed in some running stream. If none was near, they were washed in large sieves, the wire as fine as that of wheat sieves, half a bushel at a time, the roots being carefully pulled apart while washing. Two hands could thus wash 125 to 150 bushels per day. They were then spread on platforms made of tight boards, making a layer of roots four inches in depth upon each, and dried in the sun, the platforms being set up so as to incline towards the south. Five or six days of dry weather, with protection from dews at night, was found sufficient to cure it. Subsequently it was kiln-dried and ground.

Kiln-drying.—The following plan was recommended and adopted in these Ohio experiments, by which the drying was accomplished in ten or twelve hours: "Place four strong posts in the ground, twelve feet apart one way and eighteen the other; the front two fourteen feet high and the other eighteen; put girths across the bottom, middle, and top, and nail boards perpendicularly on the outside, as for a common barn. The boards must be well seasoned, and all cracks or holes should be plastered or otherwise stopped up. Make a shed roof of common boards; in the inside put upright standards about five feet apart, with cross-pieces to support the scaffolding; the first cross-pieces to be four feet from the floor, the next two feet higher, and so on to the top. On these cross-pieces lay small poles about six feet long and two inches thick, four or five inches apart. On these scaffolds the madder is to be spread eight or nine inches thick. A floor is laid at the bottom to keep all dry and clean. When the kiln is filled, take six or eight small kettles or hand-furnaces and place them four or five inches apart on the floor, (first securing it from fire with bricks or stones,) and make fires in them with charcoal, being careful not to make any of the fires so large as to scorch the madder over them. A person must be in constant attendance to watch and replenish the fires; (but he should be cautioned not to remain long inside, as the gas from charcoal fires is liable to cause suffocation.)"

Breaking and grinding.—The roots, which are brittle when dry, were broken by threshing with flails, or passing through a bark mill or other crusher. They were ground immediately after kiln-drying; otherwise they would gather dampness. After crushing, the grinding was done in a common grist-mill. It was then packed in vessels, like flour, and was ready for market.

So far as I have been able to ascertain, the culture of madder is not carried on to any extent in this country at the present time. We have a suitable climate and productive soils. The greatest obstacle to success with it seems to be the high price of agricultural labor and the scarcity of casual or irregular labor, which renders it difficult to obtain help at the precise season when required. Another reason is found in the proverbial disinclination of our people to agricultural or any other species of productive industry which requires three years to secure returns. It seems to be a remunerative crop, if it can be produced under favorable circumstances. By the selection of a proper soil and a very favorable climate, (perhaps in the southern States or in California, where its constant growth might produce an excessive yield with labor of German women or children, or Chinamen,) with system and labor-saving appliances in cultivating and preparing it, a profitable result might be secured. It is very proper and highly desirable that a fair and persistent trial should be made to overcome the difficulties which have interfered with the enterprise thus far.

If there are those who would make another effort at the present time, let them choose a southern or southwestern aspect, and select a deep, rich, sandy, and calcareous loam, free from all weeds. Let it be ploughed early in the autumn, and again turned up into ridges before the winter frosts set in, so that the soil may be finely pulverized in spring, when the beds are prepared and the sets planted. The ground should be dry before planting.

As a preparation for planting, the soil should be thoroughly and deeply pulverized, and well-rotted manure well incorporated with it. The sets, taken from plantations two or three years old, should have roots four or five inches long. The roots should be dipped in a thin paste of fine rich earth and water, and set with a dibble, leaving the crown above the surface and the earth properly compacted about the roots. During the summer months clean culture is required, with hoe or cultivator, or, while the plants are young, with a light plough; and in the autumn, after the tops decay, the plants should be earthed up for the winter, as a protection against frost.

The following extract from a note received from Mr. M. B. Bateham, of Columbus, Ohio, fomerly edirtor of the Ohio Cultivator, corroborates the views herein expressed:

"I believe the business has been entirely discontinued in Ohio, and I have no knowledge of its being practiced in any other State. The reasons for this are not from any lack of adaptedness of soil or climate, but simply because the business requires *much labor*, which must be done by hand, and can only be carried on to advantage near large towns, where Germans or other cheap laborers can be readily obtained at special times when wanted. This was the cause of the abandonment of the business by Mr. Swift and others who have tried it in Ohio. My own experiment, near Columbus, was on soil found unsuited to the purpose. It was too rich and clayey, (alluvial river bottom.) Good sandy alluvium is found well adapted to this crop. For the past few years the price of labor has been too high to encourage any one to engage in madder growing."

CHINA GRASS.

BY J. R. DODGE, DEPARTMENT OF AGRICULTURE.

The China grass of the East is attaining importance in the commercial and manufacturing circles of Europe. Specimens of the plant in the garden of the department, and of its fibre in the museum, have attracted much attention, and require a brief mention in this report.

It is a member of the nettle tribe, the *Bœhmeria nivea*, formerly known as *Urtica nivea*. It is called "*tchou-ma*" in China. A variety in Sumatra, the *Bœhmeria tenacissima*, (of Roxburgh,) is known as rami, kalmoi, or calloee hemp. The *rhea*, of Assam, is the same plant. It is understood that these two varieties (*B. nivea* and *B. tenacissima*) are distinct, though their fibre is very similar, and for all practical purposes identical.

Other nettles produce a good fibre. The *Bœhmeria puya*, of India, yields a fibre having a commercial value nearly equal to the *B. nivea*. *Urtica heterophylla*, or the Nilgiri nettle, which abounds among the Nilgiri hills and other parts of India, produces what is known as "vegetable wool," which commands £80, or $400, per ton in England.

A specimen of very strong fibre, from a variety of nettle found in Minnesota, has been received at the department, but the accompanying fragments of the plant were in a condition too imperfect to identify its botanical classification. It was sent by S. W. Pond, of Shakopee, Minnesota, who represented it as a comparatively abundant wild product of that vicinity.

It is a plant very susceptible of cultivation and propagation, in various modes, increasing readily by seed and suckers. Its growth is rapid and luxuriant, vieing in vigor with the rankest tropical weeds. It thrives in a moist climate, but is not very particular as to soils. P. L. Simmonds, editor of the Technologist, says of it: "So rapid is the growth of this plant, that, by careful observation, the colonial botanist of Jamaica found one of its shoots attain the height of six and a half feet in fourteen days, and ultimately eight and a half feet; but in good land it would exceed this by two feet, while in China and the East Indies, where it is highly cultivated, eight feet is the height mentioned it now makes, from which fibre six feet long is obtained."

Bœhmeria tenacissima was brought into Calcutta from Bencoolen, in 1803, by Dr. Roxburgh, and cultivated in the botanic garden, under his direction, for several years. Its cultivation was so extended that, in 1814, specimens of its fibre, sent to England, were experimented upon, with so favorable a result, as to strength and other valuable qualities, that the Society for the Encouragement of Arts and Manufactures awarded a silver medal to Captain Joseph Cotton, of the East India Company, for its introduction. A practical difficulty arose to prevent its immediate use for textile purposes. The processes employed in the preparation of flax and hemp and other common fibres were found entirely inapplicable to the reduction of nettle fibre. Of course the primitive and wasteful mode practiced by the natives—scraping by hand—was not to be considered. The practice of the Todawars, who previously boil the stems in water, or of the Malays, who steep the stems in water for ten or twelve days, was sufficiently effective for the requirements of Asiatic manufacture, but useless in the manufactories of civilized nations. Maceration was tried, but it was ascertained that the fibre itself was destroyed more easily than the glutinous matter that cemented it together. Several machines, intended to break the unretted stems, were originated, tested, and abandoned during the forty years that followed its introduction. A patent was obtained, in 1849, by L. W. Wright & Co., for a process for preparing this fibre, which removed, to a great extent, the practical difficulties preventing its use. It consists of an ingenious arrangement for boiling the stems in an alkaline solution, after steeping twenty-four hours in cold water, and twenty-four hours longer in water of a temperature of 90°. The fibre is then thoroughly washed in pure water, and then subjected to the action of a current of high-pressure steam till nearly dry.

Considerable quantities of "China grass" are now imported into England, and a new impetus has been given to trade by recent successes in attempts to perfect the processes of its manufacture. Beautiful specimens of China grass goods were exhibited at the international exhibitions of 1851 and 1862. Samples of the various beautiful products of this fibre have recently been received from the most successful of its manufacturers, Messrs. Joseph Wade & Sons, Bradford, England, and may be examined at the museum of the department. The following correspondence of the State Department, promptly forwarded to this office by Mr. Seward, illustrates clearly the present condition of this interesting manufacture:

UNITED STATES CONSULATE, SHEFFIELD AND BRADFORD,
At Bradford, December 16, 1865.

SIR: I have the honor to transmit herewith a report from Mr. McClintock, vice-consul at Bradford, embodying some interesting facts in relation to the manufacture at this place of the "China grass," so called, by Messrs. Joseph Wade & Sons.

The Messrs. Wade have been experimenting with this vegetable production during the last seven years, and have now brought its manufacture to a considerable degree of perfection. Many other persons have attempted the same thing, but have all, with perhaps one exception, been unsuccessful.

The grass is said to be produced in considerable quantities in China, but the continuance of the civil war in that country has interfered with its production, and it now sells in London at the rate of eighty pounds per ton.

It is believed that many parts of the United States are favorable for its growth, especially the cotton-growing States, and perhaps Kentucky, Maryland, Missouri, and other States lying in nearly the same latitude.

I presume that the consul general at Shanghai will, if application be made to him, be able to communicate full information in regard to its culture, and thus be instrumental in introducing into the United States a very valuable production.

I will forward to the department the small case of samples referred to in Mr. McClintock's report.

I have the honor to remain, sir, your obedient servant,

GEORGE J. ABBOT,
United States Consul

Hon. F. W. SEWARD,
Assistant Secretary of State.

CONSULATE OF THE UNITED STATES,
Bradford, December 15, 1865.

SIR: Upon your last visit to Bradford you expressed a wish for further information concerning the successful manufacture of the so-called "China grass" at this place. In accordance with this desire, and concurring with you in the belief that there is at present a most auspicious opening for the introduction into the United States of that valuable production, with a view to its culture upon a very large scale, I beg, through you, to call the attention of our government and people to some of the facts and arguments which seem to render its early introduction so desirable.

The Chinese have for centuries made, by hand-labor, various descriptions of "grass cloth," well known in America and Europe, and often of great strength and beauty, from the fibre of *Bœhmeria cordata*, or *Urtica nivea*, known to commerce as China grass. Large quantities of the grass have, at various times, been brought over to England, and probably also to the United States, in the hope of finding a market among the dry goods manufacturers, who are always on the lookout for new materials; but it has hitherto been, and is even now, found impossible to produce a true "grass cloth" by machinery. The fibre is rather brittle, though very strong, and it is found that the China grass cloth of commerce is only to be woven by hand-labor, in which, of course, the Chinese themselves are beyond the reach of competition.

Large quantities of the grass have therefore been in store in London and elsewhere for years. Some enterprising manufacturer would occasionally purchase a few tons with which to make experiments, but the only result, for a long time, was that he who experimented the most lost the most. Thousands and even tens of thousands of pounds were sunk by one and another, who each fancied for a time that he had discovered the true method for working up this intractable substance. Whether it was tried in the United States or not, I do not know; but the concurrent testimony of my American friends in the trade is that no one is now successfully working it at home.

Within two or three years past, however, several firms in this neighborhood, especially Messrs. Wade & Sons, of Bradford, and a company at Wakefield, have succeeded, by chemical means, in bringing the fibre into a state most closely resembling the best mohair, or other bright worsted, and have worked up great quantities of the refined material, as a substitute for worsted, in many kinds of stuff goods; always, however, in combination with cotton, (the warp being cotton and the weft of the China grass,) as they have not yet been able to work it properly alone.

The manufacture of worsted goods (that is, of goods made of long-staple wool, as distinguished from short-staple or ordinary wool) has become an immense trade, of which Bradford has, at present, almost a monopoly, although the manufacture has lately been extending in many parts of New England. Four-fifths of these goods are of mixed material—that is, are made with cotton warps. And for many articles of the kind, especially for those requiring a stiff, strong, and cool texture, combined with a glossy, silky appearance, it is found that the prepared China grass makes the very best material.

Of course the grass manufacture is yet in very few hands, of which Messrs. Wade are the most important; but its development already, even within the last few months, has been signally rapid. The market value of the raw material has, for some years past, maintained itself at the very high rate of about eighty pounds per ton, which price, it is supposed, cannot be much lessened for many years to come. Two things are certain in this respect: one, that there is now, and will be, here a practically limitless market for all the raw grass that can be imported, at from £70 to £80 per ton; the other, that under any fluctuations of the market, the material is intrinsically so valuable that it will always, in the future, command a price as high as that of cotton, and nearly or quite as high as that of worsted itself, if not even higher.

Here, then, is a great and rapidly increasing market for a certain vegetable production at a very high price. In America we have, on the other hand, vast tracts of country, which being in the same latitude and with very much the same climate as those districts of China of which the grass is native, we should be able to grow this production to great advantage. Why not, then, introduce its culture? I submit that these facts constitute a *prima facie* case for the very serious consideration both of the Agricultural Department at Washington and of our enterprising planters and farmers throughout the south.

Messrs. Wade, who have, by the way, been firm friends of our government throughout the recent rebellion, have very kindly consented to furnish me, for transmission to the United States, with a small collection of samples of the China grass in its various stages of preparation, and also of some of the varieties of cloth prepared from it. As soon as they have it in readiness, I shall have great pleasure in forwarding them, with an explanatory list. If possible, also, I shall try to secure a small quantity of the seed.

It seems certain that the manufacture of the grass fibre will be established in our country at no distant day; but in the mean time there is a market in England for all that we can conveniently grow. It is for our planters simply a question of experiment with the seed, having in view the market price of the raw product. Successful experiments have been made very recently in Java and in India, proving that the grass will grow in any climate warm enough for the culture of cotton and sugar, provided the ground chosen be sufficiently moist.

I venture to suggest that further information, as well as quantities of the seed, &c., can doubtless be furnished by our consular officers in China, especially, perhaps, by the consul at Hankow, that place being the chief market for the grass, which is brought thither from the interior, and often from a great distance.

I have the honor to be, sir, most respectfully, your obedient servant,

EMORY McCLINTOCK,
United States Vice-Consul.

GEORGE J. ABBOT, Esq.,
United States Consul, Sheffield and Bradford.

The samples sent by the Messrs. Wade are in greater variety and perfection than any others received at the museum, where they can be examined by manufacturers and farmers. They include the following items: The crude "grass," as imported; fibre in its first stage of preparation; fibre dressed and bleached, in lengths of twelve inches or more, very fine, silky, and lustrous; tufts from the dresser; noils, or short fibre, broken from the long filaments; "slivers" from tufts of dressed fibre, beautifully colored in blue, violet, &c.; worsted yarns, of fibre, silk, and wool, both pure white and a line of delicately mottled samples; grass goods, fibre and wool weft and cotton warp, of the styles known as poplins and mozambiques, of plain lavender and delicate purple and green shades, and in plaids and checks of different styles and colors. These goods are lustrous as silk, delicate in texture, and of great strength. They exhibit a triumph of art in textile fabrication which reflects distinguished credit on the patient and persevering manufacturers who have achieved it and added to the wealth of the world by utilizing an abundant and otherwise comparatively useless product of nature.

Among the specimens of textile fibre submitted to the flax commission recently working under the auspices of this department, "were specimens of cloth, China grass and wool mixed, specimens of raising, specimens of dyeing China grass, very beautiful products." The report of the commission further describes these products: "The fibres of their material are made up of very long cells, which would be ruptured in any attempts to cottonize it, and it should be used as long line. The specimens of cloth presented, in which this fibre was combined with wool, were very beautiful." Dr. Geo. C. Shaeffer, of the bureau of patents, attributes the great strength of the fibre, which is found to be much greater than that of hemp, to the fact that it has fewer breaks of uninterrupted continuity than any other. He says: "The character of the single cells is as follows: In diameter, they exceed those of fine flax, of which, however, many are required to make line of equal length. In cross section they are irregular, and the greatest diameter is found sometimes in one direction, sometimes in another, somewhat after the manner of cotton. This gives them an advantage in spinning, furnishing a better hold of the fibres upon others than if circular in section. It is said that specimens of the oriental fabric have been examined, in which the thread was untwisted, being made up of long filaments joined end to end by some glue or cement."

The *Bœhmeria* was introduced into the United States botanical garden in 1855. It was cultivated to some extent, with reference to testing the possibility of acclimatizing it in the southern States. It has not been ascertained whether such tests were actually and satisfactorily made. It is at present growing in the garden of this department from seed received from China in 1865. It proves too tender to withstand the frosts of this climate. The latitude of the Potomac is evidently its northern limit. The plant grows here very freely during the summer, and attains full size and maturity, but the roots are liable to be destroyed during winter. Experiments will be made to ascertain whether this plant cannot be cultivated advantageously by storing its roots during winter, and planting annually, as is done with many similar plants.

In China, a light sandy soil in a convenient location for irrigation is selected for its culture. Beds four feet in width are pulverized well, pressed down and rolled smooth, afterwards watered and raked again before sowing the seed, which are sprinkled on the surface, in combination with four or five parts of moist earth to one of seed, but not covered with soil. Light mats protect the seeds during germination, and the young plants where the sun's rays are most powerful. The mats are kept wet, and are removed at night.

The beds are kept clear of weeds, and the plants, when two inches high, are transferred to a stiffer soil, placed four inches apart, excluded from the light and air, and well watered and hoed. The watering is repeated every two days. After transplanting, the plants are covered with fresh horse or cow manure. They soon throw out their new shoots, which may be removed and planted elsewhere. This mode of propagation, and that of covering, are often successfully adopted. The roots, which are fleshy tubers, multiply and intertwine, and make replanting necessary in a few years.

The seed is sown in February, and the first cutting is made in June. The harvest is gathered three times during the season, at intervals of two months. The second crop is of rapid growth and of finer quality than the first or third. The stems are cut soon after new shoots put forth from the root stock. These shoots then grow vigorously and constitute the next crop. The seeds are yielded by the main shoots, are gathered in October, dried in the sun, mixed with damp sand, and covered with straw to keep them from the frost. Before they are used they are tested in water, and those that do not sink are thrown out as useless. The best seeds are in color a spotted black.

The mode of preparation in China is thus given in Warden's "Linen Trade, Ancient and Modern:"

"The first year, when the plants are a foot high, they are gathered, and the fibres of the cut straw are fit for spinning. The *tchou-ma* or China grass may be gathered three times a year, and when the stems are cut the little shoots springing up from the root stock should be about an inch high. After the large stems are cut the suckers spring up with more vigor, and soon furnish a second crop. The seed should be sown in February; within four months the first crop may be reaped; two months thereafter the second is ready, and in other two months the third and last crop may be cut. The stems of the second crop grow faster than the others, and yield the finest quality of fibre. After reaping the crop the stocks must be covered with manure, and immediately watered.

"The stems are split longitudinally with knives, the bark being first removed; then the lower layer is scraped off, and the under leaves are displayed and removed by boiling in water. The first layer is coarse and hard, and only fit for common materials; the second is finer and more pliable, and the third is the best, and is used for the finest purposes. After peeling the fibres they are tied in skeins, steeped for a night in a pan of water, and then dried. They are then again steeped in water containing ashes of burnt mulberry wood, then in water and chalk, and then boiled in water containing straw, which makes them white and supple. They are then dried in the sun, again boiled in pure water, washed, and once more dried in the sun, after which they are joined end to end and spun on a wheel, and the long threads thus formed make the warp and woof of the cloth to be manufactured. Others prepare the stems by boiling in lime water, and washing, &c.; others by wetting with dew at night, and sun-drying by day; and others by the steam of boiling water; so that the mode of softening and bleaching the fibre is not uniform."

Recent improvements in the manufacture of this fibre, as seen in specimens received from individuals in this country and Great Britain, have excited considerable interest, and elicited inquiry; in fact, the subject came before the Senate of the United States, in connexion with a letter (enclosing samples of goods) of Mr. William H. Richards, of Boston, and a resolution was adopted calling upon the Senate Committee on Agriculture to "investigate the subject of procuring the seed and cultivating the 'China grass.'"

It is to be hoped that manufacturers will continue their attempts to perfect and extend this manufacture, and that farmers, if the effort to acclimatize is successful, will, especially in the south, test the capabilities of our soils and climate for the extensive production of this fibre as a material for manufactures.

ALSIKE CLOVER.

[Translated from the "Hand-Book of Swedish Agriculture," by J. ARRHENIUS, Secretary to the Royal Academy of Agriculture, and late Superintendent of the Ultuna Agricultural Institute.]

ALSIKE CLOVER (*trifolium hybridum*) is a pale red perennial species of clover, which, mixed with grass, is cultivated with great advantage on permanent grass land, whether employed for pasture or mowing. This species of clover thrives best on marly clay with a somewhat moist bottom.

Alsike clover has obtained its name from the parish of Alsike, in Upland, where it was first discovered, and where it grows in the greatest abundance in every field ditch. Besides this, it is found wild with us from Skane up to Helsingland, and also in Norway and Finland, where, on fallow land, we have seen it growing luxuriantly. This species of clover is consequently native to our country, and proves itself, both here and in the border countries, to be a hardy plant, especially adapted to cultivation in our rigorous climate. It was not until the beginning of the present century that this species of clover was cultivated by us, and in 1834 it was introduced into England by Mr. George Stephens, under the name of *Alsike clover*. Both by this name, as well as by that of *Swedish clover*, it is now known not only in England and Scotland, but also in Denmark, Germany, and France, into which countries it is now annually imported from Sweden.

This species of clover has pale red flowers, a somewhat lank stalk, and oval obtuse leaves, which are less and of a lighter green than those of red clover. The flower-head, growing from the upper leaf joint, is globular, and formed of fragrant blossoms supported by stems. These blossoms are at first whitish and upright, and subsequently of a pale red, which, when the flowering has passed, become brown and somewhat bent. The calyx is smooth, and its tags of equal length. The seed pods, containing three or four grains of seed, extend out of the calyx, surrounded by the withered crown. The seed is much less than that of red clover, is in the form of a kidney, and dark green or verging somewhat towards violet. Yellow green seed of this plant is not ripe.

Alsike clover does not attain its full luxuriance until the second or third year after it has been sown, and during the first year seldom arrives at any great degree of growth. It is therefore best adapted to mixture with grass, for permanent grass land. It yields, on suitable and fruitful soil, rich and good fodder. It loves clayey soil, especially marly clay, with a somewhat moist position; but it also thrives on cultivated fens and marshes. Alsike clover grows but little after mowing, and no second crop can be expected from it, as is the case with red clover. Both in this respect, as well as in the longer time it requires before it yields a full crop, Alsike clover stands after red clover. Its great and undeniable advantage, on the other hand, lies in the fact that it is far more *hardy* than red clover, and can be cultivated on moist soil, and land that is flooded at certain times of the year, on which red clover will not grow. If Alsike clover be mixed with white clover and suitable grass, it yields rich and certain crops, and when cultivated on arable land common red clover may and should be mixed with the seed with which the field is sown, by which the great advantage is gained that, the first year after sowing, two crops of fodder may be gathered, chiefly consisting of red clover; and that the following years, in the same proportion as the red clover declines the Alsike clover appears in its place, and yields rich and certain crops, together with the grass with which it is sown.

With reference to cultivation and tending, the same prescriptions will apply, in the main, that are usually given with respect to red clover, with the addition of the following: As Alsike clover, in full vegetation, has a great tendency to lodge, it should always, when cultivated for fodder, be sown together with grass—by preference with meadow or fox-tail grass on marshy land, and with timothy grass on drier soil. The crops by this means become much richer, and the grass supports the Alsike clover, so that it does not fall down to the ground and rot.

As Alsike clover seed is not more than about half the size of red clover seed, no more than about half as much, in measure, of the former is required as of the latter, and may be sown winnowed or in its pods like red clover. Every farmer will soon learn by observation what quantity of seed is required to the acre. If he uses the unwinnowed, or seed in the pod, the quantity required is four or five times greater than if he uses the clean seed.

The quality of grass and other kinds of seed that should be mixed with Alsike clover in sowing, when it is cultivated for fodder, we will specify below. Alsike clover seed, both winnowed and unwinnowed, may be sown in the autumn, directly after the sowing of autumn grain, or in the spring. When the seed is unwinnowed it is considered best to sow it in the autumn; it may, however, also be sown in the spring on the last snow. From the time Alsike clover first began to be cultivated by us, it has been found that "the unwinnowed seed produces a stronger growth than the winnowed," which has been rightly attributed to the fact that "the tender shoot derives, in part, its first nourishment from the husks that surround the seed." (Annals of the Academy of Agriculture for the year 1819, 2d vol., p. 223.)

The yield of mixed grass and Alsike clover seed is, on good and rich soil, very considerable. Lundström (Hand Book for Farming, p. 294,) considers that it should yield, with certainty, from two to three tons per acre. At Frötuna, in Nerike, in four years, one of which was a very dry year, the average yield was nearly two tons of Alsike clover and timothy hay per acre; the largest crop, on well manured and lime strewed soil, amounted to between four and five tons per acre, (Farming Transactions, 2d vol., p. 104,) a yield that certainly cannot be expected, excepting on very rich soil and in rainy years, in which Alsike clover especially thrives and attains much greater luxuriance than in ordinary dry summers. It yields, however, in general, good and safe crops, and both in the middle of Sweden, (especially in Nerike,) as well as at several places in Upland, Gestrickland, and Helsingland, Alsike clover mixed with grass is prized as being far more reliable than red clover. Alsike clover yields, too, better and finer hay, and when ripe the stalk is not so hard as red clover.

Gathering the seed of Alsike clover demands especial care, as it is of importance to gather seed for home use; the purchase of such seed being always connected with considerable expense. In addition to this, however, the gathering of Alsike clover seed for sale may be attended with considerable profit, it being in great request in the foreign markets and fetching high prices. It is also well known that the gathering and sale of Alsike clover seed is now prosecuted on several estates as the main object, and it is desirable that the production of this seed for sale were more generally carried out, as from it might be derived a very profitable article of export.

On one estate in Sweden, where twenty acres were set apart for raising the seed, the average annual production for five years was 133 pounds per acre, while the production one year was 200 pounds per acre. When it is recollected that Alsike clover seed generally obtains in the market about double the price of the common red clover seed, it is evident that the gathering of the former seed must render a very handsome return.

Alsike clover seed is more easily threshed than red clover seed. When cultivated and threshed together, the Alsike clover seed always comes out of the pods before the red clover seed. The ripened seed-head of Alsike clover, however, falls off easier than that of red clover, and therefore in mowing Alsike clover that has been allowed to ripen, still greater care must be taken than with the seed of red clover.

The mowing of ripe Alsike clover should always be effected either early in the morning or late in the evening while it is moist with dew; otherwise the riper seed pods fall off with the best and finest seed, however carefully the mowing may be performed. The mowed Alsike clover is left lying as it falls, and is turned once or twice while moist with dew, after which it is housed when dry. In carting home canvas lining should be used in the carts, of sufficient size to cover the whole of the bottom and a part of the sides of the carts, so that those seed pods that fall off in carting may not be lost.

If Alsike clover be employed for home use, it may, as mentioned above, be used unwinnowed or winnowed, and if in such case it be mixed with the seed of red clover or timothy grass, no injury would be caused, as, for the reasons before stated, the seeds of these plants may in any case be advantageously mixed with the seed of Alsike clover. If Alsike clover seed is to be sold, and especially if it is to go abroad, it should be perfectly clean and free from admixture with other seed. Every grain of seed found amongst another kind of seed which is intended to be perfectly winnowed, must be considered as weed seed, and the worst weed in Alsike clover that is left to ripen is timothy grass. Red clover seed may be separated from Alsike clover seed by means of a fine riddle adapted to the purpose, so that the former remains while the latter passes through the riddle; but this is not the case with timothy seed, which is so fine that even in the last riddling (of which more below) it cannot be separated from the Alsike clover seed. It is therefore best in the early summer, if it be observed that the Alsike clover is mixed with timothy, to mow the timothy as soon as it has shot into the ear, provided the seed of the Alsike clover is intended for the market.

Alsike clover is threshed like red clover. The experience of the farmer will direct him to the best method of separating the seed from the pod. It may be done by passing the straw through a threshing machine, and then carefully separating it from the pods, which must be again (and perhaps more than once) passed through the machine to open them. But a better method, probably, is to thresh with the flail; for by this method the seed is disengaged from the pod and falls on the floor, instead of being blown away and often lost by the action of the machine. The pod is also more effectually and surely opened by the use of the flail.

When the seed has been winnowed on the corn sieve, it is riddled through three riddles of different degrees of fineness adapted to the purpose. The coarsest riddle is used first to separate coarse weed seed and anything else that may be mixed with the Alsike clover seed; then the second; and, lastly, the third and finest riddle. If the seed be dusty when it has passed through the last riddle, then, as a final process, it is slowly and cautiously passed through the corn sieve once more, by which means the dust is blown away.

BARLEY AND ITS USES.

BY J. M. SHAFFER, FAIRFIELD, IOWA.

Barley was cultivated in Egypt as food fifteen hundred years before the Christian era. The inspired historian records that hail was sent upon the land of Egypt as one of the plagues, and by it "the flax and the barley were smitten, for the barley was in the ear and the flax was bolled." Wheat was sown in that country in November and December, as soon as the Nile receded, and was reaped in May. Pliny says that barley is ready for the harvest six months after planting, and other grains seven months. There can be no doubt, from this early mention of barley in connexion with other cereals, that it formed no inconsiderable portion of the food of the people. A "homer of barley" is mentioned very frequently in the Bible, and contained seventy-five gallons and three pints, while the "ephah of barley" was about one-tenth the capacity of the homer.

The Israelites, under the leadership of Moses, in their forty years journeyings from Egypt to Canaan, were rebellious, and could only, it seems, be restrained from their lusts by a continuous display of signs and miracles. In the last year of their sojourn, Jehovah recounted their acts and His own, and, to incite them to faithfulness, He draws the following sublime picture of the land which was promised them for an inheritance: "A good land; a land of brooks of water, of fountains and depths that spring out of valleys and hills; a land of wheat, and barley, and vines, and fig trees, and pomegranites; a land of oil, olive, and honey; a land wherein thou shalt eat bread without scarceness; a land whose stones are iron, and out of whose hills thou mayest dig brass." Barley is here found associated with all that delights the eye, ministers to the comfort, and tends to render a country healthful, plentiful, and desirable. This, to the most unreflecting mind, is proof of its importance at that early period in the history of the race.

Twelve hundred and forty-five years before Christ, distinct mention is made of the "cake of barley." Gideon overheard, in the camp of the enemy, a comrade tell a dream how a "cake of barley bread tumbled into the host of Midian, and came unto a tent and smote it, that it fell." Doubtless a dream and its interpretation inspired of Deity to give assurance to Gideon that the

Midianites should be delivered into his hands. But it teaches, also, the historical lesson that this grain formed part of the food of the people. And this is further illustrated in Ruth's gleaning in the fields of her kinsman, and afterwards at night (because, doubtless, of the sea-breeze which sprang up at that hour) of winnowing the grain and taking the first step necessary for its conversion into food.

In Solomon's reign (B. C. 975) there is the first mention of barley being used as food for the inferior animals. The officers who had in charge the King's revenue bought "barley, also, and straw, for the horses and dromedaries." Solomon also agreed to pay Hyram, King of Tyre, among other things, twenty thousand measures of barley for labor and material furnished by his people towards the erection of the temple. When Jotham conquered the Ammonites he laid tribute upon them in silver and wheat and barley. Thus this grain was a "legal tender," both for labor and revenue, and cannot fail to illustrate the estimation in which it was held at that time.

These facts give abundant evidence that barley was most highly esteemed, forming a prominent item in the wealth and prosperity of the people. It was, 1st, an article of food for man; 2d, for the inferior animals; 3d, a measure of quantity; 4th, an element of worldly prosperity; 5th, a price for labor, and stone, and lumber; 6th, a symbol of Divine interposition in human affairs; 7th, the standard of wealth; and ever since those early times it has been cultivated among the nations of the earth, forming no small proportion of their food, and, in some instances, affording an element of commerce.

GENERAL DESCRIPTION.

There are several varieties of barley in cultivation. The most common are Hordeum Vulgare, H. Hexasticon, H. Distichon, and H. Zeoitron. The first-named is the spring barley; the second is the six-rowed barley; the third, the two-rowed barley; the fourth, the sprat or Battledore barley. They are found in commerce in several forms, depending upon the processes to which the grain has been subjected. *Scotch hulled, or pot barley*, is the grain deprived of its husk in a mill. *Pearl barley* is so called when all the integuments of the grain are removed, and they are rounded and polished. When pearl barley is ground into powder it is called *patent barley*.

COMPOSITION.

Einhof's analysis gives the following results:

The ripe seeds.

Meal	70.05
Husk	18.75
Moisture	11.20
	100.00

Barley meal.

Starch	67.18
Fibrous matter (gluten, Lignin, &c.)	7.20
Gum	4.62
Sugar	5.21
Gluten	3.52
Albumen	1.15
Phosphate of lime with albumen	0.24
Moisture	9.37
Loss	1.42
	100.00

The subjoined table, compiled by M. Payen, shows the proportions of the proximate principles of the cereal grains:

100 parts of—	Starch.	Gluten and other azotized matter.	Dextrin, glucose, &c.	Fatty matters.	Cellulose.	Silica, phosphates of lime, magnesia, and soluble salts of potash & soda.
Wheat	58. 12	22. 75	9. 50	2. 61	4. 00	3. 02
Rye	65. 65	13. 50	12. 00	2. 15	4. 10	2. 60
Barley	65. 43	13. 96	10. 00	2. 76	4. 75	3. 10
Oats	60. 54	14. 39	9. 25	5. 50	7. 06	3. 25
Maize	67. 55	12. 50	4. 00	8. 80	5. 90	1. 25
Rice	89. 15	7. 05	1. 00	. 80	3. 00	. 90

Barley is cultivated and raised in greater or less quantities in every State of the Union. This vast area, representing very different climates and every variety of soil, seems almost equally adapted to its growth. The testimony, however, is in favor of a rich, loose soil, and a careful preparation of the land before seeding. Delaware and South Carolina produced an equal quantity in 1847; so New York and Pennsylvania; so Tennessee produced nearly as much as New Hampshire. This grain will yield an average crop of twenty-three bushels per acre in any part of the country. Some extraordinary crops are recorded. A person in Cheltenham, England, in 1846, drilled in, February 4, five pecks to the acre; on the 4th of July it was harvested, and yielded fifty-two bushels and two pecks per acre, weight fifty-five and a half pounds per bushel. A gentleman, from seventeen grains, obtained 17,235 as the first product; another, from fifteen, obtained 290 ears, which yielded 20,880 grains.

The following table indicates the price of the cereals at Chicago at the times mentioned, and may serve as a commencement to the inquiry, "Is barley a profitable crop?"

	Wheat.	Corn.	Oats.	Rye.	Barley.
Sept., 1863–'4	$1 08 to $2 05	$0 76 to $1 30	$0 54 to $0 84	$0 82 to $1 50	$1 17 to $1 40

This table records the highest and lowest prices of grain from September 26th to July 1st, and only includes number one lots. The prices of number two are somewhat lower than number one. Barley seems to be liable to less fluctuation than wheat or rye. Edmund Burke, Commissioner of Patents in 1847, says: "With the exception of New York, the quantity raised in the United States would not be worth trying to ascertain. Its use is mainly for malt purposes, and the claims of temperance seem to have contributed very much to lessen the whole." It will be developed, in the course of this paper, that barley has been steadily increasing in favor as a field crop, and that the use of malt liquors has advanced with gigantic strides among the people. Thus the following statement indicates the product of barley for the several years stated in the United States: 1840, 4,038,315 bushels; 1847, 5,649,950 bushels; 1850, 5,109,054 bushels; 1860, 15,433,297 bushels; 1863, 17,754,351 bushels.

The wheat crop of 1850 was 100,485,944 bushels, and in 1860, 171,183,381 bushels, or an increase in ten years of about 70 per cent., while the increase of barley in the same period was nearly 300 per cent. The yield in the State of New York in 1847 was 3,931,000 bushels, or three-fifths of the entire product of the United States; while California produced, in 1863, 5,293,442 bushels. And it should be remembered that the crop of 1847 included all the States and Territories, while the estimate for 1863 mentions none of the Territories, and omits all the southern States except Maryland, Kentucky, and Missouri. These figures denote a wonderful increase of this grain, not surpassed, perhaps, by any of the agricultural products of the country.

The principal use of barley is in the manufacture of malt liquors. In 1860 there were returned by the United States census 970 breweries in the northern States, or more than double the number in the whole Union in 1850. The entire quantity of malt liquors was 3,235,545 barrels, with a value of $17,977,135, being more than three times the value of the same product in 1850. Compare these figures with the fact that the whole number of establishments for distilling spirituous liquors in 1860 was 1,138, producing 88,002,988 gallons, and valued at $24,253,176, and the rapid increase can be more readily understood. Again, in 1850, there were of both classes—brewers and distillers—4,854; in 1860 these had increased to 9,058, of which number 6,307 were brewers and maltsters. There are in New York 175 breweries, in Pennsylvania 172, and in California 71. The balance is distributed mostly over the middle and western States. There are but few towns of any considerable population or trade that do not have a brewery as a permanent institution. A census taken at this time would reveal a remarkable increase of the manufacture of beer over the figures returned in 1860. For example, the internal revenue from fermented liquors in the city of Chicago alone, in 1865, reached the sum of $209,959 37. These figures represent over 100,000 barrels of beer and ale sold in that city during a single year. In many small villages there is a beer shop, and beer is becoming, if it has not already reached so prominent a position, the national beverage.

The increase of the use of beer may be illustrated by the following tables, giving the product of barley in 1850, compared with 1860:

In the New England States.

		1850.	1860.
Connecticut	bushels..	19, 099	20, 813
Massachusetts	bushels..	112, 385	134, 891
Vermont	bushels..	42, 150	79, 211
Rhode Island	bushels..	18, 875	40, 993
New Hampshire	bushels..	70, 256	121, 103
Maine	bushels..	151, 731	802, 108
		414, 496	1, 199, 119

In the middle States.

		1850.	1860.
New York	bushels..	3, 585, 059	4, 186, 667
Pennsylvania	bushels..	165, 584	530, 716
New Jersey	bushels..	6, 492	24, 915
Delaware	bushels..	56	3, 646
Maryland	bushels..	745	17, 350
District of Columbia	bushels..	75	175
		3, 758, 011	4, 763, 469

In all the southern States.

	1850.	1860.
Busnels	56, 132	219, 930

In the western States.

	1850.	1860.
Illinois.......bushels..	110, 795	1, 036, 338
Indiana.......bushels..	45, 483	382, 245
Iowa.......bushels..	25, 093	467, 103
Kansas.......bushels..		4, 716
Kentucky.......bushels..	95, 343	270, 685
Michigan.......bushels..	75, 249	307, 868
Minnesota.......bushels..	1, 216	109, 668
Missouri.......bushels..	9, 631	228, 502
Ohio.......bushels..	354, 358	1, 663, 868
Nebraska.......bushels..		1, 108
	717, 168	4, 472, 101

In the Pacific States.

	1850.	1860.
Bushels	11, 516	4, 462, 376

These figures show that the "production of barley in all the States more than keeps up with the increase of population. In fact, the amount of barley raised to each person in 1860 was nearly twice as great as in 1850." Such being the case, it will not be deemed unprofitable to collect in this place, from the best writers, a general synopsis of its

HABITS AND CULTIVATION.

Barley readily accommodates itself to any climate, as has already been intimated, bearing the heat of the torrid zone and the cold of the frigid, and maturing in both with equal certainty. It is a native of Syria, as there is the best authority for its having been cultivated there more than three thousand years ago. The several varieties of two-rowed barley are distinguished from each other by the quality of the grain and the habit of early or late ripening. These differences arise from the effect of climate and situation in the growth of the plant. It is an annual, and belongs to the natural botanical order *gramineæ*, but it may be sown in the fall, when it acquires the habit of late ripening and is called fall or winter barley. At different periods particular kinds of barley have gained a great reputation on account of their supposed superior qualities, following the same history that has been recorded of divers species of wheat, oats, &c. For instance, the Chevalier barley, named from the gentleman who first brought it into notice, almost caused a mania in countries where this grain was largely cultivated. Samples of it were sold at enormous prices, and the fortunate possessor of a few acres of it was the object of much consideration. It seems that Chevalier had observed in his field an ear greatly superior to the rest. This he gathered with care and planted in his garden, until he succeeded in procuring sufficient seed to sow a field. Upon its diffusion, eminent maltsters and brewers declared that it possessed more saccharine matter than any other variety, and agriculturists regarded it as heavier in the grain and more productive. An author writes of it thus: "It is one of the greatest improvements of modern times!"

Soon after this mania subsided the Annat barley was introduced and had its supporters and admirers. This was the produce of three ears picked in a field in Perthshire, Scotland, and grown afterwards at Annat gardens, whence its name. It ripened five days earlier than common barley and two weeks earlier than the Chevalier, and was two and a half pounds per bushel heavier than the latter. It had its period of exaltation and decline, as fancy varieties of other grains have had for years.

Barley, like all other grains, is liable to smut, blight, mildew, &c., but its diseases are neither so numerous nor so fatal as those of wheat. Its insect enemies are not formidable, and the grain may be sown with perhaps more prospect of escape from injuries in this direction, and from disease, than any other. Yet Baxter, in his Library of Agricultural Knowledge, writes, "Barley is a tender plant, and is easily hurt at any stage of its growth. It is more hazardous than wheat, and is, generally speaking, raised at a greater expense." * * * "There is no grain, perhaps, more affected by soil and cultivation; the same species exhibiting opposite qualities, modified by the nature of the soil from which it is produced." * * * "Thus the finest samples, the growth of suitable and well-cultivated lands, if sown on a poor and sterile soil, become alike poor in appearance and indifferent in quality." These observations, made in England, will be verified by the experiences of barley growers in America. It is written, "The land that produces the best barley is generally of a silicious, light, dry nature, for a good mellow preparation and free soil are essential to the growth of malting barleys. Cold, wet soils, which are peculiarly retentive of moisture, are ill adapted to the growth of this grain, both in reference to its weight and its malting qualities." There is infinite variety in the composition of the soils in the vast region in which barley is grown in the United States; yet everywhere it is considered a profitable crop, and is found fit for malting, whether grown in Maine, Florida, Iowa, or California. There are no statistics accessible which give any comparative statement as to the relative weight of barley, or its relative malting qualities, as modified by soil and location. It has been asserted that very much of the barley grown in the United States would not be used in England in the manufacture of ale or beer, it being thought to lack some of the properties essential to the production of first rate malt. Precise figures are wanting to determine the exact differences, if any, which exist in barley grown in different locations.

Barley may be propagated by seed sown broadcast or in drills. The quantity varies from two and a half to five bushels per acre when sown broadcast, depending on the nature of the soil, cultivation, time of sowing, &c. In rich, mellow, well-tilled lands, the smaller quantity will answer; while on poor soils, with late sowing and indifferent tillage, a larger quantity will be found necessary. Being an early ripening grain, it should be sown early. The authority from which many of these suggestions are taken, insists that great care should be taken in the choice of seed. It should not be of a reddish color, as a great part of it will not vegetate. It should be of a pale hue, lively and uniform. The finest samples and plumpest grain should be selected, as these throw up strong, healthy stems, capable of resisting the effects of inclement seasons, and, under favorable circumstances, putting forth with great strength and vigor. The compiler of the United States census has this paragraph:

"Barley requires good cultivation. It delights in a warm, active, fertile soil. It does not do well on sod-lands. In England it is usually sown on light, sandy soils, after a crop of turnips that has been eaten on the land by sheep. The droppings of the sheep enrich the land, while the small feet of the sheep consolidate the light, porous soil. In this country it appears to flourish on heavier soils, especially if they are thoroughly pulverized. At all events, the soil must be well drained, and the crop sown in good season in the spring. Our season is so short, and the roots of barley extend, as compared with winter wheat, over such a small surface, that it is exceedingly important that the soil contain a liberal supply of plant food in an active condition."

More care is required in harvesting barley than in any other of the grain crops. It should be allowed to become ripe, but not dead ripe. It is very apt to be destroyed on account of wet weather, causing germination of the grain, and the consequent depreciation of its value as malt. Hence it should not be stacked or put in the barn unless thoroughly dry. None should be put away when the dew is upon it, as, from the softness of the stem and the tendency of the ears to vegetate, it will be heated, the spear will be destroyed, and maltsters will purchase it only for grinding, and then at greatly reduced rates. A writer in the London Field makes some suggestions from which the following are condensed: The grain must be ripe, but not "rotten-ripe," in order that it may germinate evenly. Wait until the red streaks which run longitudinally on the ripening grain disappear, the head begins to hang down, and the straw assumes a golden hue. Then cut it, and if sufficiently long tie up into small sheaves, in the event of bad weather. This better protects it from staining than if lying all about. Barley stacked loose gets into better condition than when tied up; the sweating is more uniform and the sample a shade mellower. Still the evidence is in favor of tying, and the practice is steadily gaining ground. It is also recommended to avoid threshing with a machine, as the germinating spear is bruised, and is as much injured by it as if heated in the mow. It is likewise important, on account of the fineness of the texture of the chaff, that the grain should not be thrown in very large heaps without daily examination, to prevent heating and fermentation. The necessity for all these cautions will readily appear when the process of malting is described in another part of this paper.

BARLEY AS FOOD FOR MAN.

It may be added to what has been already intimated, that the ancients—the Egyptians, Jews, and East Indians—cultivated barley for food in the earliest times. The common variety came to Europe by way of Egypt, and in Greece three kinds of barley were cultivated for food in former times. It was at one time in general demand in England as bread corn, and is even now, for this purpose, used to some extent on the continent. The bread is not especially nutritive, and has a dark color and strong savor that are not particularly pleasant. The Battledore barley furnishes an excellent meal. Pliny says that barley was the most ancient of all cereals used as food, and quotes the Hordearii—the barley men—the name given to the sword-fencers, in allusion to their allowance or pension of barley. Count Rumford, in his essay on "Feeding the Poor," regards barley meal, when used for soup, as three or four times more nutritious than wheaten flour. But a reference to the table on page 357, showing the proximate principles of the cereals, exhibits the fact that while wheat contains 22.75 parts of gluten and other azotized matters, barley contains but 13.96. Gluten contains nitrogen, and on this account has been called the vegeto-animal principle. Now it was demonstrated by Magendie, the great French physiologist, that gelatin, fibrin, albumen, when fed separately, do not have the power of nourishing animals for any length of time—they invariably waste away and die; but when they are fed on gluten alone, they thrive well and live long. It is thus conclusive that the more gluten contained in food, the greater will be its nutritive quality; and hence the nutritive equivalent of wheat is much greater than that of barley. Barley soup, in many places, forms an occasional dinner dish; but the limit of its use is very circumscribed. Barley bread is unknown to native Americans

AS FOOD FOR DOMESTIC ANIMALS.

While barley is less nutritive than wheat, it is twelve and a half per cent. more so than oats. From the earliest antiquity it has been employed as food for cattle, and after the introduction of wheat the Romans used it largely for horses. It is regarded as the best article for fattening swine, after they have been put up for that purpose. The flesh is not only more tender, but it increases on boiling. It forms excellent food for poultry. London dairymen use the growing crop in spring for pasturing cows; it comes early and increases the milk. It is a fine crop for sheep, and in England, when fed off early, as in April, it will spring up again and make a good crop in August. It is good for horses when fed in the spring—sparingly at first—and mixed with oats. As early as 1602 it was sown in Martha's Vineyard, and by the colonists of the "London Company," in Virginia, in 1611. Samples of the grain were sent to Holland from the colonists of Manhattan island, as evidence of their prosperous condition. In 1796 it was the chief agricultural product of Rhode Island. Doubtless, at that early day in our history, its uses as food for all the domestic animals were well understood. John Spring, writing from Indiana, in 1853, says: "The green grain affords an excellent pasture during winter, especially for colts and calves, as they injure the ground less by tramping than other and older stock. The straw is saved for winter feeding to cattle, and answers well for horses when cut and fed with the grain crushed into coarse meal. Barley is also valuable for hogs when ground and made into swill, and fed during the first stage of fermentation; or the grain may be soaked in water until it is fully swollen, and then fed to them. D. J. B. wrote, in 1855, (Agricultural Report,) "In Egypt, as also in all parts of the East, it has been used in an uncooked state, from time immemorial, as the common food of horses, where the use of rye and oats is unknown. However prejudiced farmers may be against it as horse food, from the belief that it is too heating to these animals when kept hard at work, they cannot avoid being convinced of its excellence in this respect, when they consider that in the countries where they are the most remarkable for their good qualities, as well as for their beauty, they eat no other kind of grain." Mr. Boardman, writing on the agriculture of Maine, in 1862, says: "When ground for feeding purposes, it is found to be a superior article for fattening hogs, and also for feeding horses, milch cows, and poultry." Authorities might be multiplied to an indefinite extent to illustrate its value as food for the domestic animals. When it is considered that barley is raised with equal facility as the other grains, that it grows luxuriously in almost every climate and soil, that its average yield per acre is greater than wheat, and, though less than oats, that it possesses relatively greater nutritive properties, that it is usually less in danger of diseases or from the depredations of insects, that it is alike applicable to all kinds of farm stock, it certainly recommends itself to a more general use in this direction.

AS A THERAPEUTIC AGENT.

Barley is recognized as officinal by the medical profession throughout the world. It contains much less of the flesh and blood making principles than wheat, and hence is useful as a demulcent and emollient for invalids in febrile cases and inflammatory disorders. In affections of the chest and urinary organs, requiring depletion and the avoidance of a stimulating regimen, it is highly and deservedly esteemed for its soothing effects. Its starch offers more resistance to the action of the gastric juice than that of wheat, and its meal is more laxative. Added to three times its weight of wheat flour, it gives an excellent quality to infants' food, the constipating effect of the former being counteracted. From the well known tendency of barley to act on the bowels, it should not be used in cases where there is diarrhœa, or in establishments where bowel complaints prevail. There are two decoctions of barley for use among the sick. Their preparation is very simple, and they will be found highly beneficial in cases indicated above.

MALT LIQUORS.

But by far the greatest proportion of the barley crop is consumed in the manufacture of malt liquors. Some figures have already been presented, exhibiting the magnitude of the increase of consumption of ale, beer, &c., in this country; also the great increase of the number of persons employed as brewers and maltsters. It may be profitable to add here a column of figures showing the value of importations of malt liquors for the years indicated:

Table of ale, beer, and porter imported into the United States.

1851	$241, 894	1855	$783, 573
1852	257, 440	1856	710, 897
1853	365, 492	1857	849, 840
1854	567, 009	1858	631, 134

Table of ale, beer, porter, and cider exported from the United States.

1851	$62, 449	1855	$61, 012
1852	51, 755	1856	61, 817
1853	66, 223	1857	94, 599
1854	64, 090	1858	98, 408

Total importations, value of	$4, 407, 279
Total exportations, value of	550, 353
Balance in favor of importations	3, 856, 926

During the same years were imported bushels of barley as follows:

1851	95, 663	1855	155, 782
1852	109, 192	1856	1, 770
1853	109, 461	1857	2, 924
1854	73, 700	1858	9, 755

The almost regular decrease of the importation from one hundred thousand in 1851, 1852, and 1853, to less than ten thousand in 1858, shows that the country rapidly reached independence in this regard. This table may be also profitably compared with that given on page 358. It is to be regretted that figures of a like character, bringing down the statistics to the past year, are not attainable. They would doubtless show that the astonishing increase of the barley crop has relatively lessened the importation of the grain, and perhaps, also, of foreign ale, beer, and porter. And though a high authority has asserted that the best barley grown in the United States would not be used by a London maltster, yet the favor with which American beer and ales are received by the people, and their recommendation for use of the sick by the best talent of the medical profession, goes far to show that they are equally good; and hence there would be no necessity for importing them from abroad.

MALTING.

A very brief history of this process may prove interesting. The operation of malting, by which the grain is prepared for conversion into beer, ale, &c., is composed of four distinct steps, namely, steeping, couching, flooring, and drying. In the first, it is steeped in water for about two days, when it absorbs moisture, swells considerably, softens, and adds about forty per cent. to its weight. As soon as it is easily penetrable by a needle the water is drawn off, and the grain is submitted to the next process, which is *couching*. This means placing the soaked barley in heaps two feet high, where it is allowed to remain about thirty hours. In this situation the grain acquires a temperature considerably above that of the surrounding atmosphere, but as the heat in such large masses would not be uniform, the germination would be more advanced in some parts than in others, and it is now subjected to the third step, which is *flooring*. This is done by throwing the grain on large, airy, but shaded floors, in layers a few inches thick, and in this position it is frequently turned over with a shovel, thus securing uniformity until the acrospire (a name given by maltsters to the new growth) has reached almost to the other end of the grain from which it started. At this stage the gluten and mucilage have mostly disappeared, and if the germination were allowed to proceed further the leaf would start, and the saccharine matter developed in the process would be destroyed by the growth of the plant, to the ruin of the grain for malting purposes. Great care is necessary to suspend the germination at the proper time. At the completion of this stage the grain is removed to the kiln, which is frequently prepared with a zinc or tin floor, perforated with many holes. The grain is spread two or three inches thick, and subjected to a heat gradually rising from 100° to 160°, or even higher. There are two distinct objects in this process: first, to dry the grain; second, to prevent the recurrence of germination by destroying all vitality in the plant. Malting is not performed in hot weather, the temperature selected being usually under 45° Fahrenheit, else the grain would become mouldy. Great changes occur in the chemical constituents of barley after being subjected to this process, as is shown by the following analysis:

	In 100 parts of barley.	In 100 parts of malt.
Resin	1	1
Gum	4	15
Sugar	5	15
Gluten	3	1
Starch	32	56
Hordein	55	12
	100	100

BREWING.

Barley thus malted is converted into beer by a process termed brewing. This, like malting, consists of several different operations: First. *Grinding*, or reducing the malt to a coarse powder. Second. *Mashing*, or thoroughly stirring the powder in water at a temperature of 160°, with no more water at first than is sufficient to soak the malt. After an hour, more water is added at a temperature of 194°; this is allowed to remain three or four hours, and is then drawn off; it is merely a solution of the saccharine matters. Third. *Boiling*. This is done in large copper vessels, furnished with steam-pipes. In this operation the hops are introduced, and the boiling of the mixture is continued with frequent stirring. As a general rule, one pound of hops is added to a bushel of malt for the strongest varieties of beer; for common beer, about one-fourth of that quantity. Fourth. *Straining*, by passing through a cistern which has a metallic bottom full of holes. It is important that this should be performed very carefully to have a clear, cloudless article. Fifth. *Cooling*, by exposing in broad shallow cisterns, over which currents of air can pass freely. Sixth. *Fermenting*. When the liquid is cooled to a temperature of 56° to 64° it is pumped or conducted into large open vats; the yeast is added, usually about one gallon to 100 of the wort. In order to prevent the escape of the carbonic acid, the aroma of the hops, and the alcohol, as also to avoid acetification, it is, when it has reached the proper point, transferred to large hogsheads; the fermentation goes on, and the froth is allowed to escape from the bung-hole. The loss is made up by adding fresh supplies of beer. When the process of fermentation is completed, it is transferred to hogsheads coated inside with rosin to exclude all air, corked tightly, and put in the cellar, from where it can be taken for the consumer.

The following is an analysis of some of the best-known European and American beers:

	Water.	Malt.	Alcohol.	Carbonic acid.
London ale	76.03	15.88	8.08	0.01
Double porter	88.74	5.98	6.10	0.18
Pale ale, London	89.85	4.50	5.65	
Philadelphia lager beer	92.16	4.36	3.40	0.08
Reading lager beer	91.30	4.66	3.76	0.13
Walter's lager beer	91.80	4.65	3.44	0.11
Bavarian lager beer	90.95	4.70	4.34	0.04

BEER FROM MALT.

"Beer is a thirst-quenching, refreshing, exhilarating, intoxicating, and slightly nutritive beverage;" thus writes Dr. Jonathan Periera. Notwithstanding this high authority, there has been some grave questioning as to its intoxicating and nutritive qualities. That it is thirst-quenching and refreshing will not be denied, as the water which is the menstruum of its active properties is made slightly tonic by the addition of hops. But learned judges and juries have sagely decided, as to its intoxicating power, on both sides of the question, in cases arising under the prohibitory liquor laws of the several States. It almost staggers belief when the evidence in such cases is read. Enormous quantities, amounting to many gallons, have been drunk by individuals in the course of a day without any especial blunting of the intellectual or entanglement of the muscular powers. Only a short time ago Rev. H. W. Beecher convulsed an audience with laughter in his humorous relation of the vast quantities which persons accustomed to it had consumed without appreciable intoxication. Yet, in like manner, individual instances are not wanting in which impossible potations of whiskey, wine, brandy, and rum have been taken without damage to the brain or the locomotion. But the smallest personal experience will satisfy the observer that beer will intoxicate. It is no argument against the proposition that large quantities can occasionally be drunk with impunity. Isidorus and Orosius give a description of a liquor in use by the Britons and Celtic nations in these words: "The grain is steeped in water and made to germinate, by which its spirits are excited and set at liberty; it is then dried and ground, after which it is infused in a certain quantity of water, which, being fermented, becomes a pleasant, warming, strengthening, and intoxicating liquor." Why not? It possesses alcohol; there is nothing in it to counteract the effect of that substance; alcohol will intoxicate; beer contains alcohol, therefore it will intoxicate. In fact, it is drunk for its exhilarating and intoxicating effects, and, except as a medicine, as hereinafter mentioned, for no other purpose. The taste is bitter, and, to the novice, very far from agreeable, and not many gallons would be consumed for the sake of its impression on the palate alone. When men drink together in token of social estimation, beer has the advantage of taking a much larger quantity to produce its effects than purely alcoholic drinks, and the meeting can be drawn out to a length proportionate to the degree and measure of their friendship.

Brandy has 53.39 parts of alcohol; rum, 53.68; gin, 57.60; Scotch whiskey, 54.32; claret wine, 15.10; Malaga, 18.94; Hock, 12.08; Tokay, 9.88, &c., &c. To this principle alone all liquors owe their intoxicating qualities. Because, forsooth, beer and ale contain the same principle in less quantity, is it a reason that they will not intoxicate? Some years ago a bitter newspaper war was waged between the Scientific American, which opposed the use of beer, and some physicians and chemists who favored it. It would hardly be profitable to review this controversy; only one fact is mentioned: that one savant claimed that lager beer had nutritive qualities equal to those of milk! In Bavaria it is almost an essential article of diet among the laboring classes, and in many instances it takes the place of animal food. When a gallon a day or more is drunk, little other food than bread will be required to satisfy the appetite. But what then? Next come apoplexies, palsies, and other dangers from disorder of the nervous centres. It is quite unreasonable to suppose that it would conduce to health and longevity to deluge the stomach with a gallon of fluid in order to procure an ounce of nourishment. The stimulation, like that of every other unnatural kind, is but momentary, and is followed invariably by its period of depression. Thence arises a necessity for greater stimulation—greater quantities of the fluid to produce it—and so on, until the depression gains the advantage over it, or until the nervous system is overwhelmed with disease, and death follows. The word "nutrition," by Pereira, is well and sensibly qualified by the term "slightly." In Dr. Charles A. Lee's edition of this author's work on Food and Diet, there are the following sound ideas: "The practice of taking a moderate quantity of mild malt liquor, of sound quality, at dinner is in general not only unobjectionable, but beneficial. It is especially suited for those who lead an active life, and are engaged in laborious pursuits. For the sedentary and inactive it is less fitted. * * * * With bilious and dyspeptic individuals it frequently disagrees, and by such, therefore, should be avoided. In plethoric constitutions, especially where there is a tendency to apoplexy, it is objectionable," &c., &c. The opinion of Dr. Benjamin Franklin is well known, but his words will bear repetition in this place. When a journeyman printer in London, he endeavored to convince his fellow-workmen that if they would eat a penny loaf and drink a pint of water with it, they would derive more strength from it than from a pint of beer; and in proof of this he states as follows: "On my entrance I worked as first pressman, conceiving that I had need of bodily exercise, to which I had been accustomed in America. I drank nothing but water. The other workmen, to the number of fifty, were great drinkers of beer. I carried occasionally a large form of letters in each hand up and down stairs, while the rest employed both hands to carry one. They were surprised to see, by this and many other examples, that 'the American aquatic,' as they used to call me, was stronger than those who drank porter." Dr. Lee adds that malt liquors are more deleterious in their effects upon the system than ardent spirits. "They certainly stupefy the brain, render the blood too viscid, load the cellular tissue with fat, and so modify the vital cohesion of the solids as to render wounds extremely difficult to heal, and accidents, which in water-drinkers would be attended with little or no danger, very certainly fatal."

This declaration must be received with some grains of allowance. Intemperance in beer-drinking, like excess of any kind, is undeniably detrimental to health; but a very moderate supply of pure beer will aid digestion, quicken the powers of life, give elasticity to the body and mind, and will not induce any of the terrible results above named. In certain forms of dyspepsia it is a valuable adjuvant to other remedies; and in some cases of debility, requiring a mild tonic and gentle stimulant, it has been found a great benefit. But too great care cannot be exercised in even the moderate use of a stimulant, however mild, for the tendency of frequent indulgence is always towards drunkenness. Hence, as soon as their administration as a medicine is no longer demanded by the condition of the patient, its further use had better be abandoned.

ADULTERATIONS.

There can be no doubt of the general adulteration of all malt liquors. In England and other countries, where heavy penalties are imposed, and an increasing vigilance practiced to detect and punish such frauds, by a system of inspection of all malt liquors manufactured before exposed to sale, the practice is very common. How much more in this country, where there are no laws on the subject, and no officer to carefully analyze the products of the brewery? Some years ago Professor Mapes, of New York, analyzed the beer from a dozen different breweries, and all were found adulterated with noxious substances. It is said that the sale of drugs to brewers is a profitable part of the trade. This is perfectly infamous. Cocculus indicus, (fish-berry,) nux vomica, (dog-button, from which strychnine is obtained,) are some of the delectable substances found in beer. These are potent poisons, and the brewer found using them should be drowned at once in one of his own vats. The British Parliament passed a law to prevent this nefarious business. The following is an extract: "No druggist, vendor of or dealer in drugs, or chemist, or any other person, shall sell or deliver to any licensed brewer, dealer in or retailer of beer, knowing them to be such, or shall sell or deliver to any person on account of, or in trust for, any such brewer, dealer, or retailer, any liquor called by the name of or sold for coloring, from whatever material the same may be made; or any material or preparation other than unground brown malt, for the darkening the color of worts or beer, or any molasses, vitriol, honey, quassia, cocculus indicus, grains of paradise, Guinea pepper, or opium, or any extract or preparation of molasses, or any article or preparation to be used in worts or beer for or as a substitute for malt or hops; and if any druggist shall offend in any of these particulars, such preparation, &c., shall be forfeited, and may be seized by any officer of excise, and the person so offending shall forfeit *five hundred pounds.*"

Under this law very many druggists and brewers were brought to grief, and yet the practice continues. Unless the American public are ready to admit the immaculate purity and innocence of American brewers, they must be content while drinking their beer, to cherish the belief that they are at the same time guzzling some narcotic poison or damaging medicine. In view of the unprecedented growth of the barley crop, of the great increase of the number of maltsters and brewers, of the vast unknown quantities of beer that are drunk in every city and almost every town on the continent, it is the dictate of sound wisdom, that the attention of legislators should be called to the subject of the adulteration of our malt liquors, and severe penalties should be inflicted as a preventive.

In the compilation of this brief text I am especially indebted to the "New American Encyclopædia," the "American Farmer's Cyclopædia," "Carson's Pereira," "Dr. Lee's Edition of Pereira's Food and Diet," and to the Agricultural Reports of the Patent Office from 1847 to 1860, and, from that date to 1864, to the valuable reports of Hon. Isaac Newton, Commissioner of Agriculture.

MANURES AND THEIR APPLICATION.

BY SIMON BROWN AND JOSEPH REYNOLDS, M. D., CONCORD, MASSACHUSETTS.

NATURE is always just; she never requires more of her workers than she furnishes them the means to accomplish. She requires the soil to produce plants only in proportion to the plant food she supplies to it. How does she manage with the trees of the forest? The seed is dropped upon the soil and comes up a small and tender plant, requiring but little food. Its foliage is annually dropped about its roots to protect and, by its decay, to nourish them. As it increases in size it yields more foliage, a large portion of whose substance is made up of the gases of the atmosphere condensed in the vessels of the leaves, and thus conducted to the earth. The increased amount of food which the increasing growth of the tree annually demands is thus, by its own action, annually supplied, and the supply is always in advance of the demand, so that when the trees have become too large, the mould is often accumulated to a great depth. In ancient forests, whose monumental trunks stand as landmarks of the centuries, the amount of nourishment which they require is inconceivably great; but the masses of foliage, the decaying limbs, and the broken boles decaying in the soil, supply them with abundant food. How wonderful is this process of nature, by which the supply is increased in proportion to the demand! This is true vegetable philosophy. Says Stockhardt, "Good farming consists in taking large crops from the soil, while at the same time you leave it better than you found it." This is what nature does in the forest, on the prairie and natural meadow, until man interferes with her operations. His method is wholly unlike hers. He plants a hundred apple trees upon his field; he cultivates the soil, and perhaps manures it while they are small; when they have become large enough to yield a hundred barrels of fruit, and at least a hundred barrels of leaves, he carries away the fruit, and the winds scatter the leaves. Here are two hundred barrels of vegetable matter annually removed from the soil. Could this amount of vegetable substance remain and decay upon the soil, he might reasonably expect its fertility to be sustained. But, no! He expects the soil to yield the annual crop of fruit and leaves, and to supply, in addition, the material for the increasing growth of the trees; and the larger they grow the less cultivation he gives them, and the less manure he supplies to the soil. He takes two tons of hay from his acre of virgin soil. Can he reasonably expect another crop as large unless he applies something to protect and nourish the roots of the grass? He takes two tons of stover and fifty bushels of corn from his acre. Will he take as large a crop the next year? Unless the supply returned to the soil be in some proportion to the demand made upon it, the most fertile soil will become exhausted. A virgin soil, in which a large quantity of humus has been accumulated, may endure such a drain for a few years, but the rich prairies of Illinois, under continual cropping, are yielding an annually diminishing harvest. Even the valley of the Nile and the cane-brakes of the Mississippi, unless renewed by the deposit from the overflowing water, would in time lose their fertility. This theory is confirmed by universal experience. In the new soils of the eastern and northern regions of our country scarcely two or three crops can be taken from the land without convincing proof of the truth of this philosophy. In all this region the soil, except upon the river bottoms, is comparatively thin and sterile, and the effect of every demand upon its resources, like that of a demand upon the resources of a poor man, becomes at once apparent. The great law of good husbandry is, to return to the soil an equivalent for the crop taken from it. By rotation of crops, and by deeper ploughing, tolerable crops may be obtained for a longer period, but the unproductive and deserted fields in some of the northern States and in the older southern States show that this is only a battle with time, in which time is sure to win.

We arrive, then, at the conclusion that there can be no good farming without manure. In northern climates there is an additional argument for the use of manure. Many of the most valuable crops require naturally a longer season for their growth and maturity than the climate allows, and it becomes necessary to push them forward by stimulating manures.

COMPOSITION OF MANURES.

Such being the facts, it is obvious that the manure heap is the bank from which the farmer must draw his working capital. What, then, is manure? We have said it is plant food—any substance upon which the plant feeds in the soil. Anything which the plant derives from the atmosphere, although it contributes to its nourishment, is not denominated manure. We confine the term to substances applied to the soil. The term is said to be derived from *manus*, the hand, and is confined to substances applied to plants by the hand. The food of plants consists, *first*, of carbonic acid, or carbon combined with oxygen. By this chemical combination carbon is rendered capable of being taken into the vessels of plants. The framework or chief bulk of all trees and plants is composed of carbon, and, as it decays more slowly than most of the other components of vegetables, it is left in the process of decay more or less free from all other elements. The bulk of all the solid excrement that passes through animals consists of carbonaceous matter. Starch, gum, sugar, oils, and woody fibre consist largely of carbon. Peat consists of decayed vegetable matter, chiefly carbon, combined with earths, acids, and salts. All the substances composing the compost heap, whether animal excrement or decayed vegetable matter, as muck, grasses, straw, beans, vines, fruits, grains, seeds, or other vegetable growths, consist largely of carbon, either combined with oxygen, or rapidly coming into a condition that will enable it to combine with it.

Second, Salts. Various salts enter into the composition of plants, as the salts of lime, potash, soda, silex, magnesia, sulphur, iron, and manganese. Nitrogen and hydrogen also are important elements of plants, but as they are extremely volatile they are applied in the form of ammonia, which consists of these two gases. Ammonia is never found in plants, but is decomposed either in the soil or in their vessels before its constituents are appropriated to their use. These salts are all found in the secretions of animals, especially in the liquid secretions, being derived by them chiefly from the vegetables on which they feed. Ammonia is abundant in animal secretions, being formed in them by the chemical union of hydrogen and nitrogen. The elements of ammonia not only enter into the composition of plants, but they operate as stimulants to their secreting and assimilating vessels. Decaying animal substances, as flesh, hair, wool, feathers, skin, and gelatine, yield a large amount of ammonia, it being formed in the process of putrefaction by the union of their nitrogen with the hydrogen of water. All these salts are also found in the soil, the source from which they are ultimately derived by animals. By salts we mean earths, alkalies, and metals, chemically combined with acids, as carbonate and sulphate of lime, sulphate and muriate of potash and soda, silicate of lime, sulphate of iron and manganese, &c. These all come into the category of plant food, and are essential elements of manures.

Third, Acids. These are important elements in manures. They are seldom, with the exception of carbonic acid, found in a free state, but combined with the earths, alkalies, and metals. Their chief use appears to be as solvents for these substances. Salts compounded of them enter sparingly into the composition of vegetables. The acids themselves are believed by some vegetable chemists to be decomposed, and to enter into new combinations, thus assisting to form the acids found in the fruits and juices of many plants.

Fourth, Gases. Another important element of plant food, and consequently of manure, consists of various gases combined with the soil, or dissolved in water. They are sulphuretted hydrogen, consisting of sulphur and hydrogen; carburetted hydrogen, consisting of carbon and hydrogen; phosphuretted hydrogen, consisting of phosphorus and hydrogen; and carbonic acid gas, consisting of carbon and oxygen. The sulphuretted and phosphuretted hydrogen occasion the peculiar and offensive odors given off by manures in a putrefying state. Ammonia exists in manures in a gaseous form, except when combined with sulphuric or other acids, or with carbonaceous or aluminous substances, which have the power of condensing and retaining it.

Fifth, Water. Water, either pure or in combination with acids or alkalies, is the universal solvent employed by nature. If pure water cannot dissolve a substance, nature adds an acid or an alkali, and sometimes a third substance, to enable it to effect the solution. Water cannot dissolve silex, but, by first dissolving a quantity of carbonate of lime, it becomes able to dissolve silex, and form silicate of lime. Water contains, in solution, earths, alkalies, acids, and gases. It is everywhere present when animal or vegetable growth is going on, supplying to the vessels of their organs, in that state of minute division which can be effected only by solution, the materials which they require to construct their different tissues. Besides this, it enters largely into the composition of the blood and juices of all organized beings, and readily allows itself to be decomposed when either its oxygen or hydrogen are wanted.

The above-named substances, viz: carbon, salts with alkaline, earthy and metallic bases, sulphur, iron, manganese, acids, gases, and water, are the principal elements of manures. They are found in different proportions in different manures, and are rarely all found in any one manure. The different effects of different manures is owing to this fact, as well as to the difference in the soils to which they are applied. Carbonaceous manures applied to a soil consisting largely of humus will produce but little effect upon the growing crop except as a mechanical means of lightening the soil. Such soils require alkalies or matter containing nitrogen. On the other hand, sandy soils, which are deficient in carbon, are greatly benefited by manures containing a large percentage of carbon. Hence we may learn the advantage of mixing soils containing different elements. The peaty soil does not afford the silex and lime needed to give firmness and strength to the culms of grass and grain. The sandy soil does not furnish the carbon needed to construct their growing frame work. A mixture of the two will furnish all the materials needed. Manures containing a large proportion of nitrogen stimulate plants to a large and vigorous growth. Those containing phosphorus, or phosphate of lime, contribute to the size and plumpness of the grain and seed—hence the benefit of combining them both in the culture of the garden and field. That may be considered a manure which supplies any want of the soil, or of the growing crop. But a perfect manure is that which supplies all the wants of all crops in all soils, or a manure containing all the elements above named. To use such a manure in all cases would be a waste of material, for they are not all wanted, perhaps, in any one case. To determine what elements of manure we can most economically use, it is necessary to ascertain the condition of the soil, and the elements of nutrition required by the crop to be raised upon it. Several of the elements of plant food, as we have seen, are volatile, and will not remain permanently in the soil. Others are readily soluble, and will soon be washed out of it. If they or any of them are not wanted for the immediate crop, there will be a waste of material. Could we make use, in every instance, of only those elements that are wanted to enable the soil to produce the present crop, or those that will remain permanently in the soil for the use of future crops, it is obvious that much material would be saved. Science and experience may afford us some aid, but the difficulties in the way of determining the wants of the soil and of the plants we cultivate, and of adapting our manures to these results, are so great that we must be content to submit to the loss resulting from our inability and ignorance.

THE SOURCES OF MANURE.

Carbonaceous matter, as we have seen, is derived from the natural decay or chemical decomposition of vegetables. Vegetables collected into masses, as leaves, wood, grasses, straw, the stalks and stems of all plants, fruits, grains, roots, &c., under favorable conditions of temperature and moisture, rapidly undergo, first, the fermentation; and, secondly, the putrefaction process. Where there is too much or too little heat, or too much or too little moisture, fermentation will not go on. The fibres of vegetables thus collected in masses, under favorable circumstances, soften and swell, and become permeable to air and water. Their salts, starch, gum, sugar, gluten, and extractive matter are dissolved, their carbon combines with oxygen, and carbonic acid is formed and penetrates the whole mass. This acid combines with the alkalies that are present, as potash, lime, soda, magnesia, and ammonia, and carbonates of potash, lime, &c., are formed. Certain elements in the mass soon take on the action of putrefaction. This process is owing chiefly to the presence of elements containing nitrogen, as gluten and other matters of animal origin. All animal substances pass rapidly into the process of putrefaction, and the larger the proportion of such substances mingled with the vegetable masses, the more rapidly putrefaction proceeds. Hence the addition of animal manures to vegetable composts facilitates putrefaction. By the process of putrefaction hydrogen also is rapidly developed, and combines with phosphorus and sulphur when these are present, forming sulphuretted and phosphuretted hydrogen. When the surfaces of these putrefying masses are exposed freely to the atmosphere, these gases, which are very volatile, are rapidly dissipated. To prevent this, substances should be applied which have the power of absorbing and retaining them. Carbon, when nearly pure and dry, has a strong affinity for them. The addition of dry charcoal, or of peat, will absorb large quantities of them. When these gases are thus absorbed their presence ceases to be indicated by their peculiar odors. The sulphates of lime, iron, and zinc have a similar power, hence their value as deodorizers. These sulphates have also the power of decomposing carbonate of ammonia, displacing the carbonic acid, and forming sulphate of ammonia, which is not volatile. Chloric and nitric acids will also decompose carbonate of ammonia, forming with it chlorates and nitrates of ammonia, which are soluble in water, as are also salts which they form with the other alkalies. Vegetable compost, then, when the decomposition is complete, consists chiefly of carbonaceous matter combined with gases and salts.

By a process in many respects similar to that above described, vegetable substances are decomposed in the digestive organs of animals. The fibres are comminuted by the teeth, and fitted to be pervaded and softened by the fluids contained in the stomach and intestines. A large portion of the starch, gum, sugar, gluten, and salts is dissolved out, and taken up by the lacteal vessels of the animal, and serve the purposes of nutrition, while the remainder, mixed with the juices of the animal, containing various salts, is ejected. This process is accomplished much more rapidly than the ordinary process of vegetable decay, and the substance resulting is mixed with a large amount of animal matter, which fits it for rapid putrefaction. When the necessary conditions are present, this animal matter, which pervades the mass like leaven, sets up the process of putrefaction at once. These two processes, vegetable composting and the feeding of animals with vegetables, are the sources from which carbonaceous manures are chiefly derived. Vegetables reduced by the process of digestion, although they have parted with a large portion of their nutritive elements, yet, in consequence of the condition to which they are brought, and the additions which they have received, are more valuable as manures than when, without serving the purposes of nutrition, they are reduced by the ordinary process of decay. But the slow decomposition of vegetables is always going on in nature, and thus one generation of plants affords nutriment to those that come after it.

The carbonaceous matter resulting from the decay of vegetables is not all taken up as it is formed. Masses of it have accumulated in swamps, basins, and meadows. These accumulations, mingled with more or less of insoluble earths, constitute muck or peat, and furnish an almost unlimited amount of carbonaceous material fitted for the immediate use of the cultivator. The difference which is found in different accumulations of this material is owing in part to the difference in the vegetables from which it has been formed, and in part to the difference of the soils upon which it rests and by which it is surrounded. In some deposits the matter is almost purely carbonaceous; in some the composition is complete; in others but partial. But the most essential difference in different deposits of muck is, that some contain acids, or acids combined with minerals, while others are nearly or quite free from them. These acids are the carbonic, humic, crenic, and apocrenic. When deposits of muck are underlaid by clay, or receive the wash of clay beds in their vicinity, and iron is present, which it often is in the form of bog ore, the sulphate of alumina, which is the basis of clay, is decomposed, and the sulphuric acid combines with the iron and forms sulphuret of iron, or pyrites, which is often found in muck in sufficient quantity to impair its value as a fertilizer. When any of these acids abound in muck it is unfit to be used in a simple state. Alkalies are the proper correctives, and of these lime seems to be the best adapted to remedy the evil. Quicklime, mixed with peat, has the effect of rapidly rendering it pulverulent and light. Its influence seems to extend through the whole mass, like that of yeast through the whole mass of dough, while at the same time it combines with the acids and decomposes the salts of iron, forming salts of lime, which themselves are essential to the growth of many plants. Muck, when free or nearly free from acids, may be used by itself with great benefit on light, sandy soils, or on any soils from which the vegetable matter is exhausted; or it may be composted with stable manure, ashes, guano, or animal matters, with peculiar advantage, since it has, as we have already observed, the power of absorbing and condensing the gases arising from the putrefaction of these substances. Such composts are adapted to nearly all the uses of the garden and field.

No substance is so well adapted to composting with night soil and urine as dry muck, since it deodorizes these manures and retains all their valuable elements, and renders them manageable and easy of application, affording at the same time the dilution which is necessary for the safe application of concentrated manures. Composted with putrefying fish, muck forms an exceedingly valuable manure. The best mode of preparing muck for use is to throw it from its bed in the autumn, and leave it exposed to the action of the frosts of the succeeding winter. If it is to be composted with lime or ashes it may be used the following spring. But if it is to be composted with stable manure, night soil, or animal matters, it is better to let it remain in the heap until the following autumn, when it should be deposited in the barn-yard or cellar, and mixed, from time to time, with the drippings of the animals. It should be provided in sufficient quantity to be used freely as a deodorizer about the premises whenever or wherever it may be wanted. It will thus become charged with gases and salts, and be converted into a highly valuable manure, which for a garden and for fruit culture has perhaps no equal. Many skillful farmers consider a compost of one-half good muck and one-half stable manure fully equal for corn culture to pure stable manure.

Vegetable composts, animal excrements, and muck are then the chief sources of carbonaceous manures. With these, as we have seen, are combined various gases and salts which are essential to vegetable growth, either as elements of nutrition or as stimulants. These may also be found in more concentrated forms and in smaller bulk, capable of more easy and direct application to growing plants. Variously combined and condensed, these fertilizing elements constitute the numerous articles known in commerce as artificial manures. All plants during their growth take from the soil more or less mineral matters. Some require them in large quantities. Such plants are said to exhaust the soil on which they grow. The small grains, which appropriate in their culms and seeds much silex, lime, and potash, are instances of this class. The elements of which we are now speaking are all soluble, and are washed out of the soil—and the better the soil is worked and the finer the tilth, the more rapidly does this take place—and, unless they are frequently renewed, the cultivated soil is soon exhausted of them.

Owing to their small bulk they are easily applied. Nitrogenous manures are Peruvian guano, night-soil, poudrette, urine, hair, wool-waste, fish manures, and animal substances generally. The phosphates are bone-meal, superphosphate of lime, and Mexican guano. All these are combined with mineral earths and alkalies, and it is to these that is due whatever permanent value such manures possess, the other elements being so soluble and volatile that their effects are immediate and temporary.

In this connexion we may mention the saltpetres or nitrates, a class of manures to which little attention has been paid in this country. Earth containing nitrate of potash is often found in caverns, where it has been accumulating for ages, protected from the weather. Nitrate of soda is found in extensive beds in New Jersey and in the northeast part of the State of New York. Large quantities of it are imported from Chili. The nitrates may be manufactured artificially by means of nitre beds. These are formed by means of earth and animal manures mixed with potash, lime, and soda. They are protected from the rain by roofs open on all sides to the air. The mixture is kept at the proper degree of moisture, and frequently stirred to expose new surfaces to the atmosphere. The alkalies, thus treated, combine with the nitrogen of the air confined in the porous mass, and by a somewhat complicated process nitrates of lime, potash, and soda are formed, and the whole mass becomes impregnated with them. The principal use that has hitherto been made of the substances thus treated has been to leach them, by which the nitrates of soda and potash are dissolved out. When they are reduced to a solid state by evaporation they are used for the manufacture of gunpowder, and for other purposes in the arts. The whole mass, unleached, applied to the soil, is a very active manure; and there is no doubt that large quantities of most valuable manures might thus be prepared. Whether it can be done economically, experience only can determine. Mineral substances are restored to the soil by the direct application of lime, gypsum, ground bones, ashes, salt, sea-weed, and the nitrates of lime and soda. The effects of such substances are very apparent, especially when the application is followed by crops into whose composition they largely enter, as wheat, oats, potatoes, &c.

PREPARATION OF MANURE.

We have already seen that most of the natural manures contain elements that are volatile and soluble. It is obvious that when such substances are exposed to the rain and snow the soluble portions will be dissolved and washed out, and that if they are exposed to the free action of the sun and air the volatile elements will be dissipated as fast as they are evolved, and this will be nearly in proportion to the elevation of the temperature. The free action of the air will not only dissipate their gases, but will also carry off the moisture that is necessary to sustain chemical action. Hence it follows that in composting and preparing manures for the soil, whether they consist of stable manures or those mixed with soil, or with muck or other vegetable or animal substances, they should be carefully protected from the weather. Such exposure subjects the cultivator to a loss he can ill afford. The most convenient arrangement for the protection of manures is the *barn cellar*, and this is coming rapidly into use in the eastern and northern States. In every section of the country in which barns are required for the storage of forage and the protection of stock in winter we would recommend the barn cellar as both a convenient and economical arrangement. It should be easy of access, of sufficient height, be built of brick or well-pointed stone walls, and with a bottom impervious to water. It should be protected from currents of air, and if possible secured from frost, so that fermentation and putrefaction may go on through the winter. Material should be provided and placed in or near the cellar, and be frequently spread over the fresh droppings of the animals in sufficient quantity to absorb the liquids and to take up the gases as fast as they are formed. Some careful farmers spread the material daily over the droppings, and thus a thorough mixture is secured. The materials, whether they consist of muck, loam, or leaves, should be as dry as possible. In this condition they will retain much more of the liquid excrement, are more easily pulverized, and will mix more readily and thoroughly with the droppings. There should be as much muck or other material used as will be sufficient to absorb all the liquid and render the solid excrement dry enough for convenient manipulation. When the floor of the cellar is tight, this will be found to be no less in bulk than the mass of solid excrements. When cattle are highly fed more than this will be required. When the urine is taken off by a drain into a reservoir, for separate use, a less quantity will be required. We know of no better rule with respect to the quantity of material to be added in the composting of stable manures than the above. If the mass thus gradually formed in the cellar is allowed to freeze, very little decomposition takes place during the winter. But if the frost is kept out, the laboratory will be kept at work, more or less actively, according to the temperature, through the entire winter, and the manure will be fit to be used in early spring. It will become mellowed and rendered fine by its own internal action, and will not require so much labor in overhauling for the sake of breaking and pulverizing it. If it is kept frozen, or near the freezing point, the animal excrement will be in the condition of green manure, and will not so readily combine with the soil, or act so immediately on the growing crops.

The farmer who is not so fortunate as to have a cellar should cover his manure heap with a roof at least, to protect it from the rains. If it is not covered, it would be well to remove it into the field during the winter, and deposit it in as large heaps as possible, that it may present the smallest surface to the weather, and cover it neatly with soil, that may protect it from the rain and absorb the gases as they are formed, which will be but slowly during the cold weather. It is wise economy to deposit in the autumn a quantity of dried muck near the spot where it is intended to deposit the manure from the barn. This should be mixed with it as it is hauled and used to cover the heap. Compost heaps thus formed should be overhauled in the early spring, and the ingredients well mixed. Scarcely too much importance can be attached to overhauling manure in the spring, and mixing its ingredients and making them fine, but this should be done before it is heated by fermentation, as soon as the frost is out of the heap. It should then remain a few days until it begins to be warm, when it may be overhauled again. In this state it readily combines with the soil, and comes into contact with the roots of the growing plants. It is an excellent plan to mix gypsum with it as it is being overhauled, or to sprinkle the heap from time to time with a solution of copperas, or with diluted sulphuric acid, as these will combine with and retain the ammonia as it is formed in the putrefying mass. A pound of acid, or five pounds of sulphate of iron, may be used with a barrel of water.

Ashes or quicklime should never be directly combined with green manure, or urine, or Peruvian guano, or any substance that contains a large percentage of carbonate of ammonia, as they will combine with the carbonic acid and set free the ammonia, which will, of course, be lost, unless there is some other substance present that has a strong affinity for it, which may combine with it and retain it. When lime or ashes are to be applied to the same soil with stable manure, or compost containing a large share of such manure, the best method is to plough in the manure and spread the lime or ashes broadcast on the surface, or apply them in the hill. When hoed crops are to be cultivated, ashes may be profitably applied to the surface at the first hoeing and worked in with the hoe. Manures should be applied to the soil with all the elements belonging to their constitution. If a portion of these elements is diffused into the atmosphere, it is obvious that that portion has been lost, and that is usually the most active and stimulating portion.

Some farmers prefer to introduce stable manures into the soil in a crude state. In this condition it is in a state of integrity. All its elements, as they are developed, are absorbed by the soil, and we are not surprised that those who have not experienced the advantages of composting in a cellar should prefer this mode of application. We have already referred to the combination of muck with night-soil when speaking of muck as a deodorizer. Human excrement, including urine, contains a great number of elements. In addition to carbonaceous matter, it has been shown by analysis to contain chloride of soda, or common salt, chloride of potash, hydrate of potash, soda, lime, magnesia, iron, phosphoric acid, sulphuric acid, silica, urea, and urates of lime and ammonia. The composition is doubtless much varied by the food; the number of pounds of urine is at least double that of the solid excrement. An immense amount of this material is annually wasted in our cities, which, if it could be deodorized and preserved, would be of inestimable value to the farmers and gardeners in their vicinity, and would add incalculably to the resources of their vegetable markets. Probably there is no better mode of preparing this highly valuable substance known at present, than to mix it with a sufficient quantity of peat in a dry state, to absorb its moisture and destroy its odor. If a quantity of plaster, or a little diluted sulphuric acid, be added to this composition, we shall have one of the best manures that can be composed for most crops, and especially for garden and fruit crops. It is said that the Chinese make use of clay, dried and pulverized, to mix with night-soil. This has considerable power as a deodorizer, and is very tenacious of gases and moisture, and when dried peat cannot be readily obtained may be substituted for it with much advantage.

Fowl manure.—Almost all families in the country, and many in all our villages, keep hens to supply themselves with eggs and poultry for the table. The droppings of fowls are of much more value than is generally supposed, and by a little pains a large amount of manure, which may be called domestic guano, may be prepared. Fowls, from the force of instinctive habit, always resort to the same place to roost, which should always be under a roof, where convenient roosts should be provided for them. Under the roosts a quantity of dry peat or good loam or coal ashes should be spread to receive the droppings. Once in a few days an additional quantity should be spread over them. Let this be continued through the year, and where a dozen or twenty hens are kept quite a heap of valuable manure will be found at its close. It is best not to disturb it until just before it is wanted for use, when it should be worked quite fine and well mixed and thrown into a heap. If gathered oftener, for the sake of cleanliness, it should be preserved dry, in boxes or barrels. For early garden vegetables, as lettuce, peas, sweet corn, and cucumbers, no better manure can be found. As it contains a large per cent. of ammonia, it should be exposed to the air as little as possible, and should be covered to a moderate depth in the soil. A small quantity of this manure added to the hill where corn is planted, will bring forward the young and tender blades rapidly and vigorously.

LIQUID MANURES.

The saving and use of liquid manures is deserving of more attention than it has hitherto received in this country. When cattle are kept in stalls through the winter, and especially where soiling is practiced, and cows are kept in the stall through the year, the floor should be so arranged as to conduct the urine into troughs beneath it, which will convey it into a reservoir in the cellar or outside the barn. This can be done at very little expense. The accumulated urine may be pumped into a water cart, to which a sprinkler is attached, similar to those used for watering the streets. If it is pumped in through a strainer the sprinkler does not become clogged, and it may be immediately conveyed to the field and distributed as a top dressing upon grass or grain. When the soil is not deficient in carbonaceous matter there can probably be no better top dressing applied. It is not as permanent in its effects as the solid excrements, but more immediate, and may be applied two or three times a year. For raising green crops for soiling it is invaluable. Here there is a constant and abundant supply of the material. It should be applied after the grass has started in the spring, and after each cutting. Its application is attended with less expense of labor than that of composts. The cost of the necessary apparatus for saving and distributing it is very small. As a dressing for land to be planted with turnips it is very excellent. As a top dressing in the spring or during the summer for pasture lands it is, perhaps, superior to any dressing that can be applied. If the undiluted urine is thought too strong, it may be easily diluted in the field if water is at hand. An intelligent farmer who has been using it as a top dressing for grass during the three years past, considers it fully equal in value to the solid excrement of the same animals; and he states that one man can dress as much land in one day with liquid manure, as two men can in two days with solid manure, without taking into account the expense and labor of collecting and mixing the material of which the compost is made. If this statement be correct, it must be more economical than any compost as a dressing. When applied to lands in which humus is deficient, it will not probably be found to meet all the wants of the crops. Its effects will be much like those of guano on similar soils. It remains to be determined by experience whether it is of equal value with superphosphate of lime, ashes, plaster, guano, or other concentrated manures as a top dressing. These may all be applied with equal facility and with even less labor, and some of them, as lime and ashes, are more permanent in their effects. In applying liquid manure the labor of one man and a horse will top-dress one acre a day within a quarter of a mile of the barn. This would be worth not far from three dollars. Will the value in any other dressing add as much to the value of the grass or grain crop as will the dressing in question? This can be ascertained only by experiment.

English farmers are making extensive application of manures in a liquid form. They have in some cases dissolved solid manures in large quantities of water, and applied them as a top dressing. They seem to be in favor of diluting them largely, and their effects may be due in some measure to the quantity of water in which they are dissolved. Liquid manures may be applied so strong as to injure tender plants. It is well known that pure guano, applied directly to the germinating seed, operates as a caustic upon its softened substance, and entirely prevents its growth. The same thing is true of ashes and lime under certain circumstances; and it is also true of urine, for when this is applied in large quantity upon young and tender grass, it will often kill it entirely. There is no doubt that the English mode of application is the safest, but by it the labor is much increased; and we are hardly prepared to believe that the fertilizing power is increased in proportion to the dilution, as is said to be the case with homœopathic medicines. Within certain limits the immediate effects of fertilizers may be and are increased by dilution. The particles of soluble bodies are more finely distributed, and are readily taken up by the radicles of plants and carried into the circulation. Indeed, this is doubtless the reason why liquid manures are more active than solid. Water must always be present to render manure, of any kind, effective. Potash, soda, lime, and all other salts, must be in a state of solution before they can be absorbed by plants. Horticulturists well understand that such substances can be applied with more immediate effect in a state of free solution. When the sulphates of potash, soda, and ammonia are applied in solution to strawberries, after the fruit is set, the effect upon the size of the fruit is sometimes truly wonderful. Applied in a solid form, in a season of drought, they have but little or no effect until the falling rain dissolves them, when they will operate sometimes with almost magical effect. Guano, applied as a top dressing, is often wholly inoperative unless the application is followed by rain. Hence, when this fertilizer is applied in this way, it should be in the early spring, while the ground is still wet, or during a rain, or upon an April snow, in order that it may be dissolved and carried into the ground, and thus be protected from the atmosphere as well as be applied to the roots of the grass and grain. There can be no doubt that lime and ashes, applied in the form of lime water and weak lye, would be more immediately efficacious than when applied in the ordinary way, but it would be attended with more labor and expense. How far this mode of applying manure will be found economical in this country, where labor absorbs so large a part of the working capital of the cultivator, each must judge for himself. Our own opinion is that, with the exception of urine from the stable and the house, which may be easily saved, and which is apt to be lost, in great measure at least, by any other plan of management, the application of liquid manures will be confined chiefly to the garden. For garden uses, soapsuds and the sewerage of the house are usually sufficient to fertilize a garden that will supply the family with vegetables. All the liquids from the house should be conducted to a reservoir. A garden engine and a water cart, with a few feet of hose and a sprinkler attached to it, will be all the machinery needed. The soil should be well sprinkled before the seed is sown, and at such times subsequently, during the growing season, as may be convenient or necessary. A little practice will soon teach the needful skill in the application. If plaster, or a solution of sulphate of iron, is added occasionally to the reservoir, it will act as a deodorizer, while at the same time it adds to the efficacy of the manure.

Much excellent manure might be prepared in this way if every farmer and every cultivator of a garden would take the pains necessary to provide a suitable reservoir. The material that now runs to waste, and is for the most part a nuisance around the premises, might thus be made to add no inconsiderable amount to the products of the soil. Each family, of five hundred families in a country town, might save manure to the value of five dollars annually that is now wasted. This would amount to twenty-five hundred dollars, or one dollar for each individual in the town. This would be sufficient to pay the highway tax and build one good school-house, or it would pay the entire school tax of most towns of that number of inhabitants. If such would be the value of this saving to a town of five hundred families, its value to the whole country must be a very large sum. As the population increases, the demand for garden vegetables and fruits will increase. This demand will lead to better and more thorough culture of all such products. This, in its turn, will lead to the careful preservation and application of all the means of enriching the soil. The crowded populations of Asia and Europe are far in advance of us in this respect. The low price of land has led our people to rely, hitherto, more upon the inherent energies of the virgin soil than upon the appliances of art. Our systems of agriculture have been based upon this, and when the fertility of one field is so far exhausted that it will not yield a satisfactory return for the labor expended upon it, we resort to another; but as the value of land increases we shall turn our attention to preserving and increasing the fertility of the soil we continuously cultivate. Then we doubt not that means of enriching the surface soil will be found often beneath the soil itself, and that a great amount of material that now runs to waste will be saved and applied as fertilizers to the soil.

SPECIAL MANURES.

In our discussion thus far, we have had direct reference to natural manures prepared on the farm, but we have introduced several observations relating to another class of manurial substances, which have become articles of commerce and trade. These are called *special manures*. By common consent this term has come to mean something used as a fertilizer or as a stimulant that is not derived from the ordinary sources of the farm—that is, from the stable and compost heap. The substances included under this term may be divided into commercial and artificial manures. The principal commercial manures are the guanos, bones, wool-waste, hair, woollen rags, and the oil cakes. The Peruvian and Mexican guanos, and more recently guanos from Baker's and Jarvis's islands, are, we believe, the only manures of this class imported into this country. Those that may with strict propriety be called artificial manures, are prepared on a large scale, in manufactories devoted to this special purpose, and are found for sale in all the agricultural stores. They are bone meal and flour, superphosphate of lime, muriate of lime, soda ash, sulphates and nitrates of potash, soda and ammonia, and various poudrettes. Most of these manures, as they are received from the manufactories, need little or no preparation, but are ready to be applied directly to the soil, or to be composted with other manures, or to be dissolved for use in a liquid form. Some of the old Roman writers speak of the value of ashes and lime, but seem not to have had the remotest idea of many of the important substances which have been brought to act so important a part in modern husbandry, and which do actually increase the value of many of our crops to no inconsiderable extent. One after another these specific agents have been discovered and introduced, until they are by some thought indispensable in good farming. That some of them are of great value, giving not only a present but permanent power of production to the soil, there can be no doubt. That such are the effects produced by the use of bones, was long ago learned by the farmers of England, who increased their wheat crop by the agency of bones and thorough drainage, from the low standard of fifteen bushels per acre up to forty, with an average of above thirty. So great was the demand for them that they soon became an important article of commerce, and British ships navigated every sea, and visited the remotest lands, to secure cargoes of bones. Our own shores were stripped of thousands of tons, that went to fertilize the British isles while our own acres were starving for them. They not only visited the hunting grounds of Africa, but gathered up the bones of countless herds of cattle on the pampas of South America, that had been killed for their hides, horns, and tallow alone. Even battle-fields, where men and brutes had found a common grave, were carefully gleaned of the decaying relics of unnumbered soldiers and horses, who thus found a too early resurrection from the tomb, and were exchanged for British gold. All these were transferred to the soil, and, with an improved husbandry in other respects, gave it a productive power which it never had before. And it was not a spasmodic power, but a permanent and reliable one, that has brought the most luxuriant crops for more than half a century. The example of our transatlantic friends at length awakened our own people to a sense of the importance of bones as food for plants, and some of them have been gathered and converted into superphosphates, bone meal, and bone flour, to be used both as a fertilizer and to be mingled with the food of our domestic animals. The value of bone as a fertilizer may be readily inferred from its composition. Fresh well-cleaned bone contains about thirty-eight per cent. of animal matter. The remainder is mineral matter, nine-tenths of which is phosphate of lime and one-tenth carbonate. The animal matter is of great value on account of the nitrogen it yields to the growing crops, and the phosphate is especially favorable to the development of seeds and grains. It is on account of the phosphate of lime that bone dust is so beneficial to dairy lands, as milk and cheese both contain it. There is about half a pound of phosphate of lime in ten gallons of milk. Bone dust is an excellent manure for wheat, for although this is a silica plant, in whose ashes silicate of lime abounds, the presence of phosphates in the soil is essential to the formation of the seed. If the soil be rich in silicates, but deficient in phosphates, excellent straw will be obtained, but the grain will be small in amount. It will be a crop better calculated to make bonnets than bread. It has been estimated that one hundred pounds of bone dust is equal to twenty-five or thirty hundred pounds of stable manure. Although bones contain such fertilizing elements, they must be finely pulverized in order that they may be immediately available in the nutrition of plants. It takes often twenty or more years for small fragments of bone of the size of a hazelnut to become disintegrated in the soil, and yet such fragments are often seen in the bone dust of commerce. Means have been discovered to reduce them to paste or flour, of which we shall speak hereafter.

As auxiliaries or helps in the management of soils, we can unreservedly recommend a careful and judicious use of the special manures. No exact rules can, however, be prescribed for their employment. The nature of the soil, its texture or mechanical condition, the degree of moisture it has, the state of the season, and the time of its application, all have so much to do with them, that exact rules would often prove inapplicable if they were given. The farmer will remember that plants feed only upon matter in solution—that is, the bone, plaster, potash, or ashes, must be dissolved before the roots can avail themselves of its nutriment. If, therefore, any of the special manures are applied to a soil so lacking in moisture as not to render them soluble, they remain inactive. So if a soil for the want of drainage is constantly charged with cold water, which keeps the temperature so low that putrefaction cannot take place, plants derive but little benefit from manure of any kind, even if a redundance of it is applied. These simple statements will perhaps show why so many experiments with special manures are set down as failures. They are used under such circumstances as to render them completely inoperative. They should be applied upon soils that are fine and porous, so that atmospheric action will be free among the particles, warming and moistening them. Under these circumstances the fine grains or flour of bone, guano, superphosphate, or any of the special manures, soon become softened by the dampness of the soil, then warmed by the genial rays of the sun, which easily penetrate it because it is light and fine, and by fermentation and putrefaction are soon converted into a soluble form, all ready to be appropriated by the roots of the plants.

Treated in this way special manures are quick in their action, giving plants an early and vigorous start, and pushing them rapidly forward until their roots find new means of support in the soil, which they penetrate in all directions. In rows of corn or vegetables where they are applied, the foliage will be found more luxuriant, and of a richer and deeper color, than in rows where none had been placed. These conditions must be observed or they will frequently prove a failure. They should also be near the surface, where they will be kept moist by the dampness of the atmosphere and summer showers. Even when these conditions are observed, it will be well to apply them just before a fall of rain, in misty weather, or during a gentle shower.

GUANO.

Guano has been more extensively used as a special fertilizer than any other, perhaps than all others. It consists of the excrement and exuvia of birds dropped upon the same spot through long periods of time. The birds select some island of the ocean where their favorite food abounds, congregate upon it in vast numbers, and there rear their young. This is also their resting place by day and night. The consequence is that all their droppings, when they are not upon the wing, fall upon the same place. Long before the keel of any vessel divided the waters of the vast Pacific, or the foot of man trod upon its islands, these birds were collecting their food from its prolific bosom, perpetuating their kind, and adding layer upon layer of their excrement, until some of them are now vast accumulations of guano, twenty, forty, or sixty feet in depth. It is calculated that the deposits of it in south and middle Peru amount to more than twenty millions of tons. The best guano is found in those tropical latitudes where it seldom or never rains. This vast mass, however, is not entirely composed of the digested droppings of the birds. It contains also feathers, bones, and the animal matter which comes from the decay of the birds themselves. The great difference in the results obtained from the analysis of different samples of guano indicates that age, exposure, and other circumstances greatly affect its properties. Sound guano contains a large amount of ammoniacal salts as well as phosphates. In birds, the secretions of the kidneys, as well as the intestines, are carried into the cloaca, where they become mixed and combined. The food of the sea-fowl, which produces this substance, is almost wholly fish, on which account their excrement is much richer in nitrogen than that of birds or animals that feed on vegetable food. Its value depends essentially on this fact.

COMPOSITION OF GUANO.

Professor Norton gives the composition of a few leading varieties in the following table:

Variety.	Water.	Organic matter and ammoniacal salts.	Phosphates.
Bolivian	5 to 7	56 to 64	25 to 29
Peruvian	7 to 10	56 to 66	16 to 23
Chilian	10 to 13	50 to 56	22 to 30
Ichaboe	18 to 26	36 to 44	21 to 29

This, it is evident at a glance, is an extremely rich manure; the quantities of ammoniacal salts and of phosphates are remarkably large. The Ichaboe guano contains much more water than the others, because the climate in that region is not so dry as on the west coast of South America. It is also more decomposed, giving usually a stronger smell of ammonia. The Pacific guanos have very little smell of ammonia, but if they are mixed with a little quicklime and gently heated, the odor becomes extremely pungent.

More recent importations are from two islands in the Pacific discovered by Americans, and called Baker and Jarvis islands. Says Liebig, "The guanos from these islands are distinguished from others by their acid reaction and greater solubility. They contain only a small quantity of substances containing nitrogen, no uric acid, and small proportions of nitric acid, potash, magnesia, and ammonia. The Baker's island guano contains as much as eighty per cent., the Jarvis thirty-three or four per cent., of phosphate of lime. The latter has forty-four per cent. of gypsum. These guanos approach nearest in their composition to bone dust. Their condition enables the farmer who wishes to accelerate their action, to convert them into superphosphate, by the addition of from twenty to twenty-five per cent. of their weight of concentrated sulphuric acid.

According to an analysis by Voelker, one pound of guano was found to be equal to fifty pounds of farm-yard manure, and that it contains these elements in the most concentrated form, and permits the application of them to the field more conveniently than farm-yard manure, as it may often be done after putting in the seed.

The difference between the Peruvian and Mexican guanos is, that the former contains a larger proportion of the ammoniacal salts and the latter a larger proportion of the phosphates. The especial value of the former may be seen in the increase of the straw and culms in grain and grass; while the value of the latter is manifested in the increased volume and plumpness of the grain and seeds. The high prices at which the guanos have been held for the past few years have greatly diminished their use in this country. At a reasonable price they might be used to great profit on our partially exhausted soils, especially when used in combination with carbonaceous matters. If good guano can be furnished at the seaports at from forty to fifty dollars per ton, it would find an extensive demand. It is capable of increasing, under judicious application, the crops of grain, potatoes, and grass at least thirty-three per cent. Owing to its comparative cleanliness and facility of application, it is peculiarly suited to horticultural and floral improvement.

But guano is shamefully adulterated, and the farmer not only frequently loses the money he pays for it, but loses his labor, the use of his land, and the crop which ought to grow upon it. Professor Johnston mentions an instance of four vessels which sailed from English ports, ballasted with plaster of Paris intended for admixture with the guano when the vessels were loaded at the islands. Another favorite material for adulteration is umber, so that in some cases the farmer gets fifteen hundred pounds of umber to the ton, and only five hundred pounds of guano. In order to protect the purchaser from such outrageous impositions, the professor gives the following as tests:

1st. The drier the better; there is less water to pay for and transport.

2d. The lighter the color the better; it is not so completely decomposed.

3d. If it has not a strong ammoniacal smell, it ought to give off such a smell when a spoonful of it is mixed with a spoonful of quicklime in a glass.

4th. When put into a tumbler with water and well stirred, and the water and fine matter poured off, it ought to leave little sand or stones.

What is the effect of guano upon crops?

In the first place, is it permanent? The popular notion is that it is not; but we think it must extend to two crops, because if its ammoniacal salts are nearly exhausted the first year the phosphates will continue to act beyond one year. Professor Johnston says guano very much resembles bones in its composition, and as bones are known to benefit crops in an entire rotation, guano ought to do the same. The chief difference between bones and guano is this: that the guano contains ammonia ready formed, or forming, so to speak, while the bones contain gelatine, which forms ammonia only during putrefaction. The ammoniacal part of the one, therefore, will act early; of the other, after a longer period, while the permanent effects of the remaining ingredients of both will be very much alike. The guanos, then, having the most ammonia will have the greatest present effect, while those having a larger amount of the phosphates will be the most permanent. Nearly all the authorities we have consulted agree in the conclusion that three or four hundred pounds of pure guano is worth as much as fourteen to eighteen loads of ordinary manure. An instance of its energy is stated by Professor Norton, where eight hundred pounds being put upon an acre of turnips, they all grew to tops and produced no bulbs. Even the succeeding crop of wheat was so rank in its growth that the grain was miserable. The Hon. Marshall P. Wilder, well known to the country as one of its leading pomologists, applied eight hundred pounds per acre, and harvested from it sixteen hundred bushels of carrots. The following statements were communicated to us several years since by David Mosely, esq., of Westfield, Massachusetts. Mr. Mosely is a thrifty, observing farmer, who manages his estate with singular ability and success. He says (New England Farmer, vol. 8, p. 238) that three hundred pounds of guano, in one instance, increased the crop of corn fifteen bushels per acre; that in another $53 worth of guano gave a profit of $77; that in a third instance he manured a field of seven acres with fifteen cart-loads of good stable manure, and on five acres of it sowed one hundred and fifty pounds of guano per acre. The portion on which the guano was put yielded twenty-three bushels per acre more than the remainder of the field. In a fourth instance he sowed two hundred and fifty pounds per acre, which increased the crop twenty bushels an acre, and it was ten or twelve days earlier for the guano. He further states that three hundred pounds have given him more bushels of potatoes than twenty loads of manure.

HOW AND WHEN TO APPLY GUANO.

1st. As we have already stated, guano is best applied in damp or showery weather.

2d. It should be put on grass lands in the latter part of March or the early part of April.

3d. When applied to land just ploughed, it should be immediately mixed with the soil by harrowing, or, as Mr. Mosely states, by brushing it with birches or other bushes.

4th. When grain is sowed early in the autumn, only a portion of the guano intended to be applied should be then used, but the balance should be put on in the spring. If the whole is applied in the fall the grain sometimes becomes too luxuriant and is liable to be injured by the frosts.

5th. Guano should be applied with reference to the present crop only, and not with the purpose of benefiting succeeding crops.

6th. Guano, before application, should be mixed with five or six times its weight of charcoal, fine soil, or dried muck. We once caused four tons of Peruvian guano to be spread upon a floor and mixed with six times its weight of fine black muck in layers of the two articles. After it had remained in this condition two weeks, it was overhauled and the pile evened up and covered with clean muck. The same operation was repeated in two weeks more. At planting time, two or three weeks after the second overhauling, it was shovelled into carts, taken into the field, and a moderate handful thrown into each hill. The corn not appearing in due time, examination was made into its condition, when it was found that most of the kernels had sprouted, but as soon as the tender germ had reached the guano it perished. Of the sixteen acres to which it was applied not a tenth part of the corn came up. Our next conclusion, therefore, is—

7th. That guano should on no account be allowed to come in contact with the seed.

English chemists have recommended guano as a means of increasing the growth of the sugar cane upon the partially exhausted soils of the West India islands; and we see no reason to doubt that it would give a greatly increased growth to the cotton plant, especially on soils that have been cultivated several years in that most important crop. It should be applied largely diluted with peat, rich loam, or marly earth, in the furrow at the time of sowing the seed. It should be spread over the whole width of the furrow, which should be eight or ten inches wide. It would give a rapid growth to the young and tender plants, which would thus attain a larger size and become more deeply rooted before the approach of the dry season. Experience alone can determine what quantity can be applied with advantage. Probably about the same quantity that is required for corn will be required, viz: from two to three hundred pounds, according to the condition of the soil. Guano is often applied by gardeners and floriculturists in a weak solution. If it should be found to injure the germs of the cotton plants it might be applied in solution at the first hoeing, upon the surface of the ground.

The importation of guano into Great Britain in the year 1845 was two hundred and eighty-three thousand and three hundred tons, and in 1851 two hundred and forty-five thousand tons, at a cost that year of about ten millions of dollars. So that, with the experience of six years in its use, the farmers in that country thought it profitable to expend ten millions for this special fertilizer in a single year!

BONES AND SUPERPHOSPHATES OF LIME.

Bones, as we have already said, in their entire state—that is, containing all the gelatine of the periosteum and cells which compose their framework, and all the fat and earths with which these cells are filled—consist of about thirty-eight parts animal matter, forty-four parts of phosphate of lime, three per cent. of magnesia, soda, and other salts, with twelve per cent. of moisture. If a quantity of entire bones ground to a fine powder, are placed in a box or other vessel in a warm temperature and slightly moistened, putrefaction will be quickly set up and ammonia will be rapidly evolved. It is obvious that in this condition bone must be a highly stimulating and active manure, and must contribute to a vigorous growth of the stalk and an abundant crop of grain and seed. The bone meal and flour now in the market purport to consist of the entire bone reduced to different degrees of fineness. Could we be sure that the glue-makers and soap-makers have not had a share of it, we should consider it the most valuable of all the manufactured manures. As long as we have farm stock, cattle, sheep, swine, and horses, they must have bones, and as phosphate of lime exists so largely in them, it must be provided for them in the food they eat. Accordingly it is present in all cereal grains, in leguminous plants, and many other vegetables, the soil of course furnishing it to them. It is not only, then, the animal substance in bones, the gelatine and fat, that makes them a good manure, but the mineral part is of essential service to some crops, especially if the soil be at all deficient in phosphate of lime. Bones contain, as we have seen, forty-four per cent. of phosphate of lime. But phosphate of lime is almost insoluble. We see bones lying exposed to the weather for years, and only slowly crumbling into the soil. The animal matter has long since wasted out of them; but the phosphate of lime remains. How can this be rendered soluble, so that it can speedily yield its valuable elements to the growing plants? Neutral salts consist of acids completely saturated with some base. Thus, sulphate of lime, or gypsum, consists of sulphuric acid combined with all the quicklime it will take up. The new compound thus formed no longer presents the sensible properties of either of the ingredients. The acid of the one and the alkali of the other are not perceptible to the taste, and the caustic property of both is no longer present. The compound, then, is neither acid nor alkaline, but neutral. But many neutral salts, as the gypsum of which we are speaking, are sparingly and slowly soluble in water. By the addition of an excess of the acid used in forming them, they become more soluble. By removing a portion of the base, or alkaline earth, from the compound, the same effect is produced; for if there was just sufficient in the compound to neutralize the acid, the removal of a part leaves the acid unsaturated or in excess. The salt will not then be neutral, but an acid salt, or, in chemical language, a super salt. Phosphate of lime, as found in bones, is a neutral salt, consisting of one part of phosphoric acid and three parts of lime. It may be rendered soluble by adding phosphoric acid, so that it shall no longer be neutral, but an acid or superphosphate; or the same effect may be produced by the addition of any other acid having a sufficiently strong affinity for lime to take away a portion of it from the phosphoric acid. The remaining lime no longer neutralizes the phosphoric acid, and the compound becomes an acid or superphosphate. Sulphuric acid has so strong an affinity for lime that if it be mixed with neutral phosphate of lime it will seize upon and combine with one of the three parts of lime which, as we have said, enter into its composition, and will form with it sulphate of lime, or gypsum. This mixture of phosphate of lime with sulphuric acid will then consist of superphosphate of lime and plaster or gypsum. This is the substance known in the market as superphosphate of lime. If no additional plaster or other substance is mixed with it, it is a valuable manurial substance. Could the animal matter contained in the entire bone be separated from it before it is subjected to the action of the sulphuric acid, and be restored to the mixture afterward, a very powerful manure would be obtained. This is said to be done in the manufacture of the superphosphates in the market. But we have found so much difference in the sensible properties and in the effects of different samples of it, that we conclude that the soap-maker at least gets his share, even if the glue-maker is denied, or that the material used in the manufacture consists of bones so long exposed to the action of the weather that the animal matter has been wasted out of them. When this article is manufactured on a large scale for the trade the process is as follows:

Bones are collected from every possible source; boys and girls gather them in the streets of cities; butchers and provision dealers save them; men scour the country with horses and wagons, picking up from house to house every pound or bushel they can get, while vessels collect them in large quantities wherever they can be found, and find a profit in the business. These bones are in a raw condition, not having been used by soap-boilers, or in any other way to lessen their value. When collected and thrown into heaps, under cover, each bone is examined, and all such as are suitable to be used in the arts are then laid aside for turners, cutters, and so forth, to be used for knobs, handles of knives, canes, and umbrellas, and the smaller pieces to be made into buttons. Such as are not fit to be used in the arts are thrown into iron retorts, each holding two barrels. The covers of these retorts are fitted so exactly that they are nearly or quite air-tight. When thus made ready they are let down into a furnace, where the whole mass, retort and bones, soon acquires a red heat; but no air being admitted, no flame takes place in the bones. In this intense heat, all the animal matters, the gelatine, oils, ammonia, &c., are driven off, and in the form of steam pass through a pipe to a reservoir prepared for them in a remote part of the building. The pipe through which they pass, as in the process of distillation, is immersed in cold water, so that the oil and gelatine leave it in a thickened state, and most highly charged with the pungent ammonia. Careful experiment having taught the workmen how long to allow the retorts to remain in the furnace, when that time has expired they are taken out and set upon iron wheelbarrows and placed away to be cooled off. The bones are now reduced to what is called bone-black or *animal charcoal*. This is extensively used in refining sugar. They are of a shining black color, brittle, and can be easily and rapidly ground, not into flour, but into quite small particles. Two barrels of this ground bone is then placed in a wooden vat, and spread evenly over the bottom. Four gallons of the liquid that ran out of the retort are thrown upon it, and the whole is thoroughly stirred. When the mass is sufficiently mixed, from fifty to sixty pounds of sulphuric acid are added and mingled. A powerful ebullition or boiling takes place, which continues several minutes, during which time the workmen keep the whole mass in motion. When it subsides, the article has become what is called superphosphate of lime. It is then spread upon floors in lofts, or in fine weather upon platforms made for the purpose in the open air, and when partially dried is packed in barrels or bags, and is ready for the market. By this process nothing that the bones originally contained is lost, although it has undergone important chemical changes.

Can it be doubted then that superphosphate of lime, judiciously applied to soils fitted for it and needing it, will greatly promote the growth of many of our crops? It is said, however, to be often adulterated with black loam or pulverized muck, which so nearly resembles the burnt bone in color and texture that it is difficult to detect the imposition without the aid of chemical tests.

There are other modes of reducing bones so as to make their properties available by the farmer. One of these is to mix one part of sulphuric acid with two parts water, and immerse the bones in the mixture until they are softened into a paste, and then mix them with dry muck or some other substance that will separate the adhesive particles and make them convenient for use.

Another and a better way is to reduce them by steam, by the following process: A strong steam box is hung upon a frame so as to be easily turned over. A square hole is cut through one of the sides, and a cover tightly fitted to it, and held in place by clamps and a screw. The box is charged with bones through this hole, the cover closed and the steam admitted. It requires a superheated steam to break them down, which must be constantly applied for several continuous hours. It is claimed that by this process all the animal and mineral matters that enter into the composition of bones are saved. A portion of the gelatine which is driven out from the bones is conducted away, allowed to ferment in contact with dry muck, and then a certain quantity of the dissolved bone is added, making what is termed *ammoniated superphosphate of lime.*

After the mass in the steam box is sufficiently cooked, the cover is removed, the box turned over, and the contents precipitated upon the floor; from the floor it is carried by machinery to a room above, that is heated by steam, and dried, and as it becomes sufficiently dry is moved along to a hopper, passes through a mill, and comes out in fine granular particles, which can be readily broken down by the thumb and finger. The first requisite in the use of superphosphate is that it be absolutely pure. Numerous cases of failure that have been reported, have undoubtedly arisen from the shameful adulterations, either by the manufacturer or by those who have purchased to sell again. In some instances, however, failures may be traced to total misapplication, as when it is applied to soils so completely charged with cold water that they are rarely warmed to a degree to induce fermentation and the other processes of decay; or, again, when it is applied to dry gravelly soil entirely deficient of humus. Superphosphate is not equally adapted to all plants. On all the Brassica family, including the cabbage, Swedish turnip, common flat turnip, cauliflower, broccoli, &c., its influence is usually striking and profitable. The leaves of the plants grow larger and thicker and assume a darker green than we have ever seen them under the stimulus of any other fertilizer. It is also useful to beets, mangolds, peas and beans, and all other of the field and garden crops.

Several years since we made an experiment with it on a young pear orchard containing one hundred and fifty trees. It was applied at the rate of six hundred pounds to the acre, and sowed broadcast in November. The land was a sandy loam, had been moderately manured for several years in succession, but heavily cropped each year with carrots, parsnips, grapes, and raspberries. In the spring succeeding the dressing with superphosphate, the carrots and parsnips were omitted, and white beans and grapes were planted. All the crops were almost extravagantly luxuriant during the summer. The change in the size and color of the leaves of the pear trees was remarkable, and afforded a striking contrast between themselves and the leaves of other pear trees but a short distance from them. The fruit in the autumn was of corresponding excellence. The beans planted were the white pea bean, which usually grows about a foot high; they also felt the power of the fertilizer, and instead of modestly keeping near the ground, as is their habit, made an average growth of three feet, some of them climbing into the branches of the pear trees, six feet from the ground. The young grape vines also made a rapid growth, as did the stools of raspberries. The same spot has been annually dressed in November with farm compost, moderately, and spaded in. The pear trees are ten feet apart each way. Between them in the rows is a grape vine and two stools of Brinkle orange raspberries, and beans planted between the rows of pear trees. With such management the crops, crowded as these are, continue at the close of six years to be as luxuriant as ever. During the last autumn the pear trees required propping to enable them to sustain their load of fruit, and the grapes trained to stakes broke their accustomed fastenings and fell to the ground. The beans yielded annually at the rate of about forty bushels to the acre.

We have thus stated somewhat in detail what phosphate of lime is, how it is produced, what crops it is best adapted to, and something of its power upon crops when properly used—so that the farmer, unaccustomed to its use, may avail himself of its advantages without the risk of loss.

SALTPETRE.

Nitric acid with potash, soda, ammonia, and lime, forms salts, which go by the general name of saltpetres. The nitrates of potash and soda are best known to us. The former is imported largely from the East Indies; the latter comes to this country mostly from Peru, where it is found in extensive beds combined with earths, from which it is extracted by a rude process of lixiviation and evaporation.

From some experiments which we have made with saltpetre, we are inclined to think that its value as a manure is not fully appreciated. In those experiments, at a cost of five cents a pound, we found it among the cheapest manures we had ever used. Its use is not a modern discovery. The first English author who wrote upon husbandry, in 1532, Anthony Fitzherbert, describes it as having the power to insure the farmer the most abundant crops. A hundred years after, Evelyn told the farmers of his age if they could obtain a plentiful supply of saltpetre they would need but little other compost to meliorate their ground. Even Jethro Tull, who zealously denied the necessity of manures of any kind, placed nitre at the head of his list of those substances which he deemed to be the essential food of plants. But it is only in modern days that saltpetre has been extensively used as a fertilizer, for it is not long that it has been produced in quantities sufficiently reasonable to enable the farmer to use it profitably as a manure. It is so extensively used in the arts, especially in the manufacture of gunpowder, that the price has been thought too high to make it a profitable investment in the soil. In large quantities, however, and in ordinary times, we think it may be obtained at as low prices as Peruvian guano or the superphosphate of lime.

Experiments are not wanting to show the results of the use of saltpetre upon crops, and this is the point of interest to us. A gentleman used it in the kitchen and flower garden, where it increased the beauty and prolonged the bloom of the flowers; and, at the rate of two hundred pounds per acre, on a crop of horseradish, with the most beneficial results. It prevented mildew on early peas and wall fruit trees. Its application to red clover greatly increased the crop.

In England it is supposed that the most effective method of enriching land is by folding sheep upon it, and yet a gentleman in Hertfordshire produced with one hundred pounds of saltpetre to the acre, eeffects more than equal to those produced by folding sheep. Another gentleman states that on the sandy lands of Surry, with one hundred pounds of nitre on clover, he produced results fully equal to those of twenty-five cubic yards of horse dung. Still another, by the use of one hundred pounds to an acre of light land, obtained an increase of six and a half bushels of wheat. In a report of the Hardstone Farmers' Club, it is stated to be the unanimous opinion of the meeting that saltpetre was excellent in its effects on heavy clover lays, and that on light lands it was highly beneficial to wheat, clover, and other lays, and tares. A farmer in Essex county, England, got forty-four bushels of barley, without saltpetre, on an acre, and with a top dressing of one hundred pounds got fifty-four bushels.

Several years since, when the potato rot passed over the land as a scourge, and the prospect seemed to be that this most valuable esculent was to be blotted out from the rich list of table vegetables, we instituted some experiments with saltpetre which afforded the most gratifying results. We ploughed a portion of an old grass field, harrowed it into a fine tilth, and sowed two hundred pounds of gypsum, and mingled with it one pound of saltpetre to the square rod, or one hundred and sixty pounds to the acre. The saltpetre was pulverized as finely as could well be done with the crude means at hand for such a purpose. The crop was hoed twice and all weeds kept down. The potatoes planted were of the white Chenango variety, and yielded one hundred and fifty bushels per acre. They were very smooth and fair, and not a peck of rotten ones was found where the plaster and saltpetre was applied. On a part of the field which had received no special fertilizers, the potatoes were fair, but *rotted so rapidly, and emitted so foul an odor, that a part was dug and buried in the field out of sight.*

The remark that we made respecting guano is also true of saltpetre, and in fact of all other manures, viz: that if they are made fine, and applied in wet or moist weather, their effects will be more immediately apparent.

POUDRETTES.

The poudrettes consist of blood, fish and animal matters, and night-soil, dried and combined with substances capable of deodorizing them and absorbing their ammonia, phosphuretted hydrogen, and other gases and moisture, and reduced to powder. A species of poudrette, called fish manure, is now prepared by steaming and pressing the fish, chiefly menhaden, for the purpose primarily of obtaining their oil. These fish are taken in nets in large quantities at certain seasons. They are steamed and subjected to strong pressure, by which the oil is forced out, and the residuum is left almost as dry as so much seasoned wood. It is then ground and packed in barrels for the market. All the poudrettes are packed in barrels or bags, and can be readily transported by land or water. In some instances the entire fish, fresh from the ocean, are used for carrying a crop of corn, by depositing one or two in a hill, drawing a little soil over them, and dropping the corn upon it. Fish are extensively and profitably used by the farmers on Long Island and in many places on the coast of New England. On Chesapeake bay, in Maryland, the farmers collect large quantities of fish offal and cart them many miles inland, and also from the fisheries on the Potomac, Delaware, and other rivers.

When properly manufactured the poudrettes are very valuable manures. When applied to the roots of plants, in a soil well supplied with coarser manures, they give a vigorous start to young plants, and a larger development and a deeper tint to the petals of flowers. When applied in the hill they give to the young corn a fine and early growth. They are rapidly decomposed in the soil, and should always be so deeply covered that their evolving gases may be retained by it. They should be sprinkled over a surface of ten or twelve inches square, rather than thrown in a mass around the seeds or roots of young plants. If the soil is cold, or the season backward, their good effects are immediately manifest. The poudrettes have been suggested as a means of improving the culture of the cotton plant, and as they are easy of transportation and application, it is desirable that they should be fairly tried, and the present seems to be a favorable time for trying them. On light soils, or on soils partially exhausted, they must prove a powerful stimulant to the growing plants. They would seem to be well suited to the sandy soils of the sea islands on the coast of South Carolina and Georgia. Three or four hundred pounds to the acre will probably be sufficient to insure a large crop. In the warm climates in which cotton is grown, cattle are not fed in the barn; stable composts are, therefore, not to be had. Composts made of beans, weeds, and other vegetables, with lime, ashes and salt, and guano and poudrettes, seem to be the only manures within the reach of the planters. At the present time, when labor is so difficult to be obtained, and cotton is in such demand, we would earnestly urge that experiments should be made with some or all of these substances. Oil cake, made by expressing the oil from the cotton seed, may be found an excellent fertilizer for the plant. If by these means a larger crop can be made on the acre, labor will be saved, and the profit from its culture will be increased. With the introduction of improved farm implements, improved methods of culture should also be introduced, that the losses of past years may be the more speedily recovered.

We would suggest the following method of applying poudrette or guano in cotton culture as one that is both cheap and easy: Plough furrows at such distances from each other as it is desired that the cotton should grow; sprinkle the fertilizer in these furrows; then cover it by turning a light furrow on to it from each side, which will form a ridge; now pass a light roller, long enough to take two at a time, lengthwise of the ridges; plant the seed upon the ridges with a seed sower or by hand, and cultivate in the usual way. By this method the tender germs of the seed will not be brought into immediate contact with the fertilizer; and in the case of guano and ashes this is a matter of much importance. By the time the radicles reach the manure thus buried, they will have become sufficiently firm to resist any caustic action they might exert, and be able to appropriate the stimulating nutriment they afford, and will thus make a vigorous and luxuriant growth.

THE APPLICATION OF MANURES.

We have already said so much upon the application of manures, while treating upon their composition and preparation, that the reader will very naturally expect, and probably hope, that we shall very briefly dispose of this part of our subject; but it is a matter of no small importance, and the progressive farmer will be willing to give it a careful consideration. Before discussing more particularly, however, the application of manures, we will institute an inquiry into the effects produced by manures upon growing plants and upon the soil.

Were the theory correct, advanced by Jethro Tull and others, that plants derive all their nutriment from the atmosphere, the application of manures to the soil would be of no benefit to them, unless it were to stimulate them to drink up the carbonic acid and the hydrogen, and, in some cases, the nitrogen of the atmosphere, more eagerly. But experience everywhere teaches us that the liberal application of manures causes vegetables to grow with more vigor, and to attain a much more perfect development. The obvious inference from this fact is, that manures furnish to plants the elements of nutrition, which they eagerly consume and appropriate to their growth. Vegetables, like animals, possess the wonderful, almost creative, power of assimilation; they can transfer particles of inorganic matter to their own organs, and imbue them with the life which exists in those organs. Let us illustrate this by reference to the process of digestion in animals, where it can be more readily traced. The food is received into the stomach, where it undergoes a sort of solution, and is then carried forward into the intestines, where it is presented to the mouths of myriads of little vessels, which drink up the fluid portion and convey it to larger vessels, by which it is conveyed to the heart. By the heart it is sent into the lungs, where it is acted upon by the air in the lung cells, and is then returned to the heart, and by means of the arteries sent to the various tissue-forming vessels throughout the body. The blood in the arteries is apparently a homogeneous fluid, but is in fact a very compound fluid, containing in solution various elements that previously existed in the food. The tissue-forming or assimilating vessels are endowed with the power of selecting from the compound mass presented to them, such elements as they need for their respective purposes, and rejecting the remainder. From the materials selected they build their several structures and repair the waste that is constantly going on in them. Thus one set of vessels forms bone, another muscular fibre, another skin, another hair, &c. Other vessels, from the same circulating fluid, eliminate the various fluids contained in the body, as serum, milk, urine, &c. There is a system in many respects similar in the lower grade of organized beings which we term vegetables. Fluids are drunk up by the hair-like radicles by which their roots are covered, are conveyed upward in vessels arranged for this special purpose, and when they have passed through the stem or trunk, they are distributed to the leaves. The fluid passing from the spongioles to the leaves is called the ascending sap. In the leaf the sap is acted upon by the elements contained in the atmosphere; it then becomes the descending sap, and is presented to the various tissue-forming vessels in all parts of vegetables. It is now apparently homogeneous, but, in truth, exceedingly compound, containing the various bodies in solution which were drunk up by the radicles, and which have been absorbed from the atmosphere in the leaves. The vessels of vegetables have the same seemingly intelligent power of selection that exists in the vessels of animals. They are thus enabled to select from the compound circulating sap, what each set of vessels requires to construct the tissue which each has in charge. One set selects material for the albumen, another for the leaf and leaf-bud, another forms the fruit-bud and ultimately builds up the fruit. One set constructs the woody fibre, another the starch, another the gum, another the resin, another set the bitter principle, another the sweet juices, and still another the poisonous elements. One set forms the sap that blushes or glows in the petals of the flowers; another selects, atom by atom, the lime that enters into the composition of the grain of wheat; another set weaves the covering for this same grain from the woody fibre; another deposits the fatty elements and arranges them in layers around the starch, and sugar, and lime, of which the kernel of corn is built up. Thus each tissue and each product of vegetable life is formed, by innumerable vessels, from the descending sap.

This sap, then, must contain all the elements required to form all the various vegetable tissues, and for their rapid and perfect development the supply must be abundant, and must be in due proportion, and must be furnished at the time when it is required by the formative vessels. An animal fed upon starch alone, or upon sugar alone, will soon starve and die; the various vessels cannot obtain the materials necessary to carry on their work; so, if a plant is furnished with only one element of nutrition, be it ever so abundant, it will cease to thrive, or at least only those vessels that require this element will carry on their proper work. For example: certain vegetables supplied with an abundance of nitrogenous manure will produce an exuberant growth of woody fibre, of stalk, of leaf, and but little or no fruit or seed.

We are now prepared to understand somewhat more clearly the effects of manures upon vegetable growth.

Manures furnish to the sap vessels the various elements which they need for the construction of the different tissues, in such a state of minute subdivision that they can take up, atom by atom, what each requires. All the elements existing in the soil furnish their respective quotas to the compound substance constituting the sap. Some of these elements are capable of solution in the soil; others are incapable of direct solution, and without the presence of some other element capable of either acting upon them, and thus rendering them soluble, or of combining with the solvent and imparting to it a higher power of solution, they would remain inert in the soil. Thus silex is insoluble in simple water, but the presence of lime or potash in the solvent gives rise to a new action, and silicate of lime or potash is formed, which is soluble, and thus becomes an ingredient in the sap. Silex is an important constituent in the epidermis of several of the grasses and of the straw of grain. When such plants do not contain a sufficient supply of silex in their outward coats, they break down under their own weight, and lodge on the ground before they have attained their full maturity. This we often witness in clover, and herd's-grass, and oats, upon reclaimed meadows and swamps. In such cases a top dressing of sand or gravel will impart to the growing crop of the next season sufficient firmness to enable it to stand erect until its growth is completed. In such cases, even if lime and potash are not directly essential to the growth of plants, they contribute indirectly an important service—they render the silex soluble. This instance affords a beautiful illustration of the chemical action that is constantly going on in the soil.

Different soils require different treatment. Clay soils should be treated with lime, ashes, and light composts; such as contain straw and partially decomposed vegetable matters keep such soils light, and furnish by their decomposition the humus in which they are deficient. Black, moist soils, that have been long cultivated, are generally exhausted of the lime and silex needed for grass and grain crops; hence composts containing sand are especially useful on such soils. Lime may be applied freely upon the surface of such soils in the form of plaster, slaked lime, or superphosphate, with advantage. On light, sandy soils, well-worked composts, rendered as fine as possible, and containing a large proportion of muck or other carbonaceous substances, and animal manures of all sorts, are peculiarly appropriate. The influence of animal manures upon sandy soils is well illustrated by the luxuriant growth of corn and melons upon the sands of Cape Cod, by means of fish offal and prepared fish manures. Such soils are hungry for the elements which these manures contain. Whatever manures are applied to such soils should be well covered in.

Should manures be deeply covered in the soil, or should they be applied near the surface, are questions about which cultivators differ. So much interest has this question excited, that some five years ago the Massachusetts Agricultural Society offered premiums to induce farmers in different parts of the State, to try experiments with manure placed at different depths in the soil. The plan was as follows: Five lots of the same size, on similar soil, side by side, were to be selected, marked, and numbered. On number one the manure was to be ploughed in deeply; on number two it was to be ploughed in four inches; on number three it was to be spread on the surface and harrowed in; on number four it was to be spread on the surface and not harrowed in; on number five no manure was to be put. The lots were all to be planted and cultivated alike for three years in succession, without the addition of any more manure, and the entire crop of each lot for each year weighed, and an account of the seasons, with a description of the soil, was to accompany each report. The reports indicated that the best average results were obtained from placing the manure about four inches deep. The depth at which manures should be covered will depend upon three circumstances: the nature of the soil, the kind of manure, and the kind of crop. All manures should be placed at a sufficient depth in the soil to keep them moist, or they will be inactive. When a soil is naturally heavy and moist, it is not necessary to bury manure so deep to insure its being kept in a moist state, as when it is light and dry. Manures containing a large proportion of volatile elements should be buried more deeply. These elements, when the soil becomes warm, assume the gaseous form, and tend to rise to the surface, and will be diffused through the soil lying over them, and, if there are elements in the soil having an affinity for them, will be retained. Other elements which are not volatile, as lime, ashes, and salt, but which are soluble in water, may be safely applied on or near the surface, where they will be dissolved by the rain and sink into the soil.

Some vegetables strike their roots deeply into the soil, and for their perfect development require a deep tilth. In such instances trenching or deep ploughing is peculiarly beneficial. For such crops a portion of the manure should be worked deeply into the soil. In preparing a garden soil it is a good method to spread on the surface a coating of manure, and plough or spade it in deeply, and then to add a dressing of fine compost or liquid manure, and work it in with the harrow or rake. Thus the deep-growing plants will find nutriment at every stage of their growth. By a repetition of this process a deep, rich soil will be formed, which will meet the wants of the various esculents of the garden, and supply to each what its nature and habits require. For potatoes it is not necessary to cover the manure so deeply, as they grow near the surface. The same is true of the flat turnip. The question has been often asked, How can manure be best applied for the corn crop? Shall it all be put upon the soil before ploughing, and be ploughed in deeply? or shall a portion of it be placed in the hill or near the surface? When corn is to be grown on newly turned grass land, shall the manure be spread upon the grass and turned under the sod? This is certainly the easiest mode of applying it, and many farmers assert that when it is applied in this way, although the corn may not be as vigorous in the early part of the season, yet in the latter part of it, when the roots have struck through the rotting sod and found the manure deposited beneath, it will grow with sufficient energy to make up for the time lost in the early part of the season. Others prefer to turn over the soil in the autumn, and in the spring work in the manure upon the surface of the furrows with the harrow or the cultivator. In this way it is said the corn will get a fine start in the early season, and when its roots strike into the mellow sod, they will find all the nourishment they require to complete the growth of the plant. Doubtless both these methods have been successful. If the season proves to be wet, or the soil is naturally moist, the manure near the surface will give a good crop, but if the season should prove dry, we may expect the best result from the more deeply covered manure. The manure, fermenting under the sod, causes it to become rapidly mellow and crumble into a fine tilth, and thus a rich bed is furnished to the growing roots. But the largest crop of corn we have ever seen, was produced by a combination of the two methods. Two-thirds of the manure, sixteen ox-cart loads of rich stable manure to the acre, were spread upon the sward in the spring, which was then turned over by the plough; the harrow was vigorously applied, and after this furrows were made for the rows with a light plough. Then the other third, eight loads, was put into the furrows and the kernels dropped ten inches apart. This gave the corn an early start, and it grew vigorously from the commencement, and its roots soon found the rich nutriment deposited below the sod. The crop in this case was one hundred and four bushels to the acre. As the corn crop is perhaps the most important crop in the country—is, in fact, the national crop—the proper method of applying manure to it is a subject of great importance; but it is questionable whether any rule of universal application can be given, as different soils require different modes of application. In a heavy clayey soil it is important that the management should be such as to render the soil warm and light. To accomplish this object a large portion of the manure should be incorporated with the soil by the plough. Green manures do well on soils of this description, but as such soil, unless underdrained, is cold and does not set the crop forward early, something more is wanted. A small quantity of well composted manure in the hill meets this deficiency. This process is attended with labor and expense, but these are fully repaid by the larger crop. Indeed, in such soils the crop is uncertain without the use of some such means, unless the season is peculiarly favorable. In light, warm soils the whole of the manure may be worked into the soil with safety, and perhaps with more advantage to the soil, if the object is to prepare it for future crops. In any soil, if the chief purpose is to improve it and prepare it for grass, grain, or other crops as speedily as possible, and the present crop of corn is a secondary object, the whole amount of barn manure should be thoroughly incorporated with the soil, and a little guano, poudrette, or superphosphate put into the hill to serve as a stimulus to the corn crop. In this way, when the soil is cold and tenacious, a good corn crop may be secured, and the soil rapidly prepared for future use. The stimulant will be expended on the corn crop, and will contribute little or nothing to the permanent improvement of the land.

For this we must depend wholly, so far as manures are concerned, upon stable and compost manures. When these are not used in sufficient quantity to effect this object, artificial manures must be annually applied. But we think the corn crop is of sufficient importance to be considered a primary crop, and that the mode of applying the manure in all cases should be such as to insure a good crop, while, at the same time, the permanent improvement of the soil is secured. These objects are by no means incompatible, and may both be attained at the same time, and by the same process. In the culture of corn, manures should be liberally applied. There is less labor and less expense in raising sixty bushels of corn on one acre than on two; and, in the former case, the land will be left in better condition than in the latter. One great necessity for applying manure in the northern portions of our country is, that plants may be forced more rapidly through all the stages of their growth, since, if left to themselves, the season is not long enough to bring them to perfection; and that system of culture which pushes them forward early, that they may get well rooted, and therefore be the better able to endure the droughts that so often occur in July and August, and thus arrive at early maturity before the frosts of September, must be the best system. Could we add another month to the summer in this climate, we could cultivate many crops with a much less amount of stimulants than are now required. Now we have to guard against the droughts of summer and the early frosts of autumn, and we do not esteem it safe practice to deposit the manure for the corn so deeply in the soil, that the growing crops cannot reach it till late in the season. When stable manure or compost, then, is ploughed in deeply, we would recommend the application of well-diluted guano, superphosphate, bone meal, or fine compost, in the hill. In this way, with a season at all favorable, the crop will seldom fail.

As a general rule, we would say that all compost should be well worked over in the early spring, before the weather becomes sufficiently warm to occasion a rapid development of the gases, and rendered as fine as possible. If the heap is too wet to work fine, a sufficient quantity of dry soil, peat, pulverized charcoal, or plaster should be added, to absorb the moisture and destroy the tenacity of the mass. All manures should be applied in as fine a state as is possible, without too much exposure to the action of the atmosphere. If manures are reduced in cool weather, when they are not in a state of actual fermentation, it may be done without great loss of their gases. All manures that are to be applied to the surface should be pulverized as finely as possible. Some plants spread their roots and seek their food near the surface, as the strawberry, and the whole family of the cucurbitaceæ. These, especially, require finely reduced manure. When manures are to be buried deeply in the soil, this mode of preparation is less absolutely necessary. All manures, whether applied in a coarse or fine state, should be immediately covered under the soil, that as much as possible of their volatile elements may be absorbed by the soil. These elements, as we have said, permeate the soil and divide its particles, and render them light and easily traversed by the delicate radicles of plants. This mechanical effect is one of no small importance. A soil rendered light and porous by fermenting manure is as much better for this operation, as bread risen by yeast is better than a mass of dough.

It is the general practice of our farmers to apply manures but once in a season; but certain manures may be applied more than once with much profit, provided they are applied during the growing stage of the plants, and in such a form as to mingle at once with the soil, and become a constituent part of it. It must be either finely pulverized, or in a liquid state. In either form, it should be immediately worked into the soil around the plants with the hoe or rake. Many plants, including most of the small fruits, may be treated in this way with excellent results. We have already seen that liquid manures may be applied several times during the season to grasses, thus enabling us to take two or three crops or cuttings in a year. This is an important fact in soiling cattle, as it enables us to supply them with green and succulent food during the entire summer and autumn from the same ground.

Did we understand more perfectly the chemical constitution of the plants we cultivate, we might, doubtless, in many cases, supply to the soil the elements especially adapted to them; but such is the influence of the vital powers in modifying the laws of organic chemistry, that we do not anticipate any important results from the doctrine of specific manures considered by itself. Grapes appropriate a large amount of potash. Asparagus, originally a marine plant, appropriates marine salts. But we cannot depend upon lime and ashes to give us luxuriant grapes, nor upon marine salts to give us large and succulent asparagus. They both require, in addition to these substances, a generous supply of the same elements of nutrition that other plants require. This subject is but imperfectly understood. Theories may give us indications in this direction, but they will need to be corrected by much experimental research before they can guide us to any certain results.

Nature works out from a few simple elements, variously combined, the wonderful variety of products exhibited by vegetable life. If left to herself she always obtains a supply of these elements; but when disturbed in her operations by man, who removes from the soil its productions for his own use, instead of leaving them to decay where they grew, the soil becomes exhausted of necessary elements, and, unless they are returned to it in the form of manures, she soon becomes unable to complete the process which she commences, for want of material. The plant is not perfect; its framework is not fully developed, or its seed does not reach a perfect form, or does not arrive at maturity, because the needful elements are annually diminishing. The Fellahs, in Egypt, raise wheat a few inches high, with heads not more than two inches long, upon soil that was once the granary of the world. But Ishmael is teaching them a better style of farming, by showing them upon his plantations wheat standing four feet high upon the soil. In the older western States we are told that the wheat crops have diminished from one-fourth to one-third in quantity per acre, and, unless the elements that have been removed from the soil are returned to it, the crops will continue to diminish in a still more rapid ratio, until it ceases to be a remunerative crop. In eastern Virginia and Maryland, the soils that formerly yielded thirty bushels of wheat now yield five or six, and are being deserted because their produce will not sustain their cultivators. Guano has been applied to such soils; the nitrogen, and phosphates, and alkalies which it contains, render soluble certain elements still left in the soils, and one or two crops of ten or twelve bushels have been obtained. But this process will soon cease, and the soil be left more completely exhausted than before. Portions of this exhausted soil are being treated in a different way by cultivators of market vegetables, who are applying muck, stable manure, lime, leached ashes, green crops, and whatever will restore to the soil, in the most permanent form, the elements required by such vegetables. Hundreds of acres may now be found covered by thrifty crops of strawberries, gooseberries, currants, celery, radishes, turnips, beets, onions, melons, and similar crops, which a few years ago did not repay the labor of cultivation. The favorable climate and convenient markets render such crops highly remunerative. The neighboring cities furnish the means of restoring to the soil the elements needed to sustain the large draught made upon it. The outlay for manures in this case is large, and for grain culture probably would not pay. But it shows in a convincing manner what manures may accomplish. There is a vast amount of manurial substance produced in all cities, the largest part of which is annually wasted. If it could be carefully collected and judiciously applied to the soils in their vicinity, their productiveness would be wonderfully increased. But the transportation of manures to the soil to be cultivated is an expensive operation, and will prove economical only within certain limits, and for certain purposes. The true system of farming is undoubtedly to consume upon the farm so much vegetable matter that the solid and liquid animal excrement resulting, applied either simply or composted with other suitable substances, shall enable the farmer steadily to increase his crops, while, at the same time, his soil shall be as steadily growing richer and more productive. Every acre cultivated should be left in better condition after the crop is taken off, than it was when it was put on. To attain this point, no more land should be cultivated than can be done without exhausting it. The good teamster will keep his horses or oxen at work steadily, without diminishing their flesh or strength. Every one who has had experience will affirm that it is the most profitable to keep his team in high condition. The same is true of the soil. If the good teamster has food for only two horses, he will not attempt to keep three. So the judicious farmer will cultivate no more acres than he can feed well. In most instances it is better and more profitable, and attended with less expense and labor, to raise a large crop from one acre, than to raise the same amount from two. The soil of the one acre is left in a better condition, and in a better state for any succeeding crop, than is the soil of the two acres.

We think that, in general, the farmers must rely upon their own farms for their permanent supply of manures. Imported manures and artificial manures may be resorted to occasionally as temporary expedients; but unless the produce can be sold at a near market and at a high price, their use will not be found economical in the long run. Although we think every farmer should rely upon his own farm, he may with propriety avail himself of such natural sources of supply as his own neighborhood affords. The cultivator upon the sea-shore may and ought to use the materials thrown at his feet by the waves. It would be very unwise for him not to do so. Fish and fish offal are a resource of great value to those within its reach. If combined with peat as a deodorizer during its putrefaction, it may be used without inconvenience. Marl-beds are so many mines of wealth to cultivators in their neighborhoods. In the vicinity of soap-works every one will be eager to avail himself of the leached ashes. Woollen factories afford wool-waste and the washings of the wool, articles of great value as fertilizers. Various manufacturing establishments, as glue-making, tanning, gas-making, &c., furnish waste materials that may be obtained by farmers in their vicinity at a remunerative price. Every opportunity to obtain these and similar materials to add to the manure of the farm will be improved by the enterprising farmer.

There is one other means of reclaiming and fertilizing an exhausted soil, to which we have barely alluded, that is worthy of more attention than it has received in this country, especially on light, sandy soils, at a distance from the farm or from extra sources of supply; we mean the ploughing in of green crops. As a means of recuperating exhausted lands in sections of country where stable manures cannot be obtained, as old prairie lands or cotton fields, this must ultimately come to be a matter of the highest importance. Instead of leaving such lands to lie fallow, to recover by the slow processes of nature, and to be filled with the seeds of weeds, which it requires great labor to eradicate, buckwheat, clover, or other crops, ploughed into the soil, will become the means of rapidly restoring their fertility. But this whole subject of green manuring has been treated so expansively by Mr. Wolfinger, in the last Report, that we will abstain from its further discussion.

We have now spoken of the elements which enter into the composition of the principal manures in use, of the sources from which they are derived, and the principles which should guide us in their preparation and application. The quantities of the several kinds which may be most profitably applied, must depend upon the circumstances of each case. The nature and condition of the soil, the kind of crop, and the character of the manure, must all be taken into consideration. When manures are carbonaceous, and not volatile, they may be applied in large quantities at a time, and their effects will be permanent. When manures consist largely of volatile elements it is a better rule to apply annually, or oftener, in such quantities as are needed for immediate effect. Such manures cannot be depended on for the permanent improvement of soils, for their active properties are soon converted into gases and lost; their power is expended in the growth of the present crop; hence they should be applied with reference only to the present crop, and in such quantities as its wants require. The quantity of any kind of manure must be determined by observation and experience; the judgment and skill of the farmer must be his guides in this matter. There is undoubtedly a disposition to cultivate too much land, to spread manure over too large a surface. We do not yet understand the capacity of land. A stable keeper in Massachusetts kept fifteen horses, and spread all their manure on one acre and a half of land for several years in succession, and took off at three crops seven and a half tons of good hay in a year, as much as he would have got had the manure been spread on three or four acres.

Spreading manure over a large surface answered tolerably well when the soil was new, and good crops were obtained for a time; but in this way many farms have become exhausted. As the soil becomes exhausted of the fertilizing elements stored up in it, by repeated croppings, the injurious effects of this treatment become more and more apparent. Men are slow to renounce the usages that were established in former times and under different circumstances. They hesitate to give up allegiance to custom, in agriculture as in other things, and pursue practices of ruinous tendency merely because they are sanctioned by authority. Needed reformations are seldom inaugurated until they are compelled by necessity. But many of our most intelligent cultivators have commenced the work of reform; and when we shall all so cultivate our lands that they shall become more fertile and more productive after every successive crop, we shall have learned the only true and economical method of applying manures.

CUTTING AND COOKING FOOD FOR ANIMALS.

BY E. W. STEWART, NORTH EVANS, NEW YORK.

A cursory survey of the business of agriculture will at once reveal the fact that the great effort of the farmer is to supply food for his animals, and that it requires more food to supply the animals kept in the United States than to feed its whole population. It becomes, then, one of the most important inquiries, how to economize this food so as to yield the greatest return. A saving of even ten per centum would amount to millions of dollars annually.

The discussion of the topics embraced in this article at State fairs, and by individuals, shows that farmers are anxiously inquiring upon this subject. Careful experiment is, no doubt, more satisfactory, and more convincing to the practical farmer, than any theory, however plausible, and he generally wishes to know, first of all, what the facts are. If they are upon the right side, he cares little for the reasons upon which the facts are founded. But there is no doubt, also, that a clear theory, or the justification of a process, increases confidence in its utility. The writer must, therefore, beg the indulgence of the reader, while he goes somewhat into the theory and reasons for cutting the dry food of animals.

Much has been said for and against this practice. One affirms that teeth are given to animals expressly to masticate their food, and that all attempts to grind or pulp it artificially, are impeachments of the wisdom of the Creator. The same line of argument would abolish all shelter and care of animals by man; would return man himself to the savage state, and feed him on wild fruits and nuts. Those who talk so reverently of nature, and fear so much to improve upon her, forget that cattle in their wild state crop only green, succulent grasses, and do not dry and lay up a supply for winter use. As soon as the grass becomes ripe and tough in the north, they migrate toward the south, where they find green herbage. Thus it will be seen that man, in domesticating animals and keeping them in a cold climate, changed their mode of living, substituting dry for green food in winter, and that it thus becomes necessary to compensate for this by assisting the animals in mastication. Man has produced from the wild crab-apple the splendid modern pippin; and from the lank wild bull and cow, the magnificent proportions of the Durham and the rounded beauty of the Devon. This, too, has all been done in opposition to the natural habits of tree and animal, and man is quite likely to continue his efforts so long as he is rewarded by such splendid results.

WHY FODDER SHOULD BE CUT.

The object of mastication of food is to comminute it, to break down its structure, and to render it more easily acted upon by the gastric juice, thus enabling the animal to appropriate its nutriment. Now, the more finely divided food is, when subjected to the gastric juice, the more rapidly and easily it is digested. For when finely divided it presents many hundred times more surface to the action of the digesting fluid. This is simply represented in cooking fine meal or whole grain. We know it takes but a few minutes to cook the meal, while hours are required to soften the whole grain.

When cattle eat succulent food, the fibre is easily broken and reduced to a pulpy mass; but not so with dry, woody fibre, which must be broken and comminuted before the food contained in it is accessible for animal nutrition. This the animal seldom does, and more especially the non-ruminating; therefore it becomes highly necessary that we should use machinery to assist the animal, as much as possible, in extracting the nutriment contained in dry food. And if it be profitable to cut hay, straw, and other coarse fodder, for the purpose of breaking the fibre, and rendering it more easy of mastication and digestion by the animal, then it is well to cut or divide it as finely as is consistent with economy. There is no danger of inventing machinery which will cut or pulverize it too finely. The great want now is, a machine, cheap and durable, which shall reduce woody fibre to pulp. This will require a machine which shall bruise as well as cut, so as to leave the whole fibre thoroughly mashed and divided. It will not be liable to the objection urged, that it will leave nothing for the animal to do; for this dry fibre, when reduced to the greatest degree practicable, will still require more mastication than green grass. Our whole effort in cutting and steaming is merely to produce an imitation of nature's green food.

MIXING DIFFERENT QUALITIES OF FOOD.

Here another advantage not to be overlooked is, that it enables the feeder to mix different qualities of food together, making it all palatable, and thus saving all. This is a matter of great importance, and alone would vastly more than pay all the expense of cutting. In this manner poor straw and good hay may be mixed, coarse swale meadow hay with fine hay, corn stalks with hay, and pea or bean straw with hay, when the poorer qualities would not be eaten alone; or, if hay be scarce or of too high price, cut straw may be made equivalent to the best hay, by mixing two quarts of fine middlings or bran, or one quart of corn meal with a bushel of straw.

The writer of this paper has practiced cutting and steaming fodder, of all kinds, in winter, for a stock numbering from ten to fifty-five neat cattle and horses, during the last ten years. He therefore deems his experience sufficient to enable him to speak with some degree of confidence. He tried a long series of experiments to determine the quantity of middlings or meal necessary to mix with a bushel of straw, to render it equivalent to the best hay. Ten animals of about uniform size, standing in the same stable, were parted—five being fed upon hay, and five upon the mixture. At first four quarts of middlings were mixed with a bushel of straw. The animals were fed for one month—five upon this mixture, and five upon the hay. Those fed upon the mixture were found to gain decidedly upon those fed upon the hay alone.

The experiment was then reversed, putting those upon the mixture that had fed upon the hay, and *vice versa*. At the end of the month those fed upon the straw and middlings had gained rapidly, while those fed upon the hay had hardly held their condition. Then the experiment was continued by reducing the quantity of middlings one-half, or to two quarts, on which mixture the animals did rather better than those upon hay, while, upon reversing, those at first fed upon the hay when fed upon this mixture did better than those on hay. Upon several trials afterwards it was uniformly found that a bushel of straw with two quarts of middlings was quite equal to the same weight of cut hay, and was worth 25 per cent. more than uncut hay. It was found that the animals would eat 25 per cent. more hay uncut than cut. The same experiment was then tried with corn meal, and one and one-half pints were found to make a bushel of straw equal to hay, though the formula is generally given as a quart to a bushel of straw, which will render almost any quality of straw equal to the same weight of good timothy hay.

The writer has found for many years that he can winter his stock in better condition on straw and middlings, or meal, in the proportions given, than on hay. This is a large item near a good hay market, and where straw is worth but little, or in a grain country, where little else than straw is raised as fodder for animals. In this way all the coarse fodder on the farm of every description may be consumed by animals, and thus turned into money. Where steaming is practiced there is also a large profit. Besides, this enables the feeder to prepare a special food to produce such special results as he may desire. It is well known that the intelligent feeder may increase the frame, or muscle, or fat of an animal exclusively, or he may increase them all together. If he wishes to increase the frame and muscle particularly, he will give food rich in phosphate of lime and gluten, without having much oil or a large proportion of starch; and for this purpose pea or bean meal, mixed with his coarse fodder, will produce the desired result. If he wishes to lay on fat principally, he will use corn meal or oil meal. If to produce growth of the animal in frame and muscle, as well as fat, let him mix the different kinds of food together. Thus he may produce such results as he pleases, and, at the same time, use what would otherwise be refuse and waste.

It is shown by accurate observation, that hay, straw, or other coarse fodder, when well cut, is more uniformly digested by both neat cattle, horses, and sheep, than uncut. In England large feeders have estimated the gain in nutriment and saving of waste in hay to be equal to 25 per cent. Some experiments in this country have estimated the gain even higher, and certainly the gain is more in cutting coarse fodder than on hay.

WHAT IS GAINED IN CUTTING FOR A SMALL STOCK.

An experiment will illustrate the profit of cutting. When keeping a small stock, which would consume thirty tons of hay in a winter, seven tons of hay were sold, and seven tons of middlings bought and used upon cut straw, (two quarts upon a bushel,) and the stock wintered in fine condition. The straw was thus turned into twenty-three tons of hay, worth, that year, $18 per ton in barn, or $405; (generally it is worth $12 per ton.) Hay, in most localities, is worth as much per ton as middlings, and half to three-fourths as much as corn meal; therefore the avails of one-fourth the quantity of hay requisite to winter a stock of animals will purchase the middlings or meal necessary to use upon the straw, and the hay (or its value) be saved to the farmer. Indeed, from long practice, the economy of the straw cutter is as well established with the writer of this article as that of the mowing machine.

But it is sometimes said that it may pay on a small scale, and accordingly many small hand-machines are found by which farmers cut for a few cows, or a pair of horses, still feeding the principal part of their stock uncut food. In this idea the ordinary rule of manufacturers is reversed, viz: that what will pay upon a small scale will pay much better on a large scale. It costs more in proportion to make one wagon than one hundred; so it costs more in proportion to cut fodder for five animals than for fifty. To show that it pays on a large scale to cut hay, we have only to refer to the fact that the large omnibus lines and street railroad companies of our large cities cut all the hay and coarse fodder used for their hundreds of horses. These companies have learned, from practical experience, that the saving is many times the cost of cutting.

When cutting is done for a large stock with the largest size two-horse machine, it takes but little longer to cut a ton of hay than to handle it without cutting. Horse or steam power is much cheaper than hand power when more than a few animals are to be fed.

STRAW CUTTERS.

Much improvement has been made within a few years in the construction of straw cutters. It is of the highest importance in selecting a machine to get one that cuts short and with perfect regularity; and to this end great attention must be paid to the feed apparatus. Unless the hay or straw is delivered to the knives with perfect regularity, the work will be badly done. The greatest fault of most machines is the defect in this part of the machinery. Some are fed by hand. These should be discarded, as there can in this way be no regularity of cut. A short and regular cut secured, next in importance is strength, simplicity, and durability. The two machines that combine these requisites most perfectly are the Cummings's patent, made at Fulton, New York, and the Empire Cutter, made at Rochester, New York. The writer has used one of the former for some six years, and he can say for it that it works as well as a machine can which cuts without mashing the fibre. The perfection of this kind of machine is yet to be invented which shall mash or pulp the fodder. The machine first named cuts from one-eighth to six-eighths of an inch, but both cut well and with regularity.

COOKING FOOD FOR ANIMALS.

Steaming food is less practicable but even more important than cutting. Cooking food for animals is of comparatively recent date. A brief notice of its rationale will demonstrate its importance, as well to animals as to man.

Pereira says: "To render starchy substances digestible, they require to be cooked, in order to break or crack the grains; for of the different lamina of which each grain consists, the outer ones are the most cohesive, and present the greatest resistance to the digestive power of the stomach, while the internal ones are least so." "Starch," says Raspail, "is not actually nutritive to man until it has been boiled or cooked. The heat of the stomach is not sufficient to burst all the grains of the feculent mass which is subjected to the rapid action of this organ. The stomachs of graminiverous animals and birds seem to possess, in this respect, a particular power, for they use feculent substances in a raw state. Nevertheless, recent experiments prove the advantage that results from boiling the potatoes and grain, and partially altered farina, which are given to them for food; for a large proportion, when given whole, in the raw state, passes through the intestine perfectly unaffected as when swallowed." Braconnot found unbroken starch grains in the excrement of hot-blooded animals fed on raw potatoes; hence he adds, "the potatoes employed for feeding cattle should be boiled, since, independently of the accidents which may arise from the use of them in a raw state, a considerable quantity of alimentary matter is lost by the use of these tubers in the unboiled state."

So much for the effect of heat upon grain and roots; but it may be asked whether we can derive the same benefit from cooking hay, straw, and other coarse fodder for stock. The following quotation from Regnault will show what difference exists between them, the stems containing woody fibre as well as cellulose, while roots and grains do not:

"A microscopic examination of the various component parts of plants shows them all to be constituted of cellular tissue, varying in form according to the part of the vegetable subjected to examination. The cavities of the tissue are filled with very diversified matter; sometimes, as in the case of wood, the parietes of the cells are covered by a hard and brittle substance called *lignum*, or *woody fibre*, which frequently almost completely fills their interstices; while, at other times, as in the grains of the cerealia, potatoes and other tubers, the cells contain a quantity of small ovoidal globules, varying in size, constituting *fecula* or *starch;* and lastly, in the case of the young organs of plants, the cells contain only a more or less viscous fluid, holding in solution mineral salts and various organic substances, the principal of which are gums, gelatinous combinations, designated by the general name of *albuminous substances.*" We conclude, then, that if heat aids in rendering the nutritive principles of roots and grains more accessible to the assimilating faculty, it will also assist in softening the fibre of hay and straw. The cell walls which imprison the alimentary substances mentioned, will, by the joint processes of cutting and steaming, be more or less broken and weakened.

The following extract from Johnston's Agricultural Chemistry shows the further effect of heat upon starch itself:

"When wheat flour, potato, or arrow root starch is spread upon a tray and gradually heated in an oven to a temperature not exceeding 300° F., it slowly changes, acquires a yellow or brownish tint, according to the temperature employed, and becomes entirely soluble in cold water. It is changed into dextrin gum. * * * During the baking of bread this conversion of starch into gum takes place to a considerable extent. Thus Vogel found that flour which contained no gum, gave, when baked, a bread of which 18 per cent., or nearly one-fifth of the whole weight, consisted of gum. Thus one result of baking is to render the flour starch more soluble, and therefore more easily digested." Of starch he says: "It is a property of starch of all kinds to be insoluble in cold water, but to dissolve readily in boiling water, and to thicken into a jelly or paste as it cools." It is supposed that, by digestion, starch becomes converted into gum or sugar, and the latter probably becomes absorbed. It is also an element of respiration, and, according to Liebig, contributes to the formation of fat in animals. His theory is, no doubt, well founded, and explains the fattening of animals when fed upon Indian corn.

VALUE OF STRAW, ANALYSES, ETC.

Few farmers are aware of the value of straw. By the present system of feeding in this country little or no account is made of it. It serves mostly as litter for animals. Let us examine the general analysis of straw, as compared with the forage crops and grains. The following table is from the Cyclopædia of Agriculture:

Average composition of wheat straw.

Dried at 212° Fahrenheit, 100 parts contains nitrogenous substances, or—

Muscle-producing substances	2.05
Heat-producing substances	35.06
Woody fibre	56.87
Mineral substances	6.02
	100.00

Corn fodder and bean straw.

	(J. H. Salesbury.) Corn fodder.	(Prof. Way.) Bean straw
Flesh-forming matters	8.200	16.38
Heat and fat-producing matters	35.273	33.86
Woody fibre	50.251	25.84
Mineral matters	.....	9.45
Water	6.276	14.47
	100.000	100.00

Cultivated grasses, average, dried at 212° Fahrenheit.

	(Prof. Way.)
Flesh-forming principles	10.34
Fat-producing principles	2.51
Heat-producing principles	41.29
Woody fibre	37.18
Mineral matters or ash	8.68
	100.00

Indian corn and wheat bran.

	(Salesbury.) Indian corn.	Wheat bran.
Flesh-forming principles	15.192	18.00
Heat-producing principles	78.866	63.00
Fat-producing principles	5.945	6.00
Water	....	13.00
	100.000	100.00

Oats and rye.

	(Emmons.) Oats.	(Johnson.) Rye.
Flesh-forming principles	18.447	16.00
Heat-producing principles	73.376	69.00
Fat-producing principles	8.179	....
Soluble phosphates	....	3.06
Water	....	11.04
	100.002	99.10

Barley.

	(Johnson.)
Flesh-forming principles	6.1
Heat and fat-producing principles	69.3
Husk	13.8
Water	10.8
	100.00

Beans and peas.

	Peas.	Beans.
Husk	8.3	7.0
Legumin, albumen, &c	26.4	23.6
Starch	43.6	43.0
Sugar	2.0	0.2
Gum, &c	4.0	1.5
Oil and fat	1.2	0.7
Salts and loss	2.0	1.0
Water	12.5	23.0
	100.00	100.00

The analysis of wheat straw, cornstalks, and bean straw will show at once the large amount of nutritive matter they contain, besides that denominated wood fibre. Bean straw and wheat bran, it will be seen, are very rich in nitrogenous matter, and therefore will build up the muscular system of the animal. From long experience we have found wheat bran to be equal, practically, to the analysis. If steamed, we regard it as valuable, per weight, as corn meal. Its analysis indicates that it has more muscle-forming matter than corn. This will indicate the important use that farmers should make of bran, when it is to be had for the price of hay, in feeding cows and young animals. An examination of these analyses will show readily how to mix a proper food to build up all parts of the animal system.

STEAM APPARATUS.

It will now be in order to give the reader a detailed account of the manner of conducting this cooking process. A perfect steam apparatus is yet to be invented. Many methods are used. The writer will describe the one he uses, and also a simpler and cheaper one for a small stock.

The one he has now in use consists of a wrought-iron cylinder, one-eighth inch thick, thirty inches in diameter, four feet long, with one-quarter inch iron heads. The front end has an elliptical opening, by which to draw off the water and clean it out, secured, when in use, by an iron stopper with rubber packing. On the top is another like opening, through which to fill it with water, and secured in like manner. An iron pipe, one and a half inch in diameter, is fastened to the top of the boiler, passes over the side of the brick-work, and down to the bottom of the steam box, where it enters the side near the centre. This boiler is set in brick-work, in a horizontal position. It is raised about sixteen inches above the first bed or grate. The fire is conducted under the length of the boiler, and partly up the back end; then carried along each side to near the front end in a flue, and carried back to the chimney in another flue above this. This leaves the front end of the boiler exposed, in which there is a cock from which to draw hot water if wanted. My steam box is made of matched pine plank, one and a quarter inch thick. It is four and a half by five feet, and three feet deep, holding over fifty bushels of feed. It might be larger if the stock required it, as my boiler generates steam enough for 150 bushels. The box is closed with a wooden cover.

PREPARING FOOD FOR STEAMING.

The feed is prepared for steaming thus: The cut straw, hay and straw, or other cut feed, sufficient to fill the steam box, is measured in a square six-bushel basket. It is then moistened by a four-gallon watering pot, with twenty gallons of water to fifty bushels of feed, while it is being stirred up with a fork. Then two quarts of wheat bran to the bushel of straw is mixed in the same manner, and a little salt added, when it is put into the steam box and steamed for an hour and a half. This feed will keep warm for two days in the coldest weather.

The reader will readily see the defect in this arrangement, as, with such a steam box, no considerable pressure can be obtained; hence it does not reduce the feed to such a pulp as is desirable. Yet it modifies and softens it very much. My boiler would safely bear a pressure of thirty pounds to the inch, and, with an iron steam box, the feed could as cheaply be put under that pressure and reduced to such a pulp as is desirable, as it now is steamed in the wooden box. When iron-work shall be reduced to the price charged before the war, an apparatus with iron boiler and iron steam box, will be within the easy expenditure of every considerable cattle feeder, costing not over one hundred and fifty dollars. This amount would be more than made up by its use for a single year.

CHEAP STEAMER.

We will next give a description of a very simple apparatus, which is within the reach of every farmer. It is described, without the improvement which should be made to it, in the transactions of the American Institute for 1863. "Get a sheet of No. 18 iron, (No. 16 would be better,) 32 to 36 inches wide, and seven or eight feet long (or two sheets may be riveted together, and thus make one fourteen feet long, if much work is to be done.) Take 2-inch pine plank, (maple would be better,) about two feet wide; let the sides extend three inches past the end plank; make a box a little flaring at the top and wide and long enough, so that the bottom sheet will cover and project half an inch on each side and end. Let the ends into the sides $\frac{1}{4}$ to $\frac{3}{8}$-inch in making the box, and put it together with white lead and oil, and put two $\frac{3}{8}$-inch iron rods through the sides at each end, outside of the end plank; then nail on the bottom sheet with two rows of five-penny nails, the nails about one inch apart in the rows, and breaking joints, and bend up the sheet where it projects." This will hold some thirty bushels. "Now take flat stones or bricks, and make a fireplace the length of your box, and eight inches narrower on the inside than your box is wide on the outside." Fire bed should be 16 or 18 inches deep. "Put across at each end a flat bar of iron $\frac{1}{2}$ by $1\frac{1}{2}$-inch, so as to lay a row of bricks on these for the ends of the box to rest on, and at the back end let the arch run out so as to build a small chimney, and put on some joints of stove-pipe, and you have a cooking apparatus." This is a good boiling arrangement, where only water or some thin liquid is to be heated; but if hay or straw, or even potatoes, are to be boiled with little water, as would be the case, especially in steaming fodder, it would settle and burn on the bottom. We have many times tried this in a large kettle, with this result. This difficulty can be obviated entirely, and a good steaming apparatus be made of it by placing a false bottom one inch above the real bottom. This may be done in the following manner: Take a sheet of No. 18 iron, of the size of the box, or, perhaps, one-half inch wider; have this punched with small holes, so as to let the water down and the steam up. It can be let into the side of the box, or a half inch cleat can be nailed on the side and end of the box for it to rest on. This would not sufficiently support the weight of feed to put on it, and, therefore, $\frac{3}{8}$-inch rods must be put through the sides, under this false bottom, to sustain it—one, perhaps, every foot. Then a wooden or iron faucet must be put through the side between these bottoms, to to draw off the water. Now a wooden cover on the top of the box to keep the steam in, and here is as complete, effectual, and cheap a steamer for cooking without pressure, as can be desired. The whole apparatus would not, probably, cost over $25, for the seven feet, or $50 for the fourteen feet length. This largest size would be ample for fifty to seventy-five head of cattle and horses. The chimney should be as long as the steam box, to make a proper draft.

There is, also, D. R. Prindle's agricultural caldron and steamer, a portable apparatus used for boiling and steaming. It has been used in various parts of the country and highly spoken of for its convenience in being adapted to cooking for stock, as well as for most other heating purposes on the farm.

ARRANGEMENT FOR A LARGE STOCK.

For the benefit of those who wish to feed a large stock, one to two hundred head of cattle, or more, we will suggest an arrangement which will save much labor, economize the material, and produce more uniform results.

A portable steam engine of five horse power provided, we will arrange the animals, steam box, food, &c., as follows:

The stables are in the lower story, on each side of a feeding floor ten feet wide. It would be more convenient to have room behind each tier of animals to pass a cart or wagon to carry off the manure, than to throw it out at the side. A wooden track should be laid in the centre of the feeding floor on which to run the steam boxes. Two, holding 100 bushels each, should be provided for 100 cattle. One would be run under the upper floor to be filled and steamed, and then moved away for use; while the other could be run to the spot, filled and steamed. On the upper floor the straw cutter would be placed, provided with a feeding apron to feed itself, with two bins overhead, one for cut hay or straw, the other for meal or bran. Elevators to carry up the cut feed from the straw cutter to the feed bin, as fast as cut, would be necessary.

There would also be necessary a water pipe connected with an elevated reservoir, to furnish water to moisten the feed. A tank might be placed overhead and filled by a force pump. Then, in a scuttle through the floor, directly over the steam box, there will be placed a cask or cylinder, three feet in diameter and five feet long, without a bottom, but a bar across the lower end, on which an upright revolving shaft will be set in the centre, provided with six arms, just long enough to turn inside. This shaft will pass through a like cross-bar on the top, and extending above enough to receive a pully of the proper size to revolve it some six hundred times per minute. Now a spout will extend from the elevated feed-bin to the top of this cylinder, with a slide to open or shut it; also a spout extending from the meal or bran bin, so as to communicate in the same way with the cylinder, and a water-pipe, also, furnished with stop-cock and movable cover, will be placed on top of the cylinder. A belt will run from the engine to the pully on the top of this shaft. Now, when ready to fill the steam box, this shaft will be set in motion—the spout for cut feed will be opened so as to discharge a definite quantity, the spout for meal opened to discharge the proportion desired, and the water, so as to let in twenty gallons for fifty bushels of feed. It will be seen that the feed, and meal, and water, in passing through the cylinder, will come in contact with these swift moving arms on the shaft, and be thoroughly mixed, and fall into the steam box, ready for steaming. The feed should be pressed into the steam box, as more will be steamed and better. With this arrangement, one expert man may cut and steam feed for one hundred head of cattle, and two men could easily care for two hundred. It will be seen that, with proper system and machinery, the expense of cutting and steaming for a large stock will be little more than in the ordinary way of feeding. This steam engine may be used to grind the grain, cut and steam the feed, and do all the work requiring stationary power on the farm. The engine should be placed as near the steam box and straw cutter as it can be with safety. A double spark extinguisher must be placed over the chimney, to prevent fire.

RESULTS OF COOKING.

It now remains for us to give the results of cooking by the method detailed.

First. It renders mouldy hay, straw, and cornstalks, perfectly sweet and palatable. Animals seem to relish straw taken from a stack which has been wet and badly damaged for ordinary use; and even in any condition, except "dry rot," steaming will restore its sweetness. When keeping a large stock we have often purchased stacks of straw which would have been worthless for feeding in the ordinary way, and have been able to detect no difference, after steaming, in the smell or the relish with which it was eaten.

Second. It diffuses the odor of the bran, corn meal, oil meal, carrots, or whatever is mixed with the feed, through the whole mass; and thus it may cheaply be flavored to suit the animal.

Third. It softens the tough fibre of the dry cornstalk, rye straw, and other hard material, rendering it almost like green succulent food, and easily masticated and digested by the animal.

Fourth. It renders beans and peas agreeable food to horses, as well as other animals, and thus enables the feeder to combine more nitrogenous food in the diet of his animals.

Fifth. It enables the feeder to turn everything raised into food for his stock, without lessening the value of his manure. Indeed, the manure made from steamed food decomposes more readily, and is therefore more valuable than when used in a fresh state. Manure made from steamed food is always ready for use, and is regarded by those who have used it as much more valuable, for the same bulk, than that made from uncooked food.

Sixth. We have found it to cure incipient heaves in horses, and horses having a cough for several months at pasture have been cured in two weeks on steamed feed. It has a remarkable effect upon horses with a sudden cold, and in constipation. Horses fed upon it seem much less liable to disease; in fact, in this respect, it seems to have all the good qualities of grass, the natural food of animals.

Seventh. It produces a marked difference in the appearance of the animal, at once causing the coat to become smooth and of a brighter color—regulates the digestion, makes the animal more contented and satisfied, enables fattening stock to eat their food with less labor, (and consequently requires less to keep up the animal heat,) gives working animals time to eat all that is necessary for them in the intervals of labor; and this is of much importance, especially with horses. It also enables the feeder to fatten animals in one-third less time.

Eighth. It saves at least one-third of the food. We have found two bushels of cut and cooked hay to satisfy cows as well as three bushels of uncooked hay, and the manure in the case of the uncooked hay contained much more fibrous matter, unutilized by the animal. This is more particularly the case with horses.

These have been the general results of our practice, and, we presume, do not materially differ from those of others who have given cooked food a fair trial.

OPINIONS OF AMERICAN AND ENGLISH FARMERS.

George A. Moore, at the New York State Fair discussion, 1864, says: "I was feeding sheep and cutting for them timothy hay, millet, carrots, and feeding with bean and oat meal. Before steaming, I found, by weighing, I was putting on two pounds of flesh per week. After steaming, I put on three pounds per week, and the stock eat the food cleaner, and I noticed they laid down quietly after feeding. I also experimented with sixty-four cows. Used one of Prindle's steamers; had a quantity of musty hay which I cut and steamed. They would eat it entirely up, and seemed better satisfied with it than the sweetest unsteamed hay. Steamed food does not constipate the animal, the hair looks better. I think cutting and steaming combined insure a gain to the feeder of at least thirty-three per cent. The manure resulting from feeding steamed food is worth double that from feeding in the ordinary way. Have kept eighty head of stock, and had a surplus of food, on a farm where, previously, only fifty were carried through, and hay bought at that. After cows come in, steamed food increases the milk one-third, and the cows do better when put out to grass."

George Geddes, in the same discussion, says: "I find if I take ten bushels of meal and wet it in cold water, and feed twenty-five hogs with it, that they eat it well; but if I take the same and cook it, it will take the same number of hogs twice as long to eat it up, and I think they fatten quite as fast in the same length of time. By cooking you double the bulk."

A. B. Conger, ex-president of New York Agricultural Society, said at same discussion: "But steaming alone is not sufficient in the preparation of the food. It must be first wet, so that if left alone ten hours it will heat. Water in large proportion must be added to the hay or straw after cutting. And so prepared and steamed, thirty head of stock may be kept on the same amount of food as twenty on unprepared food. The mistake made in the early experiments in this country and England was, that the food was not sufficiently wet before steaming."

Professor Mapes says, Transactions American Institute, 1854, page 373: "Raw food is not in condition to be appropriated to the tissues of animal life. The experiment, often tried, has proved that eighteen or nineteen pounds of cooked corn is equal to fifty pounds of raw corn for hog feed. Mr. Mason, of New Jersey, found that pork fed with raw grain cost twelve and a half cents a pound, and that from cooked food four and a half cents. Cooked cornstalks are as soft and almost as nutritious as green stalks. Cooking is an improvement that pays. Cattle can be fattened at about half the expense upon cooked food, in a warm stable, that others can out doors upon raw food."

S. H. Clay, of Kentucky, says: "Fed two hogs on uncooked corn in thirty days 405 pounds, and they gained 42 pounds; while two hogs fed on cooked corn meal for thirty days ate 270 pounds, and gained 80 pounds. The food was then reversed, and the two hogs that had previously had dry corn, were fed on cooked meal. In twenty-six days the two hogs that were fed on dry food ate 364 pounds of shelled corn, and gained 44 pounds; while the two hogs fed on cooked meal ate, during the same time, only 234 pounds, and gained 74 pounds." Here it appears that a bushel of raw corn makes $5\frac{3}{4}$ pounds of pork, while a bushel of cooked meal makes $17\frac{1}{2}$ pounds.

James Buckingham gives, in the Prairie Farmer, an experiment with cooked corn meal, corn in the ear, and raw meal. He put three hogs into separate pens. "One ate three and a half bushels of corn in the ear in nine days, and gained nineteen pounds. Another ate, in the same time, one and three-quarter bushels of corn ground, and gained nineteen pounds; while the third ate, in the same time, one bushel ground and boiled meal, and gained twenty-two pounds."

The society of Shakers, at Lebanon, New York, communicated the following to the agricultural report of the Patent Office: "The experience of thirty years leads us to estimate ground corn one-third higher than unground as a food for cattle, and especially for fattening pork. Hence it has been the practice of our society, for more than a quarter of a century, to grind all our provender. The same induces us to put a higher value upon cooked than raw meal; and for fattening animals, swine particularly, we consider three of cooked equal to four of raw meal. Our society, annually, for some twenty-seven years, has fattened 40,000 to 50,000 pounds of pork, and it is the constant practice to cook the meal, for which purpose six or seven potash kettles are used."

Such is the general tenor of the testimony of those who have tested cooking fairly in this country. It will be seen that most of the experiments relate to cooking grain. Steaming coarse fodder has not been extensively practiced here, but when a fair trial has been given, the result has been quite satisfactory.

Professor Horsfall, of England, has practiced mixing a special food for milch cows, to produce a large yield of milk of good quality, and to keep up the flesh of the cow in a full flow of milk. He says: "I now proceed to describe the means I am using to carry out the purposes which I have sought to explain. My food for milch cows, after having undergone various modifications, has for two seasons consisted of rape cake five pounds, and bran two pounds, for each cow, mixed with a sufficient quantity of bean straw, oat straw, and shells of oats, in equal proportions, to supply them three times a day as much as they will eat. The whole of the materials are moistened and blended together, and, after being well steamed, are given to the animals in a warm state. The attendant is allowed one to one and a half pound per cow, according to circumstances, of bean meal, which he is charged to give each cow in proportion to the yield of milk; those in full milk getting two pounds each per day, others but little. It is dry, and mixed with the steamed food on its being dealt out separately. Bean straw, uncooked, is dry and unpalatable; by the process of steaming it becomes soft and pulpy, emits an agreeable odor, and imparts flavor and relish to the mess. In albuminous matter, which is especially valuable for milch cows, it has nearly double the proportion contained in meadow hay. Bran undergoes a great improvement in its flavor by steaming, and is probably improved in its convertibility as food. Rape cake has a large proportion (nearly thirty per cent.) of albumen, rich in phosphate and oil. * * * During May my cows are turned out on a rich pasture near the homestead, towards evening they are again housed for the night, when they are supplied with a mess of steamed mixture and a little hay, each morning and evening. I have cooked or steamed food for several years, and my experience of its benefits is such, that if I were deprived of it I could not continue to feed with satisfaction."—*Transactions of the New York State Agricultural Society of* 1856, *page* 224.

Mr. Mechi, near London, has also practiced cutting and steaming straw mixed with materials similar to Professor Horsfall. He estimates straw worth about ten dollars per ton to feed after steaming. His experiments have been quite extensive, and the results most favorable to cooking food. His practice has not generally obtained yet in England, but it is constantly extending, and in this country stock feeders are just beginning to turn their attention to the subject.

AMOUNT OF STRAW AND COARSE FODDER WASTED.

If we take the amount of grain and Indian corn raised in the United States, as by the census of 1860, we shall find, by allowing forty bushels of grain to the ton of straw or corn fodder, that there were about 30,000,000 of tons. Now, at least one-third of this is wasted for every purpose except manure, and vast quantities not even used for that. Suppose we estimate this at one-half the value put upon it by Mr. Mechi, or five dollars per ton, and we have the enormous sum of $50,000,000 wasted, for want of proper economy, in a single year. We believe this estimate much below the real loss. These facts are worthy of a thorough examination by the farmers of the whole country. Let them study their own interests. Many of them will see where they have thrown away enough in ten years to double their property. Let them educate their sons for their calling. Impress upon their minds the necessity of a thorough knowledge of all the processes of nature connected with the growth of plants, and their uses in sustaining the animal economy. Impress them with a sense of the importance of their occupation, and of its true elevation in the scale of human affairs. Teach them that no occupation or profession in life requires more accurate or more thorough knowledge. Teach them that no occupation brings honor to the individual, but the individual to the occupation. Above all, teach them to shut their eyes to nothing, to examine all things, and to select that which is good.

COMPARATIVE VALUE OF CATTLE FOODS.

THE attention of the farmers of the country is now turned with more earnestness than ever before, to the raising and fattening of cattle and sheep, and for this there are several concurrent reasons.

The abrogation of the so-called reciprocity treaty, and the restrictions hereafter to be placed on the introduction from Canada of cattle and sheep, which have been brought to our markets in great numbers, afford a sufficient reason for increasing our own production.

The rinderpest, that terrible disease that has proved so fatal to the cattle and sheep of Europe, will long show its effects, and the destruction of so many thousands of cattle in England cannot fail to advance or sustain the price of our own beef. Another very strongly operating reason is found in a steadily growing feeling among the farmers of the west and northwest, that it will hereafter be more profitable to devote a larger portion of their lands to the production of meat and wool than to keep them exclusively for wheat growing.

The rates of transportation have been placed so high, that many farmers cannot send their grain to market at a paying price. Such—and there are thousands—will only grow grain enough for their own home consumption, and raise and feed cattle and sheep, which can be brought to market at less cost.

That the economical management of food in fattening domestic animals is of the highest importance, no one will for a moment deny; yet how few among our farmers are really acquainted with most of the great principles which are involved, or understand the causes of which they in their practice see only the effects. They learn from experience that some kinds of food contain greater fattening properties and some greater milk-producing qualities than others, yet are content with this imperfect practical knowledge, and pay no attention to an investigation of the causes of these differences.

It may be said that the education of our farming population precludes the possibility of such investigation. This is true in a measure, and the labors of some of the deepest thinkers and most scientific men of the age, although absorbed in this special department, have added still more to the difficulties attending the study of this exceedingly interesting subject by the employment of terms and experiments only adapted to the comprehension of those who have already acquired at least a partially scientific education. But although this fact may partly account for the existing lack of knowledge of this branch of natural science, there is no doubt that the greater portion of it is attributable to the common habit of neglecting to investigate phenomena constantly under our notice, because of our familiarity with them.

It is not, of course, to be expected that the farmer can have opportunities for scientific investigation of these phenomena, but it is not unreasonable to suppose that he might, in the common experiments which he is constantly making, by a judicious observation and analysis of some of the results, arrive at a sort of system, capable of a practical arrangement and adaptation, instead of following the beaten track of routine adopted by his ancestors, without even an effort at improvement. It is not enough that he should know that some kinds of grain or some roots possess fattening properties exceeding those of others, but he should understand *why* this is the case, and be able, in the possession of this knowledge, to arrive at the greatest results with the smallest possible outlay.

It is not only necessary that he should understand the values of the different foods, so that he can make the most judicious use of them, but he should understand the principles by which they operate and become available to him, and thus be enabled to employ those containing the most desirable elements for each particular purpose.

We have said that most of the literature on the subject of economical nutrition is, by the employment of obscure language, generally unintelligible to the farmer. We will therefore in the present article, avoid such language, and when we have occasion to use any of the experiments given by former writers, we will so far simplify them as to place them within the easy comprehension of all.

It is of primary importance to know the constituents of the body of the animal before we consider the food to be given it; and we will, therefore, make an analysis of the matured flesh of ruminating animals, to which class the present paper is intended more especially to apply.

In the proportion of one hundred parts there exist, approximately—

Water	74.5
Gelatine	10.2
Fat	8.0
Phosphate of lime	4.5
Carbonate of lime	.5
Albumen	.8
Fibrin	.75
Salts, &c	.75

Water enters largely, as will be seen above, into constituents of all animal bodies; all the fluids, as well as the solids, are largely composed of it, and it is therefore absolutely essential in the food to a certain extent; but we shall find, hereafter, that the foods which contain it in the largest quantities are of a less nutritious character than others which have it in less quantities in their composition. It is found in the different vegetables used as food in the following proportions:

Potatoes	75 per cent.
Carrots	86 "
Turnips	87 "
Parsnips	79 "
Mangold wurzel	85 "
Cabbage	92 "

The relative fattening properties of these vegetables will be discussed hereafter.

Gelatine is the material of which many of the tissues of the body are principally composed. It consists of several kinds, all nearly related, such as horn, gelatine in bones, and in cartilages. Horn is constituted nearly like albumen. It is one of the principal elements of all animal bodies, and the skin, hoofs, (or nails,) hair, and coating of the mucous membranes, the lining of the cavities of the intestines, the windpipe, mouth, and, in fact, the lining of all the cavities and surfaces of the body are largely composed of it; but these substances, although in close affinity with each other, differ considerably in their qualities, and some possess elements hardly found in others. For instance, sulphur is found in the smallest quantity in the skin and coating of the mucous membranes, but is quite abundant in the hoofs and horns, and more so in the hair. The gelatine in the cartilages and bones, although different in each, is nearly identical; they are both soluble in hot water, and coagulate, when cool, into a thick jelly, such as we observe in cold veal broth. Glue is formed of gelatine. It is present in the bones, and composes largely the fibres of the sinews and ligaments, to which it furnishes elasticity and strength.

Fat, the next important constituent, is composed principally of starch, gum, and sugar, and occurs in all animals, sometimes to the extent of ten per cent., and even more, of their entire weight. There are three kinds of fatty substances entering into the composition of bodies, viz: Oleine, margarine, and stearine. "Oleine is the chief component of all oils, and denotes their characteristic parts, which slowly coagulate by cold." Oils also contain another fat—margarine—which hardens quicker than oleine, and is observed in the form of crystals of the appearance of mother-of-pearl; hence it is called sometimes "mother-of-pearl fat." Stearine is the principal fat in animals; it is of a firmer texture than the others, and is the fat of mutton and beef, in which meats it is combined with margarine and oleine.

Fat is secreted in the largest quantities from food abounding in sugar, starch, and gum. These contain the three elements—carbon, hydrogen, and oxygen; the first element preponderating to the extent of at least fifty per cent.; hence these foods are called carbonaceous, or heat-giving foods. They seem to be of no great use in building up the body, but furnish, as we may say, the fuel by which the animal heat is maintained. The process by which this heat is produced is precisely similar to that of the burning of coal, gas, or other substances. The carbon of the food is exposed to the action of the oxygen of the air in the lungs, and the result is the burning of it, which produces as much heat as if consumed in the open air. Less heat-giving food is needed in hot weather than in cold, and less in warm climates than in cold. Thus the Esquimaux and Greenlanders are enabled to subsist on, and even require, fat or oily food that would be rejected by people living in a warmer climate. The body needs only a certain quantity of heat-giving food to maintain its natural temperature, and all consumed in excess of this quantity but furnishes material for future use, to be stored up in receptacles provided by nature in the body.

An accumulation of fat in the animal, caused by feeding it upon foods which abound in fat-forming principles, is therefore really food stored up in the animal for its support when needed.

Phosphate of lime, or bone lime, is composed of about 75 per cent. of lime and 25 per cent. of phosphoric acid. It occurs in all the animal tissues, and forms from 50 to 60 per cent. of the materials of the bones, to which it gives strength, and in which it occurs in the largest quantities in those most exposed to mechanical influences. Some foods furnish an abundance of this mineral, as Indian corn, and animals which have been fed upon it to any great extent are observed to be large-boned.

Carbonate of lime, or chalk, occurs in all bones, though in much less quantities than the preceding mineral. It is also found in less proportions in young than in old animals, being nearly from 1 to 4 parts in newly-born, 1 to 6 in adult, and 1 to 8 or 9 in old animals.

Albumen occurs in the blood and nerves of animals. It differs from fat in its composition, having the four elements—carbon, hydrogen, nitrogen, and oxygen—while fat contains but three.

All the organs of the bodies of animals contain these four elements, and food must necessarily contain them to be nutritious. We found the carbonaceous foods to be fat-producing or heat-giving. The nutritious foods containing the four elements are called nitrogenous or flesh-forming foods. They are all included in the three forms, albumen, fibrin, and casein, which contain the four elements in nearly the same proportions. Albumen, occurring in the blood and nerves of animals, and in eggs of birds, &c., is found in grains and vegetables in almost exactly identical composition. Boussingault gives the results of analyses performed by Messrs. Dumas and Cahours to prove this fact, as follows:

ALBUMEN.

	Animal.	Vegetable.
Carbon	53.5	53.7
Hydrogen	7.1	7.1
Oxygen	23.6	23.5
Nitrogen	15.8	15.7

Fibrin is the principal element of which the muscles of animals are formed; it also forms the clot and globules in blood. Like albumen, fibrin is found in vegetables in nearly identical composition with that of animals. The analysis of Messrs. Dumas and Cahours give the following:

FIBRIN.

	Animal.	Vegetable.
Carbon	52.8	53.2
Hydrogen	7.0	7.0
Oxygen	23.7	23.4
Nitrogen	16.5	16.4

Casein is found in the milk of mammals, and is identical with that called legumen, of the leguminous seeds, such as beans, peas, &c., in which it exists more abundantly than in milk itself. The analyses before referred to give the composition of the animal and vegetable casein as nearly identical.

CASEIN.

	Animal.	Vegetable.
Carbon	53.5	53.5
Hydrogen	7 0	7.1
Oxygen	23.7	23.4
Nitrogen	15.8	16.0

The similar composition of these three substances is evident from the above. Casein seems to constitute the most nourishing portion of milk, which is undoubtedly the standard of food, as furnishing all the essential principles for the support and growth of animals; and we shall find those foods to be the most *nutritive** which contain casein in the greatest abundance.

The salts and other minerals found in mammals, or phosphate of magnesia, which occurs in small quantities in the bones and fluids; fluoride of calcium, which is found in small quantities in the tissues, but more abundantly in the bones and teeth; silica, a flint which is found in the enamel of the teeth; chloride of sodium, (or common salt,) which exists in all the tissues and in blood, form at least six parts in one thousand.

Of these minerals, salt is the only one that is not supplied in vegetable food in the necessary quantities, and it is therefore absolutely necessary that it should be provided, not only because no tissue of the body can exist without it, nor the blood and cartilages maintain their proper constituents, but it is necessary in the wear and tear of the body to replace that which is abstracted from the blood by the excretions, for the urine and excrement, the tears and horny substances, have all taken it from the blood, and it must be replaced. Salt, then, is necessary to the successful management of stock, and should always be given in quantities sufficient to satisfy the cravings of nature.

In a brief review of the analysis of the bodies of mammals we find them to

* The term *nutritive* will be used in this article for convenience, as combining the flesh-forming and fat-forming elements.

consist in great part of water, which is absolutely necessary in the food to be given them for nourishment, both to assist in digestion and to replace the waste which is going on, not only in the fluids, but also in the solids; gelatine, of which many of the tissues are composed; fat, which is composed principally of starch, gum, and sugar, and requires food containing these constituents to increase its secretion; phosphate and carbonate of lime, forming the bones; albumen, casein, and fibrin, forming the flesh; and various salts and chemicals contained in small quantities, but nevertheless essential, and must therefore be furnished by the food.

We will now consider the various foods used in sustaining these different parts, and their relative and comparative values for both nourishing and fattening purposes.

We have said that milk is the type of all animal food. This is apparent from the fact that in it are found all the principles necessary to support life. It is at once a liquid and solid food; a source of albumen and of fatty substances, of sugar and the salts; and, although more abundant in water than the blood, it possesses, in its principal constituent, casein, one of the most necessary elements in the food of all mammals.

The average of several analyses in this country is as follows:

		Or, economically:	
Water	86.0	Water	86.0
Casein	5.0	Flesh formers	5.0
Fatty matter	3.5	Fat formers	8.0
Sugar	4.5	Mineral matter	1.0
Mineral matter	1.0		

The following are analyses of the milk of different cows, as given by Boussingault:

Casein, albumen, and insoluble salts.	Fatty matter.	Sugar of milk and soluble salts.	Water.	Dry matter in 100 parts of milk.	Remarks.	Authors of the analyses.
3.6	4.0	5.0	87.4	12.6	Average of twelve analyses at Bechelbrunn.	Le Bel and Boussingault.
3.8	3.5	6.1	86.6	13.4	Average of six analyses in the environs of Paris.	Quevenne.
4.5	3.1	5.4	87.0	13.0	Idem	Henri and Chevalier.
5.6	3.6	4.0	86.8	13.2	Idem	Lecann.
5.1	3.0	4.6	87.3	12.7	An analysis at Giersen	Haidlen.

It will be perceived by these analyses that there is over eighty per cent. of water. This, at the first glance, would lead us to question its value as food, particularly as some of the roots which abound in water to the same extent are notoriously unnutritious; but if we give the matter a moment's consideration we shall see that so large a proportion is almost absolutely necessary, for we found in one analysis of the bodies of mammals that about seventy-five per cent. consists of water, which in the decompositions of the body is continually passing off, and which must be replaced. A recent writer says of this fact: "If life consists in a metamorphosis of the tissues, fluids are an indispensable condition of life, for the combinations and decompositions in its substance produced by the activities of the body cannot take place without the agency of water, and since the last result of the whole process of digestion is a liquefaction of alimentary principles, the formation of the blood is impossible without water." But not only the formation, but the continual exercise also, of the organs depends upon their receiving a due amount of water. Without it no digestion or formation of blood, no nutrition or excretion, can exist. Even this statement, however, by no means exhausts the importance of water, for it is essential not only as the medium for the movements of all dissolved substances—not only is the humidity necessary for the organs of which the most active, the brain and muscles, contain the greatest proportion of water—but the hydrogen and oxygen which we take in water enter into the composition of many elementary principles of being and are transformed into the constituents of the blood. When starch or gum becomes sugar, the transformation is effected by the absorption of water; for with regard to their composition, a greater proportion only of water distinguishes sugar from starch, and a separation of oxygen from sugar causes the latter to be transformed into fat. It will be found hereafter that foods which contain a great abundance of water are not nutritious from this fact, but from the arrangement of the other constituents, and those which are concentrated and dry must be used in connexion with water to be of most value.

Milk, then, being the prototype of a perfect nutriment, those foods which contain its valuable elements in the greatest abundance are evidently of the most value in the animal economy. It only remains, therefore, in a series of comparative analyses of the different foods of the animals under present consideration, to discover those containing the most desirable qualities, and trace the circumstances and combinations in which they can be made of the highest utility and value.

The foods of all strictly herbivorous animals are derived from the mineral and vegetable kingdoms. They may properly be classified as follows:

Mineral food—water, salts, &c.; carbonaceous or fat-forming food*—starch, sugar, fat; nitrogenous or flesh-forming food—albumen, fibrin, casein, gluten; accessory or heat-giving food, which is also partly carbonaceous—gum, fibre.

The vegetable kingdom, in its various forms, supplies all these elements in different quantities and combinations, not only in the seeds and fruits, but also in the roots, stalks, and leaves. For our present purpose, we will divide the vegetable foods into three classes, viz: roots, leaves, stalks, &c., seeds, grains, &c.

FOOD FROM ROOTS.

This valuable class is already appreciated at its true value. Its importance is evident from the fact that it supplies, in the different species, all the necessary elements of food. For instance, the potato furnishes starch in abundance, which is well known for its fat-forming properties; the parsnip furnishes albumen and casein; the beet and carrot furnish sugar—in fact, all have valuable nutritive qualities, some to a surpassing extent.

We will begin our analysis of the different roots with the potato. Its constituents are, according to different authorities, as follows:

Water	75.2
Casein, &c	1.4
Starch	15.5
Dextrine	0.4
Sugar	3.2
Fat	0.2
Fibre	3.2
Mineral matter	0.9

Or, economically:

Water	75.2
Flesh formers	1.4
Fat formers	18.9
Accessories	3.6
Mineral matter	0.9

* The carbonaceous or nitrogenous foods may be called in general terms nutritive; for those requiring especial mention their proper designations will be given.

Of the high value of potatoes, when used in connexion with other foods, there is not a shadow of doubt. All experimenters and observers in the economy of food agree in saying that they are of the highest utility, but they must be used with other foods whose constituents are different from those of this root. The analysis shows that potatoes surpass in the fat-producing principles—the nutritious or flesh-forming—in such proportions that they could not alone sustain the composition of the blood, for an animal fed alone on these tubers would be obliged to consume such quantities to provide the blood with the requisite proportion of albumen, that, even if the process of digestion were not discontinued, there would be a superabundance of fat accumulated beyond the power of the oxygen to consume, which would successively absorb from the albuminous substances a part of its vital elements, and thus a check would be caused in the endless change of matter in the tissues in the nutritive and regressive transformations. These roots, then, are most valuable when used with foods in which the nutritious principles more nearly correspond with the fat-forming, and we shall find, in the course of our investigations, exactly what those foods are which will develop the utility of the potato at its highest degree. There seems no doubt that the tubers are of the most value when cooked, although some writers affirm to the contrary. It seems possible to prove this fact on philosophical principles, for it is well known that the starch contained in the potato is incapable of affording nourishment until the containing globules are broken, and one of the most efficient means of accomplishing this seems to be by heat.

Boussingault, in speaking of the economy of cooking potatoes, says: "The potato is frequently steamed or boiled first; yet I can say positively that horned cattle do extremely well upon raw potatoes, and at Bechelbrunn our cows never have them otherwise than raw. They are never boiled, save for horses and hogs. The best mode of dealing with them is to steam them; they need never be so thoroughly boiled as when they are to serve for the food of man. The steamed or boiled potatoes are crushed between two rollers, or simply broken with a wooden spade, and mixed with cut hay or straw or chaff, before being served out. It may not be unnecessary to observe that by steaming, potatoes lose no weight; hence we conclude that the nutritive equivalent for the boiled is the same as that of the raw tuber. Nevertheless it is possible that the amylaceous principle is rendered more easily assimilable by boiling, and that by this means the tubers actually become more nutritious. Some have proposed to roast potatoes in the oven, and there can be little question but that heated in this way they answer admirably for fattening hogs, or even oxen. Done in the oven, potatoes may be brought to a state in which they may perfectly supply the place of corn in foddering horses and other cattle." The apparent contradiction in the remarks will be observed; but the evident leaning in favor of cooked potatoes shows that Boussingault, although paying some attention to the theory that cooked food is not generally attended with the same benefit to ruminating as to other animals, was evidently almost perfectly convinced of the truth that those which contain an abundance of starch in their constituents must be rendered more nutritious when exposed to the action of heat.

Many experiments have been made to find the comparative value of potatoes with other foods for stock.

"From recent experiments, very carefully and skillfully made, it appears that two pounds of raw potatoes afford as much nourishment as one pound of good English hay." (Agriculture of Massachusetts, 1853, p. 35.)

In the appended table we find, by our present system of analysis, the value of this tuber, both in comparison and connexion with other foods.

One of the next in value among the roots for food is the carrot. Its constituents are as follows:

Water	87.5
Albumen and casein	0.6
Sugar	6.4
Fat	1.2
Gum	1.0
Woody fibre	3.3
Mineral matter	1.0

Or, economically:

Water	87.5
Flesh formers	0 6
Fat formers	6.6
Accessories	4.3
Mineral matter	1.0

It will be seen that the fat-forming elements surpass the nitrogenous to such an extent that other food (as with the potato) is absolutely necessary to give this root its highest value. All writers and experimenters agree in pronouncing it of considerable utility, not only in its fattening qualities, but also in its valuable medicinal properties.

Many experiments have been made to ascertain the economical value of this root. Mr. Colman, in his second report on the agriculture of Massachusetts, gives the experience of Mr. J. C. Curwen, who says: "The profits and advantages of carrots are, in my opinion, greater than any other crop. This admirable root has, upon repeated and very extensive trials for the last three years, been found to answer most perfectly as a partial substitute for oats. Where ten pounds of oats were given per day, four pounds may be taken away and their place supplied by five pounds of carrots."

Josiah Quincy's experience in the cultivation of carrots was that they cost him about eleven cents per bushel. The average cost of this root, every expense included, is probably not far from thirteen cents per bushel. This small cost, when considered in connexion with the value of the root, at once establishes the profit of its culture. The leaves of the carrot are almost as valuable as the root itself, as their constituents are nearly the same. They are most valuable when given to milch cows, as they not only increase the flow of milk to a surprising degree, but also add to its quality.

The parsnip is of about the same value for fattening purposes as the carrot, and is one of the most nutritious of the roots. The average of different analyses give its composition as—

Water	82.1
Albumen and casein	1.7
Sugar	2.9
Starch	3.5
Fat	0.6
Gum	0.7
Woody fibre	8.0
Mineral matter	1.0

Or, economically:

Water	82.1
Flesh formers	1 2
Fat formers	7 0
Accessories	8.7
Mineral matter	1 0

The same remarks will apply to this root as to the carrot. Its comparative value will be found in the appended table.

For strictly fattening purposes no root is more valuable than the Jerusalem artichoke; but although all who have had any experience in its use agree in pronouncing it of very high utility, its culture is neglected to a greater extent than that of all other roots.

The results of different analyses average as follows:

Water	76.0
Sugar	14.8
Albumen	1.0
Starch	3.0
Gum	1.2
Fat	1.0
Woody fibre	1.5
Mineral matter	1.5

Or, economically:

Water	76.0
Flesh formers	1.0
Fat formers	18.8
Accessories	2.7
Mineral matter	1.5

Abounding as this root does in fat-forming principles, to the remarkable extent of nearly nineteen per cent., its value when used in connexion with foods whose constituents are more nutritious is evident. The principal cause for its non-culture is probably the difficulty with which it is eradicated from the ground when once introduced. But this should be almost an argument in its favor, for it establishes at once its hardiness, and as it yields abundantly with ordinary cultivation, and is not liable to the diseases with which its cousin, the Irish potato, is afflicted, there seems no good reason why every farmer should not cultivate it to some extent, particularly as it thrives in shady places and on poor soil, and may be planted in some of the many patches found on all farms which probably could be turned to no other use unless at great expense and labor.

The mangold wurzel, in consequence of its great yield and great nutritive qualities, is one of the most valuable roots cultivated for food for farm stock. The analysis of the three favorite varieties, as given by Mr. Cameron, assisted by Professor Johnston, is as follows:

	Long red.	Short red.	Orange globe.
Water	85.18	84.68	86.52
Gum	0.67	0.50	0.13
Sugar	9.79	11.96	10.24
Casein, (so called)	0.39	0.26	0.33
Albumen	0.09	0.18	0.03
Fibre and pectic acid	3.08	3.31	2.45
	99.20	100.89	99.70

Or, economically:

	Long red.	Short red.	Orange globe.
Water	85.18	84.68	86.52
Flesh formers	0.48	0.44	0.36
Fat formers	9.79	11.96	10.24
Accessories and waste	4.55	3.81(?)	2.88

These analyses differ from those given by Sir Humphry Davy and Mr. Herepath, a celebrated chemist of Bristol, England, presented below, and probably represent the nutritive properties of the mangolds in the minimum degree.

The leaves of the mangold are of as much nutritive value as the root itself, if they do not surpass it.* Professor Wilson, in the Journal of the Royal Agricultural Society of England, says: "The leaves of the plants also appear to possess a far higher value, both as a feeding and manuring substance, than we are accustomed to assign to them; in fact, in a chemical point of view they are three times as valuable as the roots."

Of the value of this root in yielding immense crops there is no doubt. Dr. George B. Loring, of Salem, Massachusetts, in a statement made concerning this crop, showed that he raised on one acre and one-eighth of land, at a cost of $135, (all expenses included,) 1,800 bushels of mangolds; the seed planted was a mixture of long red and yellow globe. The doctor remarks, in concluding his statement, as follows:

"The cost of these roots, seven and a half cents per bushel, is certainly not

* Johnson's Agricultural Chemistry, p. 912.

extravagant, considering their value as food and the usual market price. They usually sell for seven dollars a ton of sixty pounds to the bushel, or about thirty-four bushels to the ton; and at this rate bring twenty cents and a fraction per bushel. The market for them is not large, it is true, but they give ample remuneration for the trouble and expense of raising in their benefit to milch cows.

"According to analysis and experiment, four hundred pounds of mangold wurzel are equivalent to one hundred pounds of English hay. At sixty pounds to the bushel the crop weighed ninety-six thousand pounds, or forty-eight tons, equivalent to twelve tons of hay, taking the estimate that four tons of mangolds are equal to one ton of hay. For the production of milk, I have no doubt that the forty-eight tons of mangolds are worth more than the thirteen and a half of hay."

It will be observed that the above crop was taken from but one and one-eighth acre of land, on which it would of course be impossible to produce the equivalent in hay. This at once establishes the value of the root for economical purposes. There are several well established varieties of the mangold, the principal of which are the long orange, red globe, orange globe, and yellow globe. The first three varieties are best suited to deep, heavy soils; and the other to those of a lighter texture. For general cultivation, the orange globe seems the best in yielding the largest crops.

The Silesian mangold, or sugar beet, is another variety of this root. The following is the average analysis as given by different authors:

Water	82.0
Sugar	12.6
Casein	0.4
Starch	1.0
Gum	0.4
Albumen	0.5
Mineral matter	3.1

Or, economically:

Water	82.0
Flesh formers	0.9
Fat formers	13.6
Accessories	0.4
Mineral matter	3.1

It will be seen that the fat-forming elements are very largely in excess of the nitrogenous, and compose about thirteen per cent. of the entire root. The value of the sugar beet is better appreciated in Europe than in this country. There, it forms one of the great staple products, and is used not only in the manufacture of sugar, but also for fattening cattle, and is quite a favorite with dairymen. There is considerable difference among writers in this country as to its value, compared with other foods; but there is no doubt that it is the most valuable of the mangolds for feeding purposes, though not so profitable in yielding great crops, as it averages only about seventy-five per cent. of the yield of the other varieties.

The ruta-baga, or Swedish turnip, is esteemed very highly by feeders; but its value is, I am inclined to think, over-estimated. The following table, the result of analyses by Sir Humphry Davy and Mr. Herepath, shows the comparative value of this root with the different mangolds:

Quantity of nutritious and fat-producing elements in 1,000 *parts.*

	Mucilage or starch.	Sugar.	Gluten or albumen.	Total.
Swedish turnips	9	51	2	62
White turnips	7	34	1	42
Mangold wurzel	13	119	4	136
Orange globe wurzel	25¾	106¾	1½	134
Sugar beet	17¾	126¾	1¼	145¾

For feeding purposes, the ruta-baga is evidently of inferior value to the mangolds, and there is but one reason why the latter should not supersede the former, and that is the greater difficulty attending the raising of the mangolds, and the superior soil which is essential for their success. The value of the ruta-baga, in fact, consists in its being grown with good returns on comparatively very poor soil.

The interesting experiments of Lord Spencer show pretty conclusively the comparative values of mangolds and Swedes for feeding purposes. He selected two steers of about the same weight and age, one being two years nine months and the other two years seven months old, and fed them on equal quantities of hay, to which was added to one animal regular rations of Swedes, and to the other mangolds. The animals increased in weight at the rate of forty-eight and a quarter pounds for every ton of Swedes, and sixty-five and a half pounds for every ton of mangolds.

Thinking that the difference in the increase of weight might have been from other causes than the values of the roots, he changed the diet of the two animals, giving to the one that he fed on Swedes, mangolds, and to the other, Swedes. The result was, the animal fed on mangolds increased in weight at the rate of thirty-six and three-fourth pounds, and the other fed on Swedes at the rate of fifteen and a half pounds, for every ton of the roots consumed. The great difference must have been caused by the change of the first animal from mangolds to Swedes; and this is proved by a third experiment. Both animals were fed on equal quantities of mangolds, when they both increased in weight at the rate of fifty pounds for every ton consumed. His lordship, in summing up the result of these experiments, remarks: "It will be for practical men to decide upon the value of this trial. What appears to me to be the most conclusive part of it is that No. 2, who had during the first month, when feeding upon mangold wurzel, increased in girth three inches, in the next month, when his food was changed to Swedish turnips, did not increase in girth at all; and when in the third month he was feeding again on mangold wurzel, he again began to increase in girth. Because it is very well known that if an animal is changed from more to less nutritious food, the probable consequence will be that his growth will be stopped.

"The result appeared to me so decisive that I have not tried the same experiment with the same accuracy since; but I did try the following year, feeding a cow alternately on Swedish turnips and mangold wurzel, and though I have not by me the details of the trial, I remember that the result confirmed the experiment of the previous year."

The white turnip is undoubtedly the least valuable of all roots for fattening purposes, as will be seen by its analysis. It seems of most utility when given to milch cows, and it produces an increased flow of milk. It is of the highest value as a field crop only when sown on land after other more valuable crops are gathered. The analysis is:

Water	90.1	Or, economically:	
Casein and albumen	1.0	Water	90.1
Sugar	4.0	Flesh formers	1.0
Gum	1.5	Fat formers	4.0
Woody fibre	2.5	Accessories	4.0
Mineral matter	0.9	Mineral matter	0.9

The leaves of the turnip are of about the same value as the root, which is also true of nearly all the preceding. The following table gives the comparatively nutritive value of the different varieties of turnips:

Grains of nutritive matter 64 drachms of the Swedish turnip afford...... 110
Grains of nutritive matter 64 drachms of the stored garden turnip afford.. 85
Grains of nutritive matter 64 drachms of the Norfolk white turnip afford.. 83
Grains of nutritive matter 64 drachms of the common or white loaf turnip afford........ 80
Grains of nutritive matter 64 drachms of the Tankard, or long-rooted turnip afford........ 76
—(*Sinclair's Hort. Glean.*, p. 406.)

FOOD FROM LEAVES AND STALKS.

This important portion of the food of domestic animals, of which grass and hay are the type, is valuable, not only in furnishing essential accessory food, but it contains, as we shall find hereafter, exceedingly nutritious and fattening principles.

Of the different varieties of this food, the most valuable are the various grasses, clovers, and stalks and leaves of the different leguminous plants. Of course, our limited space will not permit us to give an extended consideration of all these, and we must content ourselves with analyses and investigations of those most valuable and generally used, which are included in the various grasses and clovers.

In dismissing the leguminous plants, it is worthy of remark that they are acknowledged by all writers and observers to be of considerable nutritive value. The following table, from analyses of Einkop, Boussingault, and others, gives the appropriate composition of the green stems and leaves of some of the leguminous and other plants, not usually cultivated for hay:

	Green pea stalks.	Spurry.	Green stalks of buckwheat.	Common vetch.	French vetch.	White lupine.	Common white field bean.	Green oats fodder.
Water	80.00	7.7	82.5	77.5	79.5	86.0	85.0	82.0
Starch	3.40	2.3	4.7	2.6	3.8	1.3	1.5	5.0
Woody fibre	10.31	12.0	10.0	10.4	11.5	7.0	9.0	7.5
Sugar	4.55	......	......	......	......	......	0.2	3.5
Albumen	0.90	2.7	0.2	1.9	0.7	1.8	1.05	1.0
Gums, &c	0.65	5.2	2.6	7.6	3.6	2.9	2.25	0.5
Fatty matter	......	......	......	......	0.9	1.0	1.0	......
Phosphate of lime	0.19	0.8	......	......	......	......	......	0.5

The economical value of these will be found in the table appended to this article.

In the grasses and clovers are included the natural and most important foods of the animals especially under present consideration. It is, of course, impossible to investigate the comparative values of the hundreds of different species of grasses found in this country, and we shall be obliged, in this article, to speak of them under one general head, giving to the clovers, however, a separate consideration. It is true of grass that it combines all the elements in its composition necessary to support the life and physical organization of all herbivorous animals in a perfection attainable from no other foods; for in it are united not only the nutritious and fat-producing, but also the accessory and mineral elements.

Grass varies considerably in its composition in its various species, and their different ages. The following are the analyses of timothy and red-top at the time of flowering:

	Water.	Starch.	Woody fibre.	Sugar.	Albumen, &c.	Gum.	Mineral matter.
Timothy	70.0	5.5	12.5	4.2	4.0	1.8	2.0
Red-top	71.0	3.8	13.0	4.9	3.3	1.5	2.5

Or, economically:

Timothy.		Red-top.	
Water	70.0	Water	71.0
Flesh formers	4.0	Flesh formers	3.3
Fat formers	9.7	Fat formers	8.7
Accessories	14.3	Accessories	14.5
Mineral matter	2.0	Mineral matter	2.5

These two species will serve for our present purpose as a type of grass, and in fact they are the most valuable of all for food. Grass is the most valuable for hay before it has ripened, or, in other words, gone to seed, and it is of primary importance, therefore, to secure it when its most valuable constituents, as sugar, starch, albumen, &c., are in the greatest abundance in the stalks and leaves, which is the time of flowering.

This care is not the only essential, for on the process of making the hay depends almost entirely its value. Dr. Robert D. Thompson, of Glasgow, Scotland, says of this fact: "It should be an object with the farmer to cut grass for the purpose of making hay at that period when the largest amount of matter soluble in water is contained in it. This is assuredly at an earlier period in its growth than when it has shot into seed, for it is then that woody matter predominates—a substance totally insoluble in water, and therefore less calculated to serve as food to animals than substances capable of assuming a soluble condition. This is the first point for consideration in the production of hay, since it ought to be the object of the farmer to preserve the hay for winter use in the condition most resembling the grass in its highest state of perfection. The second consideration in hay-making is to dry the grass under such circumstances as to retain the soluble portion in perfect integrity."

Hay is the most valuable, therefore, which is made perfectly dry in the shortest possible time and with the least possible bleaching; for the experience of all observers is, that hay when cured with the least exposure to the sunshine and winds is much more valuable than that cured otherwise.

Fattening cattle on hay alone is the practice of many farmers, and is not inconsistent with economy where hay is plenty and markets are distant. Animals usually consume, when fed with hay alone, not far from four per centum of their live weight daily, and will gain, if properly cared for, nearly two pounds of flesh. But it is more desirable to feed the animals on not more than three per cent. of their live weight in hay, and an equivalent for the other one per cent. in Indian corn meal, or roots; and the gain would exceed the other system in a greater proportion than the cost of food.

It will be observed that the analyses of the timothy and red-top grasses were made when they were in the green state. The following is their nutritive value when made into hay, and also that of some other well-known species, as given by C. L. Flint, in his valuable work on "Grasses and forage plants."

Name of grass.	Albuminous, or flesh-forming principles.	Fatty matter.	Heat-producing principles—starch, gum, sugar, &c.	Woody fibre.	Mineral matter or ash.
Sweet-scented vernal grass	10.43	3.41	43.48	36.36	6.32
Meadow foxtail	10.32	2.92	43.12	33.83	7.81
Tall oat grass	12.95	3.19	38.03	34.24	11.59
Orchard grass	13.53	3.14	44.32	33.70	5.31
Orchard grass, seeds ripe	23.08	1.56	26.53	43.32	5.51
Meadow loft grass	11.52	3.56	39.25	39.30	6.37
Meadow barley grass	11.17	2.30	46.68	31.67	6.18
Perennial rye grass	11.85	3.17	42.24	35.20	7.54
Italian rye grass	10.10	3.27	57.82	19.76	9.05
Timothy	11.36	3.55	53.35	26.46	5.28
Annual spear grass	11.83	3.42	51.70	30.22	2.83
June grass	10.35	2.63	43.06	38.02	5.94
Rough-stalked meadow grass	9.80	3.67	40.17	38.03	8.33
Grass from irrigated meadow	25.91	6.53	32.05	25.14	10.37
Grass from irrigated meadow, (2d crop)	10.92	2.06	43.90	34.30	8.82

It is to be understood in the foregoing remarks that the average of circumstances has been considered, for, as it is well known, the composition of all plants is very materially affected by influences of soil, cultivation, and temperature, and plants grown on poor soil are poorer in nitrogenous principles than those grown on a rich soil, as much as those grown in a wet season are less rich in fat-forming elements than those grown in dry seasons.

The different clovers constitute, probably, as valuable food for cattle generally as the true grasses, and for milch cows they excel in the principles essential to an increased flow of rich milk. The analyses of the three important species used for both fodder and hay, substantially, as given by Einhof and Crome, are as follows:

	Red clover.	White clover.	Lucerne.
Water	76.0	80.0	75.0
Starch	1.4	1.0	2.2
Woody fibre	13.9	11.5	14.3
Sugar	2.1	1.5	0.8
Albumen	2.0	1.5	1.9
Extractive matter and gum	3.5	3.4	4.4
Fatty matter	0.1	0.2	0.6
Phosphate of lime	1.0	0.9	0.8

Or, economically:

	Red clover.	White clover.	Lucerne.
Water	76.0	80.0	75.0
Flesh formers	2.0	1.5	1.9
Fat formers	3.6	2.7	3.6
Accessories	17.4	14.9	18.7
Mineral matter	1.0	0.9	0.8

As with the hay of the true grasses, the dried clover is more valuable than the green, as shown by the following table:

	Red clover.	White clover.	Lucerne.
Flesh formers	22.55	18.76	12.76
Fat formers	44.00	40.00	38.00
Accessories	24.00	30.00	36.00
Mineral matter	9.45	11.24	13.24

All the above analyses of clovers were made at the time of the flowering, when the stalks and leaves contained their nutriment in the highest perfection.

The value of clover is increased instead of diminished (as with the grasses) by a slow process of curing: "It requires a longer time to cure it properly, and if exposed to the scorching sun it is soon injured even more than the natural grasses, since its succulent leaves and tender blossoms are quickly browned, and lose their sweetness in a measure, and are themselves liable to be wasted in handling over." Clover should be cut, therefore, while dry and free from dew; it should be exposed to the sun only enough to thoroughly wilt it, when it should be formed into small cocks, and permitted to dry until fit to place in the barn.

Thus the tender and succulent leaves are secured in a form nearly resembling the green plant, which is a matter of vital importance in the economy of these species.

In a brief summing up of the value of the different grasses as food, it is worthy of remark, that in the dried state they furnish essential accessory food in connexion with others more nutritive.

It is an axiom that no matter how nutritious the food given an animal is, there must be a sufficient quantity of it to satisfy the beast and produce the greatest results.

If an animal in fattening requires a certain amount of nutritive food, and that food is given it in a highly condensed condition or concentrated form—as, for instance, oil-cake—but a comparatively small quantity would be necessary to have the same value in bulk of hay. But that the food may be most perfectly exposed to the action of the digestive organs it must be of a bulk sufficient to stimulate them to exertion, and grass, in its various forms, seems particularly adapted for this purpose, for we find by the different analyses that the fat and flesh forming elements, although formed in desirable quantities, are exceeded by essential accessory food in a degree surpassing all other nutriments.

Grass, then, in its various forms, is valuable as food of itself, but is of the greatest utility as an auxiliary in the fattening of animals, for it gives bulk to the more nutritious foods used in fattening them, and stimulates the digestion in a manner essential to its maximum perfection. It is worthy of observation that, although hay possesses the quality of both distending the stomach to its fullest capacity and affording sufficient nourishment to maintain the animal, no other food has this faculty, and this fact has caused it to be considered the standard of food for herbivorous animals in the various experiments of authors.

FOOD FROM GRAINS AND SEEDS.

In this class are included not only some of the most valuable foods for the maintenance of animal life, but also those most esteemed as giving the highest amount of nutrition in a condensed form.

Nearly all the grains contain nutritious and fat-forming elements in the most desirable proportions, and some of them furnish the standard of food for the human race. For instance, wheat contains in its composition all the principles necessary to maintain life, and beans contain a greater amount of casein, or cheese, than milk itself.

The grains, therefore, are of the highest value in the fattening of animals, but they must be used in connexion with other food of a less nutritious nature, and it will be apparent hereafter which varieties are most valuable when used together, and in what amounts they must be employed.

It is true of nearly all grains that they are as valuable for food with their enveloping husk ground into meal with them, as when nothing but the clean grain is employed; in fact, some authors affirm that the enveloping husks of some of them contain more nutrition than the grains themselves. However this may be, all cereals should be broken into the form of meal to be most nutritious, and a large percentage is added to their value by the process of cooking.

This is accounted for philosophically by the following results of experiments by M. Rapsail, the author of "Organic Chemistry," and M. Biot, of the French Academy of Sciences:

1. The globules constituting meal, flour, and starch, whether contained in grain or roots, are incapable of affording any nourishment as animal food until they are broken.
2. No mechanical method of breaking or grinding is more than partially efficient.
3. The most efficient means of breaking the globules is by heat, by fermentation, or by the chemical agency of acids or alkalies.
4. The dextrine, which is the kernel, as it were, of each globule, is alone soluble, and therefore alone nutritive.
5. The shells of the globules, when reduced to fragments by mechanism or heat, are, therefore, not nutritive.
6. Though the fragments of these shells are not nutritive, they are indispensable to digestion, either from their distending the stomach or from some other cause not understood, it having been found by experiment that concentrated nourishment, such as sugar or essence of beef, cannot long sustain life without some mixture of coarse or less nutritive food.
7. The economical preparation of all food containing globules or fecula consists in perfectly breaking the shells, and rendering the dextrine contained in them soluble and digestible, while the fragments of the shells are at the same time rendered more bulky, so as the more readily to fill the stomach.

It is with this theory and with these facts in view that the following analyses and comparative values of the different grains have been made, after they were reduced to the condition of fine meal or flour. It will be observed in the analyses that all the grains contain a small percentage of water. This is present in all the varieties unless they are subjected to a heat of 212° Fahrenheit; but for our present purpose it is desirable that they should be presented as they exist in the natural ripened state. The following table of comparative equivalents of the nutritive natures of the different grains and seeds, as given by Boussingault, will be found to nearly correspond to those contained in the table appended to this article. Wheaten flour was assumed as the standard, and placed at the value of 100.

Wheat flour (good quality)	100	Maize	138
Wheat	107	Yellow peas	67
Barley meal	119	Horse-beans	44
Barley	130	White French beans	56
Rye	111	Rice	171
Buckwheat	108	Lentils	57

It must be borne in mind that this table presents those in their *nitrogenous* values, and that 100 parts of wheat flour are worth 138 parts of maize, or 44 parts of horse-beans. Their fattening properties will be found to differ greatly from the above in the subsequent analyses.

Wheat, from the great demand for it as the staple food of man, is of too much value to be used in fattening farm stock in most localities; but in sections remote from markets, and where transportation is difficult, no food can be grown to exceed this grain in feeding value. It is undoubtedly the most valuable of all the cereals, in combining in its composition not only the valuable fattening principles of some of the other grains, but also the nutritive elements that are essential in all foods.

The composition of wheat of average quality, with the greater part of the husks removed, is as follows:

		Or, economically:	
Water	14.3	Water	14.3
Gluten	12.8	Flesh formers	14.7
Albumen	1.9	Fat formers	66.4
Starch	60.0	Accessories	3.4
Sugar	5.2	Mineral matter	1.2
Gum	1.9		
Fat	1.2		
Fibre	1.5		
Mineral matter	1.2		

The practical value of wheat agrees with the theoretical. As seen by the above analysis, the flesh-forming elements constitute about 15 per cent. of the whole, and the fat-forming about 66 per cent.; the nourishment of the body is thus generously provided, and a large amount of carbonaceous material is given to cook it with. The wheat plant, like all others, is, of course, affected by circumstances of soil and temperature; that which is grown on calcareous soils is notoriously richer in gluten than that grown on others, as is also the case with that grown in warm climates in comparison with that grown in colder. The time of cutting, also, influences the quantity and quality of the grain; that which is cut a fortnight before it is ripe is found to be richer in gluten, and in fact in yield, than that cut when fully ripe.

This is shown by Professor Johnson's experiments,* the results of which are as follows:

When cut.	In the grain, per cent.			Flour, per cent.	
	Flour.	Shorts.	Bran.	Water.	Gluten.
20 days before ripe	74.7	7.2	17.5	15.7	9.3
10 days before ripe	79.1	5.5	13.2	15.5	9.9
Fully ripe	72.2	11.0	16.0	15.9	9.6

* Johnson's Lectures on Agricultural Chemistry.

His experiments must evidently have been made on grain with all the husks removed, for the gluten only existed at the most at about 10 per cent. of the entire composition, which is notoriously less than that in grains with only a portion of the husks left which abound in nitrogenous matter.

The most valuable of the cereals for fattening purposes, both from its composition and the profitable returns attending its culture, is undoubtedly maize or Indian corn. Its analysis exhibits an abundance of fat-forming principles, and also a liberal supply of the nutritious. Its analysis is as follows:

Water	15.0
Gluten	11.0
Starch	59.0
Sugar	1.0
Gum	0.3
Fat	6.7
Fibre	5.0
Mineral matter	2.0

Or, economically:

Water	15.0
Flesh formers	11.0
Fat formers	66.7
Accessories	5.3
Mineral matter	——

The same remarks will apply to this as to wheat and the other cereals regarding the influence of soils and cultivation on the composition of the grain; but the above is the average of several analyses of common yellow Indian corn, in its ripe, dry state.

Other varieties differ essentially in the amount of some of the constituents, as, for instance, the sweet corn contains not only a large amount of sugar, but also a more liberal supply of gluten; and some of the flint corns are found to contain more starch and mineral matter, but, as before remarked, the above will be found to exhibit the average composition of this grain.

The vital importance of crushing cereals before giving them to animals for food is most plainly manifested in maize, particularly when given to horned cattle. Each grain is covered with silicious coating that is impervious to the gastric juice, and must pass from the animal in an undigested condition. This is almost inevitably the case with ruminating animals, which swallow the grass or hay which constitutes the greater portion of their food in pellets or bunches, which are only passed to the first stomach, whence they return to the mouth of the animal to be ground up fine before they pass to the other stomachs and are digested. It is plainly impossible for most of the grains of corn, which are small, smooth, and detached, to be thus returned, and hence they pass the animal without conferring the slightest benefit.

The comparative value of maize with other foods has been the object of much research by experimenters; the results have been unanimously in favor of this grain before all others used for fattening animals. In our present system, the value which is given to this cereal in the appended table agrees pretty nearly with the practical and theoretical estimates of others.

The stalks of the Indian corn are of great value for fodder, particularly when grown to feed in the green state; they abound in sugar, and are of especial value when given to milch cows, as they not only greatly increase the quantity of milk, but also the quality.

Mr. Flint, in his work on "Grasses and Forage Plants," says of the culture of green corn for fodder: "The common practice with regard to this crop, which has already been partially stated, is to sow in drills from two and a half to three feet apart, on land well tilled and thoroughly manured, making the drills from six to ten inches wide with the plough, manuring in the furrow, dropping the corn about two inches apart, and covering with the hoe. In this mode of culture the cultivator may be used between the rows when the corn is from six to twelve inches high, and, generally, unless the ground is very weedy, no after cultivation is needed. The first sowing usually takes place about the 20th of May, and this is succeeded by other sowings at intervals of a week or ten days, till

July, in order to have a succession of green fodder. But if it is designed to cut it up to cure for winter use an early sowing is generally preferred, in order to be able to cut it in warm weather, in August or early in September. Sown in this way, about three or four bushels of corn are required for an acre, since, if sown thickly, the fodder is better, the stalks smaller, and the waste less."

Meal in which are ground both the cob and grain is of about three-fifths of the value of that composed of the grain alone; the ripe cob is only valuable in furnishing accessory food, as the woody fibre and mineral matter of which it is principally composed contain no nutritive matter.

The next most valuable of the cereals for fattening purposes is rye, and its nutritive elements are in valuable proportions with the fat-forming, as will be seen by the analysis, which is as follows:

Water	13.00
Gluten	10.79
Albumen	3.54
Starch	50.14
Gum	5.31
Sugar	4.74
Fat	0.93
Woody fibre	9.50
Mineral matter	2.05

Or, economically:

Water	13.00
Flesh formers	14.33
Fat formers	55.81
Accessories	14.81

This grain, like wheat, furnishes valuable food for man, and in some localities constitutes the favorite diet, as in Germany, Russia, and other European countries, where it is made into what is called "black bread," which is exceedingly nutritious and healthful. It is valuable for fattening stock, but the demand for it is so great for other uses that its employment for this purpose is unprofitable. Of the profit attending the cultivation of this grain there is no doubt. Indeed, some pronounce it the most profitable of the northern grain crops, but this statement may require modification.

The dark color of the meal or flour of this grain is owing to the presence of the enveloping husks of the kernels; if these are removed the flour is nearly as white and delicate as that of wheat. But the presence of these husks is desirable from the fact that they furnish not only valuable accessories, but the bread is actually more nutritious; for in these coverings of all grains are contained much more of gluten and fat than in the kernels themselves. The objection which many persons make to the flour in which the husks are ground, namely, that the hard tissues that it contains excite an injurious irritation in weak digestive organs and cause diarrhœa, is not of sufficient importance to reduce the value of this food, and there is no good reason why it should not be used much more extensively than it is.

There is but little difference in the values of rye and barley for fattening purposes. In fact the latter grain is in some districts the favorite, both in the natural and malt state.

The composition of barley is as follows:

Water	13.9
Gluten	13.0
Starch	47.5
Sugar	4.1
Gum	3.5
Fat	0.4
Fibre	13.4
Mineral matter	4.2

Or, economically:

Water	13.9
Flesh formers	13.0
Fat formers	52.0
Accessories	16.9
Mineral matter	4.2

Many experiments have been conducted both in Europe and this country to ascertain the relative value of barley and malt. Professor Thompson found that 100 pounds of barley would produce, by experiment, 34.6 pounds of milk, and 100 pounds of malt would produce 26.2 pounds; and the same amount of each would produce relatively 7.66 pounds and 6.35 pounds of butter. These were used in connexion with other foods which were alike in different experiments. Professor Thompson remarks of these results: "By the present mode of comparison, then, it appears that in every point of view malt is inferior to barley as an article of diet for cattle, as it gives less milk and butter, and diminishes the live weight, instead of increasing it, which barley does under the same circumstances." Of the value of barley as a crop there can be no question, and its large returns, together with its valuable fattening properties, render it justly a favorite. The malt is used most profitably when given to milch cows. Dairymen in the neighborhood of cities secure the malt of distilleries for this purpose, and all agree in pronouncing it of great utility.

Oats are of the least value for fattening purposes of all the cereals, and, unlike the others, the meal is most nutritious when made from the kernel alone. When made into bread, it possesses very great nutrition and excellence. It is rich in flesh formers, and consequently valuable for food for the laboring classes, in furnishing elements contained in a meat diet, which is not always attainable to them. This is particularly the case in portions of Europe, where it furnishes one of the principal articles of food. The composition of oats, after most of the husk has been removed, is as follows:

Water	14.0	Or, economically:	
Gluten and albumen	18.0	Water	14.0
Starch	39.9	Flesh formers	18.0
Sugar	5.3	Fat formers	51.1
Gum	2.8	Accessories	14.7
Fat	5.9	Mineral matter	2.2
Fibre	11.9		
Mineral matter	2.2		

It is a fact worthy of remark, that of 100 pounds of oats, two-ninths, or about 23 pounds, consist of husks, which are of no value as food. Oats are most valuable as food for horses, and in this country are used almost entirely for this stock.

Buckwheat, although valuable for fattening purposes, is grown but little in this country comparatively with other grains; and when it is grown, it is used most frequently as a green manure. We find in a preceding analysis the composition of the green fodder of this plant. The composition of the grain when ripened is—

Water	14.0	Or, economically:	
Gluten	9.0	Water	14.0
Starch	48.0	Flesh formers	9.0
Gum	2.5	Fat formers	52.1
Sugar	2.5	Accessories	23.3
Fat	1.6	Mineral matter	1.6
Woody fibre	20.8		
Mineral matter	1.6		

The good returns, easy cultivation on poor soils, and ability to stand extremes of temperature, render this a desirable grain on the farm, and there is no reason why it should not occupy as high a position as some of the other cereals.

The next seeds in the economy of the farm are the leguminous, which are less valuable for fattening purposes than any of the preceding, although they contain a larger proportion of *nutritious* matter than any of the cereals. The following table gives the composition of the different varieties, as given by

Braconnot and Einhof, in Professor Johnson's Lectures on Agricultural Chemistry:

Constituents.	Peas.	Kidney beans.	Field beans.	Lentils, dried.
Water	12.5	23.0	15.6	*
Husk	8.3	7.0	10.0	18.7
Legumen, albumen, &c	26.4	23.6	11.7	38.5
Starch	43.6	43.0	50.1	32.8
Sugar	2.0	0.2	2.2	3.1
Gum, &c	4.0	1.5	6.0	6.0
Oil and fat	1.2	0.7	....	....
Salts and loss	2.0	1.0	4.4	0.9

Or, economically:

Water	12.5	23.0	15.6	*
Flesh formers	26.4	23.6	11.7	38.5
Fat formers	46.8	43.9	52.3	35.9
Accessories	12.3	8.5	16.0	24.7
Animal matter	2.0	1.0	4.4	0.9

These analyses differ materially from those of the same seeds grown in this country. Whether the difference is owing to the influences of soil or climate, I am, of course, unable to say. Probably both have their effect. The seeds in the following analyses were very dry and well ripened:

Constituents.	Peas.	Kidney beans.	Field beans.	Lentils, dried.
Water	14.2	15.0	14.9	14.0
Casein	23.1	23.9	24.0	25.7
Starch	38.0	35.1	35.7	34.8
Sugar	2.0	2.1	2.0	2.1
Gum	8.7	8.5	8.7	6.9
Fat	1.9	2.1	2.0	2.0
Woody fibre	9.8	9.8	9.5	12.5
Mineral matter	2.3	3.5	3.2	2.0

Or, economically:

Water	14.2	15.0	14.9	14.0
Flesh formers	23.1	23.9	24.0	25.7
Fat formers	41.9	39.3	39.7	38.9
Accessories	18.5	18.3	18.2	18.6
Mineral matter	2.3	3.5	3.2	2.8

For our present purpose we will use the last analyses, both because they were made of seeds grown in this country, and, like the other seeds, before considered, they were perfectly ripened and naturally dried. The casein in the last analysis corresponds in nature to the legumen in the others.

The only remaining food used for fattening animals is the cake composed of the hemp and linseeds, called oil-cake. With the great fattening properties of this cake all are acquainted. The composition of this cake, as given by Professor Johnson, is as follows:

Constituents.	English linseed cake.	American linseed cake.
Water	10.05	10.07
Mucilage	39.10	36.25
Albumen and gluten	22.14	22.36
Oil	11.93	12.38
Husk	9.53	12.69
Saline matter (ash) and sand	7.25	6.35

Or, economically:

Water	10.5	10.07
Flesh formers	22.14	22.26
Fat formers	51.03	48.63
Accessories	9.53	12.69
Mineral matter	7.25	6.35

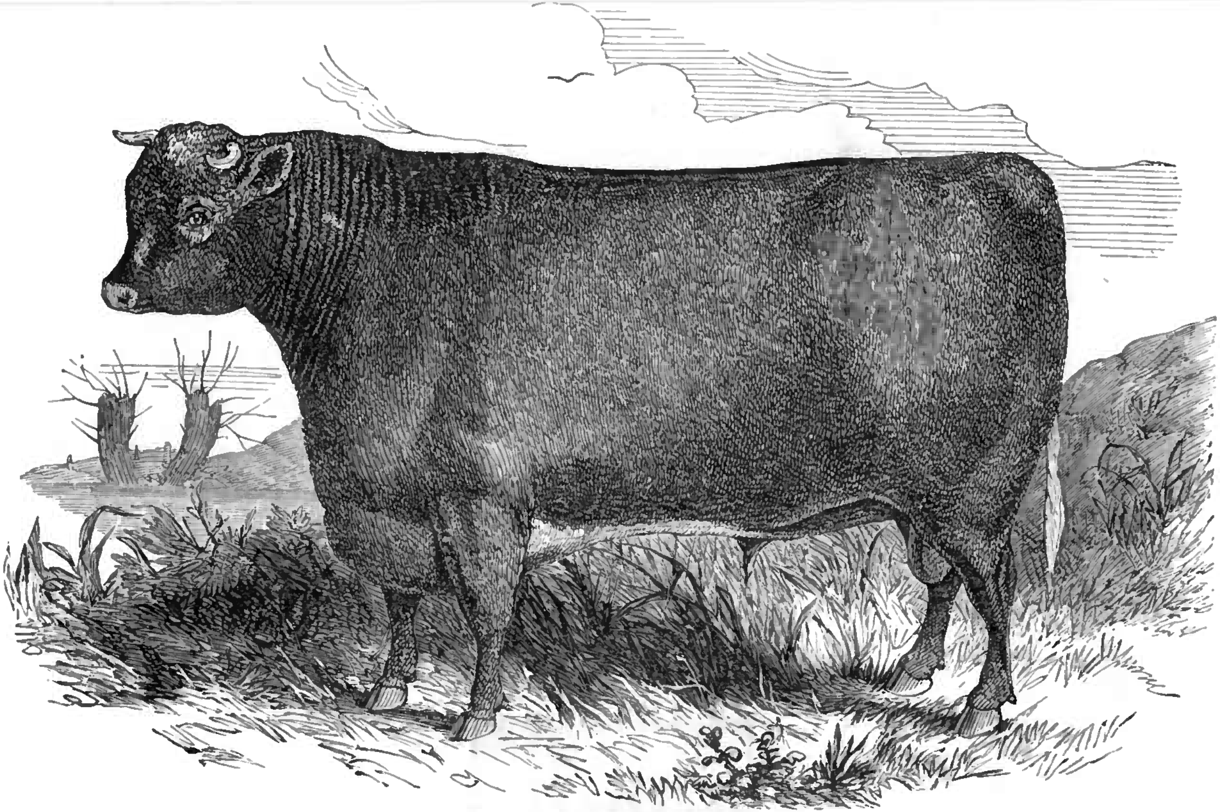
These analyses, the only ones available to me at present, show not only valuable fattening properties, but also rich nutritive elements, and establish this as one of the most valuable of the concentrated foods.

We are now acquainted with the composition of the different kinds of food used for animals, and it only remains for us to arrange them into a condensed form and prepare tables of their comparative equivalents, to be able to ascertain the value of each, and also the kinds which may be used together the most advantageously. It is of course impossible to make any calculations regarding the cost of the various kinds, as they vary in different localities. The analyses of grass and hay, as they appear in the following table, are the results of averaging the analyses of all the species hitherto considered; they will probably represent the constituents of the superior quality of English hay as grown in this country.

Table of comparative equivalents, prepared from the preceding analyses.

Foods.	Percent'ge of flesh formers in 100 pounds.	Percentage of fat formers in 100 pounds.	Total nutritive percentage in 100 pounds.	Nutritive equivalents of 100 pounds of superior English hay.
Irish potatoes	1.4	18.9	20.3	245.3
Carrot	0.6	6.6	7.2	691.6
Parsnip	1.2	7.0	8.2	607.3
Jerusalem artichoke	1.0	18.8	19.8	251.5
Sugar beet	0.9	13.6	14.5	336.5
Swedish turnip	1.0	5.2	6.2	803.2
Common white turnip	0.9	3.3	4.2	1185.7
Mangold wurzel	1.0	12.6	13.6	367.6
Green pea stalks	0.9	7.9	8.8	565.9
Spurry, (green)	2.7	2.3	5.0	960.0
Green stalks of buckwheat	0.2	4.7	4.9	1016.3
Common vetch, (green)	1.9	2.6	4.5	1106.6
French vetch, (green)	0.7	4.7	5.4	922.2
Green stalks of white lupine	1.8	2.3	4.1	1212.1
Green stalks of white bean	1.0	2.7	3.7	1345.9
Green oats, (fodder)	1.0	8.5	9.5	524.2
Green timothy grass	4.0	9.7	13.7	363.4
Green red-top grass	3.3	8.7	12.0	415.0
Superior English hay	13.5	36.3	49.8	100.0
Red clover, (green)	2.0	3.6	5.6	907.1
White clover, (green)	1.5	2.7	4.2	1185.7
Lucerne, (green)	1.9	3.6	5.5	905.4
Red clover, (hay)	22.5	18.7	41.2	120.8
White clover, (hay)	18.7	40.0	58.7	84.6
Lucerne, (hay)	12.7	38.0	50.7	98.2
Wheat flour	14.7	66.4	81.1	61.4
Indian corn	11.0	66.7	77.7	64.2
Rye meal	14.3	55.8	70.1	71.0
Barley meal	13.0	52.0	65.0	76.0
Oat meal	18.0	51.1	69.1	72.0
Buckwheat meal	9.0	52.1	61.1	81.5
Peas	23.1	41.9	65.0	76.0
Kidney beans	23.9	39.3	63.2	78.7
White field beans	24.0	39.7	63.7	78.2
Lentils	25.7	38.9	64.6	77.0
English linseed cake	22.1	51.0	73.1	68.0
American linseed cake	22.2	48.6	70.8	70.3

A careful examination of this table, prepared from the best English, American, and German authorities, and a comparison of the money value of these articles of food, modified as experience may suggest, with their feeding value as here given, would be of immense benefit to the farmers, and save them thousands of dollars, often injudiciously expended.



SHORT HORN BULL "GENERAL GRANT."

The Property of D. McMillan, Xenia, Ohio.

PLATE XXI.

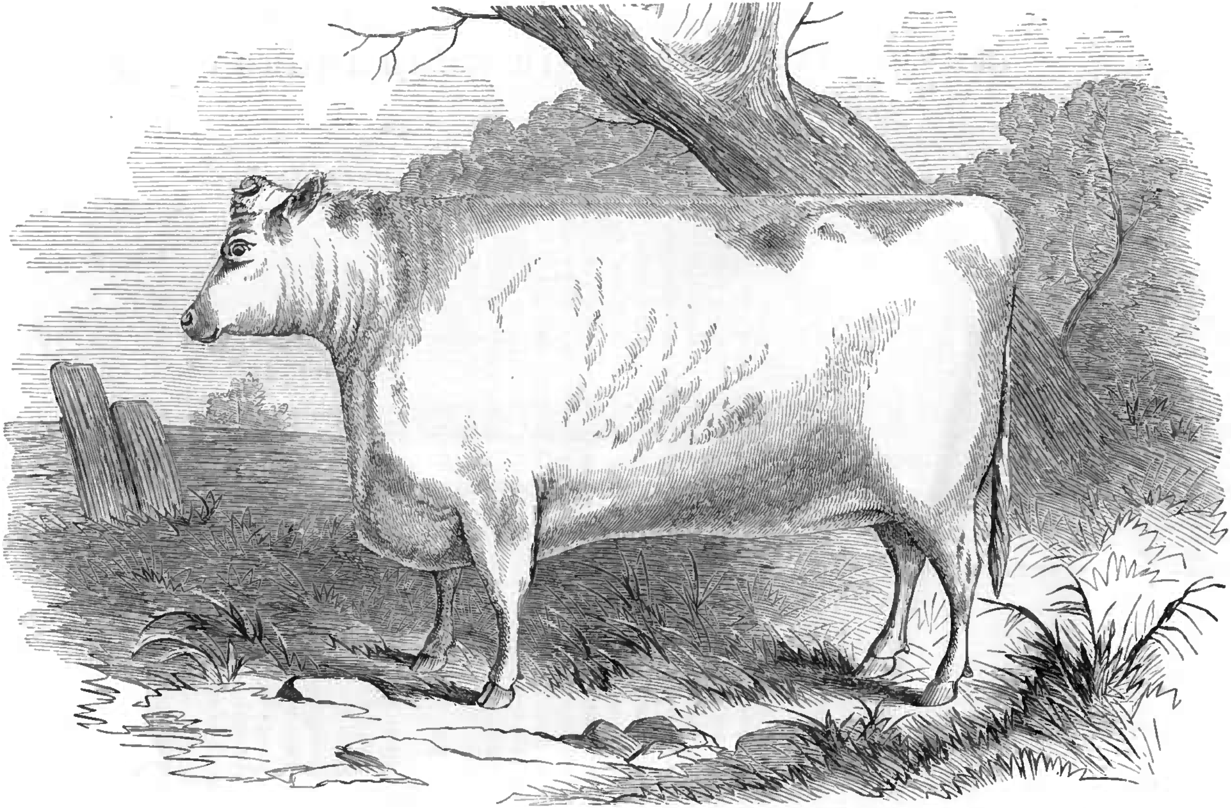


PLATE XXII.

SHORT-HORN COW "LOUAN XXIII."

The Property of D. McMillan, Xenia, Ohio.

AMERICAN DAIRYING;

ITS RISE, PROGRESS, AND NATIONAL IMPORTANCE.

BY X. A. WILLARD, A. M., OF HERKIMER COUNTY, N. Y.

THE dairy has become an important branch of national industry. It is rapidly spreading over new fields, and is engaging the attention of farmers in the western, northwestern, and middle States, wherever the lands are adapted to grazing and there are springs and streams of living water. The dairy districts, though comparatively limited, embrace a larger area than has been commonly supposed. It is true, there are extensive plains at the south and southwest where the business of dairying cannot be carried on, but broad belts and isolated patches of land are scattered over our vast domain, well adapted to grazing, and such lands, when taken in the aggregate, cover a wide extent of territory.

There are two causes that have been operating the past few years to stimulate the development of this branch of industry, and have caused it to assume proportions that give it a distinctive feature of nationality. The first is a large and increasing foreign demand for dairy products; the second is the American system of "associated dairies," now brought to such wonderful perfection that the business can be readily introduced into new sections with all the ease and certainty of success in producing the qualities attained in old dairy districts.

The foreign demand for cheese, it is believed, will be permanent, and exportations from year to year must largely increase, since the finest American grades are acknowledged to be equal to the best manufactured abroad, while the cost of production is so much less as to render competition with European dairies an easy matter on our part. This fact alone gives confidence to those about entering upon the business of dairy farming—that it will be remunerative and enduring.

In addition, as the texture and flavor of cheese have been improved, a large home demand has sprung up, which requires large quantities to meet its wants. It is believed by many that the home demand, for years to come, will more than keep pace with increased production; and home sales for the last two years would seem to prove that this view is not without foundation.

With a constantly increasing home trade and a reliable market abroad, no branch of farming to-day offers prospects of better or more permanent remuneration than the dairy.

COMMENCEMENT OF CHEESE DAIRYING AS A SPECIALTY—ITS HISTORY, ETC.

The history of American cheese dairying has never been written, and perhaps a brief glance at its rise and progress will not be out of place.

Cheese making began in Herkimer county, New York, more than fifty years ago. For upwards of twenty years its progress was slow, and the business was deemed hazardous by the majority of farmers, who believed that over-production was to be the result of those making a venture upon this specialty. The fact, however, gradually became apparent that the cheese makers were rapidly bettering their condition, and outstripping in wealth those who were engaged in grain raising and a mixed husbandry.

About the year 1830 dairying became pretty general in the towns of Herkimer county north of the Mohawk, and some years later spread through the southern district of the county, gradually extending into Oneida and adjoining counties. Up to this period, and for several years later, little or no cheese was shipped to Europe. It was not considered fit for market till fall or winter. It was packed in rough casks and peddled in the home market at from five to eight cents per pound. All the operations of the dairy were rude and undeveloped; the herds were milked in the open yard; the curds were worked in tubs and pressed in log presses. Everything was done by guess, and there was no order, no system, and no science in conducting operations.

In 1840 the value of the dairy products of New York—butter, cheese, and milk—was estimated by the United States census returns at $10,496,021, and in all the States at $33,787,008. Some idea of the comparative increase will be found when it is known that the value of the butter products of New York alone, in 1865, was more than $60,000,000.

From 1840 to 1850 cheese began to be shipped abroad, the first shipments being inaugurated under the auspices of Herkimer county dealers.

In 1848–'49 the exports of American cheese to Great Britain were 15,386,836 pounds. Much of the cheese manufactured this year was of poor quality, and British shippers claimed to have sustained heavy losses. There was a more moderate demand the following year, and prices fell off a penny a pound, varying, from fair to strictly prime, from 6 to $6\frac{1}{4}$ cents for Ohio, and 6 to $6\frac{3}{4}$ for New York State. The exports in 1849–'50 were 12,000,000 pounds, and continued to vary, without important increase, for several years. From September, 1858, to September, 1859, the exports of cheese to Great Britain and Ireland were only 2,599 tons, and in the following year, for the same corresponding period, they were increased to 7,542 tons.

During the early part of the year 1860, Samuel Perry, of New York city, a native of Herkimer, and one of the earliest operators in the cheese trade, endeavored to control the market, purchasing the great bulk of cheese manufactured in the country. He was possessed of great wealth, and had for years enjoyed the confidence of dairymen, and being liberal and straightforward in his dealings, he was enabled to secure the dairies by contract, making his purchases at from 9 to 10 cents per pound. Then commenced the exportation of American cheese on a scale hitherto unknown in the history of the trade; and to him belongs the credit of opening up a foreign market for this "class of goods." The exportation of cheese from New York to Europe during 1860 was 23,252,000 pounds, which was increased on the following year to 40,041,000 pounds.

About this time (1860) the associated dairy system began to attract attention. Several factories were in operation in Oneida county, and were turning out a superior article of cheese. The system had been first inaugurated by Jesse Williams, a farmer living near Rome, in that county, and was suggested from mere accidental circumstances. Mr. Williams was an experienced and skillful cheese maker, and at a time when the bulk of American cheese was poor. His dairy, therefore, enjoyed a high reputation, and was eagerly sought for by dealers. In the spring of 1851, one of his sons, having married, entered upon farming on his own account, and the father contracted the cheese made on both farms at seven cents per pound, a figure considerably higher than was being offered for other dairies in that vicinity. When the contract was made known to the son, he expressed great doubt as to whether he should be able to manufacture the character of cheese that would be acceptable under the contract. He had never taken charge of the manufacture of cheese while at home, and never having given the subject that close attention which it necessarily requires, he felt that his success in coming up to the required standard would be a mere matter of chance. His father therefore proposed coming daily upon the farm and giving the cheese making a portion of his immediate supervision. But this would be very inconvenient, and while devising means to meet the difficulties and secure the benefits of the contract, which was more than ordinarily good, the idea was suggested that the son should deliver the milk from his herd daily at the father's milk-house. From this thought sprung the idea of uniting the milk from several neighboring dairies and manufacturing it at one place. Buildings were speedily erected and fitted up with apparatus, which, proving a success, thus gave birth to the associated system of dairying now widely extended throughout the northern States.

The system of associated dairies, during the last eight years, has been carried into the New England States and into the Canadas. It is largely adopted in Ohio, and has obtained a foothold in Wisconsin, Illinois, Iowa, Kansas, and other States. It is known abroad as the "American system of dairying," and its peculiarities are so well adapted to the genius of our people as to give it a distinctive character of nationality.

PROGRESS OF THE FACTORY SYSTEM IN THE STATE OF NEW YORK, AND CAPITAL INVESTED IN THE BUSINESS.

The number of cheese factories in the State of New York at the commencement of the season 1866, is more than 500. The following table will show the number of factories erected in the State each year since 1850:

Year of erection.	No. of cheese factor's erected each year.	Year of erection.	No. of cheese factor's erected each year.
1851	1	1860	17
1852	....	1861	18
1853	....	1862	25
1854	4	1863	111
1855	2	1864	210
1856	3	1865	52
1857	3	1866	46
1858	4		
1859	4	Total, April, 1866	500

The 500 factories will probably average 400 cows each, making a total of 200,000 cows, which, at the low cash value of $40 each, give an aggregate of $8,000,000.

The lands employed in associated dairying in New York cannot be less than a million of acres, which, at an average of $40 an acre, would amount to $40,000,000.

We give the following table, collected from official sources, showing the amount of capital invested in factory buildings, the number of hands employed at the factories, average number of cows delivering milk, pounds of milk, and pounds of cheese made during the season of 1864, at 425 factories. The summary is made by counties, and is as follows:

Counties.	No. of factories.	Cost of buildings and apparatus.	Persons employed.		Average No. of cows.	Pounds of milk used.	Pounds of cheese made.
			Males.	Females.			
Allegany	6	$17,000	9	11	1,395	1,006,445	104,374
Broome	1	3,000	1	2	500	643,510	74,000
Cattaraugus	3	8,000	6	7	1,474	192,730	....
Cayuga	1	3,500	1	2	270	837,550	82,216
Chautauqua	11	43,720	27	24	3,003	6,423,689	625,382
Chemung	3	1,800	5	4	107	764,850	25,075
Chenango	19	54,556	31	41	6,505	17,917,494	1,879,363
Cortland	8	36,354	19	26	5,000	13,714,985	1,406,157
Erie	7	18,925	13	22	2,248	4,128,380	435,774
Essex	1	3,500	2	5	1,000	2,648,657	264,865
Fulton	2	8,500	3	4	800	....	....
Herkimer	31	79,975	57	63	11,499	32,157,583	3,092,268
Jefferson	78	76,858	101	77	14,088	32,618,713	3,357,546
Lewis	32	52,546	55	63	12,084	33,531,746	3,171,721
Livingston	2	1,200	4	2	68	....	19,900
Madison	34	72,100	55	74	11,635	33,037,450	3,420,057
Montgomery	9	33,500	17	19	3,250	5,747,902	474,622
Niagara	1	225	3	2	36	....	9,606
Oneida	80	156,084	135	178	27,146	70,414,328	8,107,018
Onondaga	4	12,200	5	6	825	2,631,304	1,272,633
Orange	20	57,583	54	26	5,837	9,962,949	724,854
Oswego	21	40,100	31	38	6,815	13,450,857	1,386,005
Otsego	35	44,500	40	47	7,055	15,455,437	1,559,591
St. Lawrence	4	9,000	6	9	1,375	2,348,322	322,615
Steuben	1	175	3	2	31	....	10,372
Sullivan	2	1,050	4	....	235	....	4,500
Tompkins	2	7,200	5	11	1,550	3,237,512	340,260
Washington	2	5,580	3	5	450	461,696	46,229
Wyoming	5	14,200	10	11	2,245	4,343,153	446,011
Total	425	862,931	705	781	128,526	307,677,242	32,663,014

From the foregoing statistics it would not be practicable to deduce general results to show the relative products and profits of manufacturing in the several counties, since some of the factories were in operation only part of the season. A better estimate can be made from the following statistics, gathered from the New York State census returns, showing the operations of 133 factories selected from the whole number, and working through the season of 1864. The tables were made up and published in the Tribune soon after the returns were completed, and for convenient reference the factories are numbered from 1 to 133, inclusive.

Table showing the capital invested in buildings, persons employed in manufacturing, number of cows, season of beginning and closing operations, pounds of milk and pounds of cheese, at 133 *different factories in various parts of the State of New York, for the year* 1864.

Counties.	Number.	Capital invested in buildings and apparatus.	Persons employed.		Average number of cows.	Season began—	Season ended—	Pounds of milk used.	Pounds of cheese made.
			Male.	Female.					
Cattaraugus	1	$2,500	2	2	420	May 5, 1864	Nov. 3, 1864	1,192,730	124,284
Chatauqua	2	5,500	3	2	475	May 10, 1864	..... do......	1,436,192	141,728
	3	5,000	3	2	350	May 3, 1864	Nov. 1, 1864	1,178,553	122,415
	4	3,120	3	2	508	May 2, 1864	Oct. 10, 1864	1,408,832	138,852
	5	3,500	3	4	520	June 28, 1864	Oct. 15, 1864	842,693	82,214
Chenango	6	2,000	1	2	375	April 11, 1864	Nov. 18, 1864	1,403,356	114,429
	7	2,500	2	1	350	May 2, 1864	Nov. 12, 1864	1,154,504	121,800
	8	3,000	2½	3	550	April 18, 1864	Oct. 31, 1864	1,755,000	175,146
	9	4,000	2	5	500	May 10, 1864	Nov. 3, 1864	1,012,692	136,271
	10	3,000	1	3	450	April 14, 1864	Nov. 1, 1864	1,171,911	113,564
	11	4,000	1	3	380	April 5, 1864	Nov. 15, 1864	1,172,590	122,966
	12	2,600	2	2	415	April 27, 1864	Oct. 29, 1864	1,227,786	127,345
	13	3,683	1	2	400	May 9, 1864	Nov. 1, 1864	1,162,252	126,254
	14	2,460	1¼	2½	400	May 10, 1864	..... do......	1,124,485	111,799
	15	5,000	3	3	700	May 11, 1864	Oct. 20, 1864	1,481,740	148,174
Cortland	16	5,000	3	2	600	May 9, 1864	Oct. 28, 1864	1,982,801	207,634
	17	5,000	3	4	800	April 9, 1864	Nov. 10, 1864	2,076,340	209,360
	18	5,937	3	3	550	May 26, 1864	Oct. 31, 1864	1,717,600	171,760
	19	4,500	2	4	900	April 10, 1864	Nov. 1, 1864	2,067,399	208,747
	20	2,847	1½	3	400	April 19, 1864	Oct. 29, 1864	1,261,119	128,478
Erie	21	2,400	2	4	534	May 14, 1864	Oct. 22, 1864	1,122,844	111,539
	22	1,000	2	6	851	May 8, 1864	Dec. 10, 1864	2,458,633	249,603
Essex	23	3,500	2	5	1,100	April 15, 1864	Nov. 15, 1864	2,648,657	264,865
Herkimer	24	4,000	2	3	460	April 21, 1864	Nov. 7, 1864	1,502,723	151,960
	25	5,000	2	4	448	May 24, 1864	Nov. 25, 1864	1,728,169	178,152
	26	3,000	3	2	400	May 12, 1864	Dec. 1, 1864	1,367,266	136,809
	27	2,500	2	2	475	Mar. 15, 1864	Dec. 10, 1864	1,760,000	176,000
	28	4,000	3	2	690	Mar. 9, 1864	Dec. 18, 1864	1,764,119	173,815
Jefferson	29	4,000	3	2	600	May 15, 1864	Oct. 29, 1864	1,418,351	142,518
	30	....	3	3	450	April 26, 1864	Oct. 31, 1864	1,327,074	134,050
	31	700	2	3	300	May 19, 1864	Oct. 8, 1864	493,866	49,386
	32	2,000	1	1	300	May 28, 1864	Oct. 22, 1864	598,756	58,875
	33	5,000	2	2	325	May 27, 1864	Nov. 1, 1864	747,393	71,000
	34	2,000	1	2	540	April 20, 1864	Oct. 15, 1864	1,282,621	128,846
	35	2,500	2	2	750	May 1, 1864	..... do......	1,700,000	165,000
	36	4,000	3	3	625	May 9, 1864	Nov. 1, 1864	1,636,644	162,000
	37	1,500	2	2	325	May 11, 1864	Oct. 31, 1864	505,600	50,560
	38	2,156	2⅓	1	425	May 3, 1864	Nov. 7, 1864	1,033,485	106,268
	39	1,500	1	2	325	May 11, 1864	Oct. 28, 1864	765,388	75,004
	40	2,538	3	2	480	May 9, 1864	Oct. 31, 1864	1,244,428	127,685
	41	1,000	2	2	450	May 1, 1864	Nov. 1, 1864	1,306,144	124,649
	42	1,000	1	3	319	April 22, 1864	..... do......	872,378	91,639
	43	4,000	5	5	1,200	May 1, 1864	Nov. 15, 1864	3,977,720	364,000
Lewis	44	3,000	3	3	850	April 10, 1864	..... do......	2,369,112	247,120
	45	3,600	3	4	600	May 22, 1864	Oct. 22, 1864	1,376,964	150,437
	46	2,196	3	2	327	May 3, 1864	Oct. 23, 1864	839,824	87,536
	47	3,000	2	4	750	April 14, 1864	Oct. 27, 1864	1,902,295	207,121
	48	2,500	2	3	580	May 11, 1864	Nov. 5, 1864	1,379,871	165,165
	49	1,500	1	2	400	May 10, 1864	Nov. 1, 1864	994,730	102,835
	50	2,500	2	3	580	May 11, 1864	Nov. 5, 1864	1,379,871	165,165
	51	1,500	1	2	400	May 10, 1864	Nov. 1, 1864	994,730	102,835
	52	2,550	2	3	425	May 2, 1864	Oct. 25, 1864	1,507,373	155,559
	53	3,000	2	4	700	April 25, 1864	Nov. 5, 1864	3,079,262	296,259
	54	3,500	3	3	600	May 20, 1864	Nov. 1, 1864	1,397,076	145,941
	55	3,300	2	3	730	April 18, 1864	Nov. 2, 1864	2,024,503	210,010
	56	1,000	1	3	460	May 5, 1864	Oct. 15, 1864	1,235,000	130,000
	57	2,500	3	3	625	May 19, 1864	Nov. 4, 1864	1,700,653	177,115
	58	1,200	1	3	300	May 3, 1864	Nov. 1, 1864	899,254	89,016
	59	2,500	2	2	550	May 16, 1864	..... do......	1,738,437	182,111
Madison	60	5,000	3	3	900	April 22, 1864	..... do......	2,772,188	272,460
	61	2,000	2	2	450	April 25, 1864	Nov. 5, 1864	1,566,872	155,400
	62	3,000	2	3	500	April 12, 1864	Nov. 4, 1864	1,703,670	170,284
	63	5,000	2	3	850	April 4, 1864	Nov. 23, 1864	2,824,179	284,379
	64	3,000	2	3	600	April 7, 1864	Nov. 5, 1864	2,046,083	199,839

Table showing the capital invested in buildings, &c.—Continued.

Counties.	Number.	Capital invested in buildings and apparatus.	Persons employed.		Average number of cows.	Season began—	Season ended—	Pounds of milk used.	Pounds of cheese made.
			Male.	Female.					
Madison	65	3,200	2	2	400	April 12, 1864	Nov. 7, 1864	1,356,000	135,621
	66	1,600	2	2	350	April 25, 1864	Oct. 25, 1864	1,220,000	122,105
	67	3,000	2	3	575	April 20, 1864	Nov. 1, 1864	1,200,000	120,000
	68	1,000	1	3	450	May 1, 1864	Oct. 20, 1864	705,990	70,600
	69	3,000	4	2	575	April 22, 1864	Oct. 28, 1864	1,880,000	199,400
	70	2,500	3	3	650	May 21, 1864	Nov. 15, 1864	2,265,543	225,341
	71	2,300	1	4	400	April 18, 1864	Nov. 4, 1864	1,175,117	115,175
Montgomery	72	2,500	2	2	325	May 23, 1864	.....do......	975,625	98,101
	73	3,400	3	2	500	April 16, 1864	Nov. 10, 1864	1,473,619	147,361
	74	5,000	2	3	450	June 6, 1864	Nov. 7, 1864	1,308,069	134,161
	75	3,000	2	2	340	April 11, 1864	Nov. 1, 1864	990,589	103,640
Oneida	76	2,400	2	2	380	May 2, 1864	Oct. 22, 1864	849,852	86,556
	77	1,800	2	2	450	May 27, 1864	Oct. 17, 1864	826,282	86,156
	78	1,800	2	2	588	May 1, 1864	Oct. 31, 1864	1,639,910	164,875
	79	4,000	3	7	1,000	April 20, 1864	Nov. 1, 1864	3,027,943	295,115
	80	2,000	2	2	350	April 25, 1864	Oct. 25, 1864	802,500	78,000
	81	2,000	2	2	300	May 2, 1864	Oct. 22, 1864	802,359	75,000
	82	2,000	2	2	400	April 11, 1864	Nov. 10, 1864	1,000,000	100,000
	83	1,200	2	3	400	April 25, 1864	Oct. 24, 1864	850,000	82,534
	84	3,000	2	3	425	April 18, 1864	Nov. 1, 1864	1,399,330	135,858
	85	2,600	2	3	650	April 11, 1864	Oct. 31, 1864	1,665,621	166,585
	86	2,100	2	3	350	April 8, 1864	Oct. 29, 1864	1,028,799	102,392
	87	2,000	2	4	600	April 14, 1864	Oct. 1, 1864	1,670,000	167,720
	88	3,500	2	5	900	April 11, 1864	Nov. 20, 1864	2,227,295	222,678
	89	1,500	1	2	350	April 18, 1864	Nov. 15, 1864	1,059,579	102,350
	90	1,000	1	2	300	May 1, 1864	Nov. 1, 1864	832,252	81,123
	91	5,000	1	3	530	May 3, 1864	Oct. 29, 1864	1,419,251	141,645
	92	4,000	2	3	525	May 20, 1864	Dec. 18, 1864	1,866,917	181,082
	93	4,000	2	4	500	April 1, 1864	Dec. 1, 1864	2,020,409	264,161
	94	2,500	2	3	400	April 5, 1864	Oct. 29, 1864	709,908	68,431
	95	2,000	1	1	400	April 12, 1864	Nov. 20, 1864	915,562	55,000
	96	1,500	1	2	350	May 11, 1864	Nov. 1, 1864	1,777,500	180,000
	97	3,400	2	4	725	April 17, 1864	.....do......	1,883,004	180,000
	98	2,500	2	3	550	May 1, 1864	.....do......	1,484,443	184,721
	99	3,000	3	3	550	April 4, 1864	Oct. 31, 1864	1,746,784	173,691
	100	3,000	3	3	400	April 29, 1864	.....do......	1,416,750	130,545
	101	3,000	2	3½	325	April 28, 1864	Nov. 1, 1864	745,692	78,976
	102	3,000	3	2	675	April 18, 1864	Nov. 12, 1864	2,177,920	208,260
	103	2,400	2	2	350	April 25, 1864	Nov. 5, 1864	1,114,238	107,805
	104	1,800	2	2	430	April 4, 1864	Nov. 30, 1864	1,331,048	128,045
	105	3,000	2	5	500	April 18, 1864	Nov. 10, 1864	1,440,590	144,059
	106	1,500	2	2	400	April 25, 1864	Nov. 1, 1864	1,184,591	121,701
	107	2,300	2	2	480	.....do......	Oct. 29, 1864	1,318,412	129,604
	108	5,000	2	3	700	April 11, 1864	Oct. 31, 1864	1,900,000	185,000
	109	2,200	2	2	420	April 20, 1864	.....do......	1,453,352	136,606
	110	3,000	2	3	575	April 1, 1864	Nov. 30, 1864	2,051,688	204,025
Onondaga	111	3,200	1	3	400	May 1, 1864	Nov. 1, 1864	1,331,304	123,734
Oswego	112	2,200	2	2	475	.....do......	Oct. 1, 1864	1,400,000	97,700
	113	2,000	2	1	500	June 13, 1864	Oct. 15, 1864	800,000	88,888
	114	2,500	2	3	500	April 15, 1864	Oct. 3, 1864	488,288	46,476
	115	1,000	1	2	300	April 19, 1864	Sept. 29, 1864	382,804	35,009
	116	2,000	2	2	400	April 15, 1864	Oct. 15, 1864	1,443,032	142,500
	117	2,500	2	1	350	May 25, 1864	Nov. 15, 1864	803,718	84,662
	118	3,500	2	4	600	May 12, 1864	Oct. 29, 1864	1,714,269	165,180
	119	2,700	2	1	375	April 7, 1864	Oct. 15, 1864	1,117,873	110,365
	120	1,600	1	2	350	April 15, 1864	Oct. 22, 1864	1,137,948	119,784
	121	2,500	1	3	300	May 16, 1864	Oct. 1, 1864	515,430	51,543
	122	2,000	1	3	400	May 10, 1864	Nov. 2, 1864	1,215,185	126,625
Otsego	123	4,200	2	4	500	April 1, 1864	Sept. 1, 1864	1,226,700	136,300
	124	3,000	1	2	500	Mar. 9, 1864	Dec. 12, 1864	1,749,974	172,894
	125	3,000	2	2	400	April 25, 1864	Dec. 6, 1864	1,446,871	137,886
	126	2,000	2	2	500	April 19, 1864	Oct. 29, 1864	1,140,000	114,000
	127	3,200	2	2	280	.....do......	Oct. 31, 1864	881,539	86,533
St. Lawrence	128	3,000	1	2	375	May 17, 1864	Oct. 23, 1864	1,107,373	109,518
Tompkins	129	1,200	3	7	900	May 2, 1864	Nov. 3, 1864	2,871,042	302,215
Wyoming	130	3,000	2	2	400	June 8, 1864	Nov. 2, 1864	820,803	84,142
	131	3,000	2	3	600	May 31, 1864	Oct. 29, 1864	1,243,469	125,664
	132	3,000	2	2	350	May 15, 1864	Oct. 25, 1864	990,000	100,000
	133	2,500	1	2	505	April 25, 1864	Nov. 12, 1864	1,139,121	120,205

The above statistics present the following aggregates: Cost of buildings and apparatus, $378,187; persons employed, (males,) 258; persons employed, (females,) 362; number of cows used, 67,034; pounds of milk used, 187,822,838; pounds of cheese made, 18,943,435; average number of pounds of milk for one of cheese, 9.915; pounds of milk to a cow, 2,802; pounds of cheese to a cow, 283; value of cheese at 20 cents per pound, $3,788,687; average value of cheese to a cow, $56 52.

The prices at which cheese sold in 1864 ranged from 10 to 30 cents, and averaged about 20 cents.

The quantity of salt used to 100 pounds of cheese was reported from 377 factories. In 101 of these the amount used was 3 pounds; in 87, 2½ pounds; in 51, 2¾ pounds; in 40, 2 7-10 pounds; in 19, 2 4-5 pounds; in 9, 2 pounds, and in 6, 5 pounds. The least quantity used was .3 of a pound. In Limburg cheeses the quantity was much greater, ranging from 14 to 17 pounds.

It would be proper to remark that since 1864 considerable improvement has been made at many of the factories, in securing a better quality and larger quantity of cheese from a given quantity of milk.

In comparing the quantity made per cow, as deduced from the foregoing statistics, with that made in family dairies, it should be remembered that the factories are not in operation during the whole milking season, and therefore due allowance should be made on this account. These statistics are of interest, and will be found of great value, as comparisons can be made of the product of cows in different parts of the State.

COST OF MANUFACTURING CHEESE IN FAMILIES, ETC.

In many counties of the State family dairying is still largely in practice, and in order to compare the two systems understandingly, it will be well to make an estimate of the actual cost of manufacturing cheese in families, after the ordinary method—say from a dairy of forty cows—together with the care and marketing of the same. We estimate from the point when the milk is in the vats, putting values, &c., on a gold basis:

Original cost of cheese house, including tables, &c	$410 00
Vats and heater	50 00
Press, hoops, curd knife, &c	40 00
	500 00

Annual interest on original outlay	$35 00
Dairy-maid, say half time, for nine months, including board	60 00
Man's time about the dairy, turning cheese, &c., say average of one hour each day, for nine months—25 days, at $1	25 00
Annual cost of fuel and its preparation for vats and curing room	15 00
Man's time boxing and marketing cheese, including team, say two days per month—18 days, at $1 50	27 00
Annual wear and tear of dairy utensils and keeping buildings, &c., in repair	15 00
	$177 00

Forty cows, averaging 500 pounds of cheese per cow, gross amount, 20,000 pounds; cost per pound for manufacturing, 9 mills; thirty cows, 15,000 pounds, say 11 mills; twenty cows, 10,000 pounds, 17 mills.

It will be seen, then, that the cost of barely manufacturing cheese in single dairies will average a little more than one cent per pound; and this sum, for the most part, is the actual cost in cash paid out, for we have not taken into account the general care and supervision necessary in the manufacture and curing of cheese, which cannot be entrusted to domestics, but must daily occupy the time and attention of the proprietor or some member of his family, who has something beyond mere wages to stimulate to action. And here it may be proper to observe that one of the inconveniences which is widely felt among dairymen, results from the difficulty of obtaining careful and reliable hands for the management of the dairy. If it is desirable to make first class cheese, that will command in market the highest price, all the operations of manufacture must be performed by tried and skillful hands, hands that can rarely be obtained for hire, and when obtained commanding comparatively large wages.

Now as cheese making is an art which must be learned like other trades, and as most of its operations are performed by females, the dairy farmer may be said to have, for the most part, nothing but apprentices in his employ; for when his dairymaid has been carefully taught the trade, she marries, and is at once lost to him.

This scarcity of skilled cheese makers is severely felt throughout the whole dairy region, necessitating the farmer and his family, and more especially the female portions, to arduous labor; taxing their strength to a degree that tells heavily on health and constitution. The result is, that persons prematurely aged and with broken health are more frequently found in a dairy region than in other farming communities.

The introduction, within a few years past, of improved dairy apparatus has, it is true, lessened the labor of cheese making; but the business still demands the same skill and careful oversight; the want of one or relaxation of the other resulting not only in immediate loss, but exerting a damaging influence upon the reputation of the dairy.

There is no desire to say one discouraging word of a business which has added so much wealth to the country, and in which those who are engaged generally prosper, and soon become independent in worldly goods, but the truth must be told, nevertheless. Wealth has its advantages, but its price should be kept in view, and if overtasked muscle, incessant care without relaxation, and, finally, disease, is to be the patrimony of wives and daughters, its charms, to say the least, are very much diminished.

A point of some moment to those engaged in cheese making is high skill and perfection in manufacture. It is not deemed necessary to enumerate all the reasons why this does not generally obtain. The fact is patent that choice cheese is made by a comparatively small number, rather than the majority of dairymen.

Even among those noted for producing a strictly prime article, the process of manufacture, as well as other work of the dairy, is at times hurried and neglected, and must be necessarily so from the nature of things. It does not pay to keep an extra force on hand to take the place of those who may be disabled by accident or sickness, or who from other causes are obliged to suspend work.

Occasional periods of farm labor, too, demanding immediate and pressing attention, occur more or less frequently; the result of which is imperfect cheese, which must be marketed as such and at corresponding prices.

One or all of these causes have been in operation in every dairy, and must continue to occur from time to time. What the losses from this source may be through the year depends of course on the many and various circumstances that have controlling influence in each particular case. We have known it to be large enough, in many instances, to cover the whole cost of manufacturing the entire cheese of the dairy for the year.

Dairymen are conversant with these facts, and they are points to be considered, and should have their proper bearing in making up our estimate of the two systems.

ADVANTAGES OF THE FACTORY SYSTEM.

The advantages claimed for the factory system are, superior quality, uniformity, higher prices, saving, by buying at wholesale, such materials as salt, bandage, annatto, boxes, &c., and, finally, relieving the farmer and his family from the drudgery of the manufacture and care of cheese.

It is not pretended that a better quality of cheese can be made at the factory than in families, but that it is quite as fine as the best, and therefore above the average of that manufactured in small parcels. We have enumerated some of the causes that conspire to depreciate the quality of cheese when made in single dairies; these are not present in the factory system.

The agent or superintendent makes it his business to see that all parts of the work are properly performed. He employs skillful workmen, and his interest and reputation are at stake, prompting him at all times to do his best. He knows that neglect or mistakes will not be tolerated, and the desire to satisfy persons interested, in order to secure their patronage, stimulates him to make every exertion to build up and sustain a reputation for "fine goods." He has every convenience at hand for manufacturing to advantage and making the business a sole employment. He is not liable to be disturbed by other matters which might serve to call his attention away from time to time, to the prejudice of the immediate work at hand.

The same rule must hold good with him as among those engaged in other professions and arts; for he who gives his whole attention and energies in a certain direction is likely to become more skilled, and arrive nearer to perfection in his calling, than he who is striving to do many and diverse things at the same time—more especially in cheese manufacture under this system, as a high degree of skill is expected, and jealous and interested eyes are daily watching and noting every short-coming. Uniformity and fine quality are more likely to obtain under this system, and whatever progress can be made towards improvement will naturally develop itself more rapidly here than among persons scattered over a broad extent of country, and who are so occupied with a variety of work as to have little time to spend in the improvement of any one particular branch.

The factories, so far as we are acquainted, have acquired a high reputation for fine quality and uniformity.

At some of these establishments we have seen a large number of cheeses, making in the aggregate more than a hundred thousand pounds, so uniform in appearance, as they lay on the tables, that the most practiced eye could detect scarcely any difference in their manufacture. Such a quantity of cheese uniform in size and quality will usually command a higher price in market than that of single dairies, from the fact that in the latter an allowance is always made by the purchaser for unequal or imperfect cheese.

We have alluded to some of the causes that operate to increase the price of well made factory cheese over that of private dairies. Another may be added, the saving of time, trouble, and expense in purchasing. The whole quantity made from six hundred or a thousand cows can be bargained for and bought in the same time and at no more expense than a "twenty-cow dairy." This item amounts to a considerable sum in the aggregate, as experts are employed by the principal commission houses in cities, by shippers and dealers, to select and purchase cheese, under salaries ranging from $500 to $1,000 per year. Others, again, get a certain percentage on what they buy. These sums, of course, come out of the producer, and hence by so much must depreciate the price of cheese.

We come now to consider the most important advantage to farmers in this union arrangement. It is the relief from the drudgery of cheese making, and the constant care and attention necessary in properly curing and fitting the cheese for market. It would be difficult to estimate this in dollars and cents, since health enters into the account more largely than is generally suspected. It is believed, and we speak advisedly, that the old method of cheese making has done more to injure the health of women in cheese dairying districts than any other cause. Much of the work about the dairies ought to be performed by men; but too often the manufacturing and most of the care of cheese are left wholly to females, overtasking their strength by hard and exhaustive labor, thereby laying the foundation of weakness and disease.

As the same process has to be gone through with in manufacturing cheese, whether the quantity of milk be large or small, and as nearly the same time also is occupied, it will be seen that what requires the labor of a great many persons to do, when cheese making is divided up in families, can be accomplished with but few persons on the factory system—some five or six being sufficient to do all the work about an establishment manufacturing the milk of a thousand or more cows.

OBJECTIONS TO THE FACTORY SYSTEM.

The objections urged against cheese factories are, difficulty of detecting adulterated milk; the carrying of milk to the factory, and liability of sour milk; difference in quality of milk, arising from the manner in which cows are fed and managed; the loss of whey; and the necessity of manufacturing the early and late made cheese in the family. These are the principal objections urged by dairymen. As the milk is measured at the factory and each credited with the amount daily furnished, it is evident that, when there is a considerable quantity, a dishonest person could add water, and thus increase the number of gallons. Such cases have occurred, and the individuals cheating have been summarily expelled from the association. We know of no instrument or mechanical device that will detect, with perfect reliability, watered milk, and therefore a watchfulness on the part of the superintendent, and the exclusion from the association of persons of doubtful honesty, are the only means of meeting the difficulty.

Some object to the labor and trouble of carrying milk to the factory, and the necessity of keeping regular hours for its delivery under all circumstances of weather, &c., since no delay at the factory can be made for the milk of a single dairy without hazarding the acidity of a large quantity—at least that contained in one vat—besides deranging in some degree the regular factory work. Others contend that, having the milk, the cheese can be made by the family with but little more trouble and labor than that of carting the milk, while one's own time and convenience can be studied at pleasure, and the cheese be at all times under immediate control.

Without extra care and cleanliness as to the pails and milk cans there is liability of sour milk from time to time, which, of course, would not be received at the factory, as milk only slightly acid would damage that with which it came in contact. The milk cans for carrying the milk, it may be observed, are somewhat difficult to cleanse and to keep sweet; and the confinement of the milk and its agitation while being carried in hot weather, render it susceptible to change, especially if there be the least taint of acidity about the cans.

Dissatisfaction often occurs at the factory with regard to the condition of milk, the superintendent being certain that the milk is slightly and perhaps perceptibly changed, while the farmer stoutly insists that it is perfectly sweet; and he goes home in no pleasant mood, complaining that his cans were not perfectly cleansed, laying the fault of the sour milk upon some member of his family, or disbelieving that the milk was changed. If the milk is not received at the factory, it is a loss to the stockholders. Hence it will be seen that more or less trouble is brought about on this account. Not unfrequently bad feeling is engendered on the part of the farmer and his family, and he withdraws from the association.

Another objection is urged, and with some apparent reason, that the quality of milk varies with different persons, according to the manner in which the cows are supplied with food and are managed throughout the season. It is contended that clean, sweet, upland pasture, an abundance of food, and plentiful supply of pure water, cattle wintered well and receiving careful treatment in every respect, will produce a better quality of milk, from which more and better cheese can be made, than when the reverse is practiced. And yet the poor herd that has been wintered improperly, that is pastured on the coarse herbage of low lands, with general bad treatment on the part of the owner, is credited according to the quantity furnished on an equality with the better herd. It is not easy to see how this can be remedied without excluding such from the association.

Then there is the loss of whey, which is regarded by some to be an important item in pork making, or as a feed for cows—for the whey is the property of the person who runs the factory; but even were it given the farmers, there is the trouble and expense of carting it home. An objection is also urged against the system, that in fall and spring, when the cows are "coming in" or being dried off, the quantity of milk is too small to be carried with profit to the factory; that the family butter is to be made; that it pays better to take off the cream for butter and turn the skimmed milk into cheese; and that, therefore, as the factory does not do away wholly with cheese making in families, cheese apparatus and implements are necessary; and if the spring and fall cheese are to be made at home, the other portion of the dairy may as well be made there also. This objection could be partly met by setting the milk and taking off a part of the cream and delivering the milk every other day, or at longer intervals.

We have now presented both sides of the question, and are prepared to advance another step in the discussion, which brings us to—

THE ORGANIZATION, SELECTION OF FACTORY SITES, ETC.

Cheese factory associations are organized in neighborhoods of ten or a dozen or more farmers.

When it is proposed to start a factory, if enough are found willing to turn in their dairies, so as to make a fair start, say 300 cows, a committee is appointed to look further into the matter, to visit factories, and get all the information on the subject that can be had. The favorable report of the committee being had, they then organize, choose directors, and adopt some general rules or plan for the guidance of the association. The next step will be the selection of some experienced cheese maker as superintendent, and the plan for the erection of the factory building.

Generally some person proposes to put up the building on his own account, and to manufacture and take care of the cheese at a fixed price per pound, demanding a contract on the part of the farmers to furnish the milk of the requisite number of cows for a certain number of years.

The milk of about 400 cows, it is believed, is the smallest quantity that can be employed by the manufacturer (when cheese making is his sole business) to obtain a fair living compensation for services, while the milk from a thousand cows can be manufactured at but little extra expense, comparatively.

FACTORY SITE.

In choosing the place for the erection of the factory buildings two requisites are sought after—good water and convenience of access and distance for the dairies furnishing the milk. The site, above all, should command an abundance of pure spring water. This is regarded by those who have had longest experience at the business as imperative.

Even in family cheese making a considerable quantity of water is needed in various ways about the dairy, for curding milk, cooking the curd, and keeping the utensils and buildings clean and sweet; but, for the factory, the quantity of water should be abundant and unfailing. It is usual to have a considerable stream of water passing under the manufacturing room, so as to carry off the drippings of whey and refuse slop, so that there be no accumulation of filth or taint of acidity hanging about the premises.

When whey and slop are allowed to collect from day to day about the milk room, the stench at times becomes intolerable and must do great damage to the milk, which absorbs taints of every character with great readiness. Hence means must be taken to have all the refuse matter swept far beyond the premises

Some factories are being built where dependence for water is placed upon wells of large capacity, but there are as yet great experiments to be tried. At all events it will be seen that much more labor will be required, with greater liability to taints, than when spring water, passing in considerable streams under the building, can be had.

COST OF MANUFACTURE AT THE FACTORY.

The cost of manufacturing cheese is, to the farmer, one cent per pound, rennet, salt, bandage, annatto, and boxes, as well as carting the cheese to market, being charged to the association and paid by each dairyman in proportion to the quantity of milk furnished during the season. The whey, as has been before observed, belongs to the factory. All other expenses, including the care of the cheese while curing, &c., is paid by the manufacturer.

To run a factory using the milk of 600 cows will give constant employment to at least four persons, half or more of whom may be females. Before the war, when prices had not become inflated, the actual cost of manufacturing the milk from 600 cows was about $700 for the season. This sum does not cover interest on capital invested for buildings and fixtures, but was the amount paid for labor, board, fuel, &c.

From these data it will be easily estimated what amount of money can be realized from the business of manufacturing. Allowing that the 600 cows produce, on an average, 400 pounds of cheese each, there will be in the aggregate 240,000 pounds. The cost of a well-constructed factory will not be far from $3,000.

We have then 240,000 pounds, at one cent		$2,400
Cost of running factory	$700	
Interest on buildings, &c	210	
Annual wear and tear, or depreciation of property	200	
		1,110
Profits		1,290

Now, for 300 cows, nearly the same expense would be incurred, and the factory account would stand thus:

120,000 pounds of cheese, at one cent		$1,200
Expense of running factory	$700	
Interest on capital invested	210	
Annual depreciation of property	200	
		1,110
Profits		90

We do not pretend to give the exact figures in the above estimate, but it will be seen that a factory manufacturing the milk of a less number than 300 cows will not be a very paying business, unless the manufacturer can have most of the work performed by members of his own family.

DELIVERING THE MILK.

When a factory is located in a neighborhood where all or nearly all the dairymen are on one street, some one of the number may be employed to gather up the milk of the several dairies, and deliver it at the factory. Neighbors living near each other may take turns, each delivering one day out of the week. When men are hired to gather up and deliver the milk for a neighborhood during the season, the price paid for such delivery is one dollar per cow.

TREATMENT OF THE EVENING MILK.

In cheese manufacture an important point to be considered is the proper management of the evening milk, and to do this to the best advantage the state of the atmosphere must be observed at the time the milk is placed in the vats. The milk room should be cool, airy, and free from impurities. In hot and sultry weather much care and attention must be given to have the evening's milk well exposed to the atmosphere, and thoroughly cooled down before it is left at rest for the night. When there are large quantities of milk to be attended to in hot weather it will be better to spread it thinly over a considerable surface, rather than deeply, as in filling the vats the temperature of the evening's milk should be so reduced that it will stand in the morning at about 62 or 63 degrees, and it should be reduced to at least 62 degrees before leaving it for the night. At the factories, where carrying the milk and mingling it together from several dairies has doubtless a tendency to hasten its acidity, there is more necessity for care and attention than in families; or, rather, there is more danger of souring.

It may be proper to observe that the requisite degree of acidity in milk to the time of setting it with the rennet for a cheese is imperfectly understood by the generality of cheese makers, and must be learned by well and carefully conducted experiments. It is not possible to make so good a quality of cheese from milk recently drawn from the cow, or from any milk that has been kept too sweet, as from milk that has acquired proximate acidity—that is, after the ordinary method of cheese manufacture. Neither will it be possible to obtain the greatest quantity of curd from the milk so manufactured. Such milk will require a treatment of sour whey, which will be considered under its appropriate head further on.

At the factories, it is believed there is more danger from too much acidity than otherwise, since there are many causes to hasten that condition of the milk which are not present in family dairies. In the factories it is usual to cool the evening's milk to about 60 degrees, by letting in water between the vats, by the use of ice, and by lifting and stirring the milk. This, under all circumstances, is, or should be, attended to. The lifting or stirring of the milk, and exposing it to the atmosphere, not only serves to cool it down to the desired temperature, but also operates favorably on the condition of the milk for the production of fine cheese, since the stirring and lifting process allows the animal odor and impurities to pass off more readily. If a considerable quantity of milk directly from the cow be placed in the vat and cooled down without proper exposure to the atmosphere it retains more or less of this taint, and more especially if the cream soon rises to the surface, forming a barrier to escape and holding it in the milk. We urge, then, that the lifting, stirring, and pouring of the milk, so as to come freely in contact with the atmosphere, is of material benefit.

Some idea may be had of the effect of this animal odor by placing milk recently drawn in a vessel where it is closely confined and excluded from the air In a few hours it becomes fetid and putrid. In family dairies too little attention is given to this point in the treatment of milk.

PROXIMATE ACIDITY OF MILK FOR FINE CHEESE.

The requisite acidity in milk for producing the best results in cheese manufacture has not been treated by American writers on the dairy, and is very imperfectly understood by most dairymen.

Experienced cheese makers have observed the fact that milk which has been cooled down to a low temperature and kept very sweet, requires more rennet to form the curd, and when coagulated is longer in cooking, and often will not work down firm, but will be soft and spongy, forming what is termed a "honey-comb cheese." Many times a superabundance of whey is retained and cannot be pressed out; this soon becomes sour and putrid; the cheese does not cure evenly, but goes on depreciating in quality until it reaches a high state of decomposition, giving off an offensive odor, and not unfrequently requiring an immediate removal from the shelves to the pig-pen. When cheeses swell and puff up the whey oozes out, carrying a portion of the butyraceous matter, changed to oil, and are saved with difficulty, and when saved, cannot be marketed at half the ordinary price of good cheese.

The principal features of this character of cheese are given, that it may be identified, and because large quantities are annually made, during spring and fall, many dairymen not knowing where the trouble lies or how to obviate the difficulty. Now, this results from manufacturing from milk that is *too sweet*, and which should have been treated with sour whey. The use of sour whey in cheese manufacture, when the temperature of the evening's milk has been kept low, we deem of imperative necessity, if uniform cheese of firm quality be desired. It may be observed that milk should never have acquired sensible acidity at the time for setting with rennet, but should nevertheless be well on its way towards that point. By sensible acidity, we mean acidity that can be detected by the taste or smell. Some milk is more acid than other soon after being drawn from the cow, and often, *when freshly drawn*, will redden litmus paper, yet to the taste is perfectly sweet. The milk from cows fed with whey, or slop, is more acid than that from those which get nothing but grass on sweet upland pastures. But if by chance or accident the milk is sensibly changed when about to be made into cheese it should be set at a low temperature, and all the subsequent operations hastened as far as practicable.

APPLICATION OF SOUR WHEY.

When the evening's milk stands in the morning at or below sixty-two degrees, the morning's milk may be added to it, and at the time of putting in the rennet a quantity of sour whey should be added, and stirred into the mass, in the proportion of two quarts whey for sixty or seventy gallons of milk. If the night's milk stands below sixty degrees a large quantity of whey may be used, and the quantity of whey always graduated according to the degree of sweetness of the milk. If the evening's milk stands at or above sixty-five degrees in the morning, no sour whey need be used, as the milk is on its way towards a change, or has acquired a sufficient acidity to render the use of the whey not only unnecessary, but a damage, from excess of acid.

When milk has not been treated with sour whey at the time of adding the rennet, and there is difficulty in cooking the curd, it will be better to add to the mass while cooking, a sufficient quantity of sour whey to harden up the curd; but it is always better, when practicable, to use the whey at the time of setting the cheese, as, by that means, the coagulation is rendered more perfect, while more of the butyraceous matter is retained, and the cheese is consequently richer and of finer texture and flavor.

When acid is used in this way to assist the rennet in its work of coagulation, it passes off in the whey, and in pressing and in the cheese room, leaving the cheese sweet, mild, firm, rich, and of the finest texture. It has none of the characteristics of cheese made from milk sensibly sour; as, in that case, it will be hard and retain an acid taste.

In hot weather there will be no occasion to use the whey, unless the milk is cooled down with running water to a low temperature and so held through the night. We may remark here that it is presumed that the milk room, dairy utensils, &c., are kept sweet and clean; for if otherwise, it will be useless to attempt uniformity of manufacture—for no degree of skill in manufacture can counteract all the damage done when the milk is constantly absorbing sour or putrid emanations, or where taints are received from unclean dairy utensils.

The whey should be distinctly acid, about like that coming from a sweet curd in summer weather and standing twenty-four hours. If the weather be cool the whey must be kept in a warm atmosphere to acquire the requisite acidity.

Milk treated as above with sour whey will produce curd that will be all that can be desired, which will work down evenly and without trouble, the cheese curing with a firm, compact texture, retaining more of the butyraceous matter, and having that mild, rich, pleasant flavor peculiar to first class cheese. Attention to this matter, and a little experience and observation in the use of the whey, will, we are convinced, work a marked improvement in the quality of spring and fall cheese, while at the same time it will add in quantity, and save that which would otherwise go off in the whey and be lost.

SIZE OF CHEESE.

In starting a manufactory some little anxiety will be had in regard to the most suitable size of the cheese to be made. This doubtless must be controlled from time to time by the market for which the cheese is manufactured. The southern home trade prefers a medium size flat cheese—say from thirty to forty pounds, and pressed in fifteen, sixteen, or seventeen inch hoops. This style of cheese should be about five inches thick. For shipping to Europe there seems to be a growing demand for cheese of moderate size. The cheddar is now very much in favor for exportation—a cheese fifteen and a half inches in diameter and twelve and a half inches high, and when made smaller, in like proportions. In former years cheeses weighing from one hundred and forty to one hundred and fifty pounds were in favor among the American dairies, but this size is now considered too large for the foreign trade, and a size not beyond sixty or eighty pounds in weight is more saleable. Small cheeses are easily handled, and in case of accident, either at the factory or in carrying to market, the loss is not so great as in the larger cheeses. Some of the factories for several years past have been making a limited number of immense cheeses, weighing seven hundred or more pounds each, and the sales of such have been in advance of the small size; but it is believed that for extensive sales, the market generally would regard them as objectionable. Ready sales of small lots of these large cheeses could doubtless be made at an extra price, because, being rare, they excite more or less curiosity and induce purchases at the shop where they are cut and sold. But such cheeses are of no better quality than the smaller size; they are more liable to be broken; are too large for families that are in the habit of purchasing a cheese from time time, and therefore can never become popular for the general trade.

COST OF PRODUCING MILK IN OLD DISTRICTS.

The question of the cost of producing milk should be determined on every dairy farm. The estimates should be carefully made and compared with the sales, and it will then be seen whether the business is profitable or not. We have entered upon an extraordinary phase in the history of American taxation, and our necessary annual expenditures must for years to come be greatly above those of the past. They must be met manfully, and ways devised for providing for their extra calls on our earnings and profits. They cannot be met by poor herds and a shiftless and improvident mode of farming.

The average annual yield of the cows must be brought up to six hundred or more pounds of cheese per head. We must learn the means of keeping more stock on a less number of acres, and at the same time supplying the herds with a greater abundance of food at a less amount of labor in obtaining it.

It has been remarked by Liebig that cows driven long distances to pasture, unless they get an extra supply of food, yield milk poor in casein or cheesy matter; the materials which would otherwise have formed that constituent of the milk being used in repairing the waste of muscles and other parts employed in locomotion. This fact is lost sight of by many farmers. Herds that are compelled to travel long distances for water, or which are occupied a considerable portion of the day in getting a supply of food, yield less milk, and of a poorer quality, than when they can fill themselves quickly and lie down to rest and manufacture their food into milk. In administering food to milch cows the first consideration should be the maintenance of a healthy, robust condition. That secured, the increase and improvement of their milk may be realized by paying due attention to securing quiet among the herds, and supplying the requisite food from which good milk may be produced.

OLD DISTRICTS UNFAVORABLY AFFECTED.—A FOREIGN MARKET NOW DEMANDED.

But it is claimed that there is one feature with regard to cheese associations that operates injuriously on the interests of old dairy districts. Cheese dairying is no longer a privileged business, narrowed down to a few places, where high skill in manufacturing has built up an enviable reputation. It is opened up to many localities. What has been acquired by long years of patient toil, by science and experience, is at once opened to whole communities, where the art of manufacture is unknown. They pick off the best cheese makers, they erect factories, and meet in the market on an equality. So long as dairying was conducted on the old system, this could only be done so slowly and gradually as not to influence the trade for years. Doubtless in this respect the factories act unfavorably on those who would prefer to see dairying confined within narrow limits, and the fears that the business may be overdone are not altogether groundless. But the step has been taken, and it is too late now to look back. It remains for us to make a market sufficiently large to take all our produce. In what manner this can be done is obvious. The quality of American cheese must be improved, so that it will be sought after in all the markets of Europe. There is no reason why American factory cheese may not become as noted in its line as the wines of Johannisberg, the porcelain of Sevres, the sword blades of Damascus, or the shawls of Cashmere. We can compete with the dairymen of the old world as to prices, and when we shall be able to outdo them in quality, a market for our "goods" is secured for all coming time.

The business of cheese dairying is now assuming large proportions, and will increase rapidly under the stimulus of rapid sales, high prices, and the facilities offered for manufacture under the factory system. How far this influx of business is to influence prices remains to be seen. Without a market in Europe, the supply, it is evident, will be so great as to glut the home trade and render cheese dairying unprofitable. It is true, nature seems to have hedged the dairy within certain limits.

The immense plains of the west and south, as well as large portions of the middle States, are not adapted to dairying. The lands are deficient in springs and streams of living water; the soil is of such a character that grasses soon run out, and pastures become brown and dried, or afford scanty herbage long before midsummer.

These lands are better adapted to wheat and corn, or the production of beef or mutton and wool, and hence will not naturally be employed for the dairy. But still there are large tracts of lands suitable for milch cows, and should they be generally devoted to the dairy, we may possibly find the annual supply of cheese so great as to sensibly affect prices. There is no question of more importance, none of more vital interest to the dairyman, than this matter of market—a market that is enduring and remunerative.

PERMANENCY OF THE SYSTEM.

The questions have been frequently asked: Is the factory system destined to stand the test of years? Is it to continue to prosper, or will it not soon break up and dairymen return again to the old order of cheese making? In my opinion it is to live. The system is a progressive step, and all history teaches that when that is taken it is difficult to retrace it.

Doubtless some may remember when the wool and the flax grown on the farm were spun and woven in the family. We shall never return to that again, because we cannot afford it. They can be more cheaply manufactured by associated capital, substituting the untiring arm of the machine for one of living muscle. The flesh and blood of our wives and daughters are of too much consequence to be worn out by this ceaseless toil, when the spindles and looms driven by steam or water power can relieve them of the burden at a fraction of what it costs in home manufacture. Why, then, should a neighborhood of dairymen do the work of cheese making in families, employing many hands, when it can be performed equally well by half a dozen persons in a well constituted factory?

Progress is a law of nature. From the earliest dawn of creation there has been a constant series of improvements in progress. Geology reveals that the lower orders of sensitive beings gave way to those of higher grade, until the last result of physical creation was attained in the creation of man, whose improvement, as a rational creature and an immortal soul, is still destined to be onward and upward.

The inauguration of associated dairies is rapidly producing a revolution in old customs and heretofore fixed ideas. It teaches the important lesson that farmers can adopt successfully the same means that have proved so beneficial to the merchant, the banker, and the commercial man of the world. By a consolidation of interests, the dairymen of to-day can wield a power and influence never before reached. The vast capital in lands and herds is of a substantial and permanent character, while the aggregate product of the farms, annually amounting in value to millions of dollars, compels respect from those who would assume that the proper province of the farmer was merely to till the soil, leaving for others to divide the profits realized in marketing his productions.

It has been suggested that an arrangement could be made by which leading European houses would take choice factory brands direct from the producer, and advance, through an agent in New York, the stipulated price. Whether more could be realized in this way than by the present system, under which the country buyer gets one commission, the house in New York another, and the shipper a third, is a matter that needs investigation.

But the dairyman with his herd of fifty or one hundred cows, standing alone, has a circle of influence whose radius extends but little beyond his farm. He is, in a measure, at the mercy of corporations and speculators, who, by operating together, may fix prices and control the trade. When associated with others in neighborhoods, in towns, in counties, and in the State, he becomes formidable, and meets on equal terms the community of dealers with whom he is operating.

BUTTER FACTORIES.

Another feature springing out of the system of associated dairies, and of national importance, is the production of butter at factories in connexion with the manufacture of cheese. Its importance will be more readily seen when it is known that the finest quality of butter can be produced under this system, thus avoiding immense losses resulting from a poor article, as manufactured in private families, together with the saving effected by turning the skimmed milk into cheese. It takes more skill and science to make cheese than butter. Cheese making is a chemical process; butter making is mechanical.

The cheese makers are, as a class, inferior butter makers. Some have attempted to account for the poor butter in cheese producing counties, on the ground that no limestone region can produce a prime article. They assert that soft water is indispensable in butter manufacture.

There are many errors afloat in the world—errors so old and so well established that they are difficult to be overthrown. I do not propose to argue the point, or to waste breath upon fine spun theories. Facts are opposing forces of more power than words, and, with due respect to the opinions of others, it is believed that as nice butter can be made in the hard water districts as in the far-famed butter regions. But the cows must be good, fed upon old, sweet, rich upland pasture, with abundance of pure water, the milk and manufacture perfect. Cows fed on beets and onions will not make good butter, even if it be washed in the softest water.

There are butter makers, even in the hard water districts of Oneida county, New York, who pack in Orange county pails, who manufacture specially for consumers in New York and Philadelphia, and whose butter is pronounced by competent judges equal to the best brought into those markets. I have seen as good butter made upon the black slate hills of Herkimer county, New York, as any in the soft water regions—butter that would keep at least nine months as sweet as a nut and as nice as could be desired. These are facts. I have no theories to advocate, and no feeling in the matter further than stating the truth.

The cheese makers have no conveniences for making butter; they have no order nor system in managing the milk. Their milk is often set in a tainted atmosphere, in cheese vats, or mixed up with cheese utensils, and the butter therefrom has an unpleasant, and often a cheesy flavor. They do not intrust the butter making to careful manufacturers, but set their raw hands to the work, pack it in any kind of a tub that will carry it to market, and get the best price for it they can. A great deal of this butter soon becomes rancid, and is a miserable grease, unfit for anybody to eat. It is sold at comparatively low prices, and hundreds of thousands of dollars are thus annually thrown away. It is hard to remedy the evil on the old system of private dairies, since the farmers will tell you it wont pay to build a spring room and hire a skillful butter maker for a few tubs of butter, spring and fall; and even should he go to extra expense and care, it is not certain that the butter would sell any higher. The wife and daughters have more labor than they can attend to, without slaving over the butter making, and so a great deal of poor butter goes to market.

The associated dairies have the means of remedying this defect, in the establishment of butter factories in connexion with cheese manufacture. Butter making at factories is of recent origin. It was inaugurated in Orange county, New York, about four years ago, and, in connexion with the manufacture of skim-milk cheese, has proved a success. A number of factories have been put in operation in that county, and the system, it is believed, will be adopted to some extent throughout the whole dairy region.

If the system can be gradually introduced and managed judiciously, it will prove a source of profit to the producer and a great blessing to consumers. There is danger, however, that too many in the cheese producing counties may rush thoughtlessly into the manufacture of skim cheese, and thus, by over-production of both butter and a poor character of cheese, make the whole thing a failure—that is, render it unprofitable. How far markets may be opened for the disposal of skim cheese remains to be seen; but it is evident that the great bulk of American cheese must be made of whole milk, or at least of milk that has been but lightly skimmed.

Dr. Voeclker's analysis of the best samples of English and American cheese shows that ours is about 2½ per cent. richer in butter than the English samples, the latter containing more moisture. Whether, therefore, we may be able to remove a portion of the cream and yet manufacture a nice, palatable cheese, equal to the best English cheddar, is for future experiments and skill in cheese making to determine.

It is believed that as we progress in the science, great improvements will be made in this direction, and a superior quality of cheese be made from milk not particularly rich in butter; but until the facts are fully established, and the processes of manufacture generally understood, there is danger of butter factories depreciating the standard of American cheese, by throwing upon the market a surplus of the poorer grades. Though in favor of butter factories, and fully in the belief that the public necessities demand them, in limited numbers, and that the system is an advanced step in dairy progress, there is necessity for caution, that we may not overdo the work and "get too much of a good thing" at once.

This danger of an excess of butter and skim cheese factories will be more apparent when the comparative profits of the two systems, at present prices, are taken into account.

In November, 1865, when in Orange county, I was told by Mr. Allison, superintendent of one of the factories, who had kept a record of work, that the average product during the season, up to October, from fourteen quarts of milk, wine measure, was one pound of butter and two of skim cheese. The cheese factories do not produce more than three pounds of cheese from the same quantity of milk. Now the average sale of factory cheese the past season (1865) has been only a little over 15 cents—call it 16 cents—and we have 48 cents as the value of the milk by that system. But by the other system, the average prices at which butter was sold in the fall would nearly cover that amount, leaving the two pounds of skim cheese as clear gain. These are the facts which serve as a basis for estimating the relative profits of the two systems. We may assume that a given quantity of milk will yield an equal weight of product by either system, but in one a third of the weight is in butter. To be exact, I suppose that by the Orange county system the milk is worked up more perfectly, or with less waste, and hence there is really a larger product by that system; but as some cheese makers claim to be able to work milk without much waste, the excess need not be named here. The cost of manufacturing butter and cheese combined is slightly in advance of manufacturing cheese alone, but the difference is not so great as to be of much account.

It will be seen, then, that the success of butter and cheese factories will depend upon the prices by which butter is to rule in the market above that of cheese, and the facility in disposing of skim cheese. Last fall the Orange county factories sold their butter at 70 cents, and their skim cheese at prices slightly in advance of whole milk cheese from the best factories of Herkimer and Oneida. But such a condition of things may never occur again, and it would not be fair or safe to make these figures a basis for future operations.

The dairy region has been trying to make a finely flavored, high-priced cheese, such as will sell in the markets of Great Britain along with improved English cheddar, at 84 to 112 shillings per hundred—that is, from 20 to 25 cents in gold.

Some of our factories, during the last two years, have come up to the required standard, and American cheese now stands equal to any manufactured in the world. I am in receipt of a letter from the London agent of one of the oldest and largest cheese dealers in Great Britain, saying that he had just sold, at wholesale, December 23, 1865, some of the Oneida fancy factory make at 84 shillings. That is not bad; and when we can prove to our English customers that we are able to supply them with the best cheese, they will take of us from fifty to one hundred millions of pounds annually and pay us well for it. But we must not get back on a poor grade, and lose the reputation we have labored so hard to obtain. These points should enter properly into the consideration of this subject, with those contemplating a change to butter and skim cheese manufacture.

The advantages of butter making on the associated dairy system over that of private families are very great. In the first plan a uniform product of superior character is secured. Every appliance that science, or skill, or close attention to business is able to obtain is brought to bear upon the manufacture, and prime quality necessarily follows as a result. If you could assume that, in a neighborhood of one hundred families, each was possessed of the skill and conveniences of the factories, and that each would give the subject the same close attention, there doubtless would be no difference as to quality of product; but such a state of things rarely exists.

Again, the factories are able to obtain a larger price, because it costs the dealer no more to purchase of the one hundred dairies combined, than it would of an individual dairy, and the uniformity and reliability of the product does not entail the losses that are constantly accruing in different lots on account of inferior quality. The factories, too, relieve the farmer and his family from a great deal of drudgery, and unless the work is to be done by members of the family who cannot be employed profitably at other labor, it is a matter of economy to have the butter or cheese made at the factory; since what would employ a hundred hands scattered over the country, is performed in the same time by three or four when the milk is worked up together at one place.

The only serious complaint against the factory system is in hauling the milk. This has been obviated, in many instances, by establishing a route of milk teams, where the milk is delivered for the season by the payment of a small sum. The associated system, applied to butter making, has all the advantages, and will do as much for the improvement of butter as it has for cheese; and no one at this day will deny that in the latter it has brought about a wonderful improvement. The butter making department can be easily applied to cheese factories. There need be scarcely any alteration in the buildings. A spring room, cheese room, and butter cellar must be added, but these need be but small and cheap structures. The spring room is to be provided with vats or tanks for holding the water. They should be sunk in the earth in order to secure a lower and more even temperature of the water, as well as for convenience in handling milk. The vats should be about 6 feet wide, and from 12 to 24 feet long, arranged for a depth of 18 inches of water. There should be a constant flow of water in and out of the vats, so as to secure a uniform temperature of the milk after it has been divested of its animal heat. The milk is set in tin pails, 8 inches in diameter by 20 inches long, each holding about 15 quarts of milk. As fast as the milk is delivered, the pails are filled to the depth of 17 inches and plunged into the water, care being taken that the water comes up even with or a little above the surface of the milk in the pails. The temperature of the water should be from 48° to 56°.

A vat holding about 2,000 quarts of milk should have sufficient flow of water to divest the milk of its animal heat in less than an hour. Good pure milk will keep sweet 36 hours when thus put in the vat, even in the hottest weather.

When milk is kept 36 hours in the water, nearly all the cream will rise. Some claim that it all rises in 24 hours or less. The time may be varied, according to the quality of cheese it is desired to make. That being determined, the pails are taken out, the cream dipped off with a funnel-shaped cup, having a long upright handle. The milk then goes to the cheese vats for making skim cheese, and the cream is either churned sweet or is placed in the pails and returned to the water, where it is kept until it sours. Sour cream makes the most butter, and sweet that of the nicest flavor. When the milk is churned sweet, the buttermilk may be put into the vats with the milk for making skim cheese, and hence there will be no loss.

The old notion that cream cannot rise through a depth of milk greater than seven inches, it is believed, is an error. The Orange county farmers say they can get as much cream by setting in pails on the above plan, as they can to set the milk shallower in pans, and the cream is of better quality, because a small surface being exposed to the air, there is not that liability for the top of the cream to get dry, which has a tendency to fleck the butter and injure its quality. Desiring to test this matter, I took glass cream jars, on which were graduated scales, and set milk of the same quality at different depths, from two to eighteen inches. The depth of the cream was always in proportion to the quantity of the milk. Mr. Jones, of Utica, the inventor of the floating thermometer and a new hydrometer for testing milk, also tried the experiment, and the same result invariably followed. Hence I conclude the Orange county butter makers are right.

The great secret in butter making, it seems, consists in attending to the following points: 1st, securing rich, clean, healthy milk—milk obtained on rich old pastures, free of weeds; 2d, setting the milk in a moist, untainted atmosphere, and keeping it at an even temperature while the cream is rising; 3d, proper management in churning; 4th, washing out the buttermilk thoroughly, and working so as not to injure the grain; 5th, thorough and even incorporation of the salt, and packing in oaken tubs, tight, clean, and well made. Cleanliness in all the operations is of imperative necessity. Judgment and experience in manipulating the cream and working the butter must of course be had.

When the butter department is to be added to cheese factories already built, about a third of the cost will be in pails, two of which are required for every cow from which milk is delivered. To build a butter and cheese factory combined, of capacity for 400 cows, fitted up with the necessary machinery complete, the cost is estimated at ten dollars per cow. It will hardly pay to build and run a factory for less than three hundred cows, and it is not desirable to have the number of cows above a thousand.

In the working of any new system, practical men always desire statistics of results. I have seen the statement of receipts and expenditures of the Wallkill factory, Orange county, for the year 1865. The quantity of milk received from April 1 to December 1 was 627,174 quarts, of which 27,308 were sold at a little above seven cents per quart, leaving 599,866 quarts to be made up into butter and cheese. The product was as follows: 31,630 pounds of butter, 81,778 pounds of skim cheese, 5,908 pounds of whole milk cheese, 2,261 quarts of cream, sold at 19 6-10 cents per quart, and 1,561 quarts of skim milk, at $1\frac{5}{8}$ cents per quart.

The net cash receipts, after deducting transportation and commissions, were as follows:

For pure milk sold	$1,926 22
skim milk	24 02
butter	13,344 21
skim cheese	11,659 08
whole milk cheese	1,065 44
2,261 quarts cream	443 33
hogs fed upon whey	446 24
buttermilk and sundries	207 49
Making a total of	29,116 03

The expense account was as follows:

For labor	$1,476 40
fuel	79 96
cheese boxes	653 17
20 sacks salt	89 25
rennet, bandage, &c	483 55
carting cheese	273 10
hogs	179 90
	3,235 33

This gives an aggregate net receipt of $25,880 70.

From these statements it appears that the butter averaged 42¼ cents per pound, the skim cheese 14¾ cents, and the wholemilk cheese 18 cents per pound, while the average amount received on the whole quantity of milk was $4\frac{1}{10}$ cents per quart. The expenses of the factory were a little over half a cent per quart.

From a recent report of average sales of cheese from the New York and Ohio factories, it appears that 15½ cents per pound is all that has been obtained by a majority of the best wholemilk cheese factories during the year 1865, and the comparative profits may be thus stated:

Fourteen quarts of milk, making 3 pounds of cheese, (at 15½ cts.,) 46½ cents; deduct cost of manufacturing, boxes, &c., 6 cents—leaving 40½ cents.

At the butter and skim cheese factory, 14 quarts of milk, at $4\frac{1}{10}$ cents per quart, amount to $57\frac{2}{5}$ cents; deduct cost of manufacturing, &c., 7 cents, and we have a difference of 10 cents in favor of the butter and skim cheese on every 14 quarts of milk.

It may be asked how do the butter and skim milk factories compare with those dairies where butter alone is manufactured from the milk. I have no statistics from dairies in Orange county showing the quantity of milk for a pound of butter, but was told that by the factory system of taking off part of the cream and working up the skim milk, greater profits were realized.

The Hon. Zadock Pratt, in the account given of his butter dairy in Green county, gives the average quantity of milk required for a pound of butter, during the season of 1860, to be $11\frac{20}{100}$ quarts, and in 1861, $10\frac{42}{100}$ quarts. In 1859 it took $14\frac{50}{100}$ quarts, and in 1858, $16\frac{16}{100}$ quarts for one pound of butter. The milk in this dairy is set shallow in pans and the cream skimmed off after the milk has soured and begins to thicken. At the Orange county factories it is not desired to take all the cream from the milk, since a portion of it is needed in the skim cheese.

That which is taken off is fresh and sweet, and is in condition to make the finest flavored butter. The management of the milk is without doubt the best that has yet been discovered, and should be generally adopted whenever good butter is sought after.

The churning and working of the butter does not differ materially at the factories from that of other experienced manufacturers. The cream is churned in the barrel and a half dash churn, and the butter worked with a lever upon an inclined slab. The whole system commends itself to the dairy public, especially to the butter districts, and if the cheese makers would adopt it at their factories for making spring, fall, and winter butter, large sums would be annually saved, and the public greatly benefited by being able to secure readily a desirable article.

DAIRY PRODUCTS OF THE UNITED STATES.

The following tables give the number of pounds of butter and cheese made in different sections of the Union, according to the census returns of 1850 and 1860. The total production of butter in the United States and Territories in 1850 was 313,345,306 pounds, and in 1860, 469,681,372 pounds. Of cheese, the product in 1850 was 105,535, 893 pounds, and in 1860, 103,663,927 pounds, showing an increase in the production of butter and a decrease in cheese during that decade. From the tables it will be seen which States are largely interested in this branch of industry:

Amount of butter and cheese made in 1860 *and* 1850.

States.	Butter.		Cheese.	
	1860.	1850.	1860.	1850.
NEW ENGLAND STATES.				
Connecticut	7, 620, 912	6, 498, 119	3, 898, 411	5, 363, 277
Maine	11, 687, 781	9, 243, 811	1, 799, 862	2, 434, 454
Massachusetts	8, 297, 936	8, 071, 370	5, 294, 090	7, 088, 142
New Hampshire	6, 956, 764	6, 977, 056	2, 232, 092	3, 196, 563
Rhode Island	10, 211, 767	995, 670	181, 511	316, 508
Vermont	15, 900, 359	12, 137, 980	8, 215, 030	8, 720, 834
Total	60, 675, 519	52, 924, 006	21, 620, 996	27, 119, 778
MIDDLE STATES.				
New York	103, 097, 280	79, 766, 094	48, 548, 289	49, 741, 413
Pennsylvania	58, 653, 511	39, 878, 418	2, 508, 556	2, 505, 034
New Jersey	10, 714, 447	9, 487, 210	182, 172	365, 756
Delaware	1, 430, 502	1, 055, 308	6, 579	3, 187
Maryland	5, 265, 295	3, 806, 160	8, 342	3, 975
District of Columbia	18, 835	14, 872	....	1, 500
Total	179, 179, 870	134, 008, 062	51, 253, 938	52, 620, 865

Amount of butter and cheese made in 1860 *and* 1850.—Continued.

States.	Butter.		Cheese.	
	1860.	1850.	1860.	1850.
WESTERN STATES.				
Indiana	18,306,651	12,881,535	605,795	624,564
Illinois	28,052,551	12,526,543	1,848,557	1,278,225
Iowa	11,953,666	2,171,188	918,635	209,840
Michigan	15,503,482	7,065,878	1,641,897	1,011,492
Minnesota	2,957,673	1,100	199,314	....
Missouri	12,704,837	7,834,359	259,633	203,572
Ohio	48,543,162	34,449,379	21,618,893	20,819,542
Kentucky	11,716,609	9,947,523	190,400	213,954
Wisconsin	13,611,328	3,633,750	1,104,300	400,283
Kansas	1,093,497	....	29,045	....
Nebraska	343,541	....	12,342	....
Total	164,786,997	90,511,255	28,428,811	24,761,472
SOUTHERN STATES.				
Alabama	6,028,478	4,008,811	15,923	31,412
Arkansas	4,067,556	1,854,239	16,810	30,088
Florida	408,855	371,498	5,280	18,015
Georgia	5,439,765	4,640,559	15,587	46,976
Mississippi	5,006,610	4,346,234	4,427	21,191
Louisiana	1,444,743	683,069	6,153	1,957
North Carolina	4,735,495	4,746,290	51,119	95,921
South Carolina	3,777,934	2,981,850	1,543	4,970
Tennessee	10,017,787	8,139,583	133,575	177,681
Texas	5,850,583	2,344,900	275,128	95,299
Virginia	13,464,722	11,089,359	280,852	436,292
Total	60,242,258	45,206,392	808,397	959,802
PACIFIC STATES AND TERRITORIES.				
California	3,095,035	705	1,343,689	150
Oregon	1,000,157	211,464	105,379	36,980
New Mexico	13,259	111	37,240	5,848
Washington	153,092	....	12,146	....
Utah	316,046	83,309	53,331	30,998
Total	4,577,589	295,589	1,551,785	73,976

We have not the exact figures at hand for giving the statistics of butter and cheese made in the Union during the year 1865, but the production of cheese in the middle and western States alone, it is believed, was more than 200,000,000 of pounds. From facts gathered by the American Dairymen's Association, it is known that there are now upward of a thousand cheese factories in operation throughout the United States. If the number of cows to each be estimated at 500, we have half a million of cows employed in the associated dairies, and if the average annual yield per cow be put at 300 pounds, we have in the aggregate 150,000,000 pounds. But there are a large number of private or family dairies in operation, especially in the eastern and middle States, the production of which, it is believed, will more than make up the estimated annual product of cheese to 200,000,000 pounds.

If the value of the cheese product of 1865 be put at an average of 15 cents per pound, it shows a total of $30,000,000, while the butter product, if no larger than that of 1860, at the low estimate of 25 cents per pound, would amount to over $114,000,000. In the estimate of the cheese product it will be proper to remark that the quantity is presumed to be the amount sold, and does not include that consumed in the families of producers.

EXPORTS OF CHEESE AND BUTTER.

The statistics of the trade show that the dairy products of the country are becoming an important branch of commerce.

The following table gives the quantity of butter and cheese exported from New York for a series of years:

	Butter.	Cheese.
1858		5, 098, 000
1859	2, 494, 000	9, 287, 000
1860	10, 987, 000	23, 252, 000
1861	21, 865, 000	40, 041, 000
1862	29, 241, 000	38, 722, 000
1863	23, 060, 793	40, 781, 168
1864	14, 174, 861	49, 755, 842
1865		43, 101, 000

The decrease in the cheese exports of 1865 from those of the year previous, resulted from an extraordinary home demand, which took large quantities of cheese at a price in advance of what shippers felt warranted to pay for it to export. The shipments abroad have been mostly to Great Britain.

A light exportation for a number of years has been kept up with the West Indies and with South America, the trade with the latter being for the most part in a poorer grade of cheese made from skimmed milk. Recently this character of cheese has found a favorite reception in China, where parcels have been sent in exchange for tea.

It is believed there is a wide range of markets yet unopened for the disposal of American cheese, needing only a little enterprise on the part of dealers for its introduction; and that when once introduced, it will increase steadily until a heavy foreign demand is reached.

Great Britain alone can now take considerably more than our surplus, and since the qualities of adaptation of styles to her needs meets, year by year, greater favor, the time cannot be far distant when America will be regarded, if she be not already, the great cheese producing country of the world.

DAIRY FARMING,

WITH SOME ACCOUNT OF THE FARM OF THE WRITER.

BY ZADOCK PRATT, PRATTSVILLE, GREENE COUNTY, NEW YORK.

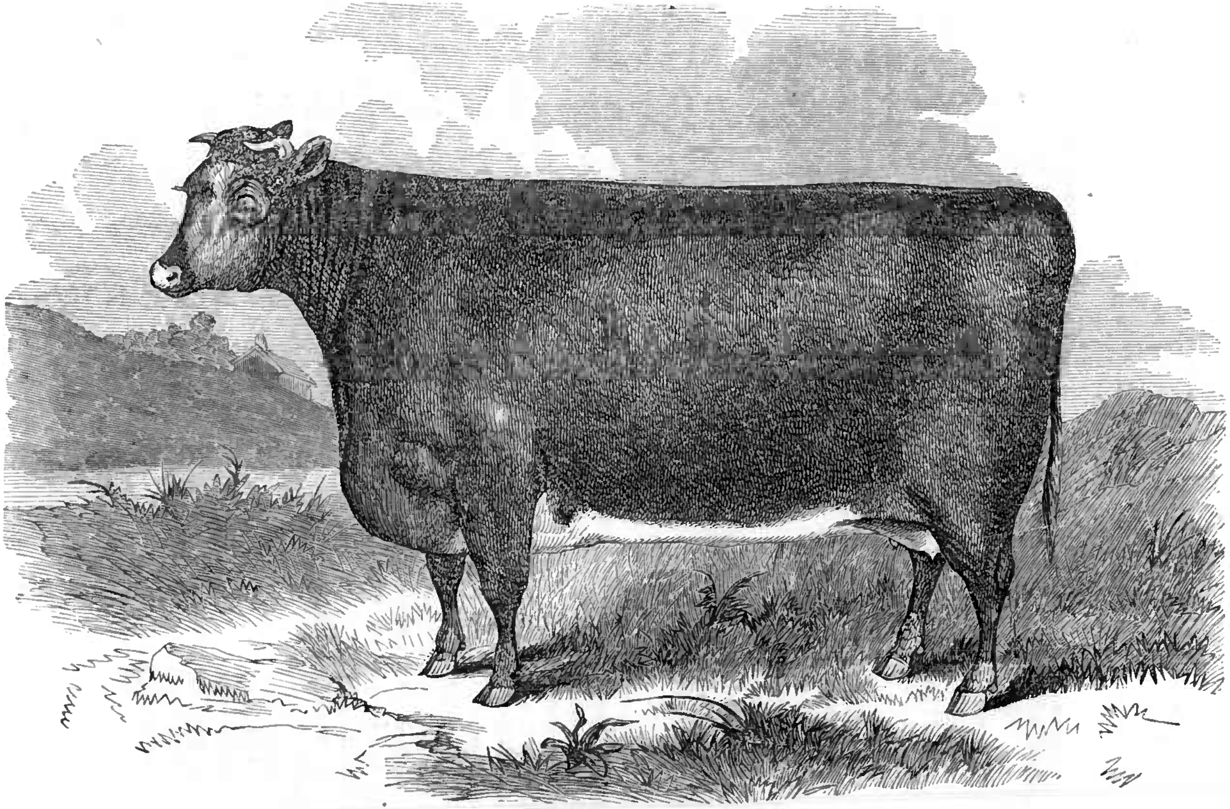
This article is not designed to describe the methods of dairy farming which are successfully practiced by the writer. In the Patent Office Report (agricultural) for 1861, the reader will find a very full and minute account of the Prattsville dairy and the method of butter making practiced there, to which, for the better understanding of the statistics appended to this article, his attention is directed. My object here is rather to show the results of dairy farming for seven successive years, as ascertained by a careful and systematic method of keeping an account of all the products of the farm—the expenses incurred, deducing therefrom the net profits of cultivating it. By doing this, I hope to encourage my brother farmers to manage their farms more intelligently, and by ascertaining the net profits of wool growing, dairy farming, stock breeding, or the culture of particular grains or grasses, to learn whether their labors meet with the proper reward.

In the article referred to above it was remarked that butter making in this country has been most successfully carried on within that belt of territory, varying from twenty-five to fifty miles in width, which begins with Orange county, near the city of New York, and extends from the Hudson river in a northwesterly direction perhaps one hundred or one hundred and fifty miles into the heart of the State of New York. Within this belt lies the town of Prattsville, situated in the northwest corner of Greene county, adjoining Delaware county; and this town and the adjoining town of Ashland may be fairly called the butter making region of Greene county.

In 1824, when the writer first located here and began to build his tannery, which afterward turned out a million sides of sole leather, all this region was a dense forest of hemlock, which yielded to the tannery one hundred and fifty thousand cords of bark. After the hemlock forests were cleared away and the tannery was removed to another locality where hemlock was nearer at hand, the writer, who, like many old tanners, had a regard for hemlock lands, felt confident that these lands would prove good for butter making, and at once turned his attention to the subject. The success which has attended his enterprise is best shown in the statistics below. It will be seen from these tables that order, regularity, attention, "minding your business," are essential to butter making, as they are to success in any department of farming. To this may be added a good thick sod, which hemlock lands afford, and an abundant supply of pure, soft, cool water.

The farm, as heretofore referred to in the report for 1861, contains 365 acres, 40 of which are fine alluvial soil. The residue is hemlock land, the soil of which is loam and gravel, and lies on the eastern slope of the Catskill mountain. The average number of cows kept on the farm was eighty, though at one time the number was one hundred. The average quantity of butter for each of sixty-four cows in 1862, as will be seen by a reference to the table, was 223 pounds. The present season this very high average has been a little exceeded; but as the number of cows has been increased to eighty, the large product which they average is still more remarkable.

From the accounts, which have always been kept with accuracy, of the management, products, and expenses of this farm, a summary in the most concise form possible is presented in the following tables:

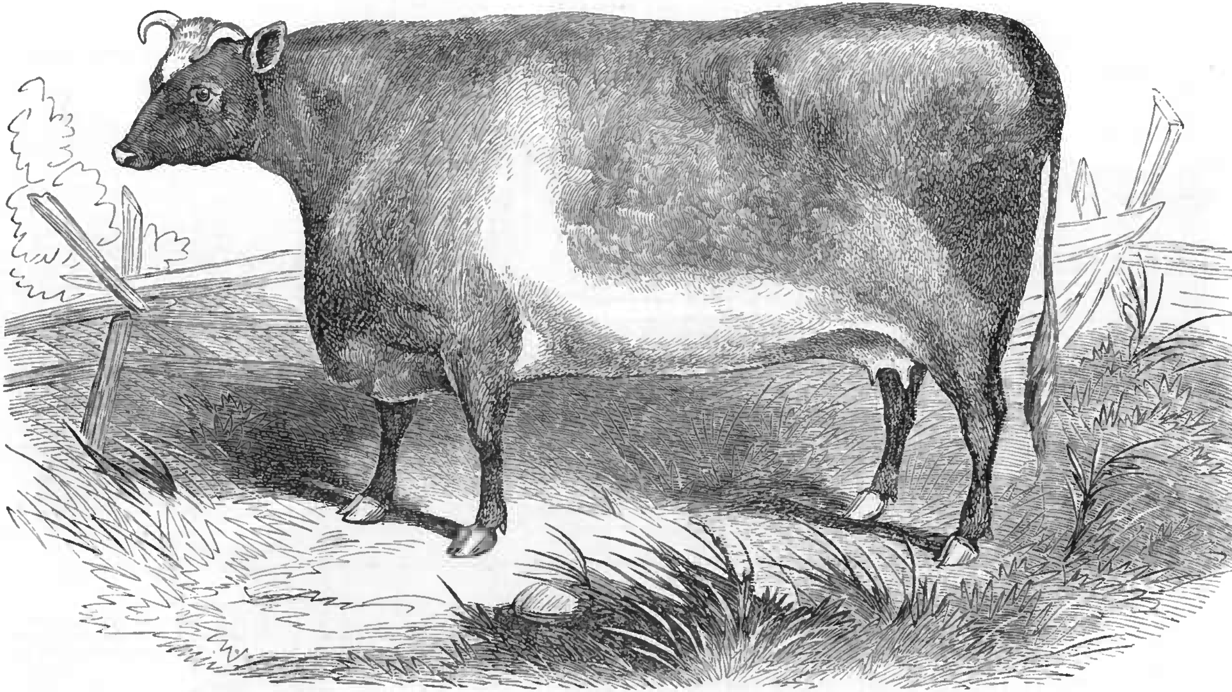


SHORT-HORN COW "JESSIE."

The Property of D. McMillan, Xenia, Ohio.

PLATE XXIII.

PLATE XXIV.



SHORT-HORN COW "PRIZE FLOWER," 8 YEARS OLD.

The Property of D. McMillan, Xenia, Ohio.

Statistics of Hon. Z. Pratt's dairy farm, at Prattsville, Greene county, New York, for the usual season of about eight months for the years 1857–'58–'59–'60–'61–'62 *and* '63, *fifty cows of what are called the native breed being kept each year.* (*In* 1863 *the average number of cows kept was eighty.*)

MILK.

	1857.		1858.		1859.		1860.		1861.		1862.		1863.	
	In lbs.	In gals.	In lbs.	In gals.	In lbs.	In gals.	In lbs.	In gals.	In lbs.	In gals.	In lbs.	In gals.	In lbs.	In gals.
Whole product	254,736.	31,842	260,450	32,556¼	240,700	30,087	217,736	26,276	227,757	28,301	282,353	35,740	36,287.1	46,731
Average per cow	5,094.48	636.31	5,209	651.12	4,814	601.74	4,354.75	525½	4,555	572.26	4,411	558.43	4,535	584
Average per day	1,044	130.50	1,067.50	133.4	982.50	122.67	888.72	107.28	870	108.85	1,085	137.4	1,343	173
Average per day for each cow	20.80	2.60	21.30	2.70	19.65	2.45	17.77	2.14	17.5	2.17	16.9	2.14	16.7	2.1
Greatest av'age in one day per cow	24.18	3.25	31.50	3.31	28.35	3.53	25.60	3.40	26.7	3.34	25.3	3.2	25.2	3.2

BUTTER.

	1857.	1858.	1859.	1860.	1861.	1862.	1863.
Whole product	6,500 pounds	8,050 pounds	8,300 pounds	9,143 pounds	10,860 pounds	14,274 pounds	17,976 pounds
Average per cow	130 pounds	161 pounds	166 pounds	182.86 pounds	217.20 pounds	223 pounds	224 7-10 pounds
Average per day	26.61 pounds	33 pounds	33.92 pounds	37.32 pounds	41.76 pounds	54.9 pounds	66½ pounds
Average per day per cow	8.50 ounces	10.56 ounces	10.84 ounces	11.94 ounces	13.36 ounces	13.71 ounces	13 3-10 ounces
Average milk to one pound butter	39.20 lbs. or 20 qts.	32.33 lbs. or 16.16 qts.	29 lbs. or 14.50 qts.	23.30 lbs. or 11.20 qts.	21 lbs. or 10.42 qts.	19.7 lbs. or 10.1 qts.	20.1 lbs. or 10.3 qts.

PORK.

	Per cow.	Total.	Per cow.	Total.	Per cow.	Total.	Per cow.	Total.	Per cow.	Total.	Per cow.	Total.	Per cow.	Total.
Pork made, in pounds	92.5	4,627	148	7,403	129	6,455	130.3	6,516	132.5	6,625	144	9,318	129	10,389

SALES.

Butter sold	$30 95	$1,547 54	$38 48	$1,924 02	$41 40	$2,070 00	$42 97	$2,148 89	$49 91	$2,497 80	$57 98	$3,711 24	$60 66	$4,853 52
Pork sold	6 56	328 16	8 42	421 08	8 36	418 00	9 12	456 12	6 62	331 25	7 28	465 90	7 14	571 39
Calves sold	....	....	....	....	....	....	....	80 00	....	38 65	....	146 55	....	195 94
Total	37 51	1,875 70	46 90	2,345 10	49 76	2,488 00	52 09	2,685 01	56 49	2,867 70	65 26	4,323 69	67 80	5,620 85
Expenses for working farm over proceeds of same, not enumerated above, including $700 for each year, for interest on investment for farm and stock, $10,000.	....	1,415 50	....	1,380 50	....	1,550 00	....	1,125 75	....	1,150 75	....	1,526 77	....	1,916 45
Net profits above interest	....	460 20	....	964 60	....	938 00	....	1,559 26	....	1,716 95	....	2,996 92	....	3,704 40

Amount realized for each cow: For butter sold..... $60 66
For pork sold...... 7 14
67 80

Other products: 1,107 bushels corn in the ear from 8¾ acres.
1,500 bushels carrots and beets.
130 loads of pumpkins.
80 tons hay.

Other products: 100 bushels oats.
Value of honey sold and on hand... $54 16
Value of new hives of bees' increase. 74 00

BEE KEEPING.

BY MRS. ELLEN S. TUPPER, BRIGHTON, IOWA.

Bees, from the earliest ages of the world, have been invested with peculiar interest, and have claimed the attention not only of the unlearned and ignorant but of the student and naturalist. The mystery which so long enveloped them and their habits added not a little to the zest with which their history was investigated.

The discoveries of the last twenty years, however, have so elucidated the laws of bee instinct, that no important point is longer a subject of controversy or mystery; and in the light now thrown upon the subject no branch of moral economy can be more definitely regulated, or conducted with such absolute certainty of success.

The management of bees can only be successful when conducted with a perfect understanding of their natural history, and in accordance with the instincts which govern them. In the words of one of the most eminent apiarians in our country, "The business may be viewed, first, as a science having for its object the attainment of a correct knowledge of all that pertains to the life, habits, and instincts of the honey bee; and, secondly, as a practical art, which regards all the attainments thus made, and to be made, as the only reliable foundation of successful management." The laws which govern these wonderful little insects are peculiar to themselves, differing from those which govern everything else. They are simple, and one can manage them in almost any way so long as he does not go counter to their instincts; but they are fixed and immutable, and when we deviate from them in the smallest particular loss must follow. To be successful, then, in the practical art, the science on which it is founded must be thoroughly understood.

All these laws have been so fully and clearly explained in various able works on the subject that to enter on them here would be superfluous; this paper, therefore, will treat only of the practical, and aim to give direction and advice as to the management of bees, in such a way that they shall every year, whatever be the season, yield a profit to their owner.

I shall recommend nothing that I have not fully tested, and give no rules which I have not myself followed with profit. The business requires but little capital, and so little strength that it may be made an agreeable recreation for the man of toil, and a most remunerative employment for invalids. There is no part of the work required which is not suitable for women; and now, when many are looking for new avenues of female labor, I would that I could induce some to find health and pecuniary profit in this business. In almost every part of the United States honey-producing plants abound; no other country in the world is so rich in them, and yet this great source of wealth is comparatively undeveloped.

By the official report of the Department of the Interior, it appears that there was produced in 1860, in the whole United States, only 23,306,357 pounds of honey, which is about half the amount of maple sugar produced the same year. For the same year the little kingdom of Denmark produced 4,758,260 pounds of honey. The island of Corsica paid, for many years, an annual tribute of 200,000 pounds of wax—which presupposes the production of from two to three million pounds of honey. The island contains only 20,200 square miles. In the province of Attica, in Greece, containing only 45 square miles and 20,000 inhabitants, 20,000 hives were kept, and an average obtained from each of thirty pounds of honey and two pounds of wax. East Friesland, a province of Holland, containing 1,200 square miles, maintained for twenty years an average of 2,000 colonies to the square mile.

I mention these facts here to show what is done with bees in different parts of Europe. Now, if these results can be obtained there, what may not be done among our rich plants, by a system of intelligent bee culture. No part of the world is more rich in honey (excepting, perhaps, California) than Iowa, and yet here, in 1865, were found but 87,118 hives of bees, or little more than $1\frac{1}{2}$ to every square mile. These hives yielded only 1,117,833 pounds of honey and wax, or about $13\frac{1}{4}$ pounds average to each hive. In view of facts like these, how important to encourage, in every possible way, the increase of bees, and circulate facts regarding their intelligent culture.

HIVES.

For fifty years Yankee ingenuity was busy in the construction of hives which should secure marvellous yields of honey and increase of bees. The idea was to invent something which should do the work for them. All such inventions (and their name is legion) proved failures, as might have been expected, since it is a fixed fact that bees will gather and store just as much honey in an old hollow log or an old barrel, *while all is right with them,* as in any hive of any patent. The object, then, in having anything else for them is not to aid the bees in storing honey or raising a brood, but to assist the owner in getting the surplus honey in the best form, without injuring the bees, and also to give him the control of the interior of the hive, so that he can tell what is wrong, and apply the remedy. From the time of Huber such an invention has been thought desirable, but it was not until our day that such a one was made.

Dzierzon, of Germany, in 1838, invented a hive in which the combs were made upon bars, and which were intended to give control of the combs; but they were too imperfect in their construction for general use. In 1852 Rev. Mr. Langstroth patented a hive, in which each comb was to be made on a movable frame which could readily be lifted out at pleasure, and thus a new era in bee keeping was commenced. There is nothing in these hives which is intended to perform the labor of the bees or their keeper. They are simply aids to the work. The great advantage which they possess is the command which they give of every comb, placing it in your power to know certainly the condition of your bees.

In the common hives it is easy to tell when your bees are prosperous and all is right. It is equally easy to tell when something is wrong, but not so easy to find out what that something is. You may perceive that the bees decrease, and suspect that they have lost their queen; or notice that they work with less energy, and think possibly (as is often the case) that they have too much honey stored in combs where the young should be. But there is no way to ascertain positively, and often before you decide the matter it is decided for you by the colony becoming worthless. In the movable-comb hive it is your own fault if you do not know positively all the time that there is no trouble. If a hive is queenless it is soon ascertained by examining the combs, where the presence or absence of eggs determines the matter. In this case another queen, or the egg from which to raise one, can be at once provided. If too much honey has by some accident been stored in the centre combs, one or more can be exchanged for empty ones, which the queen will gladly fill with eggs to replenish the hives.

And here let me say that this trouble I find to be one of quite common occurrence. During a plentiful yield of honey the bees, in their eagerness to store it, often stint the queen for room in which to deposit her eggs. I have often seen this in movable-comb hives, where the remedy can be applied in a moment. This is only one proof among many that it is not always safe to trust to the instinct of bees any more than that of any other animals.

Another advantage of these hives is the facility with which drone comb can be removed, or its building prevented. One who has not examined the matter would be slow to believe how much honey is needlessly consumed every year in drone raising. Here, again, the bee instinct falls far short of reason. When bees live wild, in isolated situations, the rearing of many drones no doubt conduces to the safety of the young queens; yet a preponderance of drone comb is, I am convinced, partly accidental. Late in the season, if honey is very abundant, and little brood being then raised, many colonies construct drone comb to enable them to store faster than they can do in the worker combs. The next spring they do not, of course, tear it down and build others, and, being there, the queen deposits her eggs in it, and drones are thus reared. It is also well known that colonies, while queenless from any cause, build drone combs, if they build any, and in the hives of such colonies there is a surplus for the next year. Now, if a hundred hives are kept together, and drones are raised in one or two of them, it is enough for all. Therefore, it is easy to see the economy of a hive in which drone raising can be restricted at will, and the honey used in raising and afterwards in feeding them be saved. I say "*restricted,*" for I have never found it best to leave any hive entirely without drone comb. It is better to leave a few inches in some central comb in every hive; otherwise, at the swarming season, they will lengthen out the worker cells and raise some drones. If they have room for a few it seems to satisfy them.

Again, the prosperity of a colony depends much on the age of the queen. All must have perceived the difference in prosperity of swarms side by side, in the same kind of hives and in the same location; one will vigorously increase and store up honey, while the other barely lives. In many cases this is caused by the difference in the age of the queen, as any one will ascertain who takes the trouble to mark the hives containing young queens. After the second year the queen is far less prolific, and then much is gained by removing her, which is easily done in these hives. It is objected by some that this is "unnatural;" but I would ask, is it any more so than to kill a hen after she is too old to yield many eggs, or to shear a sheep, or break a colt? Why may we not use bees contrary to their nature as well as domestic animals?

The strengthening of weak swarms is also facilitated by these hives. Such colonies will always be found where many bees are kept, and by the aid of these frames they may be built up into strong and vigorous ones; honey, bee-bread, and young bees being taken from a stand well able to spare it, and given to those perishing from the want of it. In this way many worthless swarms have been converted into excellent colonies. In the fall all such weak swarms may be united with strong ones, which are improved by the addition. In the spring the same thing can be done, and your hives kept always equalized and strong. Old or soiled comb can also be taken away when you please. But the pruning of old comb, which is practiced by many every year, is in most cases unnecessary. So long as it is free from mould, it is good to store honey or to rear brood in. I invariably find, all other things being equal, that bees winter better in old comb than in new. Bees have been kept in the same comb twelve years in succession, doing as well the last year as the first. When the cost of honey in building new combs is considered, the advantage of hives in which you can save all good pieces is very apparent.

It is not necessary to have these frames in a complicated hive; nor in commending them do I mean to indorse the *hundred and one* traps for the ignorant, which in many hives are added to them. You need no slides, nor hinges, nor moth traps, nor patent ventilators, nor non-swarmers. These are not only useless, but most of them injurious to the bees. Neither would I ever keep bees in a hive where the bottom board was fastened to it. On this point I am aware that I am at issue with many successful bee keepers. But for my use I want a hive which can be raised at any time, and the bottom cleanly swept. A plain tight box, well made of seasoned boards, in which the frames can be hung, is all that is really necessary. Any amount of extra outside finish may be added, and it always pays to have hives well painted.

SIZE AND SHAPE OF HIVES.

There is much difference of opinion among bee keepers on these points; and this arises, I think, from the different ways in which bees are wintered. About 2,000 square inches inside is, by exact computation, as much as can be filled by a queen with brood, and allow room for bee-bread and honey for present use. In the fall, as the brood hatches, the empty comb is filled with honey, and this size also admits of room for sufficient winter stores in any season. I once thought that much less than this would winter a colony; but one season, when we had an early frost succeeded by a late spring, and my bees gathered no honey for eight months, I am sure that the size of my hives alone saved many colonies, as they had not a pound to spare in May.

A little too much is no disadvantage, for the more they have on hand in the spring the earlier and faster do they rear young bees. The form of the hive is more a subject at issue than the size. I use one eighteen inches in length by fourteen inches in width, and ten inches deep. It is constructed with an entrance at each end, and as the honey boxes project over these entrances, I have room for eight boxes on the top, capable of containing six pounds of honey each. These boxes can be raised in the height of the storing season, and eight more be put under them; and all being near the main apartment, and easy of access, I often have colonies filling sixteen boxes at the same time. This room for boxes on top I consider an important feature in any hive, for bees often remain idle simply from want of room to labor in. I do not think there is any other form so good as this, where bees are wintered in a house, or in a cellar, or when they are buried; but if bee keepers will leave their bees on their summer stands all winter, I think a taller shape of hive will be found preferable.

Bees naturally cluster *below* their stores, and the heat of the hive then ascends where the honey is, and it is free from frost when the bees go up to get it. In the shallow form, they are compelled to cluster at the sides of the hive, and then, in severe weather, the honey is always cold. I have seen whole colonies die in these hives, leaving an abundance of honey. They simply could not get it without freezing. In the instances of this kind which have come under my notice, too much draught had been allowed in the hive, by having the entrance open below and the holes open on the top. To winter safely out of doors in the shallow hive, the entrance should be closed so as to admit of the passage of only one bee at a time, and the *cap* should be filled with straw or corncobs to absorb all moisture, and but one hole be left open. Winter passages, as they are called, should be made. These are holes an inch in diameter, two or three inches from the top, made in each comb. Through these the bees can pass without being obliged to go over and under the frosty combs, to reach their stores. With all precaution, however, I cannot recommend the shallow hive as suitable for unprotected wintering. The taller hive, with frames to correspond, will be found much less convenient where combs are to be lifted out and examined. In proportion to the depth, the danger of breaking down and the difficulty of lifting out increases; still, if obliged to winter bees out of doors, I should adopt it. I have found little trouble in making bees build straight combs. I may say I have had none, for since the first season I have had no crooked combs. The triangular guides regulate them usually, but if straight-worked comb can be obtained and pieces fastened in a few frames of each hive, it will aid them. After one has a few hives filled with straight comb, so that one frame can be given to each new colony, there will be no further trouble, if pains be taken. There will be uneven places, or pieces of comb made thick; these should be cut down and regulated as soon as perceived—using a knife dipped in hot water for that purpose. It must be borne in mind that it is not enough to have the combs so straight that they can be taken with care out of *their own* hive and replaced there; to reap the full advantage of the movable combs, every one must be straight enough to fit in any place in any hive. For this reason also, whatever form of movable comb is used, they should all be alike; every frame should fit every hive. One who has never tried it cannot imagine the trouble connected with the management of fifty or one hundred hives of different sizes and forms.

The matter of size, shape, and model should be decided with due care, and after bees are put into some of them no changes should be made, even if they seem to be for the better. I would not be understood as advising any one to make or use any form of movable-comb hive without buying a "patent right." "The laborer is worthy of his hire;" and when a lifetime has been spent in bringing to perfection so valuable an invention as this, all the better for its simplicity, the inventor has a right to his reward.

No one should attempt to make a hive without a model, unless he has had sufficient experience in bee keeping to enable him to know just what he wants. In every case they should be well made. The first dozen movable-comb hives which I used I came near discarding, simply, as I now know, because they were so badly made, of unseasoned lumber, that no part fitted as it should.

WINTERING BEES.

Bees are natives of warm climates and their instincts are given them for their protection there. When kept where the winters are severe, or where they are variable with periods of extreme cold, they should be protected in some way. Bees cluster compactly together in winter, and thus maintain their proper temperature. It requires numbers to do this—a small cluster cannot keep up the requisite heat for safety, they therefore freeze. If a thermometer be thrust into the centre of a colony of bees of a proper size, on the coldest day of winter, the mercury will rise to summer heat. The bees are constantly changing, those in the centre moving outwards and the others taking their places. If a bee, in a cold day, gets away from the cluster it is chilled and cannot return. In the coldest weather they remain in a semi-torpid state, and use but little honey. If a swarm is large enough, it cannot perish from cold, but many starve with a plenty of honey in the hive, if it is located where they cannot reach it. Many more are destroyed every season by the moisture of the hive which accumulates in the warm days, and which, by a sudden change of weather, is turned to ice in the entrances, thus shutting out the air.

I consider the requisites to successful wintering in the open air to be, abundant stores, with winter passages through the combs, a large colony of bees, and upward ventilation secured without a draught of cold air passing through the hive.

Under any circumstances it has been proved that bees consume much less honey when protected in winter. A hive weighing 60 pounds in the fall of 1863, wintered out of doors, weighed only 15 pounds the 1st of April, while twenty kept in the cellar the same three months lost on an average only five pounds each. Again, six hives wintered out of doors lost an average of 29½ pounds each in three months, while twenty in the cellar the same length of time lost an average of only 5¾ pounds. Figures like these show clearly that it pays to protect bees in winter.

The time of year when bees consume the most honey is in the spring months, while raising brood fast. The more honey they have on hand in March and

April, the faster they will rear young bees, and the more workers will be ready to gather the harvest from fruit blossoms. The bee keeper who leaves his bees only what honey they can consume, being satisfied if they barely "live" through the winter, is as foolish as the farmer who allows the team on which he depends for a summer's work to be poor in the spring and short of feed. To do a season's work in good shape, a colony should have plenty of old honey on hand until swarming time. To secure this end, leave from thirty to fifty pounds in each hive in the fall, and then protect them in some way.

I have wintered mine very successfully for six winters in a dry and moderately warm cellar, where the thermometer usually is about 30° above the freezing point. Here they are perfectly quiet, not a sound comes from them; they seem to remain torpid. I try not to keep them there over three months, but the want of a proper day in which to put them out has obliged me *twice* to keep them in four months, and no bad results followed. Where many hives are kept, the honey saved in one winter will pay the expense of a house to keep them in, if no good cellar is at hand. Such a house should be dark and tight, and the bees placed on shelves one above another.

A warm still day should be selected in which to put them out again in spring. Some are very careful to place them just where they stood before, but this is not important. When leaving the hive for their first flight every bee marks its location, and if they do remember, as some assert, the old spot, they wisely prefer the new place.

FEEDING BEES.

The best substitute for honey that I have ever found in feeding bees is sugar candy. The sugar should be mixed with water and boiled until it strings, and then cooled in thin cakes. The bees take no more of this than is necessary to sustain life, yet will never starve while they have it. I have tried feeding bees to induce them to rear drones early, and to stimulate them to swarm early, but with no satisfactory results. When I had few colonies, I have fed weak ones to save them; but find it poor economy to keep any stand of bees, under any circumstances, which require feeding—far better to unite all the weak with the strong ones.

In some sections of the country it is a great help to bees to feed them with rye meal before the first pollen-yielding flowers come. Where I live there is generally found a great deficiency of bee-bread in the majority of hives in the spring, and here the advantage of rye meal feeding can hardly be overestimated. As soon as the bees fly freely in spring, put the meal in shallow boxes or troughs a rod or two from the apiary, and attract the bees to them by pieces of empty comb laid near it. They soon learn the way to it and take it eagerly until flowers come, when it will be left untouched. I have had one hundred and fourteen pounds of meal carried away in one day. I have the rye ground and not bolted. Wheat flour will be taken by them, but not as readily. Meal-fed bees will send out larger and earlier swarms than others, because the abundance of bee-bread encourages the rearing of brood.

ARTIFICIAL SWARMING.

It is no longer a matter of doubt that the natural swarming of bees can be prevented entirely, and yet such an increase secured as may be desired by artificial means. Some bee keepers still depend on natural swarming, but my experience teaches me that the only sure way to keep bees with a certainty of regular profit is to take the matter into one's own hands and secure a moderate yearly increase, and, at the same time, more or less surplus honey, according to the season.

All admit that early swarms are the most profitable ones. How it may be in other sections of the country I cannot say, but in Iowa bees prepare to swarm every year by the latter part of May. At that season I find in every strong hive partly finished green cells and young drones; yet not one year in ten do we have more than an occasional natural swarm at that season. The reason, I think, is this: Near the last of May we have almost every year a few cold days, and these cause the bees to destroy their green cells and to cease preparations for swarming. When it is again warm some colonies prepare anew and then throw off late swarms, while others make no further attempt that season. For the last four years I have made all swarms the last week in May or first of June, and my new colonies fill the hives in many cases before my neighbors' bees swarm naturally. The two or three weeks thus saved at the right time are of the utmost importance. Natural swarming has other disadvantages besides being late. The watching for their motions involves a great expense of time and anxiety where many hives are kept. Every year, too, many natural swarms go to the woods in spite of all care, while an artificial swarm, properly made, never does. Some colonies will refuse to swarm at all, and others will swarm until the parent hive is worthless.

It is not difficult to make swarms in the common hive, but with movable combs it is less trouble to make an artificial swarm than to hive a natural one.

The danger is that one just commencing to use these hives is apt to overdo the matter. It is so hard to convince any one without *experience* that he is not growing rich in proportion as his colonies increase in number. If movable frames are not to do the person using them more harm than good, a thorough acquaintance with the internal economy of the beehive is necessary. This is precisely what beginners cannot acquire at once, and yet they are often unconscious of their ignorance. In this, as in everything else, the more one learns the more he feels his deficiencies. I have usually found that bee keepers venture less the second year of their experience than the first. I advise all who commence with the movable comb hives to be contented with a very moderate rate of increase until they have experience to aid them. In this matter, truly, "He that hasteth to be rich shall fall into a snare."

In the early days of my bee keeping I reasoned thus: Since the queen is the only one that lays eggs, the more queens I have by the 1st of June the faster my bees are increasing; for certainly two queens can multiply bees faster than one. I therefore aimed to have as many as possible early. I now see the matter in a very different light; for while it is true that two queens *can* lay more eggs than one, it is not certain that they *will*. On the contrary, I find, invariably, that the increase of brood is in proportion to the strength of the colony. If a queen in a weak colony should lay many eggs, they could not be reared when hatched, for want of honey and nurses. If many eggs are laid in such hives, they are destroyed, some say eaten, by the workers. The queens seem to have the power of increasing or decreasing their laying at will. If a queen be taken from a small colony and placed with a larger and more populous one, she soon increases in size and lays freely.

Examine a weak hive, poor in store, in the spring and you will find but few cells of brood, while a strong one in the same apiary, and under the same circumstances of season and weather, will have sheets of comb filled with it in all stages. Exchange the queens in these two colonies, and one will increase and the other decrease her laying. If this fact is borne in mind, it will be understood why one strong colony will raise more brood than several weak ones, and that it is more profitable, especially in the spring, to have many bees in one hive than to divide their strength as is frequently done. Under no circumstances is there either pleasure or profit in weak colonies. The more of them a man has the less he will like bee keeping.

One plain rule should be borne in mind in artificial swarming: "Never cripple the strength of the colony where the queen is to remain." As soon as you do this her laying diminishes. If she is driven from the hive with the new swarm, have the largest part of the bees with her in the new hive. If she is left in the old hive, leave abundant stores and young hatching bees with her, and she will be stimulated to increase her laying to replace the bees taken. It is wonderful how many bees, eggs and brood can be taken from one queen in a single season, if she is left in a strong hive well provisioned.

Instead of dividing hives, as some do, in artificial swarming, I now prefer to take brood and bees at different intervals from hives, as they can spare them, and with these build up new colonies. For instance, you have six swarms in movable comb hives. No. 1 you will not touch, but from the remaining five you take in succession two frames, each from near the centre of the hive, placing empty frames in their stead. Shake the bees off the frames, being careful that you take no queen on them.

Place the ten frames thus obtained in a new hive; then remove No. 1 to a new place, a rod or even more away, and set the hive containing the frames in the place where that stood. This operation should be performed at a time of day when many bees are in the fields, and these, as they return, will crowd into the new made colony and labor in it as well as in their own. The colony having no queen they will proceed to raise one, as they will find plenty of brood for the purpose. If, when just made, a young queen can be given them, raised in a small hive, you have a safe, sure way of increase. The hives from which the frames of brood are taken will not be crippled by it, but, in many cases, will be actually the better for it.

This operation can be performed again in two weeks if desired. The hive which you remove will not lose as many bees as if it had swarmed, but will soon be as populous as ever, and, usually, will have no inclination to swarm that season.

Two things are to be avoided in making new colonies. One is, never to leave many bees in a hive which is queenless, and raising a queen. If there are too many bees in a hive which has no queen they store honey in the combs where brood should be, and after the new queen is ready to deposit eggs she is driven to the outer combs for empty cells, and her brood cannot be as well cared for. I have seen many hives suffering from this cause. Again, never leave a queenless colony large enough to build new comb, as all the comb they build until they have a queen will be, invariably, drone comb.

Many ways of making new colonies without disturbing the queen or diminishing her laying will suggest themselves as one becomes familiar with the business. If care be taken never to weaken colonies containing queens, and if the young queens are reared for the new swarms in small hives, the number of colonies can be increased four-fold more safely than they can be doubled in natural swarming.

Whichever way you practice, *do all of it early.* Better far to leave the bees where they are than to make a swarm late in the season.

SWARMING *versus* NON-SWARMING.

There has always been a class of bee keepers who have not cared to increase their bees, but have simply wished to keep a few colonies in the best way to obtain honey for their own use, and who have neither the time nor disposition necessary to an extended business. To meet their wants, numerous bee palaces and non-swarming hives have been invented, which have all proved failures. Great yields of honey have often been obtained in these hives for one or two years, and then the bees usually died out. The reason is obvious; for, if swarming is prevented, some way must be provided to renew the queens every two or more years, for swarming is the method by which nature arranges this.

The high price of lumber for hives, and the great demand for honey in 1864, made it a good time to try what could be done in the way of restricting swarming, or preventing it altogether. I had tried the non-swarming blocks in the Langstroth hive, but found it impossible to make them of practical use. If kept close enough to prevent swarming they interfered much with the flight of the workers; besides, they did not, in any case, prevent the preparations for swarming which consume much time and honey.

Early in the spring I made some colonies very strong in numbers, and rich in stores, having them as strong as they usually are in June, hoping in this way to secure early box honey. I failed in this; for though the bees commenced working in boxes they stored slowly, and not a box was filled before June; but they all reared quantities of brood, and were ready for very early swarming.

Ten of these doubly strong colonies I treated in this way: I took from the centre of each hive, every week in June, a frame of brood and honey, supplying its place with an empty frame. Two of these swarmed in spite of this, and as the frames taken out were used in forming new colonies, it would not have been called a "prevention of swarming" if none had swarmed. Those that did swarm were, at the time, storing in sixteen boxes each, proving that bees do not migrate always for want of room.

From twenty of these strong colonies I took, in June, their queens, replacing them with young ones just commencing to lay, or with queen cells ready to hatch. Not one whose queen I changed in this way swarmed, but all worked on seemingly with new energy through the season, care being taken to give them ample room in the main hive for brood, and to change full boxes for empty ones as often as necessary. The quantity of honey obtained from each of these hives varied much. The least obtained from any one was fifty pounds; the greatest yield from one was ninety-six pounds, the average to each being sixty-two pounds. The colonies which swarmed that year all made some honey in boxes, the average being fifteen pounds. The swarms from these also stored honey, the average being thirty pounds. Thus we have an average of forty-five pounds (fifteen from the parent hive, and thirty-four from the swarm) from the swarming, against sixty-two pounds from the non-swarming hives. From the former a good colony was obtained to offset the seventeen pounds more honey averaged from the latter. These experiments were all made with the common bees.

I had previously made an ingenious calculation of this sort: "The bees consume twenty pounds of honey in forming one pound of wax. The empty comb, in a hive the size I use, (2,000 square inches,) weighs three pounds. Thus, sixty pounds of honey are consumed in making the empty comb alone to furnish the new hive. At least sixty pounds more will be used in storing the comb and raising the brood to populate it, and thirty more to furnish it with winter store. This gives one hundred and fifty pounds of honey spent on the new colony. Supposing the bees to have remained in the old hive, this one hundred and fifty pounds might have been stored in boxes." Now, this calculation is all true, but the fact remains that the bees will not put as much honey into boxes as they will gather to stock and store a new hive. The empty home stimulates them; their necessities drive them; and they "work with a will" under such circumstances, as all know who have noticed the untiring energy of a new swarm.

In the summer of 1865 I tried this plan again on a larger scale, giving to each of thirty-seven hives, in May and June, a young queen in place of an old one. Only one of these swarmed, and, in that instance, I was quite sure that they destroyed the queen given them and raised others, and this caused them to swarm.

Writers in Germany assert it as an established fact "that changing an old queen in any hive for a young one of the current year, *before preparations for swarming have been made*, will prevent it for that year." I am not prepared as yet to say that this will always be effectual, nor can I assign any reason satisfactory to my own mind why it should prevent swarming. I have given the results of my experiments, and they certainly go far to prove the fact. I would recommend all who are Italianizing their bees to try this plan, and see if like results follow from their change of queens. If swarming can be prevented in this way no better method need be sought, as it secures young and healthy queens in all hives. The rearing of queens and exchanging them is a very simple matter, and if there is a demand for queens, those taken away can be sold instead of being destroyed.

The price of honey and the demand for bees in different places must decide which is most profitable to raise, bees or honey. In most places I think bee keepers will find it pay best to secure a moderate increase every year by making one swarm, very early, from four or five old ones. In this way, quite as much, if not more, surplus honey will be obtained as when there is no increase, and the value of the new swarms (whatever that is in your locality) is just so much extra profit.

To the class of bee keepers who prefer the non-swarming method, a statement from the German Bienenzeitung (or Bee Journal) of February 15, 1864, made by M. B. G. Klein, will be interesting. He lives near Gotha, limits his apiary to eighty hives, restricts swarming as much as possible, and unites such swarms as do come with the colonies found to be weakest in the fall; carefully preserves the combs made by them for use the next spring, and winters them in the shallow, movable-comb hives; but does not say whether in doors or out.

From eighty hives he obtained *a profit* in 1861 (a very favorable year) of.	$601 82
1862, (an exceedingly poor year)	76 87
1863, (a good year)	246 96

The average price of honey there is only about eight cents per pound of our currency. Though this may seem a satisfactory profit, it is small compared with what has been obtained from bees when allowed to multiply in this country. I cannot give statistics of the amount of profit from bees in other States, but some results in Iowa far exceed this.

E. G. McNiel, of Tipton, Iowa, says: I shifted 6 colonies of bees out of logs into the Langstroth hive for a gentleman, in May, 1859; that year he increased to 24 and took off 500 pounds of honey. The next spring he began with 18 weak colonies and increased to 46. This year (1860) he took off 1,000 pounds of honey. In 1861 he increased to 60 colonies, and took off 2,200 pounds of honey. In 1862 he increased to 104 stands, but, it being a poor season, he obtained only 1,500 pounds. In 1863 he increased to 160, and took off 3,000 pounds of honey. Thus he obtained 8,200 pounds of honey and 154 colonies in five working seasons.

I am not prepared to give an accurate statement of each year's gains, either in honey or stock, since I commenced bee keeping; but in the spring of 1859 I purchased four hives for $20, two of which died before flowers came. In the autumn of 1865 I was offered $1,500 for my stock of bees, but declined selling, as they are worth much more than that to me. Thus we have, in six seasons, an increase from $10 to $1,500 in the capital alone, with no account of honey sold each season, or of bees sold repeatedly.

During the summer of 1864 I sold from twenty-two hives $409 20 worth of honey. Two of these seasons are called the poorest ever known in Iowa. What branch of agriculture or horticulture pays better than this?

UNITING BEES.

In the fall, in every apiary, some weak stands will be found. Some will have too few bees, others too little honey. In the old-fashioned bee keeping such colonies were destroyed by fumes of burning brimstone, and the honey and wax appropriated. This is a very expensive way, and, with the movable comb-hives, not a bee need be lost and all comb may be saved for the use of the bees in the future. All can see that it is poor economy to let bees live until they consume all the honey, and then die of starvation; better the old way than this. But if one containing enough honey but too few bees be united with one that has numbers and but little honey, they make one valuable stand. So two weak ones united make one good one; for a large colony does not consume nearly as much honey, proportionally, as a small one. In the spring, too, in spite of all care, some will be weak; and these are much more profitable if united with strong ones than if nursed until flowers abound.

Bees can be easily united, and will work as one colony. Some sprinkle both with sugar-water scented with peppermint, or other strong odor, to give both the same scent, and then put both in one hive. I find it easy to do it without this, and never have any difficulty in the operation.

I alarm the bees of both hives which I wish to unite, then leave them a few moments to fill themselves with honey. I then put one of them over an empty hive, (my hives have movable bottoms,) take each frame out, and shake or brush the bees into the hive below. When all are out, set the other in its place and proceed in the same way. The bees all brushed together thus into an empty hive are too much frightened to quarrel. I then arrange all my frames containing honey in one hive, and set it over the one in which the bees are. They all go up rapidly and take possession of the frames like one colony. One of the queens will, of course, be *killed;* so if you have any choice between them, find out the one you care least for and destroy her.

Every empty comb should be saved; indeed, no piece of good worker comb should ever be melted for wax—it is worth $5 a pound in honey boxes or fastened into the frames for the use of the bees. I once tried an experiment which convinced me of the great saving in providing bees with empty comb when it is possible. I had two large natural swarms come on the same day. One of them I put into an empty hive, and the other into one well filled with comb. The one in the empty hive filled it up for winter, but stored no surplus honey. The other not only filled the combs, but stored fifty-two pounds of honey in boxes. There was no apparent difference in the size or circumstances of the two swarms. The value of the comb, melted for wax, would not have exceeded a dollar at that time; while the honey sold, at 15 cents per pound, for $7 80. Straight worker combs, in movable frames, are better than cash capital to a bee keeper, and should be most carefully saved. Combs must be kept until wanted for use in a cool dry place, to guard against mould. Mice are very destructive to them. I hang mine on a rack where mice cannot get at them, and where they have abundant air. Two or three frames filled with worker comb, given to a swarm when it is first made or hived, are a great help, and cause them to build all their combs straight.

HONEY RESOURCES.

Every bee keeper should know the honey resources of his range. They differ much in different localities. My apiary is near a river bottom, where the bees have a large forest range, and here there are few days from April to October in which they do not find honey. In many localities much may be done to increase the yield of surplus honey by keeping buckwheat in blossom most of the summer. Germans estimate the yield of honey from one acre to be from 320 to 350 pounds. This crop, however, yields much more honey some seasons than others. Bees do not like buckwheat when they have anything else; and several seasons when I have had acres of it sowed for them, I have obtained no pure buckwheat honey, while another year the buckwheat sown for them the last of July has added many pounds to my surplus boxes.

White clover yields much honey for several weeks, and where it abounds bees are sure to do well. The Alsike or Swedish clover, where it has been introduced, is of great benefit. Black or common bees cannot reach the honey in red clover; the Italians can and do, under some circumstances. In the latter part of July, 1864, my common bees were idle and losing weight daily; but my Italians steadily stored honey in boxes. I took off twenty six-pound boxes from the Italian colonies, while the others did nothing. It was evident that they were obtaining it from some source not accessible to the common bee. On visiting fields of clover at various times I found it always swarming with "yellow jackets." On account of the drought the blossoms were smaller that year than usual. Late in September and early in October in the same year I had several boxes filled by the Italians after the common bees had done storing; and this honey, I doubt not, was obtained from the second crop of red clover. In some sections, rape and mustard, if sown for the purpose, would come in and fill up in time of scarcity.

It is recommended by some to cultivate borage for bees. It undoubtedly has honey in it, and is a favorite with them. But there are few regions of our country where it will pay to sow it. It is an annual, and is easily grown. It is better than weeds that have no honey, if that can be called praise. If any one watches his bees closely one year he will discover at what date they are idle, and easily arrange for another season to have some honey producing plants in blossom just when they are needed. By this way one may add many pounds to his surplus honey.

In Europe it is customary to move bees from place to place, as different crops come in bloom, and much attention is paid to raising crops which, in addition to other value, yield honey. In few parts of our country will this ever prove necessary. Wherever I am acquainted with the resources, it seems to me more necessary to have strong colonies at the right time if we would secure large honey crops.

The vicinity of bees to water is a matter of more consequence than would be supposed by one who is not acquainted with their habits. It is asserted that a colony of wild bees is never found elsewhere than near a stream, lake, or river. Bees use much water, both in preparing winter food for their young, and when they themselves are secreting wax. If no water is near the apiary, shallow troughs, with floats in them, should be kept constantly filled with water for their use, and in this way much time and labor be saved them.

THE BEE MOTH.

The injury done by the miller and its progeny of worms has been overestimated. Undoubtedly, before its advent, it was comparatively easy to care for bees. Then weak swarms could be saved and nursed into good stocks, while now they are quite sure to be destroyed by moths. In all my experience with bees I have never yet seen a good or valuable stand injured by worms. I often find them in such hives, but the bees gnaw them out and they do no real harm. But if a hive becomes queenless, or reduced in numbers, it is soon overrun. In every stock that I ever examined something was wrong before it became a prey of worms.

Much time and trouble may be saved to the bees by looking out and destroying every worm, especially in the spring. As they have four generations in one season, every one destroyed then sensibly diminishes the number. Many of them hide in "patent moth traps," and it is a good plan to catch them; but I have seen so many allowed to *hatch* there before they were caught that I cannot recommend them. To careless bee keepers, they are worse than useless; and painstaking ones do not need them. I often hear it charged that the miller is much worse in movable-comb hives, and has "much increased where those hives have been introduced." This may be, and probably is true, though not from any fault in the hives. The principle they involve is a perfect protection against the moth, but they have made the multiplication of colonies so easy that, with young beginners, many more weak colonies abound. Where a hive contains more combs than the bees can cover, the millers have a fine chance; and where a large hive has but a small colony in it, the other half is a fine shelter for them. For those, and those only, who have learned by experience that the only safe way is to keep bees strong in numbers, under all circumstances, the miller has no terrors. Patent hive vendors, who know nothing of the natural history of the bee, and care less about it, so that by some plausible story they dispose of a right, are the worst enemies of the bee that I have ever known.

Hundreds of valuable stocks have been ruined, within my own knowledge, by being transferred from one hive to another in a wrong way, or at a wrong season, or by being divided without regard to the principles which should govern the matter to make it successful. When we can enlighten people on the science of bee keeping, and awaken an intelligent interest in the subject, commensurate with its importance, we shall develop one of our great natural sources of wealth to an extent we have never yet approached.

THE ITALIAN BEE

Has now been so generally introduced into all parts of our country, and is received with so much favor, that it may seem superfluous to touch upon it here; but as I still see various queries as to its value compared with the common bee, I may be allowed to give some statistics. It is quite common to see accounts of the great yield of honey from a single stand of bees; but isolated cases of this kind prove nothing. The only fair way to decide the matter is to take these bees side by side with the others, under the same circumstances of season, pasturage, age of queen, and management. This has often been done, and always with results overwhelmingly in favor of the Italians.

In the summer of 1863 I had but two stands of Italian bees, and those not pure. One of these stored 110 pounds of honey, besides giving three swarms. The other gave two swarms and stored 96 pounds of honey. All the swarms filled their hives, and some of them stored honey in boxes. I had, the same season, 56 hives of common bees; but not one of these stored a pound of surplus honey, though a part of them were divided. That was the poorest honey season ever known in this section.

In the summer of 1865 I averaged, from nine Italian colonies, 119 pounds each. The best of these shows the following record in my journal: One full swarm taken from it the 20th of May; 156 pounds of honey taken in boxes; stored by the swarm, 80 pounds; from the swarm there came a swarm, August 15, which filled its hive and partly filled two boxes. Thus we have 236 pounds honey, besides two large swarms, from a single hive! The same summer I had 30 stands of common bees, which I prevented from swarming, yet with no increase from them. I obtained only 1,655 pounds of honey, or an average of about 56 pounds to each. The largest yield from either was 96 pounds.

In 1865 I had an average of 93 pounds from six Italian colonies, all of which were divided once, and much disturbed by taking brood from them to rear queens. During the same time I did not take a pound of honey from any colony of common bees, though I divided them all, and gave each an Italian queen.

I claim that facts like these are conclusive. All my bees were wintered alike and all in the same kind of hives, were made as equal in strength in the spring as possible, and enjoyed the same range. I might quote pages of testimony to the same effect from others; proofs abound wherever the bees have been tried in the same way. If I am asked the reasons for so decided a difference, I can hardly give such as are satisfactory. The bees do not differ much in size, but the Italians are more industrious; they work earlier in the morning and in colder weather. I am not prepared to say that they are more hardy. If they winter better, as some assert, I think it is because the queens lay later in the fall, and thus keep the colony strong in numbers until cold weather. They have access to flowers which are useless to the common bee. That their bill is longer, any one can prove to his satisfaction in this way: Fill a tumbler with diluted honey or sugar sirup, cover it with wire cloth or perforated tin; have it so full that the contents touch the cover, and set it near bees of both kinds. After the black bees have taken it as long as they can reach it through the wire, the Italians will be found still upon it, filling their sacs and evidently lowering it.

Not only do they store more honey, but their queens are much more prolific than the black queens. It is wonderful how much brood may be taken from one of these queens. From one hive the last season I took thirty-two frames of brood and eggs at different times from which to rear queens, and from another thirty-six frames, yet both hives are as strong this fall as any of the common ones from which only one swarm had been taken. As ten frames fill one of my hives, it will be seen that this was equal to three full swarms from one, and more than three and a half from the other.

CHANGING FROM COMMON TO ITALIAN BEES.

The ease with which this is accomplished brings Italian bees within the reach of all, in every part of our land. Pure queens are raised by reliable persons and sent, as ordered, anywhere with perfect safety. If it was necessary to purchase and transport full colonies, the work of introducing the new variety would be much more difficult and expensive. Now, any one who is convinced that the Italians are better and more profitable can order one or more Italian queens, and from them raise others to supply all his hives. Many and full directions have been given how to Italianize, but still the plain, simple way seems to be little understood. Having been engaged in the work for three seasons, I shall try to give some hints which may be valuable to those commencing in it.

The queen being the mother of the whole colony, it follows that if a pure Italian queen be given them instead of their own all the bees reared after the change are Italians; and as the bees already there die off they are replaced by the others, and the stock, in a short time, is fully Italianized. By a *pure* queen, I mean one of pure stock, and which has been fertilized by an Italian drone. There has been much stock reared in this country which is *hybrid*. By this I mean the progeny of a pure Italian queen fertilized by a common drone. This, in the *first generation*, is hard to be distinguished from the pure; but it soon degenerates. As the drones are *invariably* like their mother, those reared from such hybrid queens are *always pure*. This fact should be borne in mind, as it makes it comparatively easy to keep the stock right.

The queen with which you commence should be pure beyond doubt. Purchase of some one who will warrant her, and whose guarantee you can trust—remembering that in the beginning you will be no judge of their purity. The fall is the best time to purchase your queen, because she will then be ready for early operations the next season. Introduce her into the best and strongest colony you have, for safe-keeping through the winter. If you have but few colonies, the work for the next spring is very simple. About the middle of May, if you examine the hive containing your Italian queen, you will find drones in all stages. Then take the queen out and confine her in a cage made by rolling a piece of wire cloth, four inches square, into a tube, tying it firmly, and putting a wooden stopper in each end. Next remove from another hive its queen, and having killed her, insert the queen cage between the two frames, and keep her there forty-eight hours. Then release her, and that hive has an Italian queen. The one from which you took her will preserve its pure drones with care, and immediately proceed to rear queens. In ten days you will find from six to twelve queen cells nearly ready to hatch. Then take from as many hives as you have queen cells their queens, and leave them queenless about ten or twelve hours. Then from one of the hives take a centre frame containing brood, cut a hole two inches in diameter; cut out one of the queen cells from the hive containing them, with a little comb each side of it, being very careful not to press or injure it in any way; dip the edges of it in a little melted wax and insert it in the frame, and put it back in the hive. In nine cases out of ten this cell will be gladly received by the bees, and hatch in a few days. This process can be repeated with as many hives as you have cells, and if done by the last of May or first of June you may be quite sure that these young queens will be fertilized by Italian drones, *because you will have no others in your apiary so early in the season.* One or more cells must be left in the hive where they are reared, that it may be sure of a queen; and all your hives should be examined from time to time, to see that the cell in each hatches, and then to be sure that the young queens all lay at the proper time. I usually find them depositing eggs between the third and twelfth days after they hatch. If any colony fails to secure a fertile queen in this way, insert into it, from the hive which now contains your Italian queen, a frame containing eggs, and from that they will rear others. Before doing this, look over all the frames carefully to see that they have not commenced cells from their own eggs.

After you have a fertile queen in each hive, watch the young worker bees as they hatch, and if all, or nearly so, are slender in form and have three distinct golden rings, you may *hope* they are pure. If there is a doubt about any one, you can exchange it for another at your leisure. Bear in mind that the main thing the first season is to get a young queen in every hive, reared *from the one you purchased.* That accomplished, all your drones will afterwards be pure, and young queens reared from that time forth will be quite sure to meet pure drones. The following spring your hives will have drones in them two weeks in advance of all black bees in the neighborhood; and if yours are strong, and you make early swarms, the chances are much in favor of your queens being purely fertilized.

The second season of your operations all doubtful queens should be replaced; and if pains be taken you can easily have none but pure queens in your hives while the original queen which you purchased lives. I find the temper and disposition of the bees a better test of purity than their markings. The Italians are more easily managed, and less easily provoked to anger. If you open a hive of them and lift out a frame, instead of flying about in all directions and getting in a rage, (as do the black bees,) hardly a bee leaves the comb—all cling to it quietly until it is replaced. Where you find them thus clinging to the comb you have one good mark of purity.

The only *certain* test that I rely upon is the color and markings of a queen's *royal* children, or the *queens* reared from her. The female bee is invariably like the father, and the queens are the only *perfect* female bee. If you rear queens from a queen, and they are well marked and colored, you may be sure she is purely impregnated.

I had a number of fine queens last season whose worker progeny was so well marked that I had little doubt of their purity. Yet on rearing queens from their eggs they are not like their mother, and *their* eggs, when tested, produced queens hard to be distinguished from common ones. This fact will explain why the Italians, in careless hands, so soon degenerate. There is no need of this if the queen you purchase is pure, and you take pains the *first* season to put a queen reared from her into every hive you have; and, in the *second* season, to replace all which show impure marks.

The most difficult part of this process, as I have described it, (and it is more easily done than described,) consists in *finding the old* queen. At swarming time (the best season to do it) the hives are or ought to be populous; and to the beginner it seems a formidable operation to look the frames over, and find *one bee* among so many. Place an empty hive by the side of the one you wish to examine; after opening the latter very gently, sprinkle it well with sweetened water. It is better not to alarm them by the use of smoke when you wish to find the queen. Begin near the centre, and take out a frame, and look carefully on each side of it. If she is not on it, put it in the empty hive, and take out another, proceeding in the same way. If the queen is found on neither of them, spread a sheet before the hive which now contains the frames, and empty upon it the bees that remain clinging to the hive. If she is among them you will see her as she passes into the hive. If you do not find her, return the frames to the other hive, examining them with care. I have often found the queen on the first frame I took out; and then, again, have taken them all out three times before seeing her. There is little difficulty in finding Italian queens; they are not disposed to hide, and their bright colors make them very conspicuous.

Those who are Italianizing large apiaries, or rearing queens for sale, need no advice in the matter, yet may be interested in some items of my experience. I have succeeded better in rearing queens in moderately large hives than in the small ones generally used for the purpose. I now have my nucleus hives, containing three frames, the size of my large hives. A hive containing twelve frames, which can be divided into four parts at will, is very convenient, the entrance into two of the parts being at the ends, and in the others at the sides. Such a hive is warmer than a single nucleus, which is important in the early part of the year.

If such a hive contains a pure Italian queen, and she be taken from it in May, there will be eggs in each of the four parts when the dividers are put in, and from thirty to forty queen cells will be started at once. In ten days as many of these as you please can be cut out and given to other hives, but four or more should be left in it. The young queens hatched in these hives are very sure to mark their place when they go out for their excursions, as the size and entrance make it peculiar in appearance.

Much complaint is made that the whole colony is apt to go out from a nucleus hive when the queen leaves for impregnation and does not return; thus queen and all are lost. There is a sure remedy for this: Bees never desert a hive, large or small, while there is brood in it. If, then, a frame containing eggs and larvæ be given to the small colony from another hive, about the time the queen will hatch, the bees will not desert it. Some have trouble in making the bees build more than one or two cells in these little hives. That is because they do not have a large proportion of *young* bees in them. The young bees of the current year are the ones that work the wax and build queen cells. They may be seen before they are twenty-four hours old at work on them. Keep plenty of bee bread and honey in the small hive, and supply it with water and young and hatching bees, and you will have numerous cells.

Be always sure that, in the hives where you are rearing queens, there are no eggs except from a queen of undoubted purity. It has been declared impossible for bees to remove their eggs from one cell to another, but I now know that they do so. Last year I put into nucleus hives, each, a frame containing eggs, while the other combs, full of honey and bee-bread, were those preserved from hives from which the bees had been taken, and which had been all winter in a cold room. By no probability could an egg have been in these, yet repeatedly were green cells built in them, and perfect queens hatched from them. I do not pretend to say how the bees remove so delicate a thing as one of those little eggs without injury; but is it really any more wonderful than some of their other operations?

I have reared queens every week from the 1st of April to the last of October, and could perceive no difference in size or coloring at the different seasons; but out of eighteen reared in April last only two became fertile; and of twenty-two reared in October, all but four were lost, while nearly all those reared in May, June, and July were impregnated.

I do not find the pure Italian queens larger in size than the common ones; but queens reared from a pure Italian mother, fertilized by a common drone, are often very large and handsome. The colonies of such queens are, in every respect, equal to the pure. All such queens may be safely preserved, as *their drones are pure.* But no queens should be raised from them, and if swarms issue from their hives the queens should be taken from them and pure ones given them, for *nothing pure* comes from a queen reared from such queens. No one should be contented to stop short of giving a queen *which will produce pure drones* the first season to every hive he has, whether it be one or one hundred. This accomplished, your work is more than half done. The importance of this is manifest, for you will then have no common drones in your apiary the second season. When this is the case you can keep your own colonies strong, "swarm" them early, and have little to fear from outsiders.

So long as you have common drones a large proportion of your queens will meet them. I raised one hundred and forty-three queens the first season, which became fertile, and though I had many Italian drones in a dozen hives, and suppressed the common drones as much as possible, only twenty-six of my young queens were fertilized by Italians.

It is said, and I doubt not with truth, that in all Italian stock brought to this country there is a taint of impurity. This is of little consequence if we keep our stock pure. By exercising proper care, we can not only keep them as good as the original, but also do much to improve them. I have several young queens even more beautiful than those I bought, and queens reared from them are as fine as any I have ever seen. Every one which does not produce pure drones should be replaced as soon as this is discovered, and those which are only hybrid may be changed before swarms are taken from them. All this requires care and patience, but it pays well to take this care.

In no way can the yield of honey be so sensibly increased as by introducing the Italian bee into different localities. As it replaces the old variety a great change will be observed.

I cannot think it wise for those rearing queens to sell to send out any but those tested and proved pure. The practice of selling hybrid queens, or of sending those not tested, to those who are commencing in the business, promising to replace them if not pure, is a bad one. The beginner (who, perhaps, has never seen an Italian bee) cannot himself be a judge of purity, and in nine cases out of ten will be satisfied with what he gets, and rear from it. Though he will find any mixture of the Italian blood an improvement on his old stock, yet, in the second generation, he will have *nothing pure,* and be disappointed and discouraged. One had better pay a large price for a queen warranted pure by one whose reputation is at stake in the matter than to get a hybrid cheap, and find, in a year or two, that he has had all his trouble for little or nothing. I would advise every one purchasing a queen to clip her wings before putting her in a new home. It not only prevents her leaving the hive with a swarm at any time, but you are always sure that she is the one you bought, for bees often destroy a queen for no apparent reason.

SUBDUING BEES, BEE-DRESS, ETC.

I find a great difference between the Italian and common bees in their irascibility. The former are much more easily managed. Still the timid will do well always to use some precautions. Sprinkling with sugar water is the best means of subduing them when you wish to open the hive. If you wish to find a queen readily do not use smoke, it induces her to hide; but for any other examination of the hive it answers well. A wire hat with a deep curtain to it, and a pair of rubber gloves with gauntlets, make a perfect protection against stings. The gloves are very expensive, as they soon wear out from contact with the bee glue or propolis. I find a pair of woollen mittens, with thumb and finger, as knit for soldiers' use, quite as good protection. They should be dipped in cold water before using. From these glue can be easily removed. A quiet, fearless manner when among bees does much to prevent their anger. No stand should ever be made angry; they do not soon forget it, and after they are once enraged they are difficult to subdue.

ADAPTATION OF THE BUSINESS TO WOMEN.

Health is to be derived from it. The ancients called the honey bee "Deborah, or she that speaketh." Would that its gentle hum might now *speak* to many women in our land, and awaken an interest in a pursuit so interesting, and, at the same time, so profitable. The quick observation and gentle handling, so requisite in the business, belong peculiarly to women, and there is no part of it which is laborious, or that may not be appropriately performed by them.

It has proved to me of great benefit. I came west twelve years ago, under sentence of speedy death from one of New England's best physicians, yet now rejoice in perfect health restored. More than to all other causes I attribute the change to the interesting occupation which has kept me so much of the time in the open air, and *paid me for being there.* I most heartily recommend it to others, who are seeking either health or a pleasant and profitable employment.

WHITE CHESTER BREED OF SWINE.

BY PASCHALL MORRIS, PHILADELPHIA, PENN.

The most approved and desirable points of the white Chester breed of swine are length and depth of carcass, breadth of back, small bone, very small head in comparison with the size of carcass, full ham, shoulders full and well pushed towards the head, leaving little or no neck, heavy jowl, dished face, thin skin, straight hair, and straight back.

The engraving represents a large and fine animal, combining in considerable perfection all the above points. He will be sixteeen months old on the 1st of January, 1867, and is estimated to weigh at that time, when he will be slaughtered, at least 550 pounds. His face is remarkably small. This is one of the most difficult points to secure, and is often an indicator of the rest of the figure, as well as of fattening properties. I have always found that a hog with a dish-face, short nose, small head, and breadth between the eyes, is right nearly everywhere else, and is an easy and quiet feeder. On the other hand, a long nose, and a long and large head, indicate, in a general way, a hard and uneasy feeder and a great consumer.

The white Chester breed of swine is not an original, but a "made-up" breed, being a cross between the best native stock of Chester county and an imported Bedfordshire boar. He was imported by Captain James Jeffries more than forty years ago, and his stock was well distributed over the country. The differences now observed, sometimes, in the white Chesters, so that they can hardly be identified as one breed, are owing to the extra care taken by some farmers in selecting their breeding stock, or to their various fancies. Some prefer an erect ear, others a lop-ear; some prefer a slight curliness or wave of the hair, others to have it perfectly straight; some do not wish a large carcass, but a small and compact one, attaining a weight, at a year old, of about 300 pounds. The western farmers, living where corn is plenty, require a very large animal. These differences do not detract from the merits of the Chester county hog, as regards good general figure, easy feeding, and capacity to return a greater weight and value for food consumed than any breed now known. Farmers who breed for weight usually estimate a gain of one pound per day till they are two years old, and these very often far exceed this. They have attained a weight of over 900 pounds, and 500 to 600 pounds is very common.

That the Chester county pig is not an original, but a mixed breed, is proved in the very great variety in their appearance and in feeding qualities. Like does not produce like in all cases; and what is called "breeding back" is quite common. There is no absolute certainty of the offspring being like either sire or dam. Very fine and perfectly-shaped sows often have indifferent pigs, and very fine pigs are also occasionally produced from ill-shapen mothers. Sometimes blue spots on the skin and black spots in the hair occur. These are probably to be traced to a cross of Berkshire, a breed at one time quite common in Chester county. Improved stock of every description, to be kept up to a certain standard, *requires continuous care in breeding and feeding.* Hence the common saying, as respects swine, that "the breed is in the trough." While it must be admitted that the good points and properties of the Chester county breed are not so confirmed and established, that like will always produce like, there is yet, taking the best samples, so full a development of nearly perfect figure, quiet habits, and fattening tendencies, as to make a capital ground-work, which some energetic farmer may use as a starting point, as Bakewell, and Ellman, and Webb did with sheep, and bring up the white Chesters to a still higher standard and a more determined type.

The hog is often the poor man's main reliance, every portion of it being susceptible of use; and if his weight at a given age can be doubled on the same amount of food, a vast benefit will be conferred on the economic interests of the masses, and a large addition to the aggregate wealth of the country.

MODEL PIGGERY.

BY PASCHALL MORRIS, PHILADELPHIA, PENNSYLVANIA.

The plan of the piggery delineated in the accompanying engraving is susceptible of reduction or extension, for a larger or smaller number of pigs, and is intended to supersede the not only useless, but objectionable as well as expensive, mode of constructing large buildings under one roof, where confined and impure air, as well as the difficulty of keeping clean, interfere greatly with both health and thrift. Twenty-five or thirty breeding sows, farrowing at different periods of the year, can be accommodated under this system of separate pens, by bringing them successively within the enclosure; or an equal number of hogs can be fattened without any crowding or interference with each other. Some two years

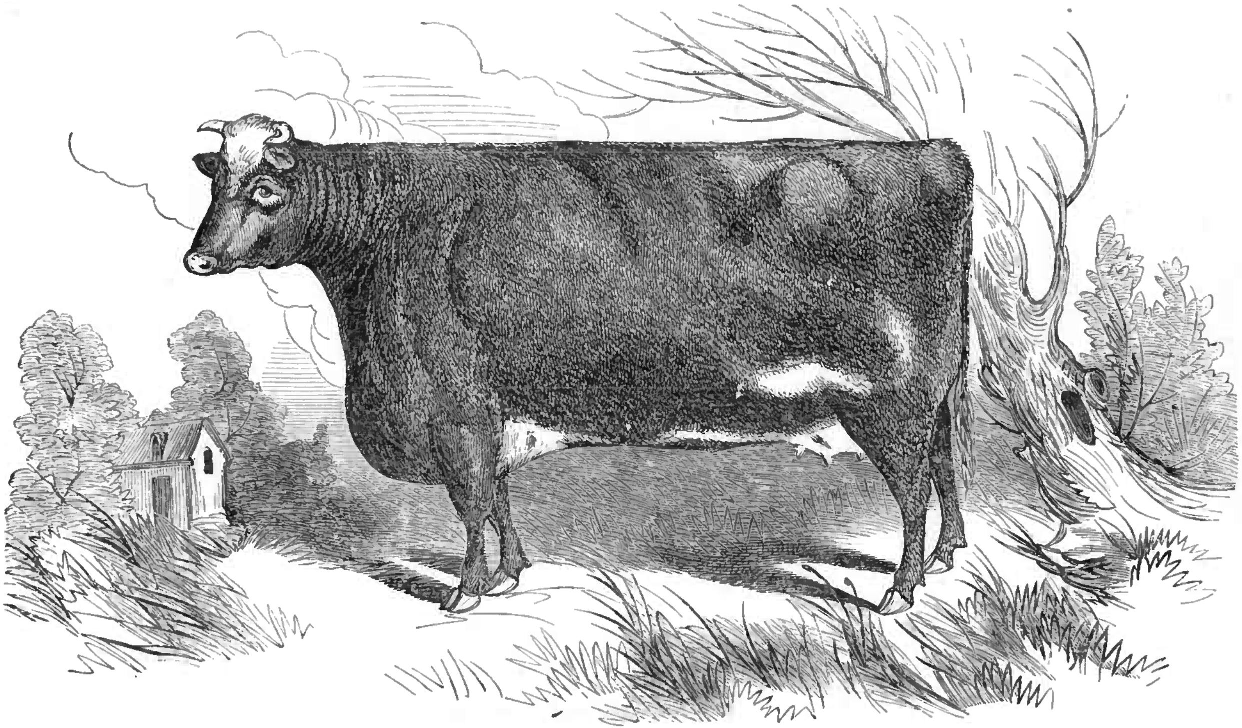
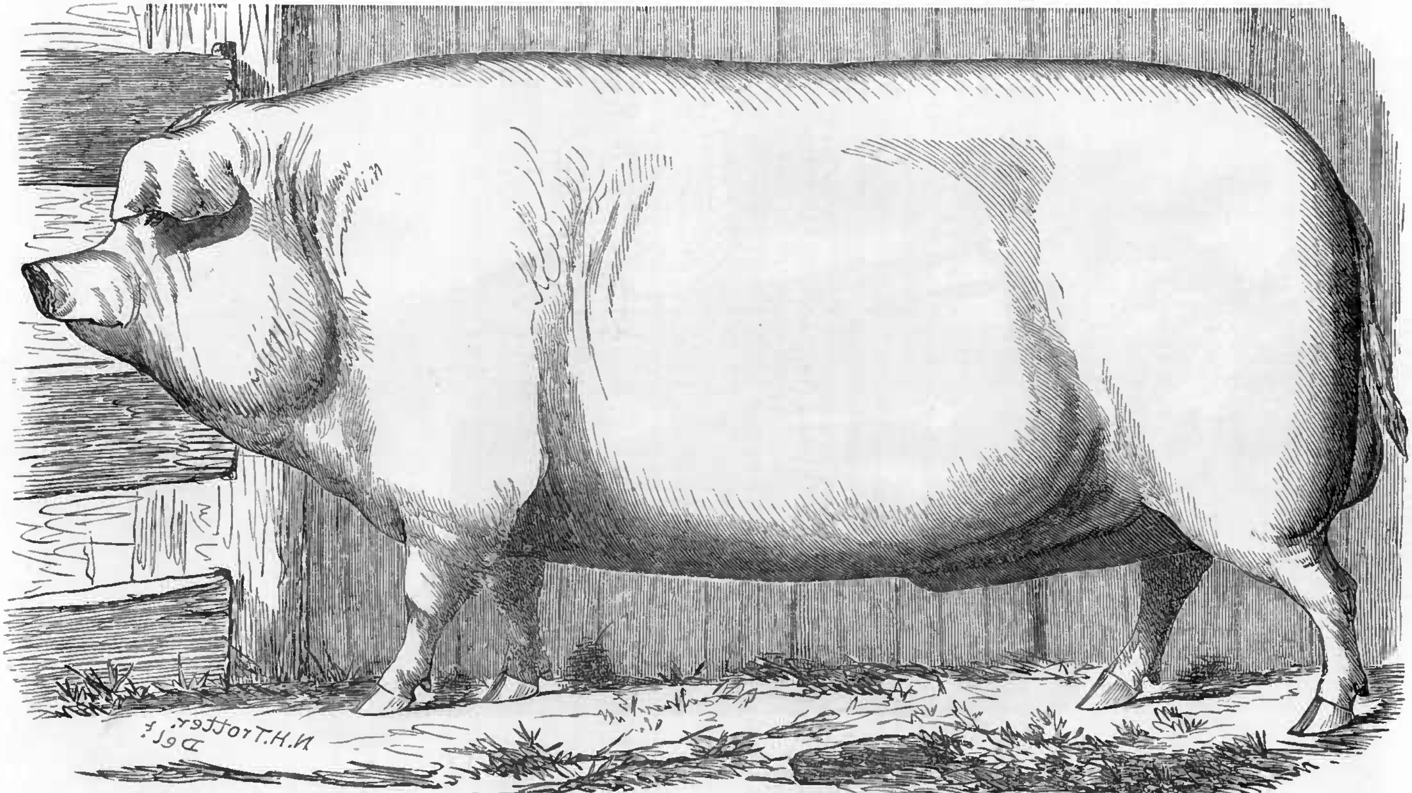


PLATE XXV.

SHORT-HORN COW "LOUAN XXI."

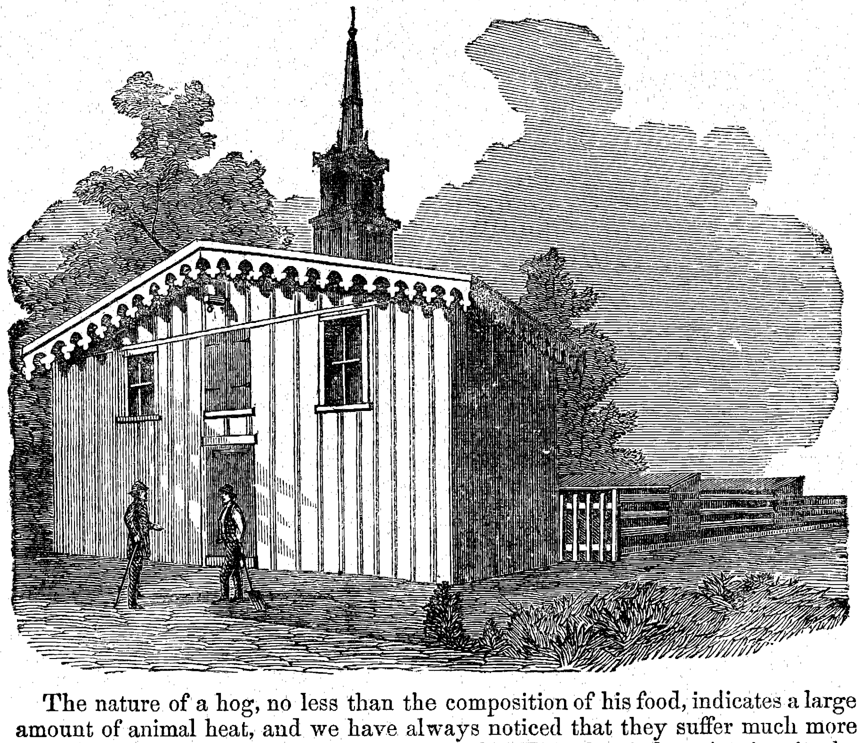
The Property of D. McMillan, Xenia, Ohio.



THE CHESTER COUNTY BOAR "VICTOR."

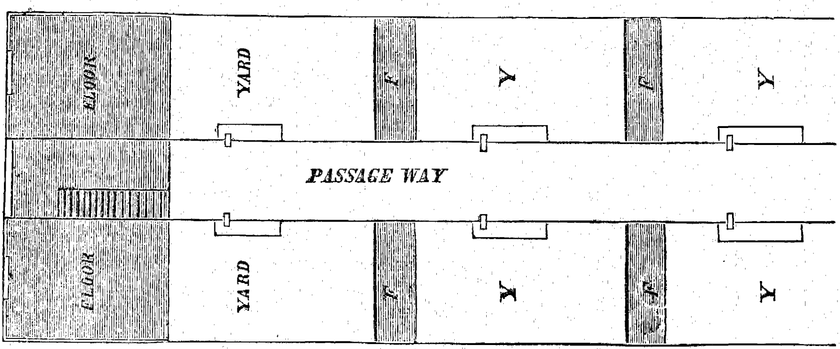
The Property of Paschall Morris, Philadelphia, Pennsylvania.

ago I sold a very fine pair of Chester county pigs to a customer, (not a farmer,) who complained that at the end of twelve months they only weighed 175 pounds each. On inquiry as to his management, I found they had been kept in the horse stable, which was cleaned regularly once a month. It was dark and badly ventilated, and the pigs were entirely out of reach of sun and pure air. The tenacity of life shown by the white Chesters, under such circumstances, spoke well for the breed. Thrift and growth were of course impracticable. Neither the white Chester, nor any other breed with which we are acquainted, will do well in confined or close quarters; and where too many are kept in a single pen the heat of contact is very apt to create mange.



The nature of a hog, no less than the composition of his food, indicates a large amount of animal heat, and we have always noticed that they suffer much more from heat and confinement than from cold. This fact is kept in view in the above arrangement. The entrance, as seen in the engraving, is on the north side of the building, which therefore fronts the south, as does also each separate pen. The main building is thirty-two feet long by twelve wide, with an entrance gate at each lower corner to the yard of two first divisions. The entry or room in the centre is eight feet wide, allowing space for slop barrel, feed chest, charcoal barrel, (almost as indispensable as feed chest,) hatchway for access to root cellar underneath the whole building, and also passage way to second story. This latter is used for storing corn in winter and curing some varieties of seeds in summer. A wooden spout, with sliding valve, conveys feed to the chest below. The grain is hoisted to the second floor by a pulley and tackle on the outside, as observed in engraving.

The perspective of main building allows a partial view of platforms, surmounted by a board roof, and divisions in the rear. The ground plan allows six of these on either side of the passage way. The first two pens, to the right and left of the door, are 12 by 12 each, and attached to them are 25 feet in length of yard by 15 feet wide. All the yards are extended three feet wider than the building, which admits of the two entrance gates at the corners.



Another division then commences, consisting of a raised platform, 6 to 8 feet wide, and extending the same width as the first pen, with a board roof over it, and also boarded up on the back, which answers the purpose of a division fence to separate from the pen behind. Twenty-five feet of yard are also attached to this, and the same arrangement is continued to all the six divisions.

We have found this board roof and wooden floor on the north side of each pen and fronting the south to be ample protection in cold, wet, or stormy weather. The floor is kept perfectly clean, and even the feeding trough is not on it, on account of more or less of wet and dirt always contiguous to the trough, which freezes in winter and becomes slippery.

Each yard is used for the deposit of refuse vegetables and weeds, litter, &c., thrown in from time to time, to be consumed or converted into manure. This is conveniently loaded into a cart passing along on the outside of each range of pens.

The passage way between each range of pens gives convenient access to the feeder for all the divisions. A door also communicates from one division to the other, to make changes when necessary; and also a door or gate from each pen to the outside, so that one or more can be removed and others introduced without any confusion or interference from any of the other pens. The two pens under the main roof of the building, being more sheltered, are reserved for sows who may happen to farrow very early in the season, or in extreme cold weather, which is always avoided if practicable.

For several reasons, the boiler for cooking food is in a rough shed adjacent to the piggery and entirely outside of it. There is no reason why this should be necessarily a part of the piggery.

The above plan is not offered as embracing much that is novel in arrangement, but as one that combines many advantages—

1st. Complete separation, as well as easy communication between each pen, as well as to outside from each.

2d. Avoiding close and confined air, and admitting of extension or alteration for a large or small number of pigs.

3d. Facilities for keeping clean and receiving refuse vegetables and weeds, &c., for conversion into manure, and also for loading from each pen into a cart passing along outside.

4th. Cheapness. With the exception of the main building, all the rest can easily be erected by an intelligent farm hand.

LONG-WOOL SHEEP.

BY J. R. DODGE, DEPARTMENT OF AGRICULTURE.

The supply of fine wool in the manufacturing markets of the world is yearly increasing, and the tendency in price is downwards. The demand for long wool is still unsatisfied, and the movement of prices for all the best styles is decidedly upwards. The English long wools bear quite as high a price as the finest of Australian merinoes, and much higher than those of the Cape and of South America, which have suffered a material decline within the past year.

The increasing manufacture of combing wools, the tendency towards which was noted particularly by the writer in his "Condition and Prospects of Sheep Husbandry in the United States," in the report for 1862, is perhaps the most notable fact concerning the woollen manufacturing industry of the present day. New and beautiful styles of ladies' goods command the admiration and patronage of the fashionable world; and invention is almost equally rife in the production of fancy goods from long wools for gentlemen.

In 1865 the imports of woollen goods into this country amounted to $20,347,563. Of this one-fourth part was for woollen cloths and shawls. The remainder was mostly for long or coarse wools, including dress goods, blankets, carpets, and flannels. The delaines and dress goods far exceed other items, amounting to $7,817,139. This fact significantly illustrates our want of combing wools. In two years the imported dress goods of the United States have cost nearly eighteen millions of dollars in gold, while the same item for the two preceding years did not reach two millions. On the contrary, more cloths and shawls were introduced in 1862 than in 1865.

The wool quotations of commercial papers, wherever examined, test the correctness of these remarks. The following are the prices quoted at the present writing: Choice Saxony, Ohio, and Pennsylvania, 67½ to 73 cents; Ohio and Virginia, half to full blood merino, 55 to 62½ cents; Ohio and Virginia, common to half blood merino, 47½ to 57½ cents; western merino, 45 to 57½ cents; Canada combing, 70 to 85 cents.

In connexion with these quotations, it is remarked that a change had occurred within the year preceding; that "then fine wool was in demand and the lower grades neglected. Combing wool, however, is in as good demand as it was a year ago, and commands as good a price." An English journal, (the Farmer's Magazine,) in alluding to our want of worsted wools, says "that there is great danger that their" (our) "worsted factories will have to be closed for want of raw material."

The high price of Cotswold wool should not be deemed extravagant, in view of the fact that its shrinkage in scouring is but from 18 to 20 per cent., while the waste in merino wools ranges from 40 to 70 per cent. A pound of average Cotswold fleece will produce as much scoured wool as two and a half pounds of merino fleece which shrinks 68 per cent.

The breeding of long-wool sheep, especially of Cotswolds, Shropshire, and other Downs, is increasing perceptibly in this country, especially in Connecticut, New York, Pennsylvania, Ohio, and Michigan; and the advance in this direction will be still more rapid in the immediate future. The necessity for good mutton is quite as urgent as the want of combing wool, and farmers near the large cities, and many even in the interior, are finding a rich profit in mutton breeds.

A few facts from the correspondence of this department will aid in elucidating the vexed question of the comparative profit of fine and long wool sheep. Aside from speculative operations, the latter, in suitable situations and circumstances, appear to have the advantage in the comparison.

From Cooper Sayre, of Oaks Corner, Ontario county, New York, a statement concerning a flock of fifty Cotswolds, regarded as thorough-bred animals, and the recipients of State fair premiums, places the cost of keeping at $2 per year for ewes and $2 50 for wethers. This includes five months' winter feeding with hay worth ten dollars per ton, and cornstalks, with one bushel of beets per day, costing twenty-five cents, and a peck of oats daily for the lambs of the flock. His ewes average seven pounds of clean wool each, and his wethers eleven pounds. The minimum sales of the former are not less than twelve dollars each. His ewes average a yearly increase (of lambs) of 120 per cent. His principal buck weighed, at 18 months, 264 pounds. At the end of the first year he expects a weight of 140 pounds, 200 pounds at two years old, and from 200 to 250 at three years old, and an increase in three months feeding for market of 40 pounds. He estimates the cost of care and labor, exclusive of washing and shearing, at $3 each. It is an interesting fact relative to a flock of this size that the loss is but three per cent.

An interesting exhibit of the debtor and credit sides of a flock of South Downs is made by Ralph H. Avery, of Canastota, Madison county, New York. Taking the average yearly cost and produce of his flock as a basis, he estimates for a flock of ten ewes as follows, with $19 10 each as a comfortable balance:

EXPENDITURES.

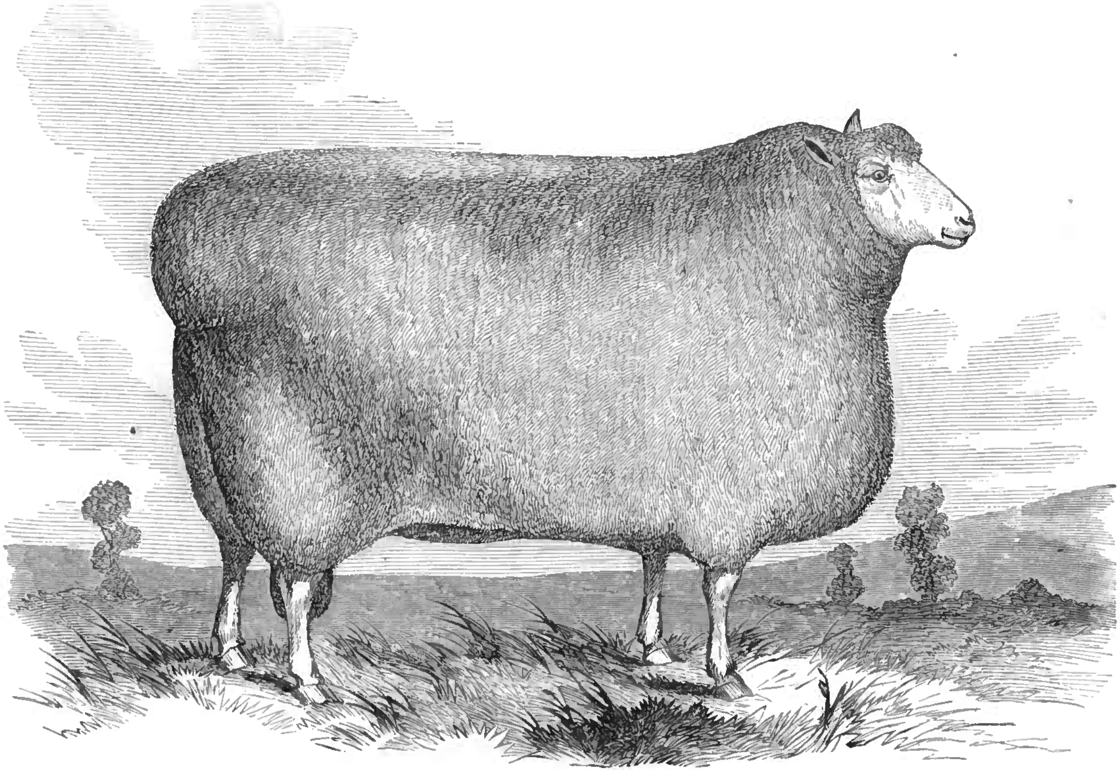
Ten ewes, at $30 each	$300 00
Interest on stock	21 00
Pasturing 6½ months, at $2	13 00
Winter food 5½ months, at $3	16 50
Salt, $1; washing, $1; shearing, 50 cents	2 50
Labor for winter care	5 00
Average loss by accident or disease, 2 per cent	6 00
	364 00

RECEIPTS.

Ten ewes, worth same at end of year	$300 00
Fifty pounds of wool of ten ewes, at 50 cents	25 00
Fifteen lambs, at $15 each	225 00
Value of manure	5 00
	555 00
Leaving a net profit of	191 00

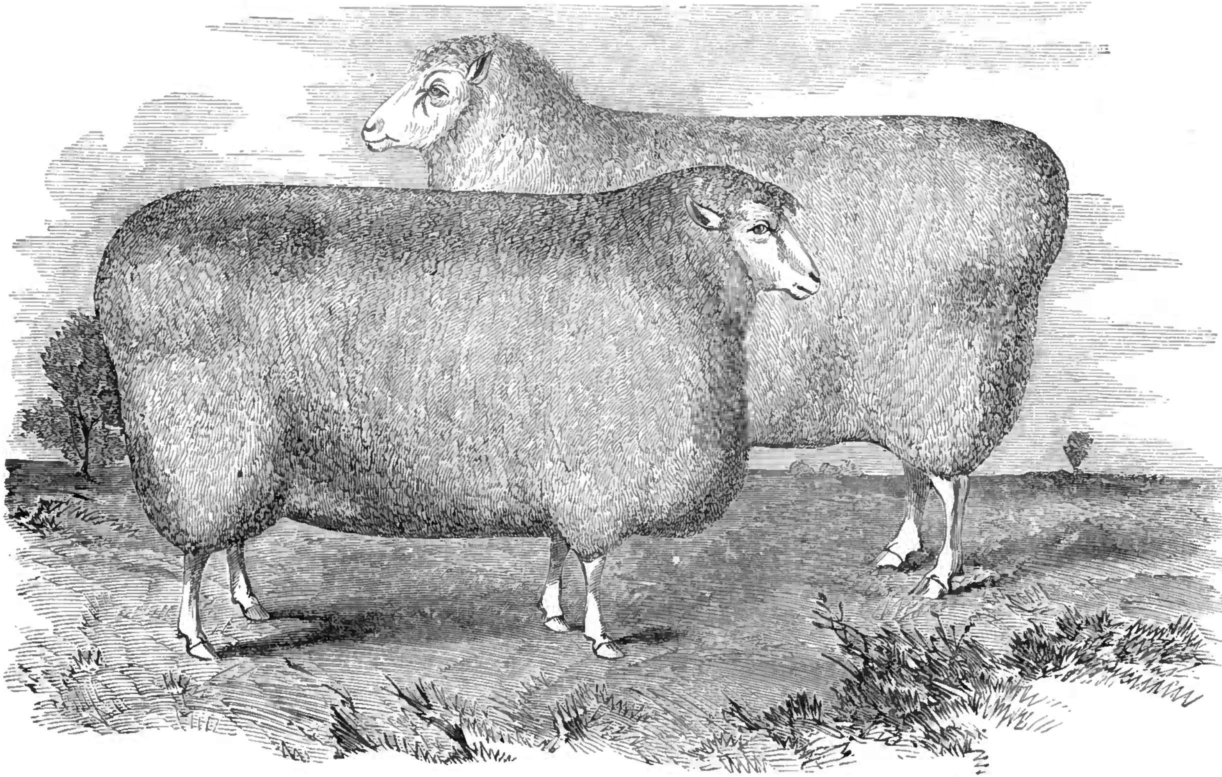
He writes further as follows: "My sheep are usually sent to pasture about the first of May, and put into winter quarters about the middle of November, making six and one-half months in pasture. During the summer and autumn I aim to prevent them from becoming too fat, which I find a very difficult matter. In this they differ from any other breed which I have kept. My only care during the season at pasture is to put tar upon their noses two or three times

PLATE XXVII.



IMPORTED COTSWOLD RAM (YEARLING) "HIS ROYAL HIGHNESS."

Bred by Robert Earne, Aldsworth, North Leach, England. Imported and owned by Burdett Loomis, Windsor Locks, Connecticut.



IMPORTED COTSWOLD EWES, YEARLINGS.

Bred by Robert Earne, Aldsworth, North Leach, England. Imported and owned by Burdett Loomis, Windsor Locks, Connecticut.

and give a supply of salt once a week. I deem it very essential that sheep have a constant supply of pure running water the year round. When put into winter quarters, which consist of a warm shed open on one side, a tight, warm, and dry stable, always well bedded with straw, and well lighted and ventilated, and an open yard in which there is a trough constantly supplied with water brought from a spring, they having free access at all times to all the different departments, as their instincts lead them. They are regularly fed three times each day upon clover hay, cut when first in bloom and cured mostly in cock, so as to preserve the leaves, color, and flavor as entirely as possible. Occasionally at noon I feed on cornstalks, wheat, oat, or bean straw, for a variety. No grain or roots are fed at any time. I, however, think a few roots, regularly fed, would be beneficial to their health. My sheep, thus kept, are always healthy and in fine condition. I never lose any except by accident.

"After a thorough trial of several breeds of sheep, I consider the South Downs the most profitable for wool and mutton combined, for this section of country. For hardiness, early maturity, and easy fattening qualities, together with the superior quality of their mutton, they are not equalled. In other sections of the country other breeds might be preferred."

The hardiness of the Cotswolds is well illustrated by the fact that they live and thrive as far north as the Ohio river without other food, summer or winter, than the natural grasses of the meadows and forests. It is a common experience in the south, and a well attested fact in Missouri, Kentucky, and Virginia. Anthony Killgore, writing from Stewartstown, Missouri, of his flock near Maysville, Kentucky, says:

"From 1852 (the year I made my first importation) to this date, my sheep have never been fed, either in winter or summer, but live bountifully the year round on blue grass pasture alone. With this treatment I have suffered serious loss from the ewes becoming too fat for breeding and compelling me to consign them to the butcher. I have never owned a common sheep for breeding purposes; nor have I ever handled anything but Cotswolds, except a few Downs, and they only for a short time. All I know of other breeds is from observation in other hands, and from this I have been satisfied to breed the Cotswold sheep exclusively. The South Down is a great favorite with me, and has some advantages over the Cotswold, while laboring, at the same time, under some great disadvantages."

Another of the sheep-breeders of Kentucky writes: "I have not fed my sheep this winter, and they are in fine order. We never feed unless the ground is covered with snow six inches or more."

Messrs. S. & S. W. Allen, Vergennes, Vermont, sends the following statement, embracing long and short wool breeds:

Expenditures.	*Merinos.*		*Leicesters.*
Interest on 10 ewes	$60 00		$20 50
Pasturing six months	9 00		12 00
Winter feed six months:			
2 tons of hay, clover, and herdsgrass	20 00	(2½ tons hay)	25 00
6 bushels of corn	7 50		7 50
12 bushels of oats	6 00		6 00
12 bushels of carrots and beets	3 00		3 00
Salt, ½ bushel	50		50
Washing			50
Shearing	1 00		1 00
Labor	2 00		2 00
Average per cent. annual loss by disease, dogs, &c	10 00		5 00
	119 00		83 00
Receipts.			
Wool, 100 lbs	50 00	80 lbs	52 00
10 lambs	500 00		150 00
Manure (summer)	2 00		2 00
Manure (winter)	3 00		3 00
	555 00		207 00
Profit	436 00		124 00
First year's average growth of lambs	50 lbs.		75 lbs.
Second year's average growth of lambs	20 "		25 "
Third year's average growth of lambs	10 "		25 "
Weight at 3 years old	80 lbs.		125 lbs.

It will readily be seen that this flock of merinoes commanded speculative prices. It would scarcely be advisable to stop breeding American merinoes so long as purchasers eagerly demand them at the rate of $100 each for ewes and $50 for lambs. But when both breeds are sold at the same price, and held for wool and mutton alone, what will this comparison show? It is worth noticing, that the amount of corn, oats, roots, salt, and labor is the same, and that the only extra expense of the Leicesters is for half a ton of hay at five dollars, and three dollars more for pasturage; ten merinoes costing, for feed and attendance, $4 90 each, and ten Leicesters $5 75 each—a difference of about fifteen per cent. in favor of the former. To counterbalance this, the wool of the Leicesters yields two dollars more per annum, and their superiority in mutton is equivalent to 45 pounds in three years, or 15 pounds per annum. For the purposes of mutton and wool, then, this showing decidedly favors the ten Leicesters, which produce nearly 150 pounds more of mutton, worth $15, and $2 more in wool, making $17, from which deduct $8 50 for extra cost of keeping, leaving a difference of $8 50 in favor of the Leicesters.

A. L. Graves, Ottumwa, Iowa, with a flock of 160, makes the average cost of feed and care of ten ewes and ten wethers $41 40, and of the same number of cross-bred sheep—South Downs and native—$42 40. The merinoes yield 100 pounds 10 ounces of wool, and the cross-breeds 96 pounds 14 ounces. Thus far the merino has the advantage in point of profit; but the mutton aspects of the case are immensely in favor of the South Down blood. The cross-bred attains its growth in two years, two-thirds of it the first year; the merino in three years, one-half the first year, and one-fourth each year of the remaining two years. In addition to earlier maturity, the size is larger and the price per pound greater in the market. These points increase, very materially, the disparity in mutton production, while the cost of keeping is very moderately enhanced. Recent speculative prices of merino lambs constitute the only element of superiority, in point of profit, which may temporarily counterbalance the superior profit from mutton production in the cross-breds.

Several statements have been received from owners of merino flocks, (most of them thorough breds,) which exhibit a wide range of expenses and balances of profit, depending upon the price of feeding material, the length and severity of the winter, and somewhat, also, upon the liberality of the feeder. They represent the different sections of the country, and a wide range of prices of sheep. These exhibits, averaged, give the following results: Average price of ewes, $16 40; wool of ewes, $6\frac{1}{3}$ pounds each, worth $3 86; average cost of keeping per annum, $2 65; percentage of lambs to ewes, 80. This is about the average prolificacy of this breed throughout the country, while Cotswolds will probably average 120, and South Downs still more. So far as indicated by statements received at this office from American breeders, founded on their own experience, South Downs would average 150 per cent. Probably the actual average throughout the country would be somewhat less. The exhibits of long-wool flocks, as shown in the preceding statements embracing both long and short wools, and in many others of a general character, indicate a smaller difference in their cost of keeping than is generally believed. Long wool sheep, of course, require more feed than small breeds, but they are of earlier maturity and more easily fattened, retaining the fat in the carcase instead of excreting it in the wool.

The original data, briefly analyzed above, illustrate conspicuously the favorable influence of the milder climate and abundant herbage of the central blue-grass regions upon the thrifty long-wool breeds. So suited are they to this climate, that in Kentucky, for instance, South Downs and Cotswolds are the favorite breeds, and many of the best farmers could scarcely be induced to exchange for fine wool sheep, however great the temporary advantage promised. To illustrate this difference in expense of feeding in different sections, and to show the money value of climate to sheep breeders, the following statements are given, each presented as the actual quantity and value of feed consumed by ten merino ewes:

G. S. Center, South Butler, Wayne county, New York, pastures six months, at a cost of $15, and feeds six months, clover and timothy hay, worth $20 per ton, and corn at $1 50 per bushel, costing $50; salt, 50 cents. Total cost of feed, $65 50.

Charles M. Clarke, Whitewater, Walworth county, Wisconsin, pastures six months, and feeds six months upon clover and timothy hay, at ten dollars per ton, and corn and oats at forty cents per bushel, costing for the year, $46 80.

E. Findley, Ottawa, Illinois, pastures eight months, at a cost of $4 60, and feeds four months six bushels of corn, worth $1 80, and one pound of hay each per day, worth $8 per ton, or $4 80 for what is required—altogether costing, including salt, less than $12.

Facts like these are directing the attention of wool-growers to the milder climates of Maryland and Virginia, as well as to Kentucky and Missouri, and to the mountains of Tennessee and the plains of Texas. The entire Alleghanian region is unsurpassed for profitable sheep husbandry. The writer of this, in his volume upon "West Virginia," refers to the fact, that in Hancock, Brooke, and Ohio counties, in that State, there were in 1860 as many sheep as acres of improved land—a proportion to acreage eight-fold greater than in Ohio, the first wool-growing State in the Union; and says of the highlands: "The mountain regions are unexcelled as sheep walks, and are beginning to be improved as such. * * * The mildness of the climate and excellence of mountain pastures are conditions favoring the production of the best quality of wool, For sweetness and flavor, the mountain mutton of Virginia is deservedly celebrated. The production of fine spring lambs, of South Down or Cotswold blood, for the markets of the eastern cities, would prove here a most profitable business."

This mountain-fed mutton, fattened upon grass alone, has long been noted in Washington and Baltimore. In a private note from Paul McNeel, of Pocahontas county, (near the summit of the Alleghanies,) whose flocks formerly numbered 900, mostly common sheep, and who acknowledges sheep husbandry to be more profitable than the production of cattle, horses, and mules, the following illustration of the above fact occurs:

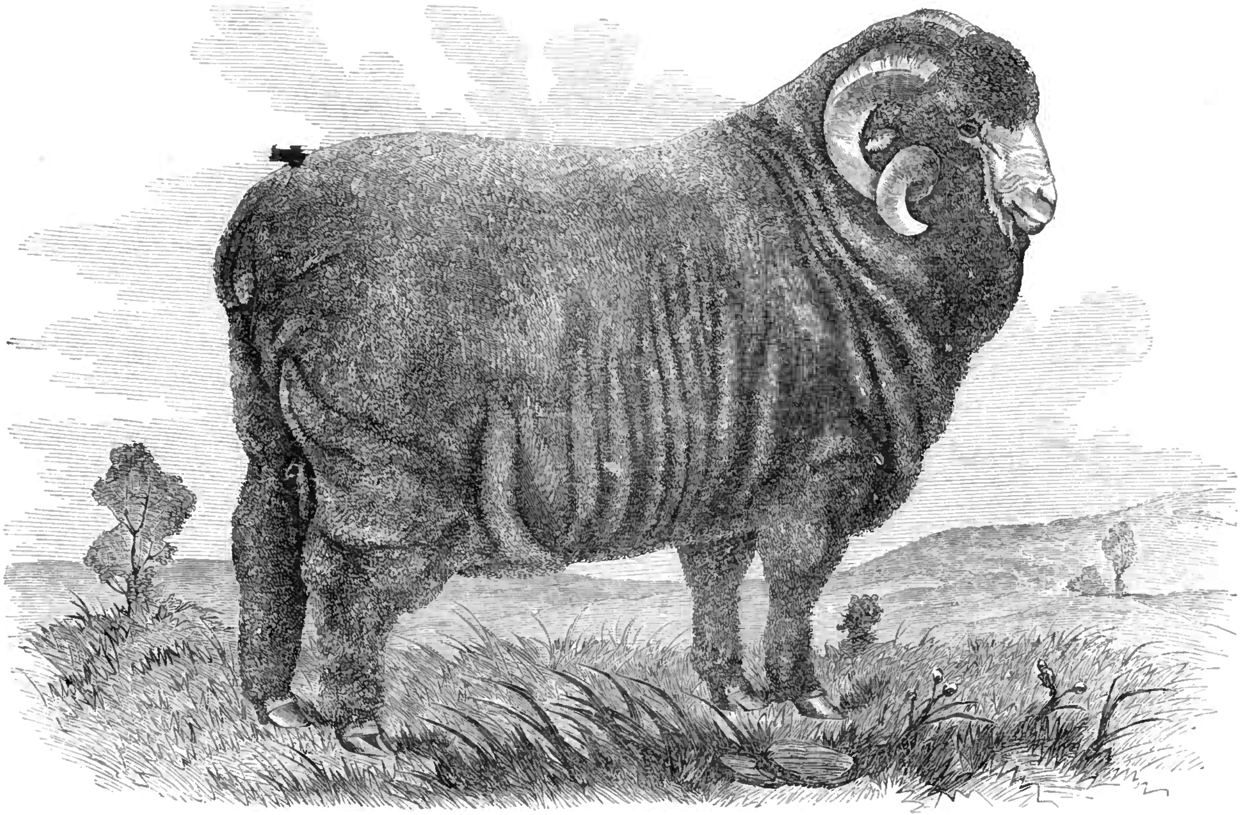
"I began with 500 or 600 sheep about the year 1830. In buying, I bought such as I could fatten the next year for the White Sulphur Springs. I suppose I furnished from 300 to 500 head each year for more than twenty years; and Mr. James Caldwell, the proprietor, told me the best muttons he bought were purchased from me. Old General Wade Hampton and Mr. Singleton, of South Carolina, built summer residences at the springs. I frequently met them, and they always asked me about my sheep, and what I did to make them so fat and the flavor of the mutton so good."

Thousands of merino sheep have recently been introduced into Virginia from the north; but the long wools, among provident and thrifty farmers, are preferred; and it is evident that the central and southern latitudes will compete successfully with more northern locations for the supply of the worsted wools of the country.

THE AMERICAN MERINOES OF VERMONT.

The increasing interest manifested of late in the breeding of pure blooded fine-wooled merino sheep indicates that the progress in sheep husbandry, which has been most remarkable during a quarter of a century past, is destined to continue, and that the growth of fine wool is to become one of the leading interests of this country.

Nowhere has there been felt so much general interest in this subject as in the State of Vermont. The Spanish merino was introduced here early in the present century, and by the judicious and careful breeding of more than forty years has become a far more perfect animal than when first imported, combining a heavy fleece of fine texture with a vigorous and healthy constitution, adapted to a northern climate, which the less hardy Saxons were unable to withstand. The flocks of such gentlemen as Edwin Hammond, of Middlebury, William R. Sanford, of Orwell, Rollin J. Jones, of Cornwall, E. S. Stowell, of Cornwall, Geo. Campbell, of Westminster, John T. Rich, of Richville, and others in Vermont, have made the thorough-bred merino sheep celebrated throughout America. Animals from these flocks are eagerly sought from all portions of the country, and at prices almost fabulous to those not familiar with the facts. Rams from one to three years old are sold at from $1,000 to $5,000, and in some cases $10,000 has been refused for a single animal. The owner of a superior ram frequently received from $2,000 to $3,000 for his services in one season, besides using him in his own flock. Ewes are sold at from $100 to $1,000. Hon. Rollin J. Jones, of West Cornwall, Vermont, sold his entire crop of ewe lambs in the season of 1865 at $100 per head when five months old. The subjoined statement shows



"SEVILLE," INFANTADO RAM, TWO YEARS OLD.

The Property of Rollin J. Jones, West Cornwall, Vermont.

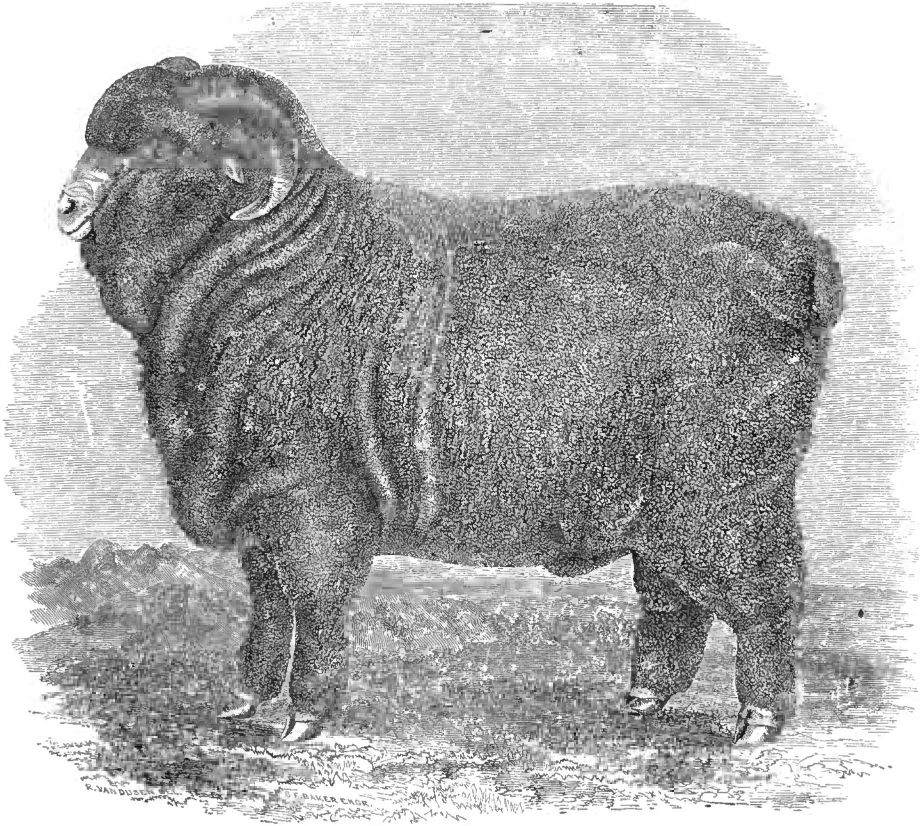
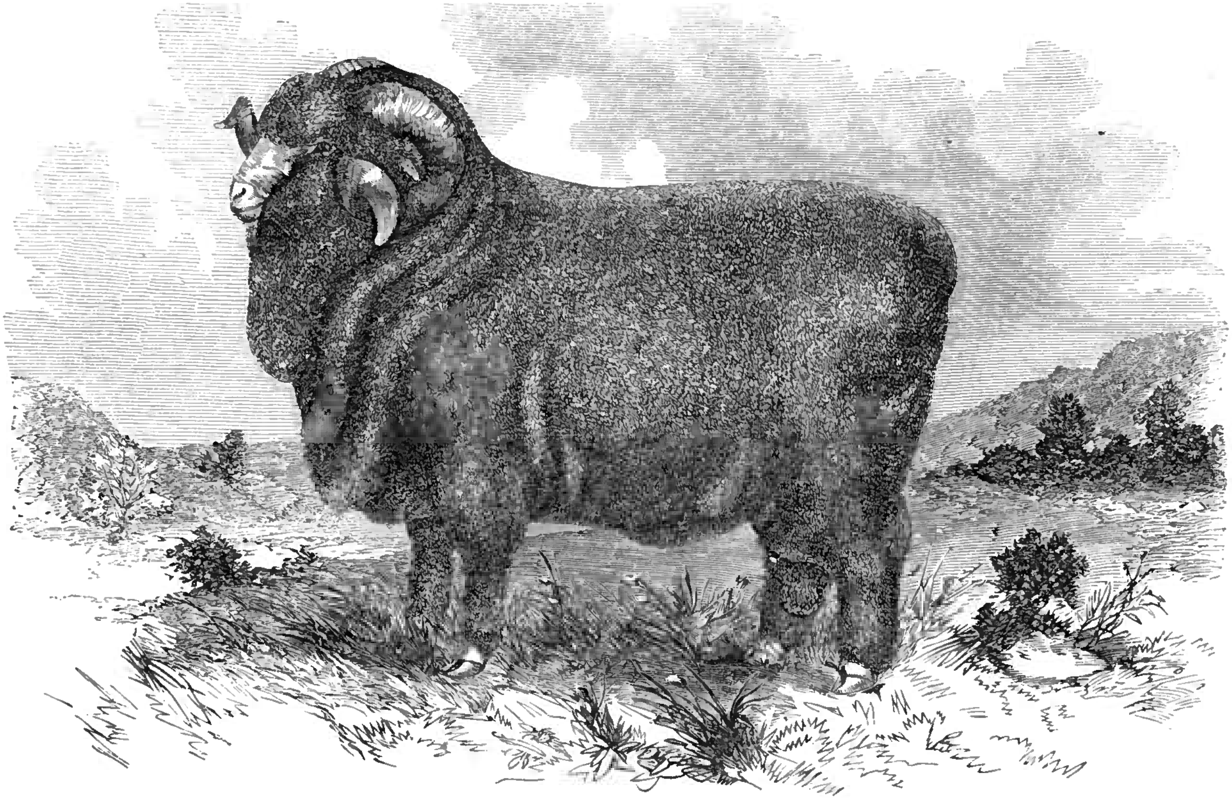


PLATE XXX.

"OPHIR." INFANTADO RAM LAMB.

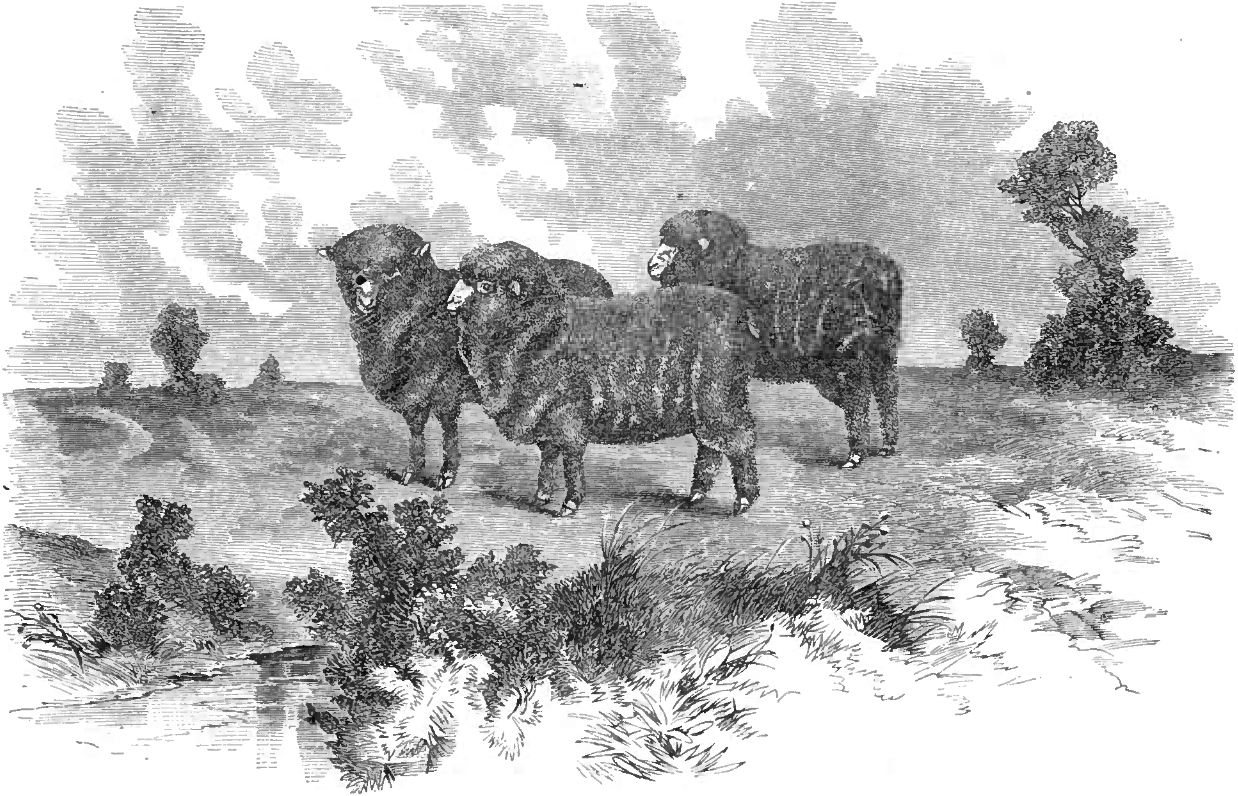
Bred and owned by Rollin J. Jones, West Cornwall, Vermont.



"MAJOR." INFANTADO RAM.

Weight of fleece, 23½ lbs. The Property of Deardorff, Walter & Co., Tuscarawas County, Ohio.

PLATE XXXII.



GROUP OF MERINO EWE TEGS.

The Property of Upton C. Deardorff, Tuscarawas County, Ohio.

the weight of fleece and weight of carcass, respectively, at a public shearing of these lambs, given by the purchaser, at West Cornwall, Vermont, May 23, 1866:

Number.	Weight of fleece.		Weight of carcass.		Number.	Weight of fleece.		Weight of carcass.	
	lb.	*oz.*	*lb.*	*oz.*		*lb.*	*oz.*	*lb.*	*oz.*
1	9	10	69	12	25	11	14	46	2
2	11	14	56	4	26	10	12	56	14
3	11	8	46	4	27	9	6	60	0
4	9	8	60	14	28	12	10	48	0
5	12	6	62	6	29	10	14	57	6
6	10	6	49	14	30	9	12	48	10
7	10	9	59	10	31	9	4	50	8
8	11	6	71	4	32	10	2	64	0
9	12	6	46	6	33	13	0	61	8
10	11	10	52	6	34	11	10	58	14
11	10	8	46	0	35	13	0	43	8
12	10	12	61	4	36	11	14	54	14
13	10	6	46	10	37	12	12	56	4
14	9	10	47	4	38	9	14	61	15
15	12	6	68	14	39	12	12	54	2
16	12	8	57	14	40	11	2	62	10
17	11	6	53	0	41	11	2	68	14
18	11	12	65	4	42	11	4	56	14
19	9	12	66	4	43	11	8	42	14
20	11	6	66	2	44	12	0	67	4
21	12	8	49	4	45	11	4	59	6
22	12	8	45	0					
23	11	14	46	12	Total	508	10	2,515	3
24	12	8	53	4					

Gross weight of carcass after shorn, forty-five ewes, 2,515 pounds, 3 ounces.
Average weight per head after shorn, 55⅝ pounds.
Average weight of fleeces, 11 pounds 5 ounces.

These lambs, like most of the principal flocks of pure bred merino sheep in Addison county—the leading sheep-growing county in the State—were descendants of the Spanish merinoes of the importation of Stephen Atwood, of Connecticut, and now generally known as the Infantado stock.

The ram lamb Ophir is a most perfect specimen of what long continued effort at improvement can accomplish. He was but ten months old when his portrait was taken. The ewes of the best flocks, when matured, shear from ten to fifteen pounds each; the ram from fifteen to twenty-five pounds, unwashed, and they are generally shorn in April or May, when the weather is cool and the fleece less oily than it would be later in the season, at the ordinary time of shearing.

The number of breeders of fine sheep is rapidly increasing. Competition is keen, and we may look for a still further advancement in the excellence of flocks and a more general dissemination of the American merino through the United States during the next decade. The addition to the material wealth of the country in this event can scarcely be estimated, as, with the requisite protection by a judicious tariff, the American breeder can be confidently assured of ample and gratifying remuneration.

The people of Texas were becoming considerably interested in sheep husbandry and the breeding of improved stock when the late unhappy rebellion terminated their intercourse with the north, and even since the close of that struggle have again commenced visiting Vermont with a view of purchasing stock and engaging anew in the prosecution of the enterprise. The soil and climate of Texas are favorable to the breeding of sheep, and we look to see the "Lone Star" become one of the leading wool-growing States of the Union.

Several of the best flocks of Vermont will be represented at the exposition at Paris in 1867, and a still greater triumph for the American breeder than that achieved at Hamburg a few years since may be expected. We hope to see it fully demonstrated that the pure bred American merino has no equal on the face of the globe.

CATTLE FARMING IN THE PAMPAS.

BY REV. G. D. CARROW, LATE SUPERINTENDENT OF THE MISSIONS OF THE METHODIST EPISCOPAL CHURCH IN SOUTH AMERICA.

There are two classes of men (discoverers by land and sea, and pioneers in new fields of tillage and commerce) who, though almost invariably distinguished for great and good qualities, seldom realize an adequate return for their services to their country and to mankind. The truth of this statement is confirmed by many facts belonging to the history of the discovery and colonization of this continent. Were we not so strongly assured of the contrary, we might suppose that the discovery and exploration of the three greatest rivers of this continent, and of the globe, were events certainly calculated to insure solid comfort to their authors during the brief period of their mortal life, as well as immortal fame on the pages of history.

What are the facts which so sternly forbid this natural supposition? Fernando de Soto was the first white man who explored the banks of the Mississippi, and saw that "father of waters" roll beneath the boughs of the primeval forest to the sea. But only a few days after his passage of the mighty stream he had ceased to live; his body, to conceal his death from his enemies, was wrapped in his mantle, and, at the hour of midnight, was silently sunk in the middle of the current. "The wanderer," says Mr. Bancroft, "had crossed a large portion of the continent in search of gold, and found nothing so remarkable as the place of his burial." Francisco de Orellana, striking a stream that wound itself along through the rugged passes of the Peruvian Andes, built a mere raft of green wood, launched it, and drifted with the current. Onward it bore him through plain and forest, mountain gorge and fertile valley, ever growing deeper and wider, till, at the end of seven months, and at a distance of four thousand five hundred miles, his frail and rudely constructed vessel felt the heaving, and his experienced eye surveyed the great expanse, of the Atlantic Ocean. He called the river *Amazon*. Marvellous was the adventure, and immortal the fame. But, ten years later, the discoverer perished in an expedition designed to locate and further explore the river, whose course he had followed from its birth in the mountains to its death in the sea.

In 1515, Juan Dias de Solis, crossing the equator, and steering boldly to the south, in the teeth of the terrific gales which sweep northward from the latitude of Cape Horn, entered what he soon perceived to be the mouth of a great river, and finding, or hoping to find, silver among its sands, called it *El Rio de la Plata*. But venturing ashore a few days after the discovery, he was put to death by the native savages. The explorers were in search of the precious metals, but died at the height of their career in poverty and disappointment. Posterity, however, was to reap incalculable advantage from their adventures and sufferings. Harvests of grain and cotton are now gathered in the valley of the Mississippi more valuable than the produce of the mines of Potosi. Harvests of fruit, corn, and cotton are to be gathered in the valley of the Amazon worth more than all the gold that streaks the mountains whence that river flows. And from the far-reaching plains of La Plata's basin, supplies of meat and clothing might be drawn in quantities sufficient to meet the necessities of more than half the world. The pampas form the larger portion of that great river's basin. Of their wool-producing capabilities, and of the extent to which they are already laid under contribution, the writer has given some account in the report of 1864, Department of Agriculture. In the present communication his purpose is to give to agriculturists of the valleys of the north some information on the subject of *horned cattle breeding* on the great plains of the South American continent.

THEIR ORIGIN.

There were no horned cattle either in the northern or southern division of this continent prior to the discovery. The first ever seen in the new world were imported by Columbus in 1493. Respecting their importation into the northern section of the southern continent, Lieutenant Gibbon, in his Exploration of the Valley of the Amazon, says: "This pampa looks like a great pasture field, enclosed by the Mamoré ditch on the south, and the Securé on the north. Under the shade of the trees stand the cattle of the field. They have gradually clambered over the Cordilleras from the flats of Guayaquil, through the table lands of Oruro, and from the salt district of Charcas. The creoles drove them down by the side of the Mamoré river, and let them out into the grassy prairie lands of Chiquitos and Mojos. When the cattle came among the Indians they knew not what to make of them. There were no such animals in their wild lands. The fierce tiger, and the poisonous serpent which they worshipped, were outdone. The cow interfered with the belief they previously had, that the largest animals were God's favorites, particularly those which had the greatest means for active aggression or self-defence. The cow helped to change such a religion. By degrees they learned that she neither bit, clawed, nor stung; that she carried a bag full of milk; that her teeth were given her to cut the pampa grass, and not to devour the flesh of a human being; that she was docile and friendly to man, and not his enemy. The Jesuits (missionaries) taught the Indians how to milk the cow and how to use her milk. They soon learned how to tend cattle, to lasso them, to yoke them by the horns, so that they may drag along a bundle of drift wood from the edge of the river to the middle of the plain. In this way they kept cattle near them, while herds roamed through the pampas, became wild, and are now so scattered through the lands that it is difficult to count them." The pampas described in the lieutenant's report form the central and southeastern departments of the present republic of Bolivia, and he is doubtless correct when he states that the first horned cattle introduced into that part of the continent came from the Pacific coast. In 1551 horned cattle were first brought into Paraguay from the coast of Brazil. These Sir Woodbine Parish regards as the progenitors of the numberless herds that for three centuries have roamed the southern plains. For the original importation Paraguay was, doubtless, indebted to the Jesuits, as was that country, and, in fact, the whole interior of the southern continent, for almost all the elements of their early civilization. Sir Woodbine is mistaken, however, in asserting that the whole pampas stock originated from the breed imported into their mission grounds by the Jesuits of Paraguay. Prior to the date to which that importation is assigned, settlements of Europeans had been effected in southeastern Peru, and the colonists, as Mr. Gibbon suggests, had brought cattle with them from the west coast. The present stock, therefore, may be regarded as the combined results of two original importations, one from the Atlantic and the other from the Pacific shore. As to the particular character of the original stock, it, no doubt, consisted of the common black cattle of Spain and Portugal.

WILD CATTLE.

There is a very common mistake in regard to what some writers designate as the "wild cattle of the south." The writers themselves are mistaken, and have led their readers to the same erroneous conclusion. The opinion is, that from an early period after the conquest herds of straying and unclaimed cattle were allowed to run wild, and that these were, in the course of many years, multiplied into countless millions, roaming wild and fierce through the forests and over the plains. It is true that portions of herds, which had never received proper care, or that by some special and violent cause had been separated and scattered, have become wild in their habits and fierce in their dispositions. But being regarded as common property, both Indians and white settlers have hunted them till the breed can no longer be said to exist, and the only wild cattle now are the few, comparatively, that have wandered away from the farms during the absence of the herdsmen in times of revolutionary commotion.

GENERAL CHARACTERISTICS.

The general characteristics of the present native stock are about the same as those of unimproved stock in this country. The principal points of difference are in the legs and horns; the legs being longer, and the horns longer and wider at the tips, than those of our native breed. Their average weight is about the same as that of our ordinary farm cattle. In a large herd almost all shades of color may be distinguished, the prevailing hues being light and dark red, and black, and dark brown. Steers frequently attain a fine size, are very symmetrical in their proportions, and when broken to the yoke and put to service are gentle in their dispositions and rapid and graceful in their motions. In regard to the qualities of the cows for the production of milk, but little can be said with certainty. On the cattle farms milk is but seldom used, and so little attention is paid to the cows that are kept by milkmen for the purpose of supplying the towns and cities, that the quantity of milk they yield cannot be taken as a fair sample of their natural capabilities. The milk itself is very rich and has an excellent flavor. The town and city traffic in that article is somewhat noteworthy. Certain police regulations are made to prevent adulteration; but they are not very effectual. Every few mornings quite a troop of milkmen's horses may be seen in line before the door of the police officer, and after due examination, the charge of adulterating being brought home, the contents of the cans are condemned and confiscated. But the adulteration of milk, like the adulteration of whiskey, is found to pay so well that the rogues can afford to suffer the penalty of the law quite as often as a policeman can be found sharp enough to detect and sufficiently conscientious to arraign them. It must, indeed, be rather an extreme case of *milk and water* to be thought grave enough to be presented for the action of municipal authority. Hence it is worthy of note, as another peculiarity belonging to this traffic, that many of the milkmen will confess to the faces of their customers the sin of adulteration. The *lachero* who supplied the family of the writer, frankly acknowledged that he regularly brought three kinds of milk to market. "I have," said he, "a double share of cream for my customers who pay me an extra price, no cream for those who pay the regular price, and milk and water for such as may not pay anything." For reasons that will be stated in connexion with another point remaining to be noticed, no attempt has been made to improve the native stock by the cattle breeders of the pampas. This, to many, will doubtless seem strange; for, considering the facilities afforded for such an experiment by the climate and pasturage of the country, it might prove successful there beyond precedent in those countries where, by crossing and careful treatment, stock has been brought to its highest degree of perfection. If the writer mistake not, there is a handsome fortune in store for any intelligent, enterprising cattle farmer who would go to that country and invest a moderate capital in the improvement of native stock, both for domestic supply and foreign exportation.

A CATTLE FARM.

An *estancia,* or cattle farm, varies in extent from one thousand to fifty thousand square leagues—the square league containing five thousand seven hundred and sixty English acres. In the districts adjacent to the cities and towns, and in those which lie upon the margin of the Plate and Parana rivers, sheep are rapidly taking the place of horned cattle. The largest estancias for cattle, in fact, are now to be found only in the interior, and in such sections as are far from the great water-courses. The cattle farms abound in what the natives distinguish as *strong* grasses. These coarse grasses gradually disappear whenever the land is appropriated to sheep. In their place there comes a rich supply of smooth-stalked meadow grass, (*Poa praténsis,*) and meadow foxtail, (*Alopecurus.*) Horned cattle, like sheep, prefer these, but thrive very well on the trefoil, wild barley, and other varieties of coarse grass which abound throughout the plains. The coarse grasses are more hardy, and stand the dry season better than finer ones, but contain less nutriment; and while stock fed upon them are preserved in a healthy and plump condition, they neither fatten so quickly nor so abundantly as when favored with their choice pasture. Pasture is most abundant in winter, the rainy season of that climate, and of best quality during the months of summer and autumn.

On a single estancia is frequently pastured a stock consisting of a hundred thousand head. The general herd is divided into smaller ones containing, each, from three to twelve thousand. A herd of three thousand can be properly cared for by one man. The entire herd is collected every evening at a spot near the farm-house. This gathering place is called, in Spanish, *rodes.* And one marked peculiarity to be observed when the stock has been assembled for the night is, that each animal is careful to select precisely the same spot on which it laid the night before, and every night, probably, since it took its place among its full grown companions. The immense herd will all lie or stand together thus, each in its own place, without enclosure of any kind, and will not separate for the day's grazing until eight or nine o'clock in the morning. Cows calve once a year; heifers as early as two years old. With regard to the longevity of horned cattle, no exact information can now be obtained. Farmers have not recorded nor perhaps even made any observations on that subject. In the opinion of Mr. Van Blarcom, (an experienced and intelligent observer,) the average age of animals may be set down as fifteen or twenty years. Neither the proprietors nor the men they employ will eat the flesh of an old cow or steer, and as stock is not bred to any extent either for milking or labor, there is no inducement to preserve animals till they have grown old, especially as the heifers and younger cows are preferred for the purpose of breeding. For these reasons but very few animals are allowed to grow old; and such as receive this privilege are permitted to die of neglect, or are killed for the hide and tallow, the carcass being thrown to the dogs and buzzards.

To secure comfort and success in cattle breeding, water is a prime consideration. The most desirable land, therefore, for this purpose, is that which is situated in those slightly undulating districts of the great plains where large ponds of water collect during the rainy season. These, however, evaporate in most cases during the heat of summer, and water must be obtained from wells. In cases where care had not been taken to provide a sufficient number of these, great destruction of stock has sometimes been the consequence. In the province of Entre Rios, in 1846, there was a general drought, unusually prolonged and disastrous. The grass was literally reduced to dust. Cattle, suffering from thirst, wandered off from their accustomed pasture grounds in search of food and water. Some farmers lost five thousand, some ten, and some as many as fifty thousand animals. It is stated, indeed, and is doubtless true, that one *estanciero*, an English gentleman, lost one hundred and fifty thousand head. In seasons of protracted drought cattle will stray in quest of water hundreds of miles. If they find water, and remain long enough in its neighborhood to calve, they will never return. But if the drought ceases before they calve, they will return to the grounds of their owners. Protracted droughts are not of frequent occurrence; and yet they are sufficiently so, one would think, to induce the farmers to adopt all suitable precautions. The immigrant farmers do provide wells sufficient to meet ordinary exigency. But the native proprietors in this, as in all things else, are disposed to take the world easy, and are perfectly willing that the morrow should provide for itself, or even prefer that it should be a day of disaster rather than to-day should be devoted to care and toil. Besides this, native labor is exceedingly scarce. The great pampas are very sparsely populated, and the necessaries of life are so cheaply and easily obtained that the few who are dependent upon their own exertions for a livelihood will do but little work. In one particular, both foreign and native proprietors are alike to blame. Dependent as they frequently are upon their wells, they have not adopted any modern improvements for pumping water. The horse-bucket system still prevails. An author very familiar with the modes and customs of the pampa cattle farmers thus describes the process: "Over the well is a framework from which is suspended a pulley through which a rope is passed, one end being secured to the bucket and the other fastened to a horse. The bucket is made of hide, very long, and of a peculiar form; the adjustment of the rope is so secured that when the horse reaches the extreme length of the rope one mouth of the bucket leans into a cistern or trough, into which it empties itself. By this primitive and tedious process it takes one man and two horses eight hours to water two thousand head of cattle. So if there should be only fifty thousand head on a particular farm, (and there is frequently double that number,) it would require a day's work for twenty-five men and fifty horses to give the entire herd a single drink of water.

There is one custom peculiar to horned cattle which the natives call *standing rodes*. The explanation is this: if one farmer lose a herd, or any portion of one, and sets out in search of the missing animals, every farmer he visits in the course of his search is required by an ancient law, enacted expressly for that purpose, to drive up his herd for the inspection of his unfortunate neighbor, that he may see whether he can identify any of his lost animals. This is what is meant by standing rodes. In a country where there are no fences, and causes are constantly occurring that tend to scatter the herds, it will be perceived that the law in question is very proper and necessary.

MARKING CATTLE.

As there are neither ditches nor fences of any kind to separate adjoining farms, each animal must be stamped with the mark of its owner, so that in case of occasional straying, or a general stampede, or other causes producing an intermixture of herds and great consequent confusion, each proprietor may distinguish and claim his own. Patterns of the various marks or brands adopted by the estancieros of a political department are preserved in the office of the *comandante*, with the names of the parties that use them; and to counterfeit or alter a mark is a penal offence of the same grade as forgery, or the counterfeiting of coin or of paper money.

The season of marking is one of great sport for the young men and boys and even the girls of a family. It corresponds, in its way, to the corn-huskings and quiltings that were so highly appreciated and keenly enjoyed by our grandfathers and grandmothers. The process is very simple. The cattle are driven into a large pen; a man or half grown boy mounts a horse; the Spanish saddle is fastened very strongly with stout and broad leather straps; in the central strap, about half way between the horse's back and belly, there is an iron ring; to this the *lasso* (a strong, plaited raw-hide rope) is attached; the other end is formed into a noose which the rider throws over the horns of the animal, and the horse dragging it from the herd its legs are then securely fettered, and being thrown upon its side the red-hot brand is produced and the owner's mark is stamped indelibly upon its smoking flesh.

The catching of a single animal for domestic use frequently presents an exciting scene. The particular one desired is singled out, and perceiving itself (as by instinct it frequently does) to be the object of some dangerous design, it breaks from the herd and bounds off into the plain. The horseman, duly equipped with a lasso, clasps the spur to his steed and bears down upon the flying fugitive. Having gained a point within convenient distance, he swings the lasso several times around his head to give it momentum, and then throws the noose around the horns of his victim. This is done while horse and steer are at the top of their speed. The moment the noose lodges on the head of the steer the horse stops and wheels to receive the shock, which is often so violent that the animal is thrown headlong and bellowing to the ground. The precision with which many horsemen throw the lasso can hardly be conceived by one not familiar with the customs of that country. The Indian's arrow or tomahawk scarcely speeds more directly to its mark. The performance is to be explained as are all the feats of human dexterity. Early training and long practice supply the horsemanship, the steady hand, and the unerring aim. The lasso is the native child's first toy; and one of his earliest amusements is found in throwing its noose over the heads of the dogs, cats, and tame sheep that follow him about his play grounds.

Another method of catching cattle is with the *bolas*. This instrument is prepared in the following manner: Three round stones or iron balls, each the size of an egg, are covered with raw hide; one is fastened to each end of a forked strip of hide, about ten feet long; the third ball is secured to a strip, attached to the main one, about five feet long. The horseman takes this in his hand, and, as in the former case, pursues the animals. When he comes within easy reach of his object, he takes hold of the end of the rope, and swinging the other that has the balls attached several times around his head, throws the whole contrivance at the animal's legs. In an instant it is entangled, and the more it endeavors to escape the more securely it is fettered till it falls. The *bolas* may be thrown fifty or sixty yards with certainty; and if the pursuit be rapid, the fleetness of the horse adding force to the throw, an animal may be struck with tolerable precision at a distance of eighty or ninety yards. An ordinary herdsman, or other laborer, receives per month from twelve to twenty silver dollars. The entire estancia, with all its arrangements, is placed under the superintendence of an experienced and well tried "major-domo," whose salary differs, according to the wealth of the proprietor and the responsibilities of the situation, from three to five hundred Spanish dollars per annum.

PREPARING FRESH BEEF FOR MARKET.

In killing cattle for home consumption the butchers first hamstring them and then cut their throats. In dressing them they are not suspended, but flayed on the ground. Some years ago the Buenos Ayrean city fathers prepared a slaughter-house of the same style and conveniences as are common in other countries, but the butchers refused to occupy it, and steadfastly adhered to the old custom of hamstringing and throat-cutting in an open pen. The carcass is divided in a mode somewhat peculiar. The tenderloin is taken out and sold by itself. Beef is never weighed in market, nor even measured, except by the butcher's eye, who acquires great exactness in subdividing the quarters of an animal so as to make the pieces suit the daily, bi-weekly, or tri-weekly demands of his customers. The beef market of the pampas was in former years probably the cheapest in the civilized world. So recently as twenty years ago an ordinary cow or heifer could be bought for one silver dollar, and a large fat steer for two dollars and a half. Now, the prices of the same animals range from eight to twenty dollars. In 1858 a piece of sirloin, weighing ten pounds, could be purchased in the market of Buenos Ayres or Montevideo for fifty cents, and in the towns of the interior for half that sum.

The natives are very partial to roast beef, which they term *asado;* but their mode of preparing it is peculiar to themselves. They take the best roasting pieces and cut away the flesh till the rib is reduced to nearly the thinness of an ordinary sparerib of pork, according to our method of butchering. This is done to suit their mode of roasting, which is never in accordance with that which obtains in Paris, London, or New York. Instead of the oven, they still use the more primitive spit. This is a piece of iron about four feet long. It is run through the meat, and, if the meat be prepared in the open air, is stuck into the ground at such an angle as brings the meat into contact with the tip of the flame; or, if the meat be prepared in the kitchen, the spit is inclined against the chimney in about the same position. The fire is kindled with weeds or small dry faggots cut from the paradise or peach tree. As this consumes very quickly, fresh fuel is constantly supplied. When the fat of the flesh ignites and blazes, the cook seizes the spit, blows out the flame, and then returns it to its place. This is repeated till the meat is nearly done, when the spit is laid across two large bricks, and the process of cooking is completed by toasting a few minutes over the fresh coals. Meat cooked in this way is somewhat smoked and a good deal blackened, but it has a juiciness and a peculiar flavor which could not fail to commend it to the palate of a finished epicure.

Some travellers complain of the toughness of the native roast, but the writer's experience is altogether in conflict with their statements, and his impression is that they must have fallen into the hands of a very unskillful cook, or upon the carcass of an animal that had been toughened by poverty and leanness or unusual length of days. The qualities of the beef are very superior. English residents, generally, do not esteem it; but this is owing to that intense national egotism from which few, even of travelled, Englishmen ever entirely recover. They will roundly assert that neither first-rate beef nor mutton can be found beyond the limits of the British isles. But many Americans, who have travelled extensively on both continents, consider the best pampa beef fully equal, if not a little superior, to the best beef ever brought to an English market. It has not the same amount of fat, nor is the fat so thoroughly distributed through the lean portions of the carcass, but it is sufficiently fat to meet the demand of any delicate and well-educated palate. The *tissues* are so fine as to render the flesh peculiarly tender, and, when cooked, it has a flavor akin to that which distinguishes the flesh of the wild duck from that of the flock which is hatched in the poultry house, and reared in the barn-yard. It is also very easily digested. A feeble, dyspeptic stomach may take as much as the appetite of a hungry man will ever crave and not be oppressed by the indulgence. Pampa beef, as well as pampa air, might safely be prescribed for all invalids suffering from dyspepsia, and assailed by its veteran ranks of horrors and blue devils.

JERKED BEEF.

An establishment for preparing this is called a "*saladero*"—literally, salting tub. The mode of slaughtering the cattle and preparing the beef is very simple. As in the case of "marking," the herd is driven into a large pen. A man or boy, with a lasso attached to his saddle girth, throws the noose around the horns of the animal. The lasso traverses a pulley, suspended from a cross-beam resting on two strong upright posts. The horse draws the head of the animal directly up to the beam where a man or boy sits with a long knife. The moment the head touches the beam the knife severs the spinal cord just back of the horns, and the animal drops on a movable platform which runs on a tramway, and is immediately drawn out of the pen by hand and placed under an open shed, where two men, without hanging the carcass, quickly flay it right and left; two others take out the intestines, cut off the head, divide the trunk into four quarters hang them on hooks, cut them in slices, throw them into a handbarrow, and, while one wheels off the flesh to be salted, another conveys the hide, bones, horns, and tallow to their appropriate places. In the salting shed is a large tank filled with strong pickle. The slices are deposited in this for a short time, in order to wash them from all blood. They are then hooked out and packed under the shed in alternate layers of meat and salt. The slices take sufficient salt in about a week. They are then removed to another part of the shed, turned, and piled again. This moving and piling is repeated several times. The meat is then hung on poles in the sun for a few days, when it is again piled for the last time, and looks in this, its last stage of preparation, in the separate pieces, very much like codfish or sole leather; and, in the aggregate pile, very much like a stack of cornhusks that has stood the storms of a New England winter.

And now, perhaps, the reader is ready to inquire whether, in its finished condition, it is a savory article of food. In reply, he may be reminded, in general terms, that *taste* is almost altogether a matter of education. At first, but very few persons relish *tomatoes;* and yet there is scarcely any one who does not learn to esteem them as one of the most delicious of all vegetables. Codfish, to an uncivilized palate, is at first about as agreeable as would be fine splints of pine board steeped in fermented and half putrid brine. Yet the civilized Yankees esteem codfish a dish worthy to be set before a king. Tobacco stands among the very first articles on the long and varied list of human luxuries. But who does not remember the retching that followed the first chew, or the first cigar? On the same principle we should not be surprised to learn that jerked beef is highly esteemed where it has been longest and most generally used. The people that manufacture it, however, will not eat it at all. It is mostly exported to Cuba and Brazil, and is appropriated to the use of the negroes who cultivate the sugar and coffee plantations.

Cattle are in best condition in March, which is the first month of autumn in that hemisphere. The principal killing season is from November to March. But most of the saladeros are continued in moderate operation all the year round. These establishments for the manufacture of jerked beef were first founded in 1815, and were among the first fruits of the immigration that flowed into the country immediately upon the achievement of its independence. During the first few years of their existence, it was rarely the case that as many as a hundred animals were slaughtered at one establishment in a single day. Now, there are, probably, nearly a hundred such establishments, at each of which are slaughtered from two to four hundred head per day.

The cost of a saladero capable of slaughtering four hundred head per day would be scarcely less than thirty thousand dollars. Take four men, skilled in such labors, and in fifteen minutes by the watch they will convert a living animal, standing in the pen, into jerked beef, salted in the common pile. The writer has measured the process, watch in hand, and is satisfied that four such workmen will average an animal to every fifteen minutes during the working hours of the day.

HIDES.

Dried hides are from cattle that are killed for domestic consumption. The drying of them is rather a tedious operation, and one that requires a good deal of care. Those intended for German and English markets are stretched lengthwise only, by which the hide acquires a much greater thickness than it would if stretched both ways. As many as twenty-four or twenty-six stakes are used for fastening the extremities of the hide to the ground. The dry hides designed for Spain, and other markets requiring thin leather, are staked so as to stretch them both laterally and longitudinally as much as possible. Hides shipped to Liverpool and Antwerp are generally twenty per cent. heavier than those intended for other ports; and those which are sent to the Spanish markets are said to be ten per cent. better in quality. Salt hides are first steeped in brine, then washed, and after the washing are packed away in alternate layers of hide and salt. Thus prepared they will keep well for at least one year after being taken from the salt. As to the quality of the pampa hides, it may safely be affirmed that better are not known to the commerce of the world. They may owe some of their superior qualities to the climate, some to the pasture, but the principal reason for their superiority is, that the breed of cattle have never been improved. The finer the animal, the thinner and less valuable the general qualities of the hide. This is mainly the reason why the most enterprising estancieros of the south have made no attempt to improve the native breed of cattle. What would be gained in flesh and tallow they think would be lost in hide and labor; and probably they are not wrong in this opinion.

TALLOW, ETC.

Every part of an animal is made available—horns, hoofs, hair, bones, and tallow, as well as the flesh and hide. The tallow is one of the most important items belonging to the general traffic. As soon as the flesh is sliced from the carcass, the bones and fat are deposited in vats, in alternate layers, for the purpose of being *steamed*. The bones are so arranged as to leave apertures through which the steam may quickly penetrate. The door of the vat is then closed, and the steam turned on. In twelve hours or more, according to the size of the vat, the liquid is drawn off by means of a brass tap. The condensed steam, in the form of a greasy liquid, is discharged first, and afterwards the liquid tallow, which is received in tubs, and thence conveyed to a large cast-iron boiler, in which it is purified. From the purifying boiler the tallow is conveyed through a shoot into a large iron tank, where it is allowed to cool down. After this it is drawn off into casks, and is then ready for shipment. Steaming for the purpose of extracting tallow was commenced about thirty-five years ago, and the process has undergone great improvement. The general arrangements necessary for steaming are quite expensive. A saladero, costing thirty thousand dollars, would require a steaming apparatus that would cost, at least, one-half that sum.

PURCHASE AND DELIVERY OF CATTLE.

Cattle are always paid for in cash. The risk of delivery is with the purchaser, as stock is invariably bought as it stands on the farm. There is a class of professional drovers in the country. Unlike the same class in this country, however, they are not proprietors, but are simply hired by the purchasers to convey their droves to market.

One *capitaz* (chief drover) with four or five assistants will convey to market a herd of five or six hundred head. The price per head for this service ranges from twenty-five to seventy-five cents, according to the distance. When taken from their accustomed pasture grounds, cattle are somewhat restive and disposed to scatter. When any special causes of disturbance occur many are lost—in a few instances whole droves have broken away from their drivers and dispersed in the plains beyond chance of recovery. While *en route* for market, the custom is to halt for the night on some spot where the feeding is good. The drovers sleep and ride round the herd by turns. On stormy nights it is particularly difficult to keep the herd together, and whenever a general *stampede* occurs it is usually at such times. Cattle in good condition will stand driving twenty-five miles per day without injury. If pushed beyond this, the effect is very perceptible in what is called "*tired beef.*" Cattle once delivered, either at the city markets or the saladeros, receive no further attention; and when the supply is large animals are allowed to remain in the pens for a week without a blade of grass or a drop of water. If they do not starve long enough to produce shrinkage of flesh, the proprietors do not care for the sufferings of the poor beasts.

LOS BARRAQUEROS.

Excepting live stock, the produce of the country is offered for sale in a public *plaza* or market-place. Sometimes the farmers themselves act as their own salesmen, but the general usage is to employ a broker. The broker is styled a *barraquero*, and his warehouse a *barraca*. When a mercantile house wishes to obtain hides, wool, or other produce of the country, a barraquero is employed to attend the sales in the plaza and make the purchase. The articles are then conveyed to his barraca. If it be wool, it is packed (or baled, rather) with a hydraulic press. Hides are simply stored in piles; and at the proper time the barraquero attends to the shipment of the cargo. The merchant has only to provide the money and keep the accounts, and the broker, for the entire cost and trouble of his agency, charges only one per cent. on the sum total of the exportation. It will readily be perceived from these facts that the barraca business is one of the most important branches of the general trade of the country. It is pretty equally shared by natives and foreigners. Some very sharp men are engaged therein. They can tell all about a hide when it is yet warm and whole on the back of the steer; or what the quality of a fleece is, and how many pounds it contains before the shears have touched it. While passing through the plaza, observing without being observed, the writer has often been reminded of the accuracy of the Jerseyman's eye and judgment, by which he correctly estimates how many square feet of ship timber or how many cords of wood there are in a standing tree.

AMOUNT OF TRADE FURNISHED BY HORNED CATTLE.

The extent and importance of this will appear from a single statement. During one year the produce of five hundred and sixty-two thousand head of cattle was shipped at the port of Montevideo alone. That city is the capital and chief port of the republic of Uruguay. And something of the great wealth of that state, in horned cattle, may be inferred from such an annual shipment, especially when it is considered that the revolutionary has become its chronic and prevailing condition. The total number of hides exported from the river Plate and the Rio Grande for one year was one million five hundred and eighty thousand; another year, one million six hundred and fifty thousand. The amounts included in this statement are nearly all the product of the great pampa lands lying on the eastern and western shores of the river Plate and its tributaries.

TRANSPORTATION.

A brief allusion was made to this subject in the article on "Sheep farming in the pampas," and as it is a matter which affects still more vitally the interests of cattle farming, some facts, additional and more definite, with regard to it will probably not be deemed out of place in the present essay. The greater part of the territory is a pampa which lies between the western banks of the Plate, Parana, and Paraguay rivers and the spurs of the Andes mountains. To its topography, either special or general, no allusion need be made, except so far as may be proper for the illustration of the point in hand. Through this generally flat (and occasionally slightly undulating) country there are two great highways. One of these connects the state of Buenos Ayres with the states of San Louis and Mendoza, and from the last named with Chile, *via* the passes of the Cordilleras of the Andes. The other connects Buenos Ayres with Cordoba, Santiago, Tucuman, Salta, Jujuy, and thence with Chiquisaca, Cochabamba, and La Paz, in Bolivia. By the first, from Buenos Ayres *via* Mendoza to Santiago de Chili, the distance is four hundred and twenty-five Spanish leagues—a league being nearly equal to four English miles. By the second, from Buenos Ayres to Laquiaca, (the connecting point between the Argentine confederation and the Bolivian republic,) the distance is five hundred and twenty-eight leagues. Until recently the only means of transit between the river and the interior on these two roads was by bullock carts, manufactured principally in the province of Tucuman. The structure and general appearance of this vehicle carries the mind back to a very remote antiquity and a very primitive civilization. It is made of timber almost as hard and heavy as iron, and has, perhaps, not one pound of that metal in its entire framework. There are neither iron boxes for the axles, nor iron tires for the wheels, nor iron bolts for the tongue, nor iron nails for the body. All is of the close-grained, hard, heavy wood which flanks the streams that form the headwaters of La Plata. The wheels are very large in circumference, for the purpose of fording streams. The hub, rim, and spokes are large and clumsy, and the wheel, when complete, looks as though it might have been formed to turn a grist-mill or propel a steamboat. The frame of the cover is of reeds, and the cover itself of straw or stout painted canvas. Six yokes of oxen are attached to a cart, and six more accompany it as a relay. The oxen draw by the horns. From the top of the cart cover several steel-pointed goads are suspended, some short, to quicken the memories of the oxen near at hand, and others long, to reach for the same purpose the remote advance. The journey is made in caravan, each consisting of fourteen carts and thirty drivers. Strange to say, the axles are never lubricated, either with tar, grease, or any other preparation; and speaking within the bounds of moderation, it may be said that the creaking can be heard in the still air of the pampas for a distance of at least five miles. A cart will convey a load weighing from thirty-five hundred to four thousand pounds.

The period for setting out from the upper provinces is in April or May, when the lowlands are dry and the streams shallow. The families of the drivers frequently accompany the caravan, taking their dogs, cats, parrots, goats, and other household pets; and the proprietors often do the same, taking their families in separate vehicles, and bringing with the carriages a troop of horses, so as to enjoy the variety of riding (as they express it, "*en coche y á caballo*") in coaches and on horseback. The caravan proper and its numerous attendants form quite a community; and for any one not in a hurry (and these people never are) the journey affords many very agreeable sources of entertainment. There is no lack of good things to eat. A fat sheep or a fine young heifer may be bought for a song. Bags of hard biscuit are stored away among bundles of hides and bales of wool. *Máte* (Paraguayan tea) is provided in abundance, and for a very old and a very hard-headed trader, occasionally something a *little stronger*. The Sabbath is not recognized; but rest is indulged whenever it seems needful for man or beast. When the moon is at her full the caravan moves through the night as well as the day. And, as the natives are all fond of music, and have a passion for dancing, the guitar and the dance are resorted to for the entertainment of the company through most of the pleasant evenings of the long journey. This is the bright side. These are the sweet ingredients to be tasted in that primitive cup of trade.

But there are also many difficulties which breed their moments of vexation and bitterness. Unexpected rains deluge the lowlands and swell the crawling streams to rushing torrents. At such times the tracts of swamp lands are so extensive that they cannot be passed in a day, and the wearied bullocks are required to stand all night up to their bellies in water. The women, children, goats, dogs, cats, parrots, and monkeys must be stowed away in the carts, each of which is filled like Noah's ark, but can hardly be supposed to have that famous vessel's good order and harmony within. The streams have no bridges, and swollen to the size of rivers, either the carts must be unloaded, and their living and dead cargoes ferried over on rafts of raw hide, or the caravan must halt for days on their wet banks till the turbid streams subside. At best the carts must be unloaded and loaded three times—twice in Santiago, and once in Tucuman. The journey is necessarily tedious when shorn of its most disagreeable causes of delay, the round trip from Salta to Buenos Ayres (fifteen or sixteen hundred miles) requiring one whole year. The expenses of this mode of transit are also very great. The cost of transportation and the duties to different provinces through which the caravan must pass amount to not less than one hundred silver dollars per ton; and as the carts are laden chiefly with hides, wool, hair—articles of large bulk in proportion to their value—the carriage alone must add forty or fifty per cent. to the original cost.

The introduction, of late years, of a few small steamers on the Parana river has somewhat lessened these difficulties. But the points of embarkation on that river are so distant from all the western and northwestern provinces of the pampa country, that the ancient bullock train must, to connect with the wooden steamboat, still wind its tedious way through hundreds of weary miles. It will be readily perceived what heavy reduction must be made from the value of interior produce when it finds its outlet by such a mode of transit. And, on the other hand, the prices paid for manufactured goods, and all articles of taste and luxury in those interior portions of the southern continent, must be so enormous that only the most wealthy can avail themselves of them. The gentle *mestiza* of San Juan or Santiago del Estero must pay a round sum for the silk handkerchief which she twines about her dark tresses and for the light shawl which she draws loosely about her delicate shoulders, for festivities of a wedding or the ceremonies of a feast day.

Railroads, with their cheap transportation, are things which belong to thickly populated territories and an advanced civilization. Not till men are thus multiplied can the iron steam-horse take the place of the sturdy bullock and the patient camel. Whether the far-stretching and beautiful plains of the south will, ere long, be so stocked with enterprising men as to reap the advantages of modern progress, may well be made a question.

Great Britain has rich and vast fields for colonization. The Orient invites her merchants, and, with them, the merchants of other nations. Australia is rich in precious metals, and offers every inducement to the pursuits of agriculture. And

> "This fair land our fathers trod—
> This land we fondly call our own"—

stretches forth her mighty arms of civil freedom and political equality, inviting the unrecognized and down-trodden of other lands to her blessed shores, and to a participation in the wealth, happiness, and honor with which she endows her native-born sons and daughters. With such competitors centuries may yet come and vanish, and the great pampas, with their verdure and flowers, remain the scene of pastoral simplicity, silence, and desolation.

COUNTRY LIFE.

Pastoral life has ever been much the same. The South American *estanciero*, who is rich in broad tracts of land and vast herds of cattle, has many features of character in common with pastoral chiefs and princes in the old countries of the east, and many of their social customs bear a strict resemblance. So, likewise, the ordinary quarter or half breed herdsman of the pampas has much in common with the herdsmen who pitch their black tents and roam with their flocks in the wilds of Arabia and Tartary. These two classes may be said to constitute the whole of the native population of the pampas. With sheep, as has been already intimated, they have but little to do, their time being almost entirely occupied with attention to horned cattle. The native proprietors owning large estates seldom reside on them during the year more than the last two months of summer. They commit the entire management to a trusty major-domo, and establish themselves in the cities and large towns, where their children can have the advantage of schools and society, and they themselves can gossip with their neighbors, lounge at the cafés, frequent the opera and the play, indulge their predilection for gaming, and, on high and solemn days, attend church to ogle the ladies, criticize the music, and stare at the performance. The rich proprietor is a gentleman of polished manners, and is never seen on the street, at church, theatre, or elsewhere with any marks of carelessness to mar his personal appearance, or anything appertaining to his costume unworthy of his character and social position. He keeps a handsome carriage and a pair of horses, round, sleek, and grave in their attitudes and motions as the Pope's mule. In this the señora, with two of his grown daughters, or a trio of the younger children, rides out on pleasant days after the five o'clock dinner. His house is richly furnished, and stocked with servants in sufficient numbers to divide the work into small departments and make it easy. The table is supplied with a plenteous variety of rich viands. The cooks are trained to remember the national taste for garlic. The wines are of respectable age and excellent flavor; and, what is much to the praise of the master and his household, are always imbibed in strict moderation. If there be extravagance anywhere, it is in the dress of the family. Here the old Spaniard's love of display marks his American descendant, and finds its utmost gratification. Even children that are still dependent on the care of their nurses are tricked out in laces, velvets, and embroidery of silver and gold. The estate which supports this style came by a long inheritance, or a short confiscation, which was one of the results of some period of bloody civil strife. It cost the proprietor nothing. Its management occasions him little, if any, annoyance or solicitude, and he spends its proceeds just as easily as they flow into his coffers. Such, in brief, is the rich Spanish-American cattle farmer or estanciero. If it be the true philosophy of life to eat and drink and die to-morrow, then is he a great philosopher and a happy man.

The second class deserving notice in any view of country life in the pampas consists of small proprietors of land and herds, small renters of land and owners of a few cattle, and the laborers who assist in the general work of the farms It will be observed that what seems to be three classes are here specified in one. The distinction, however, relates more to small degrees of difference as to wealth than to any difference in the character and appearance of the parties themselves. In their modes of thinking and ways of life, the small landed proprietor, the small land renter, and the common day laborer, are substantially the same. They are alike distinguished in that country by the term "gaucho." This is the term applied to them by the large proprietors and the wealthy and educated classes of the cities and towns. The term itself is an architectural one, and is used in the Spanish language to denote unlevel superficies. In its application to *persons*, therefore, it may be understood to signify rough, unpolished mental character, and irregular, wandering, semi-savage habits and customs. The house in which the gaucho lives, if he can be said to live in a house at all, is called a *rancho*, a term familiar to American ears since the war with Mexico and the settlement of California. The gaucho's rancho is the same thing as the Englishman's hut, or the Irishman's shanty. Its four corner posts are simple stakes driven into the ground. Its rafters and general framework are stalks of the aloe or the cane. Its sides and ends are plastered with mud, its floor is the common earth, and its roof is thatched with paja, a species of reed that is found in the low grounds and on the edges of ponds and streams throughout the pampas. It is not usually divided into separate compartments. The furniture is almost as rude as that of an Indian's wigwam. In one end are stakes driven into the ground, on which a cow-hide is stretched, forming the bed of the family. A rough wooden stool, or the skeleton of a horse's head, forms the only chair. An iron pot and a few tin pans and drinking vessels complete the sum total of the household goods and chattels. Of course, there is no very great amount of work to be done under the roof of such a primitive establishment. There is nothing to eat but beef and pumpkin. The cooking is, therefore, merely a trifle. There is not much to wash and iron, because children in that mild climate are not much addicted to clothing, and the costume of adults, except when tricked out for a visit or a holiday, is reduced to the plainest style and the smallest quantity. The pampas señora's gala dress consists of white camisa, white stockings, plain kid shoes or black lasting gaiters, a fringed silk handkerchief or bright shawl for the head, and a gown of bright-colored silk or cotton. In describing the costume of the gaucho it will be proper to include the trappings of his horse, which, like the Arab, he makes his constant companion, but which he never regards with the Arab's gratitude and affectionate consideration. The saddle consists of a wooden frame, over which are strapped woollen blankets of various colors. Thus composed, it forms an agreeable seat for the long journey of the day, and a comfortable bed when the halt is ordered for the night. The stirrup straps are made long, and the stirrup itself so small as to admit only the great toe. The bridle is of finely plaited raw-hide, and is frequently richly ornamented with silver. An unornamented bridle may be regarded as a mark of extreme poverty, and a ragged one as proof of uncommon laziness and degradation. And in this connexion it may be proper to remark that the pampa horseman never curbs the neck of his steed, but rides with a long rein. This partly accounts for the fact that the pampa horse is remarkably sure-footed, and makes a long journey with but little appearance of fatigue—galloping with ease to himself fifty miles in five consecutive hours.

If the gaucho be something of a "paquete" (or dandy) in his tastes, his style of dress is both picturesque and pleasing. His full costume in such a case consists of red cloth cap with tassels, close-fitting jacket of cloth, woollen flannel or merino, plaited on the shoulders with large flowing sleeves, resembling altogether the tightly drawn bodice of a fashionable lady. What is called in Spanish a "chiripa," usually made of some gaily striped woollen, is wound round the thighs, and fastened over the hips with a girdle, called a "teridor." These, with white cotton drawers, usually fringed at the ankle to at least the depth of twelve inches, and "botas de potro"—colt's-hide boots—constitute the gaucho's *tout ensemble.* The chiripa is usually selected with some care, but the country dandy's highest taste is expended upon the teridor or girdle around his waist. This is almost invariably adorned with Spanish silver dollars or gold doubloons, worn as buttons where there are holes for them, and simply as ornaments where there are none. Frequently both buttons and ornaments are of pure gold. The writer remembers one of these country *paquetes*, who came into town on some business with one of the American merchants, and had on his teridor sixteen gold doubloons, which, converted into United States *hard* currency, would amount to two hundred and fifty-six dollars. So the reader will perceive that semi barbarous as well as civilized life has its expensive tastes to be gratified. In this particular case the gaucho's teridor would purchase complete the toilette of the American belle, provided she would forego Brussels laces, Italian crapes, India cashmeres, and would set a dandy on his feet in Chesnut street or Broadway, in full attire, with some loose change in his pocket for the opera or the play.

The gaucho, whether dandified or plain, is a gentleman of leisure. If he be only a herdsman he has but little to engage his thoughts or tax his energies. If he be the owner of a herd, so much the better for that love of idleness which is one of his ruling passions. His establishment does not cost him a moment's care. A boy, mounted on an old horse, with a piece of broiled beef in his pocket and a jug of water within convenient reach, rides round the cattle during the day to keep them within the owner's unfenced domain, to see that some honest neighbor does not mistake them for his own property, and to drive them up to the *rodes* at sundown. To the proprietor, therefore, the boys and their herds furnish merely incidental occupation. The climate and soil are favorable to the cultivation of all kinds of vegetables, but he has no garden. The most delicious fruits might be produced, but he has neither trees nor vines. His herd would afford him milk and butter, but he does not drink a gill of milk in a round year on his own farm, nor eat an ounce of butter in a lifetime. The *sapallo*, or pumpkin, which he takes with his meat, grows like a gourd, wildly and without attention; but frequently he is even too indolent to put himself to the trouble of digging a hole and dropping the seed in, and rather than do so buys his pumpkin of some foreign immigrant or more industrious brother native. He will pay some little attention to his favorite horse, and that is about the sum of his industry and the extent of his cares in this world. As for the next he knows precious little about it, and cares still less. His serious life-long occupation consists of racing horses and gambling with his neighbors. And as he can neither read nor write, and is not obliged to labor, his passion for these pastimes is no matter of surprise. The larger portion of the proceeds of his cattle is squandered in this wretched way. As in the case of his brethren of the black-leg profession, in more civilized communities, his good fortune to-day beggars him to-morrow. The more rapid his losses, the more desperate he becomes. At such moments he will not only stake his last dollar, but his horse and trappings, the clothes on his back, and (more than this) he will even put to the hazard the concubine in his rancho, or stake his own body and soul, pledging himself to remain in confinement till some friend can ransom him by paying the required sum. Such constant and desperate playing might be expected to lead to violent quarrels, and even to bloodshed and death. Quarrels do frequently attend their play, but violence and death not often. Every gaucho carries a knife in his girdle, and the enraged player will draw and strike in the first moments of his passion, but parties interfere, he quickly cools down and is easily pacified.

An extended and detailed sketch of the native pastoral life of the pampas would be out of place in the present article. If it were otherwise, and were such a sketch faithfully drawn, it would seriously shock the feelings of those who know pastoral life only from romancing books of travel or poetic descriptions. Poets, of all living men—aye, even more than successful politicians or popular preachers—need a very wide margin. The writer knows not that he has ever been able to conceive so clear an idea of the exquisite taste and fertile ingenuity, the illimitable skill and exhaustless invention of the human soul, as when reading descriptions of pastoral life in poetic numbers or romantic prose. It is no matter of wonder that the faculties which first made pastoral life a thing of beauty afterwards invented the telescope, the quadrant, the printing press, the steamboat, the rail car, and the magnetic wire. It may be a misfortune to be destitute of that wonderful faculty which can clothe with beauty the meanest clod. But it is as surely an inestimable blessing to be endowed with that plain common sense which paints the world and men, if it may be said to paint anything, just as they live and move. And the writer would respectfully inquire of any brother of the fraternities of romantic travellers and pastoral poets, whether fleas do not abound in pastoral countries, and whether pastoral maidens were found in Swiss hats, buff skirts, kid shoes, streaming ribbons, crook in hand, seated on a flowery bank, while gentle streams went murmuring at their feet; or, half naked and besmeared with filth, they sat on the shady side of a leaking, smoky, and dirty cabin, busily employed at plucking the vermin out of each other's long, greasy, tangled hair?

The religion of the pampas is, in the native mind, a thing of vague, superstitious tradition. In the remote districts the population is so sparse and so widely scattered that it would be difficult to provide church accommodation in localities that would insure attendance. The souls that live thus secluded from the great highways of southern life are but little cared for, and are consequently acquainted only with the most simple rudiments of the national faith and worship. The cross as a symbol, the evening hymn to the Virgin, the brief prayer for protection and blessing to the patron saint, form the principal marks of distinction between the religious customs of these Christians, these mixed descendants of the Spanish conquerors, and those of their Indian neighbors of the Grand Chaco and the Patagonian wilds. Their moral habits are simply what might be expected from their rude condition and non-intercourse with classes whose education produces a better example. Far out in the plains marriage is the exception, and polygamy prevails without disgrace or even censure from the lips of either sex. It is, in brief, a state of society in which are to be found many of the vices of civilization, and but few of its virtues.

THE RIVER AND THE CITY.

La Plata, with its great tributaries, forms the grand outlet for the whole of that immense portion of the southern continent which lies south of the Amazon and east of the Andes. Of this rich and vast country, the principal port is the city of Buenos Ayres. Before the independence it was the only port, and in consequence of that fact it enjoyed almost from its foundation superior advantages. The city stands on the west bank, and extends to the edge of the river. Its site is about in the middle of a long semi-circular sweep or bend, which the river makes between Point San Fernando and Point Indio, a distance, probably, of fifty miles. The highest point of elevation in the site above the river is, perhaps, not more than fifty feet. The city covers nearly as much ground as Philadelphia, and lies much in the same form—the *reachuelo*, or little river flowing around the southwestern suburb, corresponds to the Schuylkill and La Plata to the Delaware, except that the former has, at the point where it leaves the city, a width of thirty miles. Approaching from the sea the city presents a fine appearance. The harbor is very capacious. The inner roads, where vessels of not more than two hundred and fifty tons are anchored, are about a mile and a quarter from the beach, and the outer roads, where vessels of heavier tonnage anchor, are distant from the beach not less than seven miles. To a distance of six or eight hundred yards from its margin the river is so shoal that a man may wade it. This, it may seem to us, should have taught the founders that a *mole* was a necessity of the first importance to the comfort, reputation, and prosperity of the port. But they never did so understand, and, until within the last ten years, all cargoes were landed at first in small vessels called *lighters*, and where these touched bottom their freight was transferred to horse carts having crate bodies and high wheels. Some eight years ago a mole was built extending far enough to meet the lighters. At the same time the lighters ought to have been supplanted by steam tugs, but they were not; and, it is presumed, continue to be used to this day. They afford but a sorry convenience for discharging a ship's cargo. Considering the days of high wind, when it is impossible for the lighters to carry sail, and the incessant propensity of the Spaniard to procrastinate, it may at once be inferred that the discharge of a ship is a tedious and vexatious undertaking in the port of Buenos Ayres. The fact is, that some of the captains arriving at that port for the first time wear out their patience, and then nearly swear away their lungs before they get ready to bend sail and stand southward for the ocean. Probably the principal reason in the minds of the conquerors for founding a city on a beach so broad and shallow was to place it beyond the reach of an enemy's guns. In this their plan was a triumph in their day. But in this day of swamp angels, Barnard, Gillmore, or Farragut would anchor in the outer roads, and, with their improved artillery, quickly batter the city to the ground. Buenos Ayres, in several respects, can hardly be regarded as a Spanish-American city—certainly not in the same sense as Chuquesaca, La Paz, and Cochabamba. Being the only port of entry on the river, under the dominion of old Spain, it enjoyed peculiar privileges, and cultivated intercourse with the ports of other countries to an extent which greatly modified its purely Spanish characteristics. And still, as the chief port for the immense productions of the sheep and cattle farms of the pampas, it excels in wealth and all the means of civilization, and is great enough to be a competitor of Rio de Janeiro, the commercial metropolis of the southern continent.

SYSTEM OF FARM ACCOUNTS.

BY JOHN H. BOURNE, MARSHFIELD, MASSACHUSETTS.

THE following essay is presented, not as a system of book-keeping adapted to mercantile business, where large sales are daily made, but for the use of the thousands of farmers scattered all over our broad land, from Maine to California, owning farms varying in size from ten to a thousand acres. Nor is it brought forward as the only or the best one that can be employed, but as one that has proved practicable, and that can be carried out by any one who can write and perform simple operations in arithmetic.

The importance of keeping an account of the income and expenses of the farm has not been fully estimated by the majority of farmers. If they have dealings with their neighbors, they keep some record of it; but they cannot tell how the account stands with their farm. They do not know whether there is more profit in raising hay or corn, potatoes or cabbages, cattle or hogs, or whether any thing pays. It is not always advisable to take note of the expenses of every field, yet it is often well to see what it costs to raise a crop of grain, roots, &c., in order to judge the comparative value of each.

Many farmers are deterred from keeping a record of their receipts and expenditures by the belief that it is too complicated for them; others, that it will take too much time; a few, because of their unwillingness to attend to any intellectual labor; and others, still, because they do not feel its importance. It is important and practicable for all, and no man should consider that he has reached the rank of No. 1 farmers unless he keeps accurate accounts with his farm; and one of the best means to reach that rank is to commence and continue well-arranged, simple, and accurate farm accounts. We admit that it is more difficult to arrive at the *exact* cost of a certain crop or animal, than for the merchant to get at the cost of his goods. For instance, in raising a calf it would take a great deal of time to keep an account of every quart of milk, every pound of hay, every ear of corn, pint of meal, or bushel of roots consumed, together with every hour of time employed in feeding, watering, and otherwise tending it, until it reached maturity. But an approximation can be reached near enough for all practical purposes.

Sometimes we see accounts, even in agricultural reports, in which everything a farmer raises is set down at the market value. For instance, credit is given for the number of tons of hay, the number of bushels of corn and potatoes, and everything that is raised, without a corresponding debit of what is used in keeping the stock through the year—making it appear as if the net income was very large, when, in reality, nearly all is used upon the place. A farmer may, perhaps, plough large fields that have been previously manured, and, without applying any fertilizer, obtain a good crop, which, when sold, brings in a large sum of money. He may decide that his profits are large; but a system of book-keeping that estimates the value of the land of each field, each year, would oblige him to appraise the fields from which his large crops were taken as of less value than before. This would show him that the profits were not really as large as he at first supposed. Another might spend a good deal of time and money in making improvements, which, for the present, bring in no profit, and it might seem that nothing was made by farming; yet an account of what his improvements cost, and of all that the land (on which the improvements were made) produced for several years would change his opinion. Thus by carrying out a system of book-keeping, which not only applies to the farm as a whole, but also to each operation in detail, a very large fund of practical knowledge would be obtained in a few years. If each farmer in our nation would thus estimate the expenses of his business our practical knowledge of the value of agricultural products would be much increased, and the amount of productions in the nation be vastly enlarged.

Some charge no interest upon their cattle, tools, land, and buildings; others sell a large quantity of wood each year, which is all considered as profit, without regard to the diminished value of the lot; these all deceive themselves, thinking they have made a large profit by farming, when the profit, in reality, comes from some other source.

The plan which I propose to present is one which I have, in part, followed for some years, and has answered every purpose. It is so simple that a person whose education is very limited can adopt it. The productions raised, and the prices of both productions and labor, vary much in different localities; but the principles will apply in all circumstances, and a little practice will make the application of these principles easy. For convenience, it will be better to use only one book; it may be of any size and shape, but the most convenient shape I have found to be very nearly in the form of this which you are now reading—Agricultural Report—and containing about two hundred pages, made of ruled paper, and having two ruled lines on the right hand, up and down the page, for dollars and cents, and one on the left hand for the date of the transaction. Let the book be paged, writing the numbers plainly, and place an index at the commencement. Following, should be an inventory of the value of the farm, the stock and farming implements, leaving a few blank leaves for inventories in future years. Next, may follow what may be called a memorandum or journal, in which should be noted all transactions important enough to be remembered. This will require no debit or credit, but is simply a history, important for reference, and will serve to prove the time and nature of any transaction. At one-third the distance from the beginning should commence the cash book or farm account, in which every sale is credited to the farm, and every expense is debited. Commencing with the last quarter of the book may be kept the account with different fields, hired men, and every person with whom an account is kept.

As the season begins in April, I would commence the year with that month—as less produce is on hand, and it is easier to take an inventory, (or "account of stock," as merchants call it,) which should always be done. It will require some judgment to rightly estimate how much more, or less, each animal is worth than one year before; whether your buildings and fences are in as good repair; whether your land has improved or lessened in value; whether the new tools purchased are equal in value to the loss by use of the old; whether you have more hay, grain, or vegetables on hand than at the commencement of the previous year, all of which should be correctly ascertained, being appraised at the market value. If an inventory is not taken, however accurate the account of the receipts and expenditures may have been, the real income or loss of the farm will not be known; and the more accurately the estimate is made, the nearer correct will be the figures that show the gain or loss for the year.

The farm to which the following figures apply is one upon which a mixed system of husbandry is employed, and its poverty of soil and distance from a market may, in part, account for the small net income of the year. The following will assist in understanding the plan to be pursued. It would, perhaps, be better to name and appraise each animal and each wagon separately, as, in case of losses or sales, the loss or cash could be set against it more readily.

INVENTORY OF FARM STOCK, TOOLS, ETC., APRIL 1, 1865.

Farm of about one hundred acres, upland and meadow, in a poor state of cultivation, with a house, two small barns, and other outbuildings, which would probably bring at auction	$2,550 00
One horse	100 00
Six oxen	620 00
Three cows	185 00
One heifer	35 00
Three turkeys	6 50
Ninety hens, at 75 cents each	67 50
Two swine	80 00
One express and one riding wagon	100 00
Ox wagon and ox cart	50 00
Harnesses	25 00
Truck harness	5 00
Yokes	5 00
Ploughs and cultivator	20 00
Ox sled and chains	8 00
Spades, shovels, and forks	10 00
Corn sheller and harrow	10 00
Hoes, rakes, and other tools	30 00
Horse rake	8 00
Hand threshing machine	15 00
Grindstone	5 00
Baskets	4 00
Corn	15 00
Rye	5 00
Potatoes	30 00
Wheat	5 00
Three tons English hay	75 00
Two tons salt hay	20 00
Family stores	155 00
Amount of inventory on which interest is to be reckoned for one year	4,244 00

JOURNAL.

To go through the year would occupy too much space; and as it is my purpose simply to give a specimen of what should be done, I will give a memorandum of only one week every two months. It is not necessary to note every sale in the journal, only the more important, and such transactions as one wishes to remember.

April 1, 1865.—Have this day taken an inventory of farm and what is on it, all of which are worth at the market value about $4,244.

Have engaged two men to work for the season; one, Charles Gross, at $25 per month, and the other, William Aiken, at $23.

April 3.—Ploughed for grain and grass seed.

April 4.—Ploughed for onions, and purchased onion, grass, and garden seeds, oil meal for feeding, and tools for summer use.

April 5.—Gave the onion ground thorough preparation for the seed, harrowing in fine manure, and working out all lumps and stones, making it mellow and level.

April 6.—Sowed onion seed, and finished sowing grass seed.

[Omitting till first week in June.]

June 1.—Planted cabbages, putting hen manure mixed with loam in the hills.

June 2.—Sold one yoke of oxen for $197, which cost $105 last fall. They have done considerable work, and have had good keeping of hay and meal. The only way I know in which anything can be made in keeping cattle is to feed liberally.

June 3.—Hoed potatoes and corn, and planted squashes and melons.

June 5.—Bought one yoke of oxen for $135, which are in thin flesh, but will probably gain during the coming summer.

June 6.—Hired another man, Patrick Murphy, for the remainder of the season, to be paid $24 per month. I believe in hiring an abundant supply of help, and that more is lost by not having help enough than by having too much.

[Omitting till August.]

August 1.—Men employed in hoeing cabbages and turnips.

August 2.—Went to market, carrying potatoes, cabbages, eggs, &c. Purchased one fine Cotswold buck lamb for $—.

August 3.—Employed the men in filling low, swamp land for mowing. Last year the best grass on the farm was upon land so reclaimed.

August 4.—Mowed salt grass.

August 5.—At work filling swamp land.

[Omitting till first week in October.]

October 2.—Men at work digging muck. Went to market.

October 3.—Gathered onions; a small crop, owing to a very dry summer Purchased oxen and steers for $—.

October 4 and 5.—Digging potatoes; very good crop; better than was expected.

October 7.—Drawing sea manure.

[Omitting till first week in December.]

December 1.—The time of the men being out, only one is to be employed during the winter; the others are paid.

December 2.—Spending time in making everything snug for winter. The barn and hog yards are now filled with muck, bedding is secured, and part of it is housed, and the remainder stacked, so that it can be kept dry; and everything is done to keep the stock warm and comfortable.

December 4.—Sold two fat hogs and eight pigs for $—.

[Omitting till first week in February.]

February 1, 1866.—Employed in laying plans for the coming year. In looking back over the failures of the past year, find they have generally arisen from two causes: first, poverty of soil or a lack of manure; and second, not having men enough to perform all the work at the right time. In addition may be added one beyond the control of man, which was, long and severe drought.

February 5.—Man employed in getting wood for the year.

CASH BOOK.

In this book everything spent for the benefit of the farm is charged to it as debtor, and everything sold, being the product of the farm, is credited to it instead of using the owner's name.

Each debtor page is to be headed as the following— Each creditor page is to be headed as the following—

DR.

Date.	Farm.	Amount.
1865.		
Apr. 4	To 4 lbs. onion-seed, at $2 25	$9 00
	To 30 lbs. clover-seed, at 15 cents	4 50
	To 1 bag red top	4 00
	To ½ bush. Herd's grass	2 00
	To ½ bush. orchard grass	2 25
	To garden seeds	3 50
	To 500 lbs. oil-meal, at 2½ cents	12 50
	To 2 shovels, at $1 25	2 50
	To 2 hoes, at 85 cents	1 70
	[Omitting until 1st week in June.]	
June 5	To 1 yoke of oxen	135 00
	[Omitting until 1st week in Aug't]	
Aug. 2	To 1 buck lamb	10 00
Aug. 3	To William Aiken	8 00
Aug. 4	To taxes	86 55
	[Omitting until 1st week in Oct'r.]	
Oct. 3	To 1 yoke of oxen	160 00
	To 5 steers	225 00
Oct. 5	To Patrick Murphy	24 00
	[Omitting until 1st week in Dec'r.]	
Dec. 1	To Patrick Murphy, (in full)	43 25
	To Charles Gross, (in full)	175 00
	[Omitting until 1st week in Feb'y]	
Feb. 1	To linseed meal	24 00
	Blacksmithing	7 50

CR.

Date.	Farm.	Amount.
1865.		
Apr. 7	By 2 pigs	$15 00
	[Omitting until 1st week in June.]	
June 2	By 1 yoke of oxen	197 00
June 7	By 1 calf	11 00
	By 15 bush. potatoes, at 60 cents	9 00
	[Omitting until 1st week in Aug't.]	
Aug. 2	By 8 bush. potatoes, at $1 50	12 00
	By cabbages	8 40
	By 12 dozen eggs, at 30 cents	3 60
	By 30 bunches onions, at 5 cents	1 50
	By 15 bunches turnips, at 5 cents	75
	By 20 dozen green corn, at 15 cts	3 00
Aug. 5	By 12 lbs. butter, at 40 cents	4 80
	[Omitting until 1st week in Oct'r.]	
Oct. 2	By 5 bbls. onions, at $2 25	11 25
	By cabbages	5 25
	By 15 dozen eggs, at 30 cents	4 50
	By melons	4 30
Oct. 6	By 15 bbls. onions, at $2 25	33 75
	By 4 bbls. apples, at $4	16 00
	By chickens	15 40
	[Omitting until 1st week in Dec'r.]	
Dec. 2	By 50 lbs. butter, at 45 cents	22 50
	By 940 lbs. pork, at 16 cents	150 40
	By 8 pigs, at $4	32 00
Dec. 4	By ¼ beef, 156 lbs, at 13 cts	20 28
Dec. 5	By 92 lbs. hide, at 8½ cents	7 82
	[Omitting until 1st week in Feb'y]	
1866.		
Feb. 1	By 25 bush. potatoes, at 60 cents	15 00
	By 8 bush. turnips, at 60 cents	4 80
Feb. 5	By 15 dozen eggs, at 35 cents	5 25
Feb. 6	By 4 steers	250 00

The above (being only detached parts, comprising merely six weeks of the year) will serve as a specimen to assist in understanding the manner in which each sale and expense is recorded. The debit side, or expenses, should be on the left hand page, and the credit, or sales, on the opposite (right) hand page, and when *either* page is filled, *both* should be added up, and the amounts placed at the bottom, when new charges and credits should be commenced on the next two pages. In like manner go through the year, and then the amounts can be drawn off and used in the final settlement.

The inventory at the end of the year will be omitted in this essay to save room, but the amount must be used in the settlement.

To find the gain or loss for the year, take—

The inventory April 1, 1865	$4, 244 00	The inventory April 1, 1866	$4, 123 50
Interest on that amount for one year	254 64	Amount of sales for the year	2, 545 84
Grocer's account for the year	175 85		
Butcher's account for the year	85 40		6, 669 34
Expenses of farm for the year, being the amount of all the debit pages of cash book	1, 681 29	Take expenses, value of farm. &c., April, 1865	6, 441 18
	6, 441 18	Net income	228 16

This amount is received for services of owner and family, besides that portion of their board and clothing furnished by the farm. It allows for the additional or decreased value of the farm buildings and fences.

The last quarter of the book being devoted to separate fields, poultry, cattle, grocer's account, butcher's account, &c, a few items will be given to show the method in which they are kept:

CORN FIELD, (two acres sward land.)

Dr.

May	1.	To 12 cords of manure, at $5	$60 00
	1 and 2.	To getting out and spreading	12 00
	3 and 4.	To ploughing	13 00
	8.	To harrowing	3 50
	9.	To furrowing one way, 3½ feet apart	2 00
	10.	To seed corn	1 00
	10.	To planting	3 00
June	3.	To cultivating and hoeing	6 50
	20.	To do. do.	6 50
July	1.	To do. do.	6 50
August	25.	To cutting and curing top stalks	8 00
Oct.	3 and 4.	To harvesting	15 00
		To interest on land and taxes	6 50
			143 50

Cr.

By 128 bushels corn, at $1 10	$140 80
3 tons top stalks, at $10	30 00
4 tons butt stalks, at $8	32 00
Value received	202 80
Cost of crop	143 50
Net income on two acres	59 30

CARROTS, (one-fourth of an acre.)

Dr.

May	12.	To 2 cords manure, at $5	$10 00
		To drawing manure	2 50
	13.	To ploughing and preparing land	3 00
	20.	To seed and sowing	1 50
June	20.	To hoeing and weeding	10 00
Nov.	10.	To harvesting	4 00
		To interest on land and taxes	2 50
			33 50

Cr.

By 8,450 pounds carrots, at ½ cent per pound, or $10 per ton	$42 25
value of tops	2 25
Value received	44 50
Cost of crop	33 50
Net income	11 00

ONIONS, (one-half acre.)

Dr.

April	4.	To 4 cords of manure, at $5	$20 00
		To drawing and spreading	3 00
	5.	To ploughing	2 00
		To cultivating, harrowing, and raking	4 00
	6.	To seed and sowing	12 00
June	6.	To hoeing	28 00
Oct.	3.	To harvesting and topping	12 00
Nov.	6.	To drawing to packet and freight	25 00
		To barrels	21 00
		To interest on land and taxes	5 00
			132 00

Cr.

By 95 barrels onions, at $2	$190 00
Cost of crop	132 00
Net income	58 00

BEEF ACCOUNT.

Dr.

To 4 steers, at $45	$180 00
3 tons salt hay, at $10	30 00
½ ton English hay	10 00
30 bushels meal, at $1 10, (2 quarts each per day)	33 00
	253 00

Cr.

By 4 steers	250 00
Loss besides the care of feeding	3 00

MEM.—Yet it is better to feed the hay upon the place, if as much can be obtained for it as it would bring if sold, even if little is received for the labor of feeding out. The manure thus made should be estimated as part of the credit.

COST OF RAISING "DAISY," A HEIFER TWO YEARS OLD, AND NEAR CALVING.

Dr.

To value when four weeks old as veal	$12 00
6 quarts of milk per day for three weeks	3 78
4 quarts of milk per day for next three weeks	2 52
2 quarts of milk per day for next three weeks	1 26
meal and grass to November 1	1 25
one pint of meal per day to May 1	4 00
hay to May 1	4 00
care the first year	8 00
pasture till November 1	3 00
hay and grain to April 1	15 00
care the second year	5 00
	59 81

MEM.—Not having calved, she is yet to be proved, although indications are that she will be worth all she cost. When she has been proved, her value may be entered beneath her cost stated above.

GROCER'S ACCOUNT.

April 1.	Sugar	$2 15
	Kerosene	1 40
	Molasses	2 00
3.	2 lbs. tea	2 50
5.	Crackers	25
6.	Flour	12 50

BUTCHER'S ACCOUNT.

April 1.	6 lbs. steak, at 20c.	$1 20
6.	8 lbs. beef, at 14c.	1 12
7.	15 lbs. fish, at 3c.	45

[So keep account to the end of the year.]

A similar account of dry goods and of general household furnishing should be kept; also, of all marketing sold.

It is said that farmers are more slack in their payments than most other business men. It is true they generally pay in time; but they are often short of money and get trusted for what they buy, thus keeping always in debt. This ought not so to be, and a little system in keeping an account of the income and expenses will have a favorable influence in assisting them to keep out of debt.

In order that every record may be accurate, it is necessary that it be attended to each night, while fresh in the mind. A small book in the pocket, or a slate and pencil hanging in some convenient place, may assist in retaining the principal facts and figures until they can be transferred to their appropriate places

WEEDS OF AMERICAN AGRICULTURE.

BY THE LATE WM. DARLINGTON, M. D., WEST CHESTER, PENN.

There are sundry plants which are worthless and unsightly or offensive in agricultural grounds, and others which are especially injurious as intruders among cultivated crops. Such plants are regarded by all neat farmers in our country as nuisances to be abated, and are known by the distinctive appellation of *weeds*. In preparing such a list as that here contemplated, I propose to sketch very briefly, in a familiar style, the character of the nuisances referred to, and, with a view to economizing space, detailed botanical descriptions are omitted. The curious in such matters can readily acquire the knowledge of those details by consulting local and general floras. It is designed simply to arrange the plants herein enumerated, merely in accordance with the *natural method*, as employed by some of the most approved modern authors, as De Candolle, Hooker, Torry, Gray, &c., giving the authentic scientific names of the genera and species, so that all concerned can speak of them understandingly and intelligibly, and annexing the common or popular names in the vernacular, so far as the same are known or in use. With these aids and facilities, as clews to further researches, and accompanied with familiar remarks on their character, it is believed the weeds of our agriculture may become accurately known, and be disposed of, as they ought to be, by every intelligent and enterprising young farmer in the land.

SERIES I.—PHAENOGAMOUS OR FLOWERING PLANTS.—CLASS I.—EXOGENOUS PLANTS; *outside growers.* SUB-CLASS I.—ANGIOSPERMOUS EXOGENS; *outside growers, with seed vessels.*

DIVISION I.—DIPETALOUS EXOGENS; *the petal mostly distinct.*

1. *Ranunculus bulbosus,* (L.)—Buttercup, bulbous crowfoot, (p.)* This foreigner is extensively naturalized in grass plots, meadows, and low ground pastures along our streams, where it is regarded as a nuisance by the farmers. The fleshy bulb is highly acrid, and the plant when once introduced is difficult to subdue. The most effective remedy yet found is to get the plant closely depastured in early spring by stock, especially sheep.

Another perennial species, viz: *R. acris,* (L.,) or tall crowfoot, is naturalized in New England, and is as obnoxious as its congener.

2. *Delphinium consolida,* (L.)—Field Larkspur, (a.) This introduced plant has strayed from the garden in many places, and is an unwelcome intruder in grain fields and other cultivated grounds. This and a kindred species (*D. ajacis*) (L.) have become so common in gardens that some attention is requisite to prevent them from trespassing on the farms. Plants which have matured their seeds in the garden should never be carried to the barn yard, nor permitted to mingle with farm manures, otherwise the fields will be speedily infested with worthless and pernicious weeds.

A slight ploughing after the removal of the crops from the field will favor the germination of the seeds, which will be destroyed by the regular ploughing of the field.

3. *Papaver dubium,* (L.)—Field Poppy, (a.) This foreigner has found its way into some districts, and, if unattended to, may become a troublesome weed, as it and the "Corn Poppy," *P. rhoeas,* (L.) are in Europe. A similar remark is applicable to the Prickly Mexican Poppy, *Argemone mexicana,* (L.,) another kindred weed which has been introduced. This plant should be extirpated by hand-weeding before the ripening of the seed. In Italy the prickly poppy became so obnoxious as to be called "infernal figs."

4. *Camelina sativa,* (Crautz.)—Wild Flax, gold of pleasure, (a.) A naturalized foreigner, and, where neglected, becoming a great nuisance—formerly supposed by the simple and credulous to be a sort of transmuted or degenerate flax. It has been subdued by annual ploughing, so managed as to allow the seeds to vegetate, and thus destroy the young plants before the seeds on them are matured.

5. *Capsella bursa pastoris,* (Moench.)—Shepherd's Purse, (a.) A worthless little intruder from Europe, but the valuable grasses will generally choke out such small weeds.

6. *Raphanus raphanistrum,* (L.)—Wild Radish, jointed charlock, (a.) A naturalized weed, becoming a nuisance in the northern States. It has already invaded New England and Pennsylvania, and is tending westward. The seeds are contained in a jointed pod, and are thus protected from the severity of frost and concealed from birds until liberated by the process of decay of the pod.

7. *Hypericum perforatum,* (L.)—St. John's Wort, (p.) A foreign weed, formerly supposed to cause cutaneous ulcers in *white* cows and on horses with *white* feet and noses; but, the disease disappearing, that notion seems to have become obsolete.

8. *Agrostemma githago,* (L.)—Cockle, rose campion, (b.) A well-known foreign weed infesting wheat fields. The black-coated seeds, when abundant

NOTE.—The following letters are used for the sake of brevity: (p) denotes a perennial plant or root of more than two years' duration; (b) denotes a biennial plant of two years' duration; (a) denotes an annual plant living but one year; (s) denotes a shrub or small tree—a woody perennial.

and ground with wheat, are injurious to the appearance of the flour. The root of this plant should be cut below the surface with a chisel fastened to a long handle, and wielded by children. If this is neglected in the early part of the season, the fields should be scarified immediately after the removal of the crops, to favor the germination of the seed, and ultimate destruction by fall ploughing and the frost. The seed obtained from the screening of cereals should not be thrown out upon the manure heap, but fed to fowls, and the refuse left by them should be burned the next day.

9. *Abutilon avicennæ*, (Gaertn.)—Indian Mallow, velvet leaf, (a.) This foreigner, hitherto regarded as a worthless and troublesome intruder in Indian corn fields, potato patches, and other cultivated lots, has been recently announced (together with *Hibiscus moscheutos*, (L.,) a malvaceous perennial, native of our maritime marshes,) as yielding a fibrous bark suitable for textile purposes, similar to the "Jute" of commerce, obtained from Asiatic species of corchorus, and employed in the manufacture of gunny bags. The economical value of this material, which is termed "American Jute," must be ascertained by experience.

10. *Rhus venenata*, (D. C.)—Poison Sumach, poison elder, (s.) A noxious shrub frequent in moist, low grounds, by which many persons are liable to be badly poisoned. A similar cutaneous affection is often produced by the climbing variety of another species—the *Rhus toxicodendron*, (L.,) Poison Vine or Oak.

11. *Trifolium arvense*, (L.)—Stone Clover, Welsh clover, rabbit-foot, (a.) This foreign plant is only entitled to notice on account of its worthlessness and prevalence in poor old fields. Its presence is a pretty sure indication of a thin soil and neglected agriculture, and the obvious remedy is to improve both.

12. *Potentilla canadensis*, (L.)—Cinquefoil, fivefinger, (p.) The varieties of this are rather harmless, though worthless native weeds, and are merely indications of a neglected soil. There is also a coarse, erect, homely, annual species, *P. norvogica*, (L.,) which is becoming a frequent weed in the middle States, and seems to have migrated from the North.

13. *Rubus villosus*, (Ait.,) Blackberry Bramble, common brier, (p.) Every one knows the common brier; the fruit in its season is a general favorite, and some remarkably fine varieties have been produced under careful culture. The tendency of the plant, however, to spread and take possession of neglected fields, causes it to be regarded as something of a nuisance where it prevails. Another and kindred species, the *R. cuneifolius*, (Pursh,) or Sand Blackberry, has found its way into Pennsylvania, apparently from New Jersey, and bids fair to establish itself in the land of Penn. Fence angles and waste places in which the briers have obtained a foothold should be cleaned of all weeds twice yearly, in spring and autumn. This will not only exterminate the briers, but admit air and light to the field borders, otherwise shaded.

14. *Rubus canadensis*, (L.,) Dewberry, running brier, (p.) Our American dewberry is a fine fruit, and generally preferred to all the blackberries proper, but it is not the dewberry of England, which is the *rubus cæsius* of Linnæus. There is scarcely a farmer's boy in Pennsylvania who is not well acquainted with our plant, from having encountered its prickly, trailing stems with his naked ankles while heedlessly traversing the old fields where it abounds. On well-managed farms, however, this and all other species of brier (not excepting our native raspberries) are becoming rare.

15. *Rosa carolina*, (L.,) Swamp Rose, (p.) This is often an obnoxious plant in wet meadows and low grounds, forming unsightly thickets with other weeds if neglected. Another native species, *R. lucida*, (Ehrh.,) the Dwarf Wild Rose, is quite frequent in neglected grounds. The foreign Sweet Brier, *Rosa Rubiginosa*, (L.,) is naturalized in many localities and deemed a trespasser.

16. *Sicyos angulatus*, (L.,) One-seeded Star Cucumber. This climbing vine,

with leaves resembling those of the cucumber, is a native weed, and a vile nuisance when admitted into gardens and cultivated lots.

17. *Daucus carota*, (L.,) Wild carrot, (b.) When this wild variety of the common garden carrot becomes thoroughly naturalized, as it is now on many farms in the middle States, it is a troublesome weed, and requires persevering vigilance to get rid of it. It should be diligently eradicated before it ripens its seeds. In case of snow, with a smooth surface crust, the mature umbels break off and are driven by the winds to a great distance, and thus annoy an extensive district. Another umbelliferous nuisance is created by permitting the valuable garden parsnip, *Pastinaca sativa*, (L.,) to disseminate itself and multiply rapidly in adjoining fields, and along fence rows, giving to the farms a very slovenly appearance.

18. *Archemora rigida*, (D. C..) Cowbane, wild parsnip, (p.) This native weed occurs frequently in swampy meadows, and is reputed to be an active poison when eaten by horned cattle, which, however, probably seldom happens, unless the pasture is very deficient.

19. *Ægopodium podagravia*, (L.,) Goat Weed, (p.) A foreign weed, troublesome and difficult to eradicate.

20. *Cicuta maculata*, (L.,) Water Hemlock, spotted cowbane, musquash root, (p.) The root of this is poisonous, and proves fatal to children who collect and eat it by mistake for the root of sweet cicely, *osmorhiza longistylis*, (D. C.) It is found indigenous along rivulets and margins of swamps, and should be carefully eradicated.

21. *Conium maculatum*, (L.,) Common or Poison Hemlock, (b.) A poisonous and dangerous weed, introduced from Europe, and occasionally met with about old settlements. It is supposed to be the identical herb with which the ancient Greeks put their philosophers and statesmen to death when they got tired of them.

DIVISION II.—GAMOPETALOUS EXOGENS; *Petals more or less united.*

22. *Sambucus canadensis*, (L.,) Common Elderbush, (s.) This indigenous shrub is very tenacious of life, and inclined to spread extensively along fence-rows and hedges, giving the premises a very slovenly appearance.

23. *Dipsacus sylvestris*, Mill Teasel, wild teasel, (b.) This coarse European weed is completely naturalized in some localities, and is not only worthless, but threatens to become a nuisance if not attended to.

24. *Vernonia noveboracensis*, Wild Iron Weed, (p.) A coarse native plant, quite common in moist, low meadow grounds, and along fence-rows. The root of this must be cut like the Canada thistle before the flowering season in spring, or the danger will be imminent of its over-running the whole area in a short period by means of its floating seeds.

25. *Eupatorium purpureum*, (L.,) Trumpet Weed, joe-pye weed, (p.) Several varieties of this tall, stout weed are indigenous on our moist low grounds.

26. *Aster ericoides*, (L.,) Heath-like Aster, (p.) Numerous species of this large American genus meet the eye of the farmer, in the latter part of summer, in his woodlands, low grounds, borders of thickets, &c., some of which are quite ornamental, but the little bushy one here mentioned is about the only one which invades our pastures to any material extent. In neglected old fields, it often becomes as abundant as it is always a worthless weed.

27. *Erigeron canadense*, (L.,) Horse Weed, butter weed, (a.) This American weed has diffused itself all over our country, and, it is said, has reached and pervaded all Europe. The cultivation of hoed crops will clear the fields of this pest. Other varieties of the same genus infest meadows, which, if the evil becomes too burdensome, must be ploughed up.

28. *Erigeron strigosum*, (Muhl.,) Flea-bane Daisy, (a.) This very common native weed is apt to be abundant in the first crop of upland meadow, after the

usual routine grain crop. After that, especially in good lands, it becomes more rare, being probably choked out, like many other weeds, by the valuable grasses.

29. *Solidago nemoralis,* (Ait.,) Golden Rod, (p) Several species of golden rod occur along fence rows, borders of woods and thickets, and intrude upon neglected pasture fields.

30. *Ambrosia trifida,* (L.,) Great Rag Weed, (a.) A coarse, ugly native weed, common in waste places.

31. *Ambrosia artemisiæ folia,* (L.,) Bitter Weed, rag weed, (a.) This indigenous, bushy weed occurs in most cultivated grounds, and is most abundant among the stubble, after a crop of wheat. But if the land be good, the plant seems to be smothered or choked out the next season by the usual succeeding crop of clover and the grasses. It is always ready, however, to make its appearance whenever the grassy turf is broken up by the plough.

32. *Xanthium strumarium,* (L.,) Clot-weed, cockle-bur, (a.) This vile weed, of obscure origin, has the appearance of a naturalized stranger in our country, and seems, fortunately, not much inclined to spread. The burs are a great annoyance in the fleeces of sheep.

33. *Xanthium spinosum,* (L.,) Thorny Clot-bur, (a.) This execrable foreign weed is fast becoming naturalized in many portions of our country, particularly in the southern States. It may be frequently seen also along the sidewalks and waste places in the suburbs of our northern seaports. It is stated that the authorities of a southern city a few years since enacted an ordinance against the offensive weed, in which enactment it was denounced by the misnomer of "Canada thistle." This plant may be destroyed with the hoe in the latter part of summer—in September.

34. *Bidens frondosa,* (L.,) Bur Marigold, (a.) Worthless native weeds in gardens, corn fields, &c., and particularly disagreeable by reason of the barbed awns of the fruit, which adhere in great numbers to clothing.

35. *Bidens bipinnatus,* (L.,) Spanish Needle, (a.) This, like the preceding, if not carefully watched and extirpated, is a great pest in cultivated lots. Another species, *B. Chrysanthemoides,* (Mx.,) known as Beggar-ticks, is rather showy, with its head of yellow-rayed florets, and is frequently found along swamps and rivulets in autumn. They are all regarded as nuisances on account of their adhesive fruit.

36. *Maruta cotula,* (D. C.,) May-weed, fetid chamomile, (a.) A disagreeable little foreign weed, which is extensively naturalized, and in bad odor among us.

37. *Achillea millefolium,* (L.) Yarrow, milfoil, nose-bleed, (p.) English agricultural writers speak of it as a plant of some value in their pastures; but it is generally regarded in this country as a mere weed. Certainly it is far inferior to our usual pasture plants, and our cattle are rarely, if ever, observed to eat it.

38. *Leucanthemum vulgare,* (Lam.,) Ox-eye, daisy, white weed, (p.) This intruder from Europe has obtained almost exclusive possession of many fields in eastern Pennsylvania, and the prospect of getting rid of it appears to be nearly hopeless. Its propagation and diffusion are so rapid and irresistible that one negligent sloven may become the source of a grievous annoyance to a whole neighborhood. The cultivation of hoed crops a few years will rid a field of this obstruction to useful vegetation. The Corn Marigold, *Chrysanthemum segetum,* (L.,) a kindred plant, which is said to be such a pest to the agriculture of the Old World, happily does not appear to have found its way as yet to the United States.

39. *Erechthites hieracifolia,* (Raf.,) Fire Weed, (a.) This coarse native weed is remarkable for its prevalence in newly-cleared grounds, especially in and around the spots where brush-wood has been burnt; hence its common name of "fire-weed."

40. *Senecio vulgaris,* (L.,) Common Groundsel, ragwort, (a.) A homely

worthless little herb, which Professor De Candolle remarks migrates almost everywhere with European men. It is naturalized about the seaports of the northern States, and has lately appeared in eastern Pennsylvania.

41. *Centaurea cyanus*, (L.,) Ragged Robin, blue bonnets of the Scotch, (a.) This European plant is often seen in our gardens, and in some places is gradually straggling into cultivated fields. As it is considered a troublesome weed among the grain crops of the Old World, it should be watched here, so as to prevent the *blue bonnets* from "coming over the border."

42. *Cirsium lanceolatum*, (Scop.,) Common Thistle, (b.) This foreigner, which delights in a rich soil, is abundantly naturalized in Pennsylvania and in the northern States generally. It is a very objectionable weed on our farms, requiring constant vigilance and attention to exclude or keep it in subjection. If permitted to mature its fruit, the expanded pappus may be seen by thousands floating the akenes through the air, and disseminating the obnoxious intruder far and wide. The common thistle, having no creeping roots, is not so obstinate in resisting extirpation as some other varieties. It is easier destroyed if the roots are cut with sufficient care before its flowering season.

43. *Cirsium horridulum*, (Mx.,) Yellow Thistle, (b.) This rugged, repulsive species looks like a stranger here, being hitherto chiefly restricted to the sandy sea-coast of New Jersey. It is certainly desirable that it should continue to be a stranger to every agricultural district.

44. *Cirsium arvense*, (Scop.,) Canada Thistle, (p.) This is perhaps the most pernicious and detestable weed that has as yet invaded the farms of our country. Though miscalled "*Canada thistle*," it is believed to be indigenous to Europe, and has probably acquired that name by reaching us *via* Canada. The rhizoma or subterranean stem (which is perennial and very tenacious of life) lies rather below the usual depth of furrows, and hence is not destroyed by common ploughing. The rhizoma ramifies and extends itself horizontally in all directions, sending up branches to the surface, where radical leaves are developed the first year, and aerial stems the second year. The plant—that is, the aerial portion—appears to die at the end of the second summer like a biennial, but it only dies down to the rhizoma or subterranean stem. The numerous branches sent up from perennial rhizoma soon furnish prickly radical leaves, which cover the ground so as to prevent cattle from feeding where those leaves are. Nothing short of destroying the perennial portion of the plant will rid the ground of this pest; and this has been accomplished by a few years of continued culture, (or annual cropping of other plants which require frequent ploughing or dressing with the hoe,) so as to prevent the development of radical leaves, and thus deprive the rhizoma of all connexion or communication with the atmosphere. We have a few other thistles which are all worthless weeds; but not being so obnoxious as the preceding, it is not deemed necessary further to notice them here.

45. *Lappa major*, (Gaertn,) Burdock, (b.) Everybody knows this coarse homely foreign weed, one of the earliest and surest evidences of slovenly negligence about a farm-yard.

46. *Cichorium intybus*, (L.,) Wild Succory, chiccory, (p.) This foreigner is becoming extensively naturalized. Some European agriculturists recommend it as a valuable forage plant, and cattle seem fond of it; though it is believed to impart a bad taste to the milk of cows which feed upon it. In Europe the roasted root is used as a substitute for coffee. In this country the plant is generally regarded as an objectionable weed.

47. *Taraxacum dens-leonis*, (Desf.,) Dandelion, (p.) An introduced plant, and now so extensively naturalized in our grass-plots, fields, and meadows that although not very obnoxious as a weed, it will be found a difficult task to extirpate it. The leaves and flower buds are frequently used, wilted, as a salad, and boiled as "greens," and the root has been much employed recently in do-

mestic economy, and is esteemed a pleasant and salutary substitute for the coffee berry.

48. *Lobelia inflata*, (L.,) Eye-bright, Indian tobacco, (b.) A native weed possessing acrid properties, and sometimes employed as an emetic, and as an expectorant in asthma.

49. *Andromeda mariana*, (L.,) Stagger-bush, (s.) This native shrub is very abundant in the sandy districts of New Jersey, where it is reputed to be injurious to *sheep* when the leaves are eaten by them, producing a disease called the "staggers." The evidence on this point is not quite conclusive, but if established would cause the bush to be deservedly ranked among the pernicious plants.

50. *Plantago major*, (L.,) Common plaintain, way-bread, (p.) This foreign plant is remarkable for accompanying civilized man, growing along his footpaths and flourishing around his settlements. It is alleged that our aborigines call it "the white man's foot," from that circumstance. Another foreign species, the *P. lanceolata*, (L.,) known as English plaintain, rib-wort, ripple-grass, and buckhorn plaintain, is becoming particularly abundant in our upland meadows or clover grounds. The farmer should keep its seeds from mingling with those of the red clover, and thus injuring the sale of clover seed in the market.

51. *Tecoma radicans*, (Juss.,) Trumpet-flower, (p.) This showy native climber is often cultivated and admired in the Northeastern States, but in the West, along the Ohio river and its tributaries, it is regarded as an intolerable nuisance.

52. *Verbascum thapsus*, (L.,) Common Mullein, (b.) An introduced, homely weed in our pastures and cultivated grounds. There is no surer evidence of a slovenly and negligent farmer than fields overrun with mulleins. As the plant produces a vast number of seeds it can only be kept in due subjection by eradication before the fruit is mature. There is another species called moth mullein, *V. blattaria*, (L.,) more slender, and equally worthless, becoming frequent in our pastures.

53. *Linaria vulgaris*, (Mill.,) Toad-flax, Ranstead-weed, (p.) A rather showy, but fetid weed, said to have been introduced into Pennsylvania by a Mr. Ranstead, from Wales, as a garden flower. It inclines to form large, dense patches in our pastures by means of its creeping roots, which take almost exclusive possession of the soil.

54. *Nepeta cataria*, (L.,) Cat-mint, cat-nip, (p.) This is common about old settlements. Another perennial species, *N. Glechoma*, (Benth.,) called ground-joy, and gill, is also common in moist, shaded places about farm houses.

55. *Lamium amplexicaule*, (L.,) Dead nettles, hen-bit, (a.) A worthless little weed, abundant in and about gardens in the Middle States, requiring some attention to keep it in due subjection.

56. *Leonurus cardiaca*, (L.,) Motherwort, (p.) A homely, obnoxious weed, found in waste places about houses and farm-yards.

57. *Teucrium canadense*, (L.,) Wood-sage, germander, (p.) This native plant, which is frequently seen in low, shaded grounds along streams, where it is harmless, has recently got into the fields of some of the best farms of eastern Pennsylvania, where it is now regarded as an obstinately persistent nuisance.

58. *Echium vulgare*, (L.,) Blue-weed, vipers bugloss, blue devils, (s.) A showy, but vile weed, extensively naturalized in some portions of our country, especially in Maryland and in the Shenandoah valley, Virginia. Wherever it makes its appearance the farmers should act promptly on the Ovidian maxim, "*Principiis obsta*," &c.: Meet and resist the beginning of evil.

59. *Echinospermum lappula*, (Lehm.,) Stick-seed, beggar's lice, (a.) The slovenly farmer is apt to get practically and vexatiously acquainted with this obnoxious native weed in consequence of its racemes of bur-like fruit entangling the manes of his horses and the fleeces of his sheep

60. *Convolvulus arvensis*, (L.,) Bind-weed, (p.) This foreign plant has been introduced into some portions of our country, and will give the farmers much trouble if they do not carefully guard against it.

61. *Cuscuta epilinum*, (Weihe,) Dodder, flax-vine, (a.) This remarkable parasitic plant, somewhat resembling copper-wire in appearance, was introduced with our flax crop, and was formerly a great pest in that crop, by winding round and entangling branches of stalks so as to spoil them; but the vine has become rare, and has nearly died out since the culture of flax has declined among us.

62. *Solanum nigrum*, (L.,) Night-shade, (a.) Frequent in shaded, waste places about dwellings. It is reputed to be deleterious in its properties, and ought, therefore, to be carefully excluded from the vicinity of all farm-houses, where its berries may tempt children to "pluck and eat."

63. *Solanum carolinense*, (L.,) Horse Nettle, (p.) An exceedingly pernicious weed, and the roots are so penetrating and so tenacious of life that it is difficult to get rid of. It was probably introduced from the South by *Humphrey Marshall* into his botanic garden at Marshallton, Pennsylvania, whence it has gradually extended itself round the neighborhood, and forcibly illustrates the necessity of caution in admitting mere botanical curiosities into good agricultural districts.

64. *Datura stramonium*, (L.,) Thorn Apple, Jamestown (or Jimson) weed, (a.) Two varieties of this coarse, fetid, narcotic plant (which is probably of Asiatic origin) are common among us as an obnoxious weed, and they should be carefully excluded from the vicinity of all farm-houses.

65. *Enslenia albida*, (Nutt,) Whitish Enslenia, (p.) This twining plant, allied to the Asclepias or Milk-weed family, and happily as yet unknown to the farmers of the eastern States, is reported by Prof. Short, a distinguished botanist of Kentucky, to be an intolerable nuisance on the farms along the river banks in Ohio, Illinois, &c.

Division III.—Apetalous Exogens; *Corolla usually wanting.*

66. *Phytolacca decandra*, (L.,) Poke-weed, pigeonberry, (p.) This stout native is everywhere frequent in rich soil. The *turions*, or tender radical shoots, in the spring of the year afford a popular substitute for those of asparagus; nevertheless, the plant is regarded and treated as a weed by all neat farmers.

67. *Chenopodium album*, (L.,) Lamb's Quarter, goose-foot, (a.) This coarse and rather homely weed has become common and quite troublesome in gardens.

68. *Amaranthus hybridus*, (L.,) Pig-weed, (a.) A repulsive looking weed, an annoyance in gardens and cultivated lots in the latter part of summer. If permitted to mature its seed it soon becomes very abundant.

69. *Amaranthus albus*, (L.,) White Amaranth, (a.) Another coarse weed in the farm yards of the middle States. Although supposed by some to be a native of Pennsylvania, it has a foreign habit and appearance, and probably came from tropical America.

70. *Amaranthus spinosus*, (L.,) Thorny Amaranth, (a.) This odious bushy weed, supposed to be a native of tropical America, is common in unfrequented streets and outskirts of our seaport towns, and is a vile nuisance wherever it appears. It cannot be too sedulously guarded against. Hoeing on its first appearance is often effectual for its destruction.

71. *Polygonum pennsylvanicum*, (L.,) Knot-weed, (a.) A common worthless weed on road sides and in waste places about neglected farm-houses.

72. *Polygonum pucicaria*, (L.,) Lady's Thumb, spotted knot-weed, (a.) Resembles the preceding, and rather smaller, but equally worthless wherever introduced.

73. *Polygonum hydropiper*, (L.,) Water Pepper, smart-weed, (a.) A natu-

ralized weed as worthless as most of the species are, though this is even more obnoxious than the preceding, being a highly acrid plant, and sometimes causing obstinate ulcerative inflammation when incautiously applied to the skin.

74. *Polygonum sagittatum*, (L.,) Arrow-leaved Tear-thumb, (a.) Mowers and haymakers are apt to be familiar with this annoying native weed in the second crop of swampy meadows. Another kindred species, viz. *Parifolium*, (L.,) or Halbert-leaved Tear-thumb, is an accompanying and equally obnoxious weed. Ditching and draining are the remedies for the evil. Several other *Polygonums* occur, equally worthless, but rather less offensive.

75. *Rumex crispus*, (L.,) Sour Dock, curled dock, (p.) An unsightly and objectionable foreign weed, too extensively known.

76. *Rumex obtusifolius*, Bitter Dock, broad-leaved dock, (p.) This foreign species is now more objectionable than the preceding, but is not quite so prevalent. There is also a little foreign species, well known for its acidity—the *R. acetosella*, (L.,) Field or Sheep Sorrel, (p.,) often so abundant as to be a nuisance on the farm. Improving the land, especially by adequate dressing of lime, is believed to be the best mode of expelling this and many other obnoxious weeds.

77. *Euphorbia hypericifolia*, Eye-bright, spurge, (a.) This is a common weed in dry pasture fields, especially in thinnish sandy soils, and has been suspected (how justly has not been determined) as the cause of the disagreeable salivation or slabbering with which horses are sometimes affected in the latter part of summer. There is another flatty, prostrate, bunching little species, *E. maculate*, (L.,) often abundant in Indian cornfields and other cultivated grounds.

78. *Urtica dioica*, (L.,) Nettle, stinging nettle, (p.) An exotic rather frequent in waste places about farm houses, well known to those who have come in contact with them.

Class II.—Endogenous Plants; *Inside Growers.*

79. *Symplocarpus fœtidus*, (Salish,) Swamp Cabbage, skunk weed, (p.) A worthless native weed in wet and swampy meadows, readily known by its skunk-like odor when wounded.

80. *Sagittaria variabilis*, (Englin,) Arrow-head, (p.) A common native plant of no value, found in sluggish ditches and swampy meadows. The roots, or base of stem, often produce large oval tubers in autumn, which tempt hogs to root for them, and thus disfigure the grounds in which they occur.

81. *Anacharsis canadensis*, (Planchon, Udora, Nutt,) Water-reed, (p.) This slender aquatic is supposed to be indigenous in our sluggish streams, where it often abounds, and may possibly become troublesome in our canals. It has been introduced into England, where its presence impedes the navigation of the canals to a serious extent.

82. *Smilax rotundifolia*, (L.,) Green Brier, rough bindweed, (p.) This is common in thickets, and a variety of it, S. Caduca, (L.,) often abounds in poor, neglected old fields.

83. *Ornithogalum umbellatum*, (L.,) Ten O'clock, (b.) This exotic from the gardens in many places multiplies its bulbs so rapidly as to alarm the farmer, if neglected. The bulbs are exceedingly tenacious of life, and when once in possession of the soil, it is an almost hopeless task to get rid of them.

84. *Allium vineale*, (L.,) Field Garlic, crow garlic, (p.) Tradition says this species was introduced by the first Welsh immigrants to Pennsylvania for the purpose of affording an early pasture, particularly for sheep. It was formerly so abundant in some districts as to be quite an annoyance, by imparting a disgusting flavor to milk and butter, and injuring the manufacture of wheat flour. By good farming and a judicious rotation of crops the evil has been much abated.

85. *Juncus effusus,* (L.,) Common or Soft Rush, (p.) There are numerous species of this worthless native weed, but this is the best known, and perhaps the most objectionable, as it has a constant tendency to form unsightly bunches, or *tussocks*, in moist low grounds. Mr. Elliott, an eminent botanist, says that in South Carolina this Rush occupies and almost covers rice fields as soon as they are thrown out of cultivation.

86. *Cyperus phymatodes,* (Muhl., Nut.,) Grass of Florida, (p.) This species is fortunately somewhat rare, as yet, in the northern and middle States, but it is a great pest to the agriculture of the South.

87. *Cyperus hydra,* (Mx.,) Coco grass, nut grass of South Carolina, (p.) This is regarded by the southern planters as the most intolerable pest of their agriculture. Mr. Elliot says: "It shoots from the base of its stem a thread-like fibre, which descends perpendicularly eight to eighteen inches, and then produces a small *tuber*. From this horizontal fibres extend in every direction, producing new tubers at intervals of six or eight inches; and these immediately shoot up stems to the surface of the earth, and throw out lateral fibres to form a new progeny. This process is interminable, and it is curious to see what a chain or net-work of plants and tubers can, with some care, be dug up in a loose soil. The only process yet discovered by which this grass can be extirpated is to plough or hoe the spots in which it grows every day through the whole season. In their perpetual efforts to throw their leaves to the light the roots become exhausted and perish; or, if a few appear the next spring, they can easily be dug up."

88. *Carex tentaculata,* (Muhl.,) Many-beaked Sedge, (p.) A very common species, in swampy low ground, of the large and unprofitable genus of sedges.

89. *Carex stricta,* (Lam.,) Tussock Sedge, (p.) This is one of the most common, and most difficult to manage, of all our sedges. Its roots are apt to form large dense tufts or "tussocks" in swamps. The careful farmers sometimes get rid of those tussocks by digging them out, and, when dry, collecting them in large heaps, burning them, and using the ashes as a manure. Of this remarkable and very numerous genus, (Carex,) Dr. F. Boott, an accomplished botanist of London, has now in hand one of the noblest and most elaborately illustrated monographs ever issued from the press.

90. *Panicum sanguinale,* (L.,) Crab grass, finger grass, (a.) In the middle States this troublesome grass abounds in gardens in the latter part of summer, and is frequent also in Indian corn fields, but may be kept in tolerable subjection by the early and faithful use of the instrument known as the "cultivator." The crab-grass is regarded as a serious pest in the plantations along the lower Mississippi.

91. *Panicum capillare,* (L.,) Hair-like Panicum, "Old Witch" grass, (a.) This worthless species flourishes best in a light sandy soil, but is usually more or less abundant in corn-fields. In autumn the dry culms break off and the light-spreading panicles are rolled over the field by the winds, until they accumulate in great quantities along fence and hedge rows.

92. *Panicum crus-galli,* (L.,) Cock-foot Panicum, barn-yard grass, (a.) This coarse homely grass is said to be an inhabitant of all quarters of the globe. It is usually found in the latter part of summer, rather abundant along drains of barn-yards and other waste places.

93. *Sitaria glauca,* (Beauv.,) Bristly Fox-tail grass, (a.) All our weed-like species of this genus are believed to be naturalized strangers here. This one usually makes its appearance in abundance among the stubble, after a wheat crop, and is frequent in pastures, orchards, &c., when not kept down by a more valuable growth. The *S. viridis*, (Beauv.,) called green fox-tail or bottle grass, is about equally worthless, but not quite so prevalent.

94. *Sitaria virticellata,* (Beauv.,) (a.) The adhesive bristles of this species,

frequenting gardens and neglected lots, are calculated to make it something of a nuisance if permitted to become abundant.

95. *Cenchrus tribuloides*, (L.,) Bur grass, hedge-hog grass, (a.) This pestilent nuisance is quite abundant in the sandy districts of New Jersey and along the great northern lakes.

96. *Cynodon dactylon*, (Pers.,) Dog's-tooth grass, Bermuda grass, (p.) Of this grass, which has found its way from Europe into Virginia and other southern States, Mr. Elliot remarks: "The cultivation of it on the poor and extensive sand-hills of our middle country," (viz., in South Carolina,) "would probably convert them into sheep-walks of great value; but it grows in every soil, and no grass, in close rich land, is more formidable to the cultivator. It must, therefore, be introduced with caution."

97. *Bromus secalinus*, (L.,) Cheat, chess, broom grass, (a.) This is a well-known intruder among our crops of wheat and rye, and often appears in the same fields for a year or two after those crops, but it is soon choked out by the perennial grasses.

This plant is an annual, and easy to overcome by care in sowing clean wheat, by keeping fence corners and field borders clear, and in establishing a proper rotation in cropping. The vulgar error, that this grass is merely *transmuted wheat*, came to us with the earliest immigrants, and, notwithstanding the boasted "march of mind," it yet prevails among a certain class of farmers to a considerable extent.

98. *Triticum repens*, (L.,) Couch grass, Quitch grass, (p.) This species of *triticum*, which is quite distinct in habit from the cultivated wheat, has found its way into some districts of our country, and is a pernicious intruder, when fully introduced, by reason of the exceeding tenacity of life in its rhizomas, or creeping subterranean stems.

99. *Andropogon nutans*, (L.,) Wood grass, Indian grass, (p.) This and two or three other species of native Indian grasses are common in our sterile grounds, and are no better than mere weeds.

SERIES II.—CRYPTOGAMUS, *or Flowerless Plants*

100. *Pteris aquilina*, (L.,) Brake, bracken of the Scotch, (p.) This large *fern* is often abundant in moist woodlands and borders of thickets, and in our wild forests it affords a favorite shelter, or hiding-place, for deer and other game, but it is little better than a weed on the farm.

Having thus disposed of the most prominent weeds in our agriculture, it remains merely to mention, very briefly, three or four of the injurious cryptogams, among the lower order of the fungi, viz:

Merulius lachrymans, (Schum.,) Dry-rot. This fungus, with some others which infest timber in places where a damp air is confined, as in houses and ships, is very injurious. It is said to be remedied by a wash of diluted sulphuric acid.

Ascophora mucedo, (Link.,) Mould, bread-mould. This minute fungus usually abounds on moist decaying substances, and is well known to housewives as growing plentifully on bread and pastry which have begun to "spoil;" yet it is probable that many of them have never suspected it of being as genuine a plant as any weed that grows on the farm.

Uredo segetum, (Pers.,) Blight, smut, brand. This is usually found within the glumes and fruit of wheat, barley, and other grasses, speedily filling the whole with a profuse black dust.

Puccinia graminis, (Pers.,) Mildew, rust. This often operates injuriously on wheat crops in warm, close, foggy weather, near harvest time; especially where the crop is a little backward and mingled with grass or herbage.

OBSERVATIONS ON ATMOSPHERIC HUMIDITY.

BY J. S. LIPPINCOTT, HADDONFIELD, N. J.

To a large and intelligent class of readers of the Agricultural Department reports, grape-growing has become an object of absorbing interest. Those of this class who may have read a paper on "The Climatology of American Grape Vines," in the report for 1862, and its continuation under the title of "Geography of Plants," in that for 1863, will have observed that success was promised in certain zones of summer temperature, provided the atmospheric humidity were not there deficient, either permanently or for the season. This element, so variable, seems scarcely less important than that of the mean temperature of the growing season. Experience derived from the failure of the grape crop of 1864 and 1865, over wide regions deficient in humidity, and its success in others where this element must have been abundant, have set its value in a clearer light than heretofore.

In seasons not marked by extreme fluctuations of atmospheric humidity, and accompanying reductions of temperature in midsummer, the isotherms which bound the grape-growing belts, as heretofore described, limiting the regions adapted to certain varieties of grapes, may still be esteemed as normally correct and reliable; but in seasons of exceptional character, when extremes of humidity occur, and, with them, extreme high temperatures followed by great reduction of atmospheric moisture, (and oftentimes accompanying sudden decline during the night to near the freezing point,) such isotherms cease to be the guiding clews to the regions adapted to any special variety of grape, or, indeed, to indicate that any grape can be therein successfully cultivated. There are few physical laws which can be realized with mathematical exactness, but they are generally approximations, more or less false, in each particular case. "These laws are ideal truths towards which nature tends, but which are never fully reached. Even as respects the law of gravitation, there always have been residual phenomena unexplained by the law; and so, probably, there always will be as our generalizations widen towards the great Presence of which all natural phenomena are the direct manifestation."

We have hitherto regarded the conditions of temperature as of primary importance. Though the amount of moisture in the atmosphere of each locality may be of nearly equal value, we have not the data for determining the proportions of this ingredient demanded for the successful culture of many of our garden and field products.

With regard to the grape, we are better prepared to discuss the question of the climatic value of excessive or diminished relative humidity. The very favorable reception awarded our former efforts, encourages the hope that the present will prove suggestive, if not instructive.

As a necessary consequence of the evaporation continually going on over the entire surface of the earth, the atmosphere at all times contains a proportion of vapor of water, the amount of which is perpetually varying. This amount is almost always below the proportion which experiment has shown to be the greatest degree possible at the observed temperature. It is owing to this circumstance that the air is rarely fully charged with vapor—that wet bodies become dry, and that the surface of the soil, although saturated with moisture, yet in a few hours becomes parched and dusty. By the process of evaporation from the surface of the land, as well as of the ocean, a natural distillation is thus continually carried on, and a perpetual circulation of waters maintained—those conveyed by the rivers into the sea being returned by invisible channels through the atmosphere to form clouds, which shall restore to the streams, by means of rain, their perpetual tribute to the ocean.

Upon variations in the quantity of moisture present in the atmosphere, many of the great peculiarities of our climate mainly depend. The frequency of rain, and many other meteorological phenomena of the highest interest and importance, are greatly influenced by the proportions of humidity present in the atmosphere of any locality. To attain an accurate knowledge of the quantity of aqueous vapor which exists at any given time in a certain bulk of air, becomes, therefore, a problem which is constantly requiring solution. Instruments employed for this purpose are termed hygrometers. Various methods have been devised for ascertaining the proportion of moisture in the air; and the simplest and the most accurate of these consists in the determination of the dew-point, or temperature to which the air must be reduced so that its moisture shall begin to separate and condense upon cold surfaces. This difference, alone, is sometimes used to express the dryness of the air, or the reduction of its moisture below the point of saturation. The determination of the dew-point may be readily made, on a summer's day, by noting with a delicate thermometer the exact temperature of water in a glass, at the moment deposition of vapor ceases to be made. From this temperature, and that of the air at the same time, the tension (pressure, or force) of the aqueous vapor present in the air, as exerted on the column of mercury in a barometer, may, by means of tables constructed for this purpose, be readily ascertained; and the corresponding proportion of moisture (or the relative humidity or percentage of saturation) be easily learned.

The above method, apparently so simple, is not readily employed in general practice, and has given place to the wet-bulb thermometer, or August's Psychrometer, which for simplicity and ease of manipulation leaves nothing to be desired. This consists merely of two similar delicate accurate thermometers, placed side by side on the same stand, the bulb of one covered with thin muslin, which is supplied with moisture and kept continually wet by capillary conduction from a vessel beneath. The action of this instrument may be readily understood by the uninitiated observer, who, with one hand wet and the other dry, will expose them equally to a gentle current of air, on a drying day. He will not need a thermometer to indicate which hand is most rapidly cooled, and that the drier the day, the more his wet hand will become chilled below the other. Thus it is with the "wet and dry bulb" thermometers. The wet bulb thermometer will exhibit decline in temperature if the air be not already saturated with moisture, and evaporation thereby prevented. The rate of evaporation, and consequently the depression of temperature in the wet-bulb instrument, will be greater in proportion as the air is further from the point of saturation. To determine the exact amount of vapor present, and the proportional degree or percentage of saturation, tables have been prepared which greatly facilitate the study of hygrometry; the best of which are those published by the Smithsonian Institution, at Washington. Without such tables, the indications of the Psychrometer, except when very near saturation, can be but vaguely defined, since the amount of vapor contained in the air, at any time, is reduced by a fall in temperature, more rapidly than in direct proportion to the fall; for while the temperature changes in arithmetical, the humidity varies in geometrical progression. It should be understood that the amount of vapor held in the air over any district is very variable—perhaps constantly changing in amount. The colder the air, the less the vapor it can hold; and the warmer the air, the more it may contain. But it does not follow that there must necessarily always be more vapor in the air at a high temperature than at a lower one. Air at a given temperature will hold a certain quantity of vapor, and no more; but it may hold any quantity less. If heated, it may absorb more, (if not already full or saturated,) if it can gain access to it, or to water. If already full, it will lose a part of it on being chilled. The definite quantities of vapor which air will hold at certain temperatures, by Fahrenheit's thermometer, are as follows: At zero the weight of vapor in a cubic foot of saturated air has been estimated at about three-quarters of a grain; at 32°, $2\frac{1}{3}$ grains; at 40°, 3 grains; at 50°, $4\frac{1}{4}$ grains; at 60°, $5\frac{7}{8}$ grains; at 70°, 8 grains; at 80°, nearly 11 grains; at 90°, $14\frac{1}{2}$ grains; at 95°, 17 grains, and at 160°, nearly 20 grains of vapor in each cubic foot.

When an atmosphere of very high temperature is loaded with all the vapor it can hold, as at 95°, saturated with 17 grains for every cubic foot, it becomes very oppressive to the people of the district sustaining it, and sometimes destructive to life. A consideration of the above numbers will explain the general extreme humidity of the climates of warm countries. The amount of vapor in the air is not generally expressed in grains in each cubic foot, but in inches of pressure on the barometer, and in degrees of relative humidity, 100 being taken to represent saturation. This ever fluctuating element varies from hour to hour through each day, according to the changing temperature of the air, the action of the sun's rays, the presence or absence of clouds, and the force of the wind. It may be reduced almost, if not quite, to a nullity, or may rise at high temperatures until it presses upon the barometer with a force measured by two inches of its column. Throughout the year it is generally least or lowest in the morning about sunrise, when a portion has been deposited as dew or frost; and greatest or highest at $2\frac{1}{2}$ p. m., or about the period of greatest heat; and declines again in the evening, but not to the low measure of the morning. These are the mean average conditions, but it may be, and it often is, greatest in the morning, lowest at noon, and lower in the evening than at the morning observation. It is at its lowest point, generally, in January, when we have observed about one hundredth of an inch; increases in February, and advances in quantity as the season progresses, until it reaches its greatest amount in August, during the periods of greatest heats; then declines with the decline of heat, the humidity of autumn being in advance of that of spring. The highest we have observed the pressure of vapor was on the 7th of July, 1864, when it affected the barometer to the extent of 1.235 inch, the thermometer being at 90° at 2 p. m., and on the 26th of June, 1864, 1.053 inch at 2 p. m., thermometer at 96°, both of which were followed by rain in one to three hours—the last with lightning and tornado blasts of wind.

A general idea of the comparative mean force of vapor in the air near Philadelphia may be gained from the following table of the results of reductions for two years past:

Force of vapor.	In inches.		Force of vapor.	In inches.		Force of vapor in 1864–'65.		
						Lowest.	Highest.	Range.
1864—March	.167		1865—March	.219		.05	.280	.230
April	.237		April	.285		.115	.440	.325
May	.438		May	.399		.189	.857	.668
Mean for spring		.280	Mean for spring		.301			
1864—June	.472		1865—June	.667		.213	1.053	.840
July	.543		July	.671		.276	1.235	.959
August	.659		August	.687		.327	.856	.529
Mean for summer		.558	Mean for summer		.675			
1864—September	.462		1865—September	.646		.255	.744	.489
October	.306		October	.332		.168	.723	.555
November	.253		November	.242		.103	.537	.434
Mean for Autumn		.340	Mean for autumn		.405			
1864—December	.170		1865—December	.191		.059	.407	.348
1865—January	.110		1866—January	.133		.021	.376	.355
February	.142		1866—February	.164		.043	.349	.306
Mean for winter 1864–'5		.105	Mean for winter 1865–'6		.163			
Mean for year		.327	Mean for the year		.386			

By the above table it will be seen that the mean pressures of vapor for the spring of 1864 and 1865 were nearly identical; that for the dry summer of 1864 much less than that of 1865, which was not in this region so marked by drought; that of September, 1865, greatly in excess of that of 1864, as will be remembered by many who suffered from the oppressive dampness, and by those whose grapes were destroyed by rot in that month; that the mean for autumn, 1865, was therefore greater than for the previous year, and, finally, that the past winter has also been more moist than its predecessor, and for the entire year rather greater than that of 1864; all of which is in perfect accordance with our general impressions from empirical observation.

The absolute amount of vapor present in the air, as measured by the barometer, does not express the dryness or humidity as generally affecting our feelings, or the health of vegetation, but it is the evaporating power of the air which it most concerns us to know, or its capacity to take up more vapor at the temperature observed, and to deposit a portion, or become saturated, by a loss of heat. High heats with abundant moisture, (or high relative-humidity,) are favorable to some crops at certain seasons, though injurious at others. High heat and dryness are as unfavorable to some as they are beneficial to others. In June, 1864, were observed many days of low humidity with low mean temperatures, followed by high heats with greater dryness. These proved injurious to the wheat in this region, ripening it too rapidly, drying its stem and berry before it had swelled, and preventing the elements necessary to its perfect development from reaching the grain in the gradual and timely manner needed for its perfect maturation. In June, 1865, were many days of moderate heat, none excessive, (though the mean was very high from the uniform greater heat than ordinary,) equalling the greatest mean for July, but accompanied by unusual relative-humidity, (more than 40 per cent. in advance of that of June, 1864,) and the wheat crop was again injured, while the corn made a growth so extraordinary that it was the subject of frequent remark, as exceeding anything remembered. The exceeding low relative-humidity of June, 1864, and of August, 1865, and the excessive moisture in September, 1865, of which we shall have occasion to speak, are instances of the vast utility of the presence of a due proportion of this element. By the term "relative-humidity," is intended to express the amount of moisture existing in the air, compared with that which it could hold if saturated at the same temperature. A clear comprehension of the meaning of the terms, "tension," "force," or "pressure of vapor," as measured by the barometer, and of relative-humidity, as expressive of the percentage of saturation, are necessary to an understanding of the subject under discussion. Moreover, it must be remembered that the dryness expressed by the difference between the temperature of the air and the dew-point is not to be confounded with the dryness, as expressed by the percentage of saturation. The former method is not now employed, having given place to the latter more philosophical mode of expressing relative dryness or humidity. The dew-point can be as readily calculated from the psychrometer as can the tension of vapor and its relative amount, if desired.

The daily range of humidity is considered much greater in the Atlantic States than in Great Britain, or in other countries of western Europe. As a general rule, the dew-point is here many degrees below the temperature of the atmosphere, which is thus considerably removed from saturation. The following comparison of mean temperature, &c., observed and calculated for Haddonfield, N. J., for 1864 and 1865, with the means for seventeen years at Chiswick, near London, will exhibit these facts, though not in so striking a manner as observations made at more arid points in the interior of the country would present:

A table exhibiting the temperature, dew-point, rain-fall, and evaporation at Haddonfield, New Jersey, and Chiswick, England.

1864.	Mean temperature of year.	Mean dew-point of year.	Dryness or difference between temperature and dew-point.	Relative humidity or percentage of saturation.	Possible evaporation in a gentle breeze. From 1 sq. foot in grains per minute.	From 1 acre in gallons per day.	From 1 acre in tons.	Amount evaporated in inches.	Rain and snow. Am't deposited, as rain and snow, in inches.	Am't deposited, as rain and snow, in tons.	Possible evaporation and rain-fall compared. Excess of rain-fall over evaporation, in inches.	Excess of rain-fall over evaporation, in tons.	Excess of evaporation over rain-fall, in inches.	Excess of evaporation over rain-fall, in tons.
Haddonfield, New Jersey.														
Entire year	52°.73	43°.72	9.01	72.22	2.27	2,440	3,712	32.88	43.79	4,954	10.91	1,242	....	....
Summer	73.00	61.50	11.50	68.97	5.06	5,484	2,102	18.62	8.03	908	....	....	10.59	1,294
Winter	30.67	24.00	6.67	77.03	0.84	903	142	1.26	13.17	1,489	11.91	1,347	....	....
1865.														
Entire year	53.10	46.40	6.70	80.44	1.80	1,935	2,943	26.33	55.13	6,236	28.80	3,393	....	....
Summer	73.62	66.75	6.87	81.61	3.32	3,571	1,382	12.31	12.59	1,423	0.38	41	....	....
Winter	34.58	28.80	5.78	85.24	0.82	866	140	1.24	11.24	1,268	10.00	1,128	....	....
Chiswick, near London, England.														
Mean of seventeen years	49.88	44.31	5.57	83.70	1.32	1,419	2,161	19.11	24.40	2,760	5.29	599	....	....
Summer	62.21	54.56	7.65	77.60	2.68	2,904	1,115	9.86	?5.00	?565	....	....	?4.86	?550
Winter	38.95	35.64	3.31	91.30	0.60	645	249	2.20	?5.11	?578	2.91	329	....	....

By means of the average temperature, the mean dew-point, and tables showing the evaporative force per minute in grains from a definite space, we may determine the amount of evaporation which may take place from a lake or the soil, in a calm, in a gentle breeze, or when a fresh breeze is blowing. The latter tables, prepared by Dr. Dalton, have been accepted as correct; and from them we have calculated the amount of evaporation as expressed in the accompanying table. A few remarks in explanation may be needed.

The mean temperature at Haddonfield, New Jersey, six miles southeast of Philadelphia, in 1864, being 52°.73, and the dew-point, by calculation, 43°.72, the difference indicating the dryness is found to be 9°.01, or nearly 50 per cent. greater than that for 1865, and 60 per cent. greater than that for seventeen years at Chiswick, near London. The summer of 1864 was remarkably dry, and the dryness expressed by the difference between the mean temperature and the dew-point is as well pronounced, being 11½°, or 75 per cent. greater than that of 1865, and 50 per cent. greater than the Chiswick mean for seventeen years. The relative-humidity expresses the same results. The winters of 1864 and 1865 did not differ widely, but were twice as dry as those of Chiswick. As respects evaporation, it would, of course, be expected to prove much more active in so dry an atmosphere than at places or in seasons more humid. Accordingly the possible vaporization at Haddonfield, New Jersey, for the entire year having been at the rate of about 2.27 grains of water per minute for one square foot, the average motion of the air being nearly equivalent to a gentle breeze, on which this rate of drying has been shown to attend, the corresponding values in other quantities, as gallons per day, or tons per year, and inches in depth, may be readily determined, or may be found in the foregoing table. Thus, in 1864, nearly 33 inches or 3,712 tons of water might have been evaporated from one square acre, the air moving in a gentle breeze. Had the air been at rest or calm, nearly 1,000 gallons less per day, and 1,400 tons less per annum, to each acre, might be evaporated, than if a fresh breeze prevailed for the same period. During a strong wind, or a high wind, this increase of evaporating power becomes much enlarged; and when very dry, as winds are at times in the Mississippi valley, it blasts vegetation as with a breath of flame.

In the dry summer of 1864 the evaporation was probably much greater than the rain-fall, as the soil was parched to powder, and vegetation depleted of its moisture, drawn from beneath the surface, apparently to the amount of nearly 10.59 inches, or about 1,300 tons for the season. In the summer of 1865, which in this district was not uniformly dry, the possible evaporation and rain-fall were about the same. In the summer of 1864 the possible evaporation at Haddonfield was nearly twice as great as for the average of summers at Chiswick. The excess of evaporation over rain-fall at the latter place is doubtful, our data being unreliable. The results arranged in the foregoing table must be accepted as approximations only, since accuracy cannot be attained where the elements are so difficult of authentication.* Their general accordance with known facts renders them more reliable, while they serve to show the immense importance of the evaporating action which is constantly going on around us on so grand a scale.

The increased facilities for drying the soil existing in an open, cleared, level, cultivated country, become apparent on comparing the amount of water evaporated with the rain-fall at Haddonfield in 1864 and 1865, and with similar results, determined as correct, from actual measurements made near the headwaters

---

* The evaporation must depend on the nature of the surface, and a smaller amount of vapor is produced in a given time from a given surface of moist earth than from water, and in a calm than in a current of air. The experiments of Gasparin, in France, indicate that the evaporation from the moist earth may be, at certain seasons, from one-tenth to one-sixth of that from water. The experiments of Mr. Williams show that land covered with trees or vegetables emits more vapor than the same space covered with water, even to the amount of one-third more.

of Anthony's creek, a tributary of Green Brier creek, an affluent of the Kanawha river. The discharge of this creek, of which the area of drainage was carefully surveyed, was ascertained, by daily measurements for one year, to amount to 70 per cent. of the rain-fall, and 65½ per cent. of the average fall for five consecutive years.* The waters thus hastened off by the sloping mountain sides, or sunken among the leaves or into the soil or rocky crevices, and sheltered from evaporation by forests, restore a much larger proportion of the rain to the rivers directly. In this section, as generally in an open champaign country, where drying winds prevail and much land is exposed by tillage, evaporation may take place to the extent of three-fourths of the rain-fall throughout the year, or more than twice that fall for an entire summer. Hence the value of forests, as arresters of evaporation, or as barriers against the sweep of drying winds, becomes obvious.

If our reductions as tabulated appear excessive, we may refer to other results corroborative. Thus, at Ogdensburg, New York, in one year, 19.94 inches were evaporated during the summer months, and for the entire year 49.37 inches. At Syracuse, New York, in one year, 23.53 inches were evaporated in the summer, and 50.20 inches during the entire year. At Salem, Massachusetts, the result of extensive observations, the annual evaporation was stated to amount to 56 inches; and the same was reported to have been the result at Cambridge, Massachusetts. Colonel Abert assumed, from many calculations, that the average evaporation for the summer at Baltimore, Maryland, is 19 91 inches, and that there escapes into the air from an open reservoir, in summer, twice as much water in the form of vapor as falls therein as rain. (Blodgett's Climatology of the United States:) Dalton and Hoyle's experiments on the actual amounts received and retained by the soil and sinking therein determined the annual evaporation in the moist climate of Manchester, England, to be 25 inches. A comparison of our results with the above will enable the reader to decide upon their probable correctness. As respects the contrasted climates of America and Britain, the differences in dryness noted in the table are not dependent on the relative amounts of rain, for nearly twice as much falls at Haddonfield as at London in the course of a year. The rain-fall at the latter place is, however, frequent and moderate; while at the former (and generally in the United States) the rains are heavy and of shorter continuance, alternated with longer seasons of fair, dry weather. The chief cause of the difference in dryness may be found in the fact that the humidity of Britain is borne over it from the vapor-laden ocean, while the prevailing westerly winds waft our land moisture away from us towards the sea, drying us, instead of increasing our store of vapor.

ON ATMOSPHERIC DRYNESS AS AN AID TO RADIATION AND PREVENTIVE OF UNSEASONABLE FROSTS.

One of the peculiarities of the district of lower New Jersey, where frequent instrumental observations have been made by the writer, is a general freedom from excessive humidity, even during periods of very high heats. At no time during the months of June, July, or August, 1864, did the humidity of the air reach saturation; nor did it hold as much moisture as it was capable of absorbing. The climate is consequently, in a great measure, free from those seasons of extremely hot and oppressive weather so overpowering to many persons in some other localities. The summers are not, however, free from high heats; they are, on the contrary, very warm in districts remote from the sea—a maximum of 96° having been occasionally experienced. These, and many other seasons of extreme warmth, were not attended by excessive humidity, but by great dryness or low relative-humidity. Instead of approaching saturation, the

* Ellet on the Mississippi and Ohio rivers.

amount of vapor in the air was generally but from forty to sixty per cent. of what it might have held at the high temperatures noted.

The long continuance of this low humidity is unfavorable to the growth of vegetation, and when reduced to a very low percentage, is the indirect cause or accompaniment of a fall in temperature in some instances fatal to young plants. If in June or July a few days of north or northwest wind, cool, dry, and absorbing moisture readily, blow over us, it bears away the moisture from the air and from the soil and plants beneath. On such days may be seen those beautiful white, massive, cumulus clouds which are produced by the elevation and subsequent rarefaction and cooling of large masses of air containing vapor. These clouds, which float so gracefully towards the east or southeast, "are but the visible capitals of invisible columns of humid air," which are thus borne away from us. The consequences of this removal of vapor are soon felt, and that in a manner unmistakable, though until quite recently not clearly explained.

The new researches into the phenomena of heat, which have overturned the old hypothesis of caloric and substituted the theory of vibrations, have brought to light the extraordinary fact that vapor of water is opaque to the rays of heat of low intensity, such as that which proceeds from the soil and from plants by night; in other words, that the heat of the earth cannot be radiated or projected towards the sky if there exist in the air above the spot observed a large proportion of aqueous vapor. Through pure air, free from moisture, the heat may pass off as readily as if no air existed above the cooling region. It is believed that air saturated with moisture at the ordinary temperature absorbs more than five hundredths of the heat radiated from a metallic vessel filled with boiling water, and Professor Tyndall calculates that of the heat radiated from the earth's surface warmed by the sun's rays, one-tenth is intercepted by the aqueous vapor within ten feet of its surface. Hence the powerful influence of moist air upon the climate of the globe. Like a covering of glass, it allows the sun's rays to reach the earth, but prevents, to a great extent, the loss by radiation of the heat thus communicated.

In accordance with this theory, it should be shown that the withdrawal of the sun from any region over which the atmosphere is dry, would be followed by quick refrigeration. It is said that the winters of Thibet are rendered almost unendurable from an uninterrupted outward radiation, unimpeded by aqueous vapor, and that everywhere the absence of the sun favors powerful radiation when the air is dry. "The removal for a single summer night of the aqueous vapor from the atmosphere that covers England would," says Professor Tyndall, "be attended by the destruction of every plant which a freezing temperature would kill." In the Sahara, where "the soil is fire and the wind is flame," the refrigeration at night is painful to bear, so that ice is sometimes formed there. "In short," says the Professor, "it may be safely predicted that wherever the air is dry the daily thermometric range, or the difference between the extremes of heat and cold, will be very great." Illustrations of the truth of this position may not be out of place here. They may now be found wherever we turn, though until the genius of a Tyndall demonstrated the cause of the phenomena, we failed to perceive their connexion. The student should avail himself of the instructive and delightful pages of "Heat Considered as a Mode of Motion, by John Tyndall, F. R. S," which is pronounced "one of the most valuable and profound books which this generation has produced, eloquent, simple, and clear, exemplifying the double genius of discovery and exposition." The title of this work indicates the theory of heat held by its author, the only one now held by scientific men—it is a mode of motion.

All great discoveries have been partially anticipated by keen observers, who could not wholly explain certain anomalous appearances, but whose shrewdness led them beyond the borders of the unknown. These results of Professor Tyndall were thus foretold by R. Russell, esq., of Scotland, who visited America in

1854 to study the effects of our climate upon agriculture, and whose lectures on meteorology may be found in the Smithsonian report for 1854. He asserts, on page 195 of that report, that "the influences of moisture in tempering the sun's rays is a remarkable fact and well worthy of further investigation. When the dew-point is high, or the air is filled with moisture, radiation from the earth is prevented and the temperature of the night remains almost as high as that of the day. When the dew-point is low, the sun's rays pass without absorption to the earth, and impart little of their heat directly to the air. The medium dew-points are therefore most favorable to extreme heat in the atmosphere, and the greater heat beyond the tropics is probably owing to this cause. The fact that the amount of moisture in the air regulates the temperature of the nights has not received the attention it deserves." The great amount of moisture in the air within the tropics is the cause of the warm and brilliant nights. Radiation from the air and ground, under these conditions, seems to lose its power. On the other hand, travellers in all parts of the world inform us, incidentally, as to the connexion between dry air and cold nights. Mr. Inglis, in his travels through Spain, relates that he was oppressed by the hot rays of the sun in the valley of Grenada while the hoar frost was lying white in the shade. Eastern travellers in the desert often complain of the broiling heat of the air during the day, and of its chill temperature at night. Beautiful allusions to the same law are also found in scripture, where it is related that one of the greatest hardships which Jacob experienced while tending the flocks of Laban, was that through the "drought by day and the frosts by night, sleep departed from his eyes." These conclusions are confirmed by recent travellers in a remarkable manner. We need no longer doubt the stories of Captains Riley and Paddock, as told in their once incredible narratives, when they relate that the intense heat of the sun had scorched and blistered their bodies and limbs, so that they were covered with sores, * * * while as soon as the burning sun had sunk beneath the horizon, the fresh wind cooled the earth, which became even cold before dark, * * * to be followed by fierce and chilling blasts of wind.

The experiments of Captain Sabine, made on the coast of Africa, show that while the sea breeze was blowing upon his station, the hygrometer denoted the dew-point to be about 60°; but when the wind blew strong from the land it sunk to 37½°, the temperature of the air being 66°. Notwithstanding the heat of the evaporating surface of the Sahara, the burning sands of the desert yield so little vapor that there does not exist in the winds wafted to the coast, and which constitute the true harmattan, a greater force of vapor than that which rests upon the Polar seas; for at both places the constituent temperature of the vapor, or the point of deposition, is below 32°. The sea breeze above referred to contained eighty per cent. of relative-humidity, the land breeze from the Sahara less than twenty per cent. of the same. (Daniels's Meteorological Essays, page 123.)

The desert and mountainous regions of our own continent furnish ample illustrations of these phenomena of radiation. Captain Beckwith, in his narrative of the Central Pacific Railroad survey, remarks: "We observed the greatest contrasts between the heat of the day and of the night in these mountain valleys, from noon to 3 p.m. the thermometer standing at 87° to 90°, and at night falling below the freezing point."

Colonel Emory says: "On the 23d of October we retired with the thermometer at 70°, and awakened in the morning shivering, with the mercury marking 25°, notwithstanding our blankets were as dry as if we had slept in a house." (Emory's Military Reconnoissances in California, page 63.)

These low morning temperatures were found to characterize the whole country between Upper Mexico and the settlements near Great Salt Lake, the sunrise observations for three successive days being at 14° and 15°. At Salt Lake, Utah Territory, it is difficult to grow Indian corn, because of the extreme aridity of the air, though the mean temperature is 10° above that necessary in a moist climate. The local cooling at night, and the higher heats by day, are both unfavorable in this arid atmosphere.

R. E. Alison, who ascended the peak of Teneriffe in 1865, reports that "at the crater the extreme dryness of the atmosphere and the direct action of the sun's rays were distressing. The lips cracked, the nails became brittle, and evaporation from the wet-bulb thermometer so rapid that it was necessary to watch it closely lest it should dry before an observation could be made. At the height of 8,000 feet he suffered more from radiation than from cold. In September the temperature in the shade was 40° Fahrenheit; the black bulb thermometer exposed to sunshine rose to 196°, or close to the boiling point of water, at that elevation. At times it reached 210° Fahrenheit at lower points, while the nights were extremely cold, the dryness excessive, and the dew-point frequently as low as 40° to 50° Fahrenheit." (Journal of Science, January, 1866.)

To return to the researches of Professor Tyndall upon the cause of this intense radiation on mountain tops and on desert plains, we may, in a few words, state that a long series of experiments with instruments of delicate construction have demonstrated the truth of the hypothesis that these extreme reductions of temperature are due to absence of humidity. They also show that the presence of a large proportion of vapor, even less than saturation, acts as would a dam to flowing water, restraining the escape of heat by greedily absorbing it, and that though the air itself is a perfect vacuum as regards the rays of heat, the presence of humidity in considerable quantity renders it almost completely opaque to heat of radiation.

Such are the conclusions arrived at by the physicist in his laboratory. If true, they are of immense importance in their applications to meteorology, to climate, and to human comfort. Perhaps they will explain some anomalies in our experience, clear up some difficulties in the study of climate, and enable us to protect ourselves from some of the injurious effects which follow extreme dryness at certain critical periods. That they are great truths we have never seen demonstrated outside of the lecture-room; but if sound, they must find ample evidence to sustain them whenever instrumental observations shall have been properly applied thereto.

During the years 1864 and 1865, regular observations were made by the writer upon the temperature and humidity of his district, in Camden county, New Jersey. Extremes of atmospheric dryness were noted on several occasions during June and July of 1864, and at times in 1865. These extremes of low temperature appear to have been, in some way, dependent upon the periods of dryness—a connexion which was not suspected until after the perusal of the volume before named, in which is set forth, in a most luminous manner, the results reached by the distinguished physicist already adverted to.

On June 11th, 12th, and 13th, before dawn, there occurred the remarkable reduction of temperature to 43°, 44°, and 44° respectively—temperatures much lower, with one exception, than had been observed for nearly a month previous, and 21° to 22° lower than the mean for June observations at 7 a. m. This remarkable reduction of temperature was felt throughout all the northern States, from the extreme eastern point of Maine to Wisconsin, and from New Jersey to Missouri, and even in Utah. The coldest days in June at all these places were the 10th, 11th, 12th, 13th, and 14th; on the first day in the northern, on the 11th and 12th in the middle, and the 13th and 14th in the more southern and southwestern regions. Frost occurred over a wide region on the 10th to the 12th, from Maine to Minnesota, as far south as northern New Jersey, Pennsylvania, Ohio, Indiana, and Illinois. At Haddonfield no frost appeared, though the temperature was reduced almost to the verge of freezing, as indicated by a sheltered register minimum thermometer.

It may be said, in explanation of this extreme reduction of temperature over so wide a region, that it arose from sudden and grand displacement of the upper strata of cold dry air, by the upheaval of vast masses of the lower strata, buoyant with the vapor derived from the surface; or, in other words, from the derangement and subsequent descent of the cold upper current, the result of extensive thunder-storms. This theory is worthy of consideration. These changes possibly may have much modified the condition of dryness, and thus partially explain the advent of extreme cold.

Again, in July, 1864, we observed a remarkably low temperature before dawn of the 22d, when the self-registering thermometer stood at 50°; and again, on the 23d, at 46°, at six feet above the soil—a narrow escape from frost. The same low temperatures were observed from Maine over all the northern States to Kansas, and southward to New Jersey and Pennsylvania. The reports do not correctly express the minimum temperatures by a self-register, and the reduction must have been several degrees lower than reported. On the morning of the 22d of July there was a slight frost at Baldwinsville, Massachusetts; also at Columbia, Connecticut, and Tioga, Pennsylvania.

Now, some cause acting over a wide region must be sought for to account for the widespread reduction of temperature on the days noted. Will the diminution of the due proportion of humidity in the air over this region adequately explain it? Will the westwardly winds, with their drying and absorbing action, prove to be the agents by which radiation is permitted more vigorously to proceed, and thereby effect the changes which come over us?

Let us turn to our meteorological notes and observe the figures there recorded. At Haddonfield the low temperatures were observed on the 11th, 12th, and 13th of June, 1864. On the mornings of the same days the tension of vapor was but .262 to .322, which were lower measures than were observed on any other mornings during the month, except on the 7th, when it sunk to 50°. On the evening of the 6th the humidity had been abundant, more than twice as abundant as on the evenings previous to the days above named. The tension of vapor noted on the mornings of the 11th, 12th, and 13th was less than three-quarters of the average for the month at 7 a. m., and but one-third of that prevailing on several occasions. On the 28th and 29th of June the self-register thermometer indicated, before dawn, 50° and 51° respectively, and the amount of vapor exhibited a corresponding low degree of tension, being but .389 and .356 respectively. No very low degrees of humidity were noted in July until on the mornings of the 22d and 23d, when it fell to .296 and .365, which were remarkable, and were accompanied by the low temperatures of 50° and 46° respectively. The amount of vapor in the air was noticed to be but about half the mean generally present, and one-third of that often observed. At 2 p. m. of the 22d but 22.8 per cent., and on the 23d but 26.6 per cent. of relative-humidity were noted, numbers indicative of extreme dryness—the first expressing the fact that but little more than one-fifth and the last about one-fourth of the vapor capable of being sustained in the air at the temperature then prevailing was actually present.

Now, on the 9th of June, at 9 p. m., a northwest wind had begun to raise a gentle breeze; a north wind continued all day; but it was nearly calm in the evening of the 10th. A northwest wind was blowing on the morning of the 11th, from southeast, for a short time, at noon of that day, but again north all day of the 12th and part of the 13th. All day of the 9th, 10th, 11th, and 12th the masses of cirrus and cirro-cumulus in those heavy white separated clouds sailing overhead or piled in the horizon, were moving first from the south and southwest, then from north and northwest, having been carried up beyond the influence of the surface currents or counter trades into those which were pouring over and descending, to become in turn the northwest dry wind of the surface. These cumulus clouds, which are produced by the elevation and subsequent rarefaction of large masses of air containing vapor, were doubtless "the visible capitals of those invisible columns of humid air" which the absorbing northwest wind was drawing from the surface of the earth. All the circumstances favorable to the rapid drying of the air near the earth were at work, and the humidity was consequently greatly reduced. The results promised by reduction in the amount of vapor present followed, and we experienced excessive cold, in accordance with the theory of Professor Tyndall. The blanket of vapor had been removed, and the heat escaped into space.

On the 22d and 23d of July the same general conditions of drying winds, accompanied by extreme atmospheric dryness, were present. On the 22d, the afternoon of the day before the reduction of the temperature to 46°, a neighboring farmer remarked the extreme aridity of his oats, saying they "dried before they reached the ground" while cutting them. During the 22d, 23d, and 24th, the days of lowest temperature by the self-register thermometer, a smoky haze was observed, extending from Maine over New Hampshire, Vermont, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan, and further west. An extended drought prevailed, the earth being as dry as the air above it, and north and northwest winds of very gentle action passed over us by day while the nights were calm. This calmness by night was also noticed early in June, when the lowest temperatures were observed, and was highly favorable to radiation. On the 22d of July, at 2 p. m., the force of vapor or pressure in inches on the barometer was but .188, which is lower than we have ever observed it during summer and autumn, and lower than is sometimes noticed even at the freezing point. No abnormal reduction of temperature or of humidity appeared in August of 1864.

Here, again, it might be surmised that the reduction of temperature was due solely to the descent of the colder air of the upper atmosphere, drawn from subarctic regions, were the periods of extreme cold always accompanied by northerly winds; but such is not the case at all times, though how far such north winds may have affected the temperature of our surface currents from other quarters, we cannot determine. The presence of an extreme drought extending over many hundred miles, and the canopy of haze undisturbed for several weeks, spread over all the northern States, seem to preclude the probability of the existence at the time of such descending currents from the north as would be adequate to the production of such wide-spread cold. A few local storms or mountain squalls may have been noted, but these did not disturb the haze, and the severity of the drought indicates that no rain-storms occurred. It seems much more probable that the west and northwest surface winds, whether from the Rocky mountains or the western deserts, were drying the surface,* and thus indirectly cooling us, rather than that they were the direct cause of the cold. Moreover, had this cooling been due directly to the descent of the cold upper currents, the temperature at midday would have been much reduced, which was not generally the case; some of the mornings of extreme cold having been preceded and followed by high heat at midday, just as would result from the passage of the sun's rays more freely through an atmosphere deficient in aqueous vapor. It will also be remembered that, in general, reduction of temperature, while it diminishes the capacity for humidity, tends to render that actually existing in the air proportionally greater, or to increase the relative-humidity. In the cases we consider, the relative-humidity and the temperature decline simultaneously, or, to speak with precision, the former appears to precede the latter as does a cause precede or keep pace with an effect. Whatever may be the cause, direct or indirect, of our midsummer cold, it is worthy the investigation of meteorologists, and should commend itself to American observers especially.

The experience of the writer, in 1865, is confirmatory of the asserted connexion between dryness and extreme low temperatures. In June, 1865, the

* See note on page 539.

minima temperatures were not quite as extreme as in June, 1864. Very heavy rains fell on several occasions, and the atmosphere was remarkably loaded with vapor, often to the amount of .780 to .890, at one time to .914 and .942 inch of tension, as measured by the barometer. The average force of vapor for the month was .667, while that for June, 1864, was but .492; the lowest force of vapor for June, 1865, was .421, or about that of the mean for the entire month of the previous year, thus presenting a marked contrast. There were in June a few cool mornings, as that of the 12th, when, after a day of low absolute relative-humidity, the minimum before day was 53°, and the dew heavy, showing a much lower reduction under the open sky. Most of the grape-vines had bloomed, the Herbemont being then in blossom. On June 19th mildew was observed on the Isabella, Catawba, and Herbemont—the consequence of dryness and reduction of temperature.

On the 20th of June, 1865, a heavy rain fell and the air continued loaded with moisture, .816 of an inch having been observed on that day, and on the 24th, .784 inch of tension. On the 23d, the relative-humidity was remarkably low and the tension reduced to one-half of the above numbers, and the register-thermometer indicated 62½° on the morning of the 24th, and a fog was brought over from the southeast. This high humidity and sudden reduction of moisture and of temperature (for the true minimum was perhaps 10° to 14° lower) had its usual effect; for on the 25th of June the young Catawba grapes were rotting. The high temperature of the soil which, at one foot deep, stood at 76° and 77° until 9 p. m., and parted with but three or four degrees all night, may have contributed to this result.

In July, 1865, high heats and moisture alternated with reduction of vapor, and with it low night temperatures, and the grapes were again rotting. The humidity was most excessive in the earlier part of the month, when the rotting was most observed. This at one time reached the high measure of .973 inch of tension, or nearly twelve grains of vapor in the cubic foot, with a maximum temperature of 94° on the 7th. The force or tension of vapor, or absolute humidity, as it might be termed, varied from .371 to .973 inch during the month of July, the first or lowest tension having been observed on the evening preceding the morning on which the lowest temperature of 53° was noted. Though but 1.95 inch of rain fell, the relative-humidity was nearly forty per cent. greater than in July, 1864, when 3.12 inches were deposited. On the evenings of the 13th, 14th, and 15th, the low relative-humidity appeared, and the lowest temperatures of the month were observed, the register-thermometer having indicated 53½° on the morning of the 14th, and 53° on the 15th and 16th, which were very unfavorable extremes. These variations from the temperature at or after 2 p. m. to that of the next morning before dawn, were thus in several instances upwards of 26° to 30°, as expressed by the shaded and sheltered thermometers; but under the open sky, exposed to the burning sun by day, as on the 14th, and the radiation on a clear night through an excessively dry atmosphere which was present, vegetation probably endured a range of nearly or quite 100° of Fahrenheit, highly injurious as the consequences proved, for the grape crop was entirely destroyed in this section of New Jersey, as well as generally around Philadelphia.

The first half of September, 1865, appeared to be very unpropitious for the grape; but our previous experience had been conclusive, mildew and rot having done their worst with the native vines, and the foreign, under glass, alone remained on which their destructive agency could work. From the 1st to the 15th, the absolute and relative humidity were excessive, and the 14th was among the most oppressive ever remembered or recorded by the writer, frequently rising to saturation. Though the heat was not in excess, the abundant moisture rendered some of the above days painful to endure, the feeling being, at times, that accompanying immersion in a steam bath. Our Black Hamburg grapes which had not already ripened under glass, were dissolved in a mass of rottenness in consequence of suffocation in this vapor-laden atmosphere.

No extreme low temperature appeared before dawn until the 16th and 17th, when, with the first appearance of reduced humidity, came also low minimum, though during the prevalence of the moisture the nights had been equally clear.*

The foregoing facts and comparisons appear to furnish strong evidence of the close connexion between diminution of humidity and reduction of temperature, and to confirm the assertion of Prof. Tyndall, that their relation is that of cause and effect—that loss of humidity continued through several days, from the action of a drying wind during a dry season, prepares for the escape of the heat of the earth by night, through unimpeded radiation, into space.

If a cause for the reduction of temperature has been found in diminution of

---

* As extreme variations from high mid-day heat to unseasonable cold, on the verge of frost, are evidently accompanied by, if not dependent upon, extreme atmospheric dryness, an instrument that will readily show the conditions of deficient moisture, may foretell the coming cold, and thus enable the gardener, by being forewarned, to be forearmed. The wet and dry bulb thermometer or psychrometer will often foretell, at 2 p. m. of the day before, that an extreme low temperature will probably result before dawn of the following day. The low humidity detected by the psychrometer thus often becomes a good prognosticator of frost. It is true that a change in the wind, the amount of cloudiness, &c., by increasing the proportion of vapor during the night, or bringing in warmer currents, may happily disappoint these prognostics at times. Still the gardener who daily observes the psychrometer aright, and consults the tables prepared to save calculation, or makes use of a "vapor index" (which is quite easily inspected, and dispenses with tables,) will, during the growing season, find its prognostics very valuable and may save many a tender plant.

"Lippincott's vapor index" is a very convenient card with rotating index, by which, from the observed temperatures of the wet and dry bulb thermometers, the most unskilled person may easily determine in a few seconds the actual relative-humidity or percentage of vapor in the air. It is sold at a moderate price, and may be had on application to James W. Queen & Co., opticians and dealers in philosophical instruments, 924 Chestnut street, Philadelphia.

The psychrometer and vapor index become also most valuable aids to the barometer, as foretellers of a change in the weather; indeed, it is now well ascertained that without a psychrometer the prognostics of a barometer are frequently fallacious, and that simultaneous observations of these two instruments most usefully correct each other's indications.

The rules for foretelling a change in the weather by means of the barometer and psychrometer are few and simple. Our own observations show that, as a general rule, a storm can occur only after a rise in the barometer followed by a fall, and accompanied by increased relative-humidity approaching to saturation, heavy clouding gathered from the southwest, while the surface wind is from the northeast or from the southeast. Let the changes in the barometer be what they may, if the relative-humidity be not near or at saturation, no rain can fall; and so reliable do we find these indications of the psychrometer when interpreted by the "vapor index," that we may oftentimes disregard the barometer, the other prognostics being favorable to a change. Thus one may not be at a loss for a weather-gauge with these simple instruments at hand, even though his barometer be found in the predicament of Sir William Hamilton's village hostess, who, he relates, was afraid the weather-glass was not *exactly* right, for *all* the quicksilver had run out of it.

For the economical convenience of those who cannot readily obtain psychrometers, because distant from the large cities, we may state that any two *good* thermometers, if they can be found in the country stores, and if closely alike in their range, size of bulb and bore, may be employed as a psychrometer, by covering the bulb of one of them with thin muslin, wetting this at the time of observation, and then subjecting them both to a moderate swinging until the mercury in each ceases to fall. A reference to the "vapor index" will then inform the observer how much vapor is present. All common thermometers are erroneous to the amount of one to three degrees, and should be corrected by immersion in melting ice for 32 degrees, or compared with an undoubted standard, and the tube shifted upon the index to the true degree.

The Smithsonian Institution should invite its corps of observers to add the psychrometer to their list of meteorological instruments. More extensive observations of the fall of rain and snow are also desired. The number now reporting observations made with the psychrometer is limited, and we hope our remarks on the effects of drought and the influences of humidity, excessive or deficient, will stimulate many to use the instrument by which the important phenomena referred to may be accurately determined and recorded.

The philosophy of the methods of determining the amount of vapor in the air may be seen in the Patent Office Report for 1858, article Meteorology, and should be read by all interested in this branch of the subject.

humidity in the air, over any region, a remedy must be sought in protection from influences causing excessive dryness. A remedy applicable to the wide northern territory, where these low temperatures sometimes occur during the critical periods of early spring, the direct result of the precipitate descent of cold air from the high region of the atmosphere, we fear, will not be found; but that in the lower regions, where the extremes are not so great and where they merely border on the freezing temperature, perhaps they may be applied with considerable promise of success.

Now, let us ask ourselves what are the causes operating around or above us, producing excessive dryness in our atmosphere and in the soil? A west or northwest wind is undoubtedly a cause, largely, if not wholly, competent to reduce the amount of vapor in the air, and to render it incapable of preventing the escape of heat absolved by the earth during the day. We know that the winds which are flowing towards the northeast from the regions of the tropics, part with their moisture in rains and showers over the temperate districts. We know that on the Pacific coast the prevalence of westerly winds gives a great uniformity to the temperature, and that most of the rains come from that quarter; that the cloud-bearing winds, by passing up the slopes of the Rocky mountains, lose their moisture by condensation into clouds and deposition as rain and snow, so that as they pass eastward they are dry winds, and must so continue over the vast desert region, arid and waste, which extends from the mountains on the west to the borders of the Mississippi valley on the east. These conclusions seem so well established, that it has been well remarked of the northern Atlantic States, says Robert Russell, "So long as the westerly winds continue to blow in winter, there is no cessation of your cold; and so long as they continue to blow in a broad, regular stream in summer, there is no end to your drought." (Smithsonian Report, 1854.)

A great drying agent may then be generally found in the westerly wind,* sometimes in that from the northwest. The only protection from their baleful influences appears to be ample and systematic planting of dense evergreen trees upon the west and northwest sides of orchards, vineyards, and gardens generally. The northeast also should be sheltered. We have been reckless in using the gift of Providence to our fathers. We have razed with ruthless hand the forests which were both the ornament of our region and the safeguard from the ravages of cold. The truest wisdom may be learned in the school of nature, and it is only as man imitates the plans of the Creator that he can hope to prosper.

As mitigators of the severity of radiation, the introduction of shelter trellises is highly promising. But in more northern districts, where this method may not be available, it were better to abandon all attempts to cultivate our tender fruits, except in regions where the severity of dryness and of cold in midsummer is ameliorated by the presence of widely protecting waters. It is only in these sheltered regions that we can now hope to find a climate fitted to the regular production of our leading varieties of fruits, and it is here only that we shall be able to meet with success in grape culture through a lengthened series of years. As respects the value of forest screens, a large body of testimony might be advanced; a few illustrations will suffice.

ON THE VALUE OF SCATTERING BELTS OF FOREST TREES AS PROTECTORS FROM DRYING WINDS AND EQUALIZERS OF TEMPERATURE.

The decline of many varieties of fruits once successfully grown and highly esteemed, has often been ascribed to the exhaustion of the elements in the soil necessary to healthy growth and fruiting; but we apprehend that this deteriora-

* See note on page 539.

tion is much more largely due to the distribution of our forests—to the removal of those protecting screens which once sheltered, not only from extremes of cold, but also from extremes of dryness.

It is a common experience that our best varieties of fruit trees are more liable to disease, and that their fruit is generally inferior in quantity and quality to that known to our fathers. Negligent culture and increased age of the trees, it is true, may have had some influence; but even more skilful culture applied to young and thrifty trees is not attended by the success formerly common. Our apples are more frequently scabbed and distorted; our pears so knotty, cracked, and hard, that we need not seek Australian pears (which are said to be of wood) for distortions or perversions of this fruit.

Though the practice of gardeners in Europe may not be generally applicable in America, and those who expatriate themselves to settle among us soon part with many of their home-bred customs, it were well if one of the universal rules of English gardening still held sway among us. An English garden is seldom seen without a wall or hedge surrounding it, and their fruit grounds are also generally protected in the same way. We have been under the impression that their walls are necessary in order to produce, by reflection, a higher heat for ripening the peach and the apricot, which they doubtless do cause to mature more perfectly; but any one who reads their best horticultural treatises will find that they are also intended as shelter from what are deemed blasting winds. Hear an old authority, the learned and pious John Lawrence, author of the once very popular "Gentleman's Recreations," a work now one hundred and fifty years old, but still sound and valuable: "One great cause of the want of fruit in many gardens is a lying too much open and exposed to the winds, especially the west and southwest winds, which, in many parts of the year, make terrible havoc and desolation in our island, not only by blasting the fruit in the spring, but by chilling and starving the fruit all the summer, so as to hinder it coming to any due maturity." If such are the consequences of the west and southwest winds, which are comparatively mild in England, what would we reasonably expect should result from the free range over our orchards of our westerly and northerly winds, and the raw damp northeasters of our northern States? Can we continue to feel any doubt that in this free exposure to such winds, now more than ever before free to blow where they list, we are generally so unsuccessful in our attempts to grow good and fair fruit in the open country?

As if to offer the fullest confirmation to the truth of the assumption that shelter is the *sine qua non* in fruit culture, we have the experience of our city friends, who, in horticultural efforts, always surpass us in the country, whether we regard quantity, quality, or beauty of the product. Any one familiar with the exhibitions of the Pennsylvania Horticultural Society knows that Isabellas and Catawbas grown in the city of Philadelphia surpass those grown in the country. Every one knows that a venerable amateur, Isaac Baxter, on a city lot surrounded by brick and mortar, has, for a long series of years, grown such butter pears as no resident of the country around has been able to exhibit. Let any one visit the rooms of the Mercantile Library in Philadelphia, and look upon a fine old butter pear tree standing in the back yard of the Dispensary, sheltered by walls on the northwest, north, and northeast, and note in the season the fruitage—smooth, golden, and tempting—and believe, if he can, that such pears cannot still be grown as of old under favorable circumstances, sheltered from drying winds and cold. The vine and the pear, especially, require a climate moist and warm; and shelter from drying and cooling winds, with proper southern exposure, are the prerequisites for supplying these conditions. It is to the protection from the northwest and northeast winds, with perhaps some elevation of temperature due to reflection, and the generally increased warmth of the city, that we must ascribe the success of our city amateur pomologists.

An amateur gardener in the city of Camden, New Jersey, whose grounds are surrounded by a board fence, and who is, at the same time, affected by the protecting influences flung around it by the damp atmosphere of the Delaware, (but one hundred yards distant,) produced pears upon his dwarf trees greatly exceeding any raised by his neighbors further removed from the river shore. Smooth and waxen fruits grow upon his trees, while theirs are knotty, gnarled, and worthless, because exposed to the pelting northeast, or the biting and drying northwest, with its keen and eager airs.

The distinguished meteorologist, Frederick Daniels, by whom the first regular and accurate observations on the dryness and moisture of the air were made, asserts that excessive exhalation is very injurious to many of the processes of vegetation, and that no small proportion of what is commonly called *blight* may be attributed to this alone—that evaporation is increased in a prodigiously rapid ratio with the velocity of the wind, and that anything which retards its motion is very efficacious in diminishing these exhalations from the leaves of plants. He moreover adds, that in seasons of extreme dryness tender fruits are much more liable to injury, and that artificial shelters by means of walls, palings, hedges, or evergreen screens that will break the force of the blasts, are the most efficacious methods of preventing the evils of excessive drying.

To the foregoing illustrations of the great value of the kind of protection suggested may be appended evidence of the great injury resulting from the removal of the shelters originally planted in our forest land. A few of this character may suffice, but a heavy mass of evidence could be adduced, all expressing the same great truth. Man is rashly destroying the great regulators of the climate, while in his ignorance or indifference he is making no compensation therefor, by the assiduous replanting of trees.

In the Ohio Pomological Society's report for 1864 appeared the following pertinent remarks by Dr. Peticolas, a devoted pomologist, of Mount Carmel, Ohio, now deceased. He stated that "out of one hundred and twenty or one hundred and thirty varieties of apple trees in bearing, it is difficult to select six kinds of good merchantable winter apples, because the product is not perfect, though it may be abundant. This imperfection is caused by the never-failing mildew or scab to which our apples are subject. Although some seasons are not quite as bad as others, still one-half or more, as a general rule, are unfit for market, and it is really humiliating to think that we who, a few years ago, boasted of the superiority of our fruit as compared with that of our eastern friends, (of western New York,) should now be obliged to acknowledge that they surpass us. Now, why is this? Why should such a change have taken place? No such alteration, that I am aware of, has taken place in the east; their apples are as fair and as good now as they were twenty or thirty years ago. Some of our varieties are less prolific than they were fifteen years ago. Rambos then bore, at seven years old, ten bushels of good fruit, but since have never borne over four our five, even in the most favorable seasons, and these but inferior fruit. Redstreaks, the same time and age, bore thirteen bushels, but have never in any season since borne more than three or four of comparatively poor fruit. Nor can this change be attributed to the age of the tree, for trees of nearly all ages, of the same varieties, were nearly as unproductive. The white Bellefleur was formerly one of the finest and best apples, but can no longer be realized as the same, being now so knotty and scabby, and producing but one-fourth of its former yield. The White Pearmain was another of the best keeping and finest dessert apples, but it no longer is even fit to look at, being perfectly disfigured with the scab. Most of the others were in the same condition." Our pomologist, so desponding, does not consider it of much import to point out the cause of this evil, because he is satisfied, from long observation, that it is entirely owing to variations in temperature, and believes it therefore entirely beyond our control. Herein we deem him somewhat mistaken. He asks the question, "Why should our climate have become so different from what it was formerly?"

and then cites his observations as follows: His vines when grown on an arbor suffered badly from rotting after bearing a few years, but where the vines had grown sufficiently, and had reached the side of the house to which they were tacked, the fruit was fine and as sound as possible. This result he ascribes to the heat absorbed by the house during the day, and given out by conduction or radiation at night, thereby equalizing the measure of temperature.

Every one who has a vineyard, he further remarks, must have observed that the mildew and rot supervene after some sudden change in the temperature, particularly when accompanied by rain. Now, the same effect takes place with apples and other fruits. Prince's Harvest was formerly one of our best and earliest apples for market, but the doctor had ten trees from which he had not picked ten perfect specimens in ten years, although they bore quite abundantly, the fruit being especially affected by mildew and cracked badly. This induced him to observe this variety very closely for the last five or six years, and he discovered that spots of mildew invariably formed on the young fruit immediately after a cold night, when the thermometer had indicated a change of 20 to 30 degrees.

This growth of mildew takes place when the apples are of various sizes, from the earliest formation to that of hickory nuts. These fungus growths appear as dark-colored spots, which arrest the growth of the apple immediately beneath, causing it to become distorted, while the expansion and contraction bring on diseased action, which results in the cracking and general scabbiness of the fruit.

Dr. Peticolas well remarks that no change has taken place in the climate of western New York, where apples are as fair and as good as they were twenty or thirty years ago—failing to perceive that the injury to the apples of Ohio has arisen from the changes man has wrought upon the country by indiscriminate felling of the forests. He did not perceive that the climate of western New York was preserved uniform in its measures of atmospheric humidity, and protected in a great degree from those extremes of which he complains, and which are not only extremes of cold, but also extremes of dryness, quite as unfavorable.

While conducting an extensive correspondence during the past winter, for the purpose of gaining information respecting the character of the climate of Michigan, and learning the opinions and experience of both scientific and practical men, it was interesting to perceive the perfect accordance in which they wrote respecting the effects of the removal of the forests. Says Dr. Kedzie, of the Arigricultural College, Lansing: "The meteorological changes wrought by the destruction of the forests in Michigan are well marked. From 1828 to 1841 the peach crop in Lenawee county was as reliable as any fruit crop. The trees needed no protection and received but little care, and usually bore an enormous crop, followed by two years of smaller product, thus being abundant every third year. Now, in 1865, this fruit is only raised in situations protected in some manner from southwest winds, and the experience for fourteen years has been the same as at present. In 1852, and prior thereto, peaches were grown in Eaton county, near the centre of Michigan, in abundance, however exposed; at present they are a rarity except in guarded places. Thirty years ago a frost that would injure the corn in the spring, or during the usual growing months, from May to October, was almost unknown; at present it is an element entering into the calculations of every prudent farmer, so frequently do such frosts occur. The aspects of the district above referred to have been changed by the woodman's axe, and with the last forest-clearing the peach has failed, until at present no reliance can be placed upon it except near Lake Michigan."

Says T. T. Lyon, of Plymouth, Michigan, one of the most experienced pomologists of the State: "The peach crop during the last fourteen years has failed four years out of five from winter-killing of the fruit buds, and, occasionally, of the trees, although previously it was reasonably certain."

The above testimony is confirmed throughout the West, and we are happy to perceive that the pomologists of Illinois are agitating the subject of tree planting on their extensive natural prairies. To the citizens of that great State planting is a subject of vast significance. A writer in the Prairie Farmer, whose enthusiastic spirit is worthy of all praise, exclaims: "Who can compute the amount of winter grain, of fruit, of tender shrubs, destroyed by the intensely cold sweeping blasts which rave over the prairies of Illinois? The question comes home to all the residents of such districts: Can nothing be done to soften the rigor of such sweeping storms? Yes; stud these prairies with belts and groves, with screens of evergreen and deciduous trees. Plant the railroads and highways with rapidly-growing trees, in double or treble rows, upon the sides from which drifting snows accumulate, and carefully attend to them after planting. The money spent in clearing, and keeping clear, the tracks during a heavy storm, upon one of the western railroads, would have purchased trees or cuttings sufficient to have planted the entire line of road, which, in four or five years, would have grown to a perfect barrier against accumulating snow-drifts. The benefit arising from planting trees would not stop with the saving of money to the corporations, and with the saving of life and suffering to the people. The crops would be increased in certainty and amount, the health-giving fruits secured to us, domestic animals made comfortable and thrifty, and the surface of the country would become beautiful beyond conception. Do not forget the lesson the extreme storms of cold should teach us. Let tree-planting go on henceforth with renewed earnestness and care, and anon we may laugh at the elements, and point with pride to the wonderful transformation the human hand has accomplished."*

It is the prevailing opinion that forest protection is more demanded during winter and early spring, but the experience of many pomologists points to its influence in early summer as quite as valuable. The destructive blighting which results from rapid drying by the absorbing currents of westerly winds during seasons of low, relative humidity, and consequent sudden increase of cold, has already been dwelt upon. The experience of Dr. Peticolas is confirmatory of the necessity for shelter during the fruit-forming season, and is in harmony with that of pomologists in the East, and we are convinced that belts of trees in an open country are absolutely necessary for protection from summer extremes of dryness and of cold. In our own district our winters are generally mild, and we need but little shelter from northern winds; but after the apple has set its fruit it is generally cut off or mildewed by raw northeast storms in orchards open to their range; but where protected therefrom a crop is much more assured.

Says General J. T. Worthington, of Chillicothe, Ohio, in the Ohio Pomological Society's report, 1864: "I become every year more convinced of the necessity of belts of trees in our climate of extremes to protect the annual crops from the late frosts and the fervid suns of July, August, and September; and I verily believe that if one-third of the land were devoted to belts of fruit and other valuable trees, the remaining two-thirds would produce as much as the whole without such shelter, even in average years, and far more in extreme

* A correspondent in northern Illinois writes: "I am situated on high open prairie about nine hundred feet above tide-water, and about six miles from woods or timber on the north, south, and east, while on the southwest and west is a prairie open to the Mississippi, one hundred miles distant. Our winds have free course, disturbed by no local influence, but truly go it with a rush. The force of the winds is rarely reduced to 0 or calm, but is frequently 5 to 6, at times 7 to 8, of the Smithsonian scale, which indicate a high wind to a gale, and even a violent gale. These winds from the southwest are often dry, and are sometimes so arid that in their sweep over the soil vegetation is withered before them as if at the touch of fire."

ones; but I fear it is too early to preach planting trees to a generation which considers it 'the chief end of man' to destroy them." There appears to be no room to doubt that greater dryness of the air is a result of the removal of the forests, and that the earth then ceases to be equally moist, or the springs to furnish an equal quantity of water. It is the experience of ages in various countries that the presence of forests really makes the climate comparatively wet, and their removal makes it dry. It is not conceivable that they do this by absorbing vapor from the atmosphere, converting it into water, conveying it to their roots, and thus furnishing a supply to the ground; for this would make the atmosphere drier, and it is known that it is made more moist by their presence. If forests do cause the climate to become more moist and springs to flow more abundantly, as is generally declared, it can only be by causing more rain to fall. The progressive diminution of rain in the south of Europe is ascribed to the destruction of the mountain woods; and the diminished supply of water to ponds in our immediate district is known to be closely connected with the removal of our trees. It is curious, however, to observe that, in the latter instance, extensive under-draining has, in a great measure, restored the supply driven from springs; undue evaporation having been thus checked by facilitating the descent and gradual withdrawal of water from below. The under-drainage was, of course, chiefly applied to lands formerly marshy, or holding water near the surface. When lands are very widely cleared, extensive under-draining may prove injurious. Already the want of calculation and of forethought on the part of many improvers of land has been shown by their ill-judged extension of drainage. The rain falls on the land, and in a few hours it is removed from the soil and carried off by the brooks and rivers to the sea; consequently when a season of dry weather supervenes, the farmer finds his crop perish for want of water. In England, where these results have appeared, irrigation has, all at once, become the question of the hour, and the subject is being pressed upon the consideration of agriculturists.—*Journal of Science, January*, 1866.

The action of forests in adding to the rain-fall, appears to be due to their offering an obstruction to the free flow of currents loaded with vapor, and the upward tendency such obstructions give to the air, by which it is piled up and retarded until accumulated at sufficiently high elevations to induce condensation into clouds and rain. This is one of the regular effects of mountain ridges, and any cause which shall, in like manner, force the air to rise in any particular locality may produce a similar result. The friction against the surface of the level earth impedes the free motion of air or winds, and that which follows tends to pile up upon the back of that resting on the earth, and that behind to climb still higher. If, then, the impediment of a dense forest be added to the obstruction already existing to free motion, the ascent of the strata of air will increase according to the force of the wind bearing vapor with it. When this storm encounters a forest, the resistance must be materially augmented, and the retardation of the strata becomes greater, the overlapping and ascent of the current increased, more abundant condensation takes place, and more rain falls, and the district thus becomes more wet than it would have been had the bare ground alone been left to retard the progress of the lower portions of the wind. Forests, therefore, cause the surface currents to rise higher upon their sides, as up an inclined plane, and to attain a great height, thereby affecting a district as would mountains of moderate elevation.—*Hopkins's Meteorological Essays.*

While we write, it is announced in the daily papers that the inhabitants of the Cape Verde islands are again in distress from famine through lack of rain. Having destroyed their forests they suffer terribly from periodical droughts. From 1830 to 1833 no rain is said to have fallen, and 30,000 people perished, or more than one-third of the population. Though it has been proposed to re-plant the forests, such is the ignorance and indolence of the people that little has been done towards restoration.—*Philadelphia Inquirer*, *May* 17, 1866.

Many well attested instances of local change of climate might be cited, most of which are to be referred to the influence of forests as a shelter against cold winds. To supply the extraordinary demand for Italian iron, occasioned by the exclusion of English iron in the time of Napoleon I, the furnaces of the valleys of Berganio were stimulated to great activity. "The ordinary production of charcoal not sufficing to feed the furnaces and the forges, the woods were felled, the copses cut before their time, and the whole economy of the forest was deranged. At Piazzatorre there was such a devastation of the woods, and consequently such an increased severity of climate, that maize no longer ripened. An association, formed for the purpose, effected the restoration of the forests, and maize flourishes again in the fields of Piazzatorre."

Similar ameliorations have been produced by plantations in Belgium, and a district redeemed from sterility by simply planting regular rows of trees, the oldest of which is not forty years of age. While the tempest is violently agitating their tops, the air a little below is still, and sands the most barren have, under their protection, been transformed into fertile fields. For many illustrations of the value of forest shelters, as well as proofs of the destructive activity of man, see that very valuable and instructive work, "Man and Nature; or, Physical Geography as modified by Human Action," by Geo. P. Marsh; published by Chas. Scribner, New York, 1864.

Our fathers were, perhaps, wise in their generation when they so vigorously protested against the right of the King to mark the best trees in the New World with his broad arrow, and reserve them for royal use; but it would have been well for them had they early enacted stringent laws against indiscriminate destruction of forests.

A terrible scourge, and often exercised, was the assumed right, the worst conquerors and tyrants of old usurped, of destroying the forests of the prostrate enemy. Even among the ancient Greeks, barbarous as was their code of war, (for all war is barbarous,) it was considered an unpardonable offence to cut down the olive trees in an enemy's country, and the single word *dendrotomein*, the feller of trees, conveyed, in their apprehension, the idea of the most barbarous forms of devastation.* Are we less wise, less regardful of our own interests and of those of our children—we, who boast ourselves "the most enlightened"—than were the semi-barbarous Greeks, of the interest of their enemies? Are we not devastating the fair face of our country, not, it is true, by destroying our fruit trees directly, but as surely, though indirectly, by our ravages among the forest shelters of our great inheritance, while we remorselessly consume the material for the fires, the machinery and dwellings of our children's children? Is it not high time that we had a Commissioner of Woods and Forests, and enactments regulating felling and planting, and enclosing them? We act as if our forests were inexhaustible; let us take warning by the experience of Europeans, who once thought as we now do, but were obliged, too late, to enact laws to preserve their timber and save a wreck from further destruction. In some parts of Germany no farmer is permitted to fell a tree without showing that he has planted another; and it is an inviolate custom in some German districts that a man must produce a certificate that he has set a certain number of walnut trees before he is permitted to marry. Wise precautions against the day of calamity, which the entire removal of the trees would surely bring upon them.

We are blindly following our instincts as to what may conduce to our personal and present advantage, regardless of the wide-spread evils that will assuredly flow from changes brought about by our individual labors of destruction. Let us also bear in mind that we are but tenants of this earth, not owners in per-

---

*Also, Isaiah, xiv, 8.

pertuity, and have no moral right to injure the inheritance of those who succeed us; but it is our duty to leave this world better than we found it. Not to desire to do this, is unchristian—is barbarous. Plant, then, trees; teach your children to plant trees and to love them. Again, I say, plant trees, and if you can find no other time to plant trees, arise at midnight and plant them.

ON HORIZONTAL SHELTER AS A PROTECTION FROM THE VINE MILDEW.

Among the remedies which have been proposed, whereby we may avoid the injurious effects of excessive radiation on dry nights, there are two which appear worthy of trial on an extended scale, as they have proved of much value when applied to a limited extent.

Every person who has trained vines on his out-houses has noticed, in seasons when they have suffered from mildew, that the branches which were sheltered by a projecting coping or eave were almost invariably free from injury; and that the grapes were ripened under this shelter, while shrivelled or decayed on the rest of the vine. Such has been the result of our observations, both at home and abroad, and furnishes renewed evidence that mildew and blight are generally, if not always, induced by extreme radiation at night.

The first proposed remedy we will notice is not new or untried, but can be traced back nearly one hundred and fifty years. In that excellent practical work, "The Fruit Garden Kalender," by John Lawrence, M. A., London, 1718, will be found the following: "The great misfortune which we, in this island, suffer with respect to our late fruit, is the unconstancy of the weather, and the great difference of ten times betwixt our nights and days, as to heat and cold; for we do not seem so much to want hotter days as less cold at nights." * * * Referring to "the perpendicular frosts and mists which fall so frequently in spring and autumn, and cause such fatal destruction," he says: "But were it any way practicable, nothing could more effectually bring Italy into England than a contrivance to take off the influence of our cold nights and uncertain weather. This I am persuaded might, in good measure, be done with no great charge or trouble, by means of low ordinary espaliers (trellises,) about two feet high, along the several rows of vines, to which their shoots might be carried horizontally and fastened, and the fruit itself likewise defended by horizontal shelter fixed on the top of the espaliers, made of coarse narrow planks, with a convex superfices to throw off the wet." Again, in the "Gentleman's Recreation," by the same author, he remarks, "Now these hints proceeded, I think, upon a right supposition that most of our frosts and blasts, both in spring and summer, fall perpendicularly, * * * and therefore the more anything lies open and exposed to this perpendicular descent of vapors, the more will it be subject to be frozen, or, which is the same thing, blasted; the truth of which is confirmed to us both by reason and experience. This, therefore, being the true state of the case with respect to most of our destructive blasts, a little philosophy will teach us that horizontal shelters are the best guard and defence against perpendicular frosts." The above was written nearly a century before the phenomena attending the formation of dew and frost were comprehended, and nearly a century and a half before the true theory of nocturnal radiation was announced by Professor Tyndall; yet the facts recorded and the reasoning employed harmonize completely with the doctrine of the latter philosopher.

Our ancient amateur gardener does not limit himself to horizontal shelters, as above described, extending along the top of a low trellis; but recommends a succession of short projecting tiles from a wall, or boards from a trellis, one above the other, a foot or more apart, with openings between them through which the arms and stronger branches of the vines may pass upwards; while under each of these short boards the shorter branches and fruit may be protected from the "perpendicular frosts," or, as we would now express it, from direct radiation towards an unclouded sky, and through an atmosphere deprived of its heat-absorbing and sheltering vapor. The experience of the projector of this ingenious plan of protecting vines and wall fruit he records as "highly satisfactory, especially as respects peaches, figs and grapes, which in many cold summers, without such helps, would never be ripe at all;" and "that horizontal shelters do really accelerate the ripening of fruit has been confirmed by experience."

As it is now understood that the state of the atmosphere is the predisposing cause of the check to vegetation, which prepares for the access of mildew, and that it is to deficient humidity both in the air around the vine and in the superficial stratum, whereby an excessive radiation of heat by night is encouraged, it would appear highly probable that the mode of protection suggested and applied by Mr. Lawrence one hundred and fifty years ago, in England, would be found adapted to our own needs. Nor has it been entirely overlooked. The experience of William Saunders, the excellent superintendent of the Propagating Garden at Washington, has recommended a protecting grape trellis, which has its prototype in the horizontal shelters of the English gardener. That these protectors have proven valuable, is shown by the testimony of E. W. Herendeen, of Macedon, New York, who visited the "experimental garden" at Washington in 1865, (a highly unfavorable season for vines,) and in the Country Gentleman, January 25, 1866, asserts that they answer the purpose perfectly. The roof in this case was simply a board sixteen inches wide nailed to the top of the posts. In the Prairie Farmer for December 24, 1864, T. K. Phœnix writes: "It is a fact worthy of note that those vines under our covered trellis never had a mildewed leaf and had ripened their wood hard and fine, while exposed vines all went. So much in favor of protection, and such simple protection too!"

Finally, William Saunders, to whom we are indebted for the revival of this method, adds: "I have nearly one hundred varieties of grapes under the shelter trellis, as figured and described in the Agricultural Report for 1861, and *none* so sheltered showed *any* signs of mildew, although we lost very heavily on those not protected last summer," (1864.) For a description and illustration of Saunders's shelter trellis, see Patent Office Agricultural Report for 1861, pp. 497, 498.

Another method, which has effectually prevented the appearance of mildew, by enabling the vine to withstand the effects of excessive radiation by night, is to permit the vine to trail upon the ground. We have seen very fine crops of Concords at Hammonton, New Jersey, grown without a trellis or stake, but lying upon the ground, the fruit resting upon strips of cedar bark. These grapes were nearly all perfect, and received a premium as the best grapes in the New York market. Another grower in the same county of Atlantic, New Jersey, trained five hundred Concord vines on frames near the ground, so that the surface was protected from the sunshine by the foliage. No "rot" appeared on his vines thus treated, while in the immediate vicinity Concord vines tied to stakes suffered severely from "rot." Again: the most careful cultivators at Hammondsport, Steuben county, New York, train their vines upon the low trellis in such a manner that the bunches of grapes will be near to the soil, and receive the warmth radiated from the surface; thereby insuring early maturity, a richer flavor, more abundant saccharine, and higher aroma, than if grown at a greater distance from the ground. Thus grapes on branches hanging within a foot of the soil have been found fully ripe and rich in bouquet, while those three feet higher were still unripe and extremely acid. This method of training, combined with Lawrence's shelters, but four feet from the soil, would seem to leave little to desire as requisite to safety of the leaf in summer, and perfect maturation of the grape.

As there are many localities where, from the nature of the soil, the grapes would be injured by close proximity to the earth, we would suggest that a trellis, with uprights so hinged to their foundation posts as to permit their depression in sections towards, or almost in contact with, the surface of the ground, might prove valuable. On occasions when a cold night is prognosticated by the psychrometer, by laying this trellis and its attached vines nearly horizontal, we could place them in a stratum of the atmosphere the warmest, the most humid, and, consequently, the least exposed to the evils of excessive radiation, which the overlapping leaves would in some measure also arrest. At other times when, by day, a rapidly drying circulation of air may be deemed necessary, or during a damp period, the trellis and its vines could be raised and fastened vertically, as desired. It is highly probable that, by combining the low horizontal trellis, properly sheltered, with the hinged posts depressible at will, we could avoid much of the injury we now suffer from both mildew and "rot."

ON THE ROT OF THE GRAPE AND REMEDIES THEREFOR.

The introduction of many new varieties of vines, supposed to promise better than the old, and render grape-growing generally profitable, has brought into the horticultural ranks many intelligent and educated amateurs. The keen interest with which these scrutinize, study and reason, respecting pomological practices and phenomena, while untrammelled by venerable routine, is refreshing, and cannot fail to upset many old notions and to develop many truths hitherto overlooked.

Among the errors which a sound philosophy will dissipate may be named the following, with the reasons assigned for believing them erroneous, deduced from the physiology of the vine as taught by the botanists, but disregarded by the vigneron. The more important practical errors are deep trenching, high manuring with animal and vegetable matters, planting in heavy, undrained clays,* an impervious sub-soil on low grounds with defective drainage in general, close pruning, and heavy cropping. The reason for believing the above practices hurtful are, that deep trenching causes the roots to run deep, and high manuring induces a rampant growth of wood and root; the heavy clays do not permit a ready passage of rain and air, and an impervious sub-soil retains the heavy rains around their abundant roots with their multitudes of feeders and moisture imbibers. The superabundant water from heavy rains being generally followed, in early summer, by excessive atmospheric heat and very high temperatures in some soils, which is retained during the night, the vine is stimulated to vigorous action, and draws up from the saturated earth more moisture than it can evaporate through the sparse foliage which close pruning has permitted to develop. An engorgement of the tissues of the leaf and young fruit is the consequence, and rupture and death of the fruit, known as the "rot" and blight of the leaf, which prepares for the fungous growth known as "mildew."

Added to the above causes of decay of the vine may be cited the practice of taking from it, occasionally, (or it may be successive,) heavy crops in favorable years. From two to three times as much fruit is retained as the vines should be permitted to carry, which excess so impoverishes and weakens the plant as to render it incapable of resisting any of the causes of injury to which it is exposed, even when but of moderate amount. Vines which, in many instances, might have continued moderately productive, are thus destroyed, and a continued demand sustained for "new varieties which will not rot nor mildew" to take their places, to receive the same treatment and to meet the same fate.

---

* Heavy clays where the surface drainage is good and the surrounding climatic conditions eminently favorable, may prove more productive of fruit of superior excellence and less susceptible to mildew than some sandy loams abounding in vegetable matter and partially underdrained. This may arise from the more ready absorption of water and the higher heat attained by the latter soil in early summer, when the heaviest rain-fall is often followed by very high temperatures which force the vines into excessive action; while the clay soil, with good surface drainage, will neither absorb water so rapidly nor become so quickly heated by day, nor so readily cooled by night. The mildew observed on the shores of Lake Erie appeared on land abounding in sand and vegetable matter.

A cultivator of many years' experience near the Hudson river, New York, says, that after having qualified himself, as he thought, for the business of grape-growing, it required four or five years to bring his Isabellas into bearing condition, and five years more to unlearn what he had learned. Having almost killed his vines by pursuing the close-pruning system and summer trimming, as recommended by gardeners whose knowledge had been derived from experience in the plant-propagating house, he was obliged to reform his method, and now pursues that so successful in the hands of Dr. Underhill, of Croton Point vineyards. The same grape-grower adds, that excessive bearing is a great error, and that the worst cultivator always obtains the largest crops while his vines last, and that a small uniform crop every year is indicative of good cultivation, and recommends that but five or six pounds of fruit be permitted to mature on each Isabella vine occupying a space of eight by ten feet.

In the New York semi-weekly Tribune, August 30, and October 17, 1865, is recorded the experience of E. G. Johnson, of Peoria, Illinois, which is pertinent. He says that in the black prairie soil, on clayey sub-soil, "rot and mildew" prevail, and that vines thoroughly pruned and tied to stakes rotted badly, while those which were unpruned on high trellises escaped. An amateur, residing near, always lost his Catawbas when he cut his vines; but having stopped "stopping" them for some years past, has had no "rot" since. Finally, that he had found six cases of Catawba vines in his vicinity where the grapes did not rot, nor the vines mildew; and that in each case the vines had not been cut or pruned, and that he knew of no case where pruned vines did not rot or mildew.

Dr. Warder says that the Catawbas around Cincinnati "have so degenerated that this year (1865) the vines are nearly barren." To what cause can this be ascribed, save neglect of the natural conditions of equilibrium between the roots and leaves, enfeebling of the plant from year to year, by rushing the juices into fruit, instead of dividing them in due proportion to the demands of the plant and a fair crop, with occasional severe ordeals of high atmospheric humidity on an ungenial soil, and alternating extremes of dryness during the growing season, which their enfeebled condition cannot endure?

We must learn from nature, "the kindest mother of us all," if we would learn aright. The vine, we all know, is a climbing plant, destined to rise by help of other trees, and to grow in their partial shade, sheltered from the hot noonday sun, and protected from the extremest cold by night. We cannot change its nature, but must adapt our culture to its imperative necessities. How can we reasonably expect it to thrive through many seasons where it is deprived of shelter around or above, clipped into rigid stocks, and thwarted in every direction in which its instincts prompt it to extend, enfeebled and rendered the easy prey to atmospheric changes in every district not provided by nature with countervailing advantages?

A remedy for the prevention of the "rot," where vines are already planted in deep-trenched, highly manured, tenacious, and retentive soils, has been proposed, and appears to be philosophical and highly promising. It is that of Dr. Schröder, the enthusiastic vineyardist, of Bloomington, Illinois. He remarks, as is generally observed, that the first crop of Catawbas is not injured by the rot, and therefore proposes that the vineyard shall be frequently renewed by layering, after each new vine thus formed shall have borne its first large crop, or the third or fourth year after planting. Long canes should be grown for layering and laid on the soil, extending to mid-way between the rows. By continuing this process successively from each new vine for four years, and extending the layers properly, the last plant may be brought in position to take the place of the original parent, and a vineyard of young vines be constantly maintained, which, it is claimed, are always vigorous, free from disease, and produce superior fruit.

This method, which appears well worthy of trial, certainly does away with the evil of extraordinary root extension and unnatural diminution of leaves, (or the evaporating organs,) by excessive pruning. We know that in the vine, as in other plants, the growth of the root and its branches keeps pace with the extension of the stem. As the latter shoots upwards and expands its leaves, the former grow outward, absorbing moisture to supply the evaporation into the air. The older the vines the greater must the root expansion have become, and the more numerous the rootlets occupied in absorption; but the annual pruning at one fell stroke destroys the equilibrium which nature had endeavored to establish, and the leaves and fruit of the aged pruned vine are rendered liable to engorgement and suffocation with excess of moisture or of sap.

GENERAL REMARKS ON MILDEW.

Frequent reference has been made to mildew, and some explanation of the meaning of the term and notice of our present knowledge of this evil may be here in place.

Fungi are an extensive family of cryptogamous plants, generally known as mushrooms, toad-stools, rust, smut, mould, mildews, etc. They are generally parasitic, or grow upon and derive their nourishment either entirely or in part from the substances they infest. They are found wherever there is decaying vegetation upon which to feed, and sometimes prey upon living tissues. Nothing of vegetable origin is free from their ravages, when exposed to influences favorable to their growth. They are found also on animal dejections, on insects, whose death they cause, on the human skin, and even on bare stones, on iron but a few hours removed from the forge, and on acid chemical solutions. Our house-flies are often destroyed by a mould which, growing between the segments of their bodies, produces the white rings thereon, as many may have seen. Some cutaneous disorders are the result of the operations of these vegetable parasites. *Oïdium albicans* forms the disease called *apthæ* on the mucous membrane on the tongues of infants, penetrating so deeply as to be irremovable by art. It is found also in the nose, the wind-pipe, stomach and intestines.* Fungi are an attendant of diphtheria, and are present in cholera vomitus as well as in yellow fever. Other parasites not much dissimilar abound in the scalp, causing diseases, others on the teeth, some on the respiratory organs of birds, in their brains and eggs, and they have even been observed in the midst of the human eye. Fish are often covered with them; the silk-worm has been destroyed by the *Botrytis bassianæ*, and the "potato-rot" is now ascribed to the *Botrytis infestans*, both forms of fungous growth.

---

* Dr. Laycock and others regard diphtheria as due to the *Oïdium albicans* whose sporules and mycelium have been found on the mucous membrane of the mouth, fauces, etc. Diphtheria is most common in the foul districts of France and England, and is attributed to the action of putrid effluvia on the fauces, especially the foul air of sewers and cesspools, which offer highly favorable conditions for the propagation of fungi. Vitray and Desmartis are of opinion that there is no distinction between the *Oïdium albicans* and *Oïdium Tuckeri*, the former causing the diphtheria, the latter the European vine mildew. A connexion between the appearance of the European vine-mildew and the various forms of epidemic laryngeal maladies has been observed, which strengthens this presumption, the spread of the former having been followed by that of the latter.

Rev. Mr. Berkeley, one of the highest authorities on fungi, says that the mould so extremely common in England on pears, apples, and other fruits in autumn, and frequently, while yet hanging on the tree, is the *Oïdium fructigenum*, which is another species of the genus to which that causing diphtheria belongs. He also asserts that the Isabella has never suffered from the mildew when grown in Europe, though the *Oïdium Tuckeri* destroyed the European vines generally, from England to Madeira.

Many of these conclusions we believe to be unwarranted assumptions, so much remains to be learned respecting the classification of fungi. The vine-mildew of our native vines is not the *Oïdium Tuckeri*, and even this is now shown to be but a barren form of another genus, known as *Erysiphe.*

Prof. J. H. Salisbury has shown that the cause of "fever and ague" is no longer involved in mystery. He has not only detected, figured and described with minute accuracy the species of fungus which produces this disease but has propagated and cultivated the plant within doors to an extent sufficient to contaminate the atmosphere of the apartment and induce attacks of fever among its inmates. His labors also demonstrate that measles are of cryptogamous or fungous growth. (See *Ohio Agricultural Report*, for 1863, and *American Journal of Medical Sciences, January*, 1866.) These microscopic vegetable growths are probably also the predisposing cause of variola and small-pox, of the cholera and the rinderpest, and of the plague of olden time.* Their dwelling-place is as universal as their growth is simple; the air we breathe contains them, and the winds waft their seminal spores from pole to pole. They attack the housekeeper's bread and cheese, her preserves, her paste, her ink and her linen.† Her yeast consists of a living organism which is among the lowest of the fungi, and there seems to be abundant experimental proof that the various kinds of fermentations, acetous, vinous, lactic, &c., are due to different kinds of organisms, or different generations of the same species, all of which are fungi. Their attacks are not confined to the seeming dead forms of matter, but they play havoc with our fruits, (as the peach, the pear, the plum,) and attack remorselessly the foreign gooseberry, and both the foreign and the native vine and grape.

No class of organized structures is so little known, and the study of fungi is among the most recondite of pursuits. This arises from their microscopic character, their strange growths, the variety of forms through which they pass, baffling the researches of the closest observers. But enough is now known to show that they are perfect plants, growing from and producing bodies analogous to seeds; that a single plant produces millions of spores, or reproductive bodies, which are so small that they float upon the air scarcely affected by gravity; that they remain for an indefinite period inert, and are called into sudden vitality by atmospheric changes favorable to their germination; and that their sudden appearance can be readily explained to be due to natural causes, obscure only because unseen. They have been traced through their changes from the infinitesimally small spore to the perfect plant; hence they are not the result of spontaneous generation, as has been imagined by some, though it would seem scarcely possible for any intelligent person to conceive such an origin.

The earliest vegetation of these obscure creations is a prolongation of the membrane of the spores or seminal dust, and not properly seeds, because merely individual cells. From these proceeds a delicate, minute, webby growth called the mycelium, the true vegetation of the plant, and from this arises the reproductive bodies on which are formed the spores for future growth. It is this mycelium or close-growing mould which penetrates and destroys the object on which it is parasitic, or has fastened itself. Its fibres are so minute as to readily traverse the tissue or substance of the plant, and even the pores of solid wood, as may be seen in the "dry rot." The spores produced from this mycelium are so minute as to appear like a cloud of impalpable dust. And when we consider how readily germs so minute and almost omnipresent, may be drawn up with the fluids which enter through the roots, or may be received directly through the breathing pores or plants, and remember that their office is to prey upon vegetable substances which are decaying, or have received a check through untoward at-

* The theory of the "cryptogamous origin of malarious and epidemic fevers" was broached by Dr. John K. Mitchell, of Philadelphia, upwards of twenty years ago, as will be seen on consulting his lectures bearing the above title, and republished in five essays in 1859. These lectures abound in facts of interest and value.

† Dr. Forry relates that, in Florida, he had known fungi to spring up in a night and to incorporate themselves with a woollen garment so inextricably as to render separation impracticable.

mospheric influences, we may be prepared to comprehend how they may suddenly appear over widely distant regions, and commit ravages so appalling.

So little is really known of the relations which these plants bear to each other, the transformations they undergo, or the seeming transmigrations from one form to another, under change of conditions, &c., that a wide field of inquiry is here open to the young and assiduous microscopist. When we state that the fungus, producing fermentation in yeast, (or the true yeast itself,) will grow upon the diseased scalp of a scrofulous patient, take root, and exist for years without check by the medical treatment attempted; that the fungus from the "ring-worm," a disease of the skin, has been successfully used to produce fermentation (and that nearly as briskly as healthy yeast) when added to a barley wort;* and finally, that forms of fungi considered distinct species cannot be distinguished from each other, or from yeast, but that their differences seem to be entirely dependent upon the kind of plant, or the diseased animal tissue on which the spores may chance to alight, we may well believe that much remains to be learned before the naturalist will be prepared to fix the place in his system of even the common mildew of our vines and grapes. Accordingly, the best informed mycologists have not determined to what undoubted genus our vine mildew belongs. Minds of the first class are, however, zealously engaged at present in the elucidation of the structure, and in determining the laws which govern these minute and mysterious organisms.

To discover the causes of mildew and rot has exercised the ingenuity of many inquirers. Some believe they have certainly found them in deep trenching, abounding humus, and retentive soils and sub-soils; all of which are highly injurious in seasons of great atmospheric humidity, and conducive to the production of the "rot." Others assume that the cause of the rot is also the cause of the mildew, because they appear about the same time; but we believe without good reason. Both these evils no doubt arise from some derangement affecting the normal functions of the vine—some departure from the conditions of heat and moisture, either in the air or in the soil, which are absolutely demanded for its healthy growth and the maturation of the fruit. This must be self-evident, while it should also be equally clear that these conditions of temperatures and humidity, abnormal or excessive, are aggravated or rendered more injurious by the qualities of soil or position—by some esteemed the direct and specific cause of these evils. A cause for the sudden and wide-spread advent of the mildew on our grape leaves and fruit must be found as wide in its operation as is the resultant evil consequence; and must, therefore, be climatic, and climatic only. The outline sketch of the meteorological changes which preceded and accompanied this evil, and the freedom from its extreme effects in localities near wide waters, where these excessive changes of temperature and dryness were especially modified, point to the atmosphere and its fluctuating conditions as the controlling cause of the derangement which prepares for the growth of the fungi spores.

Some may still believe we have not found this cause in the cold nights resulting from extreme dryness, and the hot days following immediately thereafter, because the leaves of the vine were not frozen, nor even appeared to be injured in every case. In reply, we may say that the extreme low temperatures, followed by extreme high heats, accompanied by excessive dryness, are all conditions highly favorable to the development of the spores of the mildew, which feed upon disorganized tissues; and that freezing is not necessary to prepare for decay, may be learned from the following passage from our highest authority in physiological botany. A. de Candolle asserts, that "cold does not kill vegetation by a mechanical action proceeding from congelation of the fluids of vegetables, as some naturalists pretend. We recognize rather a physiological action in this change, for the vitality of the tissue is destroyed by a certain degree of cold, followed by

* Journal of Microscopic Science, January 7, 1866.

a certain degree of heat, according to the peculiar nature of the plant. In the same manner as the gangrene which follows the thawing of a frozen part causes the death of an animal tissue, so the change or putrefaction which follows on rapid thawing will be the principal cause of the death of the vegetable tissue. This is illustrated by the immediate death of hot-house plants when exposed to a temperature several degrees above freezing." Herein lies the philosophy of the change in the tissue of the leaves exposed to intense radiation through dry air at night, followed by intense heats at mid-day in the same drying atmosphere. The minute vessels are ruptured or dried up, and disorganized, so that decay is induced, and the ever-present spores of the fungus at once find a nidus in the decaying matter, for the removal of which they were created, take root, penetrate the leaves, or enwrap the berries, feeding upon the former and choking the latter, and destroying the remaining vitality of both by their rapid expansion and fatal folds.

OZONE AND THE VINE-MILDEW.

There are other atmospheric conditions, resultants of extreme dryness, or extreme humidity, or unusual cold, which indirectly affect the vine, and aid the development of fungous growth. It has been suggested that the relative amount of ozone in the air, which may be a peculiar form of oxygen, (or a component of this gas, if it be compound,) may exert an influence in promoting or preventing the appearance of the fungi on our vines and on other plants. Though much remains to be learned respecting the development and character of this mysterious agent, we already know the conditions most favorable to its production, as well as those inimical to its appearance, or at least to the active exhibition of its energies. We know that chemical action increases with increase of heat and diminishes with reduction of temperature, and that ozone is less prevalent in the air during frosty weather. Moisture, to a certain amount, is favorable to chemical action, while an excess is detrimental thereto; and though there is less ozone in the air when very dry, there is still less when it is very moist—a certain degree of humidity being favorable to its development and existence. Dr. Smallwood, the meteorologist of Montreal, asserts that ozone is *never* present in dry air, and that the psychrometer will indicate its presence or absence. He adds, that east and south winds are ozonic at Montreal, and that northeast winds from off the land are not ozonic; also that westerly and northerly winds do not bear ozone with them, though sea breezes with moisture are strongly ozonic. These conditions are, however, modified in other latitudes, as we have observed repeatedly that winds from the N., NE., S.E., and S.W., may be strongly ozonic at our station. Dr. Smallwood also has shown that there is a connexion between the amount of ozone in the air and the health of a district. Thus, during the prevalence of cholera the amount of ozone is least, and the humidity was at the same time diminished. Dr. Moffatt has concluded, from the results of a large number of experiments in England, that ozone plays an important part in controlling or preventing epidemics, generally by removing the cause prevailing in the infected air of a district. Finally, C. Kosman has ascertained at Strasburg, France, that the green portions of all plants exhale ozone, the result of the chemical changes going on at the surface, or in the vessels of the leaf.

The origin of infectious diseases prevailing over wide districts has, in some instances, been shown to be due to the presence of minute fungi, or rather to their germs or spores, which are ever ready to take hold and grow in favorable positions and conditions; and we know that our grape-vines are sufferers from causes having many points of analogy with the above. Now, when we consider that the appearance of mildew is invariably preceded by sudden changes in the atmospheric moisture or dryness, heat and cold; that excessively moist air as well as excessively dry air are both unfavorable to the presence of ozone, which acts so energetically in the destruction of fungi; that plants, when in health, give out ozone, and thus protect themselves from the devouring enemy ever ready to pounce upon the unprotected organism, we need not wonder that, during our oppressively moist days and unseasonably cold nights, the chemical changes connected with (or themselves the sources of) the vitality of the plant should be subdued or oppressed, the quantity of ozone in the air and on the leaf be diminished, and the torpid condition of the leaf render it an easy prey to the invisible but omnipresent enemy, and universal mildew be the result.

THE CATTLE PLAGUE IN EUROPE.

BY J. R. DODGE, OF THE DEPARTMENT OF AGRICULTURE.

The years 1865–'6 will be memorable in the annals of British farm stock. Long will farmers of the island kingdom painfully recur to recent scenes of suffering and pecuniary loss, in yard and field, in shed and byre, when medication seemed worthless and recovery impossible. Three millions of pounds sterling, or fifteen millions of dollars, may be a moderate estimate of the diminution of the meat supply and stock of the farm; but the indirect money losses flowing from the visitation in the cost of treatment and care, in diminished profits of pasturage, reduction of the aggregate stock of farm-yard manures, derangement of crop rotations, failures of farmers of moderate resources, increase in prices of meat, and other items of pecuniary damage, are not at present calculable.

The disease has distinctive characterestics, but they are so numerous that a confusion of names for it has arisen in different countries, at different times. Formerly it was known only as a murrain, a general designation for fatal diseases among cattle. In Germany, where its visits have often excited alarm and elicited medical inquiry, it has been known by a variety of hard words, given in accordance with prevalent theories of its nature, one of them signifying an impaction of the third stomach; others having reference to the condition of the liver; others meaning gastric fever, and malignant dysenteric fever. In France it is called *Peste*, and *Le Typhus contagieux des bêtes bovines*. Sometimes it is known as the Siberian Cattle Plague, which is liable to be confounded with the Siberian Boil Plague—an enzootic rather than an epizootic disease. Gamgee formerly called it Contagious Typhoid Plague. Typhus Boum Contagiosus is common upon the continent. In Great Britain it is the Cattle Plague. It is in all these localities the same disease, having the same symptoms, and attended with similar fatality.

HISTORY OF THE DISEASE.

It is deemed probable by European veterinary authorities that rarely has a period of fifty years elapsed without a visitation of some deadly cattle disease. Homer's Iliad, Virgil's Georgics, Columella, and several ancient agricultural writers, attest the correctness of such a view. The history of six hundred years past, more familiarly known, is full of references to these murrains, generally following in the wake of large armies, and spreading desolation among farm herds. These outbreaks were not always the present rinderpest. The Black Death, commencing in 1347, attacked men, horses, cattle, deer, bears, wolves, hares, and other animals. In 1709 all countries between Russia and France were infected. At this time 70,000 head perished in Naples, 100,000 in Silesia, 300,000 in the Netherlands. In upper Italy the plague was frightful in 1744, when 40,000 perished in Piedmont, 18,000 in Milan, thence passing into Germany and destroying 200,000. From 1745 to 1749 the losses of Denmark were estimated at 280,000. It entered Sweden and destroyed 32,584 cattle in the province of Schonen, leaving alive but two per cent. of the horned stock. In 1745 it appeared in England for the fourth time. In 1774 the cattle of some of the French provinces were almost exterminated, and the losses were reported at 150,000 cattle, worth 15,000,000 francs. Just prior to the close of the last century, in three years of war, Italy lost from 3,000,000 to 4,000,000. Faust estimated a loss of 10,000,000 head of cattle in France and Belgium from 1713 to 1796.

It is officially stated that the rinderpest, since 1711, in Germany alone has carried off 25,000,000 cattle, and that the cases of recovery have averaged but one in four. Such is the fatal character of this disease, which has appeared in all seasons, spares neither young nor old, and is little dependent on external circumstances.

THE DISEASE IN GREAT BRITAIN.

Professor Gamgee cites historical mention of five outbreaks in Great Britain of a disease identical with the present plague; the first in the year 810, extending through Europe, manifesting its greatest power in Britain; the second in 1223 to 1225, attacking respectively Hungary, Austria, Italy, Germany, and the British Isles; the third, nearly five hundred years later, in 1714, at which period all Europe was severely scourged; the fourth in 1745, continuing twelve years, in the third of which 80,000 cattle were destroyed by orders in council, and in the twelfth and last the single county of Cheshire lost 30,000; and again, in 1769, when comparatively few cattle were destroyed. The present or sixth outbreak occurred in June, 1865, after three years of fearful ravages in several portions of eastern Europe. In 1862, in the Austrian dominions, 296,000 attacks were reported, and 152,000 deaths. In 1863 it overran Hungary and its dependencies, as well as Gallicia, attacking 14 per cent. of all the cattle in those countries. Dr. Marsch, veterinary professor at the Agricultural College at Altenburg, Hungary, writes of the recent visitation: "Within the last year the scourge of the rinderpest has caused ravages among the cattle to an enormous extent, chiefly in the eastern crown lands." In 1863 the fatality amounted to 65 per cent. of the cases attacked in Hungary, 77 in east Gallicia, 81 in Croatia and Sclavonia, 83 on the military frontier, 88 in Moravia, 92 in lower Austria, and 94 in west Gallicia.

The origin of the disease in England is thus given by the "commissioners appointed to inquire into the origin and nature of the cattle plague:"*

"Twenty three days at least before the first outbreak in London a parcel of Russian bullocks, the first it is asserted that were brought direct from that country to England, were sold in the metropolitan market by the importer, a London cattle salesman. They had been shipped at Revel, and landed at Hull; part of them had been sold and sent to various places in the north of England, and the rest despatched to London. The southern provinces of Russia, if not the birthplace, are the constant home of a disease which, as we shall hereafter show, is identified with the cattle plague; and to this cause the introduction of the plague into England has been often and confidently ascribed."

---

*The commission consisted of Earl Spencer, Viscount Cranborne, Councillor Robert Lowe, Dr. Lyon Playfair, C. B., Clare Sewell Read, M. P., Henry Bence Jones, M. D., Richard Quain, M. D., Edmund Alexander Parkes, M. D., and Messrs. John Robinson M'Clean, Thomas Wormald, Robert Ceely, and Charles Spooner.

Some obscurity hangs over the early history of this transaction, but the general belief is strong among intelligent Englishmen that the germ of the disease was imported from Russia in the cargo above mentioned.

In this second report, the commissioners say that the careful observations of medical officials "point distinctly to contagion as the means by which the plague was originated and propagated in London."

In France, to which country the infection spread, practical and efficacious measures were promptly adopted. Early in September last, transit and importation of all cattle was prohibited, and the refuse of all cattle of infested countries was strictly prohibited on all the frontiers; and the same prohibition was applied to countries bordering on those infested. No cattle were allowed to pass any of the frontiers without rigid and competent inspection. Such measures were adopted immediately upon the report of two professors of the veterinary school at Alfort, who were sent to make returns from official examination of the disease in Germany and England. Notwithstanding all this precaution, the disease was introduced in two different localities, almost simultaneously, in a commune in Pas-de-Calais, by an importation of two Durhams from England, and on the Belgian frontier by a cow purchased in Belgium. By prompt and vigorous action of the government, the disease was completely suppressed by the beginning of November, with the total loss of forty-three cattle. In December it again broke out in the Jardin d'Acclimation of Bois-de-Bologne, introduced by two gazelles imported from England. It spread rapidly to yaks, zebus, goats, and fallow-deer; but all infected animals were at once slaughtered, to the number of thirty-five, and all traces of the disease were extirpated.

In Belgium, where precautionary and radical measures, analogous to those which were so efficacious in France, were adopted, the number of losses has not exceeded four or five hundred.

Returns from South Holland show that out of 29,031 cases 7,410 were slaughtered, 8,966 died, and 9,896, or about twenty-four per cent., recovered. In Utrecht the number of recoveries appear to be unusually large, being 926 to 790 deaths, while few have been slaughtered. Here the action of the authorities was resisted by force, and had to be supported by military detachments; and in some cases the troops were beaten off by large bands of peasants, and were obliged to take the cow-sheds by regular siege.

Its spread in England and Scotland were in accelerating ratio from the period of its first appearance, June 27, 1865, at Islington, in a herd in which were two cows just brought from the metropolitan cattle market. The entire herd, numbering ninety-three, fell victims, with several others purchased afterwards. In certain districts in the vicinity of London four-fifths of all the cattle either died or were slaughtered.

Early in July the disease appeared in Norfolk county; soon after in Suffolk and Shropshire; thence it attacked county after county; and before the end of the month invaded Scotland. By the 14th of October it existed in twenty-nine counties in England, two in Wales, and sixteen in Scotland. The number attacked in the first week of October was 1,054; in the second, 1,729; and in the third, 1,873. Up to this date the whole number attacked was 17,073, of which but 848 had recovered, or less than five per cent.; 7,912 having died, 6,866 been killed, with 2,047 still on the sick-list. An analysis of the published returns shows that the percentage of attacks increased during 1865, and until the cattle plague act went into operation. Up to December, of every 100 cattle on farms or in sheds where the disease had established itself, 44 were attacked; to December 30, 51; and to January 27, 54. Of the total number known to have been attacked, up to the culminating point of this fatal epizootic, there were in every 100 cattle—

Date.	Killed.	Died.	Recovered.	Unaccounted for.
Up to November 4	36	43	5	15
Up to November 11	34	44	5	15
Up to November 18	32	46	6	14
Up to November 25	29	48	7	15
Up to December 2	27	50	7	15
Up to December 9	24	51	7	15
Up to December 16	22	53	8	15
Up to December 23	20	54	9	15
Up to December 30	18	56	9	15
Up to January 6	17	57	10	14
Up to January 13	16	58	10	14
Up to January 20	15	59	11	14
Up to January 27	13	61	11	13

The officially reported total number of attacks up to March 24, 1866, a month after the decline commenced, was 203,350; killed, 39,487; died, 120,834; recovered, 28,656; unaccounted for, 14,373.

It should be remembered that the cases reported are by no means all existing. The inspectors were unable to detect all the concealments practiced by butchers, jobbers, dairymen, and farmers. A London cow-keeper acknowledged to the cattle commission that of forty-one cows that died or were slaughtered on his premises, the inspector got the "knacker's" receipt for the eleven that actually died of the disease.

Cheshire suffered more than any other county. While the first appearance of the plague in England was early in June, the first case in Cheshire did not occur until the first week in October. There was but a single attack which proved fatal, and no new cases existed during the second week. Six cases appeared during the third week, and twenty-three in the fourth, ending October 28. From this time the disease spread rapidly, the new cases weekly through the year proving as follows, respectively: 40, 90, 279, 275, 343, 646, 943, 1,410. Up to January 11, 5,761 attacks had occurred in three months, while only 197 animals had been killed. But this alarming condition of affairs was only the prelude to heavier loss and more widespread alarm. In two months more the frightful total of 39,739 was reached, but still only 747 animals had been killed. With the execution of the cattle-plague act came instant and regularly increasing amelioration. Up to September 1, 1866, the proportion of attacks to total number of cattle exposed was 53.985 per cent.

A great disparity in its severity is seen in the different counties. The proportion of attacks in Cambridgeshire was 21.232 per cent. of all the cattle in the county; in the metropolitan police district, 17.784 per cent.; in the East Riding of Yorkshire, 17.537 per cent.; in Huntingdonshire, 12.583 per cent.; in the North Riding of Yorkshire, 8.888 per cent.; in Oxfordshire, 8.703 per cent.; in Lincolnshire, 8.808 per cent.; Norfolk and Shropshire came next. Ten counties show a low proportion, a fraction of one per cent., viz: Hampshire, Wiltshire, Dorsetshire, Devonshire, Cornwall, Somersetshire, Gloucestershire, Worcestershire, Leicestershire, and Rutlandshire.

The official returns up to October 13, 1866, show that the number of attacks per week in the island of Great Britain had been reduced to eleven cases. Total number of attacks, 253,702; killed, 84,992; died, 124,303; recovered, 33,413; unaccounted for, 10,994—showing a total loss, in fifteen months, of about 220,000 animals. No one supposes this is the entire loss. It cannot fall much below a grand total of 300,000 if all the cases were ascertained. At only $50 per head the direct loss in cattle would be $15,000,000. Its indirect effects upon agricultural interests have cost and will still cost many millions.

CATTLE PLAGUE IN INDIA.

While the pest has been raging in Britain, it is worthy of remark that for two years past a fatal "murrain" has ravaged British Burmah, destroying 85 out of every 100 cattle or buffaloes attacked. An official commission has examined the subject in its various aspects, and Veterinary Surgeon T. P. Gudgin, of the second dragoon guards, has prepared an elaborate report upon the nature, causes, and treatment of the disease, which has recently been received officially by the Department of Agriculture. Buffaloes constitute a large proportion of the stock of the district, being stronger and more efficient workers than the common cattle. It appears that disease has committed frightful ravages among these herds from time to time for sixty years past, usually decimating the herds of horned cattle infected, often destroying them by hundreds, and sometimes sweeping off entire herds. It is found more prevalent in trading districts, in which the movement of cattle is frequent and extensive, while isolated districts and almost impenetrable jungles are comparatively exempt from its ravages. In 1864 heavy losses were endured, and in 1865 estimates of 100,000 victims were made. The plague is yearly becoming more widely disseminated, till cattle owners have yielded to despondency, and the cultivation of vegetable products, particularly of rice, has sensibly declined. The extension of the present outbreak, while in most cases traceable to infection, is charged measurably to epizootic influence, rendering the system peculiarly liable to attacks of the disease.

The cattle are not generally bred in the district. Purchases of buffaloes are usually made near the end of the dry period in anticipation of the approaching agricultural season; and it is in the beginning of the rainy season that the disease is most rapidly extended. Sudden access to luxuriant pasturage, after a reduction in condition from insufficient or innutritious food in time of drought, may aid, it is thought, in extending the disease and increasing its severity. The report discredits the assumption that the disease is indigenous, brought into existence by atmospheric changes, or generated by the soil, or by miasmatic poisons. It acknowledges the possibility that such influences may be predisposing, but not creative. The general healthiness of the country is assumed from the condition, size, girth, and immense muscular development of the buffaloes.

The character of the disease is analogous to the "rinderpest" of the mother country, if not identical with it. It appears to have the same symptoms of a malignant and infectious fever of a typhoid character, attacking the mucus membranes, running its course in the same period, characterized by a similar amount of mortality, and displaying the same post mortem lesions. It is propagated by means of infected clothing, drinking-vessels, hides, horns, and other material substances. The period of incubation varies from five to twelve days. Little has been accomplished by the use of medicines, or by any treatment whatever, in arresting the progress or reducing the death rate of this malady.

Efforts have been put forth to reduce the febrile action, restrain the diarrhœa, and raise the nervous energies. Epsom salts, sulphur, nitre, ginger, and camphor, have been recommended for the first stage; catechu and opium for the second; and linseed oil and spirits of turpentine for the third; but it is admitted of this course of treatment that "it does not promise much." It is claimed, however, in a report by Doctor Palmer, that the success of the turpentine and oil treatment during the "Calcutta epizootic" warrants a fair trial in Burmah. The natives, too, are sedulous in administering such remedies as rice-water, the milk of the cocoa-nut, tamarind paste, pepper and salt rubbed into the tongue, "samshoo" spirted into the eyes, earth-worms, chicken's liver, elephant skin, bear's bowels, and various charms. It does not appear, however, that native veterinarians are more successful than European.

NATURE OF THE DISEASE.

The medical authorities of Europe are divided upon many points touching the nature and origin of this mysterious disease. Eminent official experimenters have examined, with a microscope magnifying 2,800 diameters, capable of rendering visible particles of matter a one hundred thousandth part of an inch in diameter, the blood, textures and mucous discharges of infected animals, without discovering the principle of contagion. Chemistry, like the microscope, fails to detect it. In its effects it resembles other animal poisons. It acts on cattle, sometimes on sheep, deer, &c., but has never been communicated to non-ruminants.

The official investigations in England do not sustain the theory that it is disseminated by a wave of poisonous atmosphere flowing over a country, though it is communicated from sick animals short distances through the air. In the Albert Veterinary College experiments, animals took the disease at twenty yards distance.* The professors do not venture to say how far the infection may be carried in the air. "A distance of one hundred or two hundred yards in some cases appears to have given immunity, while in others beasts have been affected, and presumably through the air, at longer distances. Possibly it may drift under special circumstances, as in hollows or valleys, with an almost stagnant air, whereas, in an open country, and with a rapidly moving air, it may soon be so diluted and oxidized as to be innocuous."

It is declared that the influence of varieties of soil is not very marked, and that meteorological conditions produce no decided effect. In winter, crowding of cattle together is said to be unfavorable, and in summer the freer movement of cattle often spreads the disease. It is thought that differences in elevation may exercise an important influence. In the county of Yorkshire, for example, having great diversities of surface, and suffering severely from the plague, it is stated that not a single outbreak occurred at a height of one thousand feet above the sea. In other countries a greater severity of the disease has been noted in marshy and low-lying districts.

A writer in the Edinburgh Journal of Agriculture suggests the theory that rinderpest may depend upon geological formations for the facility of its propagation; and he asserts, after examining the locality of the several outbreaks in Britain, that it had seldom or never devastated districts where the soil rests upon the older of the stratified rocks, the Cambrian, the Silurian, and the fundamental gneiss; while the sandstone formation, both old and new, have apparently been particularly obnoxious to its ravages. Of the present outbreak, both in Great Britain and on the continent, the remark appears to be true. A glance at the map, in connexion with the published statement of losses in the respective counties, shows the mountain region (with older geological formations) to be absolutely exempt from loss. Wales, for instance, an elevated and broken country, has been entirely free from disease, except a few cases in the borders of the Flint

* The report of the Aberdeenshire Rinderpest Association claims that it was clearly established that the disease was not brought to any of the infected herds by cattle, and the evidence was nearly as conclusive that it could not have been communicated by individuals. In support of the theory that it was communicated through the air, it is stated that all these points were in a line, the nearest fifteen miles, the most remote forty miles distant from a hotbed of the disease, in a neighboring county, from which a strong wind of high temperature was blowing at the right period to allow the usual time for the incubation of the disease.

and Denbigh counties, in the immediate vicinity of Cheshire, (near Liverpool,) the worst scourged district in England. The mountain region of Scotland was similarly exempt. But two counties in all England escaped—Monmouth, adjoining Wales, and Westmoreland, among the mountains of the North of England. The disease, it is stated, was again and again introduced into the Scottish counties of Selkirk and Peebles, both Silurian in their formation, but died out without inflicting much injury.

Medical authorities, with few exceptions, unite in expressing the belief that the plague has never had a spontaneous origin west of Russia; and they generally declare that no clear evidence has been adduced to show that it exists there, except by the aid of contagion, yet is always found there so constantly that the eminent veterinarians, Jessen and Unterberger, deem it necessary to inoculate every head of horned stock in that country. It is said that foreign stock introduced into Russia fall victims more readily than native cattle.

Age appears to exert little influence, though it is affirmed by some that young calves and cows are more affected than oxen, and a lean or fat ox is liable to suffer more severely than one in moderate condition. Cows yielding milk, or in gestation, particularly at the latter part of the period, are more susceptible.

It seems probable that those causes which affect the health and vigor of all animals should not only predispose to disease but render its attack more violent and the prospect for recovery more doubtful, yet there are numerous cases in which herds subjected to impure air, poor diet, and bad water have fared better than those well fed in clean and well-ventilated sheds.

SYMPTOMS.

The visible premonitory symptoms, according to Professor Gamgee, "consist in shivering, muscular twitchings, and uneasiness. In some cases there is dullness, and in others excitement, amounting even to delirium and associated with remarkable sensitiveness. There is often a short husky cough. The appetite is irregular, capricious, and then entirely lost; rumination ceases. The animal grinds its teeth, yawns, arches its back, and draws its legs together under its body. The eyes, nose, and mouth are dry, red, and hot. The extremities are cold, though the internal heat is high. Constipation, as a rule, exists, and secretion is generally arrested, as indicated in milch cows by the milk at once ceasing to flow. The respirations are often, but not invariably, increased in frequency; expirations succeed the inspirations tardily, and with each there is a low moan; the temperature continues to rise, though the animal's skin becomes rigid, and indicates functional derangement by a staring coat, dryness, and eruption."

The professor's extended description of the progress of the disease, reduced to a few simple paragraphs, and relieved of its technicalities, presents the following conditions:

Redness of the visible mucous membranes appear, especially of the gums, lips, and papillæ on the inside of the cheeks, and is at first partial, pale, and patchy. Whitish opaque specks the size of a pin's head are seen; softening and exfoliation of the mucous surfaces occur, resulting in dirtyish yellow flaky appearances in the worst cases.

The muscular twitchings of face and neck are characteristic, but not so typical as the discharge from eyes and nose, which is first glary and watery, and afterwards turbid. Animals sometimes exhibit a similar secretion when suffering from catarrh, but it is always an early symptom of rinderpest.

Restlessness is a marked symptom. Lying down and rising, looking round to the flank, drawing the hind legs forward as if suffering from colic, are frequent signs. Severe diarrhœa sets in, and the animal becomes very thirsty. There is an increase in the severity of the symptoms in the night-time. The discharges are fetid, the urine scanty and albuminous.

After three days the symptoms increase in severity. The dysentery is aggravated, weakness increases, making standing or walking difficult. The pulse becomes feeble, but rapid, beating from 90 to 130 per minute. The discharge from eyes, nose, and vagina increases; the cough becomes less audible; the muscle, angles of the mouth, and nasal orifices are ulcerated with a greenish-yellow and somewhat dense granular deposit. Stupor, drowsiness, quick breathing, fætor of the exhalations, jerking respirations, coldness of the extremities, and moaning, are unfavorable symptoms in this stage. The fæces, at first dark and slimy, filled with detached masses from the mucous surfaces, are very fetid and more or less tinged with blood.

In the last stage the mucous membranes acquire a leaden hue, the erosions are marked, and blood-spots occur; and involuntary evacuation of excrement, extreme fætor of the discharges, lowering of temperature, and increasing retlessness, betoken the approach of death.

Sometimes there is improvement about the third day, followed by a relapse; and cases of apparent convalescence occur, while the gastric and intestinal lesions continue; and in possibly two or three weeks, when least expected, alarming symptoms supervene, with severe diarrhœa and other discharges, and the animal sinks and dies.

As early as 1757, during the twelve years' visitation of the plague in England, Dr. Layard, the historian of the disease in that day, thus identifies it with the present malady: "The first appearance of the infection is a decrease of appetite; a poking out of the neck, implying some difficulty in deglutition; a shaking of the head, as if the ears were tickled; a hanging down of the ears, and deafness; a dullness of the eyes; and a moving to and fro in a constant uneasiness. All these signs except the last increase till the fourth day. Then a stupidity and unwillingness to move, great debility, a total loss of appetite, a running at the eyes and nose, sometimes sickness and throwing up of bile, a husky cough and shivering. The head, horns, and breath are very hot, while the body and limbs are cold. The fever increases towards evenings; the pulse is all along quick, contracted, and uneven. A constant diarrhœa, or scouring of fetid green fæces, a stinking breath, and nauseous steams from the skin, infect the air they are placed in. The blood is very florid, hot and frothy. The urine is high-colored; the roofs of their mouths and their barbs are ulcerated."

The third and final report of the British commissions to inquire into the nature and origin of the disease gives a description of the visible symptoms following the incubative period, of which the following is a brief epitome:

The first outward sign is the peculiar eruption upon the lining membrane of the mouth and of the vagina. In the following day a disinclination to eat and ruminate is observed.

Two days after the first sign, marked indications of illness are apparent, and after this period the constitution is thoroughly invaded; and then ensue the drooping head, the hanging ears, the distressed look, the failing pulse, the oppressed breathing, the discharge from the eyes, nose, and mouth, the eruption of the skin, the fetid breath.

In two days more there occurs a great diminution of the contractile force of the heart and voluntary muscles, the pulse becomes very feeble and thready, the respiratory movements are modified, the temperature rapidly falls, and death usually occurs in the fifth day from the first visible signs of disease.

A DISCOVERY.

The possibility of discovering efficient remedies seemed to depend upon the practicability of indicating the existence of the disease by earlier signs than any of the visible symptoms above recorded. The subject was referred to Dr. Sanderson and Professor Gamgee, whose investigations are declared to establish the fact that the rise of temperature precedes any other symptom about forty-eight hours. The discovery is of practical value, in the opportunity for more prompt separation from sound animals, for shortening the period of quarantine, and for increasing the chances for success in medical treatment. Like diphtheria, and some other maladies of the human subject, this disease has so progressed in the period of incubation, when no danger was known or suspected, that recovery becomes difficult if not impossible. Within thirty-six to forty-eight hours after the animal has taken the plague by inoculation the natural temperature rises from 102° to 104°, and sometimes 104½° Fahrenheit. No acceleration of pulse is at this time apparent; eating, rumination, lactation, and other functions are performed as in health, so far as can be distinguished by the most careful attendants. Dr. Sanderson was able, in eighty cases, to recognize the disease unfailingly by this rise in temperature. Professor Gamgee, called to test the incipient existence of the disease in a herd of forty apparently sound Ayrshire cows, from which a few attacked with the disease had been separated, discovered an increase of temperature ranging from 102° to 107°; and in seven days thirty-five of the number were dead, and none escaped the contagion. His test was made by inserting a delicate thermometer in the rectum, dipping the bulb in water at 100° between each examination.

EFFECTS.

The effect of the disease upon the blood is to diminish greatly the serum, probably as a result of the intestinal discharges, and to increase the amount of fibrine and corpuscles. The blood is drained of its soluble albumen.

The effect on the milk, as appears from analysis, is to increase the butter, salts, and casein, while the sugar of milk is greatly diminished.

The urine is albuminous, and is not coagulable in the severest cases. Bile-coloring matter, often imparting a deep green color, is usually present.

Food remains undigested in the various reservoirs for its proper preparation for assimilation; the secretion of the gastric juice ceases; the intestines become the seat of inflammation, and the disorganization and destruction of the blood and mucous membranes render recovery impossible.

Veterinarians have no faith in the attempted destruction of the virus in the living animal. When its efforts are palpable in visible symptoms of the disease, medication is powerless to neutralize it.

The disease is like other fevers in its periodicity, with abatement in the morning and increase at night. As in the pleuro-pneumonia, in certain cases, a chronic, hectic fever exists, from which the animal sinks. While death usually occurs between the third and sixth day, in some instances it supervenes within twenty-four hours of the exhibition of active symptoms. A sudden aggravation of alarming symptoms betokens approaching death; but convalescence is preceded by a gradual abatement of their severity, and attended with such indications of a return of appetite, a moist muzzle, more equable temperature of the body and extremities, and restored secretions of milk.

MEANS OF PREVENTION.

The prevention of cattle plague has been sought in various expedients, such as the prohibition of stock importation from foreign countries, quarantine, inspection of frontier posts and town markets, slaughtering sick and infected animals, indemnity, insurance, stopping of fairs and markets, the use of disinfectants, vaccination, and inoculation.

That non-importation may be relied on for protection has been repeatedly shown; but to prove a certain safeguard, the protection must be absolute and smuggling prevented. Ireland has no cities to feed with foreign meat, and no occasion for importing cattle; it is also isolated by ocean walls, and has, therefore, been exempt from the infliction, notwithstanding the false alarm and consequent panic of last winter.

Hygienic management, where the pole-axe is not permitted full sway, may accomplish something for the protection of uninfected animals. The diseased should be kept warm in detached buildings provided with facilities for thorough ventilation and drainage; the sheds, and particularly all urine and excrement, should be disinfected; attendants should not be permitted to visit other farms, fairs, or markets; dogs should be kept tied, and utmost cleanliness should be maintained at all times.

Hygiene.—Among skillful veterinarians and sensible farmers, hygienic means are depended upon far more than medication. It is preferred to clothe the animal rather than close the apertures for ventilation. Cleanliness and fresh air, with suitable absorbents of noxious gases, are preferred to the vitiation of the air by chlorine or other gases evolved by disinfecting agents. Food is very sparingly given; at first, linseed tea or gruel; and afterwards, when purging begins, oatmeal gruel, free from coarse and indigestible portions of the meal. If appetite remains, well-boiled mashes, made of beans or peas and other material, are used to advantage. Particular care is advised to prevent this food from becoming sour. Vegetable mashes are preferable to milk or soups. Moderation in diet is very essential, and cold water should be frequently supplied for drinking.

Medical treatment.—The administration of medicine has been resorted to in thousands of cases under varying circumstances and in all sections, and experiments have been made with agents running through the whole range of the *materia medica* with very little success, except to teach "how best to employ medicines, so as not to aggravate the malady in animals which have a chance of recovery." Medicines have signally failed as curative means, but may be aids to a proper system of hygienic management. It is thought possible, by the help of medical investigations and experiments, to aid nature without unduly taxing the animal system in those cases in which vitality resists disease with some prospect of success. Medicinal agents have been used in every imaginable form of application; have been introduced into the stomach, the rectum, the open tissue beneath the skin, and the veins; and applications to the surface have been made by means of poultices and wet baths. Stimulants, sedatives, purgatives, neutral salts, mineral and vegetable tonics, antiseptics, and mineral acids have been called into requisition in vain. Allopathic and homœopathic treatment, water-cure, and botanic practice are attended with many deaths and few cures; and the result varies by a percentage too small for estimation if the animal has no treatment whatever. While the plague assumed a mild type in some instances, in others the fatality reached the high rate of ninety-five per cent. From actual returns of ten thousand cases, under various forms of treatment, the following tabular statement shows almost precisely similar results, averaging 26.256 per cent.:

Mode of treatment.	Total number treated that recovered or died.	PERCENTAGE.	
		Recovered.	Died.
Antiphlogistic	958	27.453	72.547
Tonic and stimulant	2,301	25.858	74.142
Antiseptic	2,355	26.369	73.631
Special	1,173	25.831	74.169
Total	6,787	26.256	73.744

This is a more favorable showing than the average of recoveries throughout the course of the plague, but the difference is fully accounted for by the tendency to exaggerate the effects of a favorite mode of treatment, or by the fact that milder cases are selected for trial, and is not deemed to be due to medication.

The commissioners, in their third report, say that "with the widest differences in the modes of treatment, there is hardly any difference in the alleged results, and the natural inference is, that the various drugs employed have produced very little effect.

The effect of dieting is more conclusive and favorable. Out of 503 cases judiciously fed with soft mashes of vegetable food, 381 per cent. recovered; and 813 cases are reported as follows:

Kind of dieting.	Number of cattle.	Recoveries, per cent.
1. Cottagers' cattle, generally fed on mashed food	95	73.7
2. Larger stock, where dry food was often given during convalescence	105	57.5
3. Cattle treated with mixed food of mashes and hay	303	22.2
4. Cattle fed with dry food, and treated medically with drugs	310	13.5

If 73 per cent. of cures could be expected, as in the case of cottagers' cattle, the plague would be, in a measure, disarmed of its terrors. The cases cited are few in number, occur in comparative isolation, and under a mode of feeding, perhaps better than others calculated to fortify the animal against the attack; and they may not be relied upon as a fair indication of the effect of such a mode of treatment among large herds. It is scarcely safe to credit this success solely to the mode of feeding, in view of the Scotch test, in large and small stocks, showing that 62 per cent. recovered in 200 cases occurring in stocks of less than thirty, while the recoveries were but 22.2 per cent. in stocks of thirty to eighty cows.

While it is shown that medicine is powerless to cure, and of doubtful value as an aid, even in hopeful cases, it is proved, to the satisfaction of the cattle commission itself, that powerful drugs, of all kinds, heighten the mortality.*

A degree of success was at one time claimed for a modified homœopathic treatment by two Belgian gentlemen, at Mathenesse, near Schiedam, in South Holland. Public expectation in England was excited in consequence, and an experiment was undertaken. Of the result the commissioners write: "Out of the forty-five only one animal seems not to have contracted the disease; of the rest, four recovered, and forty died."

Concerning the treatment of Mr. Worms, of which so much was boasted, consisting of the administration of assafœtida, ginger, onions, and garlic, with liquid food, it is declared that the restriction as to food was probably the most important part of the treatment, for experience has shown that no reliance can be placed on the drugs alone.

The official report refers to the inhalation of chloroform in favorable terms, without venturing to indorse the treatment until further and more decisive tests are made. The inhalation of oxygen gas is declared useless.

*The minister of the interior of Holland, in his report upon the cattle plague, says: "No mode of treatment has hitherto proved itself advantageous over any other. Veterinary practiitoners seem to have found the greatest benefit from mineral acids, from quinine, and from carbolic acid. A favorable issue depends, according to them, in a great measure on the care with which the beasts are tended, on cleanliness, and fresh air."

Similar statements are made by officials in various European countries.

The British commission arrives at the broad conclusion "that in this as in other countries no drug has been found that can be recommended as either an antidote or a palliative," but that "it may, nevertheless, be desirable under stringent regulations, and by the instrumentality of competent persons, to investigate the influence which certain specific agents may have on the cause of the disease."

Inoculation.—The official report of Russian experiments relative to the protection of cattle from rinderpest by inoculation was communicated to this department by the Russian minister through the Department of State. These experiments are probably the most extensive and long-continued ever conducted. A digest of this voluminous history will illustrate the difficulties which medical men must encounter in attempting to find a remedy or prevention of this mysterious disease.

Experiments of a similar character were initiated, in accordance with the suggestion of Professor Jessen, of Dorpat, in 1852, with results so various and indefinite that the government determined further and more thoroughly to test the virtues of inoculation. Accordingly an appropriation was made of ten thousand roubles annually, for three years, and a committee appointed, on which were Professors Jessen, Rawitch, and Roynoff, with instructions to continue experiments in three established institutions for inoculation. This was in 1858, but active operations did not commence till 1860, and then only at two points in southern Russia—Salmysche and Bondarewka—under the immediate superintendence of Veterinary Surgeon Kobuscheff at the former place, and of Surgeon Sergeeff at the latter These experiments continued through four seasons.

The results, though still various and in some respects conflicting, are interesting and instructive. They show certainly the different degrees of susceptibility in different breeds, and the loss or destruction of the vitality of the virus with age. The wide difference in severity and fatality, noticed in the two series of experiments, is readily suggested by the fact that matter from two to nine months old was principally used at Bondarewka.

At this place in 1860, 58 cattle were inoculated, 9 were very sick, and 3 died. In most of these cases the matter was from five to nine months old. Reinoculation of 37 with fresh matter resulted in the sickness of 5, of which 3 died.

In 1861, 257 were inoculated inside of the institution, and 220 outside. Of the former only 5 were very sick, 177 were slightly ill, 42 had some symptoms of the disease, and but 1 died. About half of those outside had the disease in a mild form. In one experiment two animals were inoculated with slight effect, and afterwards took the disease naturally, notwithstanding inoculation, and both died.

At the arrival of the commissioners in 1863, 295 had already been experimented upon by Veterinary Surgeon Sergeeff, of which 51 had slight symptoms, 136 had some cough and epiphora, 33 remained well, and 75 were not observed by the inoculator.

In three years Sergeeff inoculated 1,028 animals, but used old matter, except in 45 cases, of which 17 took very sick and 4 died. The loss of contagious power in old matter is shown, further, by experiments of the commissioners upon 21 of Sergeeff's subjects with fresh matter, of which 9 took sick, and 4 died. In another case, 65 head were tried with fresh matter, and 39 were severely affected, and 19 died, an unusual degree of fatality at Bondarewka. Matter from one to nine months old was tried upon 14 animals, all escaping infection; but upon reinoculation with fresh matter 10 became sick and 3 died.

In one experiment two sheep were infected, and matter taken from them was used successfully in infecting six cattle; all were sick, and all but one died.

Inoculated animals were frequently exposed to contagion with impunity, unless in caces in which the symptoms were comparatively mild.

In 1860, the whole number vaccinated at Salmysche was 64; 36 took sick after the first inoculation and 13 died; the other 28 were again inoculated, of which 16 sickened and 7 died. Of the other 12, 10 were a third time inoculated, and 4 a fourth time, with only one animal in each case slightly affected. Of the whole number, 64, 53 animals were infected, and 20 died. No milder effect was produced by matter "of the fifth generation." Of three animals inoculated with matter of the second generation, two were infected and one died, while four animals died out of seven infected with matter of the fifth generation. In most of these experiments, matter over twenty-five days old had no effect.

In 1851 there were 151 inoculated, of which 69 remained well, 39 had slight symptoms of disease, 43 had it severely, and 24 of them died. These 69 and 4 others slightly affected were reinoculated; 43 of which sickened and 17 died. Of 27 inoculated the third and fourth time, 14 took sick and 8 died. In these experiments some that were slightly sick at the first inoculation died as the result of the second.

Some died after the third inoculation. Matter more than nine days old was found inefficient.

In 1862, the third year, there were 51 deaths from 130 infections out of 167 inoculations. It is a noticeable fact that of two breeds, the Baschkir and the Kirgis, less than a fourth of the latter became slightly sick, while about two-thirds of the former experimented upon were infected, and more than one-third of the whole number died.

Of 466 cattle inoculated by Veterinary Surgeon Kobuscheff at Salmysche, partly under supervision of Professor Jessen and Roynoff, from October 1, 1860, to July 5, 1863, 379 were infected, and 148 died. Thus about 80 per cent. of all took the infection, and more than 30 per cent. died.

In the experiments of the commissioners in 1863 are a few noteworthy features. In the fifth experiment, four animals that had been inoculated without effect were left to take the contagion naturally; all became diseased, and three died. In another instance, several animals mildly affected by a former inoculation were inoculated with fresh matter without effect. Again, in several cases, animals that had once had the disease were exposed to contagion with impunity.

Ten sheep were exposed to contagion, and five were inoculated without effect, and they encountered subsequent exposure unharmed.

It will be seen that in one location, and that in which the greater number of fatal cases occurs, ten sheep were entirely unaffected, while at the other station two were inoculated successfully, and matter of extraordinary potency obtained for further experiments upon cattle.

The following is a translation from the journal of the committee of their conclusions upon certain points, in view of the results of their experiments:

1. Is the rinderpest similar to the abdominal typhus of a human being, and to what degree?

The rinderpest must be considered as a contagious typhus *sui generis,* as well in its clinical as anatomical pathological appearance, and is very similar to the abdominal typhus of a human being, but different from the same by its rapid course and the constant complication of catarrh in all the mucous membranes.

2. Is there any evidence that the rinderpest has its origin only or principally in the steppe countries of Russia, and that it was transferred thence to the other provinces of the country?

The rinderpest was brought from the steppe countries, but the place of its origin is not yet known. Therefore there is no positive evidence on hand to decide this question.

3. Are there any localities in Russia where the rinderpest began spontaneously?

Considering the reports on hand, there are places in the northern part of Russia where the rinderpest was developed by itself, but this assertion is difficult to prove, because no scientific examination has been made in these places concerning this question.

4. Is the rinderpest only contagious by direct contact with the infected animal or through miasmatic propagation?

The rinderpest is contagious as well by direct contact with the sickly or dead animal as by its exhalations.

5. Is the rinderpest alike contagious in all parts of Russia, and is the mortality the same everywhere?

The rinderpest is less contagious in the southern parts of Russia, and less fatal there in comparison with other regions of that country.

6. Does the season influence the contagion of the rinderpest?

The rinderpest is less contagious in summer and winter than in spring and fall.

7. Are certain breeds of cattle more disposed to rinderpest than others?

Not all breeds are alike disposed to contagion. The experiments at Salmysche and at Bondarewka have shown that the Kirghis and south steppe breeds are less disposed to contagion than others.

8. Do all cattle of a herd take sick at the outbreak of the rinderpest?

This is the case sometimes in the northern part of Russia, but hardly ever in the southern part.

9. Is the virus of the rinderpest mitigated by successive generations of the disease?

Some cases have been very favorable to mitigation, but the latest experiments have shown that no mitigation of the effect of the virus took place even in the fifteenth generation. Therefore, in accordance with these results, mitigation of the virus of the rinderpest cannot be expected. (Professor Jessen is against this conclusion.)

10. How long does virus of the rinderpest preserve its power of contagion, and has old matter the same effect as fresh matter?

The experiments made so far have not produced any positive results in determining the length of time that the virus will preserve its vitality. In some cases the virus lost its effect in several days, but in others it maintained the same after eleven months. It is therefore remarked that the duration of the effect of the virus depends considerably upon the manner of preservation. Experiments have shown, as far as the difference in effect between fresh and old matter is concerned, that inoculation with fresh matter generally causes a severe sickness, but inoculation with old matter a slight illness, and in some cases that it is without any effect.

11. Does inoculation with the rinderpest always preserve the animal from a repeated attack of the plague?

Animals which show strong characteristic marks of the rinderpest after inoculation certainly will not again contract the disease, but those which show light symptoms of the sickness after inoculation are not always safe from a repeated attack.

12. How long can an animal be considered safe after being inoculated?

The results obtained do not render it certain how long this immunity will last; perhaps it will extend through the whole life of the animal, but our experiments only reach up to six years.

Experiments in inoculation with the virus of cattle plague, in England, tend to show that in no degree is the severity of the disease mitigated by transmission of the contagion through the bodies of sheep or goats, but that repeated transmission of the virus through cattle slightly weakens its power. Practically the attempt to destroy its virulence, or render the system of the ox insusceptible to its influence, has proved a failure.

Disinfection.—It is universally conceded that a very important means of prevention is disinfection, or destruction of the animal poison. This poison is constantly discharged from the diseased surfaces, and is also held in suspension in the air; and the disinfectants employed must therefore be both fixed and volatile, and should be harmless in their action upon men and cattle, and sufficiently cheap to make their liberal application practicable. Many substances were tried. Iron in various compounds, zinc, lead, manganese, arsenic, sodium, and lime, lacked volatility; iodine, bromine, and nitrous acid were either injurious or too expensive. The best disinfectants were found to be chlorine, ozone, sulphur, and carbolic and cresylic acids. The chlorine and tar acids, being liquid and æriform, efficient in application to solids or the poisons diffused in the air, were found very advantageous. It is assumed that chlorine and ozone act as oxidizers, destroying the vitality of the contagion; that the sulphurous acid destroys the virus by its antiseptic quality; and that the tar acids, without interrupting oxidation, arrest all fermentative and putrefactive changes, annihilating with equal certainty the germ of infection. Official experiments conducted by William Crookes, F. R. S., tend to show that the tar acids, with sulphur as an occasional agency, furnish the most simple and powerful means of disinfection. The experimenter anticipates valuable results from the use of these antiseptics, about farm buildings, manure heaps, and applied to sewage,* in preventing typhoid fevers, diphtheria, and that class of diseases in man; and asserts that sheep are free from foot-rot, and potatoes from disease in tracts of land to which disinfected sewage has been applied.

In the course of the plague multitudes of exemptions from infection are noted, apparently due to disinfectants. In some cases, animals condemned, on the breaking out of disease in the herd, were respited by magistrates and saved, the disinfecting processes being continued. One proprietor using chlorine extensively with his own herd lost none, while tenant farmers upon his estate lost heavily. Similar cases were everywhere reported, and other instances are noted in which such processes were not sufficient to secure the safety of the herd.

Legal Means.—The most efficient of all repressive measures was the law of Parliament requiring destruction, with compensation. Local efforts were feeble, conflicting, and utterly unavailing. At first slow, gradually increasing and gathering strength in accelerating ratio, the progress of the disease was at last so fearful as to excite alarm in all classes, and sweep away as cobwebs the strenuously urged objections to so radical an enactment. October 7, more than three months after the disease broke out, 11,300 had been reported. The progress thereafter was as follows:

November 4	20, 897	January 27	120, 740
December 2	39, 714	March 1	177, 689
December 30	73, 549	March 24	203, 350

The effect of the law is well illustrated by reference to the great cattle counties of Yorkshire and Cheshire, which suffered terribly. There was more or

* The contents of sewers are beginning to be extensively used in England for farm irrigation.

less laxity in enforcing the law in the several counties. In Yorkshire, where greater strictness prevailed, the decline was most rapid:

Week ending—	YORKSHIRE.		CHESHIRE.	
	Fresh attacks.	Killed.	Fresh attacks.	Killed.
Before the act.				
January 6	2,028	28	1,883	14
January 13	1,508	48	2,317	13
January 20	1,314	40	3,547	9
January 27	2,034	36	3,448	7
February 3	1,426	23	3,005	3
February 10	1,455	17	4,671	11
February 17	1,836	51	4,378	8
After the act.				
February 24	1,369	277	3,671	446
March 3	1,193	739	1,273	855
March 10	811	882	1,827	1,514
March 17	999	972	1,380	1,151
March 24	683	659	1,271	1,104
March 31	534	517	765	660
April 7	338	330	808	707

The total number of attacks, deaths, and recoveries throughout the island, after the commencement of the destruction, for the eight weeks ending April 21, were as follows:

Week ending—	Attacked.	Died.	Recovered.
March 3	7,310	3,271	2,102
March 10	6,518	1,185	1,151
March 17	6,261	779	1,014
March 24	4,704	318	543
March 31	3,996	154	394
April 7	3,361	131	267
April 14	2,582	108	354
April 21	2,823	93	210
Total	37,515	6,039	6,035

The decrease in the number of attacks has been regular since April 21. The number for the week ending June 23 was 500; July 28, 210; August 25, 160; September 29, 43; October 13, 11. The disease is now nearly extinct. The total number of officially reported attacks in the first year, ending in the third week of June, was 251,150.

There will be danger, for several months, of the reappearance of the disease, as in 1757, after twelve years of death and slaughter, when Layard wrote: "The disease, thank God, is considerably abated, and only breaks out now and then in such places where, for want of proper cleansing after the infection, or carelessness in burying the carcasses, the putrid forms are still preserved, and are ready, at a proper constitution of the air, or upon being uncovered, to disperse such a quantity of effluvia that all the cattle which have not had it will be liable to infection."

The success of legal measures of repression in Great Britain was foreshadowed by the result of voluntary local law. In several instances early in the season of the plague, the farmers of the county of Aberdeen, in Scotland, watchful and provident, early sought to protect themselves and repel the invader. An association was formed, participated in by all of the parishes, eighty-four in number, and a voluntary assessment of one penny per pound of the agricultural rental was made, collected at once, and four-fifths of the sum actually realized as a fund with which to compensate for animals killed. When the plague did come, the first animal infected in a herd was slaughtered before the sickness had progressed. If a second attack occurred the whole herd was immediately slaughtered. The disease appeared in seven different centres, but so thorough was the destruction that the county was cleared of the pest before the coming of winter, with the loss of but three hundred and six animals, averaging, large and small together, a cost of £10 per head.

The English people, slow to ask for restrictions of commerce, especially in food products, (and cattle particularly, of which from 5,000 to 10,000 are imported weekly,) suffered much from the hesitating, dilatory, and irregular policy of the government. Orders in council were issued from time to time regulating the movement of cattle, and prescribing various police details, the result of which was to circumscribe the powers of the inspectors, to enlarge those of local authorities, and finally to replace the latter by new local authorities, with a new sphere of jurisdiction; and between the several local authorities there proved to be no concert of action, and little prevention of disease. The Economist thus accounts for its rapid diffusion: "You could not persuade the English people to hurt themselves so much until the evil was apparent. When the disease had reached their own locality, when it got pretty near, when it had killed half the cattle of a county off, then the sluggish mass of common Englishmen would be roused and awake; but not till then. Even the distant calamities of great magnitude would not move them to the constant exertion, the perpetual watching, the diffused and never-resting care which would be needful; and as the disease now is, when its ravages were a matter of figures, and but a small matter, you might as well expect aid from the English cattle as from the English peasantry or the smaller English farmer."

The plague still continued its ravages, the government as well as people became alarmed, and a law was enacted, based upon the idea of crushing out the infection by wholesale destruction of infested herds, with partial compensation to owners.

BRITISH CATTLE PLAGUE ACT.

The existing act, as finally perfected, is of great length, and a brief synopsis of its provisions must suffice. It provides for the slaughter by the local authorities of all animals affected with the cattle plague, and for compensation to the owners equal to two-thirds of the value of each animal, not to exceed £20. Every dead or slaughtered animal must be buried in its skin, covered with quicklime or other disinfectant, and not less than six feet deep of earth. Very minute and thorough provisions secure the cleaning and disinfection of premises and clothing of attendants, and prevent the introduction of other animals for thirty days. Local authorities are empowered to require the slaughtering of exposed animals, if they see fit, and may allow the owners to sell the meat, and shall pay for the animal if the owner prefers not to dispose of it himself, such sum, not exceeding £25, as may equal three-fourths of its value. It provides also for compensation for slaughtering by any inspector, under authority of prior enactments of August and September, 1865. It prohibits all markets, fairs, auctions, exhibitions or public sales of cattle, except markets, for the sale of animals intended for immediate slaughter. Stringent regulations are required in all markets in the metropolis, to prevent the removal of cattle.

Part second requires every person having an infected animal to give notice to the local authorities, and to keep it separate from others, and forbids its removal from the premises, its exposure for sale, or its passing along a public highway, common, or unenclosed forest or other land.

It provides that the compensation and medical expenses shall be defrayed, two-thirds out of the local rate, and one-third from a special cattle rate, which may be levied at any interval of time not less than three months, and in amount not exceeding five shillings per head for all cattle one year old and upwards. The tenant of a farm may deduct from his rent half the amount of his rate.

The law provides relative to infected places—

1. That no cattle shall be moved out of or into an infected place, or along any highway within an infected place.

2. No hides, horns, hoofs, or other parts of cattle shall be removed from an infected place, unless with a license from some officer, appointed in that behalf by the local authority, certifying that such articles have not formed part of an animal afflicted by cattle plague, and have been properly disinfected, if necessary.

3 No dung of cattle, and no hay, straw, litter, or other articles that have been used, in or about cattle, shall be removed from an infected place. And any local authority may make orders as to the shutting up of dogs in an infected place, and the destruction of stray dogs found within or coming out of the same.

As to the movement of cattle, it requires all imported animals to be marked by clipping the hair off the end of the tail, and no animal so marked may be moved from the port of landing alive; and provides that no cattle shall be moved, except by railway, after sunset and before sunrise, except within the limits of the metropolis; that no animal shall be taken into any district in opposition to the prohibition of its local authorities; or at any time between sunset and sunrise be put on a railway.

It authorizes local authorities to prohibit or impose restrictions or conditions on the introduction or removal of—

1. Any specified description of animals, excepting for a distance not exceeding two hundred yards, from part to part of the same farm.

2. Raw or untanned hides or skins, horns, hoofs, or offal of animals, or of any specified description thereof, except hides, skins, horns, or hoofs imported into the United Kingdom from India, Australia, South Africa, or America.

3. Hay, straw, litter, or other articles that have been used in or about animals.

LAWS OF CONTINENTAL NATIONS.

In Russia the police regulations are very strict. On the breaking out of an epizootic immediate notifications of the police authorities are enforced, and the sheriff, with a politico-medical officer, a veterinary surgeon, repairs at once to the spot. The medical officer, after examinations, living and post mortem, defines the extent and nature of the disease, reports the facts to the local authorities, giving information of the number and breeds of the animals in the district. The local police then direct the adoption of measures of prevention. In villages within the jurisdiction of the department of crown lands, the rural police are assisted by the local department authorities.

If these local measures are not effectual, the chiefs of provinces, upon consultation with the members or inspector of the medical court, or committee of public health, devise other and more stringent means. Of the appearance, mode of treatment, and final disappearance of the disease, the minister of the interior is fully advised.

Among the preventive means adopted in cases of cattle plague are the following: Separation from healthy cattle. Shepherds and cattle-feeders are not allowed to visit infected places. Purchases of cattle, milk, hides, or tallow, in infected districts, to be carried to healthy places, are forbidden. Persons attending diseased cattle must wash their hands in a solution of potash and vinegar, and change their clothes before approaching healthy cattle. When dead animals are removed in carts drawn by horses, care must be taken that no liquid matter is dropped. Neither skin, horns, nor hoofs may be removed from a dead animal, which must be buried deeply, far from dwellings of man and feeding-places of cattle, in open rather than wooded spaces, where they may not be liable to be dug up by wolves or other animals.

In the Netherlands, provision has been made by law for the prohibition of importation and transit of cattle and the holding of cattle markets, and regulations have been established relating to the sale, treatment, and disinfection of living or dead cattle, meat, hides, hair, wool, dung, and other offal. Any animal removed and sold, to evade the provisions of the law, may be seized and confiscated, and punishment by fine of 25 to 500 florins, and imprisonment for eight days to three months, are penalties of its transgression. A liberal indemnification is made for all animals slaughtered by order if the disease has been made known by the proprietor himself.

Stringent regulations are enforced by law in Prussia. Medical treatment is forbidden, as also the recommending and publicly advertising of remedies.

Legal measures, various in character and complete in details as experience and practical wisdom are able to suggest, are also enforced in France, Belgium, Austria, Denmark, Switzerland, Bavaria, Saxony, Hanover, Baden, and by other (and probably all) governments of Europe.

AMERICAN CATTLE IN DANGER.

It would be strange if America should escape the visitation many years. Cholera, arising in the east, has traversed Asia and continental Europe, leaped the North sea, and passed the ocean barriers repeatedly. Diphtheria and other subtle animal poisons have been disseminated over islands and continents. Deadly murrains have decimated or destroyed the herds of all nations in all ages. Apparently new forms of disease appear occasionally, destroying particular genera of animals, while others escape unscathed. This cattle plague is not altogether new in Europe, having been traced back, by characteristic manifestations, a thousand years and more, during which time at least six separate outbreaks in Britain are chronicled. America has never yet been visited, so far as is known, but who can guarantee continued immunity?

When the red men roamed the forest alone, they were free from European infectious diseases. That exemption ceased with the landing of the colonists at Jamestown, and the arrival of the Mayflower in Massachusetts bay. Our cattle have hitherto been subject, in a limited degree, to occasional epizootic outbreaks, in their comparative isolation and freedom from disease-producing influences. Importations of foreign cattle are fortunately prohibited, yet infection may come at any moment, wafted by the winds of commerce, in a bale of wool, a bag of rags, a bundle of hides, a package of horns, a crate of crockery, or in a single straw, or in the clothing of a herdsman, for it has been proved that the infection can live and multiply after many months of rest.

And if it comes, what shall hinder its sweeping the country, and destroying as many millions of dollars as would suffice to connect the Mississippi and the Hudson by a ship canal that should be ample for the transportation of the products of a continent? We have had one warning. Pleuro-pneumonia, which has ravaged portions of Europe during the past half century, was a few years since introduced into Massachusetts; and but for the prompt and vigorous action of the legislature of that State, by which diseased and exposed animals were slaughtered and the disease thus "stamped out," the losses of cattle-owners might have been many millions of money, if not millions of cattle.

But a worse than the pleuro-pneumonia is the rinderpest. In some countries the recoveries do not exceed five per cent., and (if it is not a witticism) a portion of those which recover ultimately die before they reach the butcher. Lancisi, a great Italian writer, declared that the cures spread the disease. When this disease approaches, the knife is the proper medicine, arterial bleeding the only radical cure; yet there would be hesitation here as elsewhere, and delay and paltering with remedies. Already a dozen have been proposed in advance, and a score of ridiculous theories of its nature and cure propounded; and some have recognized its actual outbreak in Pennsylvania, and others again in Kentucky. American nature is human nature, and cattle plague history would again repeat itself. As in 1750, the sixth year of the fourth visitation, which lasted twelve years in England, when people complained that the sick beasts were not killed soon enough, there would be loud outcries against the dangerous dilatoriness or reckless cupidity that hoped for cures while spreading infection. As then, after years of killing and saving, and the lamentation that "Cheshire might have saved 6,000 if the farmer at Elton had killed his cattle," there would be the same mistaken mercy mingled with wholesome severity, the same concealments and hesitation, similar declarations of the incurability of the disease and the folly of treatment, and after all, at the last record of the eventful history it would be written of some Doctor Jones or Veterinary Smith, that "a never-failing remedy had been discovered." Thus "hope springs eternal in the human breast," and the dire plague "never is, but always to be" cured.

Great Britain has enacted a stringent and effectual law, which effectually set a barrier to the regular weekly increase of attacks, and secured a constant and rapid decline of the disease. The Congress of the United States would pass no similar law for killing and compensating by wholesale. The matter has already been broached among members of Congress, and State rights have stood as a lion in the way. The subject is referred to the several States, as a matter of domestic and local concern, and here would be one great danger in the case of an outbreak in this country. Thirty-six States would have thirty-six separate and diverse laws on the subject, but for the fact that half of them would have none at all, at least for the first year or two, or until the infection was almost remedilessly spread throughout their borders.

Then if the railroad system of England, with its systematic vigilance and watchful care, is the means of extending the disease, what reeking infection might not be conveyed on our uncleaned cattle trucks and uncared-for railway cattle pens.

Scarcely a government in Europe has neglected to enact laws for arresting the spread of this fatal disease. These laws commonly have the following objects:

1. To make it the legal duty of the stock-owner to give the earliest notice of its approach.
2. To arm either the local authorities or the executive with power to isolate or slaughter herds.
3. To make pecuniary compensation for animals slaughtered.
4. To provide a supply of competent veterinary surgeons.

It is urgently suggested, in conclusion, that State legislatures take up, at the earliest possible moment, the question of permanent general enactments, applicable to all virulent, infectious, or contagious diseases, and pass such laws as the security of farm stock within the several States may require. Massachusetts has already an efficient law of this character.

DONATIONS.

Donors and their donations to the museum of the Department of Agriculture.

Name.	Residence.	Articles.
Charles Roos	New Ulm, Minn	Sorghum sirup; grasshoppers and eggs; samples wool.
Tilden, Dep't Ag're	Washington, D. C	Bottle petroleum.
Hon. R. B. Miller	Utica, N. Y	Manufactures from epilobium fibre.
H. Cummin	Bethany, N. Y	Samples Spanish merino wool.
Dr. Winslow		Sapan nuts; sample cotton.
C. W. Wandell	Beaver, Utah	Rock salt from Arizona.
Judge Fisher	For Mrs. Phillips, Del	Cotton and cotton yarn.
James Sanders	Marietta, Penn	Tobacco and cigars.
J. H. Richards	Schuykill Falls, Penn	Medlars.
A. L. Silar	Northup, Utah	Bottle of insects; petrified wood.
J. Pierce	Washington, D. C	Seeds magnolia grandiflora.
Hon. J. L. Driggs	Saginaw, Mich	Cabbage weighing 30 pounds; beet weighing 27 pounds.
W.S.Loughborough	Rochester, N. Y	Apples, Calvert and russet mixed.
V. D. Collins	For Chinese government	Seven cases of insects; samples sorghum sugar and sirup; varieties of paper, fibres, shoes, hats, agricultural machinery, coins, &c.
M. Guerin Meneville	Paris, France	Silk insects, cocoons, &c.
John Goddard	Greensburg, Ind	Sorghum sirup; samples of corn.
E. S. Whitney	Washington, D. C	Petroleum from Dunkirk wells.
Ransom Bullard	Litchfield, Mich	Sorghum sirup.
A. H. Wrenn	Mt. Gilead, Ohio	Corn.
Ch's Y. Sundell	U. S. consul at Stettin	Silk cocoons and pine fibre.
J. M. Davis	Washington, D C	Egyptian corn.
Prof. A. L. Fleury	Pittsburg, Penn	Oil rock from Mecca, O.; bitumens, &c.
H. D. Dunn	San Francisco, Cal	Nuts, spices, cotton, &c.
T. Bausket	Ocala, Florida	Native fibre.
Allen Crocker	Burlington, Kansas	Box lepidoptera; bottles insects; skins of animals.
Allan Dodge	Georgetown, D. C	Samples of corn.
O. H. Kelley	Minnesota	Saltpetre from tobacco.
H. D. Scott	Terre Haute, Ind	Samples of corn.
Josiah Wilson	Vinton Station, Ohio	Sorghum stalk 17 feet 7 inches long.
H. Ellsworth	Eugene City, Oregon	Oregon wheat.
J. F. Wilson	Iowa	Sorghum sugar.
John Pierce	Colorado	Petroleum coal.
J. H. McNall	North Star, Penn	Skin of Angora goat.
W. F. Geer	North Becket, Mass	Skins of rats.
Jules Laverriere	Paris, France	Cocoons and silk; colored plates of fruits; Ervum ervilia plant and seed.
Vilmorin, Andrieux	Paris, France	Album Vilmorin.
J. N. Russell	Fulton House, Penn	Samples of corn.
B. M. Bugby	California	Wheat, barley and rye.
J. S. Gallaher, jr	Washington, D. C	Silk reeled from Cynthia cocoons; artificial fuel.
Mr. Budd	Florida	Native fibre.
T. Glover	Dep't Ag're, Washington, D. C	Pine leaf fibre and cloth; rice paper; pyrethrum for destroying insects, &c.
Mrs. G. H. Pennfield	Hartford, Conn	Eight specimens emery rock.
R. O. Thompson	Brookfield, Mo	Cotton grown in Nebraska.
E. C. Rice	New York city	Thread from China grass.
G. J. Abbott	U. S. consul, Sheffield, Eng	Splendid specimens China grass (Bœhmeria nivea,) manufactured by J. Wade and Sons, Bradford, England.
John Bowles	Augusta, Ga	Millet, two varieties.
E. W. Rogers & Sons	Whallonsburg, N. Y	Merino wool.
M. Dodge	Maryland	Red ochre.

Name.	Residence.	Articles.
N. Dunbar	East Roxboro', Mass	Yellow ochre.
L. Perrot	Greenville, Wis	Skins of birds and animals.
F. Edmondton	Hoyleton, Ill	Sorghum sugar.
B. K. Tully	Russellville, Ky	Skin of Angora goat.
Aug. Herman	New York	Insect powder.
Dr. H. Erni	Dep't Ag're, Washington	Guano from Patagonia.
W. N. Byers	Denver, Colorado	Wheat and oats.
W. H. Richards	Boston, Mass	China grass manufactured.
F. Hassler	Cape Vincent, N. Y	Bird skin.
Z. Moses	Marcellus, N. Y	Fullers' teasels.
Gen. Salgar	Colombia, S. A	Pita, fibre of Agave Americana.
M. Sartrado Roldan	Colombia, S. A	Palm cotton; palm wool; sandals from fibre of fig.
T. E. Wright	Cambridge, Md	Fibre.
Bachelder & Cotter	Elk Grove, Cal	Spanish merino wool.
Clay Crawford	East Cleveland, Ohio	Maple sirup.
J. M. Moore	Corpus Christi, Texas	Cottonized flax.
Hon. J. Bidwell	California	Box California raisins.
C. F. Loosey	Consul General in Austria	Silk and cocoons from Bohemia.
M. Stabler	Sandy Springs, Md	Oats.

METEOROLOGY OF 1865.

BY A. B. GROSH, DEPARTMENT OF AGRICULTURE.

[Compiled from the monthly reports of nearly two hundred and fifty observers in more than thirty States and Territories of the Union, made to the Smithsonian Institute through this department.]

The increased and increasing attention of agriculturists to meteorology, as connected with the science and art of tilling the soil, is one of the gratifying signs of our times, presaging a future of crops more carefully adapted to climate, circumstances controlled so as to render harvests more certain, cultivators better remunerated, markets more regularly supplied, and the aggregate resources of our country greatly and permanently increased. This, with the cordial reception given to essays in the annual reports of this department, in which meteorological principles and facts are applied to agriculture, requires that those interested should have information that will enable them better to understand and apply the statements made by those writers. The present volume contains similar articles, which, it is believed, will quicken and strengthen a desire to use these tables, and to acquire more information in relation to the climatic peculiarities of our widely spread country.

Nor is this all. Those who are led to acquire information will also become qualified to impart it. There are many subjects on which the common farmer—illiterate though he deem himself or be considered by others—may gather and communicate information valuable to scientific men as well as to his fellow-farmers. The general expansive and upward activity of mind in agricultural circles indicates a dawn of important discoveries, to the unfolding of which things old as well as new may be greatly subservient. For instance and illustration, the Rev. George A. Leakin, of Baltimore, Maryland, has requested this department to call the attention of farmers to well-remembered seasons remarkable for droughts or rain, scanty or abundant harvests, &c., and to communicate such facts and dates to this department. To use his own words in the letter referred to—

"While engaged as hospital chaplain, United States army, I was led to suspect a greater prevalence of the periodic law than was generally recognized Indeed, convinced of its universality, my main design was its extension into a realm hitherto unexplored, viz., the mental and moral. In this investigation, I could not fail to discover that famines, droughts, and abundant harvests, apparently fortuitous, were reducible to a sure recurrence, and that when the same observations were applied to them as to life insurance, we might guard against harvest failures with equal advantage."

This is already done in Great Britain. At least the "Royal Farmers' Insurance Company," in London, advertises to "insure wheat, barley, oats, peas beans, rye, turnips, clover, &c., against loss by hail-storms, at moderate rates." Mr. Leakin continues—

"Did my limited observation present no fact, I could no more doubt the connexion of periodicity with the field of agriculture, than the existence of gravitation in some unexplored island; but I have it in my power to send you the following extract of an official report made to our State Superintendent of Education on the statistics of Montgomery county, Maryland:

"'The climate, though variable, is healthy, and the seasons favorable for agricultural purposes. Four remarkable droughts have occurred within the past century: the first in the summer of 1806, the second in the summer of 1822, the third in the summer of 1838, the fourth in the summer of 1854—an exact period of sixteen years interval. Whether the same phenomenon will occur in 1870, remains to be seen.'

"I have been further informed, by a gentleman of the highest official authority, that 'in parts of Illinois, every seven years is marked by drought.'

"Strikingly coincident with the above is the following: 'The Paris Constitutionnel gives a list of the famines and periods of scarcity in France during the last three centuries, from which it appears that in general one year of want has occurred for every six years of plenty. These statistics are true in the main of other countries besides France. In England, where the cultivation is more thorough, the periods of scarcity are less frequent. In Poland, the Ukraine and the Danubian provinces, where farming is the rudest, they occur more often.' *It is plainly owing to some law of nature, yet undiscovered, that these unfruitful seasons take place at comparatively regular periods.* They are probably the means of recuperating the soil. In this event the average production may be greater, notwithstanding the scarcity, than if there had been no bad crops. It is within the memory of all that the summer of 1854 witnessed an excessive drought. Shrewd agriculturists suggested, even then, that the parched condition of the ground would bring to the surface the salts which pervaded the lower soil, and of which the top had been exhausted by successive crops; and they foretold in consequence an enormous harvest for 1855. Whether the theory was correct or not, it is a fact that the result verified the prediction.' "

Now, Mr. Leakin, and the writers quoted by him, may or may not be correct—and the few instances given in proof are insufficient to establish their theory, and would prove a variable periodicity for different localities—yet the furnishing of the information requested, if it does no more, would refute the idea, and turn the minds now engaged in its support to some more profitable, because successful, labor. Even failure is often the precedent to great success. But if acts should be collected sufficient to unfold the existence of such a law for large sections of country, what an immense gain—what a valuable saving of time, labor, and crops—would result to the farmers and the nation.

But the above is given merely as an illustration, to show how valuable may be the most commonplace contributions of facts, such as can be made by any one who can write, to the interests of science. It needs only that the facts be well and truly remembered, with dates and attendant circumstances, and be plainly and fully stated with their details, and they become mighty to the building up or pulling down of the mere theories and speculations of the philosopher. The observant farmer has it, therefore, in his power to furnish the foundation stones and to build up the substructure of agricultural science in all its branches, as his skill and labor furnish the materials on which rest all the interests and prosperity, the wealth and resources of the community. And as he is to profit, finally, by the labors of men of science, as he profits by the manufactures and commerce of the nation, it is his duty to do good in return, and communicate all aid in his power.

But to return to our tables. It is to be deplored that many important sections of States, and even whole States and Territories, have no reporting observers, and that even many of the reports regularly made do not furnish more details. But it is hoped that in time individuals may arise in all these places, who will willingly labor to gather and report facts to the Smithsonian Institution, from whose stores thus accumulated through long years, science may gather materials with which to build up systems that will bless mankind.

We have omitted the tables of averages this year. Those for several previous years have been frequently given in the annual and monthly reports of the department. Those for 1865 can readily be ascertained by adding the mean temperatures and rain-fall of a State or Territory, and dividing the total by the number of stations to which they belong. We have also condensed the tables by giving the observations of two months in each table; though this reluctantly compelled us to omit the names of the highly esteemed observers who furnished the information. Their names, however, are given in previous years and in many of the monthly reports. In some cases where two reports are furnished from the same locality, we have given that only which gave the fullest details.

The department respectfully solicits information of any errors or omissions in this or former reports, that they may be corrected before any further use of these tables.

All the observations, with slight or occasional exceptions, were made daily, at the hours of 7 a. m. and 2 and 9 p. m.; and the same hours are recommended to all for the sake of uniformity.

METEOROLOGY OF 1865.

Places in States and Territories.	JANUARY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	FEBRUARY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
MAINE.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Steuben	9	36	17	—12	16.1	4.44	23, 26	40	12	— 7	23.4	3.78
Lee	10, 13	34	20	—20	13.5	4.05	23	45	12	—20	22.7	1.95
West Waterville	13	35	28	—13	14.7	4.90	26	46	12	—12	22.1	2.40
Gardiner	6, 10, 14	34	17	—22	15.3	3.10	23, 26	43	12	—14	22.7	2.85
Lisbon	14	35	17	—20	14.7	2.68	26	44	3	— 9	22.2	2.29
Cornish	7	39	17	— 6	15.6	3.93	23	45	12	— 4	22.3	......
Cornishville	7	50	16	— 8	16.6	3.72	23	43	12	— 1	23.0	3.10
NEW HAMPSHIRE.												
Stratford	6, 14	30	8	—18	10.7	3.00	23	42	13	—20	17.0	2.32
Shelburne	13	37	17	—18	16.8	2.42	23	48	12	— 6	23.5	......
Barnstead	6	38	28	— 2	19.5	2.70	21	49	12	1	26.1	2.55
Claremont	6	38	28	—16	16.3	......	23	48	14	—10	22.1	......
Do	13	39	28	—12	16.5	2.95	23	50	14	—11	22.6	2.15
VERMONT.												
Lunenburg	6, 10, 23	32	17	—25	14.8	3.35	26	65	13	—20	19.0	1.75
Craftsbury	14	32	8, 16, 18	—12	11.3	2.65	23	40	13	—12	17.4	1.80
Middlebury	13	36	18	—16	14.9	2.15	26	44	11, 13	— 8	19.9	1.58
MASSACHUSETTS.												
Sandwich	7	50	28	3	23.6	6.60	26	51	3	9	28.9	3.69
Topsfield	6	44	28	9	25.8	3.82	26	52	12	13	31.5	4.05
Newbury	6	44	28	— 3	19.9	......	23	51	12	3	26.9	......
New Bedford	7	48	29	4	23.3	5.18	26	47	13	6	29.5	3.79
Worcester	6, 31	40	8, 29	4	21.2	3.92	26	48	13	2	......	......
Mendon	31	40	29	0	19.2	......	26	48	12, 13	3	26.1	......
Baldwinsville	6, 14, 31	35	8, 28	— 7	13.7	4.02	23	43	......	—13	......	......
Amherst	......	......	......	......	......	......	23	45	14	— 1	25.0	2.88
Springfield	6, 31	39	19	— 9	19.5	3.23	26	48	12	0	26.3	2.47
Westfield	6, 14	36	19, 29	— 5	18.6	3.28	26	46	3, 13, 15	1	25.3	3.30
Richmond	6, 10	40	28	— 4	17.7	5.45	23	56	13	— 6	24.4	3.17
William's College	6	37	18	— 5	17.3	......	26	45	14	— 6	23.7	1.04
CONNECTICUT.												
Pomfret	6	38	8	2	19.2	3.55	26	45	13	— 1	25.5	5.00
Columbia	30	44	19	0	23.7		21	56	13	0	28.9	......
Middletown	13	42	19	— 4	21.7	4.16	......	......	......	......	......	......
Colebrook	6	38	19, 28	— 5	15.9	......	26	47	13	— 9	21.9	......
NEW YORK.												
Moriches	10	52	19	— 9	26.3	6.07	27	51	13	4	32.1	6.76
South Hartford	6, 23	39	18	—13	17.1	2.60	......	......	......	......	......	......
Fishkill Landing	14	41	21	— 1	18.5	2.82	23	51	13, 14	— 2	28.5	2.81
Garrison's	14	35	8, 20	2	19.0	2.46	17	41	13	— 3	24.5	2.68
Deaf and Dumb Inst	31	45	28	6	26.6	3.41	26	50	13	9	32.9	4.06
Columbia College	10	45	8, 28	7	22.8	......	26	44	13	5	29.1	4.58
St. Xavier's College	10	46	8, 28	8	24.6	......	26	50	13	4	30.3	......
Flatbush	10	46	19	4	22.9	3.36	26	47	13	5	29.3	3.72
Newburgh	14	40	18, 20, 21, 25, 26, 27, 28	10	23.9	......	23	50	......	......	......	......
Gouverneur	6	37	18	—28	13.3	1.48	26	45	13	—29	16.3	1.57
Clinton	13, 23	40	8	—10	20.9	2.42	26	49	13	—16	25.3	4.65
South Trenton	......	......	19, 26	—22	......	5.70	......	......	......	......	......	......
Oneida	6	40	8	— 4	20.7	3.80	26	54	13	—28	23.9	3.36
Cazenovia	13	34	8	—16	16.0	5.70	26	46	13	—27	20.2	5.03
Theresa	6	36	18	—31	12.8	1.13	26	44	13	—31	15.2	1.29
Depauville	10	36	18	—14	16.3	3.60	......	......	......	......	......	......
Oswego	6, 13	36	8	— 4	20.1	3.95	26	45	13	—11	22.2	3.61
Palermo	6	36	8	—14	15.1	3.40	26	45	13	—22	20.0	2.30
Baldwinsville	6, 22	35	8	— 4	18.3	1.80	26	43	13	—11	21.9	......
Skaneateles	22	34	8	— 7	17.2	......	23	44	13	—14	23.8	......
Auburn	6	36	28	2	18.4	......	23	42	13	—16	22.9	4.90
Nichols	13	40	27	— 9	17.3	......	26	52	14	—16	23.3	......
Palmyra	22	42	8, 16	8	24.7	......	22	47	14, 15	6	28.5	......
Geneva	13	39	28	4	20.3	2.54	26	45	13	0	23.9	2.48
Rochester Univ	22	43	8, 18	4	20.6	2.83	22	50	14	— 2	24.3	......

Meteorology of 1865—Continued.

Places in States and Territories.	JANUARY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	FEBRUARY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
NEW YORK—Con'd.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Rochester	22	42	8, 18	4	21.1	2.83	24	50	14	—2	26.8	1.74
Buffalo	22	37	18	—6	20.4	4.31	22	46	13	—11	20.4	2.23
Jamestown	9	41	20	—9	17.2	......	21	53	12	—22	24.1	......
NEW JERSEY.												
Paterson	13	43	19	—11	22.3	4.89	26	49	13	0	29.3	4.60
Newark	10	44	19	3	23.2	4.09	26	49	13	1	29.4	4.57
New Brunswick	6	44	19	—4	22.3	......	26	52	13, 14	3	28.6	......
Burlington	10	57	19, 28	4	24.3	4.15	26	56	13	—2	30.9	3.80
Progress	13	40	19	4	23.0	4.05	26	49	13	2	29.1	4.90
Mount Holly	10	54	19	0	25.4	......	26	56	13	3	31.6	......
Moorestown	10	54	28	6	24.8	......	......	......	......	......	......	......
Haddonfield	10	55	19	—1	25.8	3.60	26	55	13	3	31.2	4.33
Greenwich	10	52	5	7	26.4	3.81	26	57	13	2	32.2	4.62
PENNSYLVANIA.												
Fallsington	10	52	5, 19, 28	6	25.0	3.10	26	51	13	2	30.7	4.80
Philadelphia	10	51	28	7	26.5	3.60	26	54	13	4	32.4	5.49
Germantown	31	44	28	2	......	......	17	50	13	1	......	......
Mooreland	10	48	19	2	29.2	3.05	26	50	13	0	29.5	......
Dyberry	10	39	18, 19	—10	13.9	......	26	51	14	—20	21.9	......
Nazareth	13	42	28	1	21.6	......	23	49	......	......	......	......
North Whitehall	22, 31	40	19	—6	22.0	......	26	46	13	3	28.1	......
Silver Spring	13	45	26	3	23.3	......	23, 26	49	13	—6	28.3	......
Mount Joy	13	46	28	4	24.9	3.15	26	53	14	—5	29.9	2.10
Harrisburg	13	39	28	9	25.0	4.15	27	44	14	1	29.5	3.51
Lewisburg	23	38	20	—9	19.4	4.73	23	45	14	—24	23.4	3.38
Tioga	6	48	18	—14	19.3	2.36	26	55	14	—18	25.0	1.96
Gettysburg	13	43	28	2	21.0	4.24	27	47	14	—11	27.9	3.06
Pennsville	5, 6	41	19	—7	18.5	3.24	23	45	13	—17	25.0	3.53
Connellsville	22	49	8, 19	—8	20.9	......	21	48	13	—16	28.6	......
Canonsburg	9, 23	39	19	—8	......	......	21	46	13	—13	28.2	1.38
DELAWARE.												
Wilmington	10	53	28	5	26.9	6.80	26	56	13	0	31.1	8.00
MARYLAND.												
Woodlawn	......	......	......	......	......	......	26	48	13	0	......	5.53
Annapolis	10	47	28	8	29.4	4.68	26	60	13	5	31.5	5.14
St. Inigoes	10	58	28	12	32.1	3.40	26	60	13	10	37.2	2.88
Sykesville	13	43	5, 8	5	22.1	3.50	26	50	13	2	27.6	3.50
SOUTH CAROLINA.												
Beaufort	23	66	1	19	42.4	4.76	27	72	10, 13	24	48.3	3.36
Hilton Head	21	68	27	24	44.5	3.63	4, 5	66	10	27	49.7	2.13
TEXAS.												
Austin	5	73	24	20	45.0	3.12	16	80	8	32	53.8	6.00
MISSISSIPPI.												
Natchez	3, 5	68	24, 25	20	44.7	8.05	3, 17	75	10	20	52.3	12.70
TENNESSEE.												
Clarksville	5	53	27	8	31.4	2.38	20, 21	63	9, 13	22	41.6	3.97
KENTUCKY.												
Louisville	5	47	28	—6	25.8	3.41	21	64	13	16	38.4	3.54
Chilesburg	22	50	28	0	......	3.65	21	64	13	12	36.8	3.30
Danville	21	57	1, 28	1	29.2	4.12	21	64	13	15	39.4	3.91
OHIO.												
Saybrook	22	40	18, 20	—1	19.6	......	22	47	13	—15	24.7	......
Austinburg	6	46	20	—1	18.5	......	22	45	13	—26	21.0	1.60

Meteorology of 1865—Continued.

Places in States and Territories.	JANUARY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	FEBRUARY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
OHIO—Continued.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
New Lisbon	6	42	8, 19	—12	19.7	3.59	26	48	13	—20	28.3	1.48
East Fairfield	22	39	19	— 5	20.2	2.88	......	......	......	......	......	......
Steubenville	......	42	......	0	23.3	1.73	......	......	......	......	......	......
Welshfield	22	41	18, 25, 27	1	20.2	3.57	22	48	13	— 6	26.8	2.30
Milnersville	5	48	20	—14	19.7	2.63	25	50	13	—10	28.0	0.75
Cleveland	5	43	19	3	23.2	1.77	22	50	13	— 5	29.1	1.46
Wooster	5	42	19	—10	20.1	......	21	50	13	—10	28.4	......
Smithville	5	48	18, 19	—10	20.5	......	21	46	13	—10	28.3	......
Kelley's Island	9, 13	42	25, 26	3	23.2	1.27	22	46	13	— 8	28.7	1.53
Norwalk	5	45	19	— 2	21.7	1.17	21	54	13	— 6	29.0	1.40
Westerville	5	42	18, 25	— 3	18.2	1.80	25	54	13	— 3	29.0	1.30
Kingston	5, 22	43	30	1	23.2	3.51	21	55	13	6	33.3	1.52
Portsmouth	5	44	28	8	26.3	3.70	26	53	13	12	35.7	2.42
Toledo	......	......	......	......	......	......	22	50	13	4	29.1	1.69
Marion	......	......	......	......	......	......	22	48	13	— 4	......	......
Urbana University	22	42	1, 18	— 5	20.0	1.55	25	50	13	2	30.1	1.97
Hillsborough	5	44	25	— 2	23.6	3.19	22	49	13	7	31.4	2.36
Ripley	5	49	......	......	......	4.27	21	61	13	14	34.1	4.51
Bethel	5	43	25	— 1	21.4	1.29	21, 22	52	13	8	31.2	2.58
Farmers' College	22, 31	40	28	0	22.5	4.13	21, 25	56	13	8	33.0	3.78
College Hill	5	43	25, 28	0	22.1	3.70	20	50	13	10	33.6	3.13
Cincinnati	5	45	28	3	24.7	2.45	21, 25	57	13	12	35.2	2.43
MICHIGAN.												
Pontiac	5	41	20	0	21.1	......	22	48	13	— 9	26.2	......
Monroe	5	44	11	0	23.7	......	22	54	12	3	29.7	0.26
State Agr. College	5	39	27	1	21.1	0.65	21	44	13	— 1	26.8	1.76
INDIANA.												
Vevay	5	45	28	— 4	26.3	......	21	63	13	14	37.5	......
Pennville	13, 30	48	1	—11	20.1	......	21	58	12, 13	8	30.6	......
Spiceland	......	......	......	......	......	......	21, 22	53	9	15	32.5	2.40
Madison	13	41	28	— 4	26.3	4.25	21	62	13	20	39.3	5.50
New Albany	5	48	27, 28	2	25.4	2.80	26	64	13	17	39.1	1.50
South Bend	21	44	26	— 5	21.0	1.95	21	51	12	9	30.8	2.05
Indianapolis	31	45	18	— 4	22.2	1.72	21	59	12	18	34.7	2.94
Rensselaer	21	46	26	— 4	21.0	1.05	21	56	9	11	31.0	3.28
Bloomingdale	29	48	28	— 2	33.4	......	21	64	9	14	34.8	......
New Harmony	31	48	28	6	28.4	2.10	21, 25	65	13	20	38.4	2.82
ILLINOIS.												
Chicago	21	44	26	— 8	18.5	......	21	46	9	8	24.7	......
Riley	9, 20, 21	40	18	—15	17.8	0.60	21	48	12	5	28.4	5.39
Sandwich	9	51	25, 26	— 8	20.6	0.25	21	56	12	11	32.7	3.50
Ottawa	30	44	25	— 8	21.6	0.45	21	54	12	12	29.3	3.99
Winnebago	20	38	18	—18	17.4	0.27	21	46	12	5	28.3	3.25
Wyanet	12, 20	44	18	—11	20.2	0.30	21	54	12	8	30.8	3.40
Tiskilwa	20	42	25, 27, 28	0	22.5	......	21	53	9	13	31.9	......
Elmira	12	47	26	— 8	21.4	0.31	......	......	......	......	......	......
Hennepin	12, 20	42	19	—10	23.0	......	3	48	12	8	29.0	......
Peoria	20	48	26	— 2	24.2	0.22	21	56	9, 12	14	34.6	4.01
Pekin	......	......	......	......	......	......	21	57	9	10	33.0	4.82
Springfield	12	50	26	— 2	27.0	......	21	62	9	15	36.8	......
Waverly	20	45	26	— 5	23.7	0.20	20, 21, 25	53	9	8	32.8	5.85
Galesburg	20	41	25, 26	— 7	21.0	0.30	21	46	12	10	30.5	2.72
Manchester	20	51	26	— 3	25.1	0.25	21	60	9	14	35.9	5.23
Augusta	20	48	26	— 7	22.1	0.15	20	49	9	11	31.7	2.82
WISCONSIN.												
Manitowoc	21	41	18, 25, 26	— 4	20.6	0.27	21	43	12	4	28.4	2.05
Milwaukee	21	43	25	— 7	19.4	0.22	21	42	12	5	27.7	3.58
Green Bay	5, 20	37	18	—11	15.3	0.61	21	42	12	3	25.1	1.93
Geneva	21	40	25	—10	17.5	0.30	3	42	12	4	27.0	......
Delaware	20, 21	38	18	—13	16.6	0.17	21	49	12	4	27.1	2.33
Waupacca	21	40	18	—13	16.6	0.50	......	......	......	......	......	......
Embarrass	31	38	18	—22	15.5	1.00	1	40	12	— 5	25.3	......
Baraboo	20	42	18	—10	20.3	0.48	3, 18, 20, 21	42	12	6	29.1	......
Beloit	......	......	......	......	......	......	21	47	12	4	27.3	1.17

Meteorology of 1865—Continued.

Places in States and Territories.	JANUARY.						FEBRUARY.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
MINNESOTA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Beaver Bay	......	......	......	......	......	......	21	39	5	—11	21. 3	1. 20
St. Paul	12	38	24	—17	13. 7	0. 66	21	44	5	— 3	24. 4	1. 85
Minneapolis	12	42	18	—21	13. 0	0. 75	21	43	19	— 7	23. 4	......
New Ulm	4	41	18	—18	13. 3	0. 40	21	43	5	— 6	22. 0	1. 64
IOWA.												
Lyons	20	40	18, 25	—10	18. 3	0. 50	3, 16, 21	42	9, 12	10	29. 2	8. 50
Dubuque	12, 14	39	18	—16	15. 3	0. 24	21	45	12	8	28. 6	2. 19
Muscatine	20	44	18	—10	18. 9	0. 46	21	48	12	9	29. 7	2. 90
Fort Madison	......	......	......	......	......	......	20, 21	47	9, 12	11	31. 5	3. 62
Monticello	20	43	18	—13	14. 1	0. 29	3	42	12	3	26. 0	2. 28
Guttenberg	12, 20	36	18	— 8	16. 7	0. 09	......	......	......	......	......	......
Mount Vernon	......	......	......	......	......	......	21	43	5	6	28. 1	......
Iowa City	12	46	25	—10	20. 5	0. 30	21	48	5, 9	10	31. 5	3. 15
Independence	12	43	18, 26	— 7	17. 9	0. 25	21	42	9	2	23. 0	7. 00
Waterloo	12	46	23	—14	24. 4	......	16	46	19	4	27. 3	......
Iowa Falls	12, 20	40	18	— 4	16. 9	0. 16	21	45	19	4	25. 2	6. 27
Algona	12	43	24, 26	—14	15. 3	0. 60	21	46	5	— 1	22. 9	6. 25
MISSOURI.												
St. Louis University	......	......	......	......	......	......	21	61	9	19	38. 4	3. 33
Allenton	20	53	11	— 7	25. 4	0. 65	20	62	9	7	35. 1	4. 27
Athens	......	......	......	......	......	......	1	65	10	16	37. 3	5. 98
Canton	20	53	26	— 6	21. 9	0. 14	21	56	9	9	32. 2	3. 16
Harrisonville	12	48	26	— 6	25. 5	0. 45	20	60	8, 9	16	34. 0	3. 20
Easton	12	48	26	—10	22. 8	0. 13	......	......	......	......	......	......
KANSAS.												
Olatha	12	52	26	— 6	21. 6	0. 53	20	62	9	8	32. 2	5. 49
Agricultural College	4, 19, 31	49	23	— 5	27. 5	0. 33	20	58	26	13	35. 2	2. 21
Fort Riley	12, 19	55	26, 28	— 1	29. 7	......	11	60	26	18	40. 0	1. 55
NEBRASKA.												
Elkhorn	14	47	26	—12	21. 2	......	2	45	5, 7	12	28. 6	......
Bellevue	19	50	26	— 9	23. 2	0. 13	2	47	7	14	30. 7	4. 00
Nursery Hill	12	50	26	— 8	22. 4	0. 30	2, 20	48	5	10	29. 3	7. 75
UTAH.												
Great Salt Lake City	2	45	25	— 2	24. 0	1. 22	......	......	......	......	......	......
St. George	30	65	23	14	42. 0	2. 40	17	63	22	19	39. 5	0. 83
WASHINGTON.												
Neeah Bay	......	......	......	......	......	......	10	48	28	24	37. 0	9. 30
CALIFORNIA.												
San Francisco	27	60	22	32	48. 7	4. 40	10	59	21	35	48. 2	0. 99
Sacramento	......	......	......	......	......	......	11	57	4	38	49. 1	0. 53
Meadow Valley	15	66	22	10	34. 0	11. 10	11	52	3, 22, 26	11	31. 6	4. 45

	MARCH.						APRIL.					
MAINE.												
Steuben	20	50	7	4	33. 3	4. 97	27	61	17	29	41. 1	5. 40
Lee	16	50	6	0	31. 7	6. 00	27	66	17	21	40. 4	4. 50
West Waterville	29	51	7	4	33. 5	4. 50	27	73	9	30	44. 5	4. 40
Gardiner	20	52	7	10	34. 8	5. 39	27	70	26	31	44. 9	4. 43
Lisbon	......	......	6, 7	8	......	5. 08	......	......	......	......	......	......
Cornish	29	53	6, 12	10	33. 1	5. 18	27	73	4	28	44. 4	3. 50
Cornishville	29	50	12	11	33. 1	4. 52	27	74	9	32	44. 9	4. 04
NEW HAMPSHIRE.												
Exeter	16	63	6	15	37. 8	......	28	75	......	......	......	......
Stratford	16	55	6	2	31. 5	4. 69	27	68	9	23	39. 7	3. 24

Meteorology of 1865—Continued.

Places in States and Territories.	MARCH. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	APRIL. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
N. HAMPSHIRE—C'd.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Shelburne	16	57	7	— 2	34.3	......	27	74	4	21	43.1	......
Barnstead	20, 30	56	12, 13	15	36.2	4.78	27, 28	72	21	33	47.6	2.61
Claremont	21	59	6	10	35.5	......	27	74	4	26	45.9	......
Do	29	59	6	10	36.0	3.35	27	76	4	26	47.6	5.55
VERMONT.												
Lunenburg	21, 22	78	12	0	49.9	5.98	27, 28	70	2, 9	20	41.0	3.25
Craftsbury	30	53	12	0	30.2	3.13	26, 27	66	9	25	39.4	2.25
Middlebury	21	66	12	8	36.1	3.95	27	72	9	28	46.7	2.36
MASSACHUSETTS.												
Sandwich	21	63	12	18	40.4	4.95	19, 26, 29	67	4	30	49.2	2.03
Topsfield	16	60	12	23	40.9	4.20	28	75	4	37	50.2	2.00
Georgetown	20	61	12	15	36.9	......	28	79	4	34	48.4	......
Newbury	16	62	12	14	37.8	......	28	80	4	35	49.2	......
New Bedford	21	61	12	19	39.8	4.70	19	67	9	36	49.6	3.09
State Lunatic Hosp'l	21	67	6, 12	18	39.2	4.72	27	79	4	32	50.3	2.51
Mendon	21	68	6	16	39.2	......	27	79	24	33	50.2	3.25
Baldwinsville	21	60	12	10	32.5	3.62	28	74	9	28	45.6	3.75
Amherst	20	57	6	13	37.1	5.98	27	80	4, 9	33	49.0	2.90
Springfield	21	72	6	14	38.0	5.07	27	85	9	27	48.4	2.72
Westfield	21	63	6	14	38.4	6.29	27	78	21	34	48.9	2.90
Richmond	21	72	12	10	37.0	7.79	28	76	2	27	46.8	4.35
Williams' College	21	69	12	11	36.7	5.29	......	......	......	......	......	......
CONNECTICUT.												
Pomfret	21	69	6, 12	16	35.4	5.25	27	77	9	31	48.6	2.88
Columbia	21	76	6, 12	20	41.5	......	27	80	3	33	51.5	......
Middletown	21	76	6	17	41.0	4.75	27	84	9	35	51.8	3.41
Colebrook	21	72	6	9	36.3	......	28	76	9	28	46.5	......
NEW YORK.												
Moriches	8	68	11	22	44.6	7.31	19	73	3	37	53.1	4.75
South Hartford	16, 20, 22	60	6	12	39.0	6.08	27	76	16	34	51.1	2.70
Fort Ann	17	67	2	10	43.9	4.17	27	82	23	39	54.9	4.70
Fishkill Landing	21	71	6	14	40.4	4.56	27, 28	78	3, 9	34	51.2	2.37
Garrison's	21	69	6	15	40.3	6.40	27	77	3	33	52.0	3.00
Deaf and Dumb Inst	21	71	11	22	45.6	8.32	28	81	17	40	54.5	4.14
Columbia College	21	67	11	21	41.6	3.81	27	78	9	36	52.1	2.97
St. Xavier's College	21	71	11	20	43.3	......	27	79	9	36	51.3	3.77
Flatbush	21	64	11	19	42.4	3.97	27	75	3	36	50.8	4.24
Newburgh	21	73	10	20	43.1	1.90	28	79	8	37	51.1	2.20
Gouverneur	21	74	12	— 5	34.0	2.84	26	70	9, 24	27	44.8	3.13
Clinton	16	72	12	9	40.1	2.32	......	......	......	......	......	......
South Trenton	16	54	12	8	32.5	6.35	28, 29	56	2, 8, 9, 22	28	40.1	7.20
Cazenovia	21	82	12	4	37.7	2.96	26	73	9	28	47.0	4.23
Oneida	21	71	12	10	35.5	2.82	26	74	9	30	48.6	6.26
Sherburne	21	75	12	6	36.6	......	27	80	8, 9, 17	28	47.5	......
Theresa	21	70	12	— 6	33.9	3.66	26	72	9	29	45.2	3.73
Depauville	......	......	......	......	......	......	6	66	9	27	46.2	......
Oswego	21	72	12	6	36.0	4.86	26	73	9	29	45.1	3.58
Palermo	21	68	12	4	33.5	4.70	26	75	9	27	45.2	2.70
Baldwinsville	16	63	12	5	35.4	......	26	68	9	28	45.6	......
Skaneateles	21	68	12	4	35.5	......	26	72	2, 3, 16	30	45.9	......
Auburn	21	76	12	8	36.6	......	26	80	3	32	52.1	......
Nichols	21	76	10, 11, 12	10	39.9	......	26, 27	79	9	30	38.7	......
Palmyra	21	75	12	14	40.7	......	26	76	9	32	49.9	......
Geneva	21	73	12	10	37.6	2.05	6, 26	68	8	30	47.4	2.66
Rochester Univer'y	21	75	12	6	36.8	3.17	26	74	8, 9	30	47.9	3.03
Do	21	73	12	8	35.8	3.17	26	78	8, 9, 17	32	48.4	3.03
Warsaw	22	77	12	3	39.4	2.47	26	75	2	30	46.3	2.54
Buffalo	21	72	12	6	36.1	4.96	28	67	8	28	44.6	4.00
Jamestown	20	78	5	0	38.1	3.80	26	76	17	27	48.0	4.30
NEW JERSEY.												
Paterson	21	72	6, 11	19	42.8	7.36	27	79	3	37	53.4	3.89
Newark	21	74	6	20	43.2	4.89	27	79	9	35	53.0	3.34
New Brunswick	21	74	7	25	43.7	......	......	......	......	......	......	......

Meteorology of 1865—Continued.

Places in States and Territories.	MARCH.						APRIL.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
NEW JERSEY—Continued.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Burlington	16, 21	72	6, 11	22	41.2	4.40	27, 28	76	9	36	52.7	3.15
Progress	16	76	11	22	45.0	3.42	......	......	......	......	......	......
Moorestown	......	......	......	......	......	......	25	79	9	38	55.1	2.72
Mount Holly	21	74	11	23	46.2	......	28	78	9	37	54.8	......
Seaville	21	70	10	20	45.3	5.20	27	78	2	36	54.7	4.30
Haddonfield	21	75	11	24	46.2	4.17	27, 28	76	3, 9	39	54.4	2.80
Greenwich	21	72	11	24	46.0	4.31	27	76	9	40	55.2	2.86
PENNSYLVANIA.												
Fallsington	16	74	6, 11	24	45.7	4.60	28	77	9	39	54.0	1.40
Philadelphia	21	76	11	25	46.9	4.88	27, 28	78	9	40	55.9	2.83
Germantown	21	76	11	20	......	......	27	81	2	37	......	......
Mooreland	21	73	11	22	44.6	4.99	26	76	18	30	53.1	2.11
Dyberry	21	72	6	1	34.9	......	28	75	3	22	44.6	......
Nazareth	28	78	12	22	43.5	......	26, 27	80	10, 23	37	53.2	......
North Whitehall	21	70	6	16	43.1	......	26, 27	80	3	31	52.7	......
Mount Joy	......	......	......	......	......	......	28	83	17	42	57.5	1.15
Harrisburg	21	72	6, 11	25	45.2	5.78	27	81	9	40	55.7	2.24
Lewisburg	20	74	6	15	41.2	6.47	27	80	23	34	52.1	2.36
Tioga	21	74	6	5	40.2	5.30	27	82	9	26	50.7	2.23
Fleming	......	......	......	......	......	......	28	79	14	25	52.5	2.95
Pennsville	21	78	11	7	38.6	6.24	6	74	17	28	47.1	3.42
Connellsville	20	74	10	8	44.8	......	21	80	1	30	53.6	......
Canonsburg	20	71	10	20	42.8	5.10	21	77	2, 17	28	51.3	2.20
DELAWARE.												
Wilmington	21	74	11	21	47.1	7.70	27, 28	78	9, 17	38	55.2	2.40
MARYLAND.												
Woodlawn	21	70	11	20	46.0	6.10	27	74	10, 23	40	55.5	2.88
Annapolis	16	66	11	23	47.3	6.58	27	76	17	40	56.8	2.98
St. Inigoes	21	71	11	30	48.7	......	22, 26	76	23	45	59.4	3.48
Sykesville	20, 21	73	11	15	43.4	6.50	26, 27	76	6, 10	40	53.4	3.25
WEST VIRGINIA.												
Ashland	......	......	10	20	......	......	......	......	14	36	......	......
SOUTH CAROLINA.												
Beaufort	3, 23	78	11	40	58.2	7.11	......	......	......	......	......	......
Hilton Head	22	77	17	45	58.1	6.83	18, 20, 30	83	1	54	69.1	1.10
TEXAS.												
Austin	20	80	9	26	59.4	6.51	3, 17, 30	83	21, 22	50	66.5	2.42
MISSISSIPPI.												
Natchez	2, 7, 18	76	10	22	57.3	8.40	18, 19, 20, 29	80	25	43	64.3	8.61
TENNESSEE.												
Clarksville	19	75	10	16	50.9	7.98	20	80	9, 23	42	58.7	11.33
KENTUCKY.												
Louisville	15	77	10	15	49.5	7.86	4, 26, 27	77	8, 23	34	56.6	8.84
Chilesburg	15, 20	72	10	16	......	5.88	20	80	8	34	56.8	6.52
Danville	15, 20	78	10	26	50.8	6.00	20	84	22	40	58.9	5.02
OHIO.												
Saybrook	20	71	5, 10, 12	9	38.2	......	6, 21	75	16	25	48.1	......
Austinburg	20	73	5	6	37.9	3.15	21, 26, 27	75	2, 7, 8, 9	32	44.7	3.25
New Lisbon	14, 20, 28, 29	70	10	8	41.4	5.44	20	82	17	30	52.5	3.72
East Fairfield	20	71	10	11	41.8	5.56	......	......	......	......	......	......
Welshfield	20	70	10	8	39.6	5.36	27	77	8	29	49.3	3.97

Meteorology of 1865—Continued.

Places in States and Territories.	MARCH. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	APRIL. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
OHIO—Continued.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Milnersville	20	75	10	10	43.0	4.38	21	82	17	27	......	2.88
Cleveland	20	74	10	13	41.6	2.62	26	79	8	27	50.3	2.84
Wooster	20	72	10	8	41.2	......	21	77	8	33	51.9	......
Gallipolis	......	......	......	......	......	......	21	81	2, 8, 17, 23	38	56.2	2.33
Kelley's Island	20	63	10	10	38.9	2.04	21	69	8	31	48.6	2.65
Norwalk	20	72	10	10	42.1	2.15	26	78	8	29	50.5	2.61
Westerville	20	70	10	18	45.2	3.73	26	74	7	33	54.0	3.77
Kingston	20	75	10	17	47.4	4.00	20	80	8	34	55.3	2.33
Portsmouth	20	73	10	19	47.0	6.15	21	77	23	38	58.1	2.45
Toledo	20	72	10	8	40.2	1.75	20	72	8	29	49.4	3.13
Marion	20	70	10	9	42.1	......	20, 27	76	8	30	51.8	......
Urbana University	20	72	10	9	43.4	4.68	27	78	8	30	53.1	6.92
Hillsborough	20	70	10	12	44.0	4.87	20	75	8	31	51.4	4.14
Ripley	15, 20	75	10	18	49.1	7.32	19	84	8, 23	37	57.8	8.27
Bethel	15	74	10	16	40.6	4.01	19, 20, 21	80	8	32	52.2	4.70
Cincinnati	15	75	10	15	47.3	4.40	20	81	23	34	56.4	3.89
Farmers' College	15	74	10	10	45.2	6.25	20, 27	76	8	32	54.5	6.35
College Hill	15	75	10	11	44.9	5.13	20	80	8	30	53.7	4.75
MICHIGAN.												
Pontiac	20	70	10, 12	10	36.3	......	21, 25, 26	70	8	26	47.3	......
Monroe	20	68	10	15	38.8	3.13	26	75	8	30	49.3	0.79
State Agr. College	20	68	10	9	37.0	2.79	20	71	8	26	47.4	2.32
Homestead	27	58	12	— 1	......	3.66	25	73	8	19	41.7	......
INDIANA.												
Vevay	20	78	10	16	48.8	4.82	19	82	8	34	56.4	5.73
Pennville	21	68	10	5	44.4	......	19	83	8	24	55.0	......
Richmond	......	......	......	......	......	......	19	75	8	28	51.5	5.50
New Castle	20	74	10	4	42.0	6.33	......	......	......	......	......	......
Spiceland	20	73	10	7	43.8	6.20	19	79	8	26	52.5	3.60
Madison	15, 20	74	10	20	50.2	12.00	......	......	......	......	......	......
New Albany	18	94	10	14	46.3	3.15	19	80	23	37	57.3	6.23
South Bend	21	69	9	3	38.0	3.30	26	77	9	25	48.0	2.21
Indianapolis	20	74	10	8	43.6	......	19	80	8	25	52.4	......
Rensselaer	20	72	10	0	39.2	3.78	27	74	8	16	49.2	2.85
New Harmony	20	76	10	16	48.2	4.93	19	83	8	37	56.9	4.70
ILLINOIS.												
Chicago	20, 31	64	10	— 2	32.9	......	17, 24, 25	70	8	15	43.4	......
Riley	31	63	10	— 8	32.8	4.60	17	72	8	13	45.5	3.62
Sandwich	31	68	10	0	37.9	3.82	......	......	......	......	......	......
Ottawa	20	74	9	0	36.5	3.15	17	77	8	21	49.9	5.48
Winnebago	31	62	10	— 5	32.7	3.58	25	75	8	14	46.8	4.33
Wyanet	19	69	10	0	36.0	3.13	17, 25	74	8	15	49.0	5.97
Tiskilwa	19, 31	66	10	3	39.5	......	5, 25	70	8	18	49.4	......
Elmira	19	68	9	1	37.0	2.31	17	76	8	19	50.1	4.44
Hennepin	19	60	10	— 2	31.0	......	4, 25	60	8	2	35.3	......
Peoria	31	67	10	8	40.5	3.57	19	75	8	22	51.7	4.27
Pekin	20	71	10	7	40.1	3.74	19	80	8	22	50.8	5.88
Springfield	17, 20, 31	70	10	10	45.2	......	19	88	8	32	55.3	......
Waverly	19, 20	70	9, 10	10	41.3	5.55	19	81	8	27	51.3	3.40
Murrayville	19, 20	70	......	......	......	......	19, 26	80	8	24	51.4	4.92
Galesburg	19	67	10	3	35.1	3.52	17	74	8	20	48.0	4.65
Augusta	19	69	9	0	38.2	4.02	19	81	8	23	50.0	5.77
WISCONSIN.												
Manitowoc	30	56	10	— 1	31.1	3.12	14	68	8	18	42.5	2.53
Milwaukee	28, 31	58	10	1	31.8	3.19	5, 24, 25	71	8	16	44.1	2.57
Green Bay	20, 31	55	8	— 1	27.8	2.57	25	74	8	13	41.7	4.02
Geneva	20	60	10	— 5	32.5	......	......	......	......	......	......	......
Delavan	20	60	10	— 4	32.0	3.52	17	71	8	17	44.8	2.88
Waupacca	30	64	3	— 5	29.7	......	25	75	8	15	45.6	......
Embarrass	29, 30	48	3	— 2	27.5	......	25	76	8	16	41.5	......
Rocky Run	30	59	10	— 3	30.7	3.56	......	......	......	......	......	......
Baraboo	30	60	10	0	33.6	......	26	75	8	20	47.4	1.74
Beloit	31	58	10	— 4	32.1	1.62	25	73	8	19	46.4	1.45

Meteorology of 1865—Continued.

Places in States and Territories.	MARCH.						APRIL.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
MINNESOTA.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Beaver Bay	21, 22	48	11	−13	23.4	1.16	25	67	8	5	36.4	3.45
Afton	......	......	......	......	......	......	24	76	8	5	42.8	......
St. Paul	30	57	4	−26	24.9	2.10	24	77	8	8	44.2	4.29
Minneapolis	30	56	4	−27	24.3	......	24	77	7, 8	8	44.0	......
New Ulm	30	58	4	−18	23.6	2.45	24	79	8	10	43.8	3.50
IOWA.												
Lyons	19	64	9	− 9	33.2	7.50	4	78	8	22	48.2	7.50
Dubuque	20	61	10	− 2	32.0	3.33	25	75	8	13	47.4	3.92
Muscatine	19	64	9	− 4	33.7	2.76	4	75	8	15	44.1	6.00
Fort Madison	31	68	9	− 2	36.8	3.78	17	77	8	20	49.0	6.35
Monticello	30	60	9	− 8	29.1	3.50	25	79	8	17	45.5	5.44
Guttenberg	30	57	9	− 3	27.8	2.60	25	72	8	18	45.2	......
Mount Vernon	19	63	9	− 5	31.7	......	25	78	8	11	46.9	......
Iowa City	19	70	9	− 5	34.3	3.92	25	75	8	20	48.1	9.31
Independence	30	60	9	−11	28.3	6.10	25	77	8	11	45.8	4.70
Waterloo	19, 30	58	9	− 6	31.0	......	25	74	8	20	46.4	....
Iowa Falls	20, 22, 26, 31	52	4	−15	26.3	......	24	74	8	13	44.0	3.52
Algona	30	56	4	−14	24.6	1.50	24	74	8	12	41.8	2.03
MISSOURI.												
St. Louis University	17	71	9, 10	16	46.9	6.45	......	......	......	......	......	......
St. Louis	17	71	10	14	45.5	8.61	26	81	8	33	54.9	3.31
Allenton	19	73	10	8	43.5	8.87	26	85	8	30	53.7	3.89
Athens	19	80	9	− 1	38.0	......	2	70	6	30	47.7	6.25
Canton	19	75	9	− 2	37.2	......	19	83	8	26	51.0	8.88
Harrisonville	20	74	9	− 4	40.5	3.43	4, 18, 19	76	6, 8	26	52.3	7.43
KANSAS.												
Olatha	19	74	9	−16	38.3	3.65	......	......	......	......	......	......
Agricultural College	19	74	9	− 8	42.0	2.27	19	76	6, 23	27	54.7	2.03
Fort Riley	19	76	9	1	40.1	......	25	86	7, 8	30	52.9	1.13
NEBRASKA.												
Elkhorn	19	64	9	−15	30.0	......	24, 25	76	8	17	45.6	.....
Bellevue	20	64	9	−15	33.1	0.25	25	74	6	19	46.5	2.65
Nursery Hill	19	62	9	−14	31.3	3.86	25	84	6, 8	22	......	6.73
UTAH.												
Great Salt Lake City	24	62	9	6	37.7	2.38	28	76	6	20	42.5	2.43
St. George	23	78	3	24	49.1	0.01	30	96	6	29	57.4	0.52
CALIFORNIA.												
San Francisco	28	65	2	38	49.8	0.49	20	70	11	43	52.2	0.81
Sacramento	31	71	2, 3	35	54.6	0.48	30	80	5	43	57.4	1.37
Monterey	22	73	3	37	51.1	0.31	21	76	3, 6, 8, 18	44	53.1	0.36
Meadow Valley	......	......	......	......	......	......	24	79	5	23	48.1	0.75
ARIZONA.												
Fort Whipple	......	......	......	......	......	......	30	88	6	24	46.9	......
WASHINGTON.												
Neeah Bay	......	......	......	......	......	......	20	57	1, 4, 5	32	43.7	6.50

	MAY.						JUNE.					
MAINE.												
Steuben	17	76	3, 7	38	50.9	7.80	8	84	14	46	63.3	2.10
Lee	21	80	5	34	51.4	7.14	......	......	......	......	......	......
West Waterville	17	80	7	37	54.9	2.80	30	90	3, 6	52	67.8	1.35
Gardiner	17	85	6, 7	39	54.7	5.05	30	87	3, 6	50	65.8	2.68
Lisbon	......	......	......	......	......	6.07	30	91	......	......	......	1.45
Standish	17	91	6	38	56.1	5.71	4, 30	93	3, 6	54	65.7	2.30
Cornish	17	86	6	35	54.4	5.30	25	93	14	51	68.1	1.90
Cornishville	17	87	6, 7	36	55.5	5.80	30	88	6	51	69.1	2.25

Meteorology of 1865—Continued.

Places in States and Territories.	MAY.						JUNE.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
NEW HAMPSHIRE.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Shelburne	17	87	1	32	54.1	......	4, 30	90	3	35	77.8	......
Stratford	31	78	13	31	51.8	4.48	17, 18	88	3	43	64.8	3.23
Barnstead	17	87	5, 6	40	57.2	5.80	17	92	6	51	69.4	1.65
Claremont	17	88	13	34	56.1	6.20	17, 25	90	11	54	69.6	3.52
VERMONT.												
Lunenburg	15, 17, 31	75	5	32	48.1	6.25	19, 24, 25	92	7	32	67.3	2.75
Craftsbury	31	76	6, 13	34	50.8	3.70	18	84	3	50	63.7	3.52
Middlebury	17	79	2	36	55.1	4.19	17	84	3	51	69.1	1.85
Brandon	......	......	......	......	......	......	25	92	......	......	......	......
MASSACHUSETTS.												
Topsfield	17	88	6, 28	44	58.3	5.10	30	91	5	50	70.6	1.87
Georgetown	18	88	3, 6	41	56.2	......	30	91	5	50	69.3	......
Newbury	17	88	6	41	56.8	......	4, 17, 30	92	2	51	69.6	......
New Bedford	31	76	1, 3	46	57.7	6.17	30	83	1, 2, 5, 6	57	68.8	1.54
Worcester	17	85	1, 2, 13	45	58.0	5.43	30	85	15	56	70.5	1.72
Mendon	17	86	6	42	56.5	4.40	30	89	5	54	70.5	1.40
Baldwinsville	17	82	6	38	54.4	6.53	9, 17	85	2, 6, 15	52	67.5	2.50
Amherst	17	86	1, 6	43	57.1	7.89	4, 17	87	3	56	69.2	2.40
Springfield	17	95	13	36	56.7	8.39	18	95	9, 15	51	69.8	3.40
Westfield	17	87	13	40	56.3	8.32	17	87	3	53	69.1	2.82
Richmond	31	86	1	38	58.2	12.58	9, 17	92	11	55	72.7	5.40
Williams' College	......	......	......	......	......	......	24	88	3	49	68.6	2.93
CONNECTICUT.												
Pomfret	17	83	1, 6	42	......	2.12	30	85	6	54	......	4.31
Columbia	17	88	3	40	59.4	......	17	92	5	52	72.0	......
Middletown	17	90	13	44	59.7	6.85	3	92	6	57	72.2	2.41
Colebrook	17	83	2, 12	40	56.2	......	4, 25	86	6	55	69.3	......
NEW YORK.												
Moriches	31	82	12	47	61.1	5.97	23	90	2	60	72.9	2.28
South Hartford	17	90	12	36	58.9	7.53	18, 25	90	3	58	73.0	3.99
Troy	17	88	12	40	58.5	5.93	4	89	3	57	71.6	1.74
Fishkill Landing	17	85	1, 12	46	59.7	6.45	30	90	9, 10	60	69.9	3.78
Garrison's	17	86	12	41	56.7	7.11	4, 30	89	14, 15	59	70.0	6.54
Throg's Neck	17	81	1	47	59.0	......	18	90	6, 15	58	71.0	......
Deaf and Dumb Inst	17	87	12	46	63.1	5.56	3	94	15	62	77.1	10.42
Columbia College	17	84	12	46	59.7	3.97	30	92	6	58	72.7	2.97
Flatbush	17	82	2, 12	45	57.8	5.63	30	91	12, 15	58	72.2	3.58
Newburgh	17, 31	85	1, 12	46	......	7.00	30	90	6	61	......	4.10
Gouverneur	20	82	2	33	54.9	1.51	18	92	10	52	68.8	3.91
South Trenton	17	78	11	30	55.6	2.85	18	92	2, 14	50	70.2	5.40
Cazenovia	17	83	3, 12	38	56.3	3.99	24	90	13	51	69.0	3.61
Oneida	16	85	2, 12	38	57.3	5.40	25	90	2, 23, 27	56	69.2	5.58
Sherburne	17	83	4	31	55.2	......	28	88	27	48	65.4	......
Theresa	21	80	11, 12	40	55.9	3.03	18	90	10	51	67.4	4.04
Depauville	16	78	2	36	58.6	......	18, 19, 25, 29	86	11	55	68.2	......
Oswego	16	81	2, 12	39	56.8	2.60	29	86	13	53	66.0	5.95
Palermo	16	84	1, 2, 12	39	54.9	3.30	7	94	13	52	68.1	8.80
Baldwinsville	17	81	2, 3, 12	37	54.8	......	7, 17, 25	84	3, 28	54	67.4	......
Skaneateles	17	84	1, 11	35	55.1	......	25	89	13	52	68.4	......
Auburn	17	92	11	40	62.2	......	25	92	11	56	73.5	......
Nichols	31	88	11, 12	39	57.9	......	18	93	27	55	71.7	......
Palmyra	17	85	2, 12	41	57.1	......	25, 29	89	11	55	69.5	......
Geneva	16, 17	84	2, 11, 12	38	56.1	3.92	29	94	11	55	69.1	3.56
Rochester	17	86	12	39	57.1	3.30	25, 29	91	10, 11, 13, 27, 28	58	66.7	5.43
Rochester Univer'y.	17	86	12	38	56.1	3.30	6, 25	90	11	57	70.1	5.43
Buffalo	20	85	1, 11	38	56.0	3.38	6	94	10	55	70.0	2.78
Jamestown	16	86	1, 2, 12	36	57.4	4.30	6	92	12, 23	55	70.7	7.30
NEW JERSEY.												
Paterson	17	85	12	46	61.6	7.88	18, 30	94	12	59	74.1	7.11
Newark	17	83	2	42	59.3	5.73	18, 30	89	15	58	71.7	3.49
New Brunswick	17	85	1	40	60.4	......	39	97	6	60	67.3	......

Meteorology of 1865—Continued.

Places in States and Territories.	MAY.						JUNE.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
NEW JERSEY—Continued.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Mount Holly	17	85	2	41	61.7	......	30	89	6	59	73.5	......
Burlington	......	......	......	......	......	......	30	89	6, 7, 12, 15	60	72.1	4.50
Moorestown	......	......	......	......	......	......	5, 30	89	6	59	73.8	3.70
Seaville	......	......	......	......	......	......	30	92	12	59	74.3	1.80
Haddonfield	17	82	12	45	61.9	7.87	5	87	6	62	73.6	4.68
Greenwich	17	81	2	44	61.7	6.04	5, 30	86	6, 7, 12	63	73.8	1.82
PENNSYLVANIA.												
Nyces	17	92	4, 13	28	......	8.95	1, 4, 13, 22, 30	88	7	58	72.2	8.40
Fallsington	17	83	1, 12	45	62.0	6.00	5, 30	90	6, 15	61	73.3	3.70
Philadelphia	17	84	2, 12	46	63.4	7.69	30	93	6	64	77.3	4.82
Germantown	17	88	12	42	......	......	4, 8	94	6, 11	61	......	......
Mooreland	17	81	1	43	60.3	6.15	30	88	15	60	72.9	5.13
Dyberry	17	85	4	28	44.1	......	25	90	15	53	67.2	......
Nazareth	17	87	1	40	61.6	......	13, 18	92	15	57	73.7	......
North Whitehall	17	84	4	38	61.0	......	5, 30	90	24	57	72.7	......
Oxford	17	84	12	41	62.2	7.40	9, 30	88	11, 15	62	74.2	5.66
Silver Spring	17	88	1, 12	42	62.0	......	5	93	15	56	75.2	......
Mount Joy	17	88	1	47	66.2	4.75	4	100	1, 11	69	80.0	2.80
Harrisburg	17	87	12	45	63.7	8.57	4, 5, 24, 29	91	15, 28	67	79.1	2.12
Fleming	17	90	4	36	58.7	3.01	1	92	27	57	71.1	3.98
Lewisburg	17	88	12	41	59.5	5.48	4, 18	88	27	58	73.3	5.22
Tioga	17	92	3	32	58.8	4.82	17	98	28	50	71.8	7.64
Pennsville	17	88	2	34	57.1	4.53	5, 7	92	28	55	70.6	3.64
Connellsville	17	86	1	32	60.6	......	5	92	11	60	74.1	......
Canonsburg	16, 17	82	2	30	58.7	4.68	7	88	27	56	71.6	6.65
DELAWARE.												
Wilmington	17	85	2	42	62.5	5.80	5	92	12	63	74.2	3.30
MARYLAND.												
Woodlawn	17, 31	80	12	43	61.8	5.75	5	90	15	60	76.3	4.[illegible]3
Annapolis	17	81	2	42	64.8	6.34	30	91	6	65	77.3	2.15
Sykesville	18	81	2, 12	43	62.4	7.00	5	91	6, 15	63	72.8	4.25
WEST VIRGINIA.												
Cabell Court-House	16	86	12	40	61.5	13.27	8, 29	90	1	56	74.6	3.63
SOUTH CAROLINA.												
Hilton Head	23, 24	87	28	61	73.9	3.20	14, 16, 17, 28	92	2	70	81.0	6.93
TEXAS.												
Austin	25	103	11	51	75.4	0.17	25	96	29, 30	69	80.6	5.29
MISSISSIPPI.												
Natchez	22	86	12	45	70.3	0.35	6, 7, 10, 24	87	27	65	78.5	3.14
TENNESSEE.												
Clarksville	20	83	12	41	65.4	3.39	23	90	1, 2	62	74.6	2.68
KENTUCKY.												
Louisville	16, 21	86	12	33	63.4	7.57	18	91	1	54	75.6	3.86
Chilesburg	5, 16, 17, 21	80	12	40	62.7	8.98	5, 6, 7, 23, 24, 29	88	1, 26	64	75.0	4.05
Danville	15, 16	86	12	39	64.5	5.82	5, 6, 7, 29	92	1	67	76.6	4.84
London	5	84	12	38	......	......	29	90	1	61	75.9	......
OHIO.												
Saybrook	16	86	12	37	56.3	......	7, 25	90	10, 11, 21, 22, 27	58	71.6	......
Austinburg	16	86	11	30	57.8	2.80	25	90	11, 21, 27	57	71.0	2.90

Meteorology of 1865—Continued.

Places in States and Territories.	MAY.						JUNE.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
OHIO—Continued.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
New Lisbon	17	93	12	35	64.1	2.26	5, 6	98	1, 11	62	77.5	6.27
Welshfield	17	85	1, 11	36	58.5	4.87	5, 6, 17	90	10	56	73.3	6.32
Milnersville	16, 31	85	2	28	......	2.94	......	......	......	......	......	......
Cleveland	16	86	1, 12	40	58.1	2.27	......	......	......	......	......	......
Wooster	16	87	11	34	59.9	......	6	93	10	59	74.6	......
Gallipolis	16, 17	84	12	34	61.1	10.09	6, 15, 17	90	10	58	74.4	......
Kelley's Island	31	83	11	39	59.3	2.46	6	92	26, 27	60	74.5	2.77
Norwalk	16	85	11	34	58.9	2.78	18	92	27	57	72.4	4.08
Westerville	16	82	11	36	63.8	5.76	......	......	......	......	......	......
Kingston	16	86	12	34	62.4	9.62	6, 18	92	1	62	75.9	3.42
Portsmouth	16	83	12	41	63.9	10.45	29	88	1	65	76.6	1.45
Toledo	16	86	11	39	59.7	2.25	6	93	26	54	73.3	3.63
Marion	16, 23	83	11	35	59.7	2.71	24	94	10	59	75.0	3.37
Urbana University	16	86	11	34	61.6	4.11	6, 23	90	1, 10, 11	60	74.5	5.06
Hillsborough	16	81	12	34	60.8	8.30	6, 18	87	27	58	73.4	4.01
Ripley	15	93	12	41	64.6	10.94	6	97	2, 26	65	78.5	3.75
Bethel	16, 17, 21	85	11	35	53.0	8.63	6	91	21, 27	60	73.2	2.23
Eaton	16	83	11	39	60.5	10.30	5, 24	87	27	60	73.0	3.49
Cincinnati	16	88	12	42	65.4	8.46	24	93	27	63	77.8	1.88
Farmers' College	16	84	12	32	61.2	9.05	6, 7	88	26	64	......	4.03
College Hill	16	85	12	35	61.7	7.88	6, 7	92	1	60	75.2	2.00
MICHIGAN.												
Pontiac	31	84	11	36	57.6	......	6	90	26	52	71.1	......
Monroe	16	85	1	40	59.5	1.42	17	90	26	54	73.8	1.92
Manchester	16	90	11	36	58.6	......	5, 6, 18	94	26	52	72.5	......
State Agr. College	31	83	1, 11	39	57.7	1.77	18	90	10	52	70.8	3.55
Homestead	31	88	10	29	55.6	......	17, 18	92	10	47	68.3	......
INDIANA.												
Vevay	21	89	11	40	64.4	11.80	24	97	1	63	77.6	2.45
Pennville	16	87	11	36	63.9	......	6	94	27	57	72.9	......
Richmond	16	82	11	37	60.0	5.79	6	91	26	56	73.1	4.49
Spiceland	15, 31	84	11	39	59.1	6.50	6	93	26	55	74.8	6.80
Madison	16	80	12	44	......	10.74	......	......	......	......	......	......
South Bend	5, 16, 31	87	1	32	59.5	1.30	17	92	25	50	73.8	4.13
New Albany	16, 21	85	11	40	64.1	5.92	6, 18, 24	90	1	62	77.5	......
Indianapolis	16	86	11	41	62.7	......	6, 23	91	27	63	74.8	......
Rensselaer	16	84	6	38	61.4	2.95	24	94	10	52	74.1	6.80
Farmers' Institute	17	87	10	41	62.2	4.13	4, 17, 24	86	26	58	73.0	4.45
New Harmony	16	87	1	44	66.6	5.98	5, 6, 7, 24	91	26	67	78.2	3.29
ILLINOIS.												
Chicago	31	88	1	30	52.4	......	6	97	10	46	67.8	......
Evanston	16	84	2	34	54.9	1.75	6	92	10	48	69.9	3.71
Marengo	......	......	......	......	......	......	26	86	6, 8, 10	48	60.0	4.67
Riley	31	85	10	34	53.3	1.61	3	92	25	52	66.0	8.15
Sandwich	31	85	10	35	60.1	0.97	5	94	10	53	71.7	5.31
Ottawa	......	......	......	......	......	......	5	95	10	53	73.9	5.17
Winnebago	30, 31	86	1, 11	41	60.3	1.56	6	90	26	51	71.4	4.46
Wyanet	28	85	11	32	60.4	1.35	5, 6	90	11	49	71.6	4.47
Tiskilwa	4	88	1, 10, 11	40	59.5	......	5	92	26	56	71.9	......
Elmira	30	86	1, 13	43	63.4	2.56	5, 6	92	26	57	73.7	3.38
Hennepin	31	84	......	......	......	......	6	91	11	50	71.0	......
Peoria	5, 20, 31	82	11	44	63.8	2.34	5, 6	92	26, 27	61	75.1	1.86
Pekin	5	88	13	41	63.8	2.46	5	94	21	59	74.9	6.01
Springfield	24	92	1	42	68.3	......	24	94	26, 29	60	76.5	......
Dubois	......	......	......	......	......	......	24	93	26	55	71.8	3.50
Waverly	......	......	......	......	......	......	17, 24	90	26	57	74.2	2.65
Murraysville	4, 24	87	10	40	64.6	1.50	23, 24	95	25	56	74.9	3.29
Galesburg	28	83	1, 10	43	60.5	1.58	4, 5, 6	87	10	58	71.4	3.94
Augusta	20	87	1, 11	42	63.2	0.70	4, 5, 6	89	26	57	73.6	6.77
WISCONSIN.												
Manitowoc	21	80	10	36	53.1	0.27	2	92	10	44	63.2	4.09
Milwaukee	16	85	10	36	53.3	1.36	6	93	10	47	67.7	3.82
Green Bay	31	92	10	34	56.3	0.88	4	92	26	51	68.0	4.70
Geneva	31	81	10	26	56.2	......	6	87	10	49	67.0	......
Delavan	31	85	10	35	57.6	1.32	5, 6	90	20, 26	53	69.3	4.55

Meteorology of 1865—Continued.

Places in States and Territories.	MAY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	JUNE. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
WISCONSIN—Con'd.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Waupacca	30	93	10	38	61.2	......	4	94	10	52	71.6	......
Embarrass	31	100	10, 11	28	60.8	2.85	2	100	27	42	67.5	5.92
Weyauwega	30	92	11	34	60.7	0.89	2	94	9, 26	52	71.2	2.70
Rocky Run	30	90	10	39	60.1	1.22	4	91	20, 26	52	70.2	5.23
Baraboo	30, 31	90	10	32	60.1	0.25	2, 3, 4	91	26	48	70.6	7.75
Beloit	31	87	1	35	59.2	0.73	4, 5, 6	89	26	49	68.6	3.85
Plymouth	......	......	......	......	......	......	2, 4, 5	95	26	45	68.1	3.20
Odanah	......	......	......	......	......	......	3	88	9, 10	44	58.7	......
MINNESOTA.												
Beaver Bay	30	84	3, 9	35	51.6	2.79	11	90	10	43	55.8	3.08
Afton	28, 29	90	10	34	56.4	......	2	94	20	46	68.6	......
St. Paul	28	87	2, 10	35	58.9	4.20	2	92	20	46	67.1	6.72
Minneapolis	30	91	2	35	60.9	......	2	95	20	50	70.4	......
Sibley	28	96	10	29	61.4	3.73	2	94	21	48	71.8	3.65
New Ulm	30	92	12	38	62.1	6.13	3, 5	96	20	47	72.5	3.88
IOWA.												
Lyons	28	85	11	40	62.0	1.55	3, 5, 6	92	20	86	73.1	6.11
Dubuque	28	87	1, 10	41	62.0	1.19	4, 5	91	10, 21	57	71.3	8.78
Muscatine	23	86	1	37	57.1	1.05	5, 17	91	26	54	72.5	3.69
Fort Madison	28	88	13	40	63.4	1.22	5, 6	92	10	60	75.2	6.61
Monticello	28	91	10	37	59.9	0.84	3, 4, 5	90	20	54	69.0	9.02
Guttenberg	30	84	10	39	59.7	......	4	89	20	57	69.2	......
Mount Vernon	20	88	12	32	61.8	......	3, 4, 6	91	25	53	71.0	......
Iowa City	27, 28	86	11	32	61.4	2.72	6	88	26	54	74.9	6.96
Independence	28, 30	89	10	33	60.0	2.50	3	94	......	......	68.4	3.03
Pleasant Plain	......	......	......	......	......	......	3, 6	94	26	55	76.5	5.63
Waterloo	28	87	7	22	63.0	......	3	90	1	54	69.0	......
Iowa Falls	20	84	13	30	50.9	3.77	3	86	21	50	67.0	16.09
Algona	30	90	10	31	59.4	1.63	4	94	21	42	68.0	6.06
Davenport	......	......	......	......	......	......	5	88	26	58	72.0	3.43
MISSOURI.												
St. Louis	20	88	10	47	66.8	5.66	24	96	26	63	77.5	5.21
St. Louis University	21	88	11	51	68.5	3.81	24	95	26	67	78.9	4.40
Allenton	20	92	11	41	64.0	4.63	28	93	26	58	73.0	4.57
Athens	13	81	5	49	66.5	1.81	13	81	5	49	66.5	1.81
Canton	4	93	2	42	63.0	0.71	6	96	20	56	74.8	5.01
Harrisonville	21	88	11	36	65.6	4.82	6	90	25	60	76.1	11.86
Easton	21, 29	90	10	39	68.5	1.10	4, 5	92	25	61	......	8.40
KANSAS.												
Olatha	4	91	11	32	......	11.25	14	94	25	56	......	15.80
Atchison	4	94	11	30	62.8	......	3, 21	96	26	57	73.4	......
State Agr. College	4	90	10, 11	32	68.2	2.04	4, 5, 28	90	25	59	76.1	7.98
Fort Riley	4, 20	95	10	34	68.0	1.10	23	97	10, 17, 18	63	76.0	5.47
NEBRASKA.												
Elkhorn	29	90	10	37	63.2	......	4	96	18	56	71.7	......
Bellevue	3	87	10	39	61.2	1.45	5	92	20	57	73.7	5.05
Nursery Hill	4, 21, 29	91	11	32	63.8	2.94	......	......	......	......	......	......
UTAH.												
Great Salt Lake City	27, 29, 31	88	1	38	68.2	2.60	20, 25	90	17	45	70.4	7.00
St. George	6, 26	101	1	58	80.9	0.00	21	107	17	68	85.3	0.01
St. Mary's	......	......	......	......	......	......	26	100	17	31	63.1	......
CALIFORNIA.												
San Francisco	5	84	1, 2	49	58.7	0.42	19	81	3, 9, 10	51	59.0	0.00
Sacramento	7	97	24, 31	57	70.2	......	24	94	2	57	71.1	0.00
Monterey	7	85	23	50	59.7	0.31	18	89	2, 5	53	57.0	0.00
Meadow Valley	......	......	......	......	......	......	30	105	1, 2	44	65.9	0.25
WASHINGTON.												
Neeah Bay	6, 7, 9	64	26	41	50.8	6.70	......	......	......	......	......	......
ARIZONA.												
Fort Whipple	26	98	11	42	70.5	......	21, 22	110	4, 5	52	75.7	......

Meteorology of 1865—Continued.

Places in States and Territories.	JULY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	AUGUST. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
MAINE.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Steuben	24	82	7,8,14,15	54	62.5	5.30	2, 14	78	29	48	64.1	0.70
Lee	25	85	31	48	65.8	4.92	4	89	30	46	65.2	3.25
West Waterville	28	86	31	54	67.5	5.55	4	91	24	50	67.4	1.00
Gardiner	21, 24, 25	80	31	57	67.6	4.61	4	86	29	50	66.1	1.46
Lisbon	......	......	......	......	......	4.12	4	90	......	......	......	2.34
Standish	25	92	31	54	66.5	3.08	4	94	24	53	69.1	2.07
Cornish	25, 28	87	15	53	69.3	3.00	3	93	24	48	67.0	4.90
Cornishville	28	87	5, 14	56	69.0	5.00	3, 4	90	24	52	68.9	4.37
NEW HAMPSHIRE.												
Stratford	28	83	15	49	62.7	5.42	3	89	18, 23, 24, 29	46	62.5	1.68
North Barnstead	28	87	13	57	69.7	2.73	4	94	23, 24	52	70.1	2.52
Claremont	28	85	31	52	68.0	3.72	3, 4	92	29	44	68.0	1.47
VERMONT.												
Lunenburg	31	85	8, 9, 10	40	60.8	3.92	3	95	14	48	70.8	1.00
Craftsbury	28	78	14, 31	50	61.4	5.95	3	84	24	44	61.9	3.25
Middlebury	2	82	31	55	67.1	5.13	3, 4	82	29	50	67.6	2.54
Brandon	28	88	14	54	68.1	4.16	3	93	24	49	68.2	1.51
MASSACHUSETTS.												
Topsfield	28	87	11	57	70.7	2.62	4	92	25	50	68.8	1.45
Georgetown	25	87	11, 22, 31	57	69.7	......	4	97	24	53	68.9	......
Newbury	25, 28	91	9	56	70.0	......	4	95	24	47	68.5	......
New Bedford	7	87	14	60	71.5	5.14	3	84	24	53	70.0	1.16
Worcester	7, 28, 29	83	22	45	70.4	3.37	4	89	29	50	69.4	3.39
Mendon	29	88	14	57	71.1	2.70	4	91	24, 25	51	70.0	2.30
Baldwinsville	28	82	13, 15	54	67.5	1.75	4	88	24	46	61.9	3.45
Amherst	7, 28	85	15	55	69.1	3.72	4	90	24, 29	48	68.6	1.86
Springfield	28	93	15	47	69.6	3.86	4	98	24, 29	44	70.0	1.67
Westfield	28	85	10, 14, 15	54	68.7	3.55	4	89	24, 25	52	68.7	1.30
Bichmond	......	......	......	......	......	......	2, 3	90	24	46	72.1	0.70
Williams' College	29	84	14	53	66.0	4.83	4	85	29	46	66.8	0.65
CONNECTICUT.												
Pomfret	7	83	11	56	......	5.72	4	85	23	50	67.0	0.97
Columbia	28	89	13	60	73.5	......	4	91	29	50	72.2	......
Middletown	7	91	11, 15	60	72.0	4.65	3	91	23	35	70.6	1.85
Colebrook	28	88	13, 14, 15	54	68.5	......	3	89	29	49	68.3	......
NEW YORK.												
Moriches	7	95	14	62	75.6	3.69	9	93	24, 25	58	75.2	1.50
South Hartford	8, 28	86	15	56	72.7	4.56	4	92	23, 24, 29	54	72.6	0.95
Albany	7	88	10	62	73.1	3.98	4	89	24	54	73.5	1.37
Fishkill Landing	7	90	14	57	71.4	4.54	2, 3	88	23	50	71.4	1.56
Garrison's	7	90	11, 14	58	73.4	5.04	3, 4	90	22	52	62.8	1.30
Throg's Neck	7	92	1	47	73.1	......	......	......	......	......	......	......
Deaf & Dumb Inst.	28	95	11	67	78.3	5.21	3	94	24	57	76.8	2.23
Flatbush	7	91	11, 14, 19	61	71.5	3.54	3	85	24	54	75.3	2.90
Newburgh	7	92	11	60	75.2	4.10	4	92	23, 24	51	71.4	1.39
Gouverneur	27	84	31	51	66.2	1.85	3	91	28	40	66.0	0.99
South Trenton	28	86	13	50	66.9	5.77	4	89	29	42	64.9	1.22
Oneida	28	86	31	50	66.6	6.21	31	90	29	49	66.8	1.58
Sherburne	28	88	31	42	65.1	......	31	93	29	39	65.4	......
Houseville	......	......	......	......	......	......	3	89	23	49	65.6	1.20
Theresa	27	81	14	50	65.5	2.71	3	88	28	48	66.5	1.22
Depauville	25	82	14, 30	55	67.7	......	3	87	23, 24	50	67.5	......
Oswego	12	82	13, 31	52	65.2	2.35	31	86	29	48	66.3	1.13
Palermo	28	87	13	48	65.9	3.00	6, 31	90	29	47	66.6	1.10
Baldwinsville	27, 28	80	31	50	64.8	......	31	84	29	45	65.0	......
Skaneateles	28	84	14	50	63.9	......	31	88	23	48	67.3	......
Auburn	4, 28	86	13, 14	50	70.8	......	3, 4, 31	90	23, 24, 29	50	72.1	......
Nichols	4	89	14	50	68.9	......	3	92	24	46	67.2	......
Palmyra	28	86	31	52	67.5	......	3	92	29	48	66.5	......
Geneva	28	86	31	53	72.0	2.90	3	87	23, 24, 29	52	68.4	1.94
Rochester	25, 28	87	30	54	68.4	1.47	3	93	23, 28	50	68.0	1.04
Rochester Univer'y.	28	85	13	54	68.6	1.47	3	91	23, 24, 29	50	67.9	1.04
Buffalo	28	85	13, 14	45	70.0	1.67	30	88	28	49	68.6	0.89
Jamestown	6	90	13, 15	52	67.2	6.30	31	92	22, 24	48	66.8	2.30

Meteorology of 1865—Continued.

Places in States and Territories.	JULY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	AUGUST. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
NEW JERSEY.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Paterson	7	93	14	58	74.6	9.92	4	92	24	50	71.3	2.20
Newark	7	92	14	54	72.5	6.74	3	88	24	50	69.8	3.94
New Brunswick	28	97	14	56	74.1	......	5	97	24	48	71.5	......
Burlington	7	93	15	60	73.7	1.80	4	90	24	55	69.9	3.30
Moorestown	7	94	10	61	74.4	3.11	4	95	22, 23	54	71.8	3.41
Mount Holly	7	91	15	60	73.9	......	4	88	23	54	70.7	......
Seaville	7, 29	96	14	52	72.4	4.05	3	89	24	55	73.0	3.20
Haddonfield	7	93	14	60	74.7	1.95	5	88	24	54	72.6	5.96
Greenwich	7	90	14	61	74.9	2.55	4	85	24	54	71.3	3.19
PENNSYLVANIA.												
Nyces	28	88	30	47	65.9	4.20	4, 5	88	24	41	65.7	4.80
Fallsington	7, 28	90	15	61	72.7	2.30	4	90	22	55	71.7	2.00
Philadelphia	7	97	14	64	78.3	2.14	3, 4	90	23	59	75.9	2.99
Germantown	7	98	10, 14	60	75.8	......	3	95	24	51	72.1	......
Mooreland	7	91	10	59	72.4	6.00	4	88	24	54	70.2	2.98
Dyberry	7	86	14, 15	45	63.9	......	4	84	25	39	62.0	......
Nazareth	28	98	13	55	73.0	......	4	92	24	49	70.8	......
North Whitehall	7	90	14, 15	52	71.7	......	3, 4	88	25	47	69.5	......
Oxford	7	92	14	58	73.9	5.58	3, 4, 5	86	24	53	71.3	1.91
Silver Spring	7	94	13, 14	57	74.0	......	4, 5	90	24	52	70.8	......
Mount Joy	7	98	14	66	79.2	6.10	6	96	24	56	76.6	0.80
Harrisburg	7	94	14	63	77.5	2.69	5	89	25	57	75.0	3.53
Lewisburg	7	94	13	52	71.5	3.79	4	88	24, 25	50	68.8	2.12
Tioga	7, 8, 27, 28	90	14	50	69.8	7.95	2, 3	92	23, 24	46	67.1	3.34
Fleming	8	93	14	40	69.3	5.36	6, 31	86	23	47	67.9	2.71
Pennsville	6	90	19	49	67.4	5.11	2	90	25, 26	44	65.2	3.37
Connellsville	6, 7	92	13	50	71.4	......	2, 3, 31	88	24	48	69.1	......
Canonsburg	7	90	14	46	68.7	5.61	4	87	25	42	68.1	4.20
DELAWARE.												
Wilmington	7	96	14	58	73.7	5.70	21	88	24	51	73.1	3.60
MARYLAND.												
Woodlawn	7	94	10, 14	62	75.2	6.96	4	90	23	56	72.6	1.51
Annapolis	7	96	14	61	78.2	8.75	21	88	23	56	75.3	3.86
St. Inigoes	......	......	......	......	......	......	4	96	23	59	76.6	3.55
Sykesville	21	88	14	57	73.7	3.70	4, 6	85	23, 24	57	71.1	3.25
WEST VIRGINIA.												
Cabell C. H	5, 6, 7	92	14	58	75.4	5.70	3	88	25	48	70.1	2.10
TEXAS.												
Austin	21, 23, 24, 25, 26, 29	95	6	75	84.0	0.23	17	106	26, 28, 31	75	85.1	0.00
MISSISSIPPI.												
Natchez	22	92	14	70	82.7	2.33	15	91	1	68	80.6	1.91
TENNESSEE.												
Clarksville	7	89	17	63	75.7	5.14	29, 30	89	25	58	74.3	4.92
KENTUCKY.												
Louisville	4, 7	95	18	53	74.5	6.92	30	92	25	50	73.5	3.68
Chilesburg	6	93	17	61	75.0	5.05	3, 29, 30	88	24	56	72.8	4.69
Danville	4, 6, 7	96	17	60	76.2	6.75	4	93	23	57	74.5	1.68
London	7	95	18	59	76.6	......	......	......	......	......	......	......
OHIO.												
Saybrook	6	89	14	54	68.0	......	31	85	25	50	67.3	......
Austinburg	6	90	13, 14	53	70.0	5.30	9	87	25	46	67.0	0.75
New Lisbon	4, 6, 7	98	14, 17	60	......	3.70	31	95	24, 25	48	73.3	2.79
Steubenville	......	......	......	......	......	......	......	88	......	46	71.0	3.60
Welshfield	6	88	14	54	69.4	7.42	4	90	23	50	68.7	2.89

Meteorology of 1865—Continued.

Places in States and Territories.	JULY.						AUGUST.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
OHIO—Continued.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Milnersville	7	95	14	45	......	3.90	4	94	25	44	68.1	2.62
Cleveland	25	91	10	54	73.6	3.57	6	92	30	50	69.8	3.45
Wooster	6, 7	94	13	54	71.8	......	30, 31	90	24	49	69.9	......
Gallipolis	5, 7, 8, 28	94	15	51	73.4	6.30	3	93	25	46	70.5	2.48
Kelley's Island	6	90	13	58	71.5	4.54	31	90	24	59	71.9	1.75
Norwalk	6, 7	90	16	52	68.9	4.77	30	90	24	50	71.0	2.55
Kingston	4	93	17	58	72.4	4.86	31	93	22, 24	54	72.4	2.41
Portsmouth	4	95	15	61	76.3	3.70	10	84	25	55	72.5	1.47
Toledo	6	94	14, 16	55	69.3	6.06	3	90	25	53	68.8	3.75
Marion	6, 7	92	13	55	70.0	4.91	3, 21	86	23	51	68.4	2.11
Urbana University	5	94	14	54	71.8	4.62	3	88	23, 24	50	69.7	6.66
Hillsborough	6, 7	90	14	55	72.0	7.37	31	85	23, 24, 25	52	69.7	2.52
Ripley	7	97	14	60	77.7	6.16	31	93	23	56	74.6	4.52
Bethel	6, 7, 8	93	13	55	72.9	6.38	30	92	23, 24	50	71.0	3.38
Eaton	6, 7	90	16	57	71.5	6.91	......	......	......	......	......	......
Cincinnati	7	97	14	62	77.2	8.01	30	92	25	58	76.6	2.26
Farmers' College	4, 5, 6, 7	90	17	60	74.9	6.88	29, 30	87	25	54	73.2	5.80
College Hill	4, 5	94	16, 17	57	75.0	8.00	3, 4	92	24, 25, 26	53	74.0	3.50
MICHIGAN.												
Pontiac	6	87	13	50	66.3	......	31	92	24	42	67.7	......
Monroe	6	90	16	52	68.1	4.95	3	89	23, 25	50	68.4	4.60
Manchester	6	92	31	48	......	......	2, 3, 31	92	24	40	67.8	......
State Agr. College	6	87	13	50	65.7	3.91	2	86	22, 24	48	65.9	3.38
Grand Rapids	31	86	13	58	......	......	......	......	......	......	......	......
Homestead	6	83	29	48	64.6	......	2	86	23	42	65.0	......
INDIANA.												
Vevay	4	100	18	58	77.8	4.70	30	95	23, 24, 25	58	74.8	1.98
Pennville	5	97	16	52	69.7	......	2, 3, 4	88	23	47	70.2	......
Richmond	5, 7	90	13, 16	56	70.9	7.93	2	86	23, 24, 25	54	69.1	7.92
Spiceland	5	95	16	55	72.0	9.20	3, 30	91	22, 23	54	71.0	1.70
Madison	......	......	......	......	......	......	30	99	25	57	74.1	......
New Albany	7	95	17	58	76.0	5.37	30	91	24	57	75.6	3.31
Indianapolis	4, 5	93	3, 13, 15, 16, 17	60	72.6	......	3	92	24	55	71.4	......
Rensselaer	5	96	13	48	69.3	8.15	3, 29	91	23	49	70.7	9.41
Farmers' Institute	6	90	13	50	69.3	6.75	29	85	22	53	65.3	6.44
Bloomingdale	7	96	17	58	71.2	......	......	......	......	......	......	......
New Harmony	6	95	17	63	76.3	5.16	30	90	25	60	75.4	3.56
ILLINOIS.												
Chicago	6	92	12, 13, 17	52	65.9	......	2, 29, 30	88	17, 24	50	66.5	......
Evanston	6	88	13	54	66.5	3.44	18	88	24, 25	58	72.9	5.84
Marengo	4, 5, 6	90	16	50	66.1	3.78	......	......	......	......	......	......
Riley	5, 6	90	12	50	66.0	7.84	29	86	24	55	70.3	9.15
Sandwich	5	95	12, 16	53	68.3	3.84	27, 28, 30, 31	90	22, 24	50	69.5	7.38
Ottawa	5	97	16	48	70.2	5.01	29	92	22	49	70.9	5.50
Winnebago	4	91	13	53	67.8	6.17	31	89	16	51	69.8	7.22
Wyanet	7	93	14, 17	50	68.1	6.96	31	91	23	50	70.9	8.79
Tiskilwa	4, 5, 6	93	13	50	69.8	......	9, 19	90	23	52	70.9	7.75
Elmira	4, 5	93	13	51	70.2	4.32	29, 31	88	23, 24	54	71.4	5.25
Hennepin	......	......	......	......	......	......	31	87	23	43	69.1	......
Peoria	6	93	13, 14	56	71.2	5.77	30	89	23	57	73.2	3.61
Pekin	5, 7	96	17	53	71.5	5.93	30	91	23	53	73.4	1.49
Springfield	7	98	14, 17	56	74.4	......	10, 30	94	24	52	74.7	......
Waterloo	4, 7, 8	97	16	64	77.4	......	5	98	23	67	80.2	......
Dubois	4	95	17	48	69.3	6.00	29	92	23	46	67.0	3.75
Waverly	3, 5	93	17	56	71.8	6.70	1	89	23	53	72.6	0.50
Murraysville	7	99	11, 13, 16	58	72.7	6.98	9	92	22, 24	58	74.1	0.55
Galesburg	5	89	13	52	67.0	6.74	9, 29, 30	88	13	49	71.4	4.70
Augusta	4, 5	91	16	57	70.2	9.59	9	89	23	54	72.0	1.69
WISCONSIN												
Manitowoc	6	88	13	48	64.1	7.16	18	84	11, 22	50	65.3	2.93
Milwaukee	6	91	12, 13	52	65.2	2.08	31	90	24	53	......	5.03
Green Bay	6	86	15	44	64.2	4.17	2	89	17	47	65.0	2.19
Geneva	4	87	12, 13	47	65.3	......	29	88	16, 22	52	67.0	......

Meteorology of 1865—Continued.

Places in States and Territories.	JULY. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	AUGUST. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
WISCONSIN—Con'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Delavan	4, 5, 6	87	12	48	65. 6	2. 54	2, 31	85	23	48	67. 7	4. 97
Waupacca	8, 11	90	21	52	69. 5	......	26	88	22	52	70. 5	......
Embarrass	11, 31	90	13, 14	42	64. 7	7. 80	......	......	......	......	......	......
Weyauwega	3, 6	87	5, 12, 21	54	67. 4	11. 72	26	89	12	53	68. 9	7. 10
Rocky Run	4, 6	87	13, 15, 16, 21	54	66. 2	3. 78	28, 29, 30, 31	88	22	49	68. 4	......
Baraboo	5	90	21	54	70. 2	7. 25	29	90	22	48	69. 7	......
Beloit	4, 6	90	13	52	67. 1	3. 00	31	86	24	52	68. 2	4. 00
Plymouth	6	91	13	45	64. 9	3. 30	31	93	22, 23	48	66. 4	6. 00
Odanah	3	86	4, 12, 13, 15, 21	50	65. 4	......	30	88	22	58	64. 9	5. 06
MINNESOTA.												
Beaver Bay	17	88	5, 13	48	62. 1	1. 53	30	85	21, 22	48	63. 1	4. 47
Afton	5	88	1	51	67. 2	......	29, 30	90	22	50	68. 1	......
St. Paul	5	84	1	51	66. 4	2. 55	30	85	22	52	66. 7	9. 16
Minneapolis	5	88	1	52	68. 1	......	30	91	22	53	69. 2	......
Forest City	5	87	29	54	67. 3	3. 82	7, 8	86	22	54	68. 0	6. 66
Sibley	4, 5	92	29	55	70. 2	5. 03	30	89	23	51	71. 3	6. 06
New Ulm	5	96	28	58	72. 0	5. 13	29	92	22	56	73. 4	4. 50
IOWA.												
Lyons	5	93	13	54	70. 5	7. 42	31	91	23	47	72. 9	10. 55
Dubuque	5	92	15	55	68. 7	2. 98	28, 31	90	23	52	71. 9	3. 99
Muscatine	5	93	13	53	69. 3	4. 50	28	88	23	46	70. 2	4. 25
Fort Madison	3, 7	94	15	57	74. 0	9. 93	9	95	23	49	73. 1	2. 03
Monticello	5, 6	91	13	51	66. 6	4. 35	28, 31	88	23	51	68. 9	2. 78
Guttenberg	4, 5	87	15	55	69. 5	......	28, 31	88	22	52	69. 0	......
Ceres	4, 5, 6	88	15	53	67. 8	......	31	90	22	54	70. 3	......
Mount Vernon	5, 6	90	13	52	68. 1	......	27, 28	89	23	50	70. 6	......
Iowa City	5	91	17	55	69. 3	7. 30	10, 30	90	22	55	72. 4	1. 35
Independence	5	93	10	50	69. 3	4. 20	28, 31	92	23	52	71. 7	4. 30
Pleasant Plain	4, 6	96	11, 14, 15	56	71. 2	15. 00	9	95	22	55	74. 1	3. 00
Waterloo	4, 5, 6	88	15	50	66. 6	......	27, 28	90	24	52	70. 3	......
Iowa Falls	5	86	10	50	66. 3	7. 45	9	89	24	50	71. 7	2. 81
Algona	4	92	15	52	67. 6	2. 63	......	......	......	......	......	......
Davenport	4, 5, 6	89	13	52	68. 0	5. 41	28, 30	86	22, 23	56	71. 2	4. 52
Des Moines	......	......	......	......	......	......	9	94	23	56	73. 2	......
MISSOURI.												
St. Louis	5, 6	97	14	61	75. 4	7. 94	30	93	23	57	75. 9	1. 96
St. Louis University	5	97	14	61	76. 2	6. 26	30	92	23, 24	61	76. 9	1. 84
Allenton	3, 4	96	17	53	71. 8	9. 26	......	......	......	......	......	......
Athens	......	......	......	......	......	......	31	93	9	57	71. 1	1. 45
Canton	5, 7	97	15	56	72. 8	8. 54	31	94	23, 24	57	78. 4	2. 06
Harrisonville	6, 7, 8	92	16	58	74. 5	10. 66	14	95	23	60	75. 8	6. 45
Easton	3	95	16	58	74. 6	8. 66	28	92	23	61	75. 8	8. 07
KANSAS.												
Olatha	7	96	16	57	......	13. 75	28	96	23	58	70. 5	13. 10
Atchison	4	98	17	53	75. 3	......	10, 16, 17	100	22	59	76. 2	......
State Agr. College	3, 5, 6	93	17	50	75. 7	6. 42	30, 31	90	24	59	75. 4	5. 04
Fort Riley	6	96	16	60	77. 0	2. 80	20, 21, 28, 29	94	22	65	75. 5	......
NEBRASKA.												
Elkhorn	5	94	16	56	70. 9	......	27, 28, 30, 31	90	3, 22	60	72. 8	......
Bellevue	3, 4	93	11, 16	60	75. 2	3. 72	......	......	......	......	......	......
Ionia	31	96	16, 17, 21, 22	58	......	6. 50	26	94	23	54	74. 2	1. 50
UTAH.												
Great Salt Lake City	......	......	......	......	......	......	25	95	30	63	77. 0	......
St. George	1	108	16	65	83. 3	1. 03	26	103	16	74	87. 7	0. 22
St. Mary's	1, 12, 15	92	27, 28	......	66. 8	......	6	91	30	44	70. 1	......
CALIFORNIA.												
San Francisco	20	80	5, 6, 7	53	55. 7	0. 00	23	71	5	51	57. 8	0. 00

Meteorology of 1865—Continued.

Places in States and Territories.	JULY.						AUGUST.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
CALIFORNIA—Continued.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Sacramento	21	94	6, 8	61	74. 0	0. 00	23, 24 25, 27	88	17	60	71. 9	0. 00
Monterey	20	81	7, 17, 23	54	61. 6	0. 10	23	74	19	53	61. 8	0. 00
Meadow Valley	27, 28	102	8, 10, 13, 17	50	71. 4	0. 00	2	96	31	46	67. 9	0. 10
Nevada City	28	84	11, 12	62	74. 0	......	20	80	29	64	71. 0	0. 00
WASHINGTON.												
Neeah Bay	13	71	2, 3, 4, 6	48	55. 7	0. 30	16, 19	67	12, 24	48	56. 3	5. 00
ARIZONA.												
Fort Whipple	1	105	14	42	70. 9	......	......	......	......	......	......	......

Places in States and Territories.	SEPTEMBER.						OCTOBER.					
MAINE.												
Steuben	1, 12	84	23	38	59. 5	1. 05	1	65	30	25	43. 5	4. 90
Lee	14	84	27	34	59. 8	*2. 75	1	66	27	17	43. 8	3. 90
West Waterville	14	86	28	40	63. 8	0. 57	1	70	31	22	44. 4	3. 35
Gardiner	1	83	27	39	62. 0	0. 84	1	69	25	25	44. 0	4. 75
Standish	1	96	18	42	65. 7	1. 26	2	76	24, 27	26	44. 9	4. 63
Cornish	1	89	27	35	63. 4	1. 70	1	68	24, 25	23	42. 2	4. 20
Cornishville	1	88	18	41	65. 4	1. 58	1	70	27	25	43. 9	4. 72
NEW HAMPSHIRE.												
Stratford	5	82	27	30	58. 7	1. 51	1	63	25	18	38. 5	2. 42
Shelburne	5	94	27, 29	36	52. 1	......	1	70	31	18	42. 1	......
North Barnstead	3	91	18	40	68. 2	1. 76	1	75	27	26	45. 3	4. 44
Concord	1, 5	88	28	39	66. 2	......	1	70	25	22	45. 7	4. 90
Claremont	1	90	27	39	65. 1	3. 38	1	70	24	23	44. 0	5. 78
VERMONT.												
Lunenburg	1, 13	90	27	30	56. 4	4. 63	19	65	26	16	37. 4	3. 05
Craftsbury	14	85	19, 27	34	59. 1	1. 87	1, 19	58	25, 27	22	38. 1	2. 71
Middlebury	5	82	27	36	63. 5	2. 66	1	64	25	25	43. 4	3. 30
Brandon	3, 6	90	27	37	64. 9	2. 17	1	68	24	24	44. 1	3. 68
MASSACHUSETTS.												
Topsfield	1	90	28	43	65. 7	0. 40	1	74	24	29	48. 2	6. 26
Georgetown	1	93	27	45	65. 2	......	1	76	30	27	46. 1	......
Newbury	1	92	18, 27, 28	43	64. 9	......	1	71	25	29	46. 3	......
Cambridge	......	......	......	......	......	......	1	74	24	26	46. 7	......
New Bedford	7	85	27	48	67. 4	0. 25	10	78	30	33	51. 9	4. 83
Worcester	1	85	18	45	66. 0	0. 68	1	71	30	29	47. 4	4. 41
Mendon	14	89	18	44	66. 5	0. 60	1	73	23, 30	28	48. 3	6. 25
Baldwinsville	......	......	......	......	......	......	1	67	25	23	......	5. 48
Amherst	1	89	28	35	65. 6	0. 37	1	72	24	24	46. 0	4. 98
Springfield	15	94	28	36	67. 0	0. 65	10	78	24, 25	25	47. 3	4. 57
Westfield	1	88	20	39	65. 3	0. 86	10	72	14, 25	27	45. 8	4. 51
Richmond	1	94	27	36	68. 3	2. 44	......	......	......	......	......	......
Williams' College	1	85	27	36	63. 7	2. 27	7	70	24	25	44. 0	5. 27
RHODE ISLAND.												
Newport	6	85	19, 27	48	......	......	10	76	26	30	51. 7	4. 64
CONNECTICUT.												
Pomfret	15	84	18	43	64. 2	0. 31	10	72	24, 25, 30	30	49. 9	4. 47
Columbia	1, 15	90	28	46	68. 5	......	1	82	24	30	52. 0	......
Middletown	15	92	28	43	68. 4	0. 75	10	82	26	27	50. 3	3. 21
Colebrook	1	86	27	40	65. 3	......	10	74	30	25	43. 6	......

Meteorology of 1865—Continued.

Places in States and Territories.	SEPTEMBER.						OCTOBER.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
NEW YORK.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Moriches	15	95	29	51	71.9	3.53	10	85	14	33	55.9	4.06
South Hartford	3	90	27	38	68.7	2.08	1	72	24, 25, 27	25	46.4	2.27
Albany	1	89	27	47	70.9	2.80	1	72	24, 27	35	50.9	4.59
Fishkill Landing	1	88	27	45	68.3	1.48	10	78	25	31	50.1	3.05
Garrison's	1	87	27	42	66.7	2.02	10	79	14, 25	32	50.3	4.64
Throg's Neck	15	89	18	45	68.3	......	8	74	25	33	50.4	......
Deaf and Dumb Inst	1, 14	90	18, 19	51	72.7	4.21	10	83	25	39	54.0	4.94
Columbia College	......	......	......	......	......	......	10	76	25	35	51.2	3.16
Flatbush	6	88	19	45	67.8	2.21	10	80	25	34	51.3	5.75
Newburgh	1, 15	87	18	50	68.8	1.50	8	75	22	35	50.1	3.60
Gouverneur	4, 5	88	27	33	63.0	2.36	10	61	25	20	42.4	3.22
South Trenton	4	91	20	40	64.3	2.96	11	70	24, 25	24	43.7	4.78
Oneida	3, 4	87	26	44	65.2	9.16	10	68	24	27	47.2	7.84
Sherburne	3	92	28	42	66.2	......	......	......	......	......	......	......
Theresa	4	88	19, 26, 27	40	64.2	2.67	7	64	24, 25	20	41.5	4.36
Depauville	3, 13	88	27	38	65.9	4.10	7	65	27	24	43.7	7.00
Oswego	13	82	27	44	64.9	3.30	1	65	24, 25	30	47.2	6.32
Palermo	4	93	26	40	64.7	4.20	1, 9	65	24, 25	20	42.8	5.60
Baldwinsville	4	84	28	41	64.9	......	10	65	25	27	43.7	......
Skaneateles	3, 4	88	26, 27	43	66.4	......	10	68	25	26	44.6	......
Auburn	1, 3, 4	90	27	43	69.2	......	11	78	25	26	50.0	......
Nichols	4	92	28	44	66.7	......	10	80	24	24	45.6	......
Palmyra	14	87	27	43	67.1	......	......	......	......	......	......	......
Geneva	4, 13, 17	85	26	48	68.0	4.86	10	71	24	29	47.0	3.43
Rochester	13	88	27	44	67.2	4.33	10	69	21, 25	27	46.8	4.29
Rochester Univer'y	14	88	27	42	67.0	4.33	7, 10	69	25, 29	28	46.8	4.29
Buffalo	2, 12	91	19	41	63.0	3.29	11	69	24	26	47.8	3.00
Jamestown	17	89	19, 20	45	71.5	8.80	10, 11	78	24	27	47.5	1.30
NEW JERSEY.												
Paterson	1, 3	87	19	45	68.2	3.35	10	81	25	32	51.8	5.04
Newark	6	86	19	44	68.4	3.21	10	80	26	33	52.2	4.69
Trenton	......	......	......	......	......	......	10	83	25, 26, 30	40	59.4	7.97
New Brunswick	13	92	19, 27	45	71.3	......	10	83	26	32	......	4.45
Burlington	6	88	28	45	68.3	2.60	10	80	14, 25, 26, 30	32	51.2	4.50
Moorestown	6	90	19	51	69.7	3.25	2, 10	79	26, 30	34	51.8	4.23
Mount Holly	6	85	19, 28	48	69.5	......	10	78	30	33	51.8	......
Seaville	3	92	19, 27	52	72.3	4.80	9, 10	76	17	32	49.3	5.00
Haddonfield	4	86	28	47	69.2	7.72	10	78	30	32	51.4	3.25
Greenwich	6	85	19, 28	49	70.4	3.59	10	78	30	35	52.9	2.52
PENNSYLVANIA.												
Nyces	1	90	19, 26, 28	48	65.7	1.80	10	78	24	24	46.4	3.45
Fallsington	6	88	19	48	70.9	2.00	10	80	26	35	52.0	5.00
Philadelphia	4, 6	88	19	50	74.0	6.58	10	78	25	38	55.9	3.36
Germantown	4, 6	91	19	47	70.1		......	......	......	......	......	......
Mooreland	6	87	19	45	68.6	4.65	10	80	30	31	51.1	4.25
Dyberry	1	83	27	32	60.5	......	10	76	25	19	43.0	......
Nazareth	6	90	18, 28	48	68.9	......	10	80	29	34	50.4	......
North Whitehall	6	87	19	42	68.1	......	10	78	30	25	49.7	......
Oxford	6	90	19	49	70.7	2.25	......	......	......	......	......	......
Parkesville	......	......	......	......	......	......	11	85	30	32	52.2	3.84
Silver Spring	1, 4	90	27	43	68.4	......	10	81	25	28	50.5	......
Mount Joy	5, 13, 14	93	17	59	74.9	0.30	1	80	25	35	57.1	......
Harrisburg	4, 6, 14	87	29	53	73.2	4.75	10	77	26	38	54.2	3.09
Lewisburg	14	87	27	45	66.9	5.46	10	79	25	25	48.0	1.34
Tioga	4	96	27, 28	44	71.3	3.94	10	78	22	24	49.8	2.65
Fleming	5	87	30	39	67.8	5.09	11	76	5	22	46.3	2.56
Pennsville	5	87	20	42	67.0	6.19	10	75	22	26	46.5	3.12
Connellsville	11	88	19	48	70.0	......	10	76	30	24	49.0	......
Canonsburg	10, 12	87	29	44	68.9	4.60	10	74	30	23	47.0	3.07
DELAWARE.												
Wilmington	3	88	28	49	69.6	6.95	10	80	30	34	51.3	4.00
MARYLAND.												
Woodlawn	6	91	28	49	71.5	1.07	10	83	30	34	53.3	4.01
Annapolis	6	92	20, 28	52	74.3	3.79	10	81	30	32	50.7	4.16
St. Inigoes	7	94	19, 29	57	75.7	0.62	10, 11	82	30	40	57.9	3.95
Sykesville	3	86	20	48	76.1	1.75	10	80	26, 30	31	51.6	3.00

Meteorology of 1865—Continued.

Places in States and Territories.	SEPTEMBER.						OCTOBER.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
WEST VIRGINIA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Cabell Court-House	27	92	20	56	73.3	3.10	10	80	29	32	54.3	0.90
TEXAS.												
Austin	15, 16	96	23, 30	72	82.2	8.62	12	90	30	42	66.9	3.52
MISSISSIPPI.												
Natchez	4, 8, 11, 12	86	19	65	77.4	5.17	26	82	19, 21, 29	40	63.6	1.77
TENNESSEE.												
Clarksville	11	88	19, 30	56	74.1	6.19	12	76	29	38	55.9	1.03
KENTUCKY.												
Louisville	5, 15	91	20	50	75.5	5.61	7	79	29	36	55.6	1.84
Chilesburg	11	90	20	55	73.3	7.17	8, 9, 10, 11	76	29	33	54.5	1.55
Danville	5, 9, 12, 13	92	30	56	74.7	3.75	9, 10	78	29	35	55.8	1.25
London	3, 21, 29	89	25	55	73.5	......	13	78	13, 30	36	56.5	......
OHIO.												
Saybrook	13	86	19	48	68.3	4.10	9	73	24, 25	31	49.4	2.00
Austinburg	13	91	19, 27	45	66.0	3.95	9	75	24	24	46.4	0.50
New Lisbon	4	95	27	42	70.0	6.75	9	76	30	26	49.6	1.15
East Fairfield	9	82	27, 29	51	68.0	5.74	10	70	22, 30	30	48.6	1.44
Steubenville	......	88	......	50	71.3	9.50	......	......	......	......	......	......
Welshfield	4, 13	88	19	48	70.7	9.84	9	76	29	32	48.1	3.90
Milnersville	13	88	29	46	69.0	4.47	10	76	30	25	......	1.26
East Cleveland	13	90	19	49	69.7	4.82	9	77	21, 30	33	51.2	2.75
Wooster	14	88	27	52	71.3	......	9	78	30	28	49.8	......
Gallipolis	11, 13	89	20	48	71.3	5.42	10	76	30	29	52.0	1.71
Kelley's Island	10, 17	88	19	57	73.0	8.23	7, 9	74	28, 29	38	53.5	3.11
Norwalk	10, 13	88	27	48	69.7	5.30	9	75	29, 30	30	48.6	2.03
Westerville	16	89	18	52	69.4	5.65	9	80	30	28	47.2	0.85
Kingston	17	92	19, 27	54	73.9	5.51	9	81	30	31	52.2	0.92
Toledo	4	90	19	46	70.2	10.19	9	79	30	32	50.2	2.25
Marion	10	85	19	48	69.4	6.38	9	72	29, 30	30	47.7	1.41
Urbana University	5, 17	88	19	50	72.4	5.32	9	76	29	29	50.0	1.22
Hillsborough	10, 13	84	19	52	71.3	5.45	9	73	29	32	51.3	0.87
Ripley	13	92	19	54	75.9	3.92	9	81	30	31	55.4	0.88
Bethel	15	92	20	53	71.7	6.75	12	78	29	31	53.4	0.75
Cincinnati	12	95	19	50	75.3	5.76	10, 12	79	29	33	54.0	0.86
Farmers' School	......	......	......	......	......	......	2, 3	80	29, 30	32	53.0	0.80
College Hill	12	93	19	52	75.3	4.13	9	77	29	31	54.3	0.75
MICHIGAN.												
Monroe	10	88	18	51	69.6	5.05	9, 10, 11	72	22	31	48.3	2.52
State Agr. College	10	85	19	43	67.7	4.79	9	74	29, 30	29	46.5	2.79
Homestead	3	88	19	43	66.1	......	9	73	29	20	44.6	......
INDIANA.												
Vevay	12	99	19	51	77.2	6.51	10	96	27, 29	30	55.1	1.55
Richmond	9	88	30	49	71.1	5.37	8, 9	73	29	29	49.1	1.11
Spiceland	12	91	19	47	72.7	3.00	8	79	29	32	51.0	1.60
Madison	11	88	19	58	77.0	8.50	11	85	28	39	......	......
Columbia City	4	96	19, 30	50	75.3	6.69	9	91	30	28	51.0	2.38
New Albany	5	90	19, 20	53	74.3	6.85	9, 12	78	29	37	54.0	1.09
Indianapolis	12	91	19, 20	51	73.0	......	8	79	29	31	51.9	......
Rensselaer	4, 13	90	30	50	72.4	6.25	......	......	......	......	......	......
Farmers' Institute	4	95	30	50	70.8	6.75	11	73	28	30	55.2	1.75
New Harmony	9, 10	90	19, 30	57	76.5	5.26	11	77	29	37	56.3	1.38
ILLINOIS.												
Chicago	2	90	30	44	67.4	......	9	78	29	22	48.9	......
Evanston	3	87	30	50	73.7	3.32	9	77	29	25	51.0	2.45
Riley	3	87	20	47	68.5	3.34	9	77	29	23	47.0	2.20

Meteorology of 1865—Continued.

Places in States and Territories.	September. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	October. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
ILLINOIS—Cont'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Sandwich	3	92	19	45	70.4	5.72	7, 9, 10	75	29	22	49.4	1.48
Ottawa	9	94	18, 30	48	72.1	3.89	7	81	28, 29	28	50.8	1.84
Winnebago	3, 9, 14	89	30	46	70.2	9.09	7	78	29	17	48.2	3.53
Wyanet	3	91	19, 30	48	71.6	11.57	9	82	29	25	52.6	2.90
Tiskilwa	9	94	19	46	74.2	......	7, 8	78	29	26	51.4	......
Elmira	9	89	30	47	70.8	7.50	9	76	29	22	52.0	2.25
Hennepin	......	......	......	......	......	......	7, 9	76	29	26	52.0	......
Peoria	4	89	30	52	73.4	8.31	7, 8	79	29	29	54.7	1.67
Pekin	4, 12	92	30	47	73.6	11.30	1	89	29	28	54.6	1.83
Springfield	4	95	19	52	72.9	......	1	84	28	32	51.6	......
Dubois	12	92	19	45	73.2	5.00	23	82	29	30	53.8	3.45
Waverly	12	92	19	50	73.4	4.20	8	81	29	28	54.9	2.10
Murraysville	4	94	29	45	73.7	5.83	8	80	29	26	55.2	2.25
Galesburg	3	88	19	50	70.0	5.08	8	79	29	29	52.2	4.39
Augusta	2, 3, 12, 13	89	30	49	72.3	5.80	8	79	29	24	53.7	3.35
WISCONSIN.												
Manitowoc	24	85	18, 19	49	66.6	4.83	9	79	29	30	48.0	3.33
Milwaukee	14	90	19	50	68.9	6.37	9	79	29	28	49.8	5.23
Green Bay	3	89	18	44	66.1	5.87	......	......	......	......	......	......
Geneva	3, 14	87	29, 30	46	68.2	......	7	76	29	20	48.0	......
Delavan	3	86	30	45	67.8	6.09	9	75	29	17	46.5	2.52
Waupacca	3	90	18	46	68.7	......	9, 10, 11	80	30	25	46.4	......
Weyauwega	22	92	30	47	69.2	8.63	10	79	30	22	46.7	5.50
Embarrass	3	95	18, 30	42	66.4	3.27	9	82	29	20	45.4	3.28
Rocky Run	3	87	18	46	67.3	4.20	10	78	29	17	47.3	4.06
Madison	3	85	19	62	70.9	......	......	......	......	......	......	......
Baraboo	3	90	30	45	69.6	7.35	10	76	29	20	49.6	5.63
Beloit	3	86	30	45	68.0	5.23	7, 9	74	29	20	47.2	2.65
Plymouth	3	88	18	48	67.1	11.30	9, 10	80	29	23	46.3	3.70
Odanah	......	......	......	......	......	......	6, 9	76	30, 31	26	43.7	......
MINNESOTA.												
Beaver Bay	16	80	30	40	60.7	3.53	17	66	30	24	44.5	1.05
Afton	1	88	18	45	65.4	......	......	......	......	......	......	......
St. Paul	3	84	18	47	67.8	1.90	6	79	29, 30	22	47.0	2.30
Minneapolis	3	88	30	47	68.4	......	6	86	30	19	47.6	2.65
Forest City	9, 16	86	30	43	67.2	2.74	6	84	29	18	48.8	0.66
Sibley	2	88	30	40	68.9	8.01	6	86	29	18	49.4	4.52
New Ulm	1, 2, 9	91	30	50	71.7	2.51	6	87	29	22	51.5	3.11
IOWA.												
Clinton	......	......	......	......	......	......	6	78	29	22	51.7	4.00
Lyons	14	82	18	54	74.5	7.00	6	78	29, 30	28	51.9	4.07
Davenport	3	88	30	52	69.8	3.68	7	75	29	25	49.3	2.67
Dubuque	3	91	30	50	70.3	4.17	9	77	29	21	50.6	3.77
Muscatine	3	92	19	44	70.8	4.28	8	77	29	22	50.4	3.63
Fort Madison	2	91	19, 30	47	72.7	6.63	7	84	29	23	54.1	2.73
Monticello	14	94	30	44	73.1	5.62	......	......	......	......	......	......
Guttenberg	9	88	30	46	......	......	9	78	29	16	47.6	......
Ceres	3	90	30	50	69.9	......	6	74	29	14	48.7	......
Manchester	3	88	30	44	68.2	3.44	6	78	29	18	48.1	5.72
Mount Vernon	3	90	30	47	70.3	......	6, 8	78	29	24	50.5	......
Iowa City	3	90	30	44	72.6	3.65	8, 10	82	29	25	53.9	6.35
Independence	13	97	19	36	70.6	6.80	6	86	27	10	46.7	10.20
Waterloo	2, 3, 11	88	28, 29	52	69.0	......	6	80	29	16	51.0	......
Iowa Falls	2	86	19	50	73.5	2.87	5, 7	78	29	22	47.2	6.31
Des Moines	3	91	29, 30	48	70.7	2.75	6, 8	81	29	23	47.9	7.50
MISSOURI.												
St. Louis	10	94	30	53	75.5	2.60	11	80	29	30	57.3	3.33
St. Louis University	8, 10, 12	92	19	54	76.7	2.83	8	80	29	34	58.8	3.11
Athens	3, 4, 15	93	20	58	......	2.96	7	72	17	37	54.5	3.94
Canton	2	97	19	51	74.0	7.42	7	87	29	21	55.8	3.96
Harrisonville	13	90	30	58	74.4	8.09	5, 6, 7, 8	80	29	26	56.6	0.72
Easton	13	92	30	50	73.6	4.78	7	83	29	25	56.7	2.81

Meteorology of 1865—Continued.

Places in States and Territories.	SEPTEMBER.						OCTOBER.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
KANSAS.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Olatha	14	93	29, 30	54	72.5	8.10	5	82	28	24	42.9	2.85
Atchison	13	97	30	46	73.6	......	5	86	29	20	55.5	......
State Agr. College	2	90	......	......	......	......	......	......	......	......	......	......
Fort Riley	3	95	30	52	75.3	1.00	......	......	......	......	......	......
NEBRASKA.												
Elkhorn	2, 8, 13	90	30	46	71.6	......	5	85	29	16	54.0	......
Bellevue	12	87	29, 30	59	72.9	1.31	6	80	28	20	55.7	3.32
UTAH.												
Great Salt Lake City	15	85	10	35	64.6	1.52	2	83	30	30	56.4	4.10
St. George	12, 16, 17	95	10	52	73.9	0.20	2	87	31	32	60.7	0.80
St. Mary's	12	84	29	28	59.6	......	1	78	30	17	46.8	......
NEVADA.												
Star City	......	......	......	......	......	......	5, 6, 7	72	24, 26, 28, 29	30	50.4	......
WASHINGTON.												
Neeah Bay	4, 20	62	12, 13	46	53.7	13.30	7	60	25	37	49.3	8.40
CALIFORNIA.												
San Francisco	4	87	12, 14, 16, 23	52	61.9	0.24	6	73	24, 29, 30	48	56.0	0.29
Sacramento	5	90	27	54	60.9	0.01	6	85	23	50	63.1	0.48
Monterey	4	92	13, 21	52	61.5	0.17	6	78	28	47	57.9	0.17
Meadow Valley	5	93	28	33	56.8	1.75	1	79	28	25	50.7	4.00

	NOVEMBER.						DECEMBER.					
MAINE.												
Steuben	17	56	12	6	37.2	5.84	27	50	23	—11	24.2	4.93
Lee	17	60	12	—2	34.8	3.70	27	50	23	—15	22.1	3.35
West Waterville	17	61	12	8	36.4	3.40	13	46	22	— 6	24.1	3.25
Gardiner	17	65	12	10	37.1	3.24	13, 27	47	23	—10	24.4	3.23
Webster	......	......	......	......	......	......	27	47	23	— 1	23.8	......
Standish	17	70	8, 12, 29	20	38.2	3.74	27	55	22, 23	0	25.3	2.61
Cornish	17	68	12	15	37.1	7.98	27	52	22	— 3	24.4	2.72
Cornishville	17	67	11	16	37.9	3.72	27	54	22	— 2	25.7	3.84
NEW HAMPSHIRE.												
Stratford	17	58	12	2	33.1	1.67	27	49	22	—12	20.5	3.01
Shelburne	17	66	12	7	36.9	1.00	4, 25	47	23	— 1	25.5	1.43
North Barnstead	17	75	8	21	41.2	2.89	27	56	22	2	29.4	0.95
Concord	16, 17	69	12, 29	19	39.6	2.88	......	......	......	......	......	......
Claremont	17	70	12, 29	18	38.0	3.20	27	51	22	— 3	27.0	3.38
VERMONT.												
Lunenburg	13	58	9	14	34.6	2.95	4	48	22	—17	24.5	1.03
Craftsbury	17	61	8	11	32.9	2.22	27	42	16, 23	— 7	21.4	3.48
East Bethel	17	65	8	17	36.5	3.50	27	58	22	— 8	26.4	2.32
Middlebury	17	65	8.29	22	38.3	3.03	4	45	22	0	27.2	2.46
Brandon	17	68	29	18	37.1	3.51	27	54	23	0	28.1	1.69
MASSACHUSETTS.												
Topsfield	17	72	11	23	44.3	3.74	27	61	23	11	34.3	3.00
Georgetown	17	71	29	18	49.5	......	27	62	22	1	29.3	1.65
Newbury	17	72	29	18	40.5	......	27	61	22	2	30.1	......
Cambridge	16, 17	67	12	20	40.8	......	27	59	9	2	30.0	0.83
New Bedford	14	65	8	23	45.3	4.33	3, 4	57	16	11	36.0	4.28
Worcester	17	69	11	20	41.8	2.36	27	59	9, 23	8	32.1	2.75
Mendon	16, 17	69	29	19	41.2	3.40	27	58	9	6	31.7	3.90
Baldwinsville	17	66	8	14	......	2.51	27	57	23	3	......	......

Meteorology of 1865—Continued.

Places in States and Territories.	SEPTEMBER. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	OCTOBER. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
ILLINOIS—Cont'd.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Sandwich	3	92	19	45	70.4	5.72	7, 9, 10	75	29	22	49.4	1.48
Ottawa	9	94	18, 30	48	72.1	3.89	7	81	28, 29	28	50.8	1.84
Winnebago	3, 9, 14	89	30	46	70.2	9.09	7	78	29	17	48.2	3.53
Wyanet	3	91	19, 30	48	71.6	11.57	9	82	29	25	52.6	2.90
Tiskilwa	9	94	19	46	74.2	......	7, 8	78	29	26	51.4	......
Elmira	9	89	30	47	70.8	7.50	9	76	29	22	52.0	2.25
Hennepin	......	......	......	......	......	......	7, 9	76	29	26	52.0	......
Peoria	4	89	30	52	73.4	8.31	7, 8	79	29	29	54.7	1.67
Pekin	4, 12	92	30	47	73.6	11.30	1	89	29	28	54.6	1.83
Springfield	4	95	19	52	72.9	......	1	84	28	32	51.6	......
Dubois	12	92	19	45	73.2	5.00	23	82	29	30	53.8	3.45
Waverly	12	92	19	50	73.4	4.20	8	81	29	28	54.9	2.10
Murraysville	4	94	29	45	73.7	5.83	8	80	29	26	55.2	2.25
Galesburg	3	88	19	50	70.0	5.08	8	79	29	29	52.2	4.39
Augusta	2, 3, 12, 13	89	30	49	72.3	5.80	8	79	29	24	53.7	3.35
WISCONSIN.												
Manitowoc	24	85	18, 19	49	66.6	4.83	9	79	29	30	48.0	3.33
Milwaukee	14	90	19	50	68.9	6.37	9	79	29	28	49.8	5.23
Green Bay	3	89	18	44	66.1	5.87	......	......	......	......	......	......
Geneva	3, 14	87	29, 30	46	68.2	......	7	76	29	20	48.0	......
Delavan	3	86	30	45	67.8	6.09	9	75	29	17	46.5	2.52
Waupacca	3	90	18	46	68.7	......	9, 10, 11	80	30	25	46.4	......
Weyauwega	22	92	30	47	69.2	8.63	10	79	30	22	46.7	5.50
Embarrass	3	95	18, 30	42	66.4	3.27	9	82	29	20	45.4	3.28
Rocky Run	3	87	18	46	67.3	4.20	10	78	29	17	47.3	4.06
Madison	3	85	19	62	70.9		......	......	......	......	......	......
Baraboo	3	90	30	45	69.6	7.35	10	76	29	20	49.6	5.63
Beloit	3	86	30	45	68.0	5.23	7, 9	74	29	20	47.2	2.65
Plymouth	3	88	18	48	67.1	11.30	9, 10	80	29	23	46.3	3.70
Odanah	......	......	......	......	......	......	6, 9	76	30, 31	26	43.7	......
MINNESOTA.												
Beaver Bay	16	80	30	40	60.7	3.53	17	66	30	24	44.5	1.05
Afton	1	88	18	45	65.4	......	......	......	......	......	......	......
St. Paul	3	84	18	47	67.8	1.90	6	79	29, 30	22	47.0	2.30
Minneapolis	3	88	30	47	68.4	......	6	86	30	19	47.6	2.65
Forest City	9, 16	86	30	43	67.2	2.74	6	84	29	18	48.8	0.66
Sibley	2	88	30	40	68.9	8.01	6	86	29	18	49.4	4.52
New Ulm	1, 2, 9	91	30	50	71.7	2.51	6	87	29	22	51.5	3.11
IOWA.												
Clinton	......	......	......	......	......	......	6	78	29	22	51.7	4.00
Lyons	14	82	18	54	74.5	7.00	6	78	29, 30	28	51.9	4.07
Davenport	3	88	30	52	69.8	3.68	7	75	29	25	49.3	2.67
Dubuque	3	91	30	50	70.3	4.17	9	77	29	21	50.6	3.77
Muscatine	3	92	19	44	70.8	4.28	8	77	29	22	50.4	3.63
Fort Madison	2	91	19, 30	47	72.7	6.63	7	84	29	23	54.1	2.73
Monticello	14	94	30	44	73.1	5.62	......	......	......	......	......	......
Guttenberg	9	88	30	46	......	......	9	78	29	16	47.6	......
Ceres	3	90	30	50	69.9	......	6	74	29	14	48.7	......
Manchester	3	88	30	44	68.2	3.44	6	78	29	18	48.1	5.72
Mount Vernon	3	90	30	47	70.3	......	6, 8	78	29	24	50.5	......
Iowa City	3	90	30	44	72.6	3.65	8, 10	82	29	25	53.9	6.35
Independence	13	97	19	36	70.6	6.80	6	86	27	10	46.7	10.20
Waterloo	2, 3, 11	88	28, 29	52	69.0	......	6	80	29	16	51.0	......
Iowa Falls	2	86	19	50	73.5	2.87	5, 7	78	29	22	47.2	6.31
Des Moines	3	91	29, 30	48	70.7	2.75	6, 8	81	29	23	47.9	7.50
MISSOURI.												
St. Louis	10	94	30	53	75.5	2.60	11	80	29	30	57.3	3.33
St. Louis University	8, 10, 12	92	19	54	76.7	2.83	8	80	29	34	58.8	3.11
Athens	3, 4, 15	93	20	58	......	2.96	7	72	17	37	54.5	3.94
Canton	2	97	19	51	74.0	7.42	7	87	29	21	55.8	3.96
Harrisonville	13	90	30	58	74.4	8.09	5, 6, 7, 8	80	29	26	56.6	0.72
Easton	13	92	30	50	73.6	4.78	7	83	29	25	56.7	2.81

Meteorology of 1865—Continued.

Places in States and Territories.	November. Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	December. Date.	Max. temp.	Date.	Min. temp.	Mean temp	Rain or melted snow.
PENNSYLVANIA—Continued.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Tioga	16, 17	70	12	18	40.1	2.85	4	66	16, 22	4	31.3	0.51
Fleming	17	67	12	17	39.6	1.36	4	65	16	1	30.8	2.51
Pennsville	15, 16	65	11	18	37.2	2.07	4	60	16	2	28.7	3.57
Connellsville	17	67	12, 28	20	39.6	......	3	70	15	1	35.7	......
Canonsburg	17	66	11, 12	20	38.4	0.70	3, 4, 26	58	15	0	32.5	2.90
MARYLAND.												
Woodlawn	17	78	11	23	45.5	2.82	4	68	16	11	37.1	6.00
Annapolis	17	65	12	28	46.5	3.66	4	69	16	11	38.7	5.43
St. Inigoes	16, 17	71	8	33	48.1	5.55	4, 27	70	16	14	40.1	4.31
Frederick	......	......	......	......	......	......	4	66	16	1	34.0	4.10
Catonsville	......	......	......	......	......	......	27	59	16	10	33.1	......
DIST. OF COLUMBIA.												
Washington	17	72	12	27	46.1	2.22	4	69	16	12	38.3	5.29
WEST VIRGINIA.												
Cabell C. H.	3	78	16, 23	8	37.5	6.20	3, 4	69	23	5	40.1	......
Weston	16, 17	70	12	23	43.2	......	......	......	......	......	......	......
VIRGINIA.												
Wythesville	1, 16, 17	63	8, 28	21	41.4	......	3	64	15	8	39.6	......
GEORGIA.												
Atlanta	19	78	30	27	51.8	4.53	3	75	15	19	47.9	8.66
TEXAS.												
Austin	15	83	6	36	58.1	1.49	3	82	14	18	48.0	0.95
MISSISSIPPI.												
Natchez	16, 17	75	6	32	56.4	2.70	3, 4, 25, 26	76	14, 15	22	52.5	6.30
ARKANSAS.												
Helena	......	......	......	......	......	......	2	79	14	13	45.5	5.22
TENNESSEE.												
Clarksville	16	70	6	27	47.5	1.22	3	74	14	8	40.4	9.76
KENTUCKY.												
Louisville	16	67	27	22	45.1	1.25	3	72	14, 15	6	37.7	7.90
Chilesburg	16	70	6, 21	26	48.2	0.59	3	70	15	4	38.3	8.94
Danville	16	72	6	28	46.5	0.65	3	72	14, 15	8	39.8	8.63
London	17	75	6	21	45.8	......	......	......	......	......	......	......
OHIO.												
Austinburg	16	70	11	20	38.5	1.65	3	56	16	—2	28.1	3.00
Saybrook	16	69	11	16	40.6	2.25	12	58	16	1	30.9	4.55
New Lisbon	16	65	11, 13	22	39.5	1.03	4	68	15	5	33.6	2.03
East Fairfield	16, 17	64	11, 12	23	40.9	0.79	3, 4	62	15, 16	5	32.9	1.61
Steubenville	......	......	......	......	41.5	0.86	......	......	......	—5	35.4	3.31
Welshfield	16	69	11	20	40.1	2.05	3	57	15, 23	2	31.3	3.81
Milnersville	17	66	8	18	......	......	4	60	23	0	30.0	3.02
East Cleveland	16	70	11	16	41.2	0.86	12	61	15	3	32.8	3.71
Wooster	16	71	28	18	38.4	......	12	60	23	—4	41.4	......
Gallipolis	16	70	28	24	42.2	1.00	3	75	23	9	40.2	5.13
Kelley's Island	16	61	11, 12	32	42.8	0.43	3, 4	52	23	6	31.6	3.26
Norwalk	16	72	11, 12, 28	23	39.7	0.50	4	59	23	—2	30.6	2.81
Westerville	16	70	11, 20, 27, 28	24	40.0	......	3	63	15	1	33.0	4.11
Kingston	16	73	12, 28	22	41.5	0.51	3	72	15	4	35.7	3.10
Toledo	16	67	28	26	41.1	0.31	11	51	28	10	29.9	3.56

Meteorology of 1865—Continued.

Places in States and Territories.	November. Date.	November. Max. temp.	November. Date.	November. Min. temp.	November. Mean temp.	November. Rain or melted snow.	December. Date.	December. Max. temp.	December. Date.	December. Min. temp.	December. Mean temp.	December. Rain or melted snow.
OHIO—Cont'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Marion	16	68	28	21	38.9	0.57	3	58	23	— 1	31.1	3.60
Urbana University	16	71	12, 21	22	38.6	0.73	4	64	14, 15	1	31.3	3.20
Hillsborough	16	69	6, 12, 28	28	41.7	0.58	3	68	15	4	33.7	4.49
Ripley	15	79	12	30	45.7	0.64	2, 3	68	15	9	40.0	3.73
Bethel	16	71	12, 27	25	41.4	0.75	3	71	15	4	36.1	4.38
Cincinnati	16	75	8, 12, 24, 28	28	43.3	0.56	3	69	14	5	37.0	3.89
College Hill	16, 17	70	11	29	42.8	0.28	......	......	......	......	......	......
Farmers' School	15	70	8, 11, 13, 20, 24	26	40.5	0.30	3	70	15	3	32.9	4.88
MICHIGAN.												
Monroe	16, 17	66	12	25	39.1	0.01	3	55	23	— 2	30.5	1.86
State Ag. College	16	66	24, 27	23	38.6	0.68	11	46	23	— 5	26.7	1.43
Homestead	15	60	26	24	38.6	......	11	47	23	— 5	25.0	......
INDIANA.												
Vevay	16	78	8, 12, 13	24	44.1	1.25	3	76	15	4	36.7	6.70
Richmond	16	68	27	20	37.8	0.73	2, 3	58	14, 15	1	31.4	4.40
Spiceland	16	68	7, 21	24	41.0	0.80	2, 3	58	14	— 1	30.0	4.10
Madison	16	74	27, 28	30	......	......	......	......	......	......	......	......
Columbia City	13, 15, 16	72	29	18	40.4	0.35	3	58	23	—12	27.0	2.73
Indianapolis	15, 16	65	7, 27	22	39.3	......	3	60	14	— 1	30.6	......
New Harmony	15, 16	63	7, 27	27	44.6	0.21	3	70	14	5	34.8	5.84
ILLINOIS.												
Chicago	16	60	5, 27	20	37.3	......	11	42	21	—12	20.5	......
Evanston	15	65	5	30	43.7	0.32	7	49	21	— 9	24.9	......
Marengo	......	......	......	......	......	......	11	45	21	—11	21.5	......
Riley	13	64	27	18	38.2	1.23	......	......	22	—22	......	0.30
Aurora	13	58	5, 22	25	39.0	0.67	11	45	21	—15	22.2	0.60
Sandwich	13	62	7	21	37.5	0.37	11	45	21	—17	20.3	0.45
Ottawa	13, 16	65	7	25	40.1	0.49	11	49	21	—19	23.7	0.59
Winnebago	13	62	27	22	38.0	0.42	11	43	21	—17	19.0	0.74
Wyanet	12	67	5	22	41.8	0.28	11	50	21	—17	22.1	0.54
Tiskilwa	16	62	5	26	41.8	......	11	58	21	—12	24.1	......
Elmira	16	64	5	20	40.6	0.19	10	49	21	—18	22.8	0.40
Hennepin	13	66	5	25	42.0	......	11	48	21	—16	21.0	......
Peoria	16	65	5	26	42.8	0.31	11	50	21	— 9	25.5	1.08
Springfield	13	76	7, 11, 27	30	47.2	......	2	62	21	— 4	28.8	......
Dubois	17	68	7	23	44.4	0.35	10	57	14	— 2	30.5	5.75
Waverly	16	68	5, 7	22	41.8	0.00	11	55	21	—10	25.0	2.15
Galesburg	16	67	5	22	40.8	0.00	2	45	21	—14	21.7	1.00
Augusta	16	69	5	22	42.1	0.12	11	51	21	—16	23.8	1.25
Manchester	......	......	......	......	......	......	2	57	15, 21	— 7	25.3	1.63
WISCONSIN.												
Manitowoc	14	63	5, 7, 30	28	41.1	0.54	10, 11	44	15	— 8	24.2	0.77
Milwaukee	15	65	5	28	42.7	0.41	10	44	15	— 8	23.9	......
Ripon	15	61	5	23	40.1	......	10	43	15	— 9	22.2	......
Geneva	13, 14	59	5	24	......	......	......	......	......	......	......	......
Delavan	13	60	26	22	37.6	0.10	11	45	15	—11	19.7	0.32
Waupacca	14	64	5, 27	25	39.4	......	11	44	15	—11	21.1	0.11
Weyauwega	13, 15	62	5	21	39.3	0.10	26	50	15	—15	22.0	......
Embarrass	15	64	27	22	37.5	0.84	2	44	15	—16	19.2	0.85
Rocky Run	14	62	5, 9	23	37.1	0.38	10	45	15	—12	21.4	0.38
Baraboo	13, 15, 16	64	5, 26	24	41.8	1.66	3	46	14, 21	— 4	23.3	0.85
Beloit	14	60	26	19	37.1	0.10	10	45	21	—20	20.5	1.40
Plymouth	15	61	4, 5, 7, 18, 27, 30	25	38.5	0.40	10, 11, 25, 26	43	15	—13	21.0	0.80
Odanah	......	......	......	......	......	......	3	40	15, 22	— 6	......	......
MINNESOTA.												
Beaver Bay	13	58	27	25	39.8	0.33	25	42	20	—16	13.7	0.77
Afton	14	64	27	11	37.7	......	10, 24	37	21	—32	10.6	......
St. Paul	15	63	27	18	37.0	0.23	10	36	21	—26	10.3	2.19
Minneapolis	15	67	5	15	36.8	0.63	10	41	21	—33	8.0	2.28
Forest City	15	66	5	14	36.6	0.50	9	44	15	—30	12.0	1.70
Sibley	15	66	27	15	38.3	0.62	24	37	22	—26	......	0.70
New Ulm	15	71	27	18	40.0	0.31	10	42	21	—22	11.8	0.99

Meteorology of 1865—Continued.

Places in States and Territories.	NOVEMBER.						DECEMBER.					
	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.	Date.	Max. temp.	Date.	Min. temp.	Mean temp.	Rain or melted snow.
IOWA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Clinton	15, 16	65	27	20	39.6	1.00	25	46	21	—20	21.0	2.20
Lyons	14	64	4	26	40.4	0.42	11	52	14	— 8	20.3	......
Davenport	17	69	5	22	39.3	0.24	11	43	21	—15	20.4	0.40
Dubuque	14	63	27	25	40.9	0.20	10	44	21	—18	20.8	1.04
Muscatine	16	64	27	17	36.5	0.20	11	44	21	—17	21.0	0.62
Fort Madison	16	65	5	21	42.1	0.28	1	51	21	—15	25.1	1.11
Guttenberg	16	64	27	21	38.5	0.41	10	45	21	—21	17.5	......
Ceres	15	63	5, 27	22	36.3	......	11	42	21	—22	17.3	......
Manchester	14	64	27	12	36.5	0.89	25	42	21	—27	17.7	0.46
Mount Vernon	14	63	5	22	39.5	......	11, 25	44	21	—18	19.0	......
Iowa City	13	66	5	20	42.6	0.25	11	50	21	—17	21.0	0.32
Independence	16	67	27	13	36.4	0.80	25	44	21	—27	14.0	1.00
Waterloo	16	66	5, 27	18	40.2	......	11, 25	46	20	—13	18.6	......
Iowa Falls	14, 16	62	5	18	37.8	0.03	10	38	22	—12	17.1	1.17
Des Moines	16	67	5	17	40.2	0.25	1	50	21	—22	19.2	......
Clarinda	......	......	......	......	......	......	1, 4, 28	48	21	— 9	26.0	0.81
MISSOURI.												
St. Louis	8	70	5	27	47.1	0.00	2	62	21	1	30.4	3.63
St. Louis University	8, 16	70	5	28	49.1	0.08	2	64	21	2	32.2	2.80
Athens	16	63	6	28	46.2	2.75	11	60	21	—10	27.0	0.75
Canton	16	69	5	19	40.6	......	1	50	21	—19	22.4	1.22
Harrisonville	8, 16	68	5	20	46.8	0.04	1	56	21	— 7	24.6	1.03
Easton	16, 23	69	2, 26, 29	25	46.5	0.01	1	56	21	—12	22.8	1.80
KANSAS.												
Olatha	8, 23	69	5	20	44.4	......	1	57	21	— 9	22.7	1.76
Atchison	10, 11	74	5	18	44.3	......	3	50	14, 15	— 8	21.2	......
Fort Riley	23	72	2, 27	26	48.3	......	1	56	13, 15	— 7	21.2	1.25
NEBRASKA.												
Elkhorn	23	67	5	17	41.9	......	1	56	21	—20	15.7	0.63
Bellevue	12, 15	68	5	24	45.2	......	1	52	21	—15	16.3	1.39
UTAH.												
Great Salt Lake City	22	71	1	22	45.2	4.22	1	42	15	6	23.0	6.69
St. George	15	72	30	27	......	0.25	20	68	29	5	......	1.30
St. Mary's	21	66	1, 27, 28	16	40.5	......	24	36	14, 15	—14	14.5	......
CALIFORNIA.												
San Francisco	4, 5	70	24	44	55.8	3.27	10, 24	57	18, 19	35	45.0	0.76
Sacramento	4	74	26	45	56.9	2.43	10	58	19	31	45.0	0.76
Monterey	2	82	23, 25	40	56.7	1.78	8	58	19	31	47.0	1.36
Meadow Valley	5	65	11	27	43.9	......	8, 9, 10, 27	47	4	7	31.5	1.70
Nevada City	6	68	24	46	45.5	......	......	......	......	......	......	......
WASHINGTON.												
Neeah Bay	9, 12	58	15, 23, 24	36	46.2	27.60	7	50	12	22	35.5	14.00
OREGON.												
Albany	......	......	......	......	......	14.43	......	......	......	......	......	12.25
NEVADA.												
Star City	7	68	28	22	44.0	......	9	48	14, 15, 18	2	20.5	5.50

INDEX.

A.

N.

O.