Perspectives on Wheat Yield Losses Due to Weeds in North America

Michael L Flessner[1], J Anita Dille[2], Peter H Sikkema[3], Ian C Burke[4], Wesley J Everman[5], and Mark J VanGessel[6]

[1]Virginia Tech, [2]Kansas State University, [3]University of Guelph, [4]Washington State University, [5]North Carolina State University, [6] University of Delaware

Introduction:

- Weeds are one of the most significant threats to crop production in North America. Crop losses in yield and quality due to weed interference, as well as costs of controlling weeds, have a significant economic impact on crop production.
- Canada and the United States (US) account for 4.0 and 8.9%, respectively, of the world's wheat production (2.46 billion bu) (FAO Stat 2019).
- WSSA Weed Loss Committee has generated reports in 1984 (Chandler et al.) and 1992 (Bridges) that summarized crop losses due to weeds across the US and Canada.
- Chandler et al. (1984) reported an estimated 9 to 20% wheat yield loss with an average of 13% across US and 5 to 15% wheat yield loss across Canada due to weeds.
- Bridges (1992) reported 1 to 20% wheat yield loss due to weeds across the US using current management (i.e. Best Management Practices (BMPs) with herbicides). BMPs but no herbicides resulted in 3 to 60% wheat yield loss.
- These data have been useful to highlight the continued need for weed science research in wheat.

Objective:

- To report potential wheat yield and economic losses due to weeds in the US and Canada.

Table 1. Percent of production sampled.

	Winter Wheat	Spring Wheat
US	48.9%	46.1%
Canada	63.1%	0.0%
Total	47.7%	20.0%

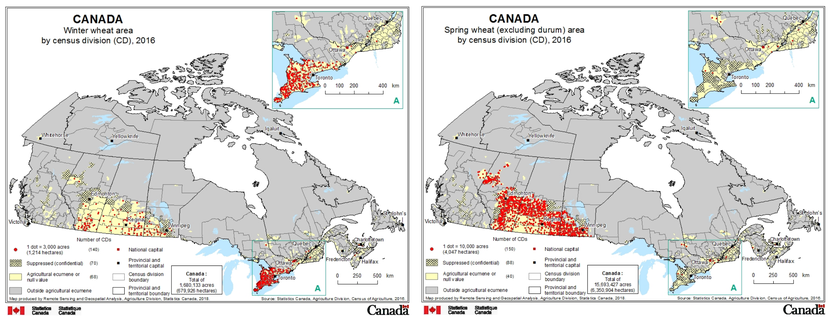
Methods:

- Requests for data were sent to research and/or extension weed science specialists in 2013 and 2014. Each specialist was asked to provide results of up to 10 individual studies conducted within a year during the period of 2007 to 2013 on weed control in both winter and spring wheat. Data were also obtained from weed control research reports for several states and provinces.
- Information requested:
  - **Weedy yield** = average yield from the nontreated weedy plot (yield using BMP but no weed control)
  - **Weed-free yield** = average yield from a herbicide control plot with > 95% control for each weed species (yield with BMP and excellent weed control)
- Yield loss (%) was determined for each individual study, then averaged within a year, and averaged across the seven years for each state or province:

$$Yield\ Loss\ (\%) = \frac{(weed\text{-}free\ yield - weedy\ yield)}{weed\text{-}free\ yield} \times 100$$

- State- and province-level data for total winter and spring wheat acres harvested, average wheat yield (bushels/acre), as well as total production (bushels) and yearly average commodity prices (US $/bushel) were obtained from USDA-NASS and Statistics Canada reports.
- Average commodity price for the period of 2007 to 2013 was US $5.68/bushel for winter wheat and US $ 6.38/bushel for spring wheat and used to determine potential loss in value due to weeds.

Winter Wheat **Spring Wheat**



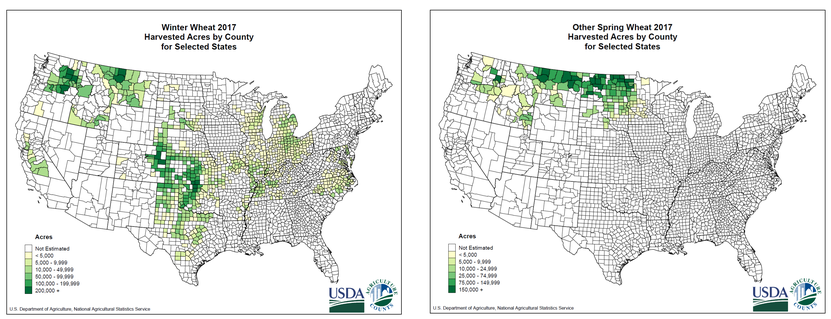


Figure 1. Distribution of winter and spring wheat acres harvested in the United States (2017) and in Canada (2016). Images and data from USDA-NASS and Statistics Canada, respectively.

Table 2. Potential winter wheat yield and monetary loss due to weeds for each state or province that provided data for the period of 2007 to 2013. Harvested acres, average yield, and yearly average commodity price were obtained from USDA-NASS and Statistics Canada reports.

Region state or province	Acres harvested	Average yield	Yield loss	Potential loss in production	Potential loss in value (US$ 5.68/bu)
	(ac)	(bu / ac)	(%)	(bu)	(US $)
Northern Plains					
Kansas	8,427,273	40	25.8	87,845,154	498,960,476
Nebraska	1,421,818	44	34.0	21,358,294	121,315,111
South Dakota	1,262,727	47	34.4	20,494,752	116,410,194
Corn Belt					
Missouri	714,545	54	5.3	2,058,800	11,693,986
Ohio	675,455	68	8.3	3,822,459	21,711,565
Lake States					
Michigan	550,455	75	3.0	1,235,363	7,016,862
Ontario	1,040,182	76	2.9	2,262,291	12,849,815
Appalachian					
Tennessee	360,000	62	30.1	6,762,214	38,409,374
North Carolina	588,182	52	23.0	7,096,168	40,306,232
Mountain					
Montana	2,126,364	42	32.0	28,407,542	161,354,836

Table 3. Potential spring wheat yield and monetary loss due to weeds for each state or province that provided data for the period of 2007 to 2013. Harvested acres, average yield, and yearly average commodity price were obtained from USDA-NASS and Statistics Canada reports.

Region state or province	Acres harvested	Average yield	Yield loss	Potential loss in production	Potential loss in value (US$ 6.38/bu)
	(ac)	(bu / ac)	(%)	(bu)	(US $)
Mountain					
Idaho	493,636	77	36.7	14,027,769	89,497,168
Montana	2,537,273	31	28.6	22,344,060	142,555,102
Northern Plains					
South Dakota	1,213,182	42	26.8	13,765,239	87,822,224
Lake States					
Minnesota	1,410,909	56	47.0	36,949,883	235,740,252

Summary:

- On average, weeds cause **22.4%** yield loss in winter wheat across North America and **35.3%** yield loss in US spring wheat when using BMPs but no herbicidal weed control.

Table 4. Potential production and monetary losses due to weeds for North America.

	Winter Wheat		Spring Wheat	
	(bu)	(US $)	(bu)	(US $)
US	385,548,909	2,189,917,806	189,051,037	1,206,145,613
Canada	15,301,000	86,909,680	---	---
Total	400,849,909	2,276,827,486	---	---

Acknowledgements:

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References:

- Bridges DC (1992) Crop losses due to weeds in the United States – 1992. WSSA special publication, Champaign, IL.
- Chandler JM, Hamill AS, Thomas AG (1984) Crop losses due to weeds in Canada and the United States. WSSA special publication, Champaign, IL.
- [FAO] Food and Agriculture Organization of the United Nations (2019) www.faostat.fao.org/
- Statistics Canada (2016) www.statcan.gc.ca
- [USDA-NASS] National Agricultural Statistics Survey (2017) www.nass.usda.gov