

Plant-Back Restrictions: What Do They Really Mean?
(Spoiler Alert: They Are Not Always There to Protect Your Crop)

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ABSTRACT: The Environmental Protection Agency recently became aware of misperceptions about the purpose for plant-back intervals (PBI), or plant-back restrictions, on pesticide labels and uncertainty why PBIs are not better described in regards to “cover crops.” In many cases, end users believe that PBIs are on labels to inform concerns over phytotoxicity to the planted crop following a pesticide application. EPA’s focus in setting rotational crop PBIs is to ensure that label instructions are supported by the established tolerances and to include all residue sources (from applications within current and previous growing seasons) when assessing human dietary exposure. This poster describes how PBIs relate to cover crops versus rotational crops. For instance, if a “cover crop” is harvested for human consumption or grazed by or harvested and fed to livestock that will be consumed by humans, the Agency considers the “cover crop” to be a rotational crop and labeled PBIs should be followed. Because of the potential dietary exposure and tolerance issues, PBIs are imposed as a mandatory requirement on labels. PBIs may be imposed as label requirements for any pesticide type, not just herbicides. However, if a “cover crop” is not harvested for human consumption or is not grazed by or fed to livestock that will be consumed by humans (e.g., planted for erosion control) then there is no risk associated with dietary exposure. When a “cover crop” has no dietary exposure, end users can conduct bioassays to assess phytotoxicity concerns to determine if crop injury will occur if the cover crop is planted prior to the PBI on the label. This poster will also provide additional information about the Agency’s data requirements for establishing PBIs.

SITUATION: State FIFRA Issues Research and Evaluation Group (SFIREG) recently submitted an issues paper asking the Environmental Protection Agency (referred to as the Agency or EPA) to provide clarity over plant-back intervals (PBI) or plant-back restrictions and cover crops. Based on their request of the Agency, it became apparent that the Agency’s intended purpose of PBIs may not be well understood by end-users and possibly even some university researchers and extension personnel. For instance, some of the following statements were found in extension literature available online:

- “...labels list the longest plant-back restriction where herbicide companies can be confident potential herbicide carry-over effects are negligible...”
- “...The crop rotation interval is required for two main reasons, first, a rotation interval that ensures potential herbicide residues in the soil will not affect plant establishment, and second, it ensures there are no unsafe levels of herbicide in plant tissues...” (While this statement has correct information, the emphasis should be on the “no unsafe levels of herbicide in plant tissues” not “plant establishment.”)

The objective of this poster is to inform pesticide users about: differences between rotational crops and cover crops when determining a plant-back interval; differences between PBIs for human health concerns and phytotoxicity; and data the Agency requires for residues-/ tolerance-related concerns for human health versus what is needed to address phytotoxicity concerns.

Differences between a Rotational Crop and a Cover Crop

EPA's pesticide regulations do not define cover crop, but for the purpose of the poster, a working definition for a **cover crop** is *a crop planted to improve soil quality, reduce soil erosion, reduce water quality degradation, and to manage weeds, insect pests, and/or plant diseases. A cover crop can be used for food and/or feed purposes if labeled rotational crop plant-back intervals are followed.* A working definition for a **rotational crop** is *a crop planted following application to a treated crop and used for food and/or feed. Rotational crops may include cover crops if the cover crop is used for food and/or feed and labeled plant-back intervals are followed.*

Plant-back Intervals on Label

EPA's focus in setting rotational crop plant-back intervals is to prevent tolerance-related issues in plant and livestock commodities and to include all residue sources when assessing human dietary exposure. Therefore, cover crops that are used for food/feed purposes must follow the labeled plant-back intervals.

Sometimes, registrants can choose to add more restrictive rotation instructions and/or phytotoxicity statements on labels; however, these statements must meet the minimum residue-based plant-back intervals set by EPA. Since label restrictions based on phytotoxicity are typically determined by the registrant, it is possible that labels may be silent on phytotoxicity to rotational crops if the residue-based plant-back intervals are greater than those based on phytotoxicity.

Data Required for Establishing Plant-Back Intervals

To determine the appropriate plant-back intervals to prevent illegal tolerance-related residues, EPA requires registrants to conduct and submit specific residue chemistry guideline studies. These are Office of Chemical Safety and Pollution Prevention (OCSPP) Guideline 860.1850 Confined Accumulation in Rotational Crops and OCSPP Guideline 860.1900 Field Accumulation in Rotational Crops. See 40 Code of Federal Regulations (CFR) Part 158, Subpart O.

Labeled plant-back intervals are based on the available rotational crop residue data. Labels may not specify plant-back intervals for certain crops if the available data does not support rotation to those crops. The Agency assumes that the registrant will provide sufficient rotational crop data to make the product desirable to growers and does not generally require the submission of data to support rotation to certain cover crops or intervals. Registrants can establish any interval for a specific crop if data following the protocols in the residue chemistry guideline studies are submitted and provided the risk assessment supports the said intervals. Registrants may establish longer plant-back intervals than the residue-based intervals if they feel it is necessary, for example, due to phytotoxicity concerns.

Options for PBIs when Planting Crops Not Specified on the Label or Grazing Non-food animals

The intent of PBIs on labels is to prevent illegal tolerance-related residues for dietary exposure concerns. Therefore, when planting a cover crop that will not be harvested for human consumption or fed to animals that will be consumed by humans, individuals should consult the registrant about potential phytotoxicity concerns.

Phytotoxicity or germination effects will depend on the pesticide(s) used previously and how much time has elapsed since the application. The chemical-physical properties, persistence of each pesticide, and environmental conditions will determine how long pesticidal activity remains in the field. Some registrants do encourage bioassays and include bioassay instructions on labels. In cases where labels do not discuss conducting a bioassay, the Agency encourages growers to consult with the registrant for information on phytotoxicity concerns or how to conduct bioassays to test for potential phytotoxicity prior to planting a cover crop to reduce the likelihood of damage occurring.

Other Points to Consider about Plant Back Intervals

In areas where rice and crawfish are grown, crawfish would be a rotational crop. Many pesticides have statements stating that the product cannot be used on fields where crawfish are grown. This statement may not be on the label because the product is toxic to crawfish, but rather, the registrant has not submitted the necessary data to determine if residues are present, which may require establishing a tolerance

It is important to note that, while the bulk of the concerns for residue testing appear to revolve around herbicides and phytotoxicity, plant-back intervals are equally important for insecticides, fungicides, plant growth regulators, and other pesticides to prevent illegal residues and associated human health exposure concerns.

Example: Applying Cover Crop Label Language

Ultimately, whether or not a cover crop can be planted into a treated field depends on several primary factors: 1) the type of cover crop; 2) will the cover crop be used for feed or food purposes; and 3) when was the pesticide application made to the previous crop, relative to planting the new crop. The following is an example of how growers can determine if a cover crop can be planted into a treated field.

The example below is based on an herbicide for use in cotton. However, similar considerations apply to all pesticides because the plant-back intervals refer to residue concerns related to tolerance enforcement and potential exposure from humans consuming food or meat from livestock fed vegetation that was planted after a previous crop received an application of the pesticide in question.

According to the example label, the herbicide has 4 different plant-back intervals: 3 months/90 days for wheat; 8 months/240 days for field/sweet corn and peanuts; 9 months/270 days for rice, grain, sorghum and soybean; or 12 months/365 days for all others not listed (Figure 1). The application timing ranges from 75 days before planting up to 60 days before harvest.

Plantback intervals for the following crops in areas oth

- 3 months for wheat
- 8 months for field corn, sweet corn, and peanuts
- 9 months for rice, grain, sorghum and soybeans
- 12 months for all other crops not listed above

Figure 1. Plant-back intervals identified on the example label.

As mentioned, the date of the last application is important in determining how long a grower must wait to plant a cover crop after applying an herbicide to cotton. Below are example calculations for determining when a plant-back interval has been met using the label requirements.

Example A. Grower wants to rotate to wheat which has a 90-day plant-back interval (above)

Application: herbicide applied 75 days before planting cotton

- 255 days have elapsed between application and cotton harvest*
- Wheat can be planted since 90 days have elapsed since application

Example B. Grower wants to rotate to tomato, which has a 365-day plant-back interval (above)

Application: herbicide applied 75 days before planting cotton

- 255 days have elapsed between application and cotton harvest*
- Tomato can be planted 110 days after cotton is harvested (365-day plant-back interval – 255 days for cotton crop = 110 days)

* cotton takes 150-180 days from planting to harvest¹. For the example, 180 days is used --- 75 days before planting + 180 days for cotton to be harvested = 255 days.

Another consideration that is of interest is how the phytotoxicity or “crop safety” fits into the decision on what cover crops can be planted. The example label does not have information about crop safety; therefore, hypothetical durations were developed for the purposes of discussion. It is assumed that when labels do not have this information, growers would conduct germination tests to see if the desired plants would be injured after a given number of days following a pesticide application. For this hypothetical discussion, the days required for “crop safety” range from 90 to 120. Similar calculations would be conducted as above, but the number of days used for plant-back intervals would be replaced with number of days needed for crop safety. It is worth noting that the Agency does not review information on crop safety as it relates to rotational crop intervals, so any labels that have this information would have been added at the discretion of the registrant.

¹ National Cotton Council. Undated. Cotton: from field to fiber. Available at: <https://www.cotton.org/pubs/cottoncounts/fieldtofabric/crops.cfm>

Table 1 describes the interaction of the cover crop planted, plant-back interval and phytotoxicity concerns for the cover crop plant. Using the crop maturity profile of cotton (180 days) to provide estimates and when the application of the herbicide occurred, there could be as few as 60 days between application and harvest/planting or as many as 255 days. The plant-back restrictions range from 90 to 365 days and the hypothetical number of days required to ensure crop safety range from 90 to 120. The table also assumes planting of the cover crop would occur the day of harvest, so additional time could be added to the “interval between application and harvest” when considering field work required for preparing the field for planting.

With this information, one can estimate a range of times describing the period between the application and harvest. In the table below, depending on when the application occurred, nearly all non-food/non-feed cover crops are acceptable. However, there were examples that did not allow the planting of certain cover crops (i.e., wheat or “grains”) immediately after harvest following a late application because only 60 days would have lapsed, and there are “hypothetical” phytotoxicity concerns until 120 days after application. Therefore, a grower would need to wait another 60 days before there are no phytotoxicity concerns.

Application timing is a large factor in determining when and what type of cover crop can be planted following a pesticide application in the previous crop. The earlier an application is made, the more likely that crop safety and plant-back issues are not problematic because the pesticide has more time to breakdown. Conversely, the later the application, the less time there is for the pesticide to breakdown and the more likely an application may result in an issue with plant-back intervals and/or crop safety. There may be some species of cover crop that may have crop safety concerns that may not have plant-back restriction concerns and the registrant may extend the EPA-required plant-back interval or leave that particular crop off the listed crops so that it falls under the “other crops” category that require a 365-day plant-back interval, the maximum interval based on required residue data. The Agency only requires plant-back intervals for purposes of tolerance enforcement and to be protective for human dietary risk; label language concerning phytotoxicity is developed by the registrants.

Table 1. Determining an Accepting Plant Back Interval Using Hypothetical Cotton and Phytotoxicity Scenarios.

Rotated Cover Crop (CC)	Plant-Back Interval (PBI) (days)	Hypothetical Phytotoxicity / (germination tests) (days)	Interval Between Application and Harvest/Planting (days)	Can CC be planted after the phytotoxicity data indicates it is "safe" ² ?	
				Non-Food/Non-Feed	Food/Feed
Earliest possible application - 75 days before planting					
wheat ³	90	120	255 ¹	Yes - because it is non-food/non-feed use, residues are not a concern	Yes - there would be 255 days that passed since the application and only 90 were needed to ensure there are no residues of concern
"grains"	270	120	255	Yes - because it is non-food/feed use, residues are not a concern	No - even though phytotoxicity tests indicate it is "safe" for the desired cover crop, residue data indicate 270 days are required but only 255 days lapsed. However, accounting for time to prepare the field - it is reasonable that a grower could wait 15 days to adhere to the PBI.
clover (or "all other crops")	365	90	255	Yes - because it is non-food/non-feed use, residues are not a concern	No - even though phytotoxicity tests indicate it is "safe" for the desired cover crop, residue data indicate 365 days are required but only 255 days lapsed.
Latest possible application - 60 days before harvest					

¹ 75 [days before planting based on the label] + 180 [days between planting and harvest].

² During a period of time of 365 days after an application.

³ In this example, the PBI is less than the phytotoxicity interval; therefore, the registrant should be aware of the phytotoxicity and would likely establish a PBI that was protective of residue and tolerance concerns as well as phytotoxicity.

Rotated Cover Crop (CC)	Plant-Back Interval (PBI) (days)	Hypothetical Phytotoxicity / (germination tests) (days)	Interval Between Application and Harvest/Planting (days)	Can CC be planted after the phytotoxicity data indicates it is "safe"²?	
				Non-Food/Non-Feed	Food/Feed
Wheat³	90	120	60	No – only 60 days lapsed and there needs to be 120 days lapse before there are no crop safety issues. Registrants would provide this information on the label, but the Agency would not require this.	No - residue data indicate 90 days are required but only 60 days lapsed; additionally, there is a crop safety issue until 120 days after application.
"grains"	270	120	60	No – only 60 days lapsed and there needs to be 120 days lapse before there are no crop safety issues. Registrants would provide this information on the label, but the Agency would not require this.	No - residue data indicate 270 days are required but only 60 days lapsed
clover (or "all other crops")	365	60	60	Yes - because it is non-food/non-feed use, residues are not a concern	No - even though phytotoxicity tests indicate it is "safe" for the desired cover crop, residue data indicate 365 days are required but only 60 days lapsed.