

## Herbicide Carryover Injury to Cover Crops

### Staff Contact:

**Stefan Gailans** – (515) 232-5661  
[stefan@practicalfarmers.org](mailto:stefan@practicalfarmers.org)

**Sarah Carlson** – (515) 232-5661  
[sarah@practicalfarmers.org](mailto:sarah@practicalfarmers.org)

### Cooperators:

• **Meaghan Bryan** – Iowa State University  
Department of Agronomy – [mjbryan@iastate.edu](mailto:mjbryan@iastate.edu)

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### Web Link:

[http://bit.ly/pfi\\_fieldcrops](http://bit.ly/pfi_fieldcrops)

### In a Nutshell

- Increased adoption of cover crops in corn-soybean production systems has led to concerns of injury to cover crops by carryover activity of commonly applied herbicides.
- Four cover crop species were sown into plots with standing corn where one of seven common herbicides had been applied in spring.
- **Key findings:**
  - Of the four cover crop species studied, winter cereal rye was the least affected by the herbicides included. Only the 2x rate of Dual II Magnum™ injured the rye.
  - Farmers will want to avoid using the herbicides Balance Flexx™, Corvus™, and Hornet™ when looking to establish hairy vetch, lentil, and/or radish as cover crops.
  - Atrazine, Callisto™, and Laudis™ resulted in no significant injury to any of the cover crop species studied.



*A hairy vetch seedling exhibiting bleaching symptoms from a Group 27 herbicide. Photo courtesy of Meaghan Bryan - Iowa State University.*

### Background

Adoption of cover crops in corn-soybean rotations is on the rise in the Corn Belt. This has led to concerns about the carryover effect of herbicides commonly used in these rotations on the successful establishment of cover crops later in the growing season. The best current advice is for farmers to abide by suggested crop rotational intervals on herbicide product labels (Curran and Lingenfelter, 2012). These herbicide labels, however, do not often list species that are commonly used

as cover crops. Practical Farmers of Iowa partnered with researchers from Iowa State University to conduct a trial among several common herbicides and cover crops to address this concern. The experimental site was located at an Iowa State University research farm near Ames. Corn was planted in mid-June 2013 with herbicides applied to plots the following day. Cover crops were hand-seeded to plots in mid-September and assessed for herbicide injury in early November.

The objective of this experiment was to determine any injury to late-summer-

planted cover crops caused by carryover activity of herbicides applied early in the season for corn production.

### Method

Plots measured 10 ft wide by 25 ft long with four replications of each herbicide x cover crop species combination established. Including control plots, there were 256 total plots. A timeline of events, herbicides applied, and cover crop species planted and evaluated are presented in **Table 1**.

Table 1

**Timeline of events, herbicides applied, and crop type**

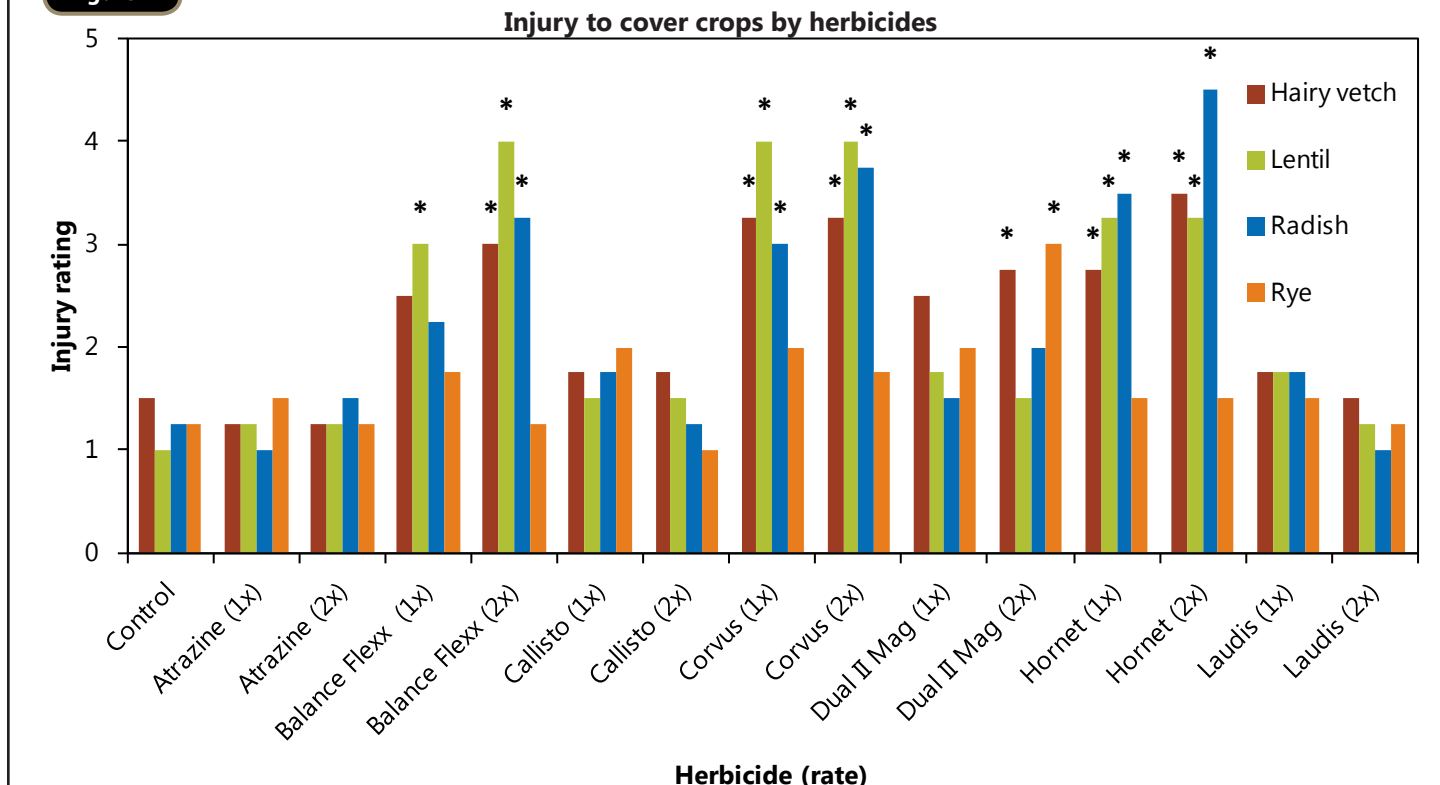
<b>Mid-June: Corn planted</b>	
<b>Mid-June: Herbicides applied at 1x and 2x their recommended rates</b>	
<b>Herbicide (active ingredient[s])</b>	<b>Site of action group(s)</b>
Atrazine	5
Balance Flexx™ (isoxaflutole)	27
Callisto™ (mesotrione)	27
Corvus™ (thiencarbazone + isoxaflutole mix)	2 and 27, respectively
Dual II Magnum™ (s-metolachlor)	15
Hornet™ (clopyralid + flumetsulam mix)	2 and 4, respectively
Laudis™ (tembotrione)	27
Control (no herbicide)	
<b>Mid-September: Cover crops hand-seeded to plots</b>	
<b>Cover crop species</b>	<b>Seeding rate (lb/ac)</b>
Hairy vetch	35
Lentil	50
Cover crop radish	15
Winter cereal rye	120
<b>Early October: Corn harvested</b>	
<b>Early November: Cover crop herbicide injury ratings scored</b>	
<b>Appearance</b>	<b>Rating</b>
No apparent damage	1
Slight damage (i.e., stunting)	2
Showing apparent symptoms (i.e., bleaching)	3
Significant damage	4
Visible dead plants	5

**Results and Discussion**

Injury to cover crops by herbicides is displayed in **Figure 1**. Herbicide injury to a cover crop species is compared to the same cover crop where no herbicide was applied early in the season (control).

Both rates of Corvus™ and Hornet™, and the 2x rate of Balance Flexx™, significantly injured hairy vetch, lentil, and cover crop radish compared to these cover crops' controls. Corvus™ and Balance Flexx™ share a common herbicide active ingredient, isoxaflutole. Researchers in Illinois have also observed injury to hairy vetch and radish from carryover activity of isoxaflutole herbicides (Corzatt and Bernards, pers. comm.). Product labels for Corvus™ and Balance Flexx™ suggest waiting 10-18 months before seeding alfalfa or canola to a field after applying these herbicides. The product label for Hornet suggests waiting 10 months before planting legumes and 26 months before planting canola to a field after applying this herbicide. As cover crops in this study were seeded within 4 months of herbicide application, damage caused by these herbicides to hairy vetch and lentil (legumes, similar to alfalfa) and radish (brassica, similar to canola) is not surprising.

Winter cereal rye was only affected by the 2x rate of Dual II Magnum™ compared to the control rye that received no herbicide. According to the product label, rye can be planted to a field 4.5 months after Dual II Magnum™ is applied. As the 1x rate of Dual II Magnum™ did not affect the rye in this study, the 2x rate likely contributed to increased persistence and carryover activity of the herbicide.

**Figure 1**

**Figure 1.** Herbicide injury ratings for cover crop species following corn harvest in Fall 2013.

'\*' indicates that injury is significantly different from the same cover crop species receiving the control (no herbicide) at  $P \leq 0.05$ .



Atrazine, Callisto™, Laudis™, and the 1x rate of Dual II Magnum™ did not affect any of the cover crop species relative to their controls. Laudis™ and Dual II Magnum™ are considered to have low carryover potential (Curran and Lingenfelter, 2012). The previously mentioned researchers in Illinois observed slight to no injury to hairy vetch and tillage radish by atrazine and mesotrione, the active ingredient in Callisto™, when three half-lives of the herbicides were simulated. The product label for Callisto™ suggests waiting 10 months before seeding alfalfa or canola and 4 months before seeding rye to a field after applying this herbicide.

Lentil and cover crop radish appeared to be the most susceptible to herbicide injury as they suffered the highest levels of injury compared to hairy vetch and winter cereal rye. Winter cereal rye was the least susceptible of the cover crop species to injury by the herbicides included in this study.

It should be noted that degradation of spring-applied herbicides in fields will vary among environments. For instance, soils with a pH above 7.0 can result in increased residual activity of some herbicides (Curran and Lingenfelter, 2012).

Carryover herbicide activity and subsequent injury to cover crops may reduce the cover crops' ability to scavenge nutrients and hold soil in the fall and also to survive through the winter. As much of a cover crop's benefits to a cropping system are realized in the following spring, it stands to reason that herbicide injury to cover crops suffered in the fall may deprive the farmer of potential benefits associated with cover crops.



**Above: An uninjured radish and rye plot in the herbicide injury to cover crops trial. Left-below: Rye seeded into standing corn. Right-below: radish with bleaching, a symptom of herbicide carryover damage. Photos courtesy of Meaghan Bryan - Iowa State University.**

## Conclusion

Farmers should take care in selecting an herbicide as part of their weed management program when also looking to incorporate hairy vetch, lentil, radish, or winter cereal rye into their cropping systems as cover crops. Farmers will want to avoid using the herbicides Balance Flexx™, Corvus™, and Hornet™ when looking to establish hairy vetch, lentil, and/or tillage radish as cover crops. Similarly, farmers will want to use caution when applying the herbicide Dual II Magnum™ in the spring prior to establishing winter cereal rye as a cover crop. Wrongly pairing a cover crop with a previously-applied herbicide could be the difference between successfully and unsuccessfully incorporating cover crops into a cropping system.



## PFI Cooperators Program

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If you'd like to be part of on-farm research in the future, contact:

**Stefan Gailans** – (515) 232-5661  
[stefan@practicalfarmers.org](mailto:stefan@practicalfarmers.org)

## References

Curran, W. and D. Lingenfelter. 2012. Herbicides and fall cover crop establishment. Available at <http://extension.psu.edu/plants/crops/news/2012/08/herbicides-and-fall-cover-crop-establishment> (accessed 19 May 2014). Penn State Univ. Extension.