

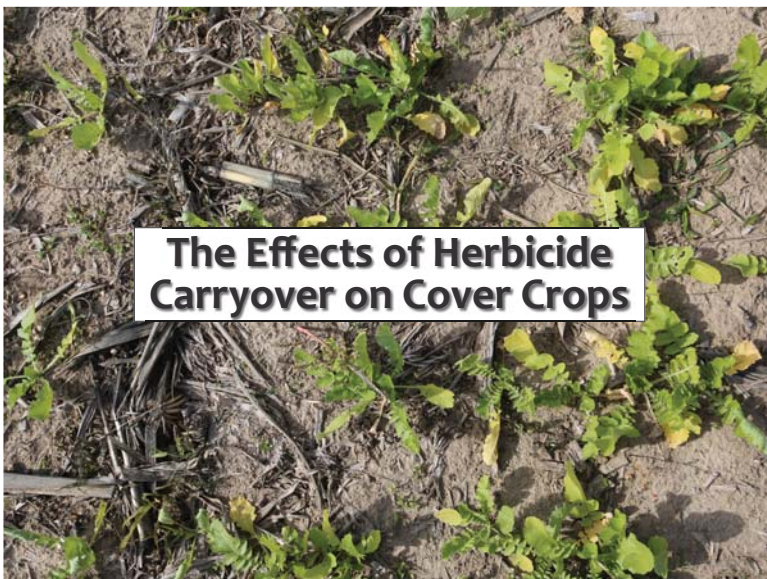
A Weed Scientist's Perspective on Cover Crops

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University of Missouri



From a weed scientist's perspective...

1. We must be able to effectively kill whatever cover crop species we are planting.
2. We must have a real understanding of what cover crops actually do for weed control.
3. We must know which corn or soybean herbicides are most likely to carryover and cause injury to cover crop species.



The Effects of Herbicide Carryover on Cover Crops

Influence of Soybean Herbicide Treatments on Fall Cover Crop Biomass (2013-2015)



■ No biomass reduction in any year
 ■ Biomass reduction in 1 of 3 years
 ■ Biomass reduction in 2 of 3 years

Herbicide Treatment	Rate	Cover Crop Species								
		Winter Wheat	Tillage Radish	Cereal Rye	Crimson Clover	Winter Oat	Austrian Pea	Annual Ryegrass	Hairy Vetch	
Spartan	8 fl ozs	Green	Green	Green	Green	Green	Red	Green	Green	
Valor	2.5 ozs	Green	Green	Green	Green	Green	Red	Green	Green	
Sencor	0.5 lb	Green	Green	Green	Green	Green	Green	Green	Green	
Authority First	6.4 ozs	Green	Green	Green	Green	Green	Green	Green	Green	
Classic	1.5 ozs	Green	Green	Green	Green	Green	Green	Green	Green	
Flexstar	20 fl ozs	Green	Green	Green	Green	Green	Red	Green	Green	
Cobra	12.5 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green	
Pursuit	4 fl ozs	Green	Green	Green	Green	Green	Red	Green	Green	
Firstrate	0.6 oz	Green	Green	Green	Green	Green	Green	Green	Green	
Synchrony XP	0.375 oz	Green	Green	Green	Green	Green	Green	Green	Green	
Dual II Magnum	1.33 pts	Green	Green	Green	Green	Green	Red	Green	Green	
Warrant	1.5 qts	Green	Green	Green	Green	Green	Red	Green	Green	
Zidua	3 ozs	Green	Green	Green	Green	Green	Green	Red	Green	
Prefix	2 pts	Red	Red	Green	Green	Green	Green	Green	Green	

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Influence of Corn Herbicide Treatments on Fall Cover Crop Biomass (2013-2015)



■ No biomass reduction in any year
 ■ Biomass reduction in 1 of 3 years
 ■ Biomass reduction in ≥ 2 of 3 years

Herbicide Treatment	Rate	Cover Crop Species								
		Winter Wheat	Tillage Radish	Cereal Rye	Crimson Clover	Winter Oat	Austrian Pea	Annual Ryegrass	Hairy Vetch	
-----% Biomass Reduction relative to non-treated, 28 days after emergence-----										
Atrazine	2 qts	Green	Green	Green	Red	Green	Green	Green	Green	Green
Callisto	3 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green	Green
Laudis	3 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green	Green
Impact	3/4 fl oz	Red	Red	Green	Green	Red	Green	Red	Red	Green
Balance Flexx	5 fl ozs	Green	Red	Green	Green	Green	Green	Green	Green	Green
Stinger	1/2 pt	Green	Green	Green	Red	Green	Green	Green	Green	Green
Python	1 oz	Green	Green	Green	Green	Green	Green	Green	Green	Green
Resolve	1 oz	Green	Red	Green	Green	Green	Green	Red	Red	Green
Accent Q	0.9 oz	Red	Red	Green	Green	Green	Green	Green	Green	Green
Surestart + Atra	1.75 pt + 1 qt	Green	Green	Green	Green	Green	Green	Green	Green	Green
Halex GT + Atra	4 pt + 1 qt	Green	Green	Green	Red	Green	Red	Red	Red	Green
Capreno	3 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green	Green
Zidua	3 ozs	Green	Green	Green	Green	Green	Green	Red	Red	Green

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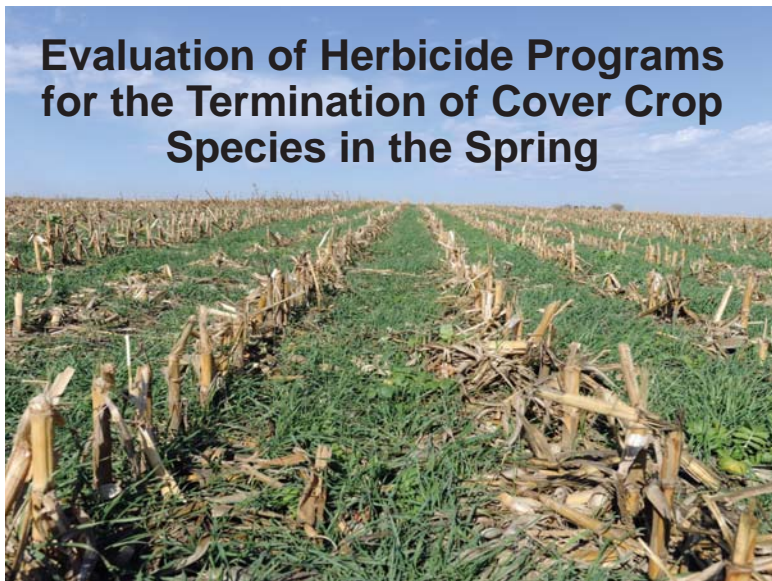
Conclusions

Herbicide carryover injury on cover crop species is going to vary from year to year, largely due to rainfall and time of application

The general order of sensitivity of cover crops to herbicide carryover, from greatest to least sensitive: **tillage radish > Austrian winter pea > crimson clover = annual ryegrass > winter wheat = winter oats > hairy vetch = cereal rye**

Soybean herbicide treatments that were most injurious to cover crops: **fomesafen (Flexstar/Prefix), pyroxasulfone (Zidua), imazethapyr (Pursuit), acetochlor (Warrant), sulfentrazone (Authority products)**

Corn herbicide treatments that were most injurious to cover crops: **topramezone (Impact), mesotrione (Callisto, Halex GT, etc.) clopyralid (Stinger, SureStart), isoxaflutole (Balance Flexx), pyroxasulfone (Zidua, etc.), nicosulfuron (Accent Q, etc.),**



Evaluation of Herbicide Programs for the Termination of Cover Crop Species in the Spring



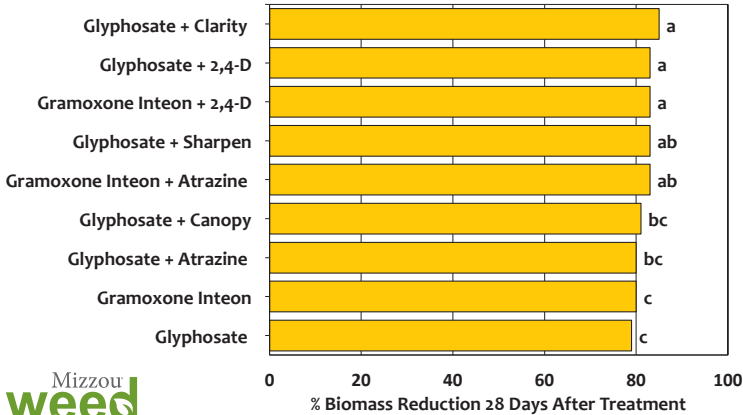
Some species will winter kill...

Tillage Radish 12/3/2013
Columbia, Missouri

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Influence of Selected Herbicide Treatments on Cover Crop Biomass Reduction

(results averaged across 7 cover crop species and 3 years in Missouri)



*Bars followed by the same letter are not different, LSD_{0.05}

Mizzou
weed
science

Conclusions:

Most effective herbicide program across all cover crop species

In general, herbicide programs that contained a growth regulator resulted in the most consistent control across all cover crop species:

Biomass Reduction:

- Glyphosate + 2,4-D: 83%
- Glyphosate + Clarity: 85%

Visual Control:

- Glyphosate + 2,4-D: 90%
- Glyphosate + Clarity: 90%



Effective Kill of Cover Crop Species

- Proper herbicide timing (late March/early April) is important for most species
- Proper temperature/environment before and after application may be just as important
- Species that are likely to winter kill in central Missouri = **tillage radish**, **sometimes oats**
- Species that have proven difficult to control = **wheat**, **crimson clover**, **Italian ryegrass**, **vetch**
- Species that are fairly easy to control = **cereal rye**, **Austrian winter pea**



Influence of Various Cover Crop Species on Winter and Summer Annual Weed Emergence



Cover Crops & Winter Annual Weeds

Based on our research and the results of other **PUBLISHED** studies, the ability of cover crops to reduce the emergence of **WINTER ANNUAL** weed species:

- Is variable and rarely 100% but matches the biology of winter annual weeds very well
- Is dependent on the time of winter annual weed emergence
- Is dependent on the cover crop species and/or mix selected

Conclusions:

Influence of Cover Crops on **Winter Annual** Weed Density

All cover crop species reduced winter annual weed densities by **23 to 72%** compared to the non-treated control:

- Cereal rye: 72%
- Cereal rye/vetch: 68%
- Wheat: 51%
- Fall herbicide: 99%



Cover Crops & Summer Annual Weeds

Based on our research and the results of other **PUBLISHED** studies, the ability of cover crops to reduce the emergence of **SUMMER ANNUAL** weed species is determined by the:

1. Cover crop species selected
2. Amt. of cover crop biomass accumulated
3. Time of cover crop termination
4. Type of weed species

Conclusions:

Influence of Cover Crops on **Summer Annual** Weed Density

- Cereal rye, the mix of cereal rye + hairy vetch, and Italian ryegrass provided density reductions similar to the residual herbicide program
- Few cover crops provided any substantial reduction in **late-season** weed emergence compared to the full residual program (90%)

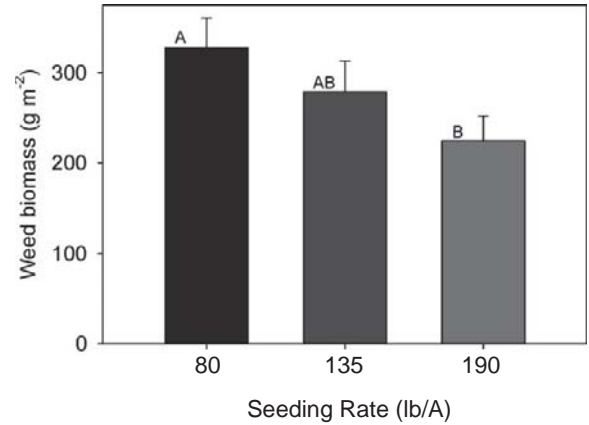


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Influence of Cereal Rye Seeding Rate on Weed Biomass 10 Weeks after Cereal Rye Termination



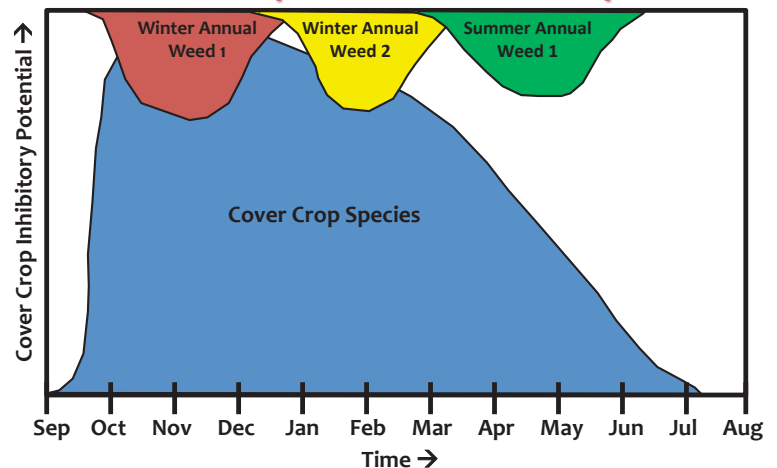
Mirsky et al. 2011. *Weed Science* 59:380-389.

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Relationship Between Inhibitory Potential of Cover Crops and Various Weed Species



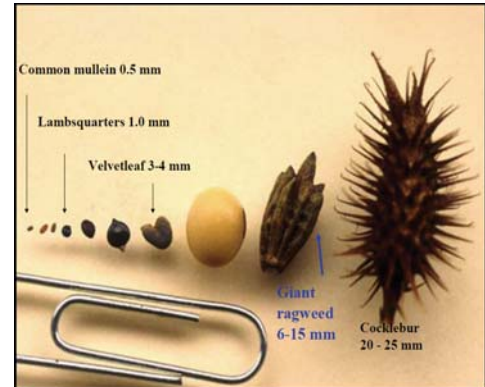
Adapted from Kruidhof et al. 2010. *Weed Research* 51:177-186.

Cover Crops & Summer Annual Weeds

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Different Weed Seeds are Affected Differently by:
soil cover, light, temperature, soil depth, etc.



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Fun Facts


Scotch Broom (*Sarothamnus nemoralis*) is said to have helped with a battle. Norsemen came ashore planning to burn sleeping Scottish forces and removed their boots for a quieter assault. A prickly patch of thistle growing between the two armies is said to have saved the day and became the Scottish national flower.

Mycopy passionflower (*Passiflora inornata*) is an increasing problem weed in a number of Missouri pastures.

Welcome to the University of Missouri's Weed Science homepage. Here you can find information related to our extension, research, and teaching programs or visit some of our web resources like the Missouri Weed Identification or Herbicide Injury Guides. In our "Research Results" section, you can search results from our field research by year, herbicide, weed, or crop. Additionally, you can click on our publication section to see all of the publications and newsletter articles we provide as well as to view and/or listen to some of our power point presentations. We welcome your comments and/or suggestions about this site.

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