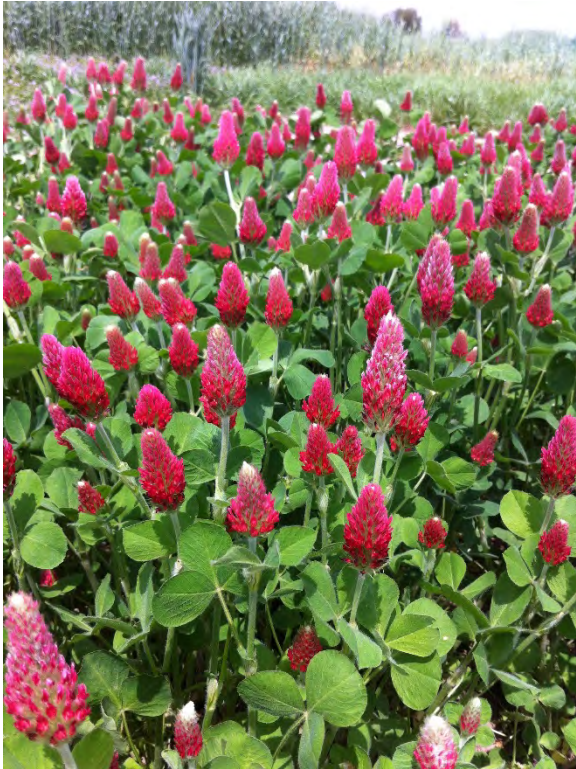


A top-down photograph of a field with cover crops. The plants are green but show signs of stress, with some leaves appearing yellowed and damaged. The ground is sandy and covered with dry, brown plant matter. A white text box is overlaid in the center of the image.

The Effects of Herbicide Carryover on Cover Crops

Objective

To determine which corn and soybean herbicides are most likely to carryover and cause injury to cover crop species.



Cover Crop Carryover Research - Methodology

General: Field experiments were conducted in 2013-2015 in Columbia, MO. Corn and soybean were planted in May/June. All herbicide programs tested were POST applications and applied in late June to early July.

Cover Crop Planting Dates: Sept. 10 or 11, 2013-2014

Seeding Rates (lb/A):

| | |
|-----------------------|-----|
| Wheat = | 120 |
| Cereal Rye = | 110 |
| Italian ryegrass = | 25 |
| Oats = | 70 |
| Crimson Clover = | 30 |
| Austrian Winter Pea = | 50 |
| Hairy Vetch = | 20 |
| Tillage Radish = | 8 |



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

■ No stand reduction in any year
 ■ Stand reduction in 1 of 3 years
 ■ Stand 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 |
| | --product/A-- | -----% Stand Reduction relative to non-treated, 28 days after emergence----- | | | | | | | |
| Spartan | 8 fl ozs | Yellow | Yellow | Green | Green | Yellow | Green | Yellow | Green |
| Valor | 2.5 ozs | Green | Yellow | Green | Green | Green | Green | Yellow | Green |
| Sencor | 0.5 lb | Yellow | Green | Yellow | Green | Green | Yellow | Green | Green |
| Authority First | 6.4 ozs | Green | Green | Green | Yellow | Green | Green | Yellow | Green |
| Classic | 1.5 ozs | Yellow | Yellow | Green | Green | Green | Green | Green | Green |
| Flexstar | 20 fl ozs | Green | Red | Green | Yellow | Red | Green | Green | Green |
| Cobra | 12.5 fl ozs | Green | Green | Green | Green | Green | Green | Green | Green |
| Pursuit | 4 fl ozs | Green | Red | Green | Yellow | Yellow | Green | 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 | Yellow | Green | Green | Green | Green | Green | Green | Green |
| Warrant | 1.5 qts | Green | Yellow | Green | Red | Green | Green | Yellow | Green |
| Zidua | 3 ozs | Yellow | Green | Green | Green | Red | Green | Red | Green |
| Prefix | 2 pts | Green | Red | Green | Green | Yellow | Green | Yellow | Green |

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 |
| | --product/A-- | -----% Biomass Reduction relative to non-treated, 28 days after emergence----- | | | | | | | |
| Spartan | 8 fl ozs | Yellow | Green | Yellow | Green | Yellow | Red | Yellow | Green |
| Valor | 2.5 ozs | Green | Yellow | Yellow | Yellow | Yellow | Red | Green | Yellow |
| Sencor | 0.5 lb | Yellow | Green | Green | Green | Green | Red | Green | Yellow |
| Authority First | 6.4 ozs | Yellow | Red | Green | Yellow | Green | Green | Green | Green |
| Classic | 1.5 ozs | Green | Yellow | Green | Yellow | Yellow | Green | Green | Green |
| Flexstar | 20 fl ozs | Green | Red | Green | Red | Green | Red | Green | Green |
| Cobra | 12.5 fl ozs | Green | Green | Green | Green | Green | Green | Green | Green |
| Pursuit | 4 fl ozs | Yellow | Red | Green | Red | Red | Green | Green | Green |
| Firstrate | 0.6 oz | Yellow | Green | Yellow | Green | Green | Red | Green | Green |
| Synchrony XP | 0.375 oz | Green | Green | Green | Red | Green | Green | Green | Green |
| Dual II Magnum | 1.33 pts | Green | Green | Green | Yellow | Green | Red | Yellow | Yellow |
| Warrant | 1.5 qts | Green | Green | Green | Red | Yellow | Red | Green | Yellow |
| Zidua | 3 ozs | Red | Green | Yellow | Yellow | Yellow | Red | Red | Yellow |
| Prefix | 2 pts | Red | Red | Yellow | Yellow | Green | Yellow | Green | Green |

Carryover of POST Soybean Treatments to Tillage Radish



Carryover of POST Soybean Treatments to Cereal Rye



Non-treated, Annual Ryegrass



3 ozs Zidua, Annual Ryegrass



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

■ No stand reduction in any year
 ■ Stand reduction in 1 of 3 years
 ■ Stand 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 |
| | --product/A-- | -----% Stand Reduction relative to non-treated, 28 days after emergence----- | | | | | | | |
| Atrazine | 2 qts | Green | Green | Green | Green | Green | Green | Green | Green |
| Callisto | 3 fl ozs | Green | Green | Green | Green | Green | Green | Green | Green |
| Laudis | 3 fl ozs | Green | Green | Green | Green | Green | Green | Green | Green |
| Impact | 3/4 fl oz | Green | Green | Green | Green | Red | Yellow | Green | Green |
| Balance Flexx | 5 fl ozs | Green | Yellow | Green | Green | Yellow | Yellow | Green | Green |
| Stinger | 1/2 pt | Green | Green | Green | Yellow | Green | Yellow | Yellow | Green |
| Python | 1 oz | Green | Yellow | Yellow | Green | Green | Yellow | Green | Green |
| Resolve | 1 oz | Green | Yellow | Green | Green | Green | Yellow | Yellow | Green |
| Accent Q | 0.9 oz | Red | Yellow | Yellow | Green | Green | Yellow | Green | Green |
| Surestart + Atra | 1.75 pt + 1 qt | Green | Green | Green | Green | Green | Green | Green | Green |
| Halex GT + Atra | 4 pt + 1 qt | Green | Green | Green | Green | Yellow | Green | Red | Yellow |
| Capreno | 3 fl ozs | Green | Green | Green | Green | Green | Yellow | Green | Green |
| Zidua | 3 ozs | Green | Green | Green | Green | Yellow | Yellow | Red | Green |

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 | Yellow | Green | Green | Red | Green | Green | Yellow | Green |
| Callisto | 3 fl ozs | Green | Green | Green | Green | Green | Yellow | Green | Yellow |
| Laudis | 3 fl ozs | Yellow | Yellow | Green | Yellow | Green | Green | Green | Green |
| Impact | 3/4 fl oz | Red | Yellow | Green | Green | Red | Green | Red | Green |
| Balance Flexx | 5 fl ozs | Yellow | Red | Yellow | Yellow | Yellow | Green | Green | Green |
| Stinger | 1/2 pt | Yellow | Yellow | Yellow | Red | Green | Yellow | Green | Yellow |
| Python | 1 oz | Yellow | Yellow | Green | Green | Green | Green | Green | Yellow |
| Resolve | 1 oz | Green | Red | Green | Green | Green | Green | Red | Green |
| Accent Q | 0.9 oz | Red | Red | Green | Yellow | Green | Green | Yellow | Green |
| Surestart + Atra | 1.75 pt + 1 qt | Yellow | Yellow | Yellow | Yellow | Green | Yellow | Green | Yellow |
| Halex GT + Atra | 4 pt + 1 qt | Green | Yellow | Green | Red | Yellow | Red | Red | Yellow |
| Capreno | 3 fl ozs | Green | Green | Green | Green | Green | Yellow | Yellow | Green |
| Zidua | 3 ozs | Yellow | Green | Green | Yellow | Yellow | Green | Red | Green |

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.),**