

## Cover Crop Response to Residual Herbicides in Peanut Final Report

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Cover crops can provide many benefits to peanut and cotton rotation in terms of suppressing weeds, conserving soil moisture for planting, increasing soil organic matter, and reducing soil erosion. There has been an increased use of residual herbicides to combat herbicide resistant weeds such as palmer amaranth. Soil composition, pH and microorganism populations all affect how fast a soil herbicide degrades. Previous field studies in corn and soybean rotation have shown residual herbicides, used during the growing season, have been observed to negatively affect the establishment of cover crops. There has been little research done on the effects of residual herbicides used in peanut and cotton rotation and their effects on cover crops in the Southeast. The objective of this study was to investigate the responses of six cover crops (daikon radish, cereal rye, cocker oats, crimson clover, winter wheat, and common vetch) to twelve common soil herbicides used in peanut and cotton. Treatments included *S*-metolachlor, acetochlor, pyroxasulfone, diclosulam, imazapic, chlorimuron ethyl, bentazon plus acifluorfen, pyriithiobac sodium, trifloxysulfuron sodium, diuron, prometryn, flumioxazin, and a non-treated check (NTC). Herbicide treatments were applied at 10% of full-labelled rate at planting. This study was conducted at Wiregrass Research Extension Center in Henry County, AL and E.V. Smith Research and Extension Center in Macon County, AL in 2016-2017 and 2017-2018.

Field trials were laid out as a completely randomized factorial design with the cover crops as one set of treatments and herbicides as the other. There were 4 replications in Henry County and 3 replications in Macon County for both years. All plots were 3.65 meters by 2.1 meters. Herbicide treatments were applied November 18, 2016 and October 30, 2017 in Macon County. In Henry County, herbicide treatments were applied November 2, 2016 and October 30, 2017. Treatments were applied with a backpack sprayer with Teejet TT110025 nozzles on a 4 nozzle boom calibrated to 187 liters per hectare output. All treatments were irrigated in with 1.27 cm of water to active herbicides. No location received rainfall 7 days after herbicide applications. Henry County had Dothan fine sandy loam and Macon County had Kalmia sandy loam. Cover crops were planted November 21, 2016 and November 7, 2017 in Macon County as well as November 7, 2016 and November 3, 2017 in Henry County. All grasses were planted at 100 kg/hectare, vetch and clover were planted at 22 kg/hectare, and radish was planted at 11 kg/hectare. At approximately 50 and 150 days after planting (DAP), 10 randomly selected plant heights were collected and 2-1meter stand counts in the broadleaf cover crops and 3- 30 cm stand counts were evaluated in grasses. At 150 DAP a wet biomass weight was taken for each plot in the field.

All data was analyzed using PROC GLIMMIX in SAS 9.4. All means were converted to percentage of non-treated check and separated with Fisher's protected LSD. There was a significant difference between treatments by year so data was analyzed separately for each year. There was no significant location by treatment difference either year for stand counts so they were analyzed over all locations. In 2016-2017, significant stand reductions ( $p \leq 0.05$ ) of 30-52% in rye and 28-75% in wheat respectively were observed at 50 DAP for *S*-metolachlor, acetochlor, pyroxasulfone, diclosulam, imazapic, chlorimuron ethyl, and bentazon plus acifluorfen over both locations. Vetch had significant stand reductions for all twelve treatments at 50 DAP ranging from 12.53-80.21% over both locations. *S*-metolachlor, pyroxasulfone and acetochlor had the largest negative impacts on stand counts for rye, wheat and vetch. Daikon radish had significant height reductions of 9, 15, and 31% at 50 DAP for diuron, chlorimuron ethyl, and imazapic,

respectively, in Macon County. This was the only time and only location to show a significant plant height reduction. At 145-149 DAP, all affected cover crops had recovered from herbicide damage and did not show any significant treatment differences in any of the growth parameters evaluated in 2016. In 2017-2018, wheat had a significant stand reduction of 24% for flumioxazin at 42-45 DAP over both locations. At 147-149 DAP, clover had a significantly reduced stands of 29-41% for diclosulam and trifloxysulfuron sodium respectively, over both locations. Radish also had a significantly reduce stand of 66% for diclosulam. Oats, rye and vetch did not have any significant stand reductions at either timing in 2017/2018. No significant biomass reductions were observed for either year for any of the cover crop evaluated. Overall, the average biomass of the treated plots was not significantly different from the average non-treated check plots for each cover crop

In 2016/2017 S-metolachlor, pyroxasulfone, and acetochlor resulted in the largest stand reductions for rye, wheat and vetch at 50 DAP. In 2017/2018 more stand losses were observed at 150 DAP than 50 DAP. Diclosulam caused more stand reductions affecting all cover crops except for oats over both years. Trifloxysulfuron, diruon, and prometryn did not affect the establishment of any grass cover crop stands either year. Oats showed the most tolerance with no treatments significantly reducing stands or plant heights for either year. The type of cover crop planted should be based on the residual herbicides applied to row crops the previous season as well as the biomass goal and nutrient needs of the field. Although initial injury and stunting may occur, biomass of those cover crops may not be affected by herbicide residues evaluated in this study. Overall, cover crop stand establishment varied over the years but not locations similar to previous studies done in corn and soybean rotation. Residual herbicide dissipations varied year to year possibly due to weather such as rainfall, ambient and soil temperatures, etc. but this needs to be evaluated further in future studies. This experiment is completed and was presented at American Peanut Research and Education Societies' annual meeting in 2018 and Weed Science Society of America's annual meeting in 2019. The presentation was nominated for the Bailey Award from American Peanut Research and Education Societies. The data will also be published in a peer reviewed journal, Peanut Science, hopefully by the end of 2019.

## **Cover Crop Response to Residual Herbicides in Peanut-Cotton Rotation**

Steve Li. Extension Specialist, Assistant Professor. ACES, Auburn University

### **Introduction**

Cover crops can provide many benefits to peanut and cotton rotation in terms of suppressing weeds, conserving soil moisture for planting, increasing soil organic matter, reducing soil erosion, etc. However, in fields where residual herbicides were used during the growing season, establishment of cover crops could be negatively affected by the herbicide residues. The use of residual herbicides has increased especially in areas of herbicide resistant weeds. While herbicide labels list rotation intervals for common row crops they often do not address cover crops. Herbicide carryover can reduce the efficacy of a cover crop, wasting time and money for producers. Limited rainfall and late applications can increase herbicide carryover. Carryover will vary from year to year due to rainfall, soil type, application timing, and rates. If carryover is a concern, a resilient cover crop should be selected for that field. As the usage of cover crops increases throughout the southeast more research needs to be done to evaluate different cover crop responses to residual herbicides. The objective of this study was to investigate the responses of six common cover crops (daikon radish, cereal rye, cocker oats, crimson clover, winter wheat, and common vetch) to twelve common soil herbicides used in peanut and cotton.

### **Methods**

We evaluated how the herbicides effected plant height, stand count, and percent coverage of crop cover were evaluated at 50 and 145 days after planting (DAP), as well as a biomass at project termination. Herbicide treatments (Table 1) were applied at the day of planting. Each herbicide was sprayed at 10% of label rate to simulate herbicide carryover from cotton and peanut production. All treatments were irrigated into the field within 3 days of application. This study was conducted at two locations Wiregrass Research Extension Center in Headland, AL and E.V. Smith Research and Extension Center in Tallassee, AL.

### **Results**

Overall vetch was the most sensitive cover crop, with all 12 herbicides significantly injuring stand counts 50 days after planting. Initially Dual Magnum, Warrant, Zidua, Strongarm, Cadre, Classic, and Storm treatments reduced stand counts for rye (30%-50%) and wheat (30%-75%). Dual Magnum, Zidua and Warrant had the largest impacts on stand counts for all three cover crops (Table 1). Daikon radish showed significant reduction plant heights, 50 DAP, at the E.V. Smith location for Direx, Cadre, and Classic. The cause of the radish only being sensitive at one location is likely due to soil pH differences. However, by the end of the season the all four cover crops had outgrown this initial stunting. Caporal significantly reduced cover for clover by the end of the season. Biomass data from non-treated plots showed the top three highest residue cover crops were, clover averaged 13,631 lbs/A, oats averaged 12,308 lbs/A and vetch averaged 10,910 lbs/A. Oats showed the most tolerance with no herbicides effecting any growth parameter evaluated throughout this study and had the most consistent biomass for each of the residual herbicides.

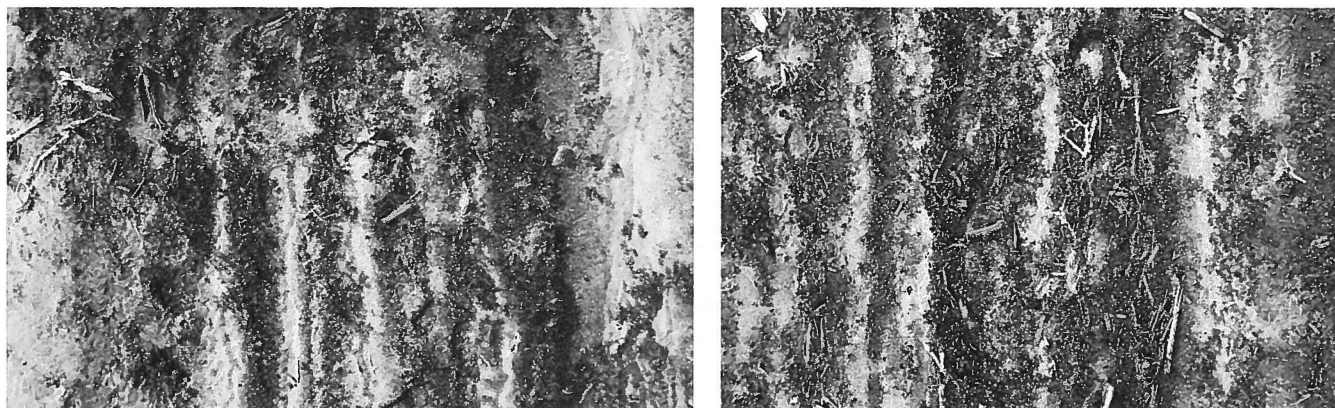


Figure 1: At 50 days after application the vetch stand count treated with Cadre at 0.4oz/a (left photo) was significantly different from the non-treated check (right photo). At 145 DAP the vetch stand count had recovered from the initial stand reduction.

Chemical	Rate	Vetch	Rye	Wheat	Radish	Clover	Oats
Dual Magnum	0.13 pt/a	3	3	3	1	1	1
Warrant	0.3 pt/a	3	3	3	1	1	1
Zidua	0.3 oz/a	3	3	3	1	1	1
Strongarm	0.045 oz/a	2	1	1	1	1	1
Cadre	0.4 oz/a	2	1	1	2	1	1
Classic	0.05 oz/a	2	1	1	2	1	1
Storm	0.15pt/a	2	1	1	1	1	1
Staple LX	0.38 oz/a	2	1	1	1	1	1
Envoke	0.045 oz/a	2	1	1	1	1	1
Direx	2.4 oz/a	2	1	1	2	1	1
Caparol	0.4 pt/a	2	1	1	1	2	1
Valor	0.3 oz/a	2	1	1	1	1	1

Figure 2: Injury Potential: 1= Low risk of injury, 2 = Some risk depending upon herbicide rate and environmental conditions. 3= High risk of injury affecting cover crop establishment

### Summary

When selecting a cover crop a producer needs to take into account any residual herbicide use and the goal of the cover crop (i.e. weed suppression, erosion control, high residue, etc.). If high residue is the goal of the cover crop but herbicide carryover is a concern, wheat and clover are the best options depending on the herbicide. If Strongarm, Classic, Envoke, Direx and Valor carryover is a concern then clover is the best option for high residue results. While wheat is the best option if Warrant, Cadre, Staple LX, and Caparol carryover is the concern. We recommend producers utilize oats as a cover crop when there is a concern for residual herbicide injury, especially if Dual Magnum, Zidua or Warrant carryover is a concern as it was the most resilient cover crop. If a high residue crop is required and herbicide carryover is not a concern then clover, oats and/or vetch would be the best options.