MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 13-2016 (YEAR 2)
2016 ANNUAL REPORT

TITLE: Influence of Cover Crops on Early Season Insect Pest Dynamics in Mississippi Soybeans

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PHD STUDENT PROJECT

OBJECTIVE 1: Determine the influence of cover crops on early season insect pest dynamics. This objective will provide MS grower with information on the potential risk of insect outbreaks with respect to cover crops, and guidance for potential control strategies.

OBJECTIVE 2: Determine the efficacy of prophylactic and threshold-based foliar spray programs on early season insect pests as affected by the use of cover crops. This objective will provide MS grower with information on the control strategies needed to deal with potential increased insect pest pressure that may result from use of cover crops.

OBJECTIVE 3: Determine the effect of cover crop usage on growth, development, and yield of soybeans in the Hills and Delta region of MS. This objective will provide MS grower knowledge of potential benefits of cover crop usage on soybean yield when insect management programs have been utilized with prophylactic and foliar-threshold IPM programs.

INTRODUCTION

The use of winter cover crops before soybean cultivation has been an increasing trend in Mississippi. Winter cover crops provide many agronomic benefits including the prevention of soil erosion, increases in water infiltration into soil, soil organic matter increases, reductions in soil compaction and nutrient losses through leaching, suppression and/or reduction of early-season weeds and weed biomass, and Increase in nitrogen supply. Cover crops also provide suitable habitat for beneficial insects that can potentially inhabit the following crop.

Insect pest problems have been associated with some cover crops before soybean. In Mississippi and other regions of the Midsouthern US, pea leaf weevil, *Sitona lineatus* L., has infested soybean following legume winter cover crops such as hairy vetch, *Vicia villosa* Roth, and Austrian winter peas, *Pisum sativum* L. ssp. *arvense* (L.) Poir. Foliar insecticidal applications can control pea leaf weevil in soybean, but adult weevils continue to emerge from cover crop residue, resulting in costly multiple applications. Neonicotinoid seed treatments can provide protection from these pests.

REPORT OF PROGRESS/ACTIVITY

OBJECTIVE I: ASSESS POTENTIAL INSECT PEST PROBLEMS IN SOYBEAN FOLLOWING COVER CROPS AND POTENTIAL MANAGEMENT STRATIGIES

Materials and Methods

An experiment was conducted in 2016 to determine the influence of winter cover crops and early season insect control strategies on soybean yield in two Mississippi locations. The R. R. Foil Plant Science Research Center in Starkville, MS served as a location in the "Hills" region of MS located on the East side of the state, and the Mississippi State University Delta Research and Extension Center in Stoneville, MS served as a location in the "Delta" region of MS located on the West side of the state.

Field trials were established in 8-row plots. Plots at the "Hills" location were planted on 38-in.-wide rows, and plots at the "Delta" location were planted on 30-in.-wide rows. The "Delta" soybean plots were irrigated, whereas those at the "Hills" location were not. The soil type of the "Hills" location was a clay loam, and the "Delta" location had a sandy loam soil type.

Treatments were arranged factorially in a randomized complete block design. Each randomization of treatments was replicated four times at each location. Factor A consisted of two cover treatments, and Factor B consisted of six control method treatments. The two cover treatments were a cover crop blend of Austrian winter pea, tillage radish, and triticale, and an unplanted treatment in which plots were allowed to naturally infest with winter weeds.

Control treatments were:

- Untreated control with only fungicide applied to soybean seed;
- A foliar application of Karate Z applied with the herbicide burndown application;
- Soybean seed treated with the neonicotinoid seed treatment CruiserMaxx (thiamethoxam, 0.0778 mg/seed);
- Karate Z burndown application plus the CruiserMaxx soybean seed treatment;
- In-furrow application of Capture LFR (bifenthrin, 8 oz./1000 row ft) applied during soybean planting; and
- A 50% increased seeding rate of 165,000 seed/acre.

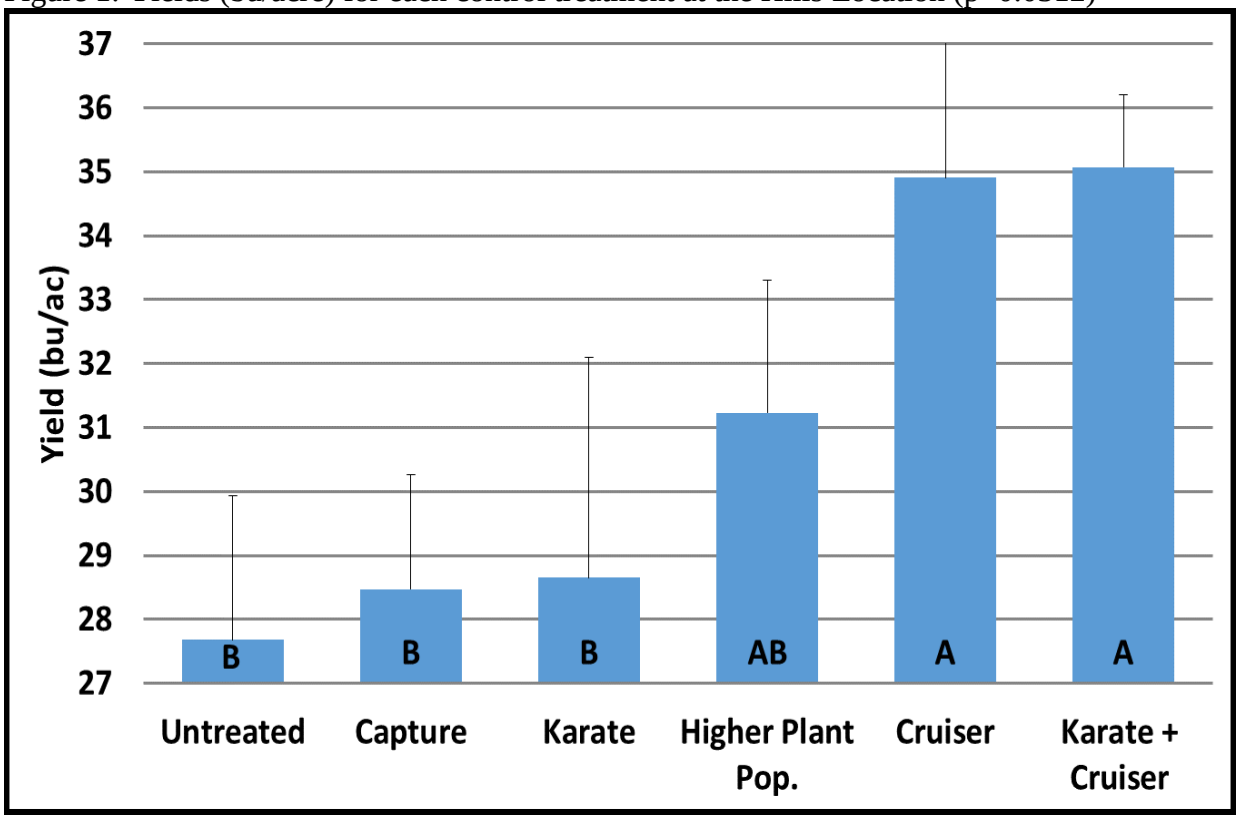
All soybean seed were treated with the fungicide ApronMaxx RTA (mefenoxam and fludioxonil, 0.0092 mg/seed). The cover crop treatment was planted and incorporated into the soil the first week of October 2015. The blended seed was broadcast over plots at an even distribution. Glyphosate at 50 fl.oz./acre was applied as a burndown application to kill the cover crops and winter weeds 4 weeks prior to soybean planting as were the termination-timed insecticide applications. Soybean (Asgrow 4835) was planted the second week of May 2016 at a rate of 111,000 seeds/acre except for the increased seeding rate treatment. Soybean plants matured and were mechanically harvested. Yields were recorded for each treatment combination. Data were analyzed using PROC GLIMMIX of SAS 9.4.

Results and Discussion

There were no detectable levels of pea leaf weevil in soybean plots. No other aboveground pests were observed at economic threshold levels during the early stages of soybean development. Below-ground pests were not sampled during the study. No significant differences between cover type and among control methods were measured for soybean yield. There were no significant interactions between cover types or among control methods for soybean yield across both locations.

Significant differences in soybean yield at the Hills location were measured among control methods (Figure 1). The neonicotinoid seed treatment provided a significant yield increase of 7.23 bu/acre when compared to the untreated control.

Figure 1: Yields (bu/acre) for each control treatment at the Hills Location (p=0.0312)



OBJECTIVE II: EFFECTS OF COVER CROPS, TERMINATION TIMING, AND NEONICOTINOID SEED TREATEMENTS ON SOYBEAN INSECT PESTS

Materials and Methods

An experiment was conducted in 2016 to determine the influence of winter cover crops, termination/burndown timings, and seed treatments on soybean yield at two Mississippi locations. The R. R. Foil Plant Science Research Center in Starkville, MS served as a location in the "Hills" region of MS located on the East side of the state, and the Mississippi State University Delta Research and Extension Center in Stoneville, MS served as a location in the "Delta" region of MS located on the West side of the state.

Field trials were established on 4-row plots measuring 3.86 m wide by 15.24 m long. Treatments were arranged factorially in a randomized complete block design. Each randomization of treatments was replicated four times at each location. Factor A consisted of three cover treatments, Factor B consisted of three termination/burndown timings, and Factor C consisted of insecticidal and non-insecticidal seed treatments. The three cover treatments were a cover crop blend of Austrian winter pea, tillage radish, and triticale, a cover crop treatment of wheat, and an unplanted treatment in which plots were allowed to naturally infest with winter weeds. Cover crop termination timings were approximately 6, 4, and 2 weeks prior to planting.

Seed treatments were an untreated control where only fungicide was applied to soybean seed and a treatment where soybean seed was treated with the neonicotinoid seed treatment CruiserMaxx (thiamethoxam, 0.0778 mg/seed). All soybean seed were treated with the fungicide ApronMaxx RTA (mefenoxam and fludioxonil, 0.0092 mg/seed). The cover crop treatment was planted and incorporated into the soil the first week of October in 2015. The blended seed was broadcast over plots at an even distribution. Glyphosate at 50 fl.oz./acre was applied as a burndown to kill the cover crops and winter weeds at the appropriate termination timing for each plot. Soybean (Asgrow 4835) was planted the second week of May 2016 at a rate of 111,000 seed/acre. Soybean plants matured and were mechanically harvested, and yields recorded for each treatment combination. Data were analyzed using PROC GLIMMIX of SAS 9.4.

Results and Discussion

There were no detectable levels of pea leaf weevil or any other foliar pests at threshold levels in soybean plots during the early growth stages. Below-ground pests were not sampled during the study. A significant difference in soybean yield was measured between the neonicotinoid seed treatment and the untreated control at both locations (Figure 2). The neonicotinoid seed treatment provided a significant yield increase of 2.2 bu/acre when compared to the untreated control.

There was significant interaction between cover type and termination date for soybean yield across both locations (Figure 3). Soybean following all cover types yielded significantly less than other treatments when the burndown application was applied late or approximately 2 weeks before planting. Soybean following burndown applications made at the early and optimal timings yielded significantly greatest.

Figure 2: Yields (bu/acre) for seed treatment and untreated plots over both locations (p=0.0004).

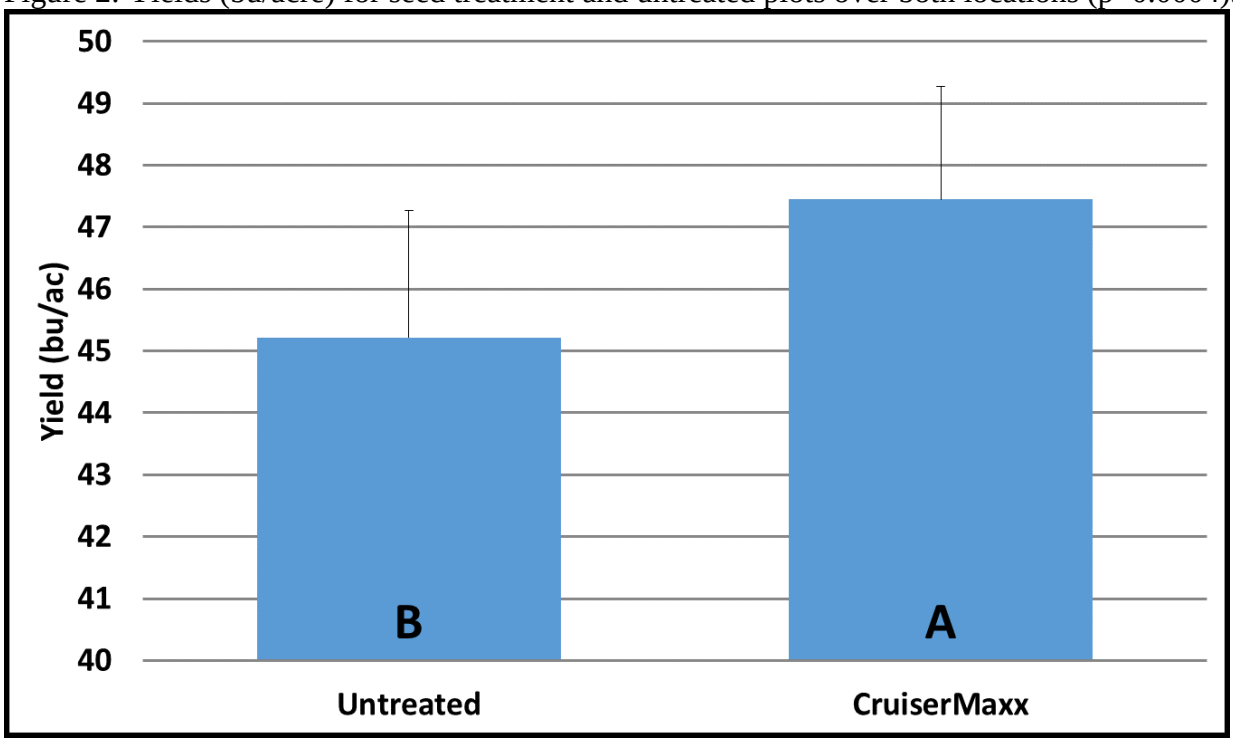
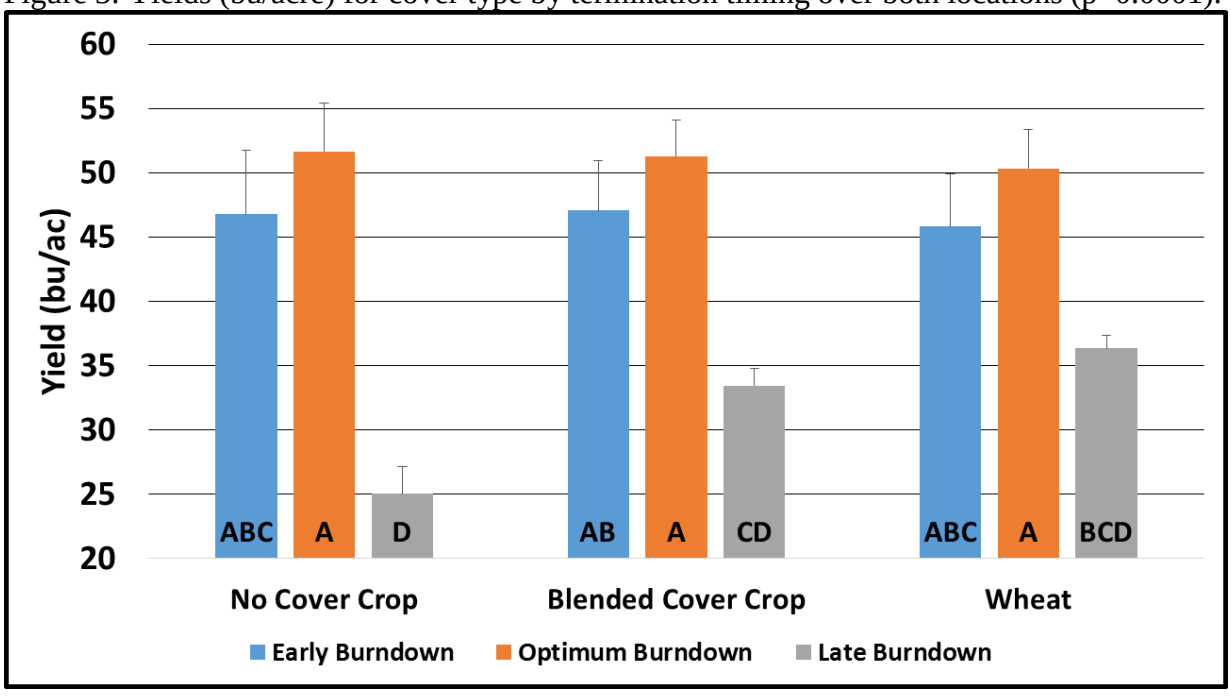


Figure 3: Yields (bu/acre) for cover type by termination timing over both locations (p<0.0001).



OBJECTIVE III: ARTHROPOD FAUNA AND AGRONIMIC EFFECTS OF COVER CROP-SOYBEAN GROWING SYSTEMS IN MISSISSIPPI

Materials and Methods

An experiment was conducted in 2016 to determine the influence of winter cover crops on arthropod diversity and the agronomic effects on soybean at two Mississippi locations. The R. R. Foil Plant Science Research Center in Starkville, MS served as a location in the "Hills" region of MS located on the East side of the state, and the Mississippi State University Delta Research and Extension Center in Stoneville, MS served as a location in the "Delta" region of MS located on the West side of the state. Field trials were established on 8-row plots measuring 7.72 m wide by 15.24 m long. Treatments were arranged in a randomized complete block design. Each randomization of treatments was replicated four times at each location.

Each field trial consisted of six cover treatments that included:

- Blend of Austrian winter pea, tillage radish, and triticale;
- Wheat;
- Only Austrian winter pea;
- Only triticale;
- Hairy vetch; and
- Unplanted treatment in which plots were allowed to naturally infest with winter weeds.

All soybean seed were treated with the fungicide ApronMaxx RTA (mefenoxam and fludioxonil, 0.0092 mg/seed); no insecticidal seed treatment was used. Cover crop treatments were planted and incorporated into the soil the first week of October in 2015. The blended seed mixture was broadcast over plots at an even distribution. Glyphosate was applied at 50 fl. oz./acre as a burndown to kill the cover crops and winter weeds 4 weeks prior to planting. Plots at Stoneville were additionally rolled after the termination application before planting. Soybean (Asgrow 4835) was planted the second week of May 2016 at a rate of 111,000 seeds/acre.

Soybean sampling was accomplished using pitfall trapping and sweep net sampling. Pitfall traps were placed on row 4 of each 8-row plot. Each plot contained two pitfall traps separated by a 24-in. steel guide vane. Individual pitfall traps were supported by an 8-in.-long piece of 6-in.-diameter PVC pipe that was buried to the top so that the pipe opening was flush with the ground. A wide-mouth pint mason jar filled approximately one-fourth full with a 50/50 mixture of propylene glycol and 70% ethanol was placed into each PVC pipe. Each pitfall trap was then capped with a 4-in. powder funnel and steel metal top. Pitfall traps were sampled weekly during soybean development. Sweep netting was performed using a standard sweep net on row 5 of each plot. A total of 25 sweeps were performed and then the contents of the net were emptied into a 1-gallon plastic bag, labeled, and stored in a freezer. Sweeping was performed every 2 weeks at each location.

Soil from soybean plots was sampled and analyzed for soil nutrient contents and nematode abundance. Soybean plants matured and were mechanically harvested and yields recorded for each treatment combination. Data were analyzed using PROC GLIMMIX of SAS 9.4.

Results and Discussion

Arthropods sampled with sweep nets and pitfall traps are currently being identified, sorted, and analyzed. Also, soil sample data are currently being analyzed. Significant differences in soybean yield were measured among cover types at the Hills location (Figure 4). Soybean plots planted behind a natural infestation of winter weeds yielded significantly more than soybean planted behind all cover crops tested except for hairy vetch.

Figure 4: Yields (bu/acre) for each cover type over both locations ($p<0.0001$).