WINTER COVER CROP-SOYBEAN SYSTEMS: AN ENTOMOLOGICAL PERSPECTIVE

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Abstract

Winter legume cover crops have led to pea leaf weevil, *Sitona lineatus* L., infestations in Mississippi soybean fields in recent years. A study was developed to determine how cover crops and early-season pest control strategies affect soybean yield in two Mississippi locations. Research plots were either planted with a blended cover crop treatment or left fallow with a natural infestation of winter weeds in the fall of 2015 and 2016. Plots were sprayed with an herbicide burndown and four weeks later planted with soybean seed in May of each growing season. Insect control strategy treatments consisted of a neonicotinoid seed treatment, a pyrethroid termination spray, a combination of the seed treatment and termination spray, an in-furrow insecticide application, a higher seeding rate, and an untreated control. Insect pests were counted per meter of row for each treatment at the V3 growth stage. Soybean plants were harvested at the end of the season and yield recorded. Significantly less insect pests were observed in plots treated with insecticides at planting compared to the untreated control, the higher plant population, and the termination timed application. There were no significant interactions between cover treatment and control strategy treatments in regards to soybean yield. Over all site years, neonicotinoid seed treatments provided a significant increase to soybean yield.

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, soil compaction reductions, reductions in nutrient losses through leaching, suppression and reduction of early-season weeds and weed biomass, and the increases in nitrogen supplies. 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 Midsouth U.S., 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.

Materials and Methods

An experiment was conducted in 2016 and 2017 to determine the influence of winter cover crops and early season insect control strategies 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 8 row plots measuring 7.72 m wide by 15.24 m long. Treatments were arranged in a factorial arrangement within a randomized complete block design. Each randomization of treatments was replicated four times at each location. Factor A consisted of two cropping system treatments, and Factor B consisted of six control method treatments. The two cropping system treatments were a cover crop blend of Austrian winter pea or hairy vetch, tillage radish, *Raphanus sativus* L. var. *niger* J. Kern., and triticale, ×*Triticosecale* Wittmark. cv. Presto, and an unplanted treatment in which plots were allowed to naturally infest with winter weeds. Control treatments were an untreated control where only fungicide was applied to soybean seed, a foliar application of Karate Z (lambda-cyhalothrin, 1.5 fl.oz./ac) applied with the herbicide burndown application, soybean seed treated with the neonicotinoid seed treatment CruiserMaxx (thiamethoxam, 0.0778 mg/seed) in 2016 and Gaucho (imidacloprid, 0.2336 mg/seed) in 2017, the Karate Z burndown application plus the neonicotinoid soybean seed treatment, an in-furrow application of Capture LFR (bifenthrin, 8 oz./1000 rowft) applied during the planting of soybean seed, and a 50 percent increased seeding rated of 165,000 plants/ac. All soybean seed was 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. The blended seed was broadcast over plots at an even distribution. A glyphosate application of 50 fl.oz./acre was used as a burndown application to kill the cover crops and winter weeds and was applied four weeks prior to soybean planting as were the termination timed insecticide applications. Soybean (Asgrow 4835) was planted the second week of May in 2016 at a seeding rate of 111,000 plants/ac except for the increased seeding rate treatment. At the V3 growth stage, pea leaf weevil, three cornered alfalfa hopper, *Spissistilus festinus* (Say), and bean leaf beetle, *Cerotoma trifurcata* (Forster), were counted per meter of row for each treatment combination. Soybean plants matured and were mechanically harvested and yields recorded for each treatment combination. Data was analyzed using PROC GLIMMIX of SAS 9.4.

Results and Discussion

There were no significant differences between cropping systems for total insect pests observed (Figure 1). Significantly less insect pests were observed in plots treated with insecticides at planting compared to the untreated control, the higher plant population, and the termination timed application (Figure 2). There were no significant interactions between cover types or between control methods for mean yield of soybean across all site years (Figure 3). No significant differences were observed between cropping systems with regards to mean soybean yield over all site years (Figure 4). Over all site years, neonicotinoid seed treatments provided a significant yield increase of 3.49 bu per acre when compared to the untreated control (Figure 5). Pests were controlled by insecticide seed treatments but unaffected by cropping system in this research trial. Plot size may have limited the ability to observe pest and yield differences among cropping systems due to potential movement of pests across the cropping system treatment plots.

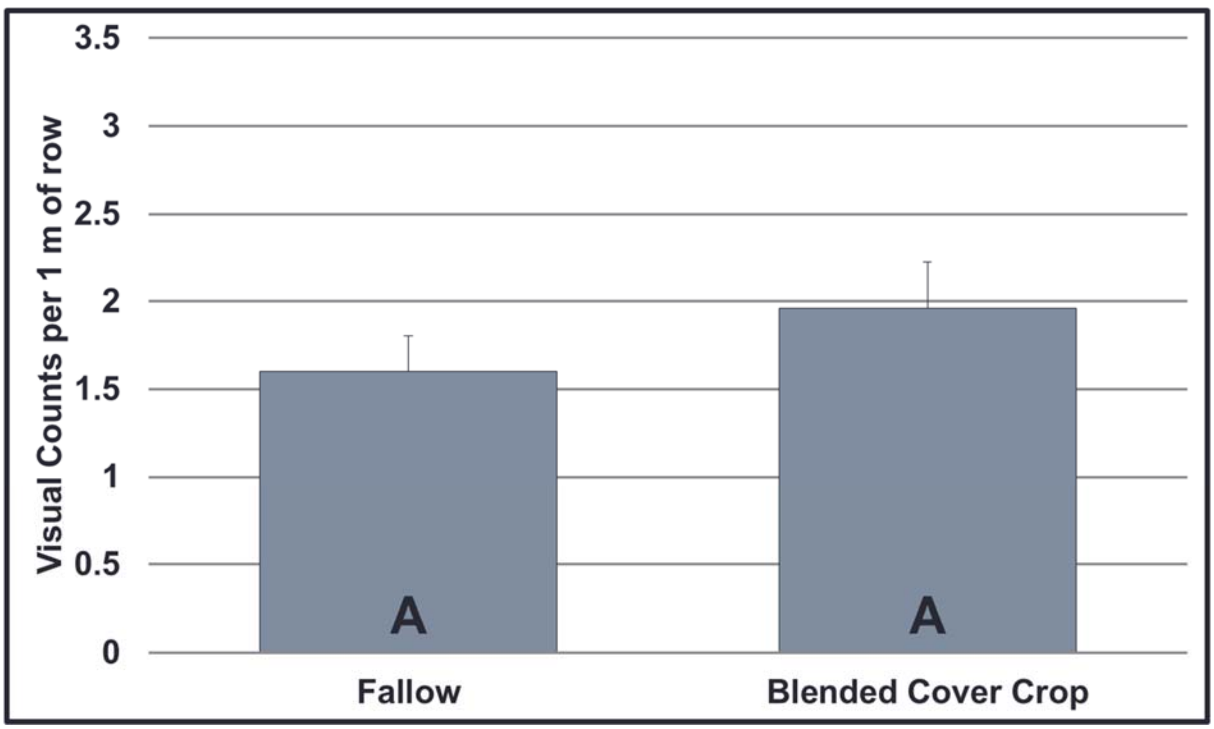

Figure 1: Total insect pest visual counts for each cropping system ($p>0.05$).

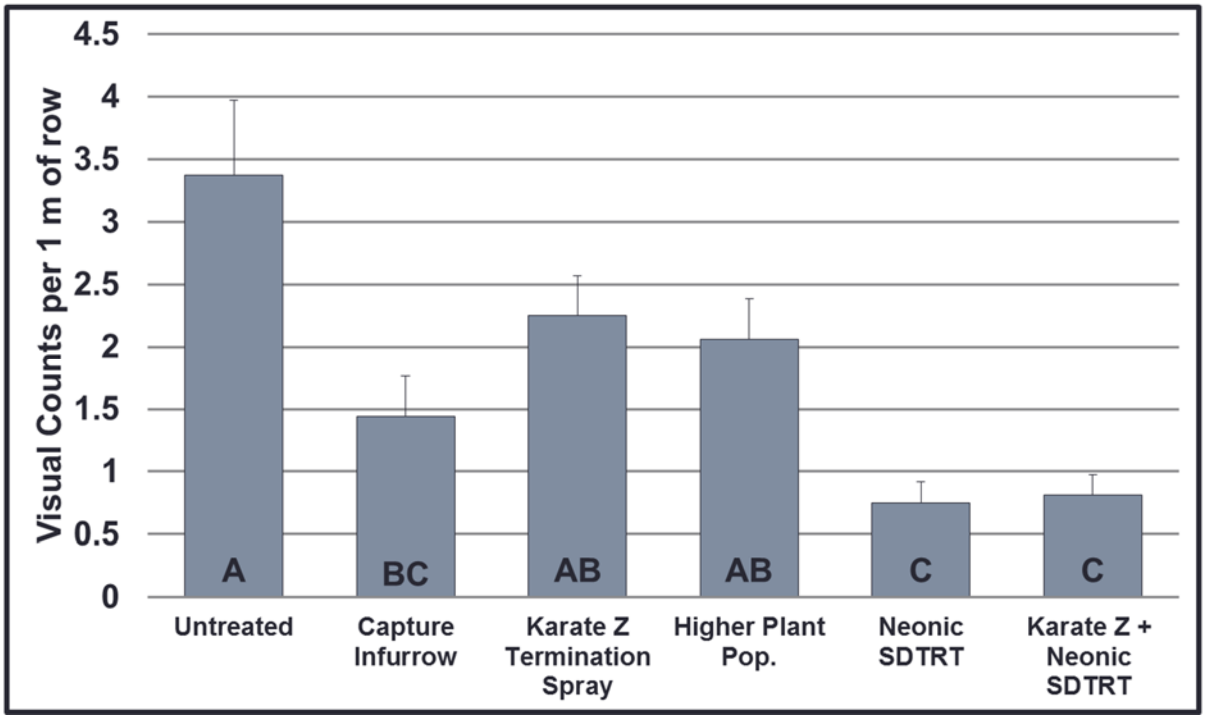

Figure 2: Total insect pest visual counts for each control method ($p<0.05$).

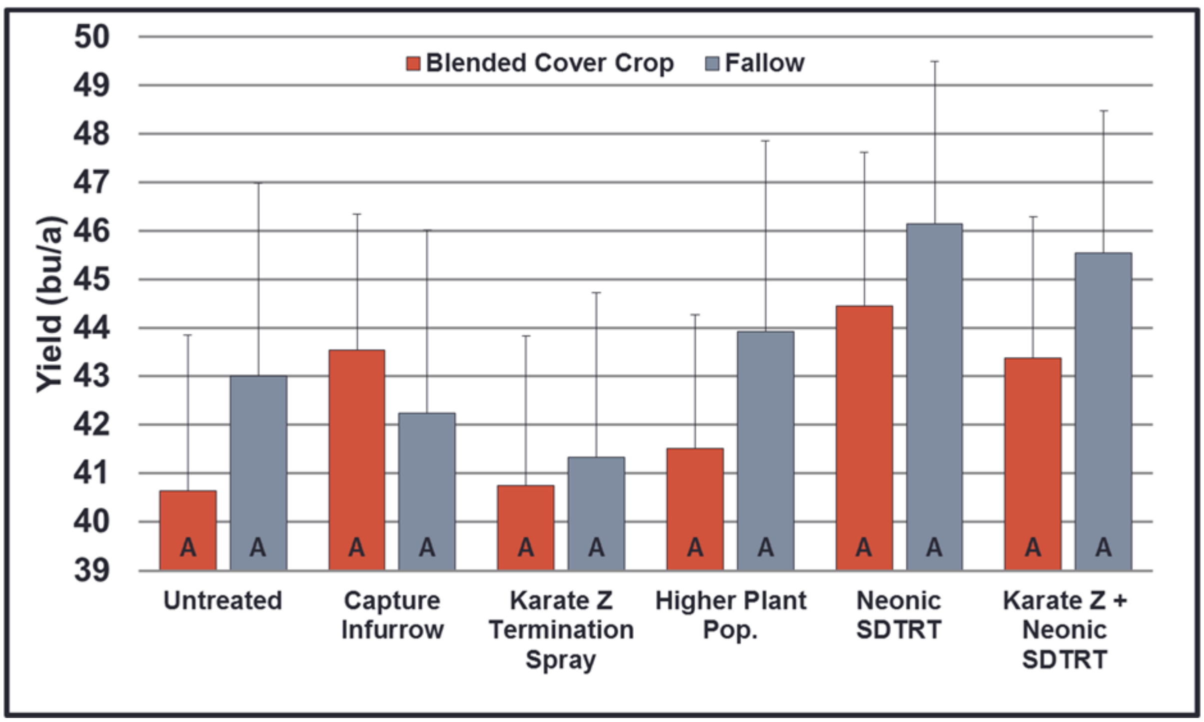

Figure 3: Yields for each control treatment in each cropping system ($p>0.05$).

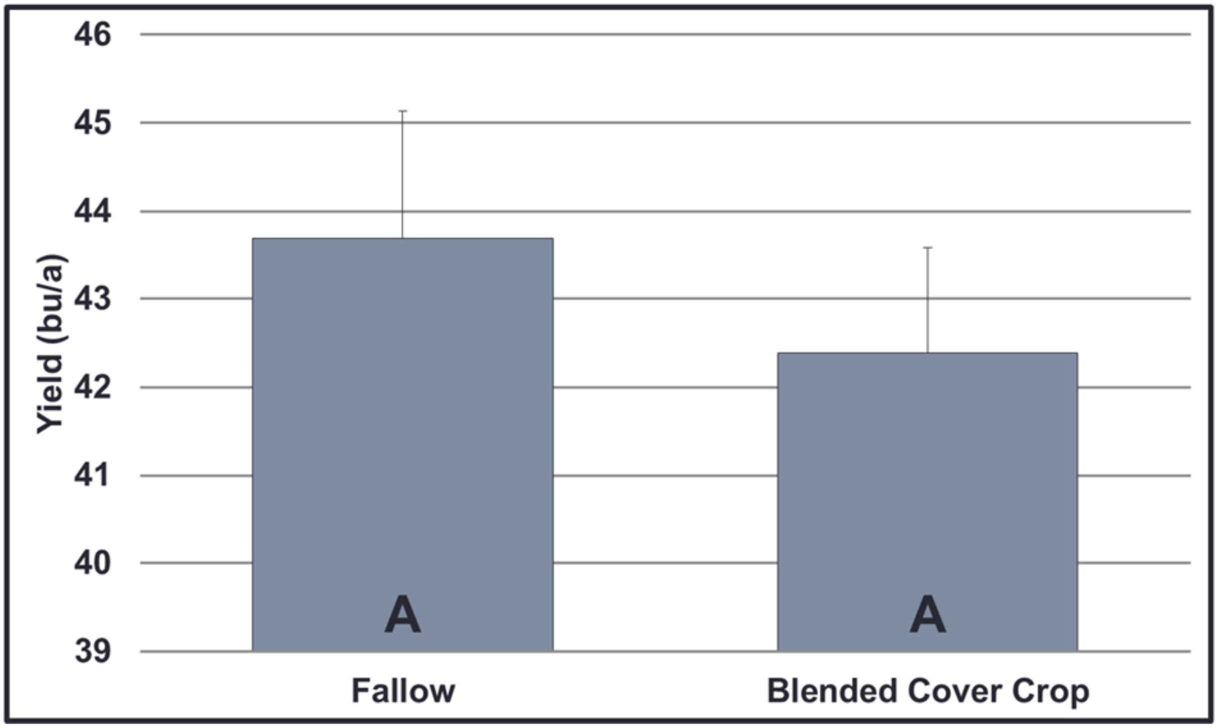

Figure 4: Yields for each cropping system ($p > 0.05$).

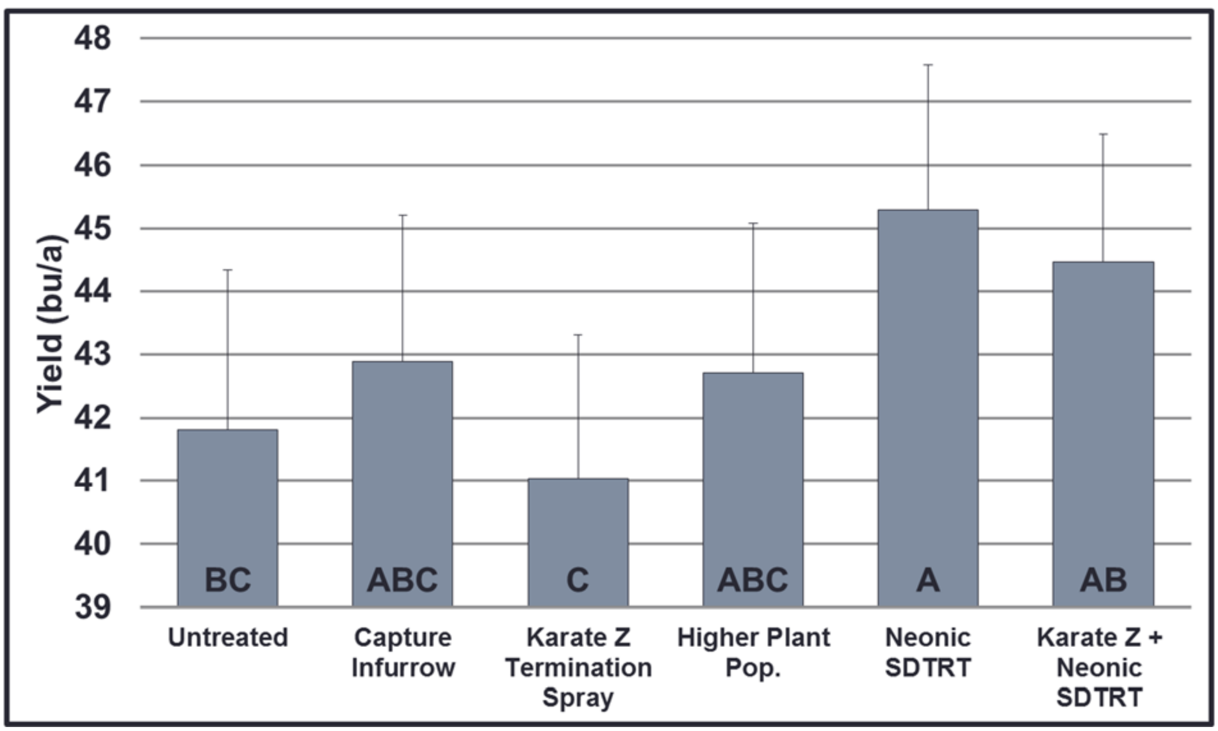

Figure 5: Yields for each control treatment across all cropping systems ($p < 0.05$).