IMPACT OF EARLY SEASON MANAGEMENT DECISIONS ON SOYBEAN YIELD

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Abstract

Neonicotinoid insecticide seed treatments are currently used in all row crops throughout the Mid-South region of the United States. They are used for their high degree of efficacy on early season pests that occur at the early growth stages of row crops. Recent studies have shown that neonicotinoid insecticide seed treatments showed a value of yield increases as well as positive net returns when utilized in soybeans. Seed treatments are one of several management tools adopted by soybean producers to achieve maximum yields across the Mid-South. A study was conducted to show the effect of stand loss on soybean yield at different plant populations and timings of plant loss. The treatments in this study included six different soybean plant populations: 185,250; 247,000; 308,750; 370,000; 432,250; 494,000 plants ha^{-1} and timings of plant loss at V1 and V4. Another study was conducted to maximize soybean yields using plant populations, seed treatments, and planting dates. The treatments in this study included six different soybean plant populations: 185,250; 247,000; 308,750; 370,000; 432,250; 494,000 plants ha^{-1}; three different seed treatments: untreated, base fungicide only, and insecticide + base fungicide; and two different planting dates: Mid-May and Mid-June. Plots were scouted weekly and insecticide applications were applied when insect thresholds were reached. Our findings determined that increasing seeding rates could compensate for stand loss, however, there is a potential risk because higher seeding rates are not as profitable when no stand loss occurs.

Introduction

Neonicotinoid insecticide seed treatments are currently used on 70% of soybean acres in Mississippi. They are used for their high degree of efficacy on early season pests that occur at the early growth stages of row crops. Recent studies have shown they can increase yields as well as net returns when utilized (North et al. 2016). Seed treatments are one of several recent management tools adopted by soybean producers to achieve maximum yields across the Mid-South. The use of plant populations, planting dates, and precision planting to achieve uniform stands early in the growing season are several recent adoptions with seed treatments to maximize yield potential. The objectives of this research are to determine the effect of stand loss on soybean yield at different plant populations and timings of plant loss and to determine the effect of plant populations, seed treatments, and planting date on maximizing yield of soybean.

Materials and Methods

An experiment was conducted in 2016 to quantify the effect of stand loss on soybean yield at different plant populations and timings of plant loss. Objective 1: ASGROW 4835 was planted at three locations in Mississippi. One trial was conducted at Mississippi State University, MS located on the R.R. Foil North Farm. Two trials were conducted at the Delta Research and Extension Center located in Stoneville, MS. Trials consisted of 12.2 m plots with 4 replications. The three trials consisted of a RCB with a factorial arrangement of treatments. Factor A was seeding rate: 185,250; 247,000; 308,750; 370,000; 432,250; 494,000 plants ha^{-1}; Factor B was percent stand loss: 0%, 20%, and 40%; and Factor C was stand loss timing: stand loss at V1 and V3. Percent loss was achieved by mixing ASGROW 4835RR (Roundup Ready) and HBKLL 4953 (Liberty Link) at the given percentages based on seeding rate. Roundup was applied to each assigned plot at V1 and V3 to remove plants with Liberty Link herbicide trait (LL) seed to achieve percent stand loss in each plot. Objective 2: ASGROW 4835 was planted at three locations in

Mississippi. One trial was conducted at Mississippi State University, MS located on the R.R. Foil North Farm. Two trials were conducted at the Delta Research and Extension Center located in Stoneville, MS. Trials consisted of 12.2 m plots with 4 replications. The three trials consisted of RCB with factorial arrangement of treatments. Factor A seeding rate: 185,250; 247,000; 308,750; 370,000; 432,250; 494,000 plants ha^{-1}; Factor B seed treatment: untreated seed, base fungicide alone, and insecticide + fungicide seed treatment; Factor C planting date: Mid-May and Mid-June planting dates.

Results

Stand Loss Trial: There were no significant differences between locations; therefore, all experiments were combined for data analysis. There were significant relationships between seeding rate and yield at 0% and 40% stand loss. There was a decrease of 1.1 kg ha^{-1} for every 1,000 seed planted at the 0% stand loss (Figure 1). There was no significant relationship between seeding rate and yield at the 20% stand loss (Figure 2), however, there was an increase of 1.7 kg ha^{-1} for every 1,000 seed planted at the 40% stand loss (Figure 3). There were significant relationships between seeding rate and net returns at 0%, 20%, and 40%. Net returns decreased as seeding rate increased however, when stand loss occurred, higher plant populations compensated for yield and offered higher net returns (Figure 4).

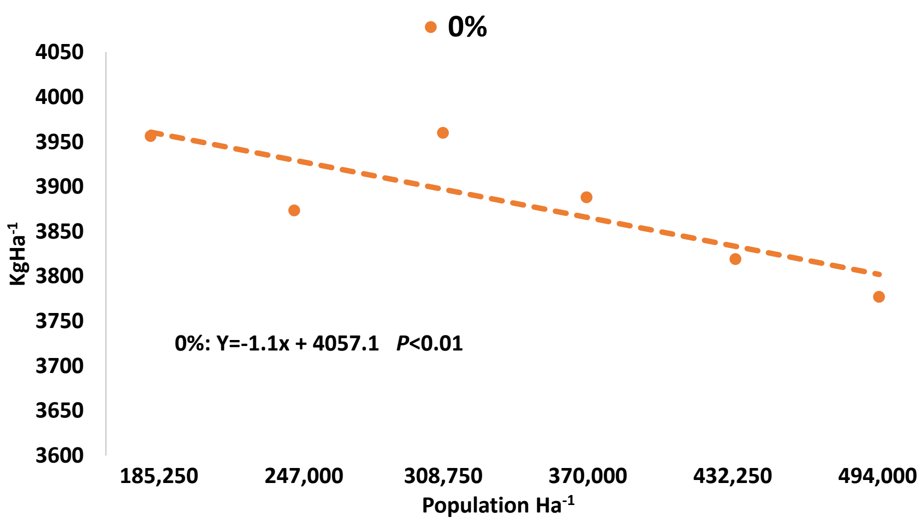

Figure 1. Relationship of stand loss and yield at 0% stand loss yield across all locations in 2016.

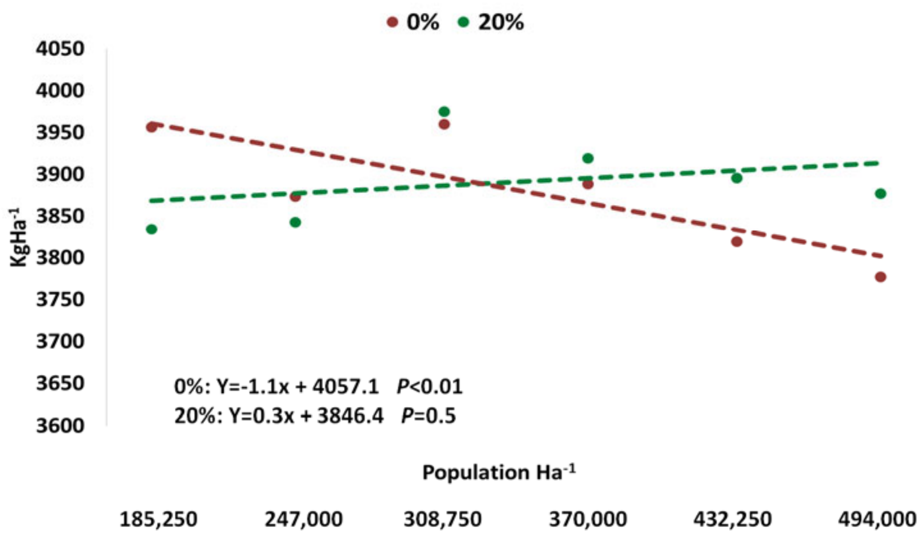

Figure 2. Relationship of stand loss and yield at 20% stand loss yield at all locations in 2016.

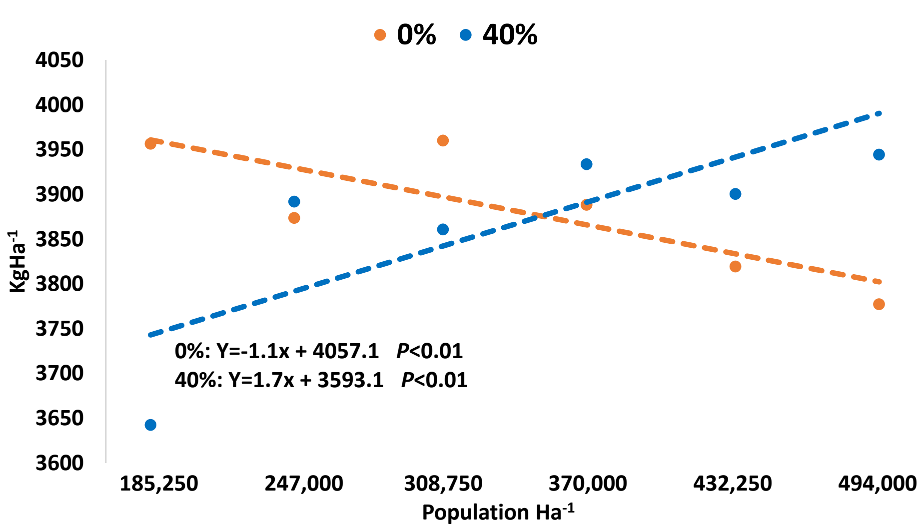

Figure 3. Relationship of stand loss and yield at 40% stand loss yield at all locations in 2016.

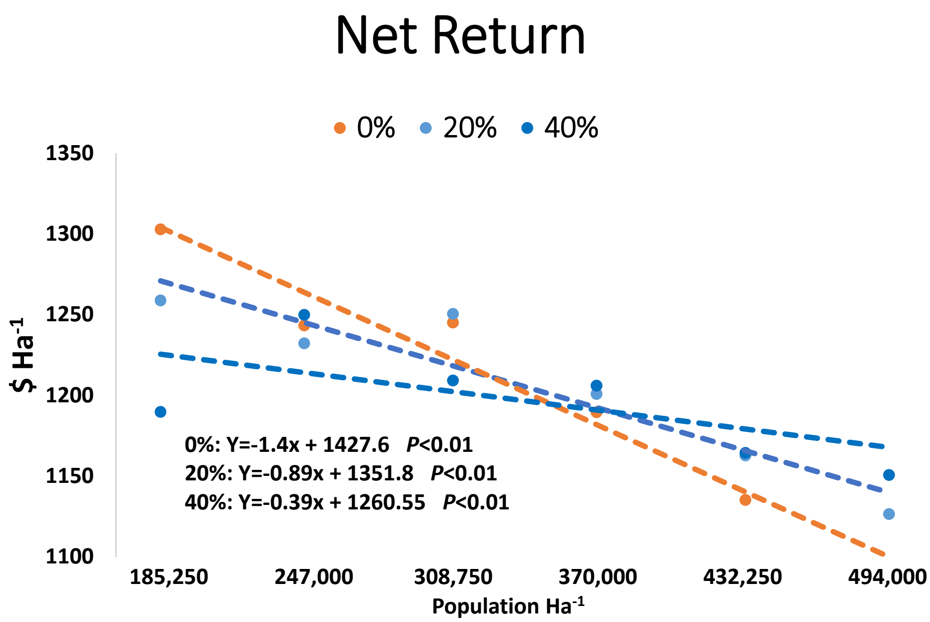

Figure 4. Net returns for stand loss trials across all locations in 2016.

Plant Population Trial: At the optimal planting date (Mid-May); untreated and fungicide only seed yielded higher than the seed treated with insecticide + fungicide at the lower seeding rate (Figure 5). However, untreated and fungicide only treated seed yield decreased as seeding rate increased but the neonicotinoid insecticide seed treatment stabilized yield across all six plant populations. At the late planting date (Mid-June); untreated and fungicide only seed increased in yield as plant population increased and the neonicotinoid seed treatment yielded higher and stabilized yield across all six plant populations. Overall, regardless of planting date, the IST stabilized yield across all six plant populations.

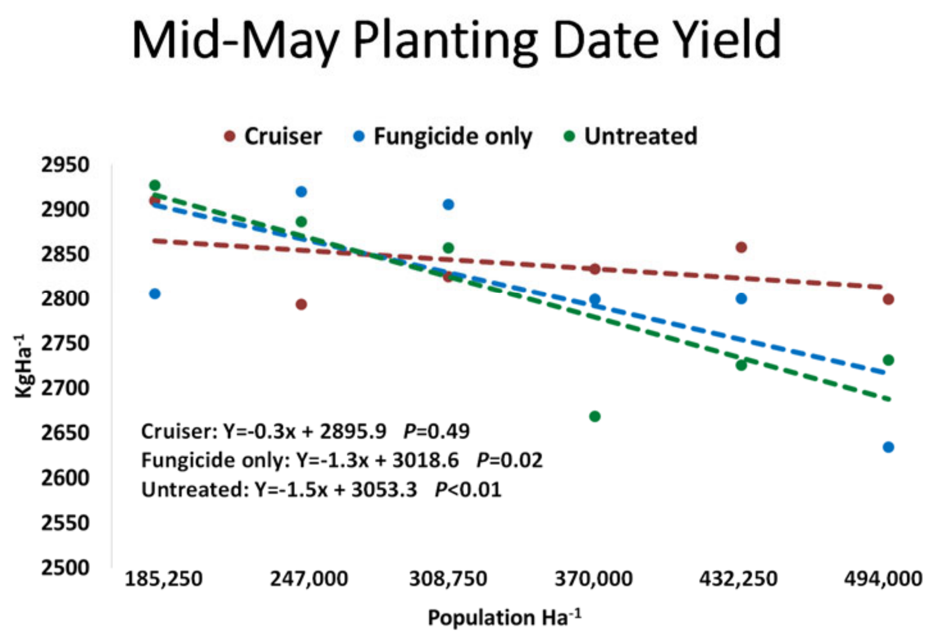

Figure 5. Plant population yields at optimal planting date across all locations in 2016.

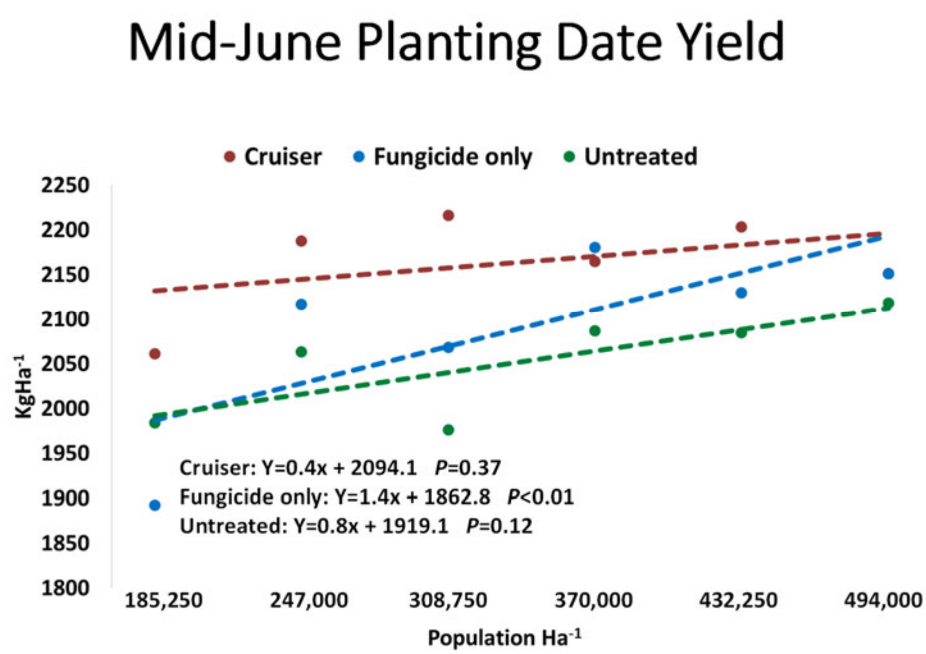

Figure 6. Plant population yields at late planting date across all locations in 2016.

Summary

Across trials in 2016, soybean yields were maximized at lower plant populations when no stand loss occurred. When stand loss occurred, soybean yields benefited from higher plant populations and compensated for the stand loss at 20% and 40%. The neonicotinoid insecticide seed treatment stabilized yield across optimal and late planting dates. Yield was penalized by increased plant populations without an IST at optimal planting dates. At late planting dates, IST stabilized yield across all plant populations and fungicide only and untreated seed benefited from increased plant populations. Overall, it is possible to compensate for stand loss by increasing seeding rate however, there is a risk associated with increasing seeding rates and losing profit when a stand loss does not occur due to higher cost of seed for higher plant populations.

References Cited

North, J.H., J. Gore, A.L. Catchot, S.D. Stewart, G.M. Lorenz, F.R. Musser, D.R. Cook, D.L. Kerns, D.M. Dodds. 2016. Value of Neonicotinoid Insecticide Seed Treatments in Mid-South Soybean (*Glycine max* L.) Production Systems. Journal of Economic Entomology 2016.