LATE SEASON – Soybean, Topeka – KS/2020

INTRODUCTION

The physiological activity of soybeans (*Glycine max* L. Merrill) reaches the maximum assimilation of carbon and nitrogen in the reproductive stage (Nelson-Schreiber & Schweitzer, 1986). During the seed filling period (R5-R7 stages), soybean accumulates between 30-50% of final yield. Therefore, management techniques that can enhance seed filling are of great interest to researchers at the field scale. Fungicides that belong to the group of strobilurins have been studied because it has benefit effects on the photosynthetic rate in treated leaves (Joshi et al., 2014). For that reason, we aim to evaluate the effects of foliar insecticide, fungicide and fertilizer applications at the beginning of seed-filling period (at this point, considered late season) on biomass and grain yield in soybean seeds.

PROCEDURES

Site description

This study trial was conducted at K-state research station in Topeka, KS (39.07° North, 95.76° West), during the 2020 season. The site utilized conventional tillage a few days prior to sowing. The crop was developed in rainfed condition. Before planting, soil samples were taken (24-inch depth) to chemical and physical characterization. It presented 12% clay, 47% silt,41% sand, with pH (water) of 7.05, phosphorus (Mehlich) level of 11.7 ppm (below the critical threshold of 90 ppm), and organic matter of 1.7%.

Experimental design

The experiment was carried out in a randomized complete block design with 5 replications. Nine foliar application treatments were applied at R3 (beginning pod) growth stage: i) Control: No treatment applied; ii) fungicide protection: Headline (Pyraclostrobin - 9 fl oz/A); iii) insecticide protection: Siavanto (Flupyradifurone – 7 fl oz/A); iv) full-foliar protection: combination of fungicide + insecticide (Pyraclostrobin+ Flupyradifurone); v) N fixation longevity: *Bradyrhizobium japonicum* inoculant; vi) plant nutrition (PN) (standard): Sulfur (S) application; vii) PN (complete): Pulse Ni (Phosphate (P2O5) 6.0%; Soluble Potash (K2O) 4.0%; Magnesium (Mg) 1.0%; Water-soluble Magnesium (Mg) 1.0%; Cobalt (Co) 0.5%; Molybdenum (Mo) 10.0%; Nickel (Ni) 1.5%; Zinc (Zn) 6.0%) and S application; viii) PN (complete) + N fixation: Combination of treatments vi and vii; ix) intensified inputs: All treatments combined.

Soybean variety was AG42X6 (maturity group 4.2) were sowed with density of 140,000 seeds/acre. Plots were 30 feet long and 4 rows wide spaced by 30 inches. The experiment was sown in May 05, 2020.

Plant measurements

At R5 growth stage (beginning of seed fill) shoot biomass samples were collected from a central row within a 5-feet row segment randomly selected in each plot. All samples were dried at 75ºC until constant weight and the dry shoot biomass. At harvest maturity (R8), 5 feet were harvested to estimate grain yield. Seed weight, moisture and impurity were recorded after threshing. Yield

components were adjusted to 130 g kg^{-1} moisture content. Harvest index was calculated as the ratio between grain biomass and grain plus shoot biomass at R6.

Statistical analysis

Results were analysed in R studio software, package stats, function *lme* (R Core Team, 2017). Mixed model analysis of variance (ANOVA), with plant management as a fixed effect and block as random effect. Means for significant fixed treatment responses were compared using Fischer LSD test. All statistical outcomes were significant at $\alpha = 0.05$.

RESULTS

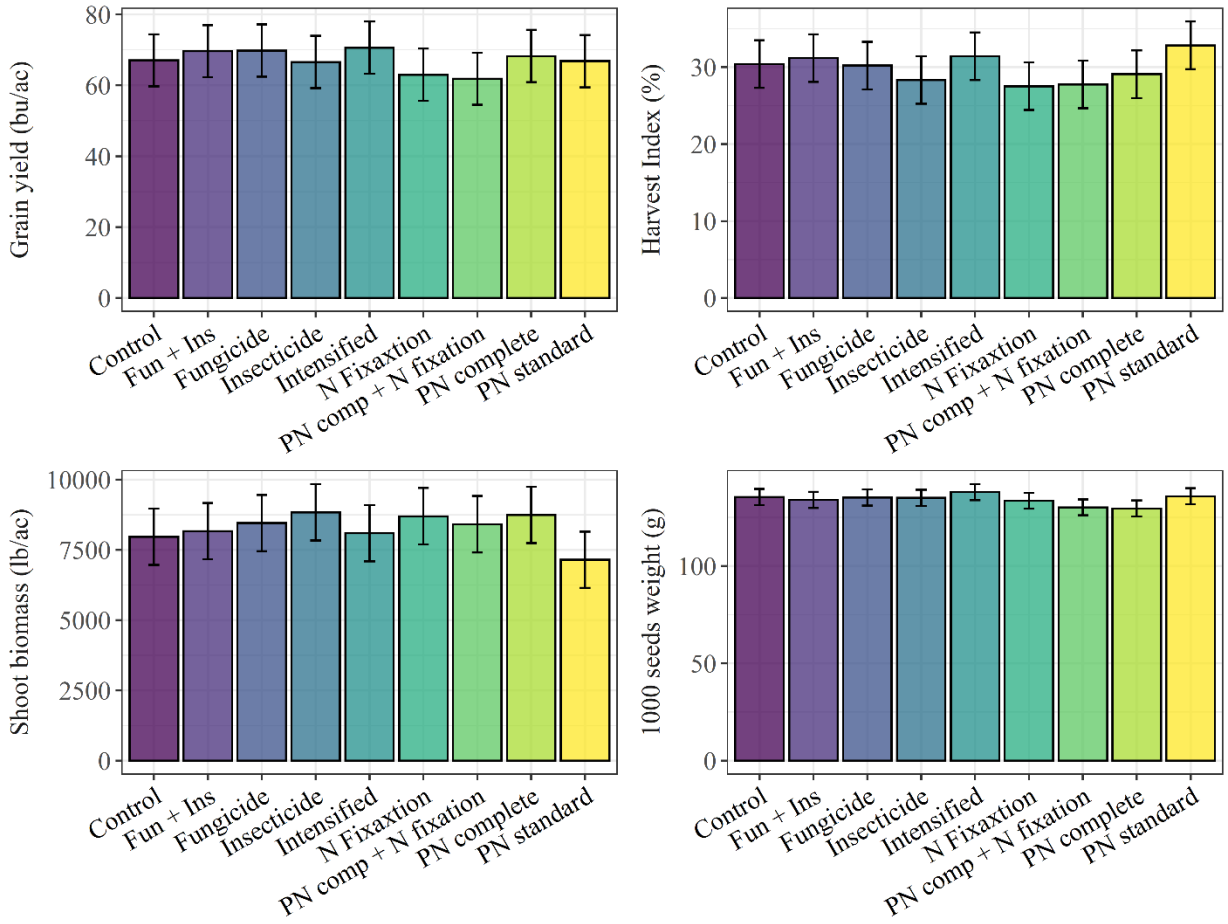

Figure 1. Results for grain yield (bu/ac), harvest index (%), shoot biomass at R5 (lb/ac), and 1000 seed weight (g) in different plant management practices. Columns refer to mean value, and the vertical lines represent the standard deviation of each variable. Different lower-case letters indicate significant differences results between treatments on ANOVA at $\alpha = 0.05$ probability.

Soybean yield and 1000 seed weight

The treatments did not affect soybean grain yield. The observed yield means ranged from 71 bu/ac (intensified treatment) to 62 bu/ac (PN comp + N fixation). Furthermore, thousand seed weight was also not affected by the treatments. The PN complete treatment obtained the lowest mean

value, 129.5 g. The intensified treatment reached the maximum mean value 138g. Along with these results, the maximum standard deviation was 7g when treated with fungicide and minimum standard deviation were 2g (fungicide + insecticide).

Shoot biomass

Treatments did not contribute to the significant changes in shoot biomass. The means ranged from 7148 lb/ac (PN standard) to 8835 lb/ac (insecticide only).

Harvest Index (%)

Furthermore, harvest index wasn't affected by foliar applications. Average value ranged from 28% (PN comp + N fixation) to 33% (PN standard).

CONCLUSION

The study demonstrates the late season treatments doesn't impact yield, shoot biomass and harvest index. Our findings imply no confirmation to apply late season management practices such as the one described in this research.

REFERENCES

Joshi, J., Sharma, S., & Guruprasad, K. N. (2014). Foliar application of pyraclostrobin fungicide enhances the growth, rhizobial-nodule formation and nitrogenase activity in soybean (var. JS-335). *Pesticide Biochemistry and Physiology*, *114*(1), 61–66. https://doi.org/10.1016/j.pestbp.2014.07.002

Nelson-Schreiber, B. M., & Schweitzer, L. E. (1986). Limitations on Leaf Nitrate Reductase Activity during Flowering and Podfill in Soybean'. In *Plant Physiol* (Vol. 80). https://plantphysiol.org