Effect of Cover Cropping Systems on Dryland Soybean Plant-vigor, Growth, and Yield

21-2021 Annual Report

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Background and Objectives

Nearly 60% of all soybeans grown in Mississippi are produced in a dryland environment. Inconsistent yields are a common problem for dryland soybean production due to irregular rainfall events during the growing season. It has been suggested that the use of cover crops might help alleviate some of the issues during the growing season through improved water infiltration, soil moisture retention, nutrient availability, and enhanced soil organic matter. Currently less than 2% of cropland in Mississippi utilizes cover crops. Therefore, the goals of this project were to evaluate various cover crops in conjunction with different planting dates and nutrient sources to determine the optimal combination for integrating cover crops into a cropping system.

Objective 1. Evaluate the effects of cover cropping systems on dryland soybean plant-vigor, growth, and yield.
Objective 2. Evaluate the effects of cover cropping systems on "soil health" (physical characteristics, microorganisms, soil moisture, etc.…).
Objective 3. Determine the economic benefit of cover crops, source of fertilizer, and planting date on soybean production.

Report of Activity

Objective 1: Evaluate the effects of cover cropping systems on dryland soybean plant-vigor, growth, and yield.

Summary: Cover crop biomass was collected for early soybean planting date on April 15. Fertility treatments were applied to all treatment combinations April 16. The early planting date cover crop was terminated April 19 and soybeans were planted April 27. For the late planting date, cover crop biomass was collected May 14 and cover crops were terminated May 17. The late soybean planting was completed May 27. Plots were maintained throughout the growing season. Soybean leaf samples were taken July 13 for the early planting date and July 30 for the late planting date.

The four center rows of soybean from each plot in the early planting date were harvested September 28. The four center rows of each plot for the late planting date were harvested October 12. Prior to harvest plant heights were taken from each plot. Cover crops were planted October 27 and are being maintained until a biomass sample will be collected in the spring. Soil samples were taken from each plot March 3. Samples were air dried and ground to prepare them for soil nutrient analysis. A subsample for each treatment was sent to Southern Soils Laboratory for analysis and fertilizer recommendations for the

current year.

Objective 2: Evaluate the effects of cover cropping systems on "soil health" (physical characteristics, microorganisms, soil moisture, etc.…).

Summary: Microorganism soil samples were collected May 7 (early planting) and June 4 (late planting). Samples were processed and stored for analyses. Soil and tissue samples taken during the growing season were processed in Dr. Kingery's laboratory on campus. Data is currently being complied for statistical analyses.

Objective 3: Determine the economic benefit of cover crops, source of fertilizer, and planting date on soybean production.

Summary: In collaboration with Dr. Xiaofei Li, applicable production functions are being developed. Data is currently being compiled for analysis. Additional data is still required for completion of analysis.

Impacts and Benefits to Mississippi Soybean Producers

In 2020, 2.0 million acres of soybeans were planted in Mississippi. Of these 2 million acres approximately 60% were planted in dryland environment. This is over 1 million acres of dryland soybeans in Mississippi that are prone to inconstant yields, due to the lack of adequate moisture during critical stages during the growing season. Dryland soybean yields were over 15 bu/ac lower than for irrigated soybeans in 2012. Identifying an affordable cover cropping system that will minimize inconsistent dryland soybean yield due to lack of timely rainfall events could provide an additional $18 million across the state of Mississippi in dryland soybean production based on a 5% increase in yield.

End Products – Completed

Graduate Student Thesis: Effects of cover crop management on biologically related soil properties in a Mississippi dryland soybean system, published 2020.
Journal publication: Agronomy, submitted November 2020, accepted January 6, 2021, published soon.
Citation: Pokhrel, S.; Kingery, W.L.; Cox, M.S.; Shankle, M.; Shanmugam, S.G. Impact of Cover Crops and Poultry Litter on Selected Soil Properties and Yield in Dryland Soybean Production. *Agronomy* **2021**, *11*, x. https://doi.org/10.3390/xxxxx
Conference presentation: "Nutrient Management and Soil Quality in Cropping Systems" was given at the annual meeting of the Mississippi Chapter of the American Society of Agronomy.

End Products – Forthcoming

It is expected that at least one additional publication will be written based off ongoing activities from this study. Additionally, several presentations will be given at relevant conferences throughout the duration of the trial.

Graphics/Tables

Figure 1. Comparison of spring cover crop biomass before planting soybean

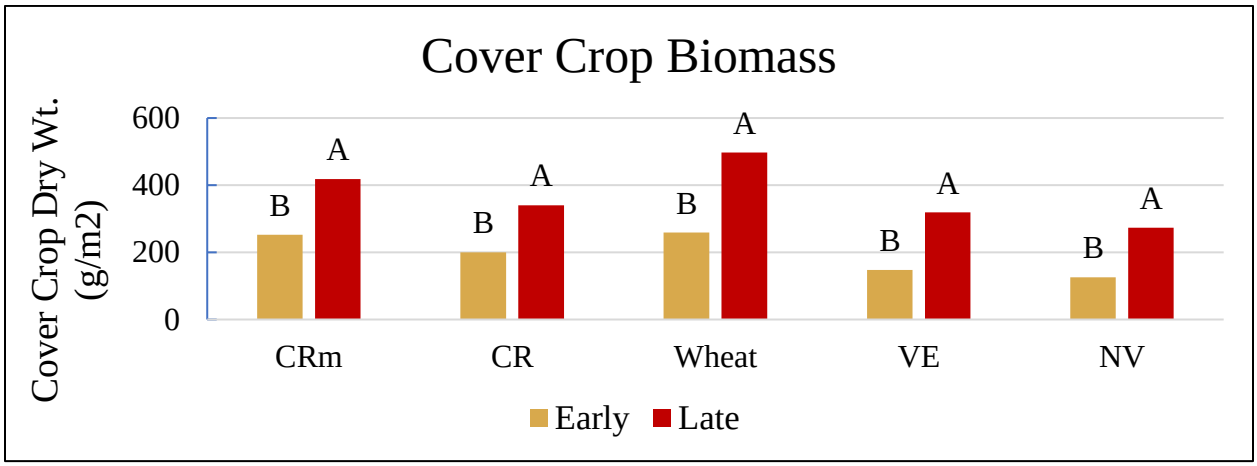

Figure 2. Soybean yield relative to planting date (Early target May 1 and Late target June 1)

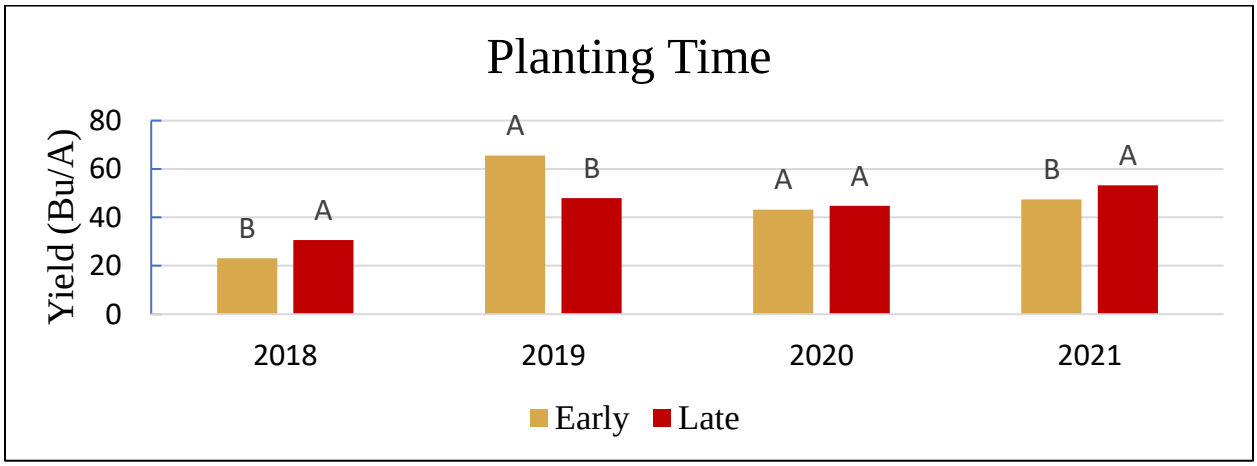

Figure 3. Soybean yield with fertilizer source at Pontotoc, MS from 2018 to 2021.