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

Dr. Mark W. Shankle

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Annual Report

INVESTIGATORS:

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BACKGROUND AND OBJECTIVE(S):

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.

In the **first objective**, different cover crops (native vegetation, cereal rye, wheat, and vetch) were planted in the fall. These cover crops were terminated in the spring where biomass yield was collected. Soybeans were no-till planted into cover crop residue at 2 different planting dates. Early season insect management was practiced to help promote soybean seedling vigor. In addition to planting times, subplots of 3 fertility practices was included; a no fertilizer check, a standard commercial fertilizer rate based on soil test recommendations of 120 lb/A K_2O and 30 lb/A P_2O5, and a poultry litter rate at a 2 ton/A rate. Ratings for soybean plant height and leaf nutrient content were collected. Each soybean plot was harvest and cover crops were reestablished.

The **second objective,** surface soil samples were collected after soybean were planted in the spring. Laboratory analyses were conducted to determine soil health characteristics.

In the **third objective**, basic economics will be utilized to calculate net return based on the current market price of implementing the different cover cropping systems (cover crop, fertilizer, and soybean).

In **summary**, studies are being conducted at the Pontotoc Ridge-Flatwoods Branch Experiment Station to evaluate the effects the different cover cropping systems on soybean growth/development and yield. Also, the effects on "soil health" (physical characteristics, microorganisms, soil moisture, etc…) are being evaluated. Standard agronomic management practices for dryland production in the area are being employed. Treatments include 5 cover crops, 3 fertilizer treatments, and 2 soybean planting times. A composite soil sample for each treatment system was taken in early spring to identify the appropriate fertilizer rate to apply. An analysis of the poultry litter indicated that total N was 3.2% and total C was 23.4%. The experiment was set-up as a split-split plot arrangement of treatments in a randomized complete block design. In addition to simple ANOVA and means separation, SAS software is being utilized for computations of correlation and regression analyses that best describe results (other methods employed if warranted).

REPORT OF PROGRESS/ACTIVITY

OBJECTIVE(S):

Objective 1. Evaluate the effects of cover cropping systems on dryland soybean plant-vigor, growth, and yield.
Cover crops were planted on 10-29-2018 and maintained until termination on April 2 and May 8, 2019. Prior to termination, cover crop samples were collected from a $1m^2$ to determine biomass. Baseline soil samples were collected and fertilizer treatments were made based on soil test laboratory recommendations. Asgrow 45X8 soybean was planted on April 30 and May 23, 2019 to represent early and late planting times. The soybean crop was maintained throughout the growing season. Soybean leaf samples were collected at the R2 growth stage. The 4 center rows from each plot were

harvested on 9-30-2019 and cover crops were re-established on 11-05-2019.

The following data was collected thought the year and analysis are currently being conducted.

- Root-zone soil samples were collected after cover crop was harvested and after soybean were planted. This is considered an "At Planting" soil sample. A second root-zone soil sample was collected at the R4-R5 soybean growth stage and whole plant samples were also collected at the time. Microbial community will be identified for these samples to ultimately determine population counts of microbes associated with nitrogen fixation processes of the soybean plant (Billy Kingery's Lab).
- Petiole and leaf samples were collected at the R2 soybean growth stage to determine nutrient content (Haile Tewolde's Lab).
- Plant heights were measured from 4 center rows of the 8 row plots prior to harvest.

Objective 2. Evaluate the effects of cover cropping systems on "soil health" (physical characteristics, microorganisms, soil moisture, etc…). Soil core samples were collected from all plots. Dr. Billy Kingery and Dr. Shankar Shanmugam collected surface soil samples from each plot to identify soil microbes that are associated with promotion of nodulation. Microorganism research is being conducted in the laboratory on campus. Soil moisture data has been collected from the center rows of each plot to determine the extent of water conservation between treatments. Remotely sensed imagery was collected throughout the season by Jay Munyon with USDA-ARS (Haile Tewolde). This data will be used to evaluate crop response to different treatments.

Objective 3. Determine the economic benefit of cover crops, source of fertilizer, and planting date on soybean production. Economic benefits will be determined after more data has been collected.

END PRODUCTS:

A graduate student, Sapana Pokhrel began working on this project in August 2018. Results from this research was reported at the annual meeting of the Mississippi Academy of Sciences in February 2019 and 2020.