

MISSISSIPPI SOYBEAN PROMOTION BOARD

Evaluating Nutrient Availability Following Cover Crops in Mississippi Soybean Production Systems.

40-2020

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RATIONALE/JUSTIFICATION FOR RESEARCH:

Numerous studies evaluating cover crops and their influence on soil nutrient availability have been carried out across the U.S. While these studies have touted greater nutrient availability following a cover crop, the actual agronomic value to the subsequent cash crop in a nutrient deficient situation is largely unknown. Similarly, knowledge of the effects of cover crops on P₂O₅ and K₂O availability in Mississippi soybean production systems is lacking. Insufficient P or K availability in soils result in lower soybean yields than the achievable maximum. A previous large scale study conducted throughout Mississippi determined that soybean yields could be increased by an average of 8 to 10 bushels with the addition of P₂O₅ or K₂O fertilizers when soil nutrient values were determined to be insufficient by the state soil testing lab. With this information available, no research has been conducted in Mississippi to determine how cover crops may affect the subsequent soybean crop when P or K may be limiting, and how these cover crop systems may interact with a fall P or K fertilizer regime.

OBJECTIVE(S):

- 1. Determine if cover crop systems will improve nutrient availability and subsequent soybean yields in a possible nutrient deficient situation.**

A corn or soybean crop was planted April 4 and April 12 to normalize the field. After the 2020 harvest the fields will be prepared for fall cover crop planting and fertilization. 2020 crops were harvested and fields prepared for fall fertilization and planting. Soil Samples will be taken, plots will be fertilized, and cover crops will be planted during the next suitable period weather permitting. Harvest data recorded via yieldsense (geospatial yield monitoring) has been entered and analyzed to determine a baseline historical yield for sites. Following harvest soil samples were collected from individual small plots to determine nutrient availability. Soil samples were dried, crushed, and analyzed for macronutrients, micronutrients, CEC, pH, and organic matter content. These values have been entered for each plot and changes following cover crop growth will be recorded and analyzed. Cover Crops winter wheat, cereal rye, crimson clover, and tillage radish were seeded into freshly shaped 76" beds via gandy box spreader (figure 3.) on October 21, 2020 at their respective seeding rates. Adequate rainfall was received within one week after seeding allowing for germination and stand establishment was achieved, pictured below (figure 4.). Cover Crop growth was negatively impacted by severe winter weather observed February 14 20, 2021 in the area. Due to this delay in growth and biomass accumulation a no-cost extension was

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applied for and granted on 3/02/2021. Since this date the cover crops have recovered well and accumulated adequate biomass (pictured below). Weather permitting, during the month of April cover crops will be biomassed, analyzed for nutrient content, and soil samples will be taken and analyzed followed by the subsequent termination of cover crops and planting of soybean.

Cover crop biomass samples were taken April 13, 2021 from each plot. Cover crop biomass was determined by sampling a meter square area in each individual plot to determine dry biomass and nutrient content of each cover crop. Cover Crops were terminated after sampling on April 13 with paraquat at 1 qt/a. Weather permitting spring soil samples were taken from every plot April 21. Soil samples were dried, crushed, and analyzed for macronutrients, micronutrients, CEC, pH, and organic matter content. Soybean variety AG48X9 was planted May 20, 2021 for the 2021 soybean crop. 2021 soybeans will be tissue sampled, biomassed, and grain yield will be analyzed to determine cover crop effect on the 2021 soybean crop.

Pooled across fertilization regimes the cover crops cereal rye, winter wheat, and crimson clover produced the greatest and similar dry biomass ranging from 250 – 275 lb. of dry biomass acre⁻¹ (Figure 1.). Following the harsh winter weather observed in February, brassica plots did not recover and dry biomass of these plots was less and similar to that of winter weeds found in the no cover crop plots. Biomass content of cover crops cereal rye, winter wheat, and crimson clover contained significantly greater P and K lb/a than the no cover and tillage radish treatments (Figure 2.). As these cover crops breakdown throughout the 2021 growing season this nutrient content will be released back into the soil solution and its effects on the current soybean crop will be monitored.

Figure 1. Dry Biomass of winter 2020 cover crops in plots at the North Mississippi Research and Extension Center.

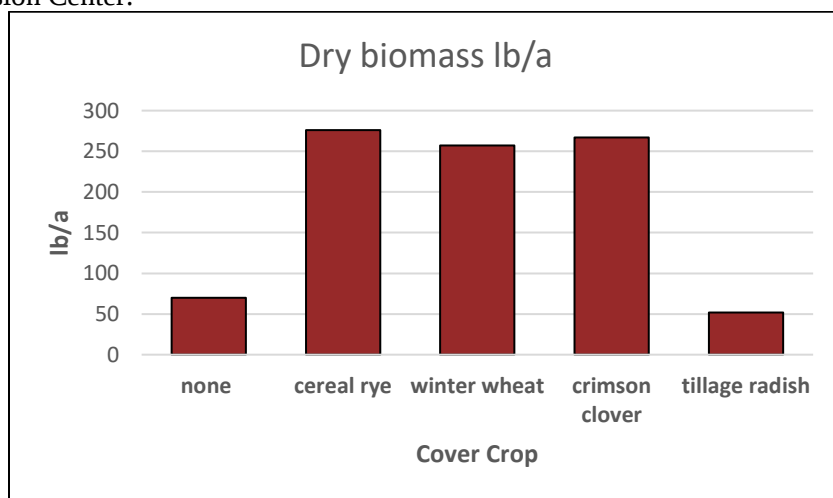


Figure 2. Nutrient Content of Cover crop biomass in plots at the North Mississippi Research and Extension Center.

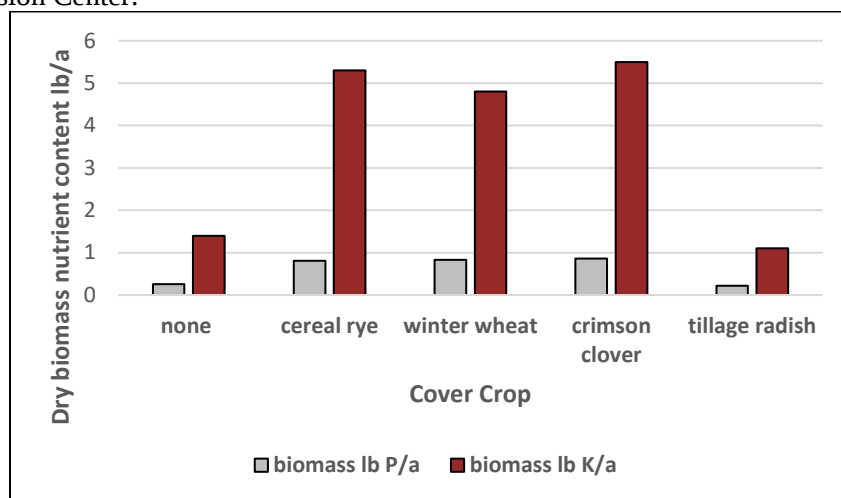


Figure 3. Seeding cover crop at NMREC via gandy box spreader.



Figure 4. Cover crop stand at NMREC pictured 12/10/2020.



Figure 5. Cover Crop stand at NMREC pictured 3/22/2021



Figure 6. Crimson Clover cover crop species.



Figure 7. Cereal Rye cover crop species.



Figure 8. Winter Wheat cover crop species.



Figure 9. Soil sampling cover crop plots at the North Mississippi Research and Extension Center.

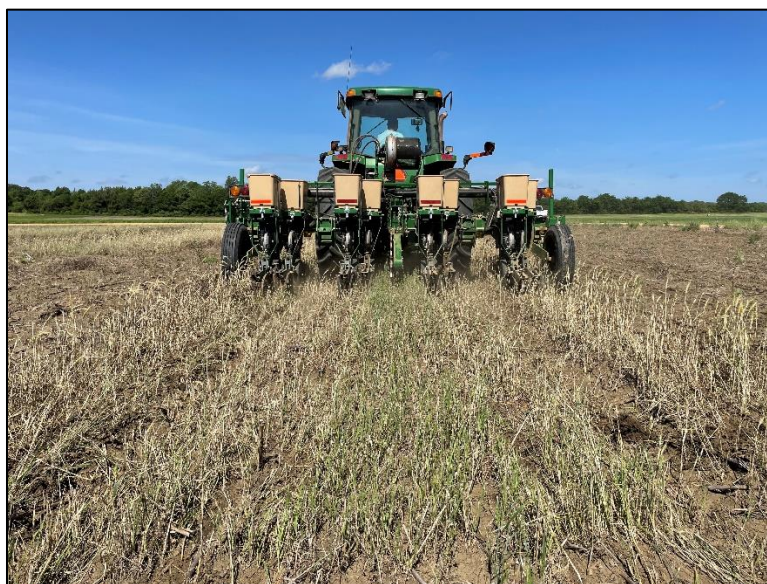


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Figure 10. Collecting Cover Crop Biomass at the North Mississippi Research and Extension Center.



Figure 11. Planting Soybean into Cover Crop plots at the North Mississippi Research and Extension Center.



2. Determine if cover crop systems will improve nutrient availability and subsequent soybean yields following a routine P and K fall fertilization regime.

A corn or soybean crop was planted April 4 and April 12 to normalize the field. After the 2020 harvest the fields will be prepared for fall cover crop planting and fertilization. Current crops have been harvested and fields have been prepared for fall fertilization and planting. Soil Samples will be taken, plots will be fertilized, and cover crops will be planted during the next suitable period weather permitting.

Harvest data recorded via yieldsense (geospatial yield monitoring) has been entered and analyzed to determine a baseline historical yield for sites. On October 21, 2020 triple superphosphate (0-46-0) or muriate of potash (0-0-60) at a rate of 100 lb/a was spread by hand onto individual small plots measuring 12.6 x 35 ft. Before fertilization soil samples were collected from individual small plots to determine nutrient availability. Soil samples were dried, crushed, and analyzed for macronutrients, micronutrients, CEC, pH, and organic matter content. These values have been entered for each plot and changes following fall fertilization and cover crop growth will be recorded and analyzed.

Cover Crop growth was negatively impacted by severe winter weather observed February 14-20, 2021 in the area. Due to this delay in growth and biomass accumulation a no-cost extension was applied for and granted on 3/02/2021. Since this date the cover crops have recovered well and accumulated adequate biomass. Weather permitting, during the month of April cover crops will be biomassed, analyzed for nutrient content, and soil samples will be taken followed by the subsequent termination of cover crops and planting of soybean.

Cover crop biomass samples were taken April 13, 2021 from each plot. Cover crop biomass was determined by sampling a meter square area in each individual plot to determine dry biomass and nutrient content of each cover crop. Cover Crops were terminated after sampling on April 13 with paraquat at 1 qt/a. Weather permitting spring soil samples were taken from every plot April 21. Soil samples were dried, crushed, and analyzed for macronutrients, micronutrients, CEC, pH, and organic matter content. Soybean variety AG48X9 was planted May 20, 2021 for the 2021 soybean crop. 2021 soybeans will be tissue sampled, biomassed, and grain yield will be analyzed to determine cover crop effect on the 2021 soybean crop.

Pooled across cover crop, the addition of potash fertilizer increased cover crop biomass by 93 lb acre⁻¹ when averaged across all cover crop species. Phosphate fertilizer additions saw a numerical increase of 10 lb acre⁻¹ across cover crops but did not differ from cover crops receiving no fertilizer (Figure 1.). Cover crops cereal rye, winter wheat, and crimson clover produced significantly greater biomass in plots receiving muriate of Potash in the fall, when compared to those in plots receiving no fertilizer (Figure 2.). Changes in soil availability of P or K from the fall to the spring were affected by winter cover crops (Figure 3.). Plots where winter wheat was grown were observed to decrease the availability of K by 50 lb/a when compared to the fall sampling. Tillage radish increased both P and K availability in the soil from the fall to the spring. This increase observed in availability due to Tillage Radish is possibly due to the early termination from frost and subsequent breakdown of organic matter accumulated and nutrient release back into the soil solution. The addition of Muriate of Potash fertilizer was observed to increase K soil availability by 30 lb/a, while plots receiving no fertilizer saw a decrease of 60 lb/a possibly due to cover crop uptake (Figure 4.). Effects of cover crops on the 2021 soybean crop will be monitored throughout the growing season and reported on at harvest.

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Figure 1. Cover crop biomass across fertilizer regime from plots at the NMREC.

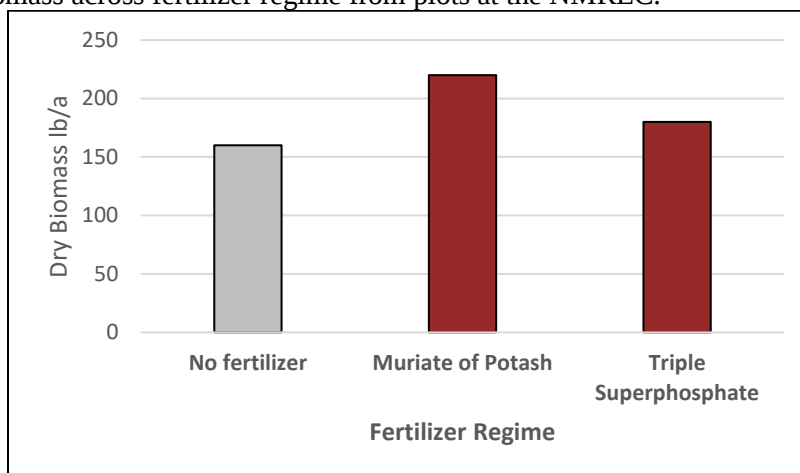


Figure 2. Cover crop biomass as influenced by the addition of Muriate of Potash at the NMREC.

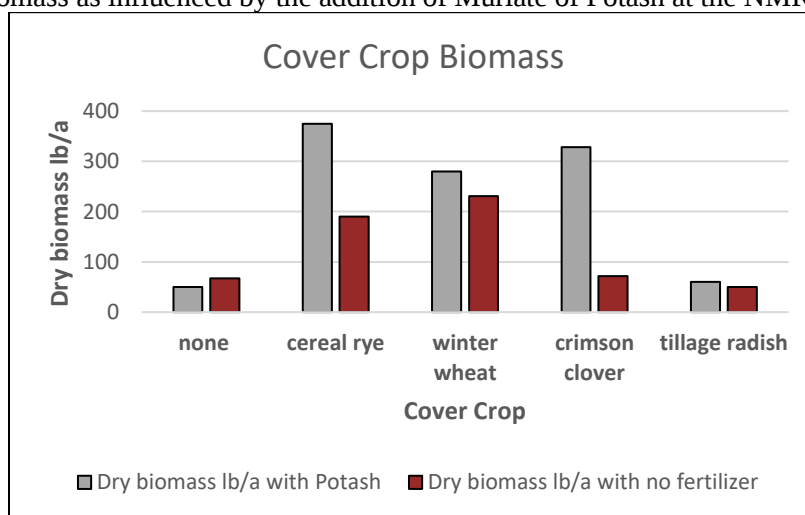


Figure 3. Change in soil availability of nutrients P and K as influenced by cover crop in plots at the NMREC.

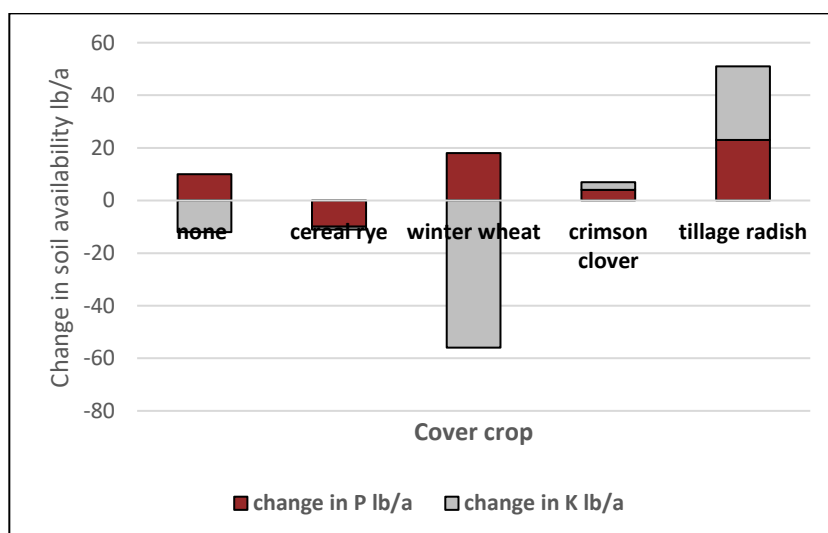
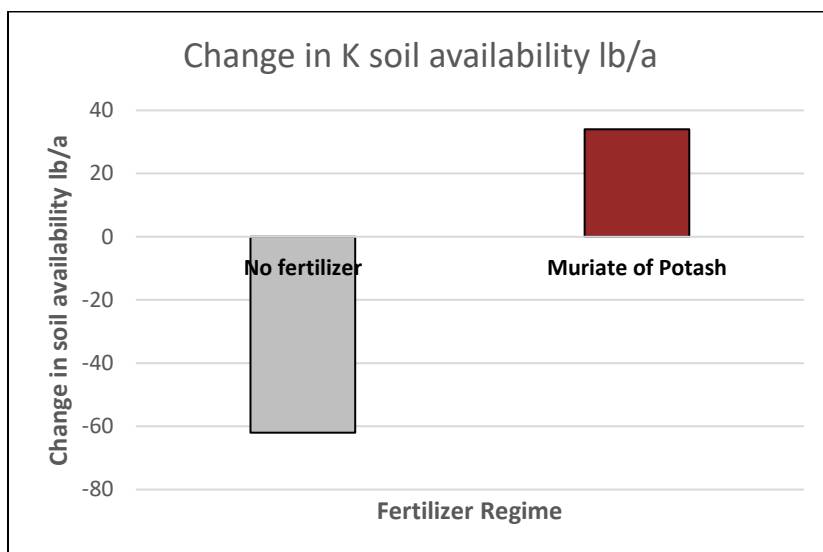


Figure 4. Change in soil availability of K as influenced by the addition of Muriate of Potash in plots at the NMREC.



3. Share project results with producers and stakeholder groups.

An invitational plot tour was held at NMREC August 18, 2020. During this tour, producers were introduced to the research plan for evaluating nutrient availability following cover crops and signage designated where the research would take place.

Objectives of the ongoing project and to date observations were disseminated to producers via the North Mississippi Producers Advisory Council Meeting February 18, 2021, Precision Technologies Round Up sponsored by New Day Precision February 24, 2021, and through the Mississippi Crop Situation Podcast. Results from the first year of the project will be disseminated to growers throughout plot tours and field visits during 2021.