**Fertility and Agronomic Resource Management Extension and Research for soybean (FAMERs) Program 02-2024**

Annual Report

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**Background and Objectives**

Proper soil fertility/plant nutrition management is a dynamic process encompassing appropriate soil sample collection and selection of proper fertilizer sources, rates, timings, and placement in consortium with a myriad of environmental factors that determines maximum agronomic and economic yield and returns. Effectively balancing all of these factors, many of which cannot be controlled, is challenging even in the best years. When faced with production environments such as our current, this management strategy becomes even more difficult as producers seek to cut all unnecessary costs. Therefore, it is imperative that solid, unbiased research is performed to ensure that all fertility based inputs and agronomic practices are working in tandem to achieve the desired outcome. The baselines of an effective soil fertility/plant nutrition program are ensuring that collected soil samples are as representative of the field as possible, that our soil pH (the key to unlocking fertility) is optimized for the crop, all fertilizer inputs are creating a positive benefit, and that observations from these trials are shared with stakeholders in a timely manner. Specific objectives of this project are: 1) Collecting data to ensure continual alignment of research efforts with stakeholder needs; 2) Optimize collection location of individual soil cores within a soil sample; 3) Determine when and where sulfur fertilizer applications are beneficial to MS soybean producers; 4) Demonstrate the effects of acidic soils (pH < 6.0) and determine if alkaline soils (pH > 7.0) effect soybean yield; 5) Evaluate the nutrient removal potential of ryegrass based on desiccation timing; and 6) Disseminate observations to MS soybean stakeholders in a timely manner.

**Report of Progress/Activity by Objective**

Objective 1: Data Collection

Data collected through conversations with MS soybean producers, consultants, and industry personnel was synthesized and used to align 2025 research trials with stakeholder needs/desires. From these conversations, additional sites have been secured to expand S fertility testing locations, an on-farm subsoiling trial has been designed and submitted, and a trial to evaluate high yield soybean production systems has been designed and submitted.

Objective 2: Determine effect of in-season potassium application on soybean yield.

This objective was completed in 2024. See final report for 02-2024.

Objective 3: Develop sulfur fertilizer recommendations for MS soybean.

A sulfur rate trial and a sulfur fertilizer source trial was conducted at two locations in 2024. The rate trials included rates of 0, 10, 20, 30, 40, and 50 lbs/a S. The source trials evaluated elemental S, ammonium sulfate, potassium thiosulfate, ammonium thiosulfate, MAP+MST, and an untreated control. In 2024 there were no differences in any of the trials. Location 1 soybean grain yields averaged 58 bu/a in the source trial and 63 bu/a in the rate trial. Location 2 soybean grain yield averaged 62 bu/a in the source trial and 63 bu/a in the rate trial. These fields were described as having a history of S deficiency but also a history of S fertilizer applications. Our data indicated that a blanket application of S would not have been beneficial to either of these fields in 2024. Moving forward more fields will be added to the trial with a greater range in soil textures.

Objective 4: Soil sample collection in nutrient stratified soils.

A P rate trial was established with four different soil sampling strategies overlaid on top of each rate. Phosphorus rates were 0, 40, 80, 120, 160, and 200 lbs/a P2O5. The soil sampling strategies consisted of collecting cores from the top of the bed only, from the side of the bed only, from the furrow only, and a combination with an equal number of cores collected from all three locations. There were no differences in yield across P rates with soybean grain yield averaging 57 bu/a. Soil test P data indicated that sampling from the top of the bed tended to give the lowest Soil Test P levels while the combination sampling strategy tended to give a good average of the other three sampling strategies (Figure 1). However, all of the differences were within the margin of field variability. This initial analysis indicates that so long as a sufficient number of cores are collected the location of the individual core collection site is not influential.

Objective 5: Lont-term soil pH effect on soybean grain yield

A long-term soil pH trial was initiated in the fall of 2023 with target pH values ranging from 4.0 to 8.5 on half-point increments. Initial pH levels were determined and either agricultural lime or elemental sulfur were applied to raise or lower soil pH as needed. In year one the lowest soil pH value achieved was 4.2 and the highest soil pH value achieved was 7.3 at the time of soybean planting. In year one there were no differences in soybean grain yield across the range of soil pH values (Figure 2). This is most likely due to the distribution of data where only a few plots made it to the lower or higher pH values targeted while the majority of plots had soil pH values between 5.5 and 7.0. With the amount of time between lime and sulfur applications and soybean planting much of the sulfur and lime most likely had not had time to react with the soil and therefore pH levels are continuing to change.

Objective 6: Determine soil nutrient removal by Italian ryegrass.

A study was initiated in November of 2024 to determine the nutrient removal capabilities of Italian ryegrass based on desiccation timing. Treatments are a weed-free check, a weedy check, and ryegrass desiccation timings of 4, 8, 12, and 16 weeks after emergence. By plot soil samples were collected prior to ryegrass emergence and will be collected again at the end of March to determine differences in soil test K levels. Biomass samples will be collected from respective plots at each desiccation timing. Biomass will be dried and weighed to calculate lbs/a and a sub sample will be sent to Waters Ag Labs for nutrient analysis. The remainder of the sample will be placed in an onion sack and placed back in the plot and reweighed at each subsequent desiccation timing to determine decomposition kinetics. To date the 4, 8, and 12 weeks after emergence samples have been collected with the 16 weeks after emergence timing expected to be collected in the next 2-3 weeks. Expected completion of year one of the objective is early April 2025.

Objective 7: Learning opportunities for MS soybean industry members.

A key component of this project is ensuring timely dissemination of research observations and interpretations to local MS soybean stakeholders. In 2024, eight field visits were conducted to aid in fertility issue diagnostics and trouble shooting. The PI also aided MS consultants and soybean producers with fertility decisions through numerous phone calls, texts, and emails.

**Impacts and Benefits to Mississippi Soybean Producers**

The benefits of these trials to date, is the continued refinement of S fertilizer recommendations in MS; determining that alkaline soils (pH > 7.0) do not negatively affect soybean grain yield, after one year; providing on call support for MS soybean producers and consultants to aid in fertility decisions and nutrient deficiency diagnostics.

**End Products Completed or Forthcoming**

Results from these trials have been presented at the ASA national meeting by the PI and one graduate student and will also be presented at the Tristate Soybean Forum meeting, the Mississippi Agricultural Consultants Association meeting, the Cotton and Rice Conference, the Southern Branch ASA meeting, and up to 5 individual county level grower meetings. At the end of each objective’s term publications as either peer-reviewed journal articles and/or updated Extension publications are expected.

Figure 1. Soil Test P values by plot based on collecting soil cores from the top of the bed only, the side of the bed only, the furrow only, and a combination of equal cores from each location.

Figure 2. Soybean grain yield as influenced by soil pH range.