

MISSISSIPPI SOYBEAN PROMOTION BOARD

Fertility and Agronomic Resource Management Extension and Research for soybean (FARMERS) **Program - 02-2023**

Final Report

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Background and Objectives

Near record high fertilizer prices has placed increased strain on already small profit margins. For this reason, up to date non-biased research data is necessary to ensure that all soil fertility management decisions are creating not only maximum yield but profitability as well. An example of this would be ensuring the any yield increases associated with micronutrient applications are similarly increasing net returns. Many growers in Mississippi also face K deficiency on a regular basis. As K is mobile in plant tissue and early detection is critical, we must ensure that tissue samples are being collected from the correct location in the plant canopy. Due to the relatively flat landscape of the Delta region of Mississippi, flooding is a problem that many soybean growers must deal with on a fairly regular basis. After flooding events growers are looking for ways to accelerate soybean recovery. With this, many growers will make a foliar application of N with the belief that it supplements what has been lost from root inactivity and hastens recovery time. It is also crucial that research personnel continually collect production field level data to stay abreast of ever-changing soil conditions and be able to proactively prepare for possible issues. Specific objectives are 1) Data collection; 2) Establishing optimum tissue sampling location within a plant canopy for early deficiency detection of plant-mobile nutrient potassium; 3) Establishing optimum boron fertilizer application rates and timings for soybean grown on soils ranging from clay to sandy loam; 4) Determine the effect of foliar N applications on soybeans subjected to flooding during the late vegetative to early reproductive growth stages; 5) Determine the effect of K fertilizer application timing on late season soybean K deficiency; and 6) Implement a self-existing soil fertility based extension program where information garnered through the research program is effectively and efficiently distributed to MS soybean growers along with providing on-site field diagnostic assistance for proper identification of nutrient deficiencies in soybean.

Report of Progress/Activity by Objective

Objective 2: Establishing optimum tissue sampling location within a plant canopy for early deficiency detection of plant-mobile nutrient potassium.

Small plot trials were established in 2022 and 2023 in Stoneville and Starkville, MS. To determine the effect of tissue sampling location within the plant canopy on early detection of K deficiency. Treatments consisted of five potassium fertilizer rates (0, 20, 40, 60, and 80 lbs K₂O per acre). Tissue sample locations within the plant canopy were upper most fully developed trifoliolate and the lower most trifoliolate. Pooled across years and locations there were no differences in yield across fertilizer rates and tissue K concentrations were similar. Lack of responsive sites prevents complete understanding of tissue sampling location effects on detection of early deficiency. Based on trends in the tissue sampling data (Figure 1), our recommendation remains that growers should tissue sample the upper most fully developed trifoliolate.

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Objective 3: Establishing optimum boron fertilizer application rates and timings for soybean grown on soils ranging from clay to sandy loam.

Trials were established in 2022 and 2023 on one soil texture (silt loam) in Starkville, MS and two soil textures (silt loam and clay) in Stoneville, MS. Treatments included two granular boron products, three foliar boron products, and an untreated control. All foliar products were applied at V2, R1, and R3 growth stages at a rate of 0.5 lbs/a B and at combinations of V2 followed by R1, V2 followed by R3, and R1 followed by R3 at a rate of 0.25 lbs/a B at each timing. Soybean was not responsive to Boron fertilizer in either year in Starkville or on the clay textured soil in Stoneville due to preplant soil test values greater than 1 lb/a boron. There was a year by treatment interaction for the silt loam soil in Stoneville. In 2022 when preplant soil test B levels were less than 1 lb/a available B, foliar applications at a rate of 0.25 lbs/a B at the R1 & R3 growth stages and 0.5 lbs/a B at the R1 growth stage increased soybean grain yield 6.5 and 6.2 bu/a, respectively. These data are consistent with data from other regions. Based on these data our current recommendation is for soybean producers in MS to make a foliar B application at either the R1 growth stage or the R1 and R3 growth stages at rates of 0.5 or 0.25 lbs/a B, respectively, when their soil test B levels are below 1 lb/a available B.

Objective 4: Determine the effect of foliar N applications on soybean subjected to flooding during the late vegetative to early reproductive growth stages.

Trials were established in 2022 and 2023 in Stoneville, MS to determine the effect of foliar N fertilizer applications to soybean subjected to late vegetative and early reproductive flooding. Treatments included flooding at V6, R1, and R3 for durations of 24, 72, and 120 hours, and foliar N application or no N application 3 days after flood removal. In both years difficulty was had in maintaining the flood at the desired depth and duration. In 2022 quick dissipation of flood waters from within the levees diminished negative effects of flooding and no treatment differences were observed. In 2023, we were unsuccessful with a new levee design and trial completion as natural rainfall prematurely flooded all bays causing levee failure. By the time levees could be repaired soybeans had advanced beyond the target growth stages.

Impacts and Benefits to Mississippi Soybean Producers

The greatest benefit to MS soybean producers from these objectives are the identification of agronomically optimum Boron fertilizer rates and timings. Assuming an application cost of \$12/acre and a soybean price of \$11.94/bushel, producers on silt loam soil textures with available soil test B level below 1 lb B/a can increase net returns up to \$65.61/a.

End Products-Completed or Forthcoming

Results from this project were presented at five county level meetings, the Mississippi and Louisiana Agricultural Consultants meetings, two Extension trainings, and used to answer multiple soybean grower questions. The boron data will also be used to update Mississippi State University Extension publications.

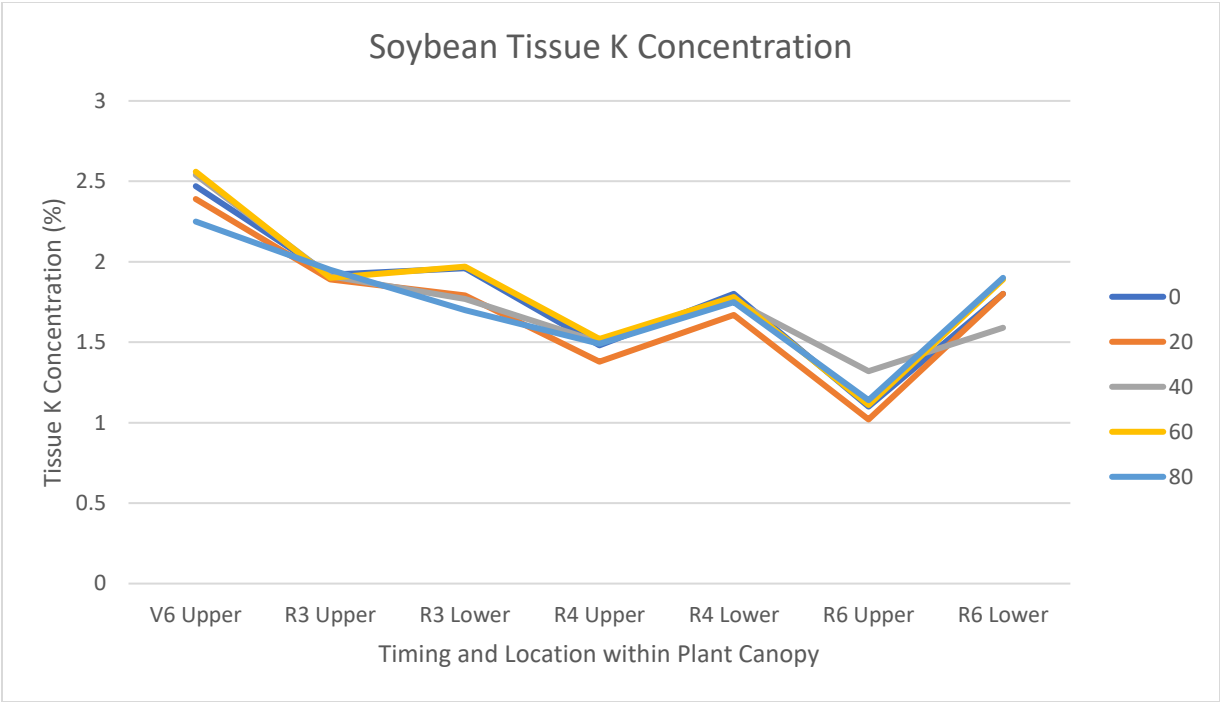


Figure 1. Soybean tissue K concentrations by growth stage and tissue sample location within the plant canopy across 5 different K fertilizer rates.