



Mississippi Corn Promotion Board 2024 Progress Report

Project

Title: Evaluation of build-up nutrient management strategies for phosphorus and potassium

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Project Summary (Issue/Response)



The fertilizer recommendations for soil-immobile nutrients phosphorus (P) and potassium (K) are generally based upon available nutrient concentration in the soil. For example, Mississippi State University (MSU) fertilizer recommendations set the critical value for phosphorus as 37 lb ac⁻¹ soil test phosphorus (STP); a soil with less than the critical value will have a P fertilizer recommendation, while above, no application will be recommended. However, other university or private consultant groups/labs may have differing strategies. Some may offer “buildup”, or “build and maintain” fertilizer strategies, which instead of fertilizing to the critical value, would offer higher application rates throughout soil test values to build residual P and K in the soil to a surplus, and to replace what P and K has been removed from the previous crop. The objective of build-up strategies is to manage P and K over a planned period of time, not just one season at a time (Leikam et al., 2003). This could allow producers to apply fertilizer less frequently, and minimize risks of missing fertilizer response in areas where a recommendation would not have been made. Yet, some studies suggest that over applying nutrients above sufficiency levels do not increase residual nutrient supply (Fulford & Culman, 2018).

Currently, MSU’s recommendations offer some build-up and maintenance recommendations, however, little data are available to show the benefits of using sufficiency or build and maintain fertilizer recommendations. There are also little data to be found about how to implement the two different strategies in Mississippi.



Project Results/Outcomes

This study was established at 4 locations in spring 2023, in Brooksville, DREC in Stoneville, North Farm in Starkville, and NMREC at Verona Research Station, and has continued each year through now. Over 2 growing seasons, we have had corn (2023) and soybeans (2024). We have applied 4 varying rates of P and K for different treatments at each location, and we are starting to see soil differences from repeated application.

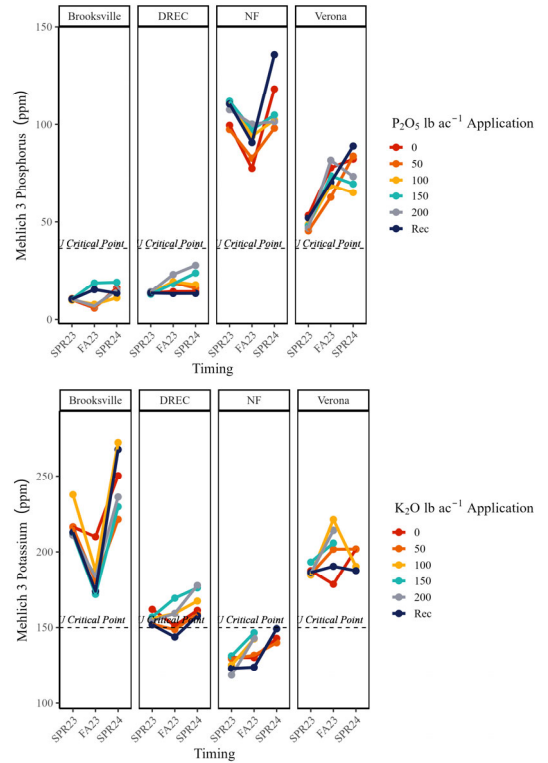
Brooksville and DREC had the lowest soil test P values at the beginning of this trial, averaging <30 ppm Mehlich 3 Extractable Phosphorus. These locations have had positive yield responses in some plots, suggesting that P was the limiting factor, however, they aren’t always predictable. They have experienced some increases in soil test values, with an average increase of 10-20 ppm Mehlich 3 P over three timings. We are slowly building up these levels of P. North Farm (NF) and Verona had higher soil test P values (average M3P = > 80 ppm), and are experiencing the greater increase based on repeated application (average increase 20-30 ppm). This follows how we expect soil chemical reactions from applications to occur, where deficient soils will have to slowly build up reserve of non-labile (non available) P before it will be able to store P in soil test extractable P.

Project Results

DREC and NF had the lowest soil test K values at the beginning of this study (DREC = 150 average, NF = 110 average), and are seeing the slowest increase, similar to what we saw in P. Brooksville, which had the greatest soil test K values at the beginning, has seen the greatest increase from repeated application. I expect at this location in the next couple of seasons, we will see a plateau effect with the higher rates when we get to 500 ppm or greater. We will see whether that is the case or not.

We did note seasonal fluctuations from both different soil tests, P and K, particularly in soils that beyond MSU critical soil test point. While we expect there to be fluctuations (due to water table movement, chemistry dynamics including soil temperature), it was interesting to see the greatest change occurring in high testing sites. This could be a matter of percent change elevating the anecdotal evidence, but we will look further into this as we collect more season to season changes in soil tests.

Changes in soil test data at 4 different locations over three sampling timings: Spring 23, Fall 23, and Spring 24.



Project Impacts/Benefits

The results of this study could be beneficial to producers in providing pertinent information on the ability to use build-up and maintain nutrient management strategies, and how much of last years nutrient application could be available next year. We believe that the results of this study will impact fertilizer recommendations in years to come from Mississippi State University.

Project Deliverables

This study was presented at the North Mississippi Research and Extension Center Field Day in 2024. Some preliminary findings of this work was presented as a part of a larger presentation at the Mid-Atlantic Crop School discussing how to manage Phosphorus, and at the Mississippi Row Crop Short Course.