



Mississippi Corn Promotion Board 2021 Progress Report

Project Title: Evaluation of a Rapid Method for Accessing Corn Nitrogen Management in Season

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Project Summary (Issue/Response)



Nitrogen management is the most yield limiting nutrient component of corn production for producers throughout the state of Mississippi. Over fertilization leads to a reduction in profitability and increases environmental impact potential. Traditional leaf tissue testing has been used to determine the N status of the crop but is costly and does not produce immediate in field diagnosis. Therefore, a rapid and economical method of assessing the N nutritional status of corn would be beneficial for producers to monitor N throughout the season and allow data for accurate management decisions. The use of a Horiba LAQUA Twin Compact Ion meter has shown feasibility as a good rapid indicator of soybean K nutritional status in trials conducted at the University of Arkansas (Sites et al., 2017). The application of this technology for Nitrate testing in corn could potentially benefit the producers of Mississippi. The proposed research could provide the capability for corn producers of Mississippi to rapidly assess the N status of individual fields, and allow for more informed management decisions regarding in-season N applications.

In 2021, Field trials were conducted at the North Mississippi Research and Extension Center in Verona, MS and the Delta Research and Extension Center in Stoneville, MS to correlate corn tissue readings from the Horiba LAQUA Twin Nitrate Compact Ion meter at various growth stages to corn N status and subsequent grain yield. Experiments were arranged as a randomized complete block design with four replications at each site/year. Treatments consisted of N rates of 0, 50, 100, 150, 200, and 250 pounds actual N per acre. Tissue samples were taken from the bottom 12 inches of a corn plant and beginning at V4 and be taken every week until the V10 growth stage. Samples were pressed and Nitrate concentration measured using the Horiba LAQUA Twin Nitrate Compact Ion meter. Corn yield was harvested with a small plot combine at maturity and reported at a standard moisture content of 15.5%.

Project Results/Outcomes

Preliminary Analysis of data collected at the North Mississippi Research and Extension Center suggest that the use of a Horiba LAQUA Twin Compact Ion meter may have feasibility as a good rapid indicator of N status of Corn. To achieve a calibration of nitrate concentrations from multiple sampling timings, research was conducted using stepwise N rates applied at the V4 growth stage. (Nitrogen rates were as follows 0, 50, 100, 150, 200, 250 lb N/a). At the NMREC the maximum corn grain yield (189 bu/a) was achieved with 200 lb N/a or greater. Corn grain yield for N rates below 200 lb N/a were less and decreased as N rate decreased with 0 lb N/a producing the least grain yield (50 bu/a). To determine recovery capability following a deficiency detection 200 lb N/a was applied to corn at the following growth stages V4, V6, V8, and V10 as well as an untreated control. Yield was greatest in plots receiving fertilizer at the V4 or V6 growth stage (155 bu/a). Applications made at V8 or V10 were greater than the utc but less than V4 or V6.

Horiba LAQUA Twin Compact Ion meter readings were taken at V4, V6, V8, and V10. At the V4 growth stage, before any N was applied all treatments NO₃- ppm readings were similar to one another and between the range of 700 - 1000 ppm. At the V8 growth stage plots receiving 0 lb N/a produced the lowest ppm readings of 450 ppm. Plots receiving 50 lb N/a were similar to plots receiving 0 lb N/a but less than all other N rates. Readings from plots receiving 150 lb N/a or greater were similar to one another ranging from 730-950 ppm. At the V10 growth stage NO₃- ppm readings from the Horiba LAQUA twin meter were lowest with N rates of 100 lb N/a or lesser. N rates of 150 lb N/a or greater produced ppm readings greater than N rates of 0, 50, and 100 lb N/a and similar to one another.

NO₃- ppm readings collected at the NMREC site closely follow the yield trend observed due to N rate. At the V10 growth stage N rates of 150 lb N/a or greater produced ppm readings greater than rates 0, 50, and 100 lb N/a. While an observable trend was observed due to sampling grain yield was not maximized in 2021 until 200 lb N/a was applied. In 2020, accurately predicted the N rate at which the corn yield was maximized, however in 2021 more variability in samples was observed. NO₃- ppm readings began to decline in the lesser N rates as the growing season progressed suggesting that N availability began to decrease and was adequately predicted by this rapid test. This data suggests this handheld meter could provide means to quickly and accurately determine corn N needs in season and warrants further consideration.

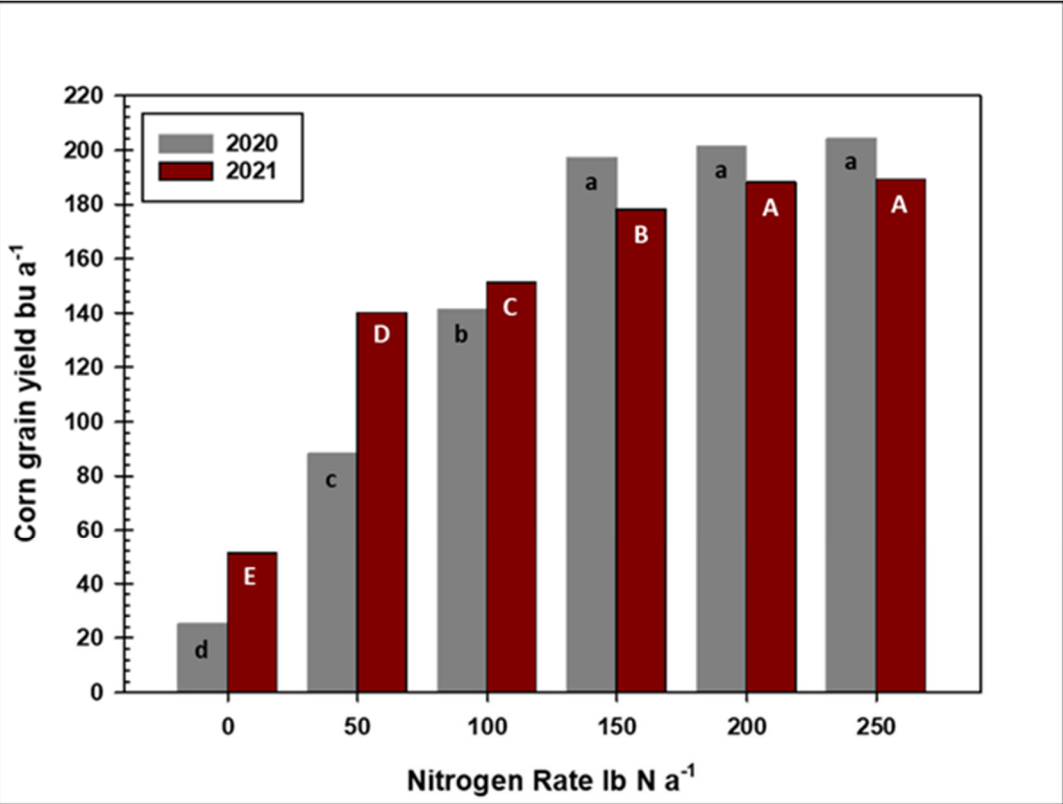


Table 1. Corn Grain yield as influenced by N rate for studies conducted at NMREC

Project Results

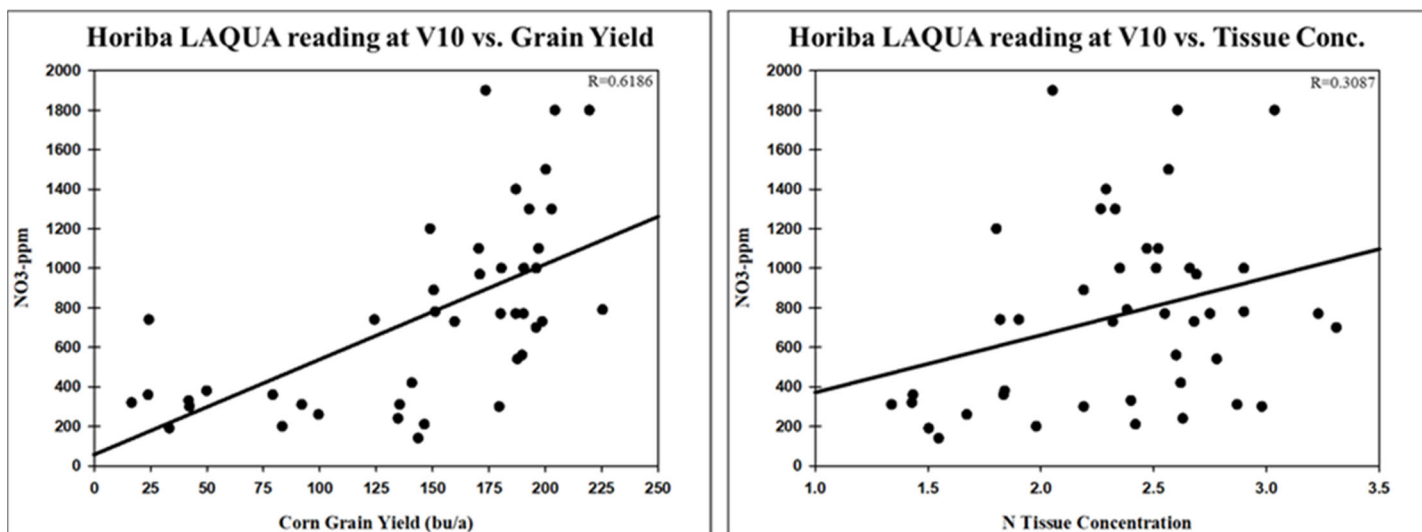


Table 2. Correlation of Horiba LAQUA reading at V10 vs Grain Yield and Tissue Conc. in 2020

Project Impacts/Benefits

Currently, the Mississippi State University Extension Service recommends using 1.3 pounds N for each bushel of corn yield goal (Larson and Oldham, 2008). This fertilizer is recommended to be applied in a split application with no more than one-third of the total nitrogen applied at planting (Larson and Oldham, 2008). This application method allows for N availability to be greatest when the crop needs it and thus reducing the potential for N losses throughout the season. Although the split application method works well for Mississippi producers, N loss due to environmental factors on Mississippi soils can be great. Extreme weather events early in the season such as heavy rainfall can cause extreme N losses through denitrification and leaching; applied N is subject to volatilization throughout the growing season. Therefore, due to the high risk of N loss in Mississippi soils many producers tend to over fertilize their crop to ensure N is not a limiting factor in production. Preliminary data collected in 2020 suggests that the Horiba LAQUA Twin Compact Ion meter may hold the potential to serve as a rapid indicator of NO₃ concentration within a corn plant. The ability to test N status of a corn crop in season could allow for more accurate N management decisions for the Mississippi corn producer throughout a growing season, allowing them to more effectively and economically apply N fertilizer.

Project Deliverables

This project was made visible and preliminary findings were discussed with producers at the NMREC 2021 invitational plot tour in August. Nitrogen rate findings stemming from the project were discussed with producers at the 2021 MSU row crop short course in December. A presentation will be made on the findings of the project at the Southern Branch ASA meeting in February 2022.



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