



Mississippi Corn Promotion Board 2012 Progress Report

Project Title: Pre-tassel Nitrogen Management for Optimum Corn Production

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Project Summary (Issue/Response)

Many cultural practices are important for optimum corn production in Mississippi. Plant population (seeding rates), nitrogen (N) fertilization, and irrigation are key components for optimum corn production in the Mississippi Delta. Corn production for the state reached 940,000 acres in 2007, an increase of two to three times the previous years. Production has not topped a million acre since 1960 at which time the yield was 27 bu/acre. Earlier planting has surfaced as a means of increasing yields in soybean and has become the norm in corn production. Increased seeding rates and N rates have been evaluated in the Mid-south as means of increasing corn yields under the growing conditions of the region. Nitrogen management issues being addressed include N rates and timing of application across many scenarios including late season N applications (pre-tassel). This study has been designed to evaluate levels of pre-tassel N applied across multiple standard N applications. The objectives are to 1) evaluate N management systems for optimum production that incorporates a range of standard N rates along with pre-tassel N, and 2) investigate the economic implications of pre-tassel N management compared to the standard N management system. As N prices continue to rise, efficient use of fertilizer N is paramount to optimum N utilization. Getting N to that plant at a time when it can be best utilized is key to efficient use. Better plant utilization also means less N subjected to loss through various means including nitrification/denitrification, volatilization, run-off, possible leaching on sandy soils, and up-take by non-target species (weeds). Enhanced utilization by target species leads to less release to the environment and overall better stewardship of input resources. Preliminary research has shown significant response to pre-tassel N with the greatest response at lower N rates.

Project Results/Outcomes

This project is a continuation of research initiated at the Delta Research and Extension Center on in 2010 and expanded in 2012. Planting seed costs and fertilizer cost are two of the highest direct costs associated with corn production. Currently recommended fertilizer N rates are 1.3 lb N/bushel of expected yield. Thus for a 200 bu/acre yield, N fertilizer would be 260 lb N/acre (less behind soybean in rotation). Nitrogen and phosphorus (P) requirements for corn are nearly double that of soybean and cotton while potassium (K) requirements for corn are 40-50% higher than for other crops. Soil testing is a must for determining overall nutrient status and should be the basis for a sound fertility program. Early planting on raised beds offers potential especially on soils with marginal drainage. Early planting helps the crop avoid mid-summer



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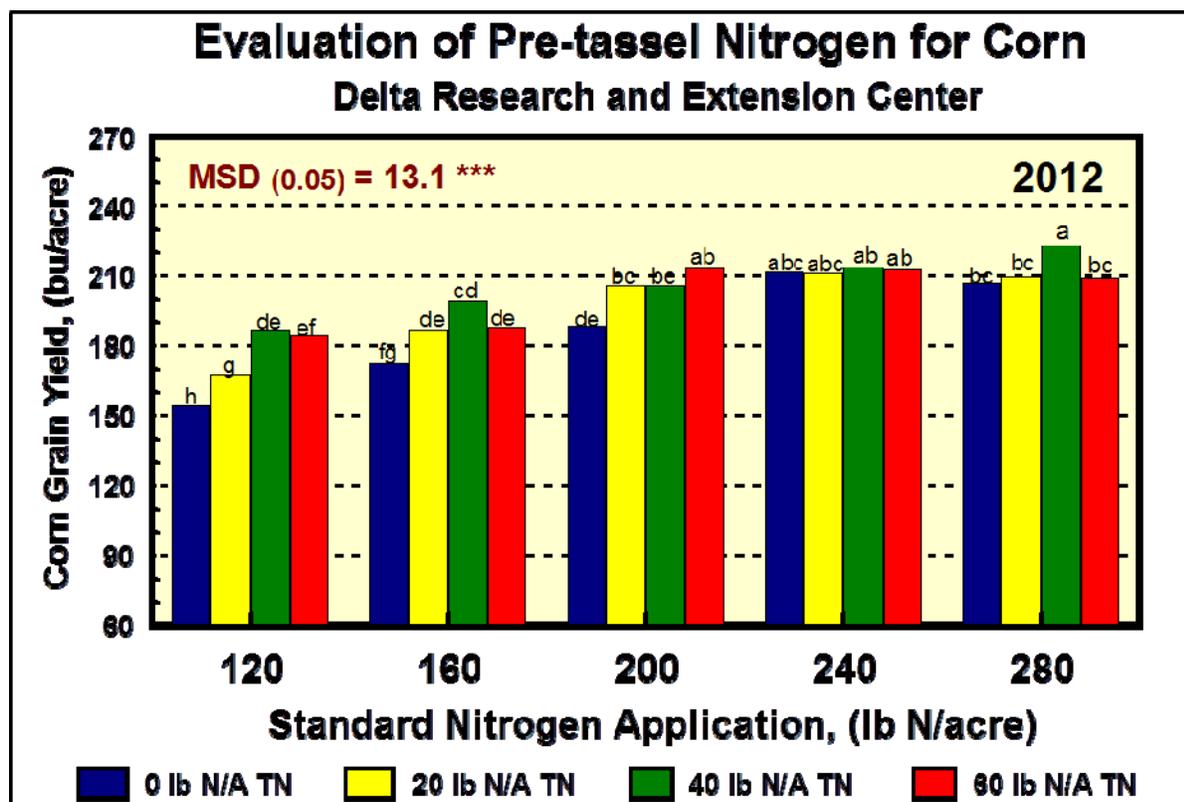
Project Results

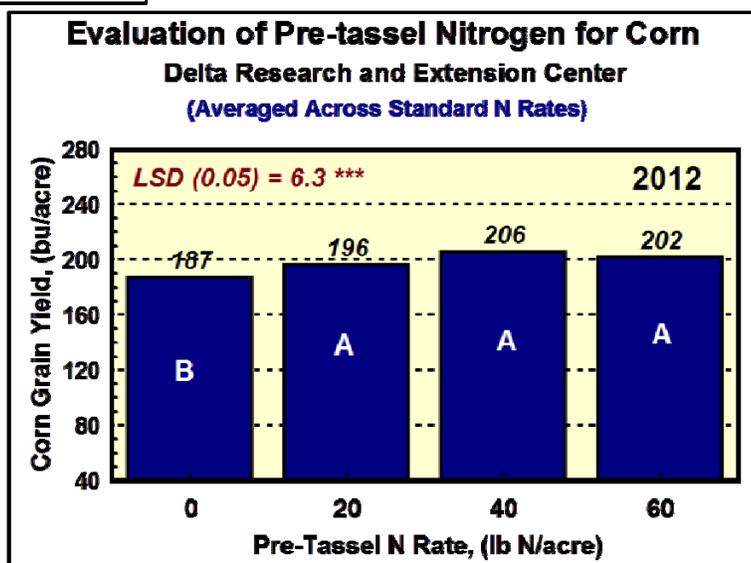
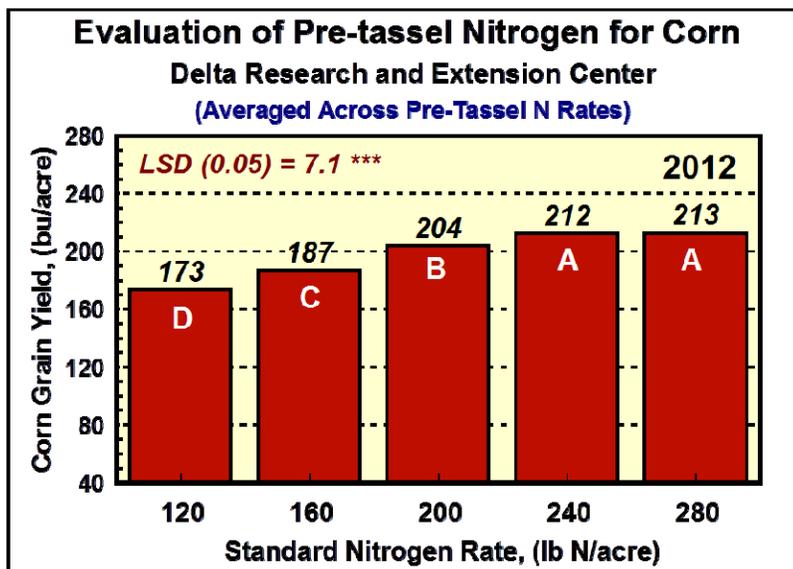
drought and pollination during the hotter summer temperatures. Irrigation can help alleviate water stress but does not negate the need for early planting to avoid the heat. In recent years, fertilizer uptake enhancers have been touted as a means to increase fertilizer efficiency. Preliminary work has begun to evaluate their efficacy.

Nitrogen rates and application timing are the most important keys to successful N management. In theory and practice, the closer N application is made to the time the plant needs it, the better the N utilization and N use efficiency. For corn, the principle N uptake form is nitrate (NO_3^-) that is also the form that is most susceptible to biological transformations in the soil. Nitrate-N can come from the mineralization of organic matter or from fertilizer additions. Mineralization releases more N from the soil in years that are favorable for good plant growth. However, early in the growing season the amount to be released through mineralization during the season is unknown. Nitrification and denitrification are biological transformations that occur throughout the year depending upon moisture levels in the soil and temperature. When soils are warm and saturated, corn plants show N deficiency because the N uptake is inhibited. While this can occur throughout the growing season, it is of primary concern during the first half of the growing season before small plants have taken up much N. To aid against denitrification losses several approaches are available. Improved drainage so that water does not stand during the late spring is one approach. Applying N near the time the plants need it is another. Sidedress application of the main N supply is still another approach, while slow release products could be another.

In the research that continues at Stoneville, pre-tassel N applications (PTN) included standard N rates (SN) from 120 to 280 lb N/acre in 40-lb N/acre increments. The SN treatments were applied with a uniform rate (120 lb N/acre applied just prior to planting followed by 0, 40, 80, 120 or 160 lb N/acre applied as a sidedress application at the V5 to V6 growth stage. The PTN rates of 0, 20, 40 and 60 lb N/acre were applied as urea to the surface followed by rain-fall or irrigation to incorporate the material. A second study was begun in 2012 on a sandier soil type to determine whether the response observed in previous years could be translated across different soil types. There was a significant response to both standard N rates and PTN rates at the original location. As with previous years, the greatest response to PTN came at the lower SN rates. When grain yields were averaged across PTN rates, there was a significant yield increase up to 240 lb N/acre but no additional response at the 280 lb N/acre rate. When averaged across SN rates, only the 20 lb N/acre PTN rate was significant.

At the new site in 2012, there was no variable response to increasing N rates with only very minimal response to N rates. This study will be repeated in 2013 with careful monitoring of water needs and irrigation. Overall yields ranged from 207 to 216 lb N/acre.





Project Impacts/Benefits

At the outset of this study, limited response was expected. However, with varying yield potential depending on the year, significant yield responses to pre-tassel N (PTN) have been observed. As the standard N rate is increased, the response to PTN is decreased or not present. These results indicate that the later application of N to the soil is being taken up and utilized by the plants. Thus, if conditions are present, early in the growing season, that lead to N transformations and N loss from the system, a later N application could be used to increase yields. To date most of the efforts on the experiment station have been on silty clay loam soil. The study was expanded in 2012 to evaluate an additional site. Additional sites are needed as well as further evaluation to help define the best time for later applications. This could be related to growing degree days since cultivars development is heat dependent. These studies could lead to better N use efficiency and an overall reduction in total N use.

Project Deliverables

The results from the on-going study has been presented at the Crop College held on the campus at the Delta Research and Extension Center and the Agronomic Crops Field Day. Other venues had included the Mississippi Chapter-American Society of Agronomy winter meeting in 2011 and the Mississippi Corn Promotion Board. Information from this study has also been presented at the Southern Branch – American Society of Agronomy Annual Meeting, and the National Conservation Systems – Cotton, Rice, Soybean, and Corn Conference (Sponsored by Mid-America Farmer Magazine and others). The re-

sults from this research have also been discussed with many producers, consultants, and industry representatives. It has also been included in the DREC Annual Report for the last few years.

