Mississippi Corn Promotion Board 2012 Progress Report

Project Title: Corn Response to Zinc Fertilization

PI: Bobby Golden

Department: Delta Research and Extension Center

Project Summary (Issue/Response)

Micronutrient fertilization is extremely important for balanced fertility, but is often overlooked when developing fertilization programs. Monocot crops, such as corn, are very sensitive to Zn deficiency. Historically, the bulk of Zn research in the Mid-South, and within Mississippi has investigated the influence of zinc fertilization on soils cropped to rice, or when used as a combined starter fertilizer in corn. Because of the recent acreage shift to corn on soils previously cropped to cotton with little history of zinc fertilization, additional research is warranted. Also, little research has evaluated the sole influence of zinc on corn growth and yield in Mississippi, or attempted to define critical soil test levels to predict yield response. Research was initiated during 2012 to attempt to meet the following objectives: 1) to evaluate the influence of Zn fertilization on tissue Zn concentration and grain yield of corn, and 2) determine the effect of Zn source, application rate and strategy on effectiveness of zinc fertilization. The proposed research would provide updated Lancaster and new Mehlich-3 soil test Zn correlation/calibration data to Mississippi corn producers, and provide insight into which Zn delivery methods are adequate for Mississippi corn production. During the season grower concern over foliar burn from top-dressed applications of zinc led us to establish a new objective. The new objective was to document if foliar injury from zinc

Project Results/Outcomes

For the first objective, 3 field trials were established. Two at the Delta Research and Extension Center, and one on the Douglas farm in Bolivar Co. near Boyle. The trials were placed on soils with characteristics that would suggest a response to zinc. Each site placement had a soil pH > 6.8 and a low Lancaster or Mehlich-3 soil test Zn level (<4 mg/kg). Mean corn grain yields were increased at two of the three research sites, the yield increases were not statistically different, but were economically different. For the two responsive sites, grain yield was increased by 16 and 29 bu/acre for the DREC and the Boyle site, respectively. In contrast tissue Zn concentrations were not increased with increasing Zn application rates on the two responsive sites, however all tissue Zn concentrations were above the critical level. Soil test correlation steps will be conducted once enough data points are collected, results from year one have provided an excellent start for the correlation process.

For objective two, two trials were established at the delta research and extension center to determine if Zn application strategy influenced corn grain yield and tissue Zn concentration. No grain yield data was collected for one of the two sites established for objective two because of root lodging. Pioneer hybrid 1615 was selected for this trial, and had a severe issue in 2012 with root lodging and green snap issues due to a perfectly timed storm that moved through Mississippi in the late spring. Tissue concentration data will be presented for both trials. In the one harvestable trial, Zn application strategy did not statistically influence corn grain yield. However, Zn added with UAN and placed 10” to the side of the row yielded 6-10 bu/acre less than when zinc was applied foliar, in furrow, or as a dry granular product to the soil surface. For both sites tissue Zn concentrations 2wk

Project Results

after application was not statistically different than the untreated control. All zinc tissue concentrations collected at both sites were above the critical value of 20 mg/kg. based on soil analysis, the two sites established for objective two showed borderline characteristics that would indicate these sites may or may not respond to zinc applications.

In many cases zinc deficiency is observed in-season, and foliar applications is the only option to meet the plants critical Zn requirement. Many consultants and producers alike experienced issues with zinc products causing foliar injury. Objective three was added during the season to address this concern. In short we chose two liquid products that are produced for foliar application, one chelated with citric acid and one chelated with EDTA. Each Zn source was applied at total Zn rates of 0.5, 1.0 and 2.0 lb Zn/acre. In general, the citric acid chelated product caused significant foliar injury, with the severity of injury increasing at total Zn application rate increased. In contrast, the EDTA chelated product caused little to no foliar injury across the range of application rates. The product x Zn rate interaction was not significant for tissue Zn concentration taken 2 wk after application. In general averaged over Zn products tissue concentration increased with increasing application rate. Preliminary data from two sites in the first year of testing suggest that grain yield is unaffected by foliar injury from application of citric acid chelated products. However, the trials were placed on corn that was seeded to soil that was not prone to zinc deficiency. It is unclear if grain yield would be influenced by the foliar injury if corn plants were Zn deficient.

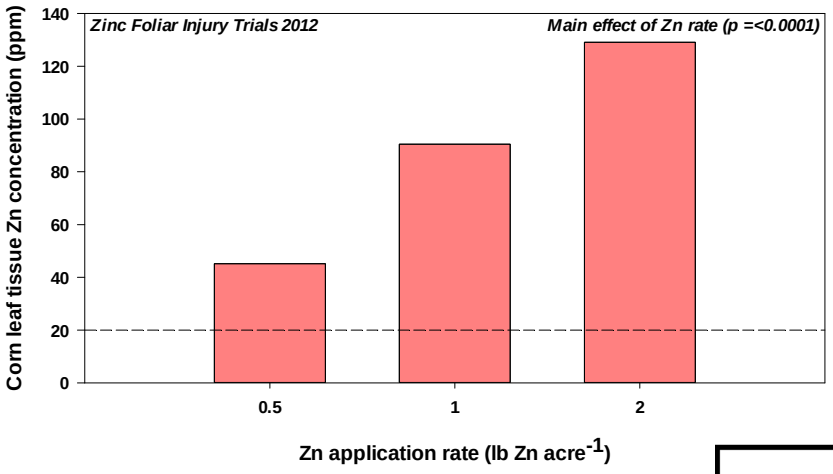

Figure 1. Tissue concentration averaged across Zn products as influenced by Zn foliar application rate for research trials managed at the Delta Re-

Figure 2. Foliar injury expressed 4 d after foliar application of Zn products chelated by two differing agents for research trials managed at the Delta Research and Extension Center during 2012.

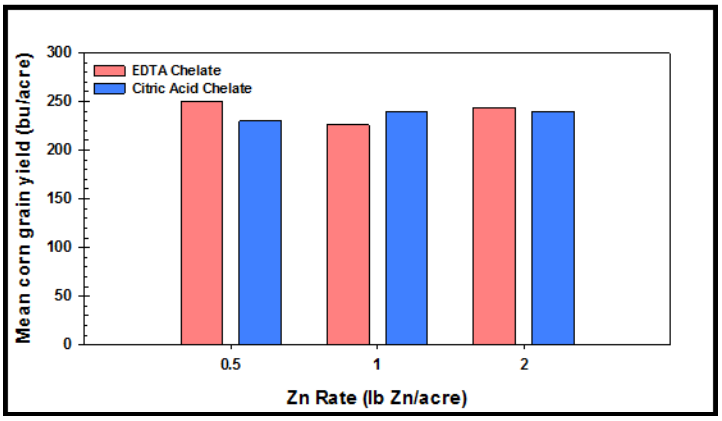

Figure 3. Mean corn grain yield as influenced by the non-significant Zn product x application rate interaction for research trials managed at the Delta Research and Extension Center during 2012.

Project Impacts/Benefits

All corn acres in Mississippi could be impacted by research results if revision of soil test recommendations is warranted. Initially impact will be limited to acres that are currently experiencing zinc fertility issues and acreage that has historically not received zinc fertilization. Potential changes in recommendations with regard to Zn delivery systems could also impact the current acreage that receives Zn fertilization.

Project Deliverables

Mississippi Agriculture Industry Conference. July 24. Orange Beach, AL. Soil Fertility Update.

Field Day, July 19 Starkville, MS. Corn and Soybean issues.

Field Day, July 19 Stoneville, MS. Corn and Soybean issues.

Delta Crop Summit, November 13, Stoneville, MS. Corn and Soybean Fertility

Mississippi ASA, November 14, Grenada, MS. Nutrient Management for Corn and Soybean.

Row Crop Short Course, December 4, Starkville, MS. Corn and Soybean Fertility Programs.

MISSISSIPPI MAFES AGRICULTURAL & FORESTRY EXPERIMENT STATION

MISSISSIPPI STATE UNIVERSITY EXTENSION SERVICE