USING SOIL AND TISSUE TESTING TO PREDICT SOYBEAN YIELD RESPONSE TO FOLIAR APPLIED MICRONUTRIENTS IN IOWA

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Abstract

Prior research with foliar application of micronutrients for soybean has shown inconsistent yield responses in Iowa and the western Corn Belt. Iowa has no interpretations for soil or tissue tests for micronutrients in soybean. This study's objectives were to evaluate soybean plant-tissue and grain yield responses to foliar application of boron (B), copper (Cu), manganese (Mn), and zinc (Zn) in Iowa. There were 22 field trials in 2012 and 21 in 2013, which were established in 20 counties and included 25 soil series. Treatments replicated four times were a control, each nutrient applied separately, and their mixture (six treatments) sprayed twice to the same plots (at the V6 and R2/R3 growth stages). Total applied rates for B, Cu, Mn, and Zn were 0.16, .078, 0.33, and 0.50 lb acre, respectively. Initial soil samples were analyzed for B (hot H_2O method) and for Cu, Mn, and Zn using both Mehlich-3 (M3) and DTPA methods. The trials conducted in 2013 are being harvested at the time so only results for 2012 are summarized.

Soil-test ranges for B were 0.23-1.23 ppm; ranges for Cu, Mn, and Zn using the DTPA method were 0.28-1.83, 3.84-42.30, and 0.48-5.32 ppm, respectively; and ranges for Cu, Mn, and Zn, using the M3 method were 1.65-5.53, 31.48-128, and 1.17-9.75 ppm, respectively. Micronutrient ranges in small plants (V6 growth stage) for B, Cu, Mn, and Zn were 24-420, 8.5-15, 30-113, and 25-42 ppm, respectively. Ranges in top mature leaves (including leaflets and petioles) in the control plots at the R2/R3 stage for B, Cu, Mn, and Zn were 27-62, 3.8-11, 26-66, and 25-47 ppm. Foliar application of micronutrients at the V6 stage resulted in small or no statistically significant leaf concentration increases at the R2/R3 stage. Study of relationships between soil Cu, Mn, and Zn measured with DTPA and M3 methods showed a high correlation for Zn (r^2 0.93), a poor correlation for Cu (r^2 0.31), and no significant correlation for Mn. Correlations between soil- and tissue-test results showed no significant correlation for B, Cu, and Zn and neither for Mn when the M3 test was used. However, there was a positive correlation between soil Mn measured with the DTPA method and the Mn concentration in small plant or leaves. There were no soybean grain yield increases (P <0.05) from micronutrient application at any site. Drought limited yield at five trials (25 to 37 bu/acre), but yields were moderate to high at the other trials (40 to 73 bu/acre). Fertilization often increased the grain micronutrient concentrations.

No strong conclusions are possible at this time since yield results of trials conducted in 2013 are not available. The results for 2012 indicated sharp disagreements between soil and tissue tests for B, Cu, and Zn and also for Mn when the M3 method was used. A positive correlation between soil Mn as measured by the DTPA method and tissue Mn concentrations indicated that both could be useful to diagnose crop-available Mn, but this could not be confirmed since no Mn deficiency was observed in 2012. The presentation at the conference will summarize results for the two years of the study.

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