2011 Statewide Nutrient Management Benchmarking Project:

Soybean Sulfur Status

Problem addressed

In general, soybean requires lower amounts of sulfur (S) to produce optimal yields than corn or alfalfa; however, soybean response to S have been also observed recently.

Soil S testing

Across Iowa, the median soil S concentration measured to a 6-in depth was 8 ppm. Three-quarters of the soil S values were between 7 and 9 ppm (Fig. 1A).

Based on the Midwest Labs sufficiency categories, about 80% of soil samples were in the Very Low and Low soil test categories (Fig. 1B)

These summary statistics and the distribution of soil S sufficiency categories for soybean fields were almost identical as those for the soil S test values for corn fields (see summary sheet 2012-NB05).

Soil S values were not related to SOM or other variables. However, two out of three fields with the highest soil S test values (>30 ppm) had some S applied with P and K fertilizer in the fall or had foliar S applications.

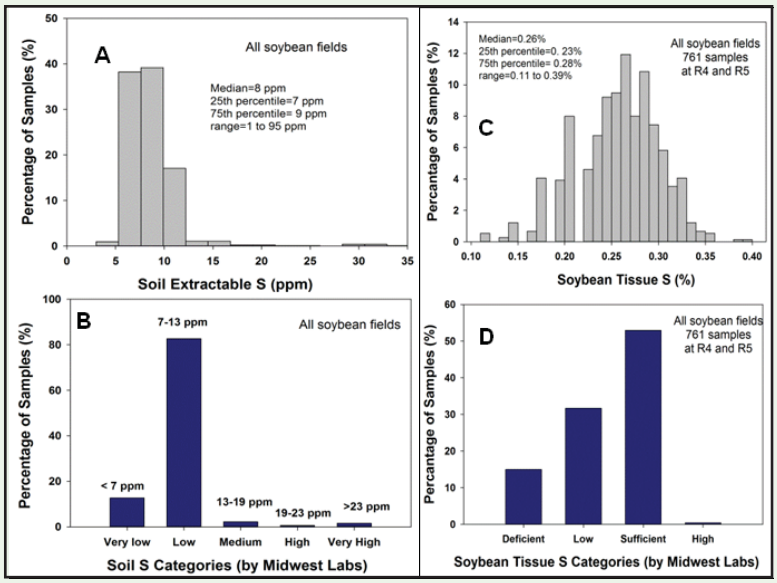

Fig. 1. Distribution and sufficiency categories of soil S test values and S concentration in fully developed trifoliate leaves for 376 soybean fields sampled across Iowa in 2011.

Tissue S testing

The youngest fully developed trifoliate leaves were sampled from 10 plants. The median tissue S was 0.28%, with 75% of the data ranging from 0.23 to 0.28% (Fig. 1C). Based on the Midwest Labs interpretations, about 50% of the samples had Deficient and Low S tissue status (Fig. 1D), which was about 30% less than it was predicted by the soil test (Fig. 1B).

Tissue S values significantly increased with an increase of tissue P values (until 0.5%) and then they decreased (r^2=0.38, data not shown), indicating a potential interaction between soybean S and P uptake.

Tissue S values were not related to the soil S values. Also, other variables (e.g., growth stage, monthly rainfall or manure history) did not affect significantly soybean tissue S concentrations.

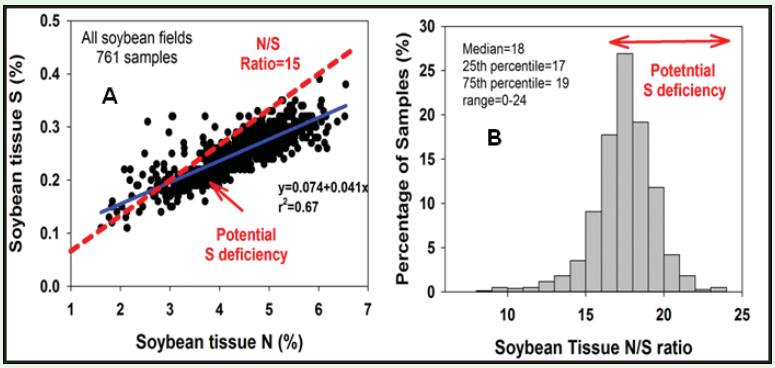

Fig. 2. Distribution and sufficiency categories of soil S test values and S concentrations of fully developed trifoliates for 376 soybeans fields sampled across Iowa in 2011.

Tissue N/S ratio testing

Across Iowa, tissue S values were remarkably positively correlated with tissue N values (Fig. 2A), suggesting that soybean plants require more S with higher N content. This could be because soybean grain has two amino acids with a relatively high S content. Similar to corn, relatively high tissue S values can still indicate S deficiency if tissue N content is relatively high.

The median N/S ratio was 18, with 75% of the data ranging from 17 to 19 (Fig. 2B). The distribution of N/S ratios for soybean was slightly shifted to the right (Fig. 2B compared with that of corn (summary sheet 2012-NB05). Considering that the critical N/S ratio is around 15 (because the ratio of N to S in some amino acids is relatively constant, 15:1), about 80% of samples could be classified as Deficient. The diagnostics based on tissue N/S ratio greatly overestimated S deficiencies. Thus, we speculate that optimal N/S ratio of 15 might be more appropriate for soybean grain than for soybean S tissue testing.

Similar to corn, soybean S deficiency symptoms are more pronounced early in the season and in younger leaves because S is relatively immobile. Reliability of soil and tissue S testing can be verified by measuring soybean yield responses to applied S in replicated strip trials across the state.