2011 Statewide Nutrient Management Benchmarking Project:

Objectives, Scale, and Methodology

Problem addressed

During the last decade, instances of visual deficiencies of several macro- and micronutrients have increased substantially in corn and soybean fields across Iowa partially due to steady increases in yield levels, commonly observed adverse weather conditions or due to reduced fertilizer applications caused by increasing environmental concerns and higher fertilizer prices.

Main Objectives

1) Characterize crop nutrient status across Iowa by conducting statewide soil and tissue testing sampling guided by late-season digital aerial imagery.

2) Establish statewide benchmark or reference distributions to monitor relatively changes in soil and tissue nutrient values or crop nutrient status over time.

3) Compare results from individual fields with the reference distributions established across the state, Iowa Landform regions or across several neighborhood counties.

4) Study the effect of rainfall, soil characteristics, crop management (including rates, forms, method of commercial fertilizer and manure applications, tillage manure application history, crop genetics, and other) on crop nutrient status.

5) Educate growers in the value, interpretation, and limitations of soil and plant tissue testing.

6) Share results from soil and tissue testing and observations from imagery at many local grower meeting across the state.

7) Identify fields, areas, soils or management practices that would require conducting on-farm replicated strip trials to verify the outcomes of the soil and tissue testing or conduct controlled correlation and calibration studies for nutrients in questions.

Field selection and digital aerial imagery collection

At least two corn and soybean fields were selected in each of the 99 Iowa counties (Fig. 1A). Locations of the fields and essential management information (crop, crop stage, management and other information) were collected in late July or early August. Field boundaries were drawn by crop consultants, agronomists or On-Farm Network staff. There were 505 corn and 376 soybean fields.

Commercial digital aerial imagery of the selected corn and soybean fields was collected in early and mid August, depending on the weather conditions. Some fields were flown twice due to difficulties in processing the imagery.

After the imagery was collected, each participating grower received a package with the imagery, sampling instructions, and sampling bags. Two soil and tissue samples were collected from each field.

Soil and tissue sampling

Based on the NDVI or color imagery, two areas were sampled within each field. Sample 1 was collected within seemingly "good area" with normal green color of the crop canopy, normal plant height and biomass, within areas without visible pest, weed or insect damages or within areas of the average or high historical crop productivity. Sample 2 was collected within seemingly "bad area" with lighter color of the crop canopy, with below normal plant height and plant biomass, or within areas that had potential nutrient problems in the past.

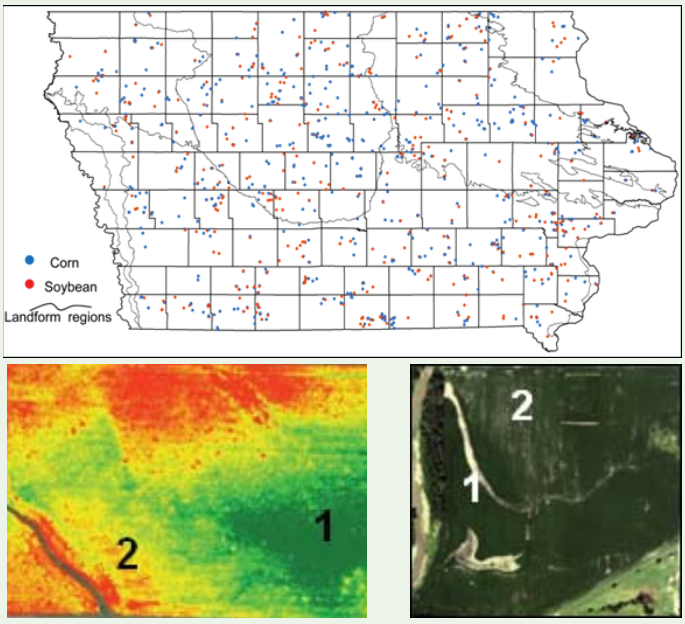

Fig. 1. Locations of 505 corn and 376 soybean fields sampled in August of 2011. Sampling area 1 ("good area") and sampling Area 2 ("bad area") were selected using NDVI or color aerial imagery.

Locations of the two sampling areas were recorded by GPS or marked on the aerial imagery.

Corn was sampled from R2 to R5 crop stage, with the majority of the fields sampled at R3 and R4. Soybean fields were sampled from R1 to R6, with the majority of the fields sampled at R4 and R5. The sampling time was slightly delayed because of the longer timing of processing aerial imagery. Ear leaf was sampled for corn and the most recently developed trifoliate for soybeans. Soil samples were collected to a 6-in. depth.

Laboratory analysis

Soil and tissue samples were analyzed by Midwest Laboratories, Omaha, NE. The soil samples were analyzed for soil and buffer pH, soil organic matter, cation exchange capacity, NO_3-N, NH_4-N. Both soil and tissue samples were analyzed for following macro nutrients: N, P, K, S, Ca, Mg and micronutrients: Zn, Cu, Fe, Mn, and B.

Each participating grower received soil and tissue testing results along with the lab interpretations expressed as crop nutrient status or crop sufficiency categories.

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