IPNI INSIGHTS
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Northcentral Research Report

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RESPONSIBLE management of crop nutrients requires research. Research is one step in the development process of best management practices (BMPs) that specify the right source of nutrient to be applied at the right rate, time, and place. Scientists need to test these practices for their impact on productivity, profitability, cropping system sustainability, and environmental health.

This issue of *INSIGHTS* features the brief Interpretive Summaries related to research projects supported by IPNI in the Northcentral Region. This information and even more detail on each project can be found at the research database at our website: >**www.ipni.net/research**<.

Iowa

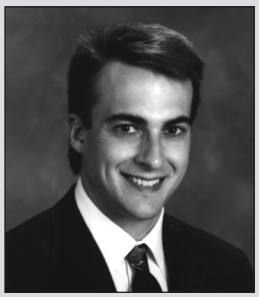
Variability in Soil Test Potassium and Crop Yield

Project Leader: Dr. Antonio Mallarino, Iowa State University, Department of Agronomy, 3216 Agronomy Hall, Ames, IA 50011-0001. Telephone: 515-294-6200, Fax: 515-294-2458. E-mail: apmallar@iastate.edu

In 2007, this project evaluated the impact of rootworm resistance genetics on grain yield and nutrient uptake by corn. Nine conventional plot trials with corn were established at five Iowa

State University (ISU) research farms. The treatments included two corn hybrids (i.e., rootworm resistant and susceptible) and five K fertilizer treatments (0 to 180 lb K_2O/A). All sites had corn planted the two previous years, which showed evidence of rootworm infestation. Initial soil test K across sites ranged from values at the borderline between very low and low to optimum and high according to ISU soil test interpretations. No insecticide was applied. Plant samples taken for nutrient determination included ear leaves at silking, total above-ground plants near silking stage, and harvested grain. Rootworm damage evaluations were made as suggested by the ISU near silking stage.

Only grain yields and rootworm damage ratings are summarized at this time, and results should be considered preliminary because no detailed outlier or statistical analyses were conducted yet. Rootworm damage evaluations showed no damage for rootworm resistant corn at any site (0.1 or less in a 0 to 3 scale) while damage for susceptible corn ranged from 0.6 to 2.2 across sites. Across K rates, the rootworm resistant hybrid yielded significantly higher than the susceptible hybrid on three fields, which had medium to high rootworm infestation. The response to K fertilizer clearly differed between hybrids at one site, where the susceptible hybrid needed more K to achieve maximum yield. Similar but less defined trends were observed at two other sites. These results are in contrast with 2006 results, when at one site the rootworm resistant hybrid yielded higher, but also needed a higher K rate to achieve maximum yield. Plant analyses that are not completed at this time should provide information useful to better interpret these results. *IA-09F*



Dr. T. Scott Murrell
Northcentral Director
International Plant Nutrition Institute (IPNI)
2422 Edison Dr.
West Lafayette, IN 47906
Phone: 765-463-1012
Fax:
e-mail: smurrell@ipni.net
website: www.ipni.net

Effect of Potassium Fertilization on Soybean Grain Yield and Disease Incidence

Project Leader: Dr. Antonio Mallarino, Iowa State University, Department of Agronomy, 3216 Agronomy Hall, Ames, IA 50011-0001. Telephone: 515-294-6200. Fax: 515-294-2458. E-mail: apmallar@iastate.edu

This study was initiated in 2005 and has been assessing effects of long-term K fertilization on soybean grain yield and incidence of various leaf diseases at five Iowa locations. Asian Soybean Rust was not present in previous years or in 2007 at any site, although there was light to moderate incidence of Brown Leaf Spot and there were isolated effects on Cercospora Leaf Spot, Frogeye Leaf Spot, and Powdery Mildew. In 2007, as in the previous 2 years, there was a significant soybean grain yield response to K fertilization in low-testing soils and a small response in soils testing optimum (131 to 170 ppm K) according to Iowa State University recommendations. In 2005, there was an inconclusive K fertilization effect on soybean leaf disease incidence with a small effect only at one of five locations by slightly reducing incidence of Bacterial Blight and Brown

Spot. In 2006, however, there was a significant K effect at reducing diseases at two locations and smaller effects at two other locations, where mainly incidence of Brown Leaf Spot and sometimes Cercospora Leaf Spot, Frogeye Leaf Spot, and Powdery Mildew were reduced. Preliminary results for 2007 (no statistical analyses have been conducted yet) showed no significant K effects at any of the five locations, even though conditions in August were favorable to disease development. The study has been showing that adequate K fertilization does increase soybean yield in low-testing soils and often (but not always) results in reduced incidence of leaf/stem diseases. *IA-13F*

Evaluation of Corn Response to Sulfur Fertilization

Project Leader: Dr. John Sawyer, Iowa State University, Department of Agronomy, 2104 Ag Hall, Ames, IA 50011. Telephone: 515-294-7078. E-mail: jsawyer@iastate.edu

Project Cooperator: Brian Lang

Over 40 years of prior research in Iowa had rarely noted improved corn yields with sulfur (S) fertilization. Recently, S deficiency was documented through increased forage yields and plant S uptake from S fertilizers applied to northeast Iowa alfalfa fields. Deficiencies were especially strong in field areas with low organic matter, eroded, and side-slope landscape positions. Exploratory work in 2006 indicated significant corn yield increases to S application in specific field areas where early-season corn plant coloration indicated possible S deficiency. In 2007, small-plot trials were initiated to test S application rates at 20 producer field sites. Four S rates were replicated at each field site.

Corn yield increase to S application was significant at 17 of 20 sites, with an average yield increase of 18 bu/A when adequate S was applied. On coarse textured soils, the optimal S rate was 24 lb S/A and it was 14 lb S/A on finer textured soils. Leaf S concentration was low at all sites. These results indicate that S deficiency in corn is more widespread in northeast Iowa than was previously suspected and further research is needed to delineate the probability and geographic extent of S deficiency in Iowa corn and other cropping systems. In addition, tools need to be developed that can be used to detect S deficiencies and improve fertilization decisions. *IA-18*

Illinois

Effect of Nutrient Management and Fungicides on Soybeans in Southern Illinois

Project Leader: Dr. Stephen Ebelhar, University of Illinois, Dixon Springs Agriculture Center, Rt 1 Box 256, Simpson, IL 62985. Telephone: 618-695-2790. Fax: 618-695-2492. E-mail: sebelhar@uiuc.edu

Project Cooperator: C.D. Hart

Field study began in 2005 at two locations to determine the effects of K, chloride (Cl^-), boron (B), and manganese (Mn) nutrition on the response of soybean to disease (possibly including Asian soybean rust) with and without the application of fungicides. Soybean crop types included Roundup Ready® and conventional herbicide tolerant varieties. Pre-plant fertilizers included a comparison of potassium chloride (KCl) and potassium sulfate (K_2SO_4) at 75 lb K_2O/A plus a check with no K. Foliar treatments included an application of either 0.5 lb chelated Mn/A or Solubor® at 0.25 lb B/A, or both, in addition to KCl.

Foliar application of B and/or Mn caused some phytotoxicity problems in dry years and with multiple applications. The fungicide treatment reduced the incidence of frog-eye leaf spot for most of the site-years, and increased yields about 50% of the time. None of the fertilizer treatments studied significantly affected soybean grain yields in any year. The foliar application of B usually increased soybean leaf B and the application of Mn usually increased leaf Mn, but neither affected yields. The application of Cl^-, Mn, and B significantly reduced disease levels in only one case at Dixon Springs in 2007, but there was no effect on soybean yields. *IL-32F*

Minnesota

Turkey Manure Ash as a Phosphorus and Potassium Source for Field Crops and Its Effects on Soil Properties

Project Leader: Jeff Strock, University of Minnesota, Dept of Soil, Water and Climate, 23669 130th St, Lamberton, MN 56152. Telephone: 507-752-5064. E-mail: jstrock@soil.umn.edu

Field studies were conducted from 2005 to 2007. The objective of this study was to test turkey manure ash (TMA) effectiveness to supply plants with nutrients compared with that of commercial sources of fertilizer for corn, soybean, and alfalfa. In 2007, none of the plots received TMA or fertilizer due to an inadequate supply of TMA. Therefore, the 2007 year was interpreted as a drawdown year. For corn, soybean, and alfalfa yield, no significant differences were observed in 2007. For alfalfa, tissue nutrient concentrations, boron (B), and copper (Cu) concentrations were higher for the control. In addition, Cu concentrations were higher with TMA than with fertilizer. Phosphorus concentrations in alfalfa tissue were highest for the fertilizer treatments. The higher P concentration in the fertilizer treatments might have been due to the higher amount of P applied in the first year.

In addition to the field study conducted from 2005 to 2007, a greenhouse pot study was also conducted. This study was conducted using a low P (6 mg/kg) and high K (121 mg/kg) soil/sand mixture with a pH of 7.0 to evaluate corn growth response to soil amended with TMA. A control and five rates based on P and K contents in the TMA were compared with equivalent triple-superphosphate (TSP) and potassium chloride (KCl) fertilizer rates. Plant height and stalk thickness for the first 31 days were highest with fertilizer, while at harvest (52 days after planting) no significant differences were found. Due to faster initial plant development, corn dry biomass was greater with fertilizer treatments compared with TMA. Regardless of nutrient source, plant biomass increased as P rate increased. Potassium did

not limit plant growth. Plant tissue P concentration was higher with TMA than with fertilizer. Plant P and K uptake increased as the P application rate increased, but were not different between TMA and fertilizer. Tissue micronutrient concentrations including B, Cu, iron (Fe), manganese (Mn), molybdenum (Mo), and zinc (Zn) were highest for the control. At equivalent rates of P application, soil P concentrations measured at harvest with the Bray P-1 extractant in TMA amended soil were higher than those in fertilizer amended soil. In contrast, soil P measured with the Olsen extractant in TMA amended soil was lower than that in fertilizer amended soil. The Olsen extractant provided a better estimate of plant available P in TMA amended soils than the Bray P-1 extractant.

A soil incubation study was conducted to learn how the availability of P in TMA behaves with time and also to determine if TMA had any liming potential. This study was also conducted using a low P soil (9 mg/kg) with pH 7.0. A control and two rates based on P content in the TMA were compared with equivalent TSP fertilizer rates. Soil samples were collected on a weekly basis from 0 to 64 days after treatment application. Soil pH was measured in a 1:1 soil water mixture, and soil P concentrations in the sampled soils were extracted using water, Bray P-1, Olsen P, and a resin extractable-P method. Concentration of water soluble P in TMA was found to be the same as in fertilizer. Bray P-1 and resin extractable-P over estimated plant available P. However the Bray P-1 and resin extractable-P tests indicated that calcium phosphate from TMA is solubilized slowly with time. The Olsen P was found to better estimate plant available P by comparison with fertilizer. Field studies should be conducted to learn if P release under field conditions is similar to that under laboratory conditions. *MN-25F*

South Dakota

A Decision Aid for Fertilizer Placement with Seed

Project Leader: Dr. Ronald Gelderman, South Dakota State University, Plant Science Department. Box 2207A, Brookings, SD 57007. Telephone: 605-688-4770. E-mail: ronald.gelderman@sdstate.edu

"How much fertilizer can I place with the seed?" That is a common planting season question. A spreadsheet decision aid was developed to assist crop advisers in applying current knowledge and pertinent factors to answer this question. A survey of the literature was used to develop relationships between plant stands and fertilizer rates used with the seed. A laboratory study is being conducted to fill in literature gaps, especially with minor crops and fertilizers. *SD-15F* ■

Send address changes or inquiries to:
INTERNATIONAL PLANT NUTRITION INSTITUTE
3500 Parkway Lane, Suite 550
Norcross, GA 30092-2806
Phone: 770-447-0335
Website: www.ipni.net

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