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Northcentral Research Report

AGRICULTURE is being asked to solve monumental problems — global warming, hypoxia, eutrophication, food security, and sustainable energy to name a few. The public is clamoring for answers, yet science seems to be moving slowly. However, to truly be of service, science must move at a careful and methodical pace, because the conclusions that it draws must, in fact, be correct. The studies contained in this publication are efforts to that end, focused on improved crop nutrition, and represent continued efforts to help agriculture meet the growing number of demands placed upon it.

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 in Iowa

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Four conventional plot trials with corn were established at four research farms in 2006, five additional trials were established in 2007, and evaluations continued in 2008 for a total of 22 site-years. Treatments replicated four times were two hybrids and five K fertilizer rates (0 to 180 lb K_2O/A). All sites had histories of rootworm infestation and soil test K ranged from the upper range of the Very Low class to a value between Optimum and High. No root insecticide was applied. Ear leaves and grain were sampled from all plots. At silking time, three contrasting K treatments were selected to sample whole plants (except roots) and to assess rootworm injury. Grain yield and rootworm injury data were summarized from 2006 to 2008, while plant analysis data were summarized for 2006 and 2007.

Average rootworm injury for the susceptible hybrid at each site-year ranged from 0.1 to 2.4 (0.9 on average) on a scale from 0 to 3, while for the resistant hybrid, injury ranged from 0 to 0.4 (0.1 on average). Potassium increased grain yield at three of the nine locations. The rootworm resistant hybrid yielded higher than the susceptible hybrid in most site-years, but the difference was significant only in 6 site-years (where root injury ranged from 0.2 to 2.2). Preliminary statistical analyses showed no significant interaction between hybrid and K rate. Yield trends suggested, however, that in one site-year the rootworm resistant hybrid yielded higher, but also needed a higher K rate to achieve maximum yield while in 3 site-years the susceptible hybrid needed a higher K rate to achieve the maximum yield. Results from the available tissue tests for 13 site-years showed that K fertilization almost always increased leaf K concentration, but the increase was significant at 8 site-years and the increases appeared consistent across hybrids. Tissue tests for above-ground plant parts also showed K uptake increases at these sites. However, effects of hybrid and K rates on plant tissue N or P were small and inconsistent. Work during 2009 will continue by evaluating the last five field trials, analyzing plant tissue samples, and summarizing data from the previous years. *IA-09F*

Effects of Potassium Fertilization on Soybean Grain Yield and Disease Incidence in Iowa

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This project was conducted from 2005 until 2008 at five Iowa locations (20 site-years) to assess the effects of K fertilization and tillage on soybean grain yield and incidence of leaf/stem diseases. Rates of 0, 35, 70, and 140 lb K_2O/A were broadcast at four locations, and the lowest three K rates were broadcast or deep-banded at the other location. Soybean was grown in rotation with corn, and treatments were evaluated each year. Soybean varieties varied across trials and were planted using a 30-in. row spacing.

There was a large grain yield response to K in low-testing soils (< 131 ppm K, 6-in. depth), a small response in soils testing optimum (131 to 170 ppm K, for which only main-

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tenance is recommended), and no response in high-testing soils. Tillage did not affect grain yield or yield response to K fertilization. Potassium deficiency symptoms were obvious on low-testing plots of several site-years. Asian Soybean Rust was not detected at any site. There was light to moderate incidence of Brown Leaf Spot and Bacterial Blight in most locations and years, and less frequent incidence of *Cercospora* Leaf Spot, Frogeye Leaf Spot, and Powdery Mildew. Tillage sometimes influenced disease incidence, but effects were inconsistent across diseases, locations, and years and are not discussed in this summary.

In 2005 disease incidence was low, and K fertilization reduced incidence of Bacterial Blight and Brown Spot at one location, mainly with no-tillage. In 2006, K fertilization significantly reduced diseases at two locations (mainly with no-tillage) and had smaller effects at two other locations. Effects were more consistent on Brown Leaf Spot than on *Cercospora* Leaf Spot, Frogeye Leaf Spot, and Powdery Mildew. In 2007, K fertilization again reduced incidence of most of these diseases at three locations where disease incidence was observed. Results for 2008 showed small or no disease pressure, although K fertilization again reduced disease incidence or severity at three locations. *IA-13F*

Evaluation of Corn Response to Sulfur Fertilization in Iowa

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Project Cooperator: Brian Lang

More than 40 years of prior research in Iowa had rarely noted improved corn yield with S fertilization. Recently, S deficiency was documented through forage yield and plant S increases from applied S fertilizers in northeast Iowa alfalfa fields, especially in field areas with low organic matter, eroded, and side-slope landscape positions. Exploratory work in 2006 indicated significant corn yield increase to S application in specific field areas where early-season corn plant coloration indicated possible S deficiency. In 2007 and 2008, S rate trials were conducted at 45 field sites in central to northeast Iowa. Four S rates were replicated at each field site.

Corn yield response to S application was significant at 28 of the sites (62%), with an average yield increase of 13 bu/A. When grouped by soil texture for the responsive sites, the yield increase was 15 bu/A for the fine-textured soils and 28 bu/A for the coarse textured soils. The optimal S rate was 16 lb S/A for fine-textured soils and 23 lb S/A for coarse-textured soils. This research indicates a change in need for S fertilization, especially in northeast Iowa, and that S application is an economically viable fertilization practice on many soils. However, the research also indicates that corn does not respond to S application in all fields or field areas and chance of S response may decrease outside of the northeast Iowa geographic area. Therefore, diagnostic tools are needed to help producers better decide when S fertilization of corn will be profitable. *IA-18F*

Illinois

Effect of Nutrient Management and Fungicides on Soybeans in Southern Illinois

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Project Cooperator: C.D. Hart

A field study was conducted at two locations – the University of Illinois Dixon Springs Ag. Center (DSAC) and Brownstown Agronomy Research Center (BARC) – from 2005 to 2008. The purpose was to determine the effects of K, Cl^-, B, and Mn nutrition on the response of soybeans to diseases (possibly including Asian soybean rust) with and without the application of fungicides, across Roundup Ready® and conventional herbicide varieties. Pre-plant fertilizers included a comparison of potassium chloride (KCl) and potassium sulfate (K_2SO_4) at a rate of 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 the KCl pre-plant treatment. *IL-32F*

South Dakota

A Decision Aid for Fertilizer Placement with Seed

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"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 has been conducted to fill in literature gaps, especially with minor crops and fertilizers. A spreadsheet version of the tool can be downloaded at >http://www.ipni.net/toolbox *SD-15F*

Indiana

Comparative Nutrient Use Efficiency by Candidate Biofuel Crops

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Switchgrass is a potential second generation biofuel feedstock. However, not much is known about how sensitive this crop is to soil P and K levels. What little nutrient work has been done has primarily focused on N. A new study has been established in an experimental area where differential P and K soil test levels have been developed. The study will examine switchgrass growth, development, and biomass yield and how they are affected by these different soil nutrient supplies, considered separately as well as interacting with one another. *IN-26F* ■