INSIGHTS
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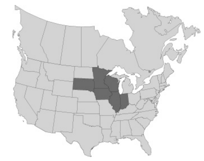
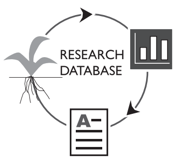
International Plant Nutrition Institute

September 2011

Northcentral Research Update Report



AGRICULTURE is being asked to solve monumental problems — global warming, hypoxia, eutrophication, food security, and sustainable energy to name a few. The research of soil fertility and plant nutrition is as important as ever as we strive to better understand the elements of sustainable nutrient management. The studies contained in this publication are efforts to that end, 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 partially supported by IPNI and the Foundation for Agronomic Research (FAR) in the Northcentral Region. This information and 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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A project studying impacts of rootworm incidence and genetic rootworm resistance on corn response to K fertilization was completed. Treatments were two hybrid isolines with or without rootworm resistance and five K fertilizer rates.

Data from 27 site-years showed that root injury by rootworms was much less for the resistant hybrid. The grain K concentration seldom differed between hybrids, but grain yield and K removal were greater for the resistant hybrid half the time. On average, the yield-maximizing K rate was slightly less for the resistant hybrid even though yield was higher. Potassium concentration and uptake in vegetative tissue was higher for the resistant hybrid when K supply was low. Results indicated better K use efficiency of hybrids with rootworm resistance, although higher grain yield and K removal resulted in higher K rates to maintain soil test K (STK).

There was progress in three other areas. Work continued at five long-term trials with corn-soybean rotations managed with and without tillage to understand STK temporal variability and relationships among fertilization rates, removal, and STK. We summarized 15 years of data for the no-till treatment. Potassium fertilization had a small effect on grain K concentration but increased yield and K removal when STK was less than 150 to 180 mg/kg. Yield was poorly correlated with grain K concentration, but was linearly correlated with K removal. Iowa's average grain K concentration corresponded with the highest concentrations observed. There was a large stratification of STK and non-exchangeable K. The non-exchangeable K partially explained large STK variation across K rates and years. We harvested and sampled the second year of two trials to evaluate interactions among hybrids, N fertilization, and K fertilization in corn. There were large yield responses to N, moderate response to K at one location, and a small positive NxK interaction at one location. Results of tissue tests for grain and leaves are being studied.

We also advanced on the study of K recycling with corn residue. This work is complemented by a similar study for soybean. There was significant K leaching to the soil from standing plants and residue during the period encompassing physiological maturity, harvest, and late fall (before the winter freeze). Study of this issue at different locations and years together with rainfall should explain a great deal of temporal variability in STK. *IA-09F*

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Evaluation of MicroEssentials Sulfur Fertilizer Products for Corn Production

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Project Cooperator: Daniel Barker

The main objective of this study was to evaluate the MicroEssentials MES10® (12-40-0-10S) product as a S and P fertilizer source for corn production. This source is comprised of monoammonium phosphate (MAP) plus ammonium sulfate (AMS) and elemental S in equal proportions. A second objective was to provide additional data on the potential for corn response to S fertilization in Iowa. In addition, a second MicroEssentials product (MESZ® 12-40-0-10S-1Zn) was evaluated as a Zn fertilizer source. Sites were chosen in New Hampton and Tripoli, Iowa, based on their potential for soil S deficiency as well as their higher probability for response to S additions.

Results indicate plant S response to applied S from all S fertilizer products (similar leaf S concentration response from each product), but no yield response to S application at either site in 2010. There was plant P response to all P fertilizer products (leaf P concentration increase), and a yield increase to applied P at both sites. The yield increase from P application was present for all P fertilizers. Based on the results in 2010, no difference was noted between S or P fertilizer products. There was no yield increase with application of Zn as MESZ. The MESZ product also appeared to supply plant equivalent S and P compared to the AMS and MES products. *IA-18F*

Illinois

Comparison of Ammonium Sulfate Nitrate and Ammonium Sulfate to Other Turf Nitrogen Fertilizer Sources

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Turf fertilizers must provide effective turf greening to maximize visual quality. Proper N nutrition is key. Currently, the industry standard for turf N fertilization is urea; however, several other products are available that may not only match the color and quality produced by urea but also provide a longer period of effectiveness. This study, conducted on a Kentucky bluegrass/perennial ryegrass mixture, investigated several different N fertilizer sources, all of which were applied at a rate of 1 lb N/1,000 ft^2: 1) ammonium sulfate nitrate (Sulf-N 26); 2) polymer-coated, sulfur coated urea (PCSCU); 3) ammonium sulfate; 4) UFLEXX, an N source containing two proprietary inhibitors; and 5) urea. Supplemental S (as gypsum) was applied to treatments where the N source did not contain it. Clipping weights and visual turf quality were measured weekly.

Clipping weights did not differ among fertilizer sources for any of the weeks following treatment application. All sources produced similar responses in biomass production and all were greater than where no N had been applied. All fertilizer sources produced improvements in turf quality, but no statistical differences existed among sources. Although not statistically significant, there is a possibility that ammonium sulfate nitrate and ammonium sulfate may produce turf quality improvements more rapidly than the other sources.

The study will be continued to further investigate these sources and more replicates over time will help improve the ability of statistical analyses to determine differences. *IL-36F*

Indiana

Comparative Nutrient Use Efficiency by Candidate Biofuel Crops

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Project Cooperators: Sylvie Brouder, Keith Johnson, and Brad Joern

This report focuses on efforts at the Throckmorton Purdue Agricultural Center, where the objective is to determine how variation in soil test P and K impacts biomass yield, tissue P and K concentrations, and biomass composition (neutral detergent fiber, acid detergent fiber, lignin, sugars, starch) of switchgrass. This research has taken on additional importance because engineers have recently revealed that efficiency of conversion of plant biomass to liquid fuels using pyrolysis is markedly reduced with K in biomass. Briefly stated, high biomass yield with minimal tissue K will be one of several key factors determining system efficacy.

Plots were established in 2007 on a site where a previous alfalfa nutrition study created a wide range in soil test P and K. Biomass yields have been obtained in 2008, 2009, and 2010. Biomass sample analyses for all years have been completed. Soil samples (0 to 10 and 10 to 20 cm) have been obtained and P and K analyses completed. Analysis of variance and regression are being used to determine the relationships among soil and tissue P and K levels and biomass yield and composition. Mr. Patrick Woodson joined the research effort in the summer of 2010 and will complete the analysis of these data for his M.Sc. degree. *IN-25F*

Agronomic Evaluations of Nine Decades of Soybeans: Nitrogen Utilization

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How has N fixation and N utilization changed in soybean cultivars over time? To answer these questions, a multi-state N utilization study was initiated in 2010. In this study, soybean yield, nutrient content, and N use efficiency are being measured and calculated. There are two whole plot treatments: 1) no N applied and 2) N applied at 500 lb N/A (non-limiting to yield). Comparing these two treatments provides insights into the N needs of soybean plants and how well these needs are being met through N fixation. To understand how N utilization has been changing over time, the N treatments are being applied to approximately 60 soybean cultivars released from the 1920s to 2009. These cultivars were acquired from the National Soybean Research Center at Urbana, Illinois, for crop maturity groups II and III. Studies were initiated in 2010 in Indiana, Illinois, Wisconsin, and Minnesota. Indiana and Illinois evaluated the group III cultivars, while Wisconsin and Minnesota evaluated the group II cultivars.

Indiana's preliminary results exhibited a gain of 0.5 bu/A/yr with the fertilizer N supply (500 lb N/A) compared to a gain of 0.4 bu/A/yr with N supply from the soil and biological N fixation. Plant tissue analyses are currently being conducted and the data are yet to be analyzed. The field experiment addresses N utilization, but is very limited in inferences of nodulation efficiency. Therefore, the nodulation of these cultivars will be examined in the greenhouse. *IN-27F*

Minnesota

Evaluation of Ammonium Sulfate Nitrate as a Nitrogen Source for Potato and Sweet Corn Grown on Sandy Soils

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A field experiment at the Sand Plain Research Farm in Becker, Minnesota, was conducted in 2010 to evaluate ammonium sulfate nitrate (ASN) as an alternative to other N sources in Red Norland potato and sweet corn. Treatments included ASN, 50/50 urea + ASN, ammonium nitrate (AN), urea ammonium nitrate (UAN, 28%), urea, and a low N control.

Potato yield and quality were not affected by treatment, possibly due to significant freeze damage early in the study. For the sweet corn study, which was planted after the freeze, application of ASN plus urea or ASN alone resulted in higher green and husked yields than AN or UAN. Sweet corn yields with urea were intermediate between AN, UAN, and the ASN treatments. The positive yield response in the sweet corn with ASN is not entirely clear, but it is likely related to better S nutrition and possibly to less leaching of N as more of the N is in the ammonium/urea form than AN. Application of ASN plus urea or ASN alone consistently resulted in a higher mean N and S concentrations in petiole samples from the potatoes than other treatments, although not always by a significant amount. The ASN treatments also resulted in consistently higher N and S concentrations in sweet corn ear leaf samples compared with AN and UAN treatments, but not always significantly higher. ASN appears to be a suitable N and S source for sweet corn. Further research is needed to evaluate ASN for potato. *MN-27F* ■

Nutrient Source Specifics

is a series of brief, condensed, one-page fact sheets highlighting common commercial fertilizers and nutrient sources in modern agriculture. These topics are written by scientific staff of the International Plant Nutrition Institute (IPNI) for educational use. Mention of a fertilizer source or product name does not imply endorsement or recommendation. This series is available as PDF files at this URL: >www.ipni.net/specifics<

1. Urea
2. Polyphosphate
3. Potassium Chloride
4. Compound Fertilizer
5. Potassium Sulfate
6. Potassium Magnesium Sulfate: Langbeinite
7. Urea-Ammonium Nitrate
8. Thiosulfate
9. Monoammonium Phosphate (MAP)
10. Ammonia
11. Potassium Nitrate
12. Ammonium Sulfate
13. Sulfur
14. Triple Superphosphate
15. Nitrophosphate
16. Gypsum
17. Diammonium Phosphate
18, Calcium Carbonate (Limestone)
19. Phosphate Rock
20. Coated Fertilizer
21. Single Superphosphate
22. Ammonium Nitrate