IPNI INSIGHTS
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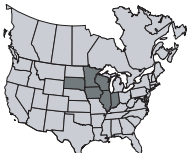
Northcentral Research Report



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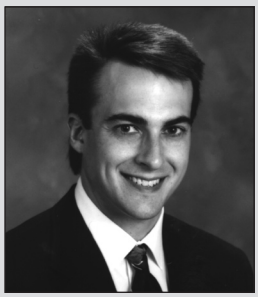

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Iowa

Removal of Phosphorus in Corn and Soybean Grain as Related to Long-Term Crop Yield and Soil-Test Phosphorus

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In many soil P management strategies, an estimate of P removal by harvested grain is used to determine maintenance fertilizer application rates. These rates are intended to keep soils at desired levels by simply replacing what is removed from the field through crop harvest. Relatively little recent work has been done to check the standard removal estimates used in university recommendations. At Iowa State University, archived grain samples from the last 12 years have been analyzed for P concentration. Analyses are showing that the current P removal estimate for soybean is fairly accurate, but the rate for corn is about 16% too high. Examination of changes in soil tests over time has revealed that reliance on these P removal estimates does a good job of maintaining soil test levels if average yields are used in the estimates. Basing maintenance estimates on yield goals that are unattainable in most years leads to application rates that build soil test levels, rather than maintain them. *IA-10F*

Foliar Fertilization and Fungicide Application for Soybean

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Soybean disease control and management is getting more attention with farmers' growing concern over Asian rust. A side benefit of fertilization is that it can sometimes help the plant suppress or withstand diseases. This study is investigating whether or not foliar fertilization provides any increased disease protection beyond what is possible with a fungicide application. In 2006, high incidences of brown spot and bacterial blight were observed at all sites of this experiment. Fungicide reduced incidence and severity of brown spot at two sites, and only severity at the third. Fungicide also reduced incidence and severity of bacterial blight at two sites. Foliar applications of fertilizer had little measurable effect on disease. Preliminary conclusions to date are that fungicide has good potential for reducing both incidence and severity of soybean diseases and increasing yields, while foliar fertilization does not. *IA-15F*

Evaluation of Alfalfa Response to Sulfur Fertilizer in Iowa

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Project Cooperators: Brian Lang and Steve Barnhart

Interpretations of sulfur (S) soil tests have been elusive in the Midwest. Historically, the greatest chances of S deficiencies have been on low organic matter, coarse textured soils. However, S deficiencies are now being observed in northeastern Iowa on soils that have higher organic matter

content and more clay minerals. This study is investigating the need for S fertilization for alfalfa in this part of the state. The results from 2006 indicate that the S soil test did not reliably predict S need. However, plant analysis was effective. Concentrations below 0.25% indicated a need and a good chance of a profitable response to S in the year of application. More research will need to be conducted to confirm the 2006 results and improve S recommendations in the future. *IA-16F*

Evaluation of 13-33-0-15S for Corn Production

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Project Cooperator: Daniel Barker

In northeast Iowa, S deficiencies are becoming more prevalent. Research is underway to determine the management practices best able to rectify the problem. In this study, ammonium sulfate and a new product containing equal proportions of elemental and sulfate-S forms were tested at two sites where corn was grown. Corn responded to S additions at only one site, although plant concentrations of S were below sufficient levels at both locations. Where the response occurred, both S sources performed equally well. This project is in its first year and will be continued to further evaluate the probability of corn response to S as well as the efficacy of both products. *IA-17F*

Illinois

Nutrient Management Effects on Soybean Rust

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Project Cooperator: C.D. Hart

This project is part of a multi-state effort examining the effects of mineral nutrition on the incidence and severity of soybean diseases, including Asian rust. Several elements, including soil applied potassium chloride (KCl), foliar manganese (Mn), and foliar boron (B), are being studied to see how they compare or interact with a fungicide treatment. In Illinois, Asian rust has not yet been observed at the research sites studied. Frogeye leaf spot has been the primary disease.

Foliar application of B and/or Mn caused some phytotoxicity problems in 2005 at each of the two locations studied, but was less of a problem in 2006. This could be related to limited rainfall at these locations around the time of foliar application in 2005 compared to 2006. The fungicide application at one location in 2005 significantly increased the level of phytotoxicity and reduced grain yield, but no problems were observed with the different fungicide used in 2006. At the other location, the fungicide treatment reduced the incidence of frogeye leaf spot, but there was no effect on yield in 2005. In 2006 there was a positive yield response to fungicide application at both locations.

None of the fertilizer treatments significantly affected soybean grain yield in either year. Variety differences were varied and there were few interactions between variety and fungicide or between variety and fertilizer treatment. The foliar application of B usually increased soybean leaf B and the application of Mn usually increased leaf Mn, but neither affected yields. Application of other nutrients such as K or S usually did not significantly increase leaf levels of these nutrients compared to the check plots, presumably because of the adequate nutrient supplying power of the soil. *IL-32F*

Indiana

Impact of Mineral Nutrition on Soybean Plant Health

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Project Cooperators: Don Huber, Lance Murrell, and Scott Murrell

This project is part of a multi-state effort examining the effects of mineral nutrition on the incidence and severity of soybean diseases, including Asian rust. Several treatments, including soil-applied potassium chloride (KCl), foliar manganese (Mn), and fungicide are being studied. Fungicide applications are the most commonly used approach to combatting Asian rust.

In 2006, no Asian rust was observed, but septoria brown spot was present. Fungicide, applied alone or in combination with KCl, reduced brown spot incidence significantly, although infection rates were low across the site. No differences existed among treatments for grain yield, protein, oil, or fiber content. *IN-24F*

Minnesota

Crop Responses to Soil Amended with Turkey Manure Incinerator Ash

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

Turkey production generates a large amount of manure throughout the year. Incineration of this manure generates additional energy and reduces storage space. A by-product of the incineration is ash. This ash contains sufficient quantities of nutrients to be used as a fertilizer, but how effective is it compared to traditional fertilizer sources? In this study, three crops were studied: corn, soybean, and alfalfa. Turkey manure ash was compared to combinations of potassium chloride (KCl) and triple superphosphate (TSP).

In 2006, corn showed no response to any nutrient source. Soybean yielded more with ash than with commercial nutrient sources. Alfalfa responded favorably to both commercial fertilizer and turkey manure, with both nutrient sources being equally viable. *MN-25F*

South Dakota

Impact of Potassium, Chloride, and Manganese Fertilizer Amendments on Soybean Rust in Eastern South Dakota

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Project Cooperators: Anthony Bly and Robert Berg

This project is part of a multi-state effort examining the effects of mineral nutrition on the incidence and severity of soybean diseases, including Asian rust. Proper nutrition has been shown to be an important component of disease management in other crops in the Great Plains, such as corn and small grains. The primary emphasis of this study is to isolate the effects of chloride (Cl^-) and manganese (Mn) on disease incidence and severity and soybean yield. Both of these nutrients are known to be important to a plant's ability to fight off or withstand disease.

In 2006, a site was chosen with low soil Cl^- levels. Conditions in May, June, and July were hot and dry. No Asian rust was observed on the soybean crop, so effects could not be determined. However, yield data indicated no significant effects of fungicide or foliar Mn. Applications of Cl^- suppressed yields significantly. *SD-14F*

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

Placement of fertilizer with the seed is a convenient option for those wishing to apply fertilizer at the time of planting. However, this practice must be used with caution since fertilizer can cause seedling damage if applied at rates that are too high. Traditionally, university recommendations have been vague or overly simplistic in their guidance for this practice. A new project at South Dakota State University reviewed many studies of seed-placed fertilizer. Summaries and statistical analyses of various crops and fertilizer sources were performed. The result is a new spreadsheet decision aid that is currently under review. The spreadsheet tool allows users to input a few key pieces of information and get back a suggested rate for a specific crop and nutrient source. *SD-15F*

Wisconsin

Improving Nitrogen Management for Corn on Irrigated Sandy Soils

Project Leader: Dr. Larry Bundy, University of Wisconsin–Madison, Department of Soil Science, 1525 Observatory Drive, Madison, WI 53706-1299. Telephone: 608-263-2889. Fax: 608-265-2595. e-mail: lgbundy@wisc.edu

Are there ways of improving N management for intensive, irrigated corn production on sandy soils? A major concern in such situations is the large potential for economic and environmental N losses through leaching. This project explores a variety of N sources, rates, and application timings on a Plainfield loamy sand soil in Wisconsin. The 2006 growing season was relatively dry with all months having below normal rainfall, except May, which was about 1.7 in. above normal. In this drier year, corn response to N topped out at about 100 to 150 lb N/A. At the 150 lb N/A rate, no differences between sources and application times were detected. Growing conditions this year favored using a single preplant application of polymer coated urea (ESN) compared to using that source at later application times. *WI-25F* ■

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Research for Managing Crop Nutrients

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Delaware

Potassium Fertilizer Requirements of Corn and Soybean on Delaware Soils

Project Leader: Dr. Greg Binford, University of Delaware, 152 Townsend Hall, Newark, DE 19716. Telephone: 302-831-2146. E-mail: binfordg@udel.edu

This study was initiated in 2006 in response to producer concerns of whether current recommendations maintain soil K. Objectives were to evaluate corn and soybean yield responses, K removal, and soil test K changes over time. Corn responses were evaluated at three sites with low to medium K fertility. Soybean responses were evaluated at two sites—one high and one low in soil K. Neither corn nor soybeans responded to applied K in the first year of this study. Work is planned to continue on these same plots to monitor the longer-term effect of K on both yield and soil test K levels. *DE-04F*

Maryland

Building a Maximum Yield Cropping System for Corn, Wheat, and Doublecropped Soybeans

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Project Cooperator: William Kenworthy

The goal of this study is to develop a management program that increases crop yield, input efficiency, and profit potential in a predominantly no-till cropping system. This cropping system consists of four crops planted over 3 years: no-till soybeans in corn stubble, followed by minimum-till wheat doublecropped with no-till soybeans, and then no-till corn.

The rotation clearly improved corn and soybean yields compared to continuous cropping. Starting in 2000, N use efficiency has appeared to improve when ammonium sulfate (AS) was blended with either urea or ammonium nitrate (AN). In 2003, with AS supplying one-third of the N, no-till and strip-till corn yield increased by 30 bu/A, particularly with split application, compared to broadcast urea. In 2004, doublecrop soybeans responded to N applied to the preceding winter wheat crop. Soybean yields were 4 to 5 bu/A higher where 120 lb N/A had been applied to wheat, regardless of whether the N had been supplied as urea or a urea-AS blend. The same N sources applied directly to single-crop soybeans produced no yield response at all. In 2004, N applied to winter wheat increased yields by 26% in no-till and by 53% in tilled soil, with an advantage of 3% to 6% from including AS in the blend. Urea plus Agrotain® boosted wheat yields by 5% compared to urea alone. Blends of fertilizers containing AS tended to produce higher wheat yields than either urea or AN alone. In contrast, a 2004 trial evaluating dry and liquid N sources for corn found little benefit to including AS in the blend, but showed some promise for several inhibitors and efficiency enhancers. In 2005, various N sources were broadcast-applied to corn at the 4-leaf stage. AN produced the highest corn yield as each pound of added N boosted yield by a bushel. Yields under urea were only 62% as high, but blending in AS or a urease inhibitor boosted yields by 30 to 50%. Liquid urea-ammonium-nitrate (UAN) produced yields about 45% higher than those with urea, but little benefit was observed from blending UAN with either AS or a urease inhibitor.

In 2006, yield responses were not as large, but two N

combinations stood out in terms of their positive influence on corn yields: a granular blend of 75% urea and 25% AS, and liquid UAN with Agrotain. In wheat, granular blends of AN or urea with AS and a liquid blend of UAN with AS produced peak yields close to 90 bu/A. *MD-06F*

Nitrogen Source Study on Potatoes

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Project Cooperator: David Armentrout

This project was carried out in the 2006 growing season, with potatoes in no-till and minimum tillage cropping systems. The objective was to compare N sources varying in proportion of ammonium sulfate. No yield benefit was observed as a result of including ammonium sulfate in a blend of ammonium nitrate and calcium nitrate as an N source. *MD-12F*

Michigan

Sulfur and Nitrogen Starter Fertilizer in Michigan Corn

Project Leader: Dr. Darryl Warncke, Michigan State University, Crop & Soil Sci Dept., East Lansing, MI 48824. Telephone: 517-355-0210. Fax: 517-355-0270. E-mail: warncke@msu.edu

Project Cooperator: Kurt Thelen

Deposition of sulfur (S) from the atmosphere has been cut in half over the past 20 years in Michigan. Growers are showing interest in improving their starter fertilizer blends for corn. The objective of this project was to test combinations of N, P, and S. Studies were conducted at 11 sites over the 2005 and 2006 crop seasons. Starter S fertilizer improved the S content of whole corn plants at growth stages up to silking. Grain yield, however, was improved by S at only one of 11 site years. The most likely benefit from ammonium sulfate, as a component of starter fertilizer, appears to occur with no-till corn grown on sandy, low organic matter soils. *MI-11F*

New York

Development and Implementation of a Fertilizer BMP Guide for Northeastern Dairy-based Cropping Systems

Project Leader: Dr. Harold F. Reetz, Jr., Foundation for Agronomic Research (FAR), 107 S State Street, Suite 300, Monticello, IL 61856-1968. Telephone: 217-762-2074. e-mail: hreeetz@ipni.net

Dairy farms in the Northeast U.S. have made a lot of progress in adopting best management practices (BMPs) for managing their impacts on the environment. Many of these BMPs emphasize manure management. This project focuses on fertilizer BMPs appropriate to the cropping systems that support dairy farms.

Nutrient cycling on dairy farms is intensive. Large amounts of nutrients are both removed from the field in the harvest of forages, and returned in the form of manure. Nutrients also flow onto the farm in the form of purchased feed inputs, and they leave the farm in the form of milk, animals, and other materials sold. Fertilizers still play an important role on dairy farms. Applying them at the right rate, the right time, and in the right place optimizes profitability and resource use efficiency, and minimizes impact on the environment.

This project is supported by a Conservation Innovation Grant from USDA-NRCS. Since January 2006, a team consisting of participants from Cornell University, Cornell Cooperative Extension, USDA-NRCS-NY, IPNI, Soil and Water Conservation Districts, crop consultants, and producers has been meeting to discuss critical development needs for fertilizer management information. An assessment of fertilizer management for over two dozen selected farms has shown considerable diversity among farms, but also that producers are conscientious in their fertilizer use. The team has agreed that the most important information need is on fertilizer credits when cover crops are included in the crop rotation. Field demonstrations have focused on conservation tillage, cover crops, and the integration of fertilizer management to suit those practices. Participating producers have made presentations on their tillage and nutrient management practices at field meetings in New York and at the InfoAg 2007 conference in Springfield, Illinois. A literature review to determine the effect of cover crops on the nutrient needs of following crops is under way. The first draft of the BMP guide is to be discussed by the team in December 2007. *NY-08F*

Ohio

Impact of Rotation, Phosphorus, and Potassium Fertilization on Soil Productivity and Profitability

Project Leader: Dr. Robert Mullen, The Ohio State University, School of Natural Resources, 1680 Madison Ave, Wooster, OH 44691. Telephone: 330-263-3785. Fax: 330-263-3658. E-mail: mullen.91@osu.edu

Project Cooperator: Edwin Lentz

Growers in the eastern Corn Belt often fertilize the whole rotation rather than the individual crops within the rotation. Typically, in the fall prior to corn planting, farmers supply enough P and K to satisfy the nutrient needs of both corn and the following soybean crop. This practice is probably a viable option for fields with more than adequate soil nutrient levels, but on marginal fields it may be limiting production, specifically with regard to low K soils. In addition, soybean K requirements may be increasing owing to the trend toward earlier planting dates. Studies in 2005 found that K boosted yield in only one of four soil types, and by only 3%. At the northwestern station, early planting pushed yields over 55 bu/A. However, the crop did not respond to K, likely because soil test was very high. Earlier planting did not affect the need for K.

In 2006, studies assessing P and K fertilization strategies were started in three locations. Two rotations were compared: corn/corn/soybean, and corn/soybean. These rotations were fertilized following soybeans, at P and K rates corresponding to zero, once and twice the crop removal for the rotation.

Corn yield was increased at one location by application of both P and K fertilizer. Optimum fertilization boosted yields from the 213 to 215 bu/A range to 223 to 225 bu/A. The other two locations did not show consistent yield increases. Continuation of this crop rotation experiment will be essential to determining the cumulative impacts. *OH-16F*

Ontario

Yield Response of Intensively Managed Corn and Soybean to Potassium Fertilizer Rate and Placement

Project Leader: Dr. Bill Deen, University of Guelph, Department of Plant Agriculture, Guelph, ON N1G 2W1 Canada. Telephone: 519-824-4120, 3397. E-mail: bdeen@uoguelph.ca

Project Cooperators: John Lauzon and Greg Stewart

The goal of this project is to examine the variation in corn and soybean yield response to varied input intensity applied across a field landscape. The objectives are to identify parts of the landscape that are most responsive to increased input levels, and to determine the particular constraints to crop growth at these locations during various stages of crop development. Seven strips of high-input treatments... comparing normal and high rates of K across normal and deep placement, and normal and high inputs of N, P, and plant density...were applied in the fall of 2001 along the full length of a large field in preparation for corn and soybeans. The treatments were repeated in 2003 and 2004 under a corn-soybean rotation. Starting in the fall of 2004, tillage and fertility treatments were applied only to corn, with soybeans relying on residual fertility.

The 2005 season featured some of the highest corn yields achieved to date. The intensively-managed high K treatment yielded a field average of 190 bu/A. Yields responded well to K rates above provincial recommendations. Deep placement of K also boosted yield by 4% in contrast to little response in the first 3 years. The 2006 season saw continued high yields under intensive management, while those under conventional management declined to only 90% as high. Postharvest soil nitrate levels ranged from 4 to 7 ppm and did not differ between intensive and conventional management. Soil test levels for P and K are showing differences in response to rates applied.

The project's 5 years of yield data are beginning to supply valuable information demonstrating the econ-omic and environmental viability of intensive crop management. The project is continuing in 2007. *ON-24F* ■

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