IPNI INSIGHTS
INTERNATIONAL PLANT NUTRITION INSTITUTE

Research for Managing Crop Nutrients

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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 Northeast Region. This information and even more detail on each project can be found at the research database at our website: >**www.ipni.net/research**<.

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Delaware

Potassium Fertilizer Requirements of Corn and Soybean on Delaware Soils

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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. In 2006, corn responses were evaluated at three sites ranging in 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 2006, even though yields were high at four of the five sites. Concentrations of N, P, and K were generally lower than book values for both corn and soybean grain, by 20 to 30% for corn, and by 11 to 16% for soybean.

In 2007, the same sites received the same K fertilizer treatments. Owing to record drought conditions from June through mid-August, irrigation was unable to keep up. Yields were modest and did not respond to applied K. Monitoring of responses is planned to continue in 2008. A few more years will be required to answer producer questions about declining soil test levels. The nutrient removal data confirm the declining trend in grain nutrient concentrations associated with genetic changes, especially in corn. *DE-04F*

Maryland

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

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Project Cooperator: William Kenworthy

Sixteen N sources were evaluated on winter wheat in 2007. The crops were grown with and without tillage on a Mattapex silt loam soil. Sources containing ammonium sulfate or ammonium nitrate tended to produce modestly higher yields. Slow-release forms of N and elemental S did not boost yields when applied with timings similar to those used with the more soluble sources. *MD-06F*

Evaluation of Fertilizer Nitrogen Applications with and without Ammonium Sulfate in Selected Vegetable Crops

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The objective of this study is to evaluate the effectiveness of ammonium sulfate (AS) in a rotation of potatoes with wheat/doublecrop soybeans, corn, and single-crop soybeans under irrigation with different levels of tillage.

Fertilizers containing AS produced slightly lower potato

Notes and Abbreviations: N = nitrogen; P = phosphorus; K = potassium; S = sulfur; ppm = parts per million.

yields in 2006 and slightly higher yields in 2007, compared to conventional N sources, with at best an average yield benefit of 1 to 2%. Fertilizer containing AS boosted wheat yields by 17% in 2007 compared to sources containing urea and ammonium nitrate. Applied to corn in 2007, AS modestly increased yields. Nitrogen fertilizers applied to doublecrop soybeans resulted in no yield benefits in 2007. *MD-11F*

New York

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

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Dairy farms in the Northeastern USA have made a lot of progress in adopting 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 them, but also that producers are conscientious in their fertilizer use. The team has agreed that the most important information needed 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 to participants of the InfoAg 2007 conference in Springfield, Illinois. A literature review to determine the effect of cover crops on the nutrient needs of following crops was conducted. The first edition of the BMP introductory guide developed by the team will be available soon. *NY-08F*

Ohio

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

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Project Cooperator: Edwin Lentz

Growers in the eastern Corn Belt often fertilize the whole rotation rather than the individual crops. 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 has proved to be a viable option for corn-soybean rotations on soils with adequate nutrient levels, but questions arise for producers in a 3-year rotation of corn-corn-soybean. Studies in 2005 found that K boosted soybean yields in only one of four soil types, and by only 3%, and that 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 range of 213 to 215 bu/A up to 223 to 225 bu/A. The other two locations did not show consistent yield increases.

In 2007, each location had corn in the first rotation and soybeans in the second. Neither crop responded to the P and K treatments, even though the soybean crop produced yields as high as 66 bu/A. Drought reduced corn yields to a range of 122 to 159 bu/A. Changes in soil test levels are being monitored.

Continuing this experiment will be essential to provide answers to producers increasing the frequency of corn in their crop rotations in response to biofuel demand. *OH-16F*

Ontario

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

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Project Cooperators: John Lauzon and Greg Stewart

The goal of this project was to examine the variation in corn and soybean yield response to varied input intensity applied across a field landscape. The objectives were 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.

In 2007, a new corn hybrid (Northrup King N45-A6) produced a top yield of 200 bu/A. As in previous years, intensive management produced yields about 10% higher than those obtained with normal management. Intensively managed corn also had 5% greater crude protein concentration in the grain, and 18% greater N concentration in the stover. Stalk nitrate was higher in treatments receiving high rates of both N and K. In contrast to the 2006 season in which treatments did not differ, residual soil nitrate levels in 2007 were 57% higher following intensive compared to normal management. Soybeans yielded 6% higher following intensively managed corn.

The project has provided 6 years of valuable data documenting the potential economic and environmental viability of intensive crop management. The project at this site was terminated with the 2007 season, and resources are being directed to a new project on ecological intensification of corn cropping systems. *ON-24F*

Optimizing Application of Phosphorus and Potassium to Processing Tomatoes under Drip Irrigation

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Recent research has indicated that processing tomatoes require higher rates of N when grown with fertigation. The objective of this research is to determine optimum rates of P and K for the higher yields obtained in this production system. Four rates of P, from 0 to 180 lb P_2O_5/A, were applied in a factorial combination with four rates of K from 0 to 640 lb K_2O/A, starting in the spring of 2006. Soil test levels were 45 to 50 ppm Olsen-P, considered high for tomatoes, and 140 to 180 ppm ammonium-acetate K.

Under fertigation, applying rates of 200 to 360 lb K_2O/A produced optimal marketable yields over 50 t/A. Without irrigation, yields were less than half as high, but high rates of K boosted marketable yield by up to 4 t/A. Soil profile nitrate was lower following fertigation, confirming the high nutrient use efficiency of this very productive system. Soluble solids as measured by Brix increased linearly with applied K. Neither P nor K were found to affect lycopene in either 2006 or 2007. This project is planned to continue in 2008. *ON-28*

Virginia

Effect of Nitrogen Source and Rate on Yield and Quality of Stockpiled Fescue

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Tall fescue is grown on more than 24 million (M) acres in the east-central and southeastern USA. It is the primary forage base for more than 9 million beef cows in this region. One of tall fescue's strongest and most under-utilized attributes is its ability to be stockpiled for winter grazing. This study was designed to determine the effect of N source and rate on the yield and nutritive value of stockpiled tall fescue. Sources compared included urea, ammonium nitrate, ammonium sulfate, urea with Agrotain®, controlled-release urea (ESN® and Nitamin®), poultry litter, processed poultry litter (Microstart 60®), and pelleted biosolids.

In the fall of 2006, yields and crude protein concentrations increased linearly in response to applied N. Sources did not differ in their effect on yield, but did differ in their effect on crude protein. The controlled-release source (ESN®) produced the highest crude protein levels at all three sites, significantly greater than urea in most cases and other sources occasionally. Pelleted biosolid, tested at only one location, did not increase crude protein as well as other sources, including urea with Agrotain®. Preliminary results from 2007 indicate that with much drier conditions during stockpiling, differences among sources are greater.

Results thus far show promise for use of N products designed for enhanced efficiency, but also demonstrate that their efficacy will be dependent on weather as well as soil and crop conditions. *VA-21F* ■

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