IPNI INSIGHTS
INTERNATIONAL PLANT NUTRITION INSTITUTE

Research Supporting Nutrient Stewardship

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THE principles of 4R Nutrient Stewardship require scientific support for the choice of practices that deliver the right source of nutrients at the right rate, time and place. The science needs to test these practices for their outcomes in terms of economic, social and environmental sustainability.

This issue of *INSIGHTS* features Interpretive Summaries of the research projects supported by IPNI in the Northeast Region. More detail can be found at the research database at **>www.ipni.net/research<**.

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 one high K site and one low K site. 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 in the grain were generally lower than book values for both corn (20 to 30% lower) and soybean (11 to 16% lower). 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, and yields were modest and did not respond to applied K.

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In 2008, three of the sites were planted to corn and one site was planted to wheat. Despite below-average rainfall from June onwards, availability of irrigation ensured high yields ranging between 205 and 220 bu/A for corn and 99 bu/A for wheat. Potassium produced a yield response at only one site, where corn yield was boosted by 31 bu/A with 70 lb/A of K_2O, the most economic rate.

These values are lower than traditional book values, reflecting gains in nutrient use efficiency for all three crops. A few more years will be required to answer producer questions about declining soil test levels. This project is expected to continue at two of the five original sites. *DE-04F*

Maryland

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

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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, including: no-till soybeans in corn stubble, followed by minimum-till wheat doublecropped with no-till soybeans, and then no-till corn.

In research on the Eastern Shore of Maryland, N use efficiency in corn and wheat has improved when ammonium sulfate (AS) was blended with either urea or ammonium nitrate (AN). Research in 2008 again confirmed that blends containing an amount of AS sufficient to supply 30 lb/A of S, whether applied pre-plant or sidedressed at the six-leaf stage, produced corn yields as high as or better than those achieved with granular urea or liquid urea-ammonium nitrate (UAN). Despite a drought year, these blends produced corn yields of around 130 bu/A with a total application of 130 lb/A of N. Under zone tillage, corn yielded up to 147 bu/A with only 120 lb/A of N applied. Two products designed to enhance N use efficiency increased yields slightly at a normal N rate, but did not make up for yield losses caused by a 25% reduction in N rate. *MD-06F*

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

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

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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 yields in 2006 and, at best, 1 to 2% higher yields in 2007, compared to conventional N sources. However, 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.

In 2008, fertilizers containing AS boosted wheat yields by 36% (to 95 bu/A) compared to those containing only urea and urea ammonium nitrate. *MD-11F*

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.

In 2008, K treatments boosted soybean yields by 7 to 10 bu/A, and the high rate of P increased corn yields by 22 bu/A at the Western Research Station, the only location not affected by drought. At the East Badger location, P treatments increased corn yields by 9%. At the Northwest Research Station, drought reduced corn and soybean yields to about half of normal, and there were no responses to P or K treatments.

These current yield response observations provide useful support for extensionists receiving questions from producers in light of their concerns with fertilizer prices. The experiment is continuing in 2009. *OH-16F*

Ontario

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

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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 in 2008 were higher than in 2007 ... 65 ppm Olsen-P, and 216 ppm ammonium-acetate K.

In 2008, in contrast to previous years, the marketable yield of tomatoes responded to P, but not to K. An optimal rate of 110 lb P_2O_5/A produced 121 ton/A of marketable yield, but nutrient use efficiency was low. Phosphorus fertilizer increased vitamin C levels by 12% in 2008, though there was no effect in 2007. Rates of 200 to 350 lb K_2O/A caused a slight increase in soluble solids content, though not large enough to compensate for the lower soluble solids under drip irrigation. Lycopene analysis remains to be completed. This project is planned to continue in 2009. This project is demonstrating that high yields of high quality tomatoes can be produced with improved nutrient use efficiency for N, P, and K by using drip irrigation. *ON-28*

Long-term Optimum Nitrogen Rates for Corn Yield and Soil Organic Matter in Ontario

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Project Cooperators: John Lauzon and Greg Stewart

Decisions on optimum N rates are often made on the basis of single-year responses. Data are limited on the long-term impact on productivity and soil organic matter of rates higher or lower than these short-term optima. This controlled experiment was designed as a base for testing the application of dynamic soil-crop-atmosphere models as predictors of N rates for corn that optimize sustainability. The specific objectives include: (1) assessment of short and long-term effects of N on productivity, environmental impact, profitability, and cropping system sustainability; and (2) validation of crop models, such as Hybrid Maize, for simulating yield potential, seasonal growth and yield, and fertilizer N management requirements.

The project began with a uniformity trial conducted in 2008 at Elora, Ontario. Long-term and short-term N rate treatments commence in 2009. *ON-29* ■