IPNI INSIGHTS
International Plant Nutrition Institute

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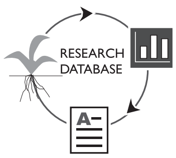
Research Supporting Nutrient Stewardship

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**<.

Ohio

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

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Project Cooperator: Edwin Lentz

Growers in the eastern U.S. 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 proven 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 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. 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. 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.

In 2009, responses to the 4 years of application of P and K occurred at only one of three sites, and were small (less than 5%). Changes in soil test P are responding to applied P. But soil test K is more puzzling, with no response to applied K in several instances. These mysteries will require further investigation. 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 2010. *OH-16F*

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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, in a drip-irrigated

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

system fertilized with N at 240 lb/A. Soil test levels for P and K varied from year to year, but were generally high, representative of those of typical producer fields.

From 2006 to 2009, marketable yield responded to P and K, each in 2 of the 4 years. Yields were boosted 5% and 11% by P at soil test P levels of 37 to 65 ppm. Potassium increased soluble solids content and also raised marketable yields by 10% and 12% at soil test K levels of 160 to 233 ppm. Vitamin C was increased 1 year in 3 by P, but not by K. Neither P nor K influenced lycopene concentrations in any of the 4 years. The positive yield and quality impacts measured at these relatively high soil test levels support current nutrient use practices of progressive growers, but opportunity to improve fertilizer uptake efficiency remains, particularly for P. The field research was completed in the 2009 growing season, and the project completion is planned for early 2010. *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 2009 growing season was the first in which treatments were applied. Economically optimum rates of N were 15% higher than recommended for the pre-plant application, and 32% higher than recommended for the side-dress application, possibly because of a relatively cool, wet, and long growing season. Corn grain N concentration was 0.60 to 0.66 lb/bu at rates of N sufficient for maximum economic yield. Residual soil nitrate increased sharply when N rates exceeded the economic optimum, and were higher for side-dress than for pre-plant N applications. This project also received support from the Ontario Agri Business Association, for sampling soil residual nitrate and soil organic carbon. The project implementation so far forms an excellent basis for achieving the long-term objectives. *ON-29*

Virginia

Evaluation of Ammonium Sulfate Nitrate in Virginia Snap Bean Production

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Fresh-market snap beans occupy 5,500 acres in Virginia. Producers are interested in exploring sources and rates to improve N use efficiency. This trial compared five N sources (urea with dicyandiamide, ammonium nitrate, calcium nitrate, ammonium sulfate-nitrate, and urea-ammonium nitrate) at three rates.

For spring-grown beans, urea with dicyandiamide increased yield by 25% over the control, while the other sources did not. For fall-grown beans, all N sources increased yield by 56% over the control, with an optimum N rate of 80 lb/A, and reduced symptoms of common rust *(Uromyces appendiculatus).*

These first-year findings support N management decisions that optimize food yields while minimizing risk of water contamination by N on the sandy loam soils of the Chesapeake Bay watershed. *VA-22F*

Evaluation of Ammonium Sulfate Nitrate in Virginia Sweet Corn Production

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Virginia farmers grow over 3,000 acres of fresh market sweet corn. They are interested in exploring sources and rates to improve N use efficiency. This trial compared three N sources (urea-ammonium nitrate, ammonium nitrate, and ammonium sulfate-nitrate) at three rates. The first two N sources were compared with and without S, applied as gypsum, at a rate designed to supply the equivalent amount of S provided by ammonium sulfate-nitrate (65 lb/A).

The N sources increased marketable yields by 16 to 50% using optimum N rates ranging from 110 to 125 lb/A. Agronomic efficiency ranged from 11 to 35 lb of marketable yield increase per pound of N applied. Sulfur added as gypsum did not increase yields, but ammonium sulfate-nitrate produced higher yields than the other two N sources.

These first-year findings support N management decisions that optimize food yields while minimizing risk of water contamination by N on the sandy loam soils of the Chesapeake Bay watershed. *VA-23F*

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 double cropped 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 2009 again confirmed that blends containing an amount of AS sufficient to supply 30 lb S/A produced corn yields higher than those achieved with granular urea applied pre-plant. Despite a drought year, these blends produced corn yields of around 120 bu/A with a total application of 120 lb N/A. Blends of ammonium nitrate with ammonium sulfate and urea produced yields as high as those with ammonium sulfate and urea in no-till and higher than those with ammonium sulfate and urea in strip-till. *MD-06F*

Ammonium Sulfate and Ammonium Sulfate Nitrate Application on White Potatoes

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Project Cooperator: David Armentrout

Managing plant nutrition for potatoes can be challenging since the crop's nutrient demands are high, and so is its potential for impact on soil and water quality. This experiment examines the effects of N sources for potatoes grown in rotation with wheat, soybeans, and corn within strip-till and no-till management systems.

In 2009, urea and ammonium sulfate applied pre-plant proved to be equally effective for increasing potato yield. Highest potato yields were obtained when urea and ammonium sulfate were applied pre-plant, followed by side-dressing with urea and ammonium sulfate nitrate. *MD-14F* ■

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COMING EVENTS

Soil Fertility II - Dealer Education Course

24-26 November 2010

Woodstock, Ontario, Canada

This course will help you develop a detailed understanding of the management of plant nutrition required for efficient use of fertilizers. The course follows the IPNI Soil Fertility Manual, and is useful for both preparation for the Certified Crop Adviser exam and for continuing education. Students are asked to bring along, for discussion purposes, one or more soil test reports and/or example cases outlining the source-rate-timing-placement for a particular crops or cropping systems of interest to their clients.

Contact: Tracey Forrester at the Ontario Agri Business Association, 519-822-3004.

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