NEWS & VIEWS

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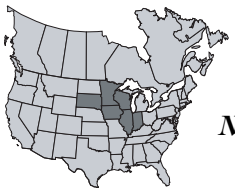

Dr. T. Scott Murrell
Northcentral Director
July 2005

Northcentral Phosphorus and Potassium Research Funded by the Foundation for Agronomic Research (FAR)

THE Foundation for Agronomic Research (FAR) is a non-profit research and education organization. Its mission is to improve the economic vigor and sustainability of agriculture while protecting and enhancing the environment. FAR is supported through cooperation with the Potash & Phosphate Institute (PPI) and numerous contributors involved in North American agribusiness. Each year, FAR helps fund research projects with universities, colleges, and government agencies, and develops agronomic educational materials. The following projects have received support from FAR in the Northcentral Region.

The summaries that follow provide a brief overview of each project. You can also view the full annual reports of each project (current and past), when available, at the website:

>**www.ppi-far.org/research**<.

Iowa

Variability in Soil Test Potassium and Crop Yield

How great is the variability in potassium (K) soil test levels across fields and years? How does this variability impact crop responses to applied K? How well do currently-used soil test K methods predict the likelihood that crops will respond to K additions? Research in Iowa is showing that the current practice of using dried samples in soil test K procedures may sometimes provide inaccurate indications of whether or not crops will respond to additional K. This finding was used to alter soil test K recommendations in 2002. Specifically, higher soil test levels are now considered optimum for crop production. In addition, band placement of K is recommended over broadcast applications in reduced tillage systems where corn and soybeans are grown. *IA-09F*

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Coordination of Management Practices Enhancing Total Efficiency (COMPETE): Iowa Project on Improved Soybean Nutrient Recommendations

In the U.S., phosphorus (P) and K recommendations are based on soil tests. For soil tests to have meaning, they must be calibrated to yield response. Much of the calibration data for soybeans was collected decades ago, when varieties, tillage, and other management practices were much different than they are today. Using outdated interpretations of soil test levels can lead to misapplications of nutrients for current and future soybean production. Consequently, the need for updated information is ever-present. This project has produced new soil test calibration data for K and has shown that higher soil test K levels are needed for economically optimum soybean production. In addition, K applied in bands in reduced tillage systems has produced superior soybean yields compared to the traditionally-used broadcast applications. An investigation into soil test procedures has revealed that new P detection methods used by many labs may lead to higher target soil test levels for soybean production. *IA-11F*

Use of Potassium to Manipulate Lycopene Content in Tomato Fruit for Improved Nutritional Quality

Fresh market tomatoes are an important part of a healthy human diet. They are a good source of K (an important electrolyte for the human body), vitamin A, and vitamin C. They are also an important source of lycopene, an antioxidant that has been found to reduce the risks of certain types of cancer. Can K fertilization increase the nutritional and cancer-fighting benefits of this important crop? Field research conducted in 2004 is showing that K fertilization can increase the size of fresh market tomatoes as well as

their K content, while reducing their sodium (Na) content. Analysis is currently underway to determine what effects K may have on lycopene content. *IA-12F*

Illinois

Coordination of Management Practices Enhancing Total Efficiency (COMPETE)

Since 1995, FAR and PPI have coordinated a series of studies involving research cooperators and farmers from up to 20 states in the Midwest, Midsouth, and Mid-Atlantic regions of the U.S., all concerning various aspects of applying site-specific management technology to soybean production systems. The United Soybean Board has been the major sponsor of these studies, with matching and in-kind support from many other sponsors. Much of the work was done on commercial farms, with standard equipment and with treatments applied by local fertilizer dealers. Over 100 total cooperators have been involved. This program ended with the 2004 growing season. Individual projects are reported in the respective regions.

The Illinois portion, coordinated by FAR, over the past 4 years has looked at the response to increased P and K soil tests. In 2004, corn plots with soil test levels at P1=32 parts per million (ppm) and K=237 ppm yielded 190 bu/A. The normal fertility plots with P1=20 ppm and K=161 ppm yielded 152 bu/A. This 38 bu/A yield differential followed a 20 bu/A differential in 2003. It appears that, under good management, corn will respond to higher soil test levels. Subsoil samples indicated that the nutrient levels lower in the profile had increased significantly due to the higher surface fertilizer applications, providing better season-long nutrient supply. Soybeans grown in rotation on these same plots have not shown a yield response. We hope to be able to continue monitoring these plots if a new source of funding can be obtained. *IL-27F*

Value of Ammonium Sulfate as a Fall-Applied Nitrogen Source for Corn

Best management practices (BMPs) for nitrogen (N) attempt to match N applications with the N need of the crop. Does the source of fertilizer N affect when the N should be applied? This study investigated several N sources applied in the fall and in the spring prior to planting corn. Granular sources of N performed better when applied in the fall than in the spring. Some reasons for this unconventional finding may be a combination of broadcasting granular N sources in conservation tillage systems combined with heavy rainfall after application. The lack of good incorporation of fertilizer granules combined with over 9 in. of rain may have led to higher N losses when the N was applied in the spring. Anhydrous ammonia performed as expected, producing higher corn yields when applied in the spring rather than the fall. *IL-28F*

Indiana

Potassium and Phosphorus Effects on Yield Components, Tissue Nutrient Concentrations, and Fertilizer Efficiency in Alfalfa

Much of the fertility research conducted on alfalfa examines the importance of a specific nutrient, studied in isolation. Very little is known about how nutrients interact to impact yield. Two nutrients commonly managed by alfalfa producers are P and K. How do these two nutrients impact the physiological components of alfalfa yield? Is their interactive impact greater than their individual effects? This research is showing that both P and K are needed to maximize alfalfa yield. Biomass per shoot is the yield component most responsive to combined P and K fertilization. In addition, balanced nutrition is important for maintaining stands and increasing taproot reserves of starch and nitrogen, both of which are important for regrowth after cutting. *IN-14F*

Potassium Bioavailability in Soil and Its Acquisition by Corn and Soybean

Crop advisers in the Midwest have been observing an increased frequency of K malnutrition of corn and soybeans as well as unexpected changes in soil test K levels. To address these concerns, this research project is re-evaluating current university K recommendations to try and gain more insight into why soil test K levels are fluctuating unexpectedly and what impact this phenomenon is having upon crop nutrition. Research to date is showing that, pound for pound, annual applications of K increase soil test K levels more rapidly than those made once every 2 years. Biannual applications are currently the standard management practice of Midwestern corn and soybean growers. Additionally, it has been found that it takes about three times as much K to increase soil test levels in the lower layer of soil than it does the upper, surface layer. Soil type as well as soil mineralogy appear to be important factors for making sense of these changes. *IN-15F*

Nutrient Management for High Yield Corn and Soybeans

The gap between current yields and those possible is an area of intense interest to corn and soybean producers. To increase yields and narrow this yield gap, producers must consider many factors. One that is thought to be important is the distribution of nutrients in the soil profile. In reduced tillage systems, nutrient stratification is common, with higher levels of nutrients near the surface and lower levels

deeper. The extent to which nutrient stratification impacts yields in high yield environments has not been extensively researched. This project is showing that higher soil test K levels are associated with increased grain oil, protein, and grain K in high oil corn. Soybean response to K applied to the previous corn crop has been limited, with only increased seed K concentrations being observed. *IN-18F*

Coordination of Management Practices Enhancing Total Efficiency (COMPETE): Indiana Project on Improving Nutrient Recommendations

In the Midwest, K malnutrition has been increasingly observed in soybeans in recent years. This has led to a re-examination of current K recommendations. This project examines how crop response to added K changes with inherent soil K supplies, measured by soil tests. This project is showing that currently recommended rates for building soil test K levels may be too low for some surface soil layers. This would explain why some soils are not increasing in soil test K as much as expected. The currently recommended target for building soil tests still appears adequate, based on soybean response. However, there is evidence that soil-specific recommendations could provide needed refinements. *IN-22F*

Coordination of Management Practices Enhancing Total Efficiency (COMPETE): Indiana Project on Improving Assessments of Soybean Nutrient Needs

Nutrient stratification in soils managed with conservation tillage practices may be adversely affecting K nutrition of soybeans. Can applications of K as subsurface bands improve K nutrition of soybeans in reduced tillage systems? This project is examining how soybeans respond to the residual effect of K banded in the previous season for corn. So far, results indicate that when soybeans are planted in narrowly spaced rows, residual K from more widely spaced subsurface bands may be inadequate when inherent soil K supplies are low. There may be a need to match the spacings of K bands with the spacing of soybean rows grown in reduced tillage systems. *IN-23F*

Minnesota

Precision Placement for Improved Phosphorus Management of Corn/ Soybean Rotations in Very Reduced Tillage Systems

Often, only short-term impacts of P fertilization are emphasized. However, P applications can have longer-term impacts. Understanding long-term impacts of P application is essential for optimizing capital investments in P with available cash flow. This study is monitoring the impacts of previously applied P on subsequent corn and soybean crops. So far, substantial yield increases have been observed 3 years after the last P application. Crop yields will continue to be monitored to determine just how long residual effects can be seen. *MN-20F*

Coordination of Management Practices Enhancing Total Efficiency (COMPETE): Improving Assessments of Soybean Nutrient Needs

In many areas of the western Corn Belt, iron (Fe) deficiency severely limits soybean yields. This deficiency arises because of the basic soil conditions encountered in these more arid areas. Soybean producers in these states have a keen interest in knowing how this affects other aspects of soybean nutrition. To address this problem, researchers at Minnesota examined how total nutrient uptake changed under varying degrees of Fe deficiency chlorosis. They found that Fe deficiency chlorosis had no special effect on uptake of P and K. Most of the changes in nutrient concentration were attributed to the deleterious effects of Fe deficiency on yield. *MN-22F*

Coordination of Management Practices Enhancing Total Efficiency (COMPETE): Minnesota Project on Gaining Better Assessments of Soil Fertility

Livestock producers are looking for better ways to integrate manure and fertilizer applications within their fields. This project is looking at immediate and subsequent years' impacts of N and P applications on crop yields and quality. Both manure and commercial fertilizer sources are being examined. This season, soybeans showed yield and protein increases when N and P, regardless of source, had been applied ahead of the previous year's corn crop. Higher P fertility also resulted in higher P concentrations in the grain and higher overall P removal rates from the field at crop harvest. Possible causes of yield variability within the field were also examined, and it looks as if soil variability is an important causal factor. *MN-23F*

South Dakota

Coordination of Management Practices Enhancing Total Efficiency (COMPETE): South Dakota Project on Improving Assessments of Soybean Nutrient Need

Currently, questions are being raised about the sustainability of corn/soybean rotations in the Corn Belt. Little is known about how this rotation changes soil carbon (C) levels over time. This research is using innovative approaches to developing C budgets on areas within farmer fields. So far, a C budget was measured for one cropping year. More budgets will follow, but the initial analysis is indicating that to keep C from being depleted in the soil, approximately 11% of the C contained in the upper 6 in. of soil must be replenished by crop residue. The amount of C lost from the soil by cropping practices appears to vary by landscape position. *SD-13F*

Wisconsin

Coordination of Management Practices Enhancing Total Efficiency (COMPETE): Wisconsin Project on Improving Assessments of Soybean Nutrient Needs

Soybean producers have a wide range of tillage systems available to them. Choice of tillage system affects several soil properties and may influence how fertilizer needs to be managed for maximum effectiveness. Results from this project are showing that the best fertilizer management strategies are not the same for all tillage systems. There seems to be an advantage to fertilizer placed near soybean rows during planting in no-till systems. However, this same placement method reduced yields in strip-till systems. Much more needs to be investigated about the causes of these differences. *WI-24F*

Improving Nitrogen Management for Corn on Irrigated Sandy Soils

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 seeks to investigate this question by exploring a variety of N sources and application methods. Findings in 2004 indicate that different N sources require different management strategies. On the sandy soil in this study, applying smaller, more frequent doses of N produced higher yields than the same total quantity of N applied all at once ahead of planting. *WI-25F* ■

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