NEWS & VIEWS

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Dr. H.F Reetz, Midwest Director
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Research Programs in the Midwest Region

THE following summaries provide a status report of the research projects funded in part by the Potash & Phosphate Institute (PPI) and the Foundation for Agronomic Research (FAR) in the Midwest Region (Illinois, Indiana, Michigan, and Ohio). We would like to express our appreciation to the researchers for their work on the projects and their cooperation in preparing the reports. We would also like to thank the other organizations, companies and agencies that provided additional support to these projects. PPI/FAR research funding is usually provided to get projects started, but their full implementation and continuation depend on cash and in-kind contributions from many sources.

Illinois

On-Farm Evaluation of Nitrogen Fertilizer Requirements of Corn

Project Leader: Dr. Fred Below, University of Illinois, Department of Crop Science, 1102 South Goodwin Avenue, Urbana, IL 61801 (217-333-9745), f-below@uiuc.edu

Ammonium sulfate [$(NH_4)_2SO_4$] is being applied throughout the fall and winter in Illinois as a nitrogen (N) source for corn. The objective is to determine the efficiency of fall and winter applications compared to similar amounts applied in the spring and to see if inefficiencies associated with fall or winter applications could be overcome by applying additional N. The experiment was conducted at 10 environments that spanned three years (1997-1999). Ammonium sulfate was applied monthly at a rate of N considered just adequate to maximize grain yield. Two additional rates of N above the standard rate were applied in October and January, while an N response titration with six rates was applied in April.

On average, a significant decrease in grain yield occurred when N applications were made during the five-month period of October through February when compared to an April application. Decreases in grain yield due to fall applications were variable. Much of the variability can be attributed to spring precipitation and, to a lesser extent, soil pH and site responsiveness to N. Although additional $(NH_4)_2SO_4$ above the standard rate increased yields in those environments where October or January applications were inefficient, it did not increase yields to the level obtained with a standard rate applied in the spring. These findings indicate that farmers should delay applications of $(NH_4)_2SO_4$ as long as possible and especially avoid applications in October.

Evaluation of Site-Specific Precision Farming Systems for Soybeans

Project Leader: Dr. Don Bullock, University of Illinois, 1102 South Goodwin Avenue, Urbana, IL 61801 (217-244-8221), dbullock@uiuc.edu

Statistical analysis of yield data from site-specific plots compared to field-average plots continues to show a small, but significant yield advantage from site-specific phosphorus (P) and potassium (K) management. This project will conclude with the analysis of the 1999 data, and the fields will be used in a new project to compare high-yield management systems with conventional management systems. This project has generated several research

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journal papers on the statistical design and evaluation of on-farm management systems research. Extension publications and presentations were also made as an outreach component of the project. The Farm Research Analyst (FRA) software package developed for this project is being made available to other researchers to aid in their on-farm studies. Several training workshops on FRA have been held and a share-ware version and documentation is under development, along with computer-based lessons to guide users.

Nitrogen Source Effects on Take-All in Wheat

Project Leader: Dr. Steve Ebelhar, University of Illinois, Rt.1 Box 256, Simpson, IL 62985, (618-695-2790); Dr. Ed C. Varsa, Southern Illinois University, Carbondale, IL 62901 (618-453-2496), varsae@siu.edu

Soft red winter wheat is grown on more than a million acres in Illinois. Markets are in decline, with other wheat types or classes becoming more prevalent. Another problem with soft red winter wheat is low protein levels. Studies have been initiated at two locations in southern Illinois to determine the effects of N management on yield, protein level, and milling and baking quality of four wheat classes (soft red winter, soft white winter, hard red winter, and hard white winter). The locations are the University of Illinois Dixon Springs Agricultural Center and the Southern Illinois University Belleville Research Center. Nitrogen management consists of rates, spring-split applications, and sources.

In study 1, two varieties of each of the four wheat classes were planted in early October. Ammonium nitrate (NH_4NO_3), urea ammonium nitrate (UAN), and $(NH_4)_2SO_4$ will be applied across these varieties either as a single spring application or spring-split applied. In study 2, three varieties (two soft red and one hard red) were planted in early October. Split N applications combined with N rates will be spring-applied across these three varieties.

Indiana

Physiological Role of Potassium and Phosphorus in Alfalfa

Project Leader: Dr. Jeff Volenec, Purdue University, Department of Agronomy, West Lafayette, IN 47907 (765-494-8071), jvolenec@dept.agry.purdue.edu

A Purdue University study focusing on the interaction of P and K on alfalfa yield and persistence is providing new insights into the mechanisms by which alfalfa responds to P and K application. The goal is to determine how P and K deficiency reduces alfalfa forage yield and plant persistence. Roots are being analyzed for physiological and biochemical attributes (including starch, sugars and proteins) critical for rapid shoot re-growth after harvest, defoliation tolerance, and winterhardiness.

Alfalfa yield did not respond to K application at harvest one of either year, but yield did increase with K application at later harvests and was increased significantly for total seasonal yield. Potassium released from clay minerals prevented a K response at harvest one. There was a response of forage yield to P application for most cuttings. For K and P, total yield differences were more pronounced in 1999 than in 1998 because soil P and K levels of the unfertilized control plots declined.

Forage yield improvement that accompanies P and K fertilizer application to alfalfa occurred because plants produced larger shoots. The other yield components (plants/area, shoots/area) were unaffected by P and K nutrition. Changes in these yield components are likely in coming years of the study. Forage quality was reduced slightly with high P and K at some harvests, but high forage yield more than made up for the slight reduction in forage quality.

Bioavailable Potassium in Corn/Soybean Production Systems

Project Leader: Dr. Sylvie Brouder, Purdue University, Department of Agronomy, West Lafayette, IN 47907 (765-496-1489), sbrouder@dept.agry.purdue.edu

For the past three years, six rates of K at five locations in Indiana have formed the basis of a major study on K management. The work involves a corn-soybean rotation system with different tillage systems and comparisons of different timing of fertilizer application. In addition, it is the basis of comparisons of several current and experimental soil analysis procedures in an attempt to find methodology that is best suited to the different types of soils. A new K electrode being evaluated in the laboratory is correlating very well with extractable K measurements across several of the soils and will be tested further in the coming year, with possibilities of application for in-field K test determinations. Soil test levels ranging from 35 to 250 parts per million (ppm) have been established in these plots over the course of the study and will provide an excellent basis for calibration and rate studies in the future. This program is becoming one of the most significant K studies in the Midwest and is expected to be the source of valuable management information in years to come.

Evaluation of Site-Specific Precision Management for Indiana Soybean Production Systems

Project Leader: Dr. Sylvie Brouder, Purdue University, Department of Agronomy, West Lafayette, IN 47907 (765-496-1489), sbrouder@dept.agry.purdue.edu

This project works toward providing scientifically sound information to Indiana soybean producers on the use of currently available and prototype precision agriculture technologies for plant nutrient management. Three specific objectives are: (1) evaluation of the experimental design, statistical procedures, and data management systems that were developed during the initial project years for their effectiveness in comparing site-specific with whole-field management for a variety of inputs to Indiana soybean production systems, (2) demonstration to Indiana soybean producers, agribusiness personnel, and crop consultants the relative merits of site-specific versus whole-farm management using established fertilizer recommendations and best management protocols for inputs, (3) creation and distribution of educational information on precision technology selection and decision support to Indiana soybean producers.

Michigan

Comparative Analysis of Site-Specific and Conventional Fertility Management for Corn and Soybeans Grown in Michigan

Project Leader: Dr. Darryl Warncke, Dr. Roger Brook, Mr. Richard Hodupp, and Dr. Scott Swinton, Michigan State University, Crop & Soil Science Department, East Lansing, MI 48824 (517-355-0210).

This project evaluates the value and utility of precision agriculture soil fertility management practices, systems, and concepts in the production of soybeans and corn under Michigan growing conditions. Specifically, variable rate applications of P, K and lime are compared with whole field application. Comparative analysis of site-specific management (SSM) and conventional whole-field fertility management (WFM) is done under similar growing conditions.

Ohio

Potassium and Phosphorus on Soybeans and Corn

Project Leader: Dr. Jay Johnson, Ohio State University, 2021 Coffey Road, Columbus, OH 43210, johnson.57@osu.edu

This project provides partial support for three different studies. The first compared the effects of starter fertilizers on corn at various K soil test levels. As soil test level increased from 156 to 222 lb K/A for a silt loam soil (Crosby), yields increased from 78 to 154 bu/A. With 300 lb of 6-18-6, yields ranged from 112 to 161 bu/A for the same soil test levels. When a micronutrient package of boron (B) and zinc (Zn) along with sulfur (S) was added to the 6-18-6, yields ranged from 125 to 175 bu/A over these soil test levels. Average yields were 132, 146, and 155 bu/A for no starter, 6-18-6, and 6-18-6 + micronutrients, respectively. With 360 lb of 0-0-10, yields ranged from 123 to 177 bu/A for these soil tests. Adding 360 lb/A of 5-15-10 without micronutrients produced average yields equal to the 0-0-10 starter program. This would suggest that K was the major limiting factor in 1999. Adding micronutrients when K was limiting may help overcome some yield losses.

Evaluation of Site-Specific Precision Farming Systems for Soybeans

Project Leader: Dr. Nathan Watermeier, OSU Extension, 26 Agricultural Administration Bldg., Columbus, OH 43210-1010 (614-688-3442), watermeier.2@osu.edu

This study was re-instated in 1999 under new leadership. Analysis of data collected in previous years was used to develop plans for 1999. Besides collecting and interpreting data bases on two major soil associations in Ohio, this study has provided a basis for field demonstrations and training for farmers and agribusinesses in Ohio. One site is on the Ohio Farm Science Review land and is used extensively for field demonstrations and field days. The project will be back in full operation for the 2000 growing season.

High Yield Soybean Systems

Project Leader: Dr. Richard Cooper, USDA/ARS, Department of Horticulture and Crop Science, OARDC, Wooster, OH 44691 (330-263-3875), cooper.16@osu.edu

This project is an ongoing study of high yield soybean management systems built around a USDA/ARS soybean breeding program. Soybeans in 1999 broke the 100 bu/A yield barrier. Comparing previous years with over 90 bu/A yields, it appears that early planting and warmer-than-normal May weather were common factors. This leads to earlier onset of pod filling and results in more energy going to the grain, thus a higher harvest index. The basic premise of this work is getting a high yield system in place and working out a systematic approach to take advantage of it. Plots are irrigated, and substantial N fertilizer is used to maximize yield potential. ■

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