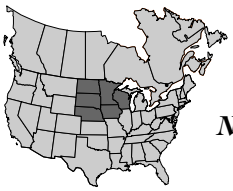
NEWS & VIEWS

A regional newsletter published by the Potash & Phosphate Institute (PPI) and the Potash & Phosphate Institute of Canada (PPIC)



Dr. T. Scott Murrell
Northcentral Director

May 2000

Research Programs in the Northcentral Region

RESEARCH is the foundation upon which best management practices are built. The Potash & Phosphate Institute (PPI) and the Foundation for Agronomic Research (FAR) provide partial or full support for research projects conducted by universities and government organizations that investigate all aspects of plant nutrition. PPI member companies and FAR contributors are concerned with discovering and implementing management practices which optimize the efficiency of inputs, maximize profitability, and protect the environment. This issue of *News & Views* is a summary of the research currently supported by PPI and FAR. For more information on these projects, please contact us or the project leader.

Iowa

Iowa Soybean Association Producer Profitability Program

Project Leader: Mr. Dave Larson, Iowa Soybean Association, Larson Enterprises, P.O. Box 25, Waukee, IA 50263 (515-987-1359).

The goal of this project is to determine which production variables are responsible for separating top soybean producers from other farmers. To accomplish this objective, this project surveys soybean producers in Iowa. The surveys consist of detailed questions concerning management practices, marketing, crop production, and input costs. The information obtained from the surveys is used to divide the group of respondents into a high profit group and a low profit group. Participants in the survey receive individualized reports comparing their production performance with those of the high and low profit groups, as well as the project average.

Averaged over the four years of this study, higher yields accounted for 67 percent of the profit difference between the high and low profit groups. Cost reductions and better marketing accounted for 21 percent and 12 percent, respectively. This study demonstrates that higher profits are attained by farmers who concentrate their efforts on more manageable aspects of their farming operations, such as cost reductions and higher yields. With shifts in Iowa Soybean Association personnel, data analysis from 1999 has been delayed.

Evaluation of Site-Specific Precision Farming Systems for Soybeans

Project Leader: Dr. Antonio Mallarino, Iowa State University, Department of Agronomy, Ames, IA 50011 (515-294-6200), x1mallar@exnet.iastate.edu

The objectives of this project are to determine the potential value of precision agriculture technologies in corn/soybean production, with emphasis on the evaluation of variable-rate P fertilization. Treatments are a check without phosphorus (P) application, a fixed P rate, and a variable P rate. Soil analysis showed very large variation in the levels of P and other nutrients within each field. The field average initial soil P was in the low class in one soybean field and borderline between the optimum (medium) and high classes in the other. However, values for about 130 samples collected by grid sampling from each experimental area ranged from very low to very high. The yield data showed large yield response in low-testing areas, little response in areas testing optimum, and no response in high-testing areas. The average responses were 5 bu/A of soybeans in the field that tested low and one bushel in the field that tested between optimum and high.

There was no yield advantage to the variable-rate application in any field. In all fields, less P fertilizer was applied with variable-rate. Furthermore, soil analyses of samples collected after harvest from two fields show that the soil P variation after fertilization was much less along the variable-rate strips than along the fixed-rate strips.

Agronomic market development information provided by:
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Between and within Field Variability of the Relationship between Soil Test Potassium and Crop Yield

Project Leader: Dr. Antonio Mallarino, Iowa State University, Department of Agronomy, Ames, IA 50011 (515-294-6200), x1mallar@exnet.iastate.edu

The objectives of this research are to: (1) study the within-field variability in soil-test potassium (K) and corn response to K fertilization, (2) evaluate a modified K soil test that has the potential to improve the predictability of crop response to K fertilization, and (3) study the relationships among yield response, K removal in grain, and long-term changes in yields and soil-test K.

Preliminary yield data are exciting and clearly show the need for this research. Large yield responses were observed at two conventional plot trials and at two strip trials. In these trials, soil test K (both ammonium acetate and Mehlich-3) varied from low to very high. As expected, large yield responses (up to 20 bu/A) were observed in soils testing low. However, variation in responses observed in soils testing optimum (medium) or high was extremely large. For example, in one strip trial there was no or little response even though soils tested from the upper optimum to the very high classes. In two other trials, however, there were large responses even though soils tested high by the ammonium acetate method. Future analysis of yield response, plant nutrient concentrations, and analytical results from all three soil test procedures is expected to provide insight into these observations.

Minnesota

Maximizing the Profitability of Site-Specific Nutrient Management in a Corn-Soybean Rotation

Project Leader: Dr. Gary Malzer, University of Minnesota, 439 Borlaug Hall, St. Paul, MN 55108 (612-625-6728), gmalzer@soils.umn.edu

A field experiment was established in the fall of 1996 in southwestern Minnesota to evaluate approaches of increasing the profitability of site-specific nitrogen (N) and P fertilization. The 30 acre test area had soil test P levels ranging from very low to high, organic matter contents of 2 to 9 percent, and pH values ranging from 6 to 8. Thirteen combinations of N and P were applied as constant rate fertilizer treatments across the field.

Site-specific crop response from corn in 1997 to applied treatments indicated that the optimum rate of N fertilization ranged from 0 to 180 lb N/A, optimum P rates 0 to 100 lb P_2O_5/A. Potential return to the producer for using the best site-specific nutrient management compared to uniform management was approximately $10/A each for N and P. This return, which was based on crop response, could not be obtained with existing approaches to fertilizer recommendations in a site-specific manner. Substantial responses (and variable) to residual P fertilizer applications were measured in the following soybean crop grown in 1998. Increased returns of up to $20 above conventional approaches could have been attained, but current approaches for making the correct management decisions were inadequate. Soil test results tended to underestimate P needs when compaction and poor drainage were present. The results from the 1999 corn crop are currently being analyzed. Preliminary results and their implications have been published as *Site-Specific Management Guideline #23*, "Getting Specific with Site-Specific Management."

A Multidisciplinary Evaluation of Precision Farming (*Evaluation of Site-Specific Precision Farming Systems for Soybeans)*

Project Leader: Dr. George Rehm, University of Minnesota, 439 Borlaug Hall, St. Paul, MN 55108 (612-625-6210), grehm@mes.umn.edu

Research is concerned with evaluating three different management strategies: (1) field-scale (uniform) management which does not utilize site-specific information, (2) non-integrated management concerned primarily with fertilizer management based on grid soil sampling, and (3) integrated site-specific management that utilizes a multidisciplinary approach to managing all information, both spatial and temporal. The field-scale and non-integrated management systems were started for the corn crop. Additional information necessary to evaluate the management strategy for the integrated system was collected during the 1999 growing season. Average corn yields across the landscape were 152 and 159 bu/A for the field-scale and non-integrated management systems, respectively. Soybean average yield was 41 bu/A. Yields of both crops varied with position on the landscape and will be related to soil properties.

Evaluating Banded Applications of Sulfur for Corn Grown in Conservation Tillage Production Systems

Project Leader: Dr. George Rehm, University of Minnesota, 439 Borlaug Hall, St. Paul, MN 55108 (612-625-6210), grehm@mes.umn.edu

This study was initiated in 1999 to evaluate the impact of placement of two sulfur (S) fertilizers, ammonium sulfate (21-0-0-24) and ammonium thiosulfate (12-0-0-26) applied at rates to supply 6, 12, and 18 lb S/A on corn grown in a ridge-till production system. Fertilizers were

applied at planting either in contact with the seed or in a band to the side and below the seed. The study was conducted at sites with either a loamy sand or a silty clay loam texture.

Use of S produced small but consistent increases in yield when the corn was grown on the loamy sand. Sulfur fertilization had no effect on yield of corn grown on a silty clay loam. When averaged over placement, both sources had an equal effect on yield when corn was grown on the loamy sand. The application of 12-0-0-26 in contact with the seed to supply 12 and 18 lb S/A caused a slight reduction in stand, but this reduction caused no decreases in yield. The weight of young corn plants and subsequent uptake of S were affected by rate, placement, and source of S. However, these differences, measured early in the season, were not consistently reflected in yield.

North Dakota

Chloride by Variety Interactions in Spring Wheat

Project Leader: Dr. Pat Carr, North Dakota State University, Dickinson Research Extension Center, 1089 State Ave., Dickinson, ND 58601 (701-483-2348), pat_carr@dsu1.dsu.NoDak.edu

Chloride (Cl) is known to suppress several wheat diseases or increase the ability of wheat to withstand infection. Wheat response to Cl fertilizer has been variable, because response depends on many factors, including soil Cl levels, pH, plant tissue levels, and variety. The goal of this study was to evaluate the response of different hard red spring wheat varieties as well as durum to Cl at Dickinson. Chloride was applied at 0 and 40 lb/A as KCl. Application of Cl significantly decreased days to heading and plant height. Unfortunately, a severe hail storm damaged the study in 1999 after plants headed but before physiological maturity was reached. As a result, no significant differences in yield were detected from the application of Cl. The study is being repeated in 2000 using funds carried over from the damaged study in 1999.

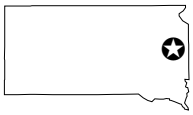
South Dakota

Chloride's Role in Maximizing Wheat Variety Performance

Project Leader: Dr. Ron Gelderman, South Dakota State University, Plant Science Department, Box 2207A, Brookings, SD 57007 (605-688-4602), geldermr@mg.sdstate.edu

A number of studies in South Dakota on spring wheat and barley have shown yield responses to added Cl. Work in Montana and Kansas has shown winter wheat responses to Cl as well. Previous work in South Dakota has shown winter wheat to be less responsive to Cl when compared to spring wheat or barley. The objectives of these studies were to determine winter wheat response and update recent spring wheat varietal response to added Cl in South Dakota. Fifteen varieties of winter wheat and spring wheat were planted near Brookings and Thomas, respectively. The selected varieties are common to South Dakota or have been found to be Cl responsive in other states.

Winter wheat grain yields were low due to poor growing conditions. Chloride did not significantly increase grain yields or test weights. Spring wheat growing conditions were excellent at Thomas; however, severe hail occurred when plant growth stage ranged from soft to hard dough, resulting in an estimated 40 percent yield loss. Eleven of the 15 spring wheat varieties had small positive grain yield and test weight increases from added Cl. Averaged across all varieties, Cl reduced the diseased area of the flag leaf from 25 percent to 13 percent for leaf spot (mostly tan spot) and reduced leaf rust from 33 percent to 12 percent. Chloride did not affect root rot or scab. In a Cl rate study on Oxen spring wheat, incremental Cl rates (up to 80 lb Cl/A) increased yields (2.2 bu/A) and test weights (1.5 lb/bu) and reduced the percentage of the flag leaf infected with leaf spot (39.2 percent to 3.8 percent) and leaf rust (42.5 percent to 3.0 percent). Completed or present research in South Dakota has shown only small positive grain yield responses from added Cl on winter wheat. This is in contrast to the average response of 4 to 6 bu/A from added Cl on spring wheat or barley.



Evaluation of Site-Specific Precision Farming Systems for Soybeans

Project Leader: Dr. David Clay, South Dakota State University, Plant Science Department, Box 2207A, Brookings, SD 57007 (605-688-5081), clay@ur.sdstate.edu

This project is a continuation of a project started in the Midwest in 1995-1996 to evaluate the agronomic, economic, and environmental implications of implementing site-specific precision farming technology in soybean management systems. During 1997-98, characterization was conducted at two different field locations. Research included soil characterization by the Natural Resources Conservation Service (NRCS), development of topography maps, collection of yield monitor information, and electrical conductivity maps generated from an EM-38 meter. Soil samples were collected on a 1 acre grid. Two basic treatments were imposed on this field: site-specific nutrient management and nutrient management based on field average soil test levels.

In all fields, there were areas with very high or very low

soil test P levels. Areas testing very high were generally small in size and reflected previous management practices, such as historic feedlots on homesteads. The frequency distributions of P soil test levels predict under-fertilization of large areas within a field if managed according to traditional whole-field approaches.

Site-Specific Management Guidelines

Project Leader: Dr. David Clay, South Dakota State University, Plant Science Department, Box 2207A, Brookings, SD 57007 (605-688-5081), clay@ur.sdstate.edu

The goal of the *Site-Specific Management Guidelines* series is to provide a mechanism to assemble expert knowledge on site-specific management into a form useful to farmers and their advisors. Without such a compilation, needless duplication will occur. Each guideline addresses a specific issue related to site-specific management. New guidelines will be added as they are completed. During the first year of the project, 29 guidelines were developed. Authors presented their guidelines at the 1999 InfoAg Conference, and guidelines were distributed to attendees. They are available from PPI. (More new guidelines are currently under development.)

Wisconsin

Evaluation of Precision Farming Systems for Soybeans: A Wisconsin Initiative

Project Leader: Dr. Richard Wolkowski, University of Wisconsin, Department of Soil Science, 1525 Observatory Dr., Madison, WI 53706 (608-262-3913), rpwolkowski@facstaff.wisc.edu

This project is a continuation of a project started in the Midwest in 1995-1996 to evaluate the agronomic, economic, and environmental implications of implementing site-specific precision farming technology in soybean management systems. It compares site-specific lime applications to lime applications based on whole field average pH values on replicated field-length strip trials. Fields had been grid soil sampled, and lime rates were applied based on current University of Wisconsin Cooperative Extension Service recommendations. Two fields were in soybeans and two were in corn. Soil pH change in response to liming was minimal because of the short time interval since the lime was applied. Consistent yield increases of about 20 percent were observed in one soybean field, while a second soybean field appeared less responsive. No yield response to liming was observed in either field planted to corn.

Nitrogen Application Effects on Residue Decomposition

Project Leader: Dr. Larry Bundy, University of Wisconsin, Department of Soil Science, 1525 Observatory Drive, Madison, WI 53706 (608-263-2889), lgbundy@facstaff.wisc.edu

The objectives of this project are to: (1) determine the influence of pre-season (fall) N fertilization at low rates (30 and 100 lb N/acre) on corn residue decomposition and (2) monitor the effects of pre-season N treatments and residue chopping on residue quantity, C and N composition, and soil temperature. Results indicate that time of surface applied N (fall or spring), N source (urea-ammonium nitrate or ammonium sulfate) and corn residue management (corn stalks chopped or not chopped) did not affect soil N mineralization rates, corn decomposition rates, soil temperature, corn yield, or total plant uptake in no-till corn.

Effect of Stand Age on Alfalfa Response to Nitrogen and Sulfur and Confirmation of Alfalfa Sulfur Needs in Wisconsin

Project Leaders: Dr. Keith Kelling and P. Speth, University of Wisconsin, Department of Soil Science, 1525 Observatory Dr., Madison, WI 53706 (608-263-2795), kkelling@facstaff.wisc.edu

Research conducted in Wisconsin has shown that alfalfa yields can be increased by S fertilization under specific environmental conditions. This research was initiated to determine if S responses are now more widespread and if they are stand-age related. Research plots evaluating two S sources and controls were established following first cutting at Arlington on a new stand (seeded in 1998) and an older stand (seeded in 1996) that have not received S fertilizer or manure. Similar plots were established following third cutting at Lancaster. Some response was seen for S treatment when combined with N on the older stand and on one cutting of the younger stand. Complementary components of this work involve evaluating the status of Wisconsin alfalfa by doing an extensive survey of 300 to 400 alfalfa fields and testing both the soil and tissue for S. Several on-farm S response demonstrations will be initiated in 2000.

Summary

We at PPI and FAR are pleased to be a part of this research, and we look forward to continued associations with researchers in universities and government organizations. ■

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