

NEWS & VIEWS

A regional newsletter published by the
Potash & Phosphate Institute (PPI) and the
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Dr. T. Scott Murrell
Northcentral Director
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Research Programs in the Northcentral Region

RESEARCH is the foundation upon which best management practices are built. The Potash and 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. If you would like more information on these projects, please contact us or the project leader.

Iowa



Iowa Soybean Association Producer Profitability Program

Project Leader: *David R. Larson, P.O. Box 25, Waukegan, 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 the goal, Iowa soybean producers are being surveyed. The surveys consist of detailed questions concerning management practices, marketing, crop production, and input costs. The information obtained is used to divide 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. In

1997, data from 91 respondents were analyzed. The most important result was that yield accounted for 73 percent of the difference in profit between the high and low profit groups. The primary importance of higher yields for increasing profitability has been a consistent result throughout the three years of this survey.

Minnesota



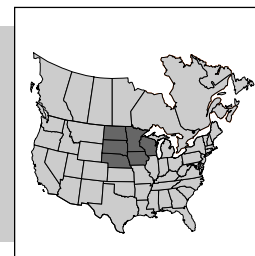
Maximizing the Profitability of Site-Specific Nutrient Management in a Corn-Soybean Rotation

Project Leader: *Dr. Gary Malzer, Department of Soil, Water, and Climate, University of Minnesota, 439 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612) 625-6728.*

A field experiment was established in southwest Minnesota to evaluate methods that could be used to increase the profitability of site-specific nitrogen (N) and phosphorus (P) fertilization. The field test site was extensively grid sampled in the fall of 1996 for routine soil analysis and for residual nitrate (NO_3). Corn was grown under five N rates and three P_2O_5 rates. Yield measurements were obtained every 50 ft. along each 1,200 foot treatment strip. Soil test P ranged from very low to high with a whole field average of low. If this field were under commercial production, University of Minnesota P recommendations would have varied from 10 to 85 lb $\text{P}_2\text{O}_5/\text{A}$ with a whole field average of 60. A uniform rate of N would have been recommended at 80 lb N/A. Based upon an analysis of the spatial data, the most profitable



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rate of fertilization averaged over the entire field would have been 105 lb N/A and 60 lb P₂O₅/A. Within the field, the economically optimum N rate varied from 0 to 180 lb N/A. The economically optimum P rate ranged from 0 to 100 lb P₂O₅/A. Uniform rates of 80 lb N/A and 60 lb P₂O₅/A were calculated to return \$69/A to the producer (assuming \$2.50/bu, \$0.16/lb N and \$0.26/lb P₂O₅). Approximately 60 percent of the fertilizer return was associated with N application while 40 percent was related to P application. Using standard recommendation procedures and reducing the grid cell size down from 30 acres to as low as 0.5 acres did not increase the net return to the producer. This may be related to the fact that most of the field tested in the low range for P, and a yield increase was obtained over most of the field to at least a modest rate of P. Approximately 20 percent of the field was substantially under-fertilized with respect to N when standard recommendations were utilized. Whole field total returns were increased about 10 percent when appropriate rates of N fertilizer were applied. High rates of N and P fertilization (180 lb N/A and 100 lb P₂O₅/A) across the entire field reduced the return associated with fertilizer application to \$27/A.

North Dakota



Addressing Soil Chloride Variability and Its Management

Project Leader: *Dr. David Franzen, North Dakota State University, Box 5758, Fargo, ND 58105. (701) 231-8884.*

Four sites in North Dakota were selected in order to study chloride (Cl) variability. This study has been conducted partially to investigate undocumented reports of Cl response in soils that test high in Cl, where no response was expected. The other purpose of this study was to determine the most appropriate soil sampling scheme for Cl. Grid sampling was employed at each site, with soil samples extending to a 2 foot depth for Cl determination. Currently, Cl levels are being analyzed from samples taken from a 110 foot grid at four locations. Preliminary results suggest that field Cl level patterns might be represented by either a 220 foot grid or by topography sampling. Higher Cl levels appear to be located in depressional areas, while lowest Cl levels appear most frequently in upland positions which are lower in organic matter and coarser in texture. There appears to be a higher degree of variability for Cl than NO₃ within a grid/management zone.



Chloride by Variety Interactions in Spring Wheat

Project Leader: *Dr. R.J. Goos, Department of Soil Science, 129 Walster, North Dakota State University, Fargo, ND 58105. (701) 231-8581.*

Chloride 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 upon many factors, including soil Cl levels, pH, plant tissue levels, and variety. The goal of this study was to evaluate historic, widely accepted, and future varieties for their responses to Cl at two sites in North Dakota. The studies, now in their second year, were located near Fargo and Dickinson. Each study included 13 hard red spring wheat and 2 durum wheat varieties. The Cl rates were 0 and 40 lb/A. At both sites, Cl treatments advanced the maturity of the crop, as evidenced by a 1-2 day advancement of heading date. Tissue samples were taken at the late boot stage and analyzed for Cl and potassium (K). Chloride levels in the 0 lb Cl/A plots were, in general, higher than predicted for the initial soil Cl levels. Yields, overall, were not influenced by Cl at the Fargo site. Yield responses ranged from +2.8 bu/A to -2.3 bu/A. During both years of the study at the Fargo site, the variety known to respond to Cl (Marshall) did give a positive response to Cl, while the variety known not to respond to Cl (Guard) either gave no response or a negative response. The Fargo site had a moderate level of head scab. Dramatic differences in disease ratings were observed by variety, but unfortunately, Cl fertilization had little or no effect on head scab. At Dickinson, yields of all varieties tended to be lower with KCl fertilization. There is currently no explanation for this. For both years of the study, kernel weights were almost always increased with Cl fertilization.



Sodium Chloride on Sugarbeet

Project Leader: *Dr. Allan Cattanch, North Dakota State University, 227 Walster Hall, Box 5758, Extension Soil/Sugarbeet, North Dakota State University, Fargo, ND 58105. (701) 231-8596.*

Research in the United Kingdom has shown that sodium (Na) and K can substitute for one another as plant nutrients; however, both Na and K are needed to some degree by the sugarbeet crop. It has been established that Na increases leaf area early in the growing season and improves the efficiency of leaves under conditions of moderate water stress. Under drier growing conditions, Na may be responsible for increased root yield and sugar content. The detrimental effect of increased soil Na levels is that Na root impurities increase. This study incorporated three rates of sodium chloride (NaCl) at three

locations in North Dakota: Fargo, Glyndon, and Crookston. A slow release form of NaCl was also included, along with both fall and spring applications. Root maggot infestations resulted in the abandonment of three replications at the Glyndon site. Results averaged across all three sites show a slight but non-significant increase in recoverable sugar per acre from spring applications of 100 and 400 lb NaCl/A. These results, however, were not consistent across all locations. Sodium chloride had no effect upon root yield, Na content, NO₃, grade loss to molasses, amino N content, or harvest population. Compared to results for 200 lb slow-release NaCl/A applied in the fall, sucrose percentage was significantly reduced at the Glyndon site when 400 lb NaCl/A was applied in either the fall or spring.

South Dakota



A Survey of Potassium Deficiency in Corn

Project Leader: *Dr. Howard Woodard, Department of Plant Science, South Dakota State University, Box 2207A, Agriculture Hall 004, Brookings, SD 57007. (605) 688-4774.*

Potassium deficiencies in western Minnesota and eastern South Dakota have historically been non-existent. Within the past several years, however, reports of K deficiencies have been surfacing. Potassium deficiencies were thought to be most prevalent with ridge-till and no-till systems, but there is evidence that this phenomenon exists under conventional tillage as well. Most K deficiencies associated with conservation tillage systems have been observed for corn grown on soils with high soil test K levels. The severity of K deficiencies has been shown to vary with soil types and corn hybrids. This new study involves conducting a survey of eastern South Dakota to identify production systems that produce corn exhibiting K deficiency symptoms. The intentions are to gather the preliminary data necessary to identify the factors that cause K deficiencies in corn in this region.



Chloride's Role in Maximizing Wheat Variety Performance

Project Leader: *Dr. Ron Gelderman, The Plant Science Department, South Dakota State University, Box 2207A, 219 Ag Hall, Brookings, SD 57007. (605) 688-4770.*

The effects of Cl on wheat, including yield increases, disease suppression, and crop quality, were evaluated for winter wheat varieties at three locations. One site suffered winter kill from adverse winter weather conditions. At another site, added Cl (40 lb Cl/A) did not increase grain yield of 15 winter wheat varieties. However, at an

adjacent site, the highest Cl rate of 80 lb/A did increase grain yield of Arapahoe winter wheat over the treatment where no Cl was applied. Chloride treatment influenced early growth and flag leaf disease only slightly at this site. Loss of some of the applied Cl due to wind erosion may explain these contradictory results from adjacent sites.



Evaluation of Site-Specific Precision Farming Systems for Soybeans

Project Leader: *Dr. David Clay, The Plant Science Department, South Dakota State University, Box 2207A, 219 Ag Hall, Brookings, SD 57007. (605) 688-5081.*

This study is part of a regional 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, characterization was conducted at two different field locations. The sites were located in the southeast part of the state (Beresford) and the east central part of the state (Flandreau). During 1997, research included soil characterization by NRCS, the development of topography maps, collection of yield monitor information, and electrical conductivity maps generated from a EM-38 meter. Soil samples were collected on a 1 acre grid. The Beresford site has 50 acres in beans and 62 acres in corn. Nutrient analyses of soil samples from this site are currently being conducted. Yield maps from both sites have been delivered to the University of Illinois. At the Beresford site, Olsen P ranged from 5 to over 40 parts per million (ppm), K ranged from 180 to 400 ppm, and NO₃-N ranged from 4 to over 50 ppm in the surface soil and from 5 to 30 ppm in the subsurface soil.

Wisconsin



Effect of Potassium Sources on Alfalfa Yield and Quality at Various Soil Test Potassium Levels and Times of Application

Project Leader: *Dr. Keith A. Kelling, Department of Soil Science, University of Wisconsin – Madison, 1525 Observatory Drive, Madison, WI 53706. (608) 263-2795.*

Alfalfa requires more K than any other nutrient; therefore, proper K nutrition is essential for optimizing alfalfa yields. This four-year project studied various topdressed K fertilizer rates applied at different soil test K levels, K fertilizer sources, and application times. The K rate study showed that at lower soil test K levels, more K was required to maximize yields than at higher soil test K levels. Yields reached a plateau at about 120 ppm soil test

K. Above 150 ppm soil test K, little response to topdressed K was observed. Potassium chloride depressed yields slightly below those of potassium sulfate (K_2SO_4) the first year. In the second year, no difference between sources was observed. Responses to sulfate sources of K (0.2 to 0.4 ton/A increases) were observed in the last two years of the study, when alfalfa yields were lower than the first two years.

Summary

The research presented in this publication demonstrates the commitment that PPI member companies and FAR contributors have for basing management decisions upon solid research. 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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