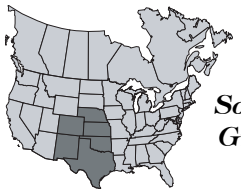
NEWS & VIEWS

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



Dr. Mike Stewart, Southern and Central Great Plains Director

July 2004

Research in the Southern and Central Great Plains Region

THE Potash & Phosphate Institute (PPI) and Foundation for Agronomic Research (FAR) program in the Great Plains Region continues to explore and increase understanding of optimal crop nutrient management practices. Eleven projects were supported in the region in the 2003 crop year. Following are brief descriptions and results from each of these.

You can also view the full annual reports of each project (current and past), when available, at the website: **>http://www.ppi-far.org/research<.**

Once at this website, click on "Continue", then click on "Expand", under North American Programs. Look for projects by state abbreviation and title.

Colorado

Potassium Needs of High-Yielding Alfalfa in Colorado

Project Leader: Dr. Jessica Davis, Colorado State University, Department of Soil and Crop Sciences, C06 Plant Sciences Building, Fort Collins, CO 80523-1170, Telephone: 970-491-1913, E-mail: jgdavis@lamar.colostate.edu

Project Cooperator: A. Wayne Cooley

Most of the soils in crop production in Colorado test high in potassium (K). A 2001 PPI soil test survey estimated that only 10% of soils in Colorado test medium or lower in K. Therefore, K fertilizer is seldom recommended by the state soil testing laboratory. Despite this, some producers and ag professionals have reported profitable response to K application to alfalfa. The objective of this project is to evaluate the impact of K fertilizer on alfalfa yields in on-farm trials in different locations across Colorado.

Application of K to three study sites in Colorado was continued in 2003. The sites were located in central Colorado (San Luis Valley), northeastern Colorado (Eaton), and another in the Arkansas River Basin (Rocky Ford). Irrigation problems arose at the Eaton site. Consequently, 2003 yield data at this site were not obtained. All sites tested high in K, hence no K fertilizer would have been recommended for these fields. Potassium fertilizer was applied to each site in the fall of 2002. Treatments included rates of 0, 40, 80, and 180 lb K_2O/A.

As in the 2002 season, no response to K fertilizer was observed at either location in 2003. Alfalfa showed significant response to K fertilizer on previous sites (1999 and 2000) in this study on the western slope of the Colorado Rocky Mountains. This was the final year of funding for the study. *CO-10F*

Kansas

Effect of Long-Term Nitrogen, Phosphorus, and Potassium Fertilization of Irrigated Corn and Grain Sorghum

Project Leader: Dr. Alan Schlegel, Kansas State University, Southwest Kansas Research and Extension Center, Rt 1, Box 148, Tribune, KS 67879, Telephone: 316-376-4761, E-mail: schlegel@ksu.edu

This long-term western Kansas study was initiated in 1961 to evaluate responses of irrigated continuous corn and grain sorghum to nitrogen (N), phosphorus (P), and K fertilization. No yield benefit to corn from K fertilization was observed in the first 30 years and soil K levels remained high, so the K treatment in the corn study was discontinued in 1992 and replaced with a higher P rate. Nitrogen treatments for corn and grain sorghum were 0, 40, 80, 120, 160, and 200 lb N/A. Phosphorus treatments for corn and grain sorghum were 0, 40, and 80 lb P_2O_5/A, and 0 and 40 lb P_2O_5/A, respectively. The K treatments for grain sorghum were 0 and 40 lb K_2O/A.

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This research continues to show that P and N fertilizer inputs are critical to the optimization of irrigated corn and grain sorghum production in western Kansas. Corn yields in 2003 were higher than the 10-year average. Nitrogen alone increased corn yield in 2003 by as much as 62 bu/A, while N and P applied together increased yield by up to 120 bu/A. Historically, 160 lb N/A has been the economic optimum N rate for corn. However, only 80 lb N/A was required to obtain greater than 90% of maximum yield in 2003. Since the 2002 crop was damaged by hail, residual N likely contributed significantly to the higher yields at lower N rates in 2003. Yields overall tended to be only slightly higher with 80 compared to 40 lb P_2O_5/A. Grain sorghum yields were also higher in 2003 than the 10-year average. Nitrogen fertilizer alone increased yield by as much as 51 bu/A, while N plus P increased yield by as much as 66 bu/A. Potassium fertilization has had no effect on sorghum yield over the course of the study. This is one of the few crop nutrition studies in the U.S. that has spanned several decades. The results of long-term experiments that evaluate the effects of fertilization and nutrient interactions are becoming increasingly valuable as nutrient use comes under greater scrutiny. Since this project continues to generate excellent long-term yield response and environmental data, support is continuing in 2004. *KS-23F*

Maximizing Irrigated Corn Yields in the Great Plains

Project Leader: Dr. Barney Gordon, Kansas State University, North Central Kansas Experiment Fields, Route 1 Box 43, Courtland, KS 66939, Telephone: 785-335-2836, Fax: 785-335-2239, E-mail: bgordon@oznet.ksu.edu

Genetic improvements in corn continue to contribute to rising yields. Newer hybrids suffer less yield reduction under conditions of drought stress and insect infestations, and also have the ability to increase yields in response to higher plant populations. The objective of this north central Kansas study was to determine if soil test recommendations are adequate for new, high-yielding corn hybrids, and to evaluate the interactions among fertility treatments and plant population in a reduced-tillage production system.

Treatments included two plant populations (28,000 and 42,000 plants/A) and nine fertility treatments. Fertility treatments consisted of three N rates (160, 230, and 300 lb N/A). The N rates were applied with: 1) university soil test recommendations for P, K, and sulfur (S)...30 lb P_2O_5/A, and no K or S; 2) 100 lb P_2O_5 + 80 lb K_2O + 40 lb S/A applied preplant, with N applied in two split applications (half preplant and half at V4); 3) 100 lb P_2O_5 + 80 lb K_2O/A + 40 lb S/A applied preplant with N split in four applications (preplant, V4, V8, tassel). The experiment was moved to a new location in 2003 where it was fully irrigated with a linear sprinkler type system. In years 2000-2002 the experiment was conducted on a Carr sandy loam soil and in 2003 it was conducted on a Crete silt loam. Soil test levels at the 2003 site were 25 parts per million (ppm) P (Bray P-1), 180 ppm K, and 15 ppm S.

Additional P, K, and S treatments increased corn grain yield by an average of 56 bu/A over the P alone treatment (30 lb P_2O_5). Applying N fertilizer in four applications was not superior to applying it in two applications. At the optimum N rate (230 lb) and the higher rates of P, K, and S, grain yield with the higher plant population was as much as 45 bu/A greater than with the lower population. Additional treatments were included in the experiment to help quantify which nutrients were providing the most yield increase. Addition of K, which was not included in the university recommendations, resulted in a 14 bu/A yield increase over the zero K treatment. Sulfur had no effect on yield in 2003, unlike earlier years where it contributed an average of 18 bu/A. This study has clearly demonstrated the importance of the role of complete and balanced nutrition in the production of optimal crop yields. Additionally, it has illustrated the interaction between nutrient inputs and plant population, and has shown the importance of using a systems approach to crop production and profit maximization. This was the fourth and final year of this study. *KS-33F*

Nebraska

Ecological Intensification of Irrigated Corn and Soybean Cropping Systems

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Project Cooperators: K.G. Cassman, T.J. Arkebauer, R.M. Caldwell, R.A. Drijber, J.L. Lindquist, J.P. Markwell, L.A. Nelson, W.L. Powers, W. K. Russell, J.E. Specht, M. Soundararajan, D.T. Walters

Research in Nebraska is showing that considerable potential exists for increasing yields and N use efficiency in Midwest corn production systems. Corn yields in 2003 were the highest ever recorded in this experiment, with a maximum yield of 285 bu/A in the main study and 314 bu/A in a satellite experiment. An important component is increased carbon and N storage in the soil that results from intensive management. Closing the gap between potential and actual yields will require higher plant populations and improved nutrient management. A significant outcome of this research was the development of a user-friendly crop simulation model, Hybrid Maize, that will help farmers and their advisers determine the attainable yield potential of their production systems. *NE-11F*

Sulfur in Starter Fertilizer for No-Till Corn Production in Eastern Nebraska

Project Leader: Dr. Charles Wortmann, University of Nebraska, Department of Agronomy and Horticulture, 154 Keim Hall, PO Box 830915, Lincoln, NE 68583-0915, Telephone: 402-472-2909, Fax: 402-472-7904, E-mail: cwortmann2@unl.edu

What factors are important for predicting corn and sorghum responses to starter fertilizer? Nutrients placed near the seed at planting can provide crop production advantages, but more research is needed to better predict how likely it is that such advantages will be seen under the many conditions encountered by producers. This project investigates corn and sorghum responses to starter fertilizers and the role that S may play as part of the nutrient mix. Sorghum responses were not observed in 2003, probably due to the warmer early season conditions during and after the dates when farmer cooperators planted their crops. However, responses were observed in corn, with S providing about a 4 to 5 bu/A yield advantage. More analytical work is being done to examine the role of other factors, such as landscape position and nutrient placement, on crop responses to starter fertilization. *NE-13F*

Oklahoma

Will Altered Levels of Nitrogen-Phosphorus-Potassium Affect the Potassium and Lycopene Content of Watermelon?

Project Leader: Dr. Penelope Perkins-Veazie, USDA-ARS, South Central Agricultural Research Laboratory, Lane, OK 74555, Telephone: 580-889-7395, E-mail: pperkins-usad@lane-ag.org

Project Cooperator: Warren Roberts

Consumer interest in food quality as it affects health has increased in recent years. Lycopene, the compound that imparts red color to watermelon, tomatoes, and some other fruits and vegetables, has been shown to reduce heart disease incidence and some cancers. The question of just how nutrient inputs impact lycopene in watermelons remains largely unanswered. The objectives of this study are to evaluate recommended, high, and low rates of P and K on the yield, quality, and composition of watermelons. Additionally, since N is important in the general performance of P and K, N rate was included as part of the treatments.

Seeded watermelon (Sangria) was planted in plots in the spring of 2003 near Lane, Oklahoma. Phosphorus and K were applied at 0, 0.5, 1, and 2X recommended rates and N was applied at 0.5, 1, and 2X recommended rates. Recommended rates (1X) are 100 lb N, 50 lb P_2O_5, and 100 lb K_2O/A. Melon length was increased as fertility increased from 0.5 to 1 or 2X rates for N, P, and K. Rind thickness was higher in melons given recommended and 2X rates of N and K. Lycopene content was increased in all treatments above 0 levels of P and K, but was not affected by fertility at any other combination of rates. Percent marketable melons was slightly increased when rates of N, P, or K were doubled. Unusually cool soil and air temperatures during June caused unexpected disease problems and adversely affected plant stands. Mineral analysis on leaves and fruits has not yet been completed. This study was planned for one year. *OK-07F*

Texas

Grain and Grazing Responses to Phosphorus Placement in Wheat Pasture in the Texas Rolling Plains

Project Leader: Dr. Don Robinson, Texas Agricultural Experiment Station, PO Box 1658, Vernon, TX 76385, Telephone: 940-552-9941, E-mail: dl-robinson@tamu.edu

Project Cooperators: Stan Bevers, Ron Gill, Dariusz Malinowski, Bill Pinchak, Todd Baughman, John Sij

Winter wheat is used for both grain and high quality forage in the southern Great Plains. There are over 6 million acres of wheat planted in Texas each year, and approximately 65% of the crop is harvested for grain. Nearly 70% of the Texas Rolling Plains wheat crop is grazed each year. The objective of this study is to determine the influence of P fertilizer and placement on forage, beef, and grain production from both dual-purpose and graze-out wheat systems.

The study was initiated in the fall of 1999 and is located approximately 8 miles south of Vernon. The experiment includes three replications of three fertility treatments applied annually: 1) surface-applied N and S; 2) surface-applied N, S, and P; and 3) deep-placed (6 to 8 in.) N, S, and P. Nitrogen, P_2O_5, and S were applied at rates of 62, 40, and 20 lb/A, respectively. All fertilizers were applied in late August to early September. Each treatment was replicated three times and each replication was 25 acres. At the beginning of the study, soil test P at the surface was 10 parts per million (ppm)...TAMU method. Where P was applied it increased to 23 ppm after 4 years. Pastures were stocked with 500 lb beef animals at a uniform forage-to-animal weight ratio in December to January of each season. Forage production, forage utilization, and animal gain were measured monthly to quantify forage relationships to animal gain. Estimates of forage standing crop, growth, and utilization were made from caged and uncaged plots in each pasture. Weather conditions the second year (2000-2001) delayed planting such that forage production was nil.

Phosphorus, regardless of application method, increased forage yields each year of the study, with the greatest increases occurring prior to the first of March. On an annual basis, P application increased forage production 35%, or nearly 1,400 lb/A. Furthermore, the response to P increased each year of the study. Deep placement showed no advantage over surface applications followed by incorporation. Phosphorus applications increased average animal gain per acre by 23 lb, or 32% during 3 years in the grazing phase. Grain yields were not significantly increased by P fertilization over the course of the study. Economic analyses showed that the dual-purpose is more profitable than the graze-out system, and that in the dual-purpose system P fertilizer increased net return by as much as $12/A. This study will be continued another year to evaluate the residual effect of P fertilizer. *TX-44F*

Effect of Potassium Fertilizers on Hybrid Bermudagrass Yields and Stand Decline

Project Leader: Dr. Vincent Haby, Texas A&M University, Texas Agricultural Experiment Station, PO Box E, Overton, TX 75684-0290, Telephone: 903-834-6191, Fax: 903-834-7140, E-mail: v-haby@tamu.edu

A field experiment was initiated in April 2001 to evaluate the effects of K, Cl, and S on hybrid bermudagrass yields and stand decline. The specific objectives of the study are: 1) to determine the effect of K, Cl, and S in K fertilizers on production, stand decline, and disease suppression in Tifton 85 bermudagrass; 2) evaluate the effect of K fertilizers on soil and forage nutrient content; and 3) investigate the effect of K and N fertilizer on bermudagrass production.

Fertilizer treatments include K sources (KCl, K_2SO_4, and KCl+S) at rates of 134, 268, and 402 lb K_2O/A/year. Sulfur was applied as elemental S to one set of KCl treatments in each replication. Split applications of one-third the yearly rate were applied April 10, May 27, and August 11, 2003. Nitrogen rates were 60 and 120 lb N/A, and were applied for each forage growth period (i.e., between harvests). Phosphorus fertilizer was applied at 180 lb P_2O_5/A in April 2001, and 120 lb P_2O_5/A in April 2002 and 2003.

There were four harvests in 2003. No statistically significant (p=0.05) differences were measured in dry matter (DM) yield due to N rate, K rate, or K source in the individual harvests, except for the first harvest where the higher N rate increased yield. Harvest total was not significantly affected by N rate. Yearly total DM yield in 2003 showed a significant difference due to K application, but there was no difference among rates. Where no K was applied, yield was 5.4 t of DM/A. Statistically higher yields of 6.5, 6.7, and 6.9 t of DM/A were harvested from the plots receiving 134, 268, and 402 lb K_2O/A, respectively. Potassium source was not an important factor affecting yield. Potassium has long been known to be an important nutrient in bermudagrass production in east Texas. More information is needed concerning interaction among K, S, Cl, and N fertilizers in bermudagrass forage production in this region. Support for this project is scheduled to continue in 2004. *TX-47F*

Accurate Fertilizer Phosphorus Rates for Ryegrass Calibrated for Different Soil Phosphorus Extractants

Project Leader: Dr. Twain Butler, Texas A&M Research & Extension Center, 1229 N Hwy 281, Stephenville, TX 76401, Telephone: 254-968-4144, E-mail: t-butler@tamu.edu

Project Cooperators: Jim Muir, Tony Provin

Annual ryegrass is an important high quality cool season forage crop with excellent yield potential. Earlier (1996 to 1999) research supported by PPI and FAR demonstrated that high yield ryegrass production in southwest Texas required substantial levels of N and P fertilizer. To further evaluate ryegrass fertility in central Texas, the current study was initiated in the fall of 2001 near Stephenville. The soil type and environment in the current study differ substantially from the earlier work. The objectives of this study are to: 1) evaluate annual ryegrass yield response to N and P fertilizer, and 2) evaluate the accuracy of soil test P methods for acid sandy soils.

Initial (fall 2001) soil pH at the study site was 5.1 and soil test P was low (6 ppm P, TAMU method). Fertilizer treatments included six rates of P (0, 20, 40, 60, 80, and 100 lb P_2O_5/A) and two rates of N (200 and 300 lb N/A). Ryegrass yield in 2002 showed no significant response to N fertilizer above 200 lb N/A. However, in 2003 there was a significant increase (716 lb dry matter) from 200 to 300 lb N. There was a significant yield response to P fertilizer in 2003…in the range of 3,300 lb dry matter (DM)/A at the 100 lb P_2O_5/A rate. Response to P over the no P control ranged from 1,544 to 3,316 lb DM/A. The greatest economic response to P in 2003 was at 60 lb P_2O_5/A, where yield increase due to P was almost 3,100 lb DM/A. The first two years of results from this study have demonstrated the importance of P fertilizer in optimizing ryegrass yield and profitability in the central Texas region. However, more data are needed to substantiate and support this information. Therefore, support for this study is scheduled to continue for at least one more year. *TX-48F*

Effect of Fall Fertilization of Bermudagrass with Potassium

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Fall application of K fertilizer is a practice that is commonly promoted in bermudagrass forage production. Logic suggests this practice may be of value in helping bermudagrass better tolerate winter cold stress and to provide improved early spring growth. However, there has been little investigation regarding the effect or benefits of fall K fertilization of hybrid bermudagrass. The objective of this study is to determine the effect of fall-applied K fertilizer on hybrid bermudagrass DM production.

The Coastal bermudagrass study site consisted of control (no K) and fall K fertilized (80 lb K_2O/A) plots. In early June 2003, a blanket application of 80 lb N/A, 16 lb P_2O_5/A, and 64 lb K_2O/A was made to the entire study area. The initial soil test of the site indicated a very low K level (66 ppm K). Due to drought conditions, only one harvest was obtained in 2003. Results from the 2002 production year suggested that fall-applied K fertilizer has the potential to substantially benefit hybrid bermudagrass production. However, in 2003 there was no significant difference in yield due to fall K application. Both treatments produced slightly over 2 t of DM/A. The lack of response in 2003 was likely due to residual soil K that resulted from low production levels, hence low K removal, throughout the study. This was the final year of the experiment. *TX-49F*

Nitrogen Management in No-Till and Conventional-Till Dual-purpose Wheat/Stocker Production Systems

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Project Cooperators: William Pinchak, Byeng Min and Jason Ott

The economy of the Texas Rolling Plains region is highly dependent on wheat/stocker operations. Practically all of the wheat in this area is planted under conventional tillage. However, a few producers have successfully implemented no-till management in grain-only systems. Reducing tillage holds promise in this region in mitigating soil and moisture losses, as well as improving revenue in wheat/stocker systems through increased soil organic matter, enhanced capture and retention of limited precipitation, and decreased risk of the necessity of reseeding. Fertilizer requirements in conservation tillage systems for wheat and stocker cattle production in the Rolling Plains are unknown. The objectives of this project are to: 1) develop guidelines for N fertilization for no-till and conventional-till wheat-grazing systems; 2) determine rainfall capture and retention, and measure soil compaction in each tillage system; 3) measure the effect of N fertilization on grain and forage quality; 4) measure the impact of N fertility-induced bloat on cattle production; 5) determine the economics of a no-till wheat/stocker system as it relates to forage production and grain yield and compare with a conventional-till system. This project was initiated in the fall of 2003, therefore no results are available yet. *TX-50F*

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