NEWS & VIEWS

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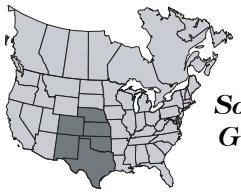

Dr. Mike Stewart, Southern and Central Great Plains Director

July 2005

Research in the Southern and Central Great Plains Region

THE Potash & Phosphate Institute (PPI) and Foundation for Agronomic Research (FAR) program in the Southern and Central Great Plains Region continues to explore and increase understanding of optimal crop nutrient management practices. Eight projects were supported in the region in the 2004 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.

Kansas

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

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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 potassium (K) fertilization. Furrow irrigation was used through 2000, and sprinkler irrigation since 2001. 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.

This project 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 2004 were considerably higher than the 10-year average. Nitrogen alone increased corn yield in 2004 by as much as 95 bu/A, while N and P applied together increased yield by up to 173 bu/A. Historically, 160 lb N/A has been the economic optimum N rate for corn. However, 120 lb N/A was required to obtain greater than 95% of maximum yield in 2004. Phosphorus fertilizer increased yield by as much as 131 bu/A at 120 lb N/A…from 103 bu/A with the zero P control to 234 bu/A with the rate of 80 lb P_2O_5/A. Corn yield overall tended to be only slightly higher with 80 compared to 40 lb P_2O_5/A. Grain sorghum yields were slightly less in 2004 than the 10-year average. Nitrogen fertilizer alone increased yield by as much as 43 bu/A, while N plus P increased yield by as much as 63 bu/A.

This is one of the few long-term crop nutrition studies in the U.S. The results of such experiments 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 will continue in 2005. *KS-23F*

Maximizing Irrigated Crop Yields in the Great Plains

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Recent research in north central Kansas has demonstrated the importance of complete and balanced nutrition in the production of high-yield corn. Fertilization of soybeans in a corn-soybean rotation has traditionally been secondary to corn fertilization. The soybean crop is commonly left to scavenge nutrients remaining after corn. The north central

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Kansas high-yield work was expanded in 2004 to determine the benefit of direct fertilizer application to sprinkler irrigated soybeans.

Treatments in this study are row spacing (30 and 7.5 in.), plant population (150,000 and 225,000 plants/A), and eight fertility treatments. Fertility treatments consist of a low P application, low P/low K, low P/high K, high P/high K, N-P-K, and an unfertilized check. Phosphorus application rates were 30 (low) or 80 (high) lb P_2O_5 /A, and K treatments were 80 (low) or 120 (high) lb K_2O/A. The N-P-K treatment consisted of application of 20 lb N, 80 lb P_2O_5 and 120 lb K_2O/A. Soil test values were: pH, 6.5; Bray-1 P, 23 parts per million (ppm, very high); and exchangeable K, 236 ppm (very high). The fertilizer recommendations from the state laboratory at these soil test levels would be 30 lb P_2O_5/A with no K. All fertilizer was broadcast in mid-March.

Increasing plant populations did not increase grain yields, nor did reducing row spacing from 30 to 7.5 in. In fact, increasing plant population in narrow rows reduced yield. However, fertilization had a significant impact on soybean yield. Applying 80 lb P_2O_5 with 60 lb K_2O/A (high P/low K) increased yield by 32 bu/A over the unfertilized check… from 53 to 85 bu/A. Applying additional K or adding N did not increase yields over the high P/low K treatment. Increasing plant population at lower fertility rates decreased yield. The first year of this study indicates a significant potential for soybean response to direct fertilization in high-yield environments. The study is continuing in 2005. *KS-33F*

Nebraska

Ecological Intensification of Irrigated Corn and Soybean Cropping Systems

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Given the lack of new agricultural lands to exploit and the ever-growing need for increased productivity on existing land, intensification strategies must be developed that are profitable and preserve the integrity of the environment. In 1999, an interdisciplinary research team at the University of Nebraska-Lincoln (UNL) established a field experiment to quantify and understand the yield potential of corn and soybeans under irrigated conditions, and identify efficient crop management practices to achieve potential yields.

The experiment has crop rotations (CC- continuous corn; CS- corn-soybean) as main plots, plant population (P1- recommended; P2 and P3- two levels of high plant density, resulting in final stands of about 35,000 to 45,000 plants/A) as sub-plots, and level of fertilizer (M1- current UNL recommendations; M2- high yield recommendations) as sub-subplots. In M1 management, nitrogen (N) fertilizer application rates have been made on the basis of yield goal, soil nitrate level, organic matter content, and credit for previous soybean crop. No P or K have been applied in M1 because of high soil test levels. The soybean crop in M1 receives no fertilizer. In M2 management, N rates are increased, N is split-applied at four stages, P and K are applied to both corn and soybeans, and soybeans receive N at later growth stages. The whole experiment is fully sprinkler irrigated.

Corn yields in 2004 were similar to 2003. The CS-P3-M2 treatment produced the highest yield in 2004 (287 bu/A). The CS system averaged about 19 bu/A more corn than the CC system. In both rotations, the yield impact from higher plant population was increased by increasing fertility input from M1 to M2, thus illustrating that to take advantage of higher plant population sufficient fertility must be in place.

An important and recent development from this project is the release of the *Hybrid-Maize* simulation model. *Hybrid-Maize* is a user friendly program that requires only basic computer skills and understanding of the factors that affect crop growth. Among the greatest values of this program is that it can be used to expose the gap between current and potential yield in a specific field situation. Once yield potential has been estimated, growers and ag professionals can identify, evaluate, and eliminate yield limiting factors, including P and K fertility, and move toward the production of profit maximizing yields. More information and the model itself are available online at >**http://www.hybridmaize.unl.edu/**<. *NE-11F*

Texas

Wheat Pasture Response to Maintenance Phosphorus and Nitrogen Fertilizer in Dual-Use, Wheat/Stocker Systems on the Texas Rolling Plains

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Project Cooperators: Ron Gill, Dariusz Malinowski, Bill Pinchak, John Sij

Winter wheat is used for both grain and forage in the Southern Great Plains. A recently completed 4-year study at the Texas Agricultural Experiment Station at Vernon showed that P fertilizer significantly increased wheat forage yield and stocker cattle gains. During the 4 years of this work, 160 lb P_2O_5/A was applied to pastures that received P fertilizer. This resulted in a two- to three-fold increase in

soil P levels. The current experiment utilized the treatments from the previous study to evaluate the impact of residual P on wheat forage and grain production. Specific objectives were to: 1) determine the influence of residual P on forage, beef, and grain yields in dual-use, wheat/stocker production systems, and 2) evaluate the effect of maintenance P application on forage, beef, and grain production.

Nine 25-acre pastures were used in this experiment. The three treatments included: 1) N only (65 lb N/A) applied to the previous study's zero P control pastures (low soil P level), 2) N only (65 lb/A) applied to pastures that received P during the previous study (high soil P level), and 3) N (65 lb N/A) plus maintenance P (20 lb P_2O_5/A) applied to pastures that received P during the previous study (high soil P level). All treatments were surface-applied and incorporated.

The fall and winter months were extremely dry, hence there was limited forage production until February. Residual P increased total, season-long forage production by about 2,400 lb/A. Although this response was not statistically significant, it is nevertheless noteworthy. Treatment effects on cattle gains in the grain/grazing system were not significant, probably because of the dry conditions during grazing. However, in the graze-out system residual P had a significant impact on beef production… increasing gain per acre by about 67%. The maintenance P application did not increase forage yield above the residual P treatments. There was no significant difference in grain yield among treatments. This study has helped demonstrate that the value of P fertilization extends well beyond the year of application. This is the final year of this work. *TX-44F*

Effect of Potassium Fertilizers on Hybrid Bermudagrass Yields and Stand Decline

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A field experiment was initiated in April 2001 to evaluate the effects of potassium (K), chloride (Cl), and sulfur (S) on rain-fed Tifton 85 hybrid bermudagrass yields and stand decline. The specific objectives of the experiment are: 1) to determine the effect of K, Cl, and S in K fertilizers on production, stand decline, and disease suppression, 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/yr. Sulfur was applied as elemental S to one set of KCl treatments in each replication. Split applications of one-third the yearly rate each were applied through the growing season. Nitrogen rates were 80 and 160 lb N/A, and were applied for each forage growth period (i.e. between harvests). Phosphorus (P) fertilizer was applied at the rate of 180 lb P_2O_5/A in April 2001 and 120 lb P_2O_5/A was applied each spring thereafter.

There were five harvests in 2004. Potassium fertilization had a significant impact on yield in each harvest. The total seasonal response to K ranged from about 2,900 lb dry matter (DM) at the 134 lb K_2O/A rate, to over 4,000 lb at the 402 lb K_2O rate. This amounted to yield increases over the no K control of 30 and 42%, respectively. For the first time since the initiation of this experiment, a difference in K source was observed. Potassium sulfate significantly increased yield over KCl treatment, indicating that S was deficient. This is consistent with field observations of S deficiency in the no S treatments. Additionally, the KCl+S treatment produced significantly more total DM than the KCl or K_2SO_4 treatments. This indicates that in the 2004 season, bermudagrass responded to both S and Cl. The higher rate of N (160 lb/A) produced approximately 1.1 ton more DM than did the 80 lb/A rate. A highly significant interaction occurred between N and K rates relative to DM yield, indicating that higher rates of K are needed to balance higher rates of N. Support for this project is scheduled to continue in 2005. *TX-47F*

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

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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/FAR demonstrated that high yield ryegrass production in southwest Texas required substantial levels of nitrogen (N) and phosphorus (P) fertilizer. To further evaluate ryegrass fertility in Texas, the current study was initiated in the fall of 2001 in the central Texas area, near Stephenville. The soil type and environment in the current study differ significantly 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 parts per million [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). There was a significant yield response to P fertilizer in 2004… as much as about 2,500 lb dry matter (DM)/A at the 80 lb P_2O_5/A rate. Response to P over the no

P control ranged from 951 lb DM/A to 2,508 lb DM/A. The greatest economic response to P in 2004 occurred at 80 lb P_2O_5/A. There was insignificant yield increase in 2004 from increasing N rate from 200 to 300 lb/A. The average yield increase from P fertilizer over the 3 years of this study has ranged from 1,039 lb DM/A (20 lb P_2O_5/A) to 2,403 lb DM/A (100 P_2O_5/A). The economic optimum P rate, on average, was 60 lb P_2O_5/A. This experiment has demonstrated the importance of P fertilizer in optimizing ryegrass yield and profitability in the central Texas region. This was the third and final year of the study. *TX-48F*

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, increasing soil organic matter, enhancing capture and retention of limited precipitation, and decreasing risk of the necessity of reseeding. The primary objective of this study is to determine optimal N rate for wheat forage yield, grain yield, and grain quality under conventional and no-till production systems. Other parameters measured included soil moisture, soil compaction, and soil N profiles.

Nitrogen treatments include 0, 30, 60, 90, and 120 lb N/A applied at planting. Half of each plot was top-dressed in January with an additional 45 lb N/A. All treatments were established on no-till and conventional-till areas.

The fall and winter months were extremely dry, hence there was limited forage production until spring. No significant differences in forage production among N treatments were observed during the grazing period ending at the end of February 2004. When cattle were removed on February 27, forage availability averaged only 75 lb dry matter (DM)/A across all treatments. Therefore, soil moisture and not N was the limiting factor in early forage production. In un-grazed plots at the end of February there were no significant differences among N rates, although all N rates (30 lb N/A and above) significantly increased forage yield above the zero N control. By the end of the season (April 22) wheat forage showed a significant response to 60 lb N/A, but not to higher rates. Nitrogen application increased grain yield in the dual-use system, with the highest rate (120 lb N/A) producing significantly more grain than lower rates. Topdressed N increased grain yield on average about 6 bu/A, except at the highest rate (120 lb N/A). Tillage systems affected soil compaction and soil moisture. There was significantly less compaction in the 0- to 6-in. soil surface layer under conventional tillage, but generally greater soil moisture in the spring under no-till. Overall, the conventional tillage treatment out-yielded no-till by about 10%. This study will continue in the 2005-06 season. *TX-50F*

Foliar-Applied Potassium to Fall and Spring Grown Muskmelon

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Low sugar accumulation in muskmelon fruits can cause marketing problems for growers. Potassium is known to be a regulator of sugar accumulation and to impact concentrations of photosynthesis-derived human wellness compounds (ascorbic acid, carotenoids, and folic acid) in fruits and vegetables. Thus, K nutrition has the potential to significantly impact muskmelon fruit quality and marketability. Potassium is taken up from soils mainly during the vegetative stage of plant growth. Therefore, during fruit development soil K alone may not be adequate to produce optimal fruit quality. A greenhouse study examining the effect of foliar-applied K on cantaloupe quality was initiated in the fall of 2004 at the USDA-ARS facility in Weslaco, Texas.

'Crusier' muskmelons were planted and established in pots in the greenhouse in August of 2004. Plants throughout the study were fertigated weekly with N, P, and K in a 20-20-20 (N-P_2O_5-K_2O) blend, except during flowering when a 10-30-20 blend was used. Beginning at flowering, plants were sprayed weekly with 24% K using either muriate of potash (KCl) or potassium metalosate with or without an adjuvant until fruit abscission (full-slip). Harvested fruit were measured for total sugars, ascorbic acid, beta carotene, K concentration, percent soluble solids, days to abscission, fresh weight, percent dry matter, and external and internal firmness. Fruit from plants receiving foliar-applied K from either source plus the adjuvant had significantly better overall quality than fruit that received no foliar K. Fruit from plants receiving KCl without the adjuvant had quality determinants equal to the control. Plants sprayed with potassium metalosate without the adjuvant resulted in the best quality fruit. *TX-51F* ■