NEWS & VIEWS

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Dr. W.M. Stewart, Great Plains Director
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Research Programs in the 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. Eight projects were supported in the region in the 2002 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 on the West Slope of Colorado

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Project Cooperator: A. Wayne Cooley

Most of the soils in crop production in Colorado test high in potassium (K). In fact, a 2001 PPI/PPIC/FAR 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. In spite of 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.

Three study sites were established in different regions of the state in the fall of 2001…a site in central Colorado (San Luis Valley), northeastern Colorado (Eaton), and another in the Arkansas River Basin (Rocky Ford). 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 2001. Treatments included rates of 0, 40, 80, and 180 lb K_2O/A. The Eaton trial was ultimately abandoned due to irrigation problems in the field.

No response to K fertilizer was observed at either location in 2002. Alfalfa showed significant response to K fertilizer on sites used earlier (1999 and 2000) in this study on the western slope of the Colorado Rocky Mountains. No response has been observed in central or eastern Colorado. This inconsistency is likely due to differences in soil chemistry and/or mineralogy. Further laboratory investigations will be conducted to help determine the cause of the observed inconsistencies. Support for this study will continue another year to gather more field and laboratory data, and to ultimately determine whether changes in fertilizer recommendations are needed for alfalfa in Colorado. *CO-10F*

Kansas

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

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This 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

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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/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 research continues to show that P and N fertilizer must be applied to optimize production of irrigated corn and grain sorghum in western Kansas. Although adverse weather conditions in 2002 (hail, high temperatures, and low rainfall) reduced average grain yield of corn, N and P fertilization increased corn yields about 40 to 50 bu/A. The long-term average increase due to N and P is more than 100 bu/A. For the third consecutive year, corn yields tended to be greater with 80 than with 40 lb P_2O_5/A. Phosphorus improved apparent corn N use efficiency by about 38% at the optimal N rate (160 lb N/A). Both N and P fertilizers increased kernel size and number of kernels/ear, which increased ear weight. Grain sorghum yields in 2002 were greater than the long-term average, with near maximum yields obtained with 80 lb N/A when applied with P. Phosphorus increased sorghum yields by at least 20 bu/A, while K fertilization had no effect on yield. This project continues to generate excellent long-term yield response and environmental data, thus support will continue in 2003. *KS-23F*

Maximizing Irrigated Corn Yields in the Great Plains

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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 study is 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/A). The N rates were applied with 1) current 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 /A + 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, V10, tassel). The experiment was fully irrigated.

Despite extremely low summer rainfall in 2002, corn yields were excellent since adequate irrigation water was available. Additional P, K, and S increased corn grain yield by an average of 75 bu/A over the university recommendations (30 lb P_2O_5/A). Applying N fertilizer in four applications was not superior to applying in two applications. There was no significant difference between plant populations when averaged over all fertility treatments. However, at the higher N rates and the higher rates of P, K, and S, the grain yield with the higher plant population was over 20 bu/A greater than with the lower population. Additional treatments were included in the experiment to determine which nutrients were providing the most yield increase. Addition of K and S, which were not included in the university recommendations, resulted in a 73 bu/A yield increase over the N and P treatment. This study continues to reveal the need for the reevaluation and update of conventional methods of fertility recommendation. Support for this study will continue in 2003. *KS-33F*

Texas

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

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Project Cooperators: Stan Bevers, Ron Gill, Travis Miller, Bill Pinchak, Todd Baughman, John Sij, David Worrall

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 placement on forage, beef, and grain production from dual-purpose wheat. Additional objectives are to evaluate grazing termination date effects on grain yield and animal performance, and identify economic costs and returns associated with P placement methods.

The test site is located approximately eight miles south of Vernon, Texas. The experiment included three fertility treatments: 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. The test location was initially deficient in N and P and a response to applied P was anticipated. All fertilizers were applied in late August to early September. Each treatment was replicated three times and each replication was 25 acres. In early December, forage biomass was measured and each pasture was stocked with 500 lb beef animals at a

uniform forage-to-animal weight ratio. 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. The study was initiated in the fall of 1999 and has been in place for three years. Two years out of three have generated meaningful forage results. Weather conditions the second year (2000-2001) delayed planting such that forage production was nil.

Phosphorus, regardless of application method, consistently increased forage yields, with a greater response the third year 2001-2002) than the first year (1999-2000). During the early grazing phase of December through February, P applications increased forage production by about 200 lb/A the first year, and by as much as 800 lb/A the third year. By the end of the grazing season in May, forage yields had increased by an average of 675 and 1,040 lb/A in the two years due to P applications. Phosphorus placement had no effect on forage yield. Beef gain per acre was increased both years with P fertilization, with placement having a minimal effect. Grain response to P fertilization has been inconsistent. In the first two years, grain yield was not influenced by P fertilization. However, in the third year grain yields were increased by as much as 8 bu/A by P fertilizer. Support for this project is scheduled to continue one more year. *TX-44F*

Potassium Requirements for Narrow Row Cotton in the Texas Blacklands

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Project Cooperators: Allen Knutson, Bill Langston, Jim Heitholt

The rather heavy textured soils that dominate the Texas Blacklands have traditionally been thought to contain adequate K for the production of most crops. However, some speculate that long-term cropping without the use of K fertilizer has resulted in a depletion of soil K in some areas of the Blacklands. In fact, in recent years there have been reports of symptoms resembling K deficiency in cotton in the northern Blacklands. The objectives of this study are to determine the effect of K fertilizer on cotton lint yield and quality in the northern Texas Blacklands. Trials were conducted at two locations on a Houston Black Clay soil at the Texas A&M University research farms at Dallas and Prosper. Potassium fertilizer was applied preplant and incorporated at the rates of 0, 24, 48, and 72 lb K_2O/A. Cotton row spacing was 40 in.

There was no significant yield difference due to K fertilizer in 2003. Potassium level of the 4th fully expanded leaf was significantly increased by K fertilizer at the Prosper site, but not at the Dallas site. Results from the three years of this project have been somewhat ambiguous. Cotton response to K fertilizer has been observed, but the responses have been inconsistent. This (2002) was the third and final year of the study. *TX-46F*

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 K, chloride (Cl), and S on Tifton 85 hybrid bermudagrass yield 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, 3) investigate the effect of K and N fertilizer on bermudagrass production.

Fertilizer treatments include K sources [potassium chloride (KCl), potassium sulfate (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 15, June 5, and July 29, 2002. 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 the rate of 120 lb P_2O_5/A on April 4, 2001 and April 17, 2002.

There were three harvests in 2002. No statistically significant differences were measured in dry matter (DM) yield due to N rate, K rate, or K source in the three individual harvests. The first harvest yields averaged from approximately 0.6 to 0.8 ton DM/A. The second and third harvests were larger, and ranged from about 2 to 3 tons DM/A. Yearly total DM yields from 2002 show no statistical differences due to N rate or K source, although yields ranged from 5.1 to 5.8 tons DM/A. Statistical differences ($p = 0.05$) were shown due to K rate in the yearly totals. Where no K was applied, yield was 4.6 tons DM/A. Statistically higher yields of 5.6, 5.6, and 5.5 tons DM/A were harvested from the plots receiving 134, 268, and 402 lb K_2O/A, respectively. Potassium is 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 2003. *TX-47F*

Accurate Fertilizer Phosphorus Rates for Ryegrass Calibration 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 N and 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.

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). Initial soil test P at the study site was low...6 parts per million P, TAMU method. Ryegrass yield showed no significant response to N fertilizer above 200 lb N/A. There was significant response to P fertilizer, with the maximum response occurring at the 100 lb P_2O_5/A rate. Response to P ranged from 620 lb dry matter (DM)/A to 1,746 lb DM/A. The greatest economic response to P occurred at 40 lb P_2O_5/A, where yield increase due to P was almost 1,400 lb DM/A. Although these first year results have demonstrated how important P fertilizer can be in optimizing ryegrass yield in the central Texas region, more data are needed to substantiate and support this year's information. Therefore, support for this study is scheduled to continue for at least two more years. *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. Anecdotal evidence and intuitive reasoning suggest this practice may be of value in helping bermudagrass better tolerate winter cold stress and 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 dry matter (DM) production.

A Coastal bermudagrass study site was established in east Texas in the fall of 2001 with control (no K) and fall K fertilized (160 lb K_2O/A) plots. In June 2002, a blanket application of nitrogen (N)-P_2O_5-K_2O (100-30-100 lb/A) was made to the entire study area. The initial soil test of the site indicated a very low K level (66 parts per million K). Soil test recommendation for K was 60 lb K_2O/A. Due to limited growth conditions only one harvest was obtained in 2002.

The average bermudagrass yield for fall K applied plots was 1.9 tons DM/A, and the mean for the no fall K plots was 1.4 tons/A. The difference was significant at the 0.001 level of probability. These initial results suggest that fall applied K has the potential to substantially benefit hybrid bermudagrass production in east Texas. However, more data are needed to substantiate these findings. This project is scheduled to continue another year. *TX-49F* ■

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