

NEWS & VIEWS

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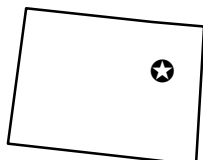


Dr. W.M. Stewart,
Great Plains Director
July 2000

Research Programs in the Great Plains Region

THE Potash & Phosphate Institute (PPI) and the Foundation for Agronomic Research (FAR) provide both financial and technical support for a broad spectrum of agricultural research and education programs. The following programs in the Great Plains Region received support from PPI/FAR during the 1999 cropping season.

Colorado



Evaluation of Soil Management Zones and Grid Sampling Maps for Variable Rate Fertilization of Corn

Project Leader: Dr. D.G. Westfall, Department of Soil and Crop Sciences, Colorado State University, Ft. Collins, CO 80523-1170 (970-491-6149).

Intense grid soil sampling can provide an accurate basis for variable rate (VRT) fertilizer application maps. However, in some areas the cost associated with intensive sampling may be prohibitive. Determining fertility management zones in a field may provide a more economical method of developing VRT application maps. Experiments were conducted in three center pivot irrigated corn fields in 1999 to compare intensive grid sampling to farmer defined management zones for development of fertilizer VRT application maps. Three N rate treatments (low, medium, and high production level) were applied across each management zone in each field.

There were significant zone effects, indicating that the management zones represented distinct sub-regions within the field. No significant differences in corn yield were observed among the VRT treatments, indicating that zone based management was as effective as grid based VRT. These results suggested that management zone VRT may be a profitable alternative to grid soil sampling.



Agronomic market development information provided by:
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Kansas



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

Project Leader: Dr. Alan Schlegel, Kansas State University Tribune Unit – Southwest Kansas Research – Extension Center, Rt. 1, Box 148, Tribune, KS 67879 (316-376-4761).

Long-term research conducted since 1962 has shown that phosphorus (P) and nitrogen (N) fertilizer must be applied for optimum grain yields and profitability of irrigated corn and grain sorghum in western Kansas. The objectives of this study were to determine the optimum rate of N, P, and potassium (K) fertilizer for irrigated corn and grain sorghum.

Various levels of N fertilizer ranging from 0 to 200 lb/A in 40 lb increments were applied to corn and grain sorghum with 40 lb P₂O₅/A and without P fertilizer. A K treatment was included in the grain sorghum experiment. Both studies were damaged by hail in July. The corn plots did not recover from the hail damage; therefore, no results were reported from this part of the experiment in 1999. Grain sorghum yields were variable in 1999, possibly because of the hail damage. Phosphorus increased yields by an average of 20 bu/A across all N rates. This is similar to yield responses in earlier years. Grain yields were not increased by N rates above 40 lb/A when applied with P, although typically 80 to 120 lb N/A are needed to maximize yields. There was no grain sorghum yield response to K applications.

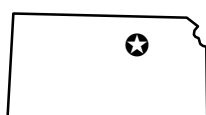


Chloride's Role in Maximizing Wheat Variety Performance

Project Leader: Dr. R.E. Lamond, Department of Agronomy, Kansas State University, 2014 Throckmorton Hall, Manhattan, KS 66506-5504 (785-532-5776).

Research in 1996, 1997 and 1998 indicated that some wheat cultivars respond consistently to chloride (Cl)

fertilization and others do not, even when soil Cl levels are low. Field research was continued in 1999 at two sites to evaluate Cl fertilization of 12 wheat cultivars. Chloride significantly increased yields of 10 of 12 cultivars at one site and 9 of 12 at the other site. Topdress applications were made in February at 24 lb Cl/A. Averaged over all cultivars, Cl increased wheat yields by over 5 bu/A. Chloride fertilization also increased leaf Cl concentrations and grain test weights. Results to date suggest that when soil test levels are 20 lb Cl/A or less (0 to 24 inches), most wheat cultivars will respond to Cl fertilization. This research also indicates that response to Cl is likely whenever wheat tissue Cl concentrations are less than 0.1 percent. This is the final year of a four-year multi-regional effort to determine the interaction between wheat cultivar and Cl fertility.



Corn and Grain Sorghum Responses to Chloride Fertilization

Project Leader: Dr. R.E. Lamond, Department of Agronomy, Kansas State University, 2014 Throckmorton Hall, Manhattan, KS 66506-5504 (785-532-5776).

Field research was continued in 1999 at six sites in Kansas to evaluate Cl rates (0, 20, 40 lb/A) and Cl sources...KCl, sodium chloride (NaCl), calcium chloride (CaCl₂)...on dryland corn and grain sorghum production. Significant yield increases with Cl fertilization were observed at every site, although not every Cl treatment resulted in significantly higher yields. Yield increases from Cl fertilization, averaged across rates and sources, were from 3 to 10 bu/A for corn and 8 to 11 bu/A for grain sorghum. These increases would provide excellent economic returns. Chloride sources produced similar yields, although CaCl₂ resulted in significantly lower yields at two sites and significantly lower leaf Cl levels at five sites. The results indicate that whenever soil Cl is below 20 lb/A (0 to 24 inches), consistent responses to Cl fertilizer are likely.



Effects of Chloride Rates and Sources on Winter Wheat

Project Leader: Dr. R.E. Lamond, Department of Agronomy, Kansas State University, 2014 Throckmorton Hall, Manhattan, KS 66506-5504 (785-532-5776).

Field research was continued in 1999 at three sites to evaluate Cl rates (0, 10, 20 lb/A) and Cl sources...KCl, magnesium chloride (MgCl₂), and NaCl...on winter wheat production.

Grain yields in 1999 were excellent. Chloride fertilization significantly increased yields at two of the three locations. One location was abandoned because of severe flooding. Chloride application of 10 lb/A increased average yields at one site by 6 bu/A and at the other by 13

bu/A. When averaged across sources, Cl increased yield by 9.5 bu/A. Chloride fertilization consistently and significantly increased wheat tissue Cl concentrations. Chloride sources performed similarly in most instances. However, KCl and NaCl produced higher leaf Cl levels than MgCl₂. Soil test Cl continues to be an excellent predictor of potential response. Soil Cl at both sites was less than 20 lb Cl/A (0 to 24 inches).



Effects of Potassium Fertilization on Growth and Water Relations of Creeping Bentgrass under Deficit Irrigation

Project Leader: Dr. Bingru Huang, Department of Horticulture, Forestry and Recreation Resources, Kansas State University, Manhattan, KS 66506 (785-532-1429).

The objective of this study is to understand the effects of different sources and rates of K fertilization on creeping bentgrass turf quality, root growth, and water relations. Bentgrass grown in a growth chamber in a sand-based medium was subjected to well watered and drought stress conditions. Within each water treatment, KCl and K₂SO₄ were supplied monthly for three months at the rates of 0.6, 1.2, and 1.8 lb K₂O/1,000 sq ft. At various times during the study, leaf water potential, osmotic potential, and turgor potential were measured. Turf quality was visually rated.

Results available at this time suggest that the 0.6 lb K₂O/1,000 sq ft rate was optimum. At this rate, and with both sources, creeping bentgrass maintained higher turf quality under drought conditions than grasses with no K or higher rates of K. The higher turf quality with K under drought stress conditions was related to improved leaf water relations, as indicated by higher relative water content and water potential.

Oklahoma



Use of Artificial Ultraviolet Light for Detecting Phosphorus Status of Winter Wheat

Project Leader: Dr. W.R. Raun, Associate Professor, Agronomy Department, Oklahoma State University, Stillwater, OK 74078 (405-744-6414).

The objective of this research was to determine the feasibility of measuring in-situ P levels in winter wheat using spectral data from ground based sensors. Spectral irradiance measurements were taken from wheat that was grown with different N and P rates on a soil low in P. Total P in wheat plant tissue and forage P uptake were correlated with various wavelengths but not always consistent across growth stages or years. However, there was some consistency for correlation between P tissue

concentration and spectral irradiance from wavelengths 705-725 (numerators) to 505-515 (denominators). Grain yield was correlated with spectral irradiance readings near 755 nm using ultraviolet (UV) light at night from Feekes growth stages 4 through 7. However, P sensing methods are in the early stages of development. Hence, further research is needed to address improvements in data collection and data processing.



Soil Chloride in Oklahoma Soils

Project Leader: Dr. Hailin Zhang, Agronomy Department, Oklahoma State University, Stillwater, OK 74078 (405-744-6414).

Research conducted across the Great Plains has shown that wheat and other crops may respond to Cl fertilization. The objective of this project is to characterize the status of soil Cl, sulfate-S ($\text{SO}_4\text{-S}$), and $\text{NO}_3\text{-N}$ in Oklahoma soils through a statewide soil test program.

Over 200 pairs of surface (0 to 6 inch) and subsurface (6 to 24 inch) soil samples were collected from 17 counties in 1999. Samples were analyzed for Cl, $\text{SO}_4\text{-S}$, $\text{NO}_3\text{-N}$, and pH. When considering the upper 24 inches, soils evaluated in this study were generally low in $\text{NO}_3\text{-N}$ and high in $\text{SO}_4\text{-S}$. Analyses of the samples further revealed that wheat may respond to Cl fertilization in about 32 percent of the fields sampled. It is important to note that these data may not accurately represent the entire state since a limited number of samples was received, but it is a significant step in further evaluating the need for Cl fertilizer in Oklahoma.

Texas



Chloride's Role in Maximizing Wheat Variety Performance

Project Leader: Dr. T.D. Miller, Department of Soil and Crop Sciences, Texas A&M University, College Station, TX 77843-2474 (409-845-0884).

This study evaluated Cl response in 11 wheat cultivars at one location and nine at a second location in the central Texas Blacklands. Treatments evaluated included a Cl topdress application, a Cl topdress followed by an application of foliar fungicide at Feekes 8, an application of foliar fungicide at Feekes 8 with no Cl, and an untreated check. Both trials were heavily infested with wheat leaf rust due to wet, warm weather during the vegetative growth period.

At one site, the application of both Cl fertilizer and foliar fungicide had a profound effect on wheat yield and

damage from wheat leaf rust. The cultivars in the untreated check ranged from 10 to 75 percent injury at bloom, with a test average of 44 percent, while the range for the same cultivars treated with Cl was from 7 to 40 percent, with a treatment average of 14 percent. Overall, the data from this site indicate that early topdress application of Cl profoundly reduced leaf rust infection in susceptible cultivars. Response to Cl fertilization at the other site was less dramatic. There was no increase when averaged across cultivars. This is the final year of a four-year multi-regional effort to determine the interaction between wheat cultivar and Cl fertility.



Effect of Nitrogen and Phosphorus Fertilization on Forage Yield and Quality of Annual Ryegrass in Southwest Texas

Project Leader: Dr. Hagen Lippke, Texas A&M University Agricultural Research & Extension Center, 1619 Garner Field Road, Uvalde, TX 78801-6205 (830-278-9151).

This study has generated three years of excellent ryegrass yield response data to N and P fertilization in southwest Texas. The last phase of this work involved analyzing N and P soil test data from samples taken in the final year of the study to determine relationships to ryegrass yield. Data were available from four different P extraction methods for samples taken shortly after the last harvest of the third year. The levels of N and P applied annually were also included in the statistical models seeking to explain sources of variation in yield. The N by P interaction effect was very strong, forcing examination of each level of N and P individually.

Ryegrass yield was strongly related to P fertilization. Generally, the amount of P fertilizer applied explained 90 percent or more of the variation in ryegrass yield within each level of N fertilization. Soil P level across the four extraction methods was only weakly correlated with ryegrass yield. The failure of soil P to influence yield is probably related to the high P fixing capacity of the alkaline clay soil. Within each level of P fertilization, the amount of N applied explained 80 to 90 percent of the variation in yield. Soil test parameters did not significantly affect yield when examined within P application rates.



Effect of Boron on Ryegrass and Bermudagrass at Varying Soil Acidity Levels

Project Leader: Dr. V.A. Haby, Texas A&M University Agricultural Research & Extension Center, P.O. Box E, Overton, TX 75684-0290 (903-834-6191).

This field research project was designed to evaluate the effect of applied B on production of ryegrass and

bermudagrass in east Texas. Ryegrass and bermudagrass were grown under a variety of soil pH and B levels that resulted from the residual effects of treatments from past experiments. Ryegrass was overseeded into established Coastal bermudagrass, and both forages were fertilized and harvested throughout their respective growing seasons.

Three cuttings of ryegrass and three cuttings of bermudagrass were made in 1999. Boron fertilization did not significantly increase either ryegrass or bermudagrass yields. Yields were also similar across lime rates. The results from 1999 are consistent with those from previous years of this study where B fertilization did not significantly affect ryegrass and bermudagrass yield.



Cotton Response to Multiple Applications of Nitrogen and Phosphorus Fertilizer

Project Leader: Dr. D.R. Krieg, Department of Plant and Soil Science, Texas Tech University, Lubbock, TX 79409-2122 (806-742-1631).

The objectives of this three year study were to determine the effect of P application method, timing, and N:P₂O₅ ratio on cotton yield, quality, and water use efficiency. Methods and timing of P application included delivery of all P in split applications through a low-pressure drop nozzle type irrigation system, sidedress applications split into preplant, first square and first flower timings, and an all preplant application. The fertigation was applied at least four times starting at first square. Ratio of N:P₂O₅ in the fertigation treatment ranged from 5:0 to 5:3.

Fertigation was an effective method of supplying P to cotton. It proved to be the most consistent method of increasing yield across the three years of the study. The banded pre-plant P application provided a yield response over the control and sidedress method. The sidedress application method was the least effective because of root pruning. Cotton grown under the lowest water supply did not respond to added P, as water was the most limiting factor. As water supply increased, fertilizer P increased yield, but N:P₂O₅ ratios above 5:1 did not significantly affect lint yield. Fertigation, where compatible with irrigation water chemistry, gives the producer more flexibility in managing P fertilizer inputs and provides associated economic and yield advantages.



Variable Rate Phosphorus Fertilizer Applications for Conventional and Narrow-Row Cotton in the Southern High Plains

Project Leader: Dr. K.F. Bronson, Texas Agricultural Experiment Station. Rt. 3, Box 219, Lubbock, TX 79401. (806-746-6101).

The objectives of this study are to determine the effect of P fertilization by conventional and variable rate (VRT) application methods on both conventional and ultra-narrow row cotton. Conventional P fertilization was preplant-incorporated by chiseling-in and was based on soil test recommendations from composite soil samples. The VRTs were based on soil test recommendations from individual sub-plots. Conventional row spacing was 40 inches, and ultra-narrow row width was 10 inches.

Cotton lint yield did not respond to either conventional or VRT P fertilizer applications. Lint yields from conventional and ultra-narrow row cotton were similar, averaging 1,100 lb lint/A. The current critical soil P level used for cotton by Texas A&M University is 40 ppm. Soil test P by this procedure in the 0 to 6 inch depth range averaged 13 ppm, but ranged from 6 to 55 ppm. Soil P from 6 to 12 inches averaged 10 ppm and ranged from 4 to 24 ppm. It is not clear why, considering soil P levels, a response to P fertilization was not observed.



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. (940-552-9941).

The majority of wheat acres planted in Texas are grazed to some extent. Deep placement of P fertilizer (6 to 8 inches) in the western part of the state has been shown to increase forage and grain yields of winter wheat over broadcast applications. Research indicates that deep P placement benefits forage yields more consistently than grain yields. Although extensive research has been done for several years on wheat response to deep banded P, no work has been done on stocker cattle response to increased forage production resulting from deep P placement.

A study was initiated in the fall of 1999 to evaluate P placement effects on forage production, grain yield, and stocker cattle performance. The economics and returns associated with P placement methods and length of grazing period will also be evaluated. Results from this study are not yet available. ■