

# NEWS & VIEWS

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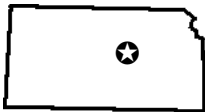


Dr. W.M. Stewart,  
Great Plains Director  
August 1999

## 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 1998 cropping season.

### Kansas



#### Effects of Chloride Rates and Sources on Winter Wheat in Kansas

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

Research on chloride (Cl) fertilization of wheat has shown significant yield response in Kansas in about 60 percent of the studies. Field research was continued in 1998 at three sites to evaluate Cl rates (0, 10, 20 lb/A) and sources...potassium chloride (KCl), magnesium chloride ( $MgCl_2$ ), and sodium chloride (NaCl)...on winter wheat yield.

Grain yields in 1998 were average to excellent, and Cl fertilization increased yields at all three study sites. Chloride significantly increased wheat grain yields at two sites by an average of 6.5 bu/A. At \$3/bu wheat this would increase gross return by \$19.50/A. Chloride fertilization consistently and significantly increased wheat tissue Cl concentrations. All Cl sources performed similarly. Soil test Cl continues to be an excellent predictor of potential response. Both responsive sites tested less than 20 lb Cl/A

(0 to 24 inch sample). This study has furthered the understanding of conditions that favor wheat response to Cl in the Great Plains.



#### Effects of Chloride Fertilization on Corn and Grain Sorghum

*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 1998 at seven sites in Kansas to evaluate Cl rates (0, 20, 40 lb/A) and sources...KCl and NaCl...on dryland corn and grain sorghum production. Yields in 1998 were average to excellent for dryland production. Yield increases from Cl fertilization were observed at sites with soil Cl levels of 20 lb/A (0 to 24 inches) or less. When soil test Cl was greater than 20 lb/A, no significant yield effects were noted. At responsive sites, yields were increased an average of 13 bu/A. This level of yield increase would provide an excellent economic return. Both Cl sources performed equally well. Chloride fertilization consistently increased leaf tissue Cl concentrations. Results to date clearly indicate that Cl fertilization should be considered when soil test Cl level is low.



#### Evaluation of Chloride Fertilization/Wheat Cultivar Interactions (Multi-Regional Project)

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

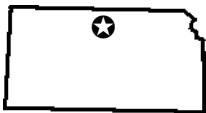
An understanding of Cl by winter wheat cultivar interactions is important in furthering optimum Cl management in the Great Plains. Research in 1996 and 1997 indicated that some wheat cultivars respond consistently to Cl fertilization and others do not, even when soil test Cl levels are low. Field research was continued in 1998 at two sites to evaluate the effect of Cl fertilization on 16 wheat cultivars.



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Chloride fertilization significantly increased yields of 13 of 16 cultivars at both sites. Interestingly, averaged over all cultivars, Cl increased wheat yields by 7 bu/A at each site. This response would result in a \$21/A increase in gross return with wheat at \$3/bu. Chloride fertilization also increased grain test weights and thousand kernel weights. The cultivar Cimarron continued to be very responsive, showing an average yield increase of 15 bu/A.

Results to date suggest that most wheat cultivars will respond to Cl fertilization when soil test levels are 20 lb Cl/A or less (0 to 24 inches). This research also indicates that whenever wheat tissue Cl concentrations are less than 0.10 percent, response to Cl is likely. Chloride fertilization consistently increased wheat tissue Cl concentration of all cultivars.



### **Effects of Placement, Rate, and Source of Starter Fertilizer Containing Potassium on Corn and Soybean Production**

*Project Leader: Dr. W.B. Gordon, Department of Agronomy, Kansas State University, Irrigation/North Central Experiment Fields, Route 1, Box 43, Courtland, KS 66939. (785-335-2836).*

Applications of starter fertilizer are often important in the establishment of spring planted crops. Evaluating yield response from starter and the potential for damage from fertilizer placed in contact with seed are critical in achieving the maximum benefits of starter fertilization. Field studies were continued near Scandia, Kansas, to evaluate the effects of starter containing  $K_2SO_4$  (SOP) and KCl (MOP) on corn and soybeans. Starter fertilizer (7-21-7) was prepared using both K sources. Two placement methods were evaluated, in-furrow with the seed and 2 inches to the side and 2 inches below the seed (2 x 2). Five application rates were employed (50, 75, 100, 150 and 200 lb/A of 7-21-7). Sulfur (S) rates were balanced. The corn received 200 lb N/A, and the soybeans received no additional N.

When starter fertilizer containing MOP was placed in-furrow, grain yield, plant stand, and early season dry matter were reduced in both corn and soybeans. In the corn experiment, in-furrow starter containing MOP applied at the 100 lb/A rate reduced yields by 12 bu/A compared to the same rate applied 2 x 2. Corn yield was reduced 40 bu/A when fertilizer containing MOP was applied in-furrow at the 200 lb/A rate. When fertilizer containing SOP was placed in-furrow with corn seed, no yield reduction was observed except at the 200 lb/A rate, where a 14 bu/A decrease was observed compared to the 2 x 2 placement. When starter fertilizer containing MOP was placed in-furrow with soybean seed, yields, and plant populations were reduced regardless of rate. Yields and population of soybean declined when in-furrow rates of starter fertilizer containing SOP exceeded 100 lb/A. The

1998 results of this study follow closely the results of previous years.



### **Precision Application of Phosphorus to Winter Wheat**

*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).*

Current phosphorus (P) fertilizer recommendations assume that the results of analysis of composite soil samples represent the fertility status of an entire field, even though soil P levels may vary considerably within fields. The objectives of this study were to characterize the spatial variability of soil P and organic matter and to quantify the influence of variable rate P applications on wheat production.

The central Great Plains site (80 acres) was sampled on 1 acre grids. Soil test P varied more than 10-fold, from 6 to 76 ppm Bray P-1. Soil organic matter ranged from 0.6 to 2.3 percent. Soil test P was highly correlated with soil organic matter, suggesting that soil organic matter, and perhaps soil color, may have potential as a coarse indicator of soil P. Fertilizer P was uniformly and variably band-injected in a lattice square design prior to planting. The rate of fertilizer P was 10 lb  $P_2O_5/A$  for the uniform application and ranged from 0 to 38 lb  $P_2O_5/A$  for the variable rate application. Grain yield ranged from less than 20 bu/A to more than 60 bu/A within the field. Average grain yield, about 41 bu/A, was the same for both uniform and variably applied P. Hence, there was no economic advantage in applying variable rate P in this study in 1998.



### **Effect of Long-Term 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 has shown that nitrogen (N) and P fertilizer must be applied for optimum grain yields of irrigated corn and grain sorghum in western Kansas. The objectives of this study were to determine the optimum rate of N, P, and K fertilizer for irrigated corn and grain sorghum.

Nitrogen and P fertilization increased corn yields more than 100 bu/A in 1998. Although there are some year to year variations, the optimum N rate (with P) for corn remained relatively constant at about 160 lb N/A. Fertilizer P at 40 lb  $P_2O_5/A$  increased corn yields by 75 bu/A when applied with at least 120 lb N/A. In 1998 grain

sorghum yields were increased over 40 bu/A by N and about 20 bu/A by P fertilization. In sorghum production, the optimal N rate has varied considerably from year-to-year. However, application of 80 lb N/A is sufficient to maximize yields in most years. Potassium fertilization had no effect on grain sorghum yields. Phosphorus fertilization has lowered soil nitrate levels due to increased N use efficiency, thus reducing the likelihood of nitrate leaching into groundwater. Long-term studies such as this are important in developing an understanding of trends in crop response and the economics of fertilization.

## Texas



### The Role of Chloride in Maximizing Wheat Cultivar Performance (Multi-Regional Project)

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

The importance of Cl in wheat production has been demonstrated in research across the Great Plains. Yield response is often associated with the suppression of fungal disease infection and is cultivar dependent. A better understanding of the Cl and cultivar interaction is needed. The objective of this study was to quantify wheat response to Cl by cultivar.

The response of 15 wheat cultivars to Cl fertilization was evaluated at a site near Abilene. Response in 1998 was erratic and ranged from an increase of about 6 to a decrease of 5 bu/A, with no average yield increase observed. The poor overall response may be attributed to the extremely dry weather from mid-March through grain fill that provided a poor environment for foliar fungal disease. Also, dry spring conditions may have resulted in an upward migration of Cl in the soil profile resulting in an unexpected increase in available soil Cl. An understanding of wheat response to Cl by cultivar is critical in the further development of Cl fertilization practices.



### Effect of Nitrogen and Phosphorus Fertilization on Forage Yield and Quality of Annual Ryegrass Grown 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).*

Texas has about one million acres in ryegrass forage production. The goal of this study was to evaluate ryegrass response to several rates of N and P fertilization. Total forage dry matter yield from six harvests during the third

year (1998) showed no response to N in the absence of applied P. Likewise, increasing levels of P fertilization provided no significant yield increases when no N fertilizer was applied. Where 240 lb N/A was applied through the season, a preplant application of 80 lb  $P_2O_5$ /A increased ryegrass yield by 350 percent. These results emphasize the importance of balanced N and P fertility and the effect of good P fertility on yield and N use efficiency.



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

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

The objective of this project was to evaluate the effect of applied boron (B) on the production of ryegrass and Coastal bermudagrass in east Texas. The importance of maintaining adequate soil B levels to optimize alfalfa yields in limed acid soils has been established in past east Texas research. In this study, ryegrass and bermudagrass were grown under a variety of soil pH and B levels that resulted from the residual effects of treatments from a past experiment. Ryegrass was overseeded into established Coastal bermudagrass, and both forages were fertilized and harvested throughout their respective growing seasons. Yields were relatively low, reflecting the severity of the 1998 drought. They were not significantly affected by B fertilization, but were increased by the residual effect of increasing lime rates. Bermudagrass yields declined where ryegrass yields increased, probably due to increased spring competition from ryegrass.



### Cotton Response to Multiple Applications of Nitrogen and Phosphorus Fertilizer

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

Between 3.5 and 4.0 million acres of cotton are planted annually in the semi-arid Southern High Plains of Texas. Approximately 50 percent of these acres are irrigated. The objectives of this study were to determine the effect of P application method and timing, and N:P<sub>2</sub>O<sub>5</sub> 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, three equal 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:P<sub>2</sub>O<sub>5</sub> in the

fertilization treatment ranged from 5:0 to 5:3.

Phosphorus fertilization in 1998 performed as well as application by mechanical means. Furthermore, lint yield was influenced by larger boll size as the N:P<sub>2</sub>O<sub>5</sub> ratio decreased. Optimizing P use efficiency is essential to maximizing profit. This project is helping develop optimum P fertilization practices for cotton in the largest contiguous cotton producing region in the world.



### **Nitrogen Fertilizer Source and Rate Comparisons on South Texas Cotton**

*Project Leader: Dr. J.E. Matocha, Texas A&M University, Research and Extension Center, Rt. 2, Box 589, Corpus Christi, TX 78406 (512-265-9201).*

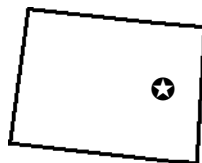
Efforts to evaluate and improve the N use efficiency of cotton are important from both the agronomic and environmental perspectives. The purpose of this experiment was to compare the effects of ammoniacal N supplied as (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> (21-0-0) with urea-ammonium nitrate solution (UAN, 32-0-0) at various rates on cotton lint yield.

Comparisons also involved the standard granular ammonium sulfate (AS) and a treated ammonium sulfate (AST). The AST was a granular material produced by compacting AS fines. The AST granules were coated with an anti-caking/dust compound that was thought to have an impact on plant growth. All N fertilizers were evaluated at 0, 30, 60 and 90 lb N/A rates.

Yields in 1998 were relatively low due to lack of moisture. Less than 0.50 inches of rainfall fell from planting to harvest. There was no significant difference in total lint yield due to N source or rate.

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## **Colorado**



### **Using Natural Soil Variability in Eastern Colorado Landscapes for Site-Specific Management of Nitrogen and Phosphorus on Dryland Crops**

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

A good fertility program depends on sound fertilizer recommendations. Fertilizer recommendations are usually based on soil tests. Soil factors not accounted for in conventional soil testing techniques may affect crop yields. This study was undertaken to develop a basis for N and P fertilizer recommendations in soils that vary by landscape position. Variability in soil properties was correlated with response of dryland corn to N and winter wheat to P fertilizer over a typical eastern Colorado landscape.

Soil P ranged from 1 to 31 ppm over a landscape of 1,400 ft. in length. At the same location, organic carbon (C) varied from 0.69 to 1.18 percent, lime from 0 to 17 percent, soil organic N from 0.057 to 0.11 percent, and available N (nitrate-N + ammonium-N) from 12 to 32 ppm. Response to N and P fertilization was erratic across landscapes. Soil N or P level did not necessarily determine response to fertilizer. Other growth limiting soil factors controlled response at some landscape positions. Results demonstrated that traditional soil testing did not accurately predict crop yields. A "soil index" was developed to predict responses of dryland corn and wheat to N and P fertilizers.

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## **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 (405-744-6425).*

Previous Oklahoma research found significant differences in soil test levels for both mobile and immobile nutrients when samples were less than 1 meter apart. These results suggest that in some fields soil sampling may be cost prohibitive to adequately characterize soil variability for site-specific management. Therefore, alternatives such as sensors that measure soil test and plant response variables at such small distances are being developed.

Remote sensing of P deficiencies in plant tissue via correlation with total P concentration is being explored in this study. Spectral radiance measurements under an ultraviolet light were used to detect P levels in winter wheat in the field and in a pot study. Several bands and combinations of indices were generated to test for correlation with forage biomass and N and P uptake at various growth stages. Initial data suggest that P tissue concentration can be predicted indirectly by using the methods employed. ■