NEWS & VIEWS

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Dr. W.M. Stewart, Great Plains Director
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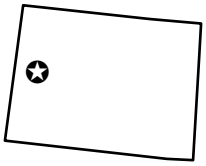
Research Programs in the Great Plains Region

THE Potash & Phosphate Institute (PPI) and 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 2001 cropping season.

Colorado



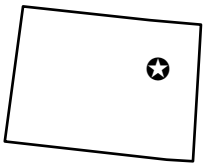
Potassium Needs of High-Yielding Alfalfa on the West Slope of Colorado

Project Leader: Dr. Jessica Davis, Colorado State University, Department of Soil and Crop Sciences, Ft. Collins, CO 80523-1170, telephone: 970-491-1913, e-mail: jgdavis@lamar.colostate.edu.

There were almost a million acres of alfalfa hay harvested in Colorado in 2000. Most of the soils in the state test high in potassium (K). In fact, a 2001 PPI soil test survey estimated that only 10 percent of soils test medium or below in K. Therefore, K fertilizer is seldom recommended by the state soil testing laboratory. In spite of this, some producers and agricultural professionals report 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 western Colorado.

Soil test K level of the west slope study sites was over 300 part per million (ppm). The Colorado State University soil testing laboratory uses a critical value of 120 ppm. Therefore, no K would have been recommended for these fields. Potassium fertilizer was applied at rates of 0, 40, 80, and 180 lb K_2O/A in the fall prior to each of the three years of the study, and it substantially increased alfalfa hay yield in 1999 and 2000. Yield increases ranged from 680 to over 2,000 lb/A in 2000.

Alfalfa yield was not significantly affected by K fertilizer in 2001. The 2001 study was conducted on a different field from the 1999 and 2000 study. The lack of response may be due to a lower soil calcium (Ca)/K ratio in the 2001 site than at the earlier site. Another factor may have been a shortage of equipment that necessitated estimation of total plot yields based on random sampling. The effect of Ca/K ratio will be further investigated, and this research will continue with the ultimate objective of determining the need for alterations in the current K fertilizer recommendations for alfalfa in Colorado. *CO-10F*



Long-Term Phosphorus Fertilization of No-till Dryland Intensive Cropping Systems

Project Leader: Dr. D.G. Westfall, Department of Soil and Crop Sciences, Colorado State University, Ft. Collins, CO 80523-1170, telephone: 970-491-6149, e-mail: dwayne.westfall@colostate.edu.

This long-term project was established in eastern Colorado in the fall of 1985. Its purpose is to determine whether current phosphorus (P) fertilization recommendations are adequate for dryland crops grown in intensive rotation.

At three sites, various three- to four-year crop rotations were implemented. Wheat has been grown every year at all sites, corn every year at Sterling, and sorghum every year at Walsh. In the original experimental design, half of each plot received P fertilizer every year, and the other half received no P fertilizer. The purpose was to determine if organic P cycling would satisfy the P needs of the crops in these no-till dryland cropping systems. By 1992, the wheat emergence and growth in the no-P side of the plots were becoming very poor, thus demonstrating the importance of P fertilization in the sustainability of intensive crop production. Therefore, the decision was made to initiate P fertilization of the whole plot every time wheat was planted (i.e., every three to four years). Annual P applications were continued on plots where originally implemented.

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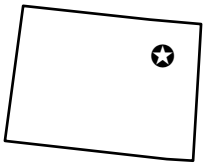
One objective of this study is to determine if carryover of P applied to wheat is adequate to satisfy the needs of dryland corn in the rotation. Results to date indicate that there is enough P fertilizer carryover from the previous winter wheat crop to meet the needs of the dryland corn crop in the rotation. *CO-11F*



Spatial Removal of Nutrients by Corn

Project Leader: Dr. Raj Khosla, Colorado State University, Department of Soil and Crop Sciences, Ft. Collins, CO 80523-1170, telephone: 970-491-1920, e-mail: rkhosla@lamar.colostate.edu.

Research in Colorado and elsewhere has demonstrated that nutrient management based on in-field production level management zones may be economical and environmentally sensible. It is logical to assume that differential application of nutrients to various management zones will result in differential nutrient removal. The specific objective of this study was to quantify nitrogen (N), P, and K uptake and removal in the above ground dry matter of irrigated corn in different management zones developed in two eastern Colorado fields. Management zones were created based on soil color, topography, and farmer experience in the field.

Nitrogen uptake among zones at one site showed no significant differences. At the other site, N uptake in the high productivity zone was greater than the medium and low zones, which were not significantly different. Both P and K were removed differently with respect to management zones. The high and medium productivity zones typically extracted more P and K from the soil. This study has shown that uptake is not solely dictated by how much nutrient is applied, but also by factors that affect productivity such as soil organic matter, texture, and past yield history. It has further demonstrated that by delineating management zones and applying nutrients accordingly, grain yields and nutrient use efficiency can be optimized. *CO-12F*

Kansas

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

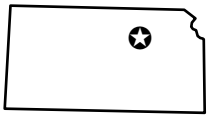
Project Leader: Dr. Alan Schlegel, Kansas State University Tribune Unit, Southwest Kansas Research and Extension Center, Rt. 1, Box 148, Tribune, KS 67879, telephone: 316-376-4761, e-mail: aschlege@oznet.ksu.edu.

This western Kansas study was initiated in 1961 to evaluate responses of continuous corn and grain sorghum grown under flood irrigation to N, 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.

This research continues to show that N and P fertilizer must be applied to optimize production of irrigated corn and grain sorghum. Averaged across the past nine years, corn yields were increased more than 100 bu/A by N and P fertilization. In 2001, N and P increased yields up to 140 bu/A. Application of 160 lb N/A generally is sufficient to maximize corn yields. Phosphorus increased yields by 70 bu/A when applied with at least 120 lb N/A. Application of 40 lb P_2O_5/A has been adequate for corn until the past two years, when yields were increased by the higher P rate (80 lb P_2O_5/A).

Grain sorghum yields averaged across nine years were increased 45 bu/A by N and 20 bu/A by P fertilization. Application of 80 lb N/A was sufficient to maximize yields in most years. Potassium fertilization had no effect on yield. Application of 40 lb P_2O_5/A was not sufficient to maintain soil test P levels for corn but was for grain sorghum.

Phosphorus fertilization reduced accumulation of residual soil nitrate-N in sorghum by 50 percent, but had an inconsistent effect on corn. This project continues to generate excellent long-term yield response and environmental data. *KS-23F*



Effects of Chloride Rates and Sources on Corn and Grain Sorghum

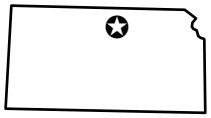
Project Leader: Dr. R.E. Lamond, Department of Agronomy, Kansas State University, 2014 Throckmorton Hall, Manhattan, KS 66506-5504, telephone: 785-532-5776, e-mail: rlamond@bear.agron.ksu.edu.

Past research from Texas to the Canadian prairies has demonstrated that wheat often responds to chloride (Cl^-) fertilizer. The objective of this research is to determine under what conditions corn and grain sorghum may respond to Cl^-.

Field research was continued in 2001 at four sites in two counties in Kansas to evaluate the effect of Cl^- fertilization (0, 10, and 20 lb Cl^-/A) from two sources, potassium chloride (KCl) and calcium chloride ($CaCl_2$), on dryland corn and grain sorghum. All four of the sites had soil Cl^- levels less than 20 lb/A (0 to 2 ft. sample depth). Chloride treatments were applied surface broadcast just after planting. Leaf samples were taken at tassel/boot stage for Cl^- analysis, and grain yields were determined.

Yields in 2001 were average to excellent at all locations. Significant yield increases were noted at three of the four sites. Yield increases due to applied Cl^- ranged from 1 to 41 bu/A. Chloride fertilization consistently increased leaf Cl^- concentrations. The sources evaluated performed similarly. Results of this work suggest that when soil Cl^- is below 20 lb/A (0 to 2 ft. sample depth), consistent responses to Cl^- fertilizer are likely on corn and grain sorghum. The support

of PPI/FAR has aided in the accumulation of 30 site years of Cl^- research on corn and grain sorghum in Kansas. This information base is necessary for the further development of markets for Cl^- in Kansas and other states. *KS-29F*



Maximizing Irrigated Corn Yields in the Great Plains

Project Leader: Dr. Barney Gordon, KSU Irrigation/North Central Experiment Field, Route 1, Box 43, Courtland, KS 66939, telephone: 785-335-2836, e-mail: bgordon@oznet.ksu.edu.

The objective of this study is to determine if current soil test recommendations are adequate for new high yielding corn hybrids and to evaluate the interactions among fertility treatments and plant population in reduced tillage systems. 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 in combination with 1) current university soil test recommendations for P, K, and sulfur (S), i.e., 30 lb/A P_2O_5, and no K or S, 2) 100 lb P_2O_5/A + 80 lb K_2O /A + 40 S lb/A applied preplant, with N applied in two split applications (half preplant and half at V4), 3) 100 lb P_2O_5/A + 80 lb K_2O /A + 40 lb S /A applied preplant, with N split in four applications (preplant, V4, V10, and tassel). The experiment was fully irrigated. Soil test P at the site was in the medium range [20 part per million (ppm), Bray P-1] and K was very high (240 ppm).

Corn grain yields were excellent in 2001, in spite of the poor rainfall distribution. When averaged over fertility treatments, grain yield at 42,000 plants/A was 15 bu/A greater than at 28,000 plants/A. Additional P, K, and S increased corn grain yield by 35 bu/A over the university recommended rate (30 lb P_2O_5). When averaged over all other treatments, yield was increased by 24 bu/A when N rates were increased from 160 to 230 lb/A. Applying fertilizer in four applications was not superior to applying in two applications. Increasing population improved yields only when additional P, K, and S were applied. Additional treatments were added in 2001 to determine which nutrients were providing the most yield increase. Addition of each fertilizer nutrient resulted in economically feasible yield increases. Addition of P, K, and S resulted in a 78 bu/A yield increase over the N alone treatment. This represents a gross revenue increase of nearly $150/A and a net increase of over $100/A. Even at very low commodity prices, additional fertilizer inputs increased profit and are therefore justified. *KS-33F*

Texas

Variable Rate Phosphorus Fertilization of Cotton in the Southern High Plains

Project Leader: Dr. K.F. Bronson, Texas Agricultural Experiment Station, Rt. 3, Box 219, Lubbock, TX 79401, telephone: 806-746-6101, e-mail: k-bronson@tamu.edu.

Phosphorus fertilizer response in cotton is sometimes inconsistent. One reason for this may be in-field variability in soil P levels where applications are based on average soil test P across a field. Variable rate (VRT) fertilizer applications can theoretically match soil test P and P fertilizer rate on a site-specific basis. The objective of this study was to compare VRT with blanket applied P fertilizer in irrigated cotton at two sites on the southern High Plains of Texas.

Grid soil samples (half acre) were taken in the spring of 2000 and 2001 at sites near Ropesville and Lamesa, Texas. Variable rate P was applied based on these grid samples, and uniform application of P fertilizer was applied based on field averages.

Lint yields at the Lamesa site in 2001 responded to blanket P application in the south-facing sideslope only. Soybeans were planted in 2001 at the Ropesville site following hailed-out cotton. There was no soybean grain yield response to P. In summary, both VRT and blanket rate P responses have been rather inconsistent in this study. *TX-43F*

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.

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 percent of the crop is harvested for grain. Nearly 70 percent of the Texas Rolling Plains wheat crop is grazed each year. The primary objective of this study is to determine the influence of P fertilizer placement on forage, beef, and grain production from dual-purpose wheat.

The summer of 2000 was extremely dry and hot, with maximum temperatures of 100 degrees or more occurring on 63 days. Very little surface soil moisture was available at recommended planting dates in September, so field operations were postponed. On October 3 and 5, fluid fertilizer was applied for the second year to three replications of three fertilizer treatments allocated to nine 25-acre pastures.

The treatments were: 1) surface applied N and S, 2) surface applied N, P, and S, and 3) deep-placed (6-8 in.) N, P, and S. Rainfall arrived in mid-October and continued through November, keeping the pastures too wet to plant until early December.

No fall forage was available for wheat pasture because of the late planting. It was early March before sufficient forage was available to graze. Therefore, the decision was made to harvest the wheat for grain rather than to graze for the remaining 60 days of the season. No significant P or placement effects on grain yields were observed. This is not surprising because of the delayed planting and wet conditions from planting through March. Since this study has the potential to significantly impact P fertilizer markets in the southern Great Plains, it will be continued until at least two more years of forage, beef, and grain production data have been collected. *TX-44F*

Potassium Requirements for Narrow Row Cotton in the Texas Blacklands

Project leader: Dr. John Sloan, Texas A&M University-Dallas, 17360 Coit Road, Dallas, TX 75252, telephone: 972-952-9260, e-mail: j-sloan@tamu.edu.

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. In fact, reports of symptoms resembling K deficiency in cotton have become more common in the northern Blacklands. The objectives of this study are to determine the effect of soil and foliar-applied K fertilizer on cotton lint yield and quality at various row spacings in the northern Texas Blacklands.

Research was conducted on a Houston Black clay soil at the Texas A&M University research farm at Prosper, Texas. Cotton row spacings of 20, 30, and 40 in. were evaluated. Potassium fertilizer was applied preplant and incorporated at the rates of 48 and 96 lb K_2O/A. Treatments included soil applications with and without foliar-applied K shortly after first bloom. Foliar K as potassium nitrate (KNO_3) was applied at the rate of 12 lb K_2O/A. A foliar K only treatment and a control were also included. All plots received a preplant N application of 85 lb/A. Soil test K level at the site was 268 lb/A (high).

There were no significant yield differences in 2001 due to either soil or foliar applied K at the 0.05 level of probability. However, lint yield in the 40-in. row spacing responded to soil-applied K at the 0.10 level of probability when no foliar K was applied. Potassium fertilization had no significant or consistent effect on any of the measured lint quality parameters. Although results have been somewhat inconsistent and ambiguous, this study has provided evidence of possible positive cotton responses to K fertilization in the Texas Blacklands. To further clarify this effect, this project will be continued in the 2002 season. *TX-46F*

Effect of Potassium Fertilizers on Hybrid Bermudagrass Yields and Stand Decline

Project Leader: Dr. Vince Haby, Texas A&M Center, P.O. Box E, Overton, TX 75684-0290, telephone: 903-834-6191, e-mail: v-haby@tamu.edu.

Tifton 85 bermudagrass is a relatively new hybrid that appears to have better nutritive value and higher yield potential than Coastal bermudagrass. Since Tifton 85 is growing in popularity among producers, there is a need for more nutrient response data. This field study was designed to evaluate the response of Tifton 85 to applied N, K, Cl^-, and S under rain-fed conditions.

This study was conducted in east Texas on a site that was limed and received 180 lb P_2O_5/A prior to sprigging in the spring of 2001. The entire study area received 200 lb N/A just after sprigging. Two more applications of N were made during the season. Two in-season rates of N for each application were compared (60 lb/A and 120 lb/A). Potassium rates ranged from zero to 400 lb K_2O/A. Chloride treatments were applied as KCl. Response to Cl^- and S were evaluated using a combination of treatments using potassium sulfate (K_2SO_4), KCl, and elemental S sources.

Yield in 2001 was not expected to be large since it was the year of establishment. Also, a sandbur infestation in June resulted in the application of a contact herbicide that caused a retardation of bermudagrass growth. Thus, only one harvest was collected in 2001. Bermudagrass dry matter yields were similar at both N rates. Increasing rates of K had no statistically significant effect on dry matter production. Dry matter yields due to K source were not statistically different. Lack of significant differences among the various treatments appears to be related to a large error term caused by irregular stand density. This problem is associated with first year grow-in and should not occur in the following seasons. *TX-47F* ■

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