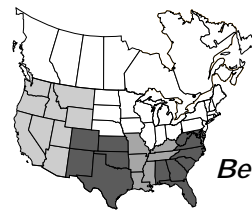


NEWS & VIEWS

A regional newsletter published by the
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Potash & Phosphate Institute of Canada (PPIC)



Multi-region
Beltwide 2000 Edition

Beltwide Cotton Research

EACH year the Potash & Phosphate Institute and the Foundation for Agronomic Research help support research across the Cotton Belt. These projects involve production in the field...research to develop efficient high-yielding and high quality cotton. They are designed to answer current production questions and related environmental concerns.

Following is a brief summary of projects that have been conducted during the past few years. Many are still in progress, and release of detailed results is strictly up to the researcher. If any project is of special interest, you might want to contact the researcher directly to get a first-hand update.

Arizona



Evaluation of Balanced Cotton Nutrition Management

Project Leader: Dr. Jeffrey C. Silvertooth, Dept. of Plant Sciences and Dept. of Soil, Water, and Environmental Sciences, University of Arizona, Tucson, AZ 85721. Phone: (520) 621-7616, fax: (520) 621-7186, e-mail: silver@ag.arizona.edu

This project has just completed its initial year of support (1999) by PPI/FAR, although it actually began in 1998. The purpose is to evaluate various commercial cotton fertilization regimes involving nitrogen (N), phosphorus (P), potassium (K), and micronutrients in relation to the University of Arizona fertilizer guidelines. Six to eight fields were studied in 1999. Individual plots, replicated four times, extend the length of the irrigation run and are sufficiently large to harvest into separate

modules. Both yield and lint quality will be evaluated. Initial results will be available in early 2000.

California



Establishing Updated Guidelines for Cotton Nutrition

Project Leader: Dr. Bill Weir, University of California Cooperative Extension Service, 2145 Wardrobe Ave., Merced, CA 95340. Phone: (209) 385-7403, fax: (209) 722-8856; e-mail: cemerced@ucdavis.edu

This project studied various aspects of K fertilization of cotton in the San Joaquin Valley of California. It was initiated in 1994 and concluded following the 1998 growing season. Previous research had verified that many cotton fields suffer from mid-season K deficiency during boll development and that 400 lb K₂O/A or more may be required to overcome K fixation by the soil and correct the deficiency.

The 1996-98 studies emphasized in-season K applications to supplement a well-managed preplant program aimed at producing high yields. Initial results substantiated that foliar K (4.5 lb K₂O/A) applied twice at one to three weeks after first bloom produced the greatest yield increases compared to that applied earlier or later in the season. Studies in 1997 showed that additional yield may be obtained by increasing rates up to 13.5 lb K₂O/A, also applied twice. Foliar applications were not beneficial in the weather-shortened 1998 season where yields were only slightly above 2 bales per acre. Overall, results indicate

Co-authors:

Dr. A.E. (Al) Ludwick
Western Director
Potash & Phosphate Institute (PPI)
P.O. Box 970
Bodega Bay, CA 94923-0970
Phone: (707) 875-2163
Fax: (707) 875-2398
E-mail: aludwick@ppi-far.org

Dr. C.S. (Cliff) Snyder
Midsouth Director
Potash & Phosphate Institute (PPI)
P.O. Drawer 2440
Conway, AR 72033-2440
Phone: (501) 336-8110
Fax: (501) 329-2318
E-mail: csnyder@ppi-far.org

Dr. W.M. (Mike) Stewart
Great Plains Director
Potash & Phosphate Institute (PPI)
P.O. Box 6827
Lubbock, TX 79493
Phone: (806) 795-3252
Fax: (806) 795-5997
E-mail: mstewart@ppi-far.org

Dr. Noble R. Usherwood
Southeast Director
Potash & Phosphate Institute (PPI)
233 Kenilworth Circle
Stone Mountain, Georgia 30083
Phone: (404) 294-0137
Fax: (404) 294-0770
E-mail: usherwood@ppi-far.org

that foliar applications of K should be recommended on potentially high yielding fields regardless of soil test or previous fertilizer applications.

Texas



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. Phone: (806) 742-1631; e-mail: dkrieg@ttacs.ttu.edu

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:P₂O₅ ratio on cotton yield, quality, and water use efficiency. Methods and timing of P application included delivery of all P (40 lb P₂O₅/A) in split applications through a low-pressure drop nozzle type irrigation system; three equal applications chisel applied split into preplant, first square, and first flower timings; and a traditional 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.

Phosphorus fertilization resulted in substantial yield increases in 1997 and 1998. Phosphorus fertigation has on average performed as well as application by mechanical means. In 1997 it was superior to the other methods. Boll size and lint yield increased as the N:P₂O₅ ratio decreased from 5:0 to 5:3. 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.



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

Project Leader: Dr. Kevin Bronson, Texas Agricultural Experiment Station, Texas A&M University, Rt. 3, Box 219, Lubbock, TX 79401. Phone: (806) 746-6101; E-mail: k-bronson@tamu.edu

Phosphorus is often the most limiting nutrient in cotton production in the Texas High Plains. Previous investigation has shown that soil P levels can vary sharply over small distances in this region. Site-specific management addresses this type of within field variability and seeks to optimize production through variable rate application of inputs. The objectives of this study are to investi-

gate the agronomic and economic feasibility of variable rate P application to both 40-inch and 10-inch row cotton on the Texas High Plains. Since this is a new study there are no data yet available.



Managing Potassium Fertility to Reduce Susceptibility of Cotton to Infection by *Alternaria macrospora*

Project Leader: Dr. M.L. McFarland, Department of Soil and Crop Sciences, Texas A&M University, College Station, TX 77843. Phone: (409) 845-5366; e-mail: ml-mcfarland@tamu.edu

An increased occurrence of *Alternaria* leaf spot has been observed in recent years in the north central Blacklands of Texas. The problem has been observed across all major cotton varieties. Potassium fertilization in this region has traditionally been limited since soil levels of K are usually assumed to be adequate. There is speculation that the recent increased occurrence and severity of *Alternaria* may be related to K fertility limitations. The objectives of this study were to evaluate the effects of K fertilization on cotton fiber quality, lint yield, and susceptibility to infection by *Alternaria* leaf spot.

Research plots were established in farmer fields the spring of 1997 at two locations in Collin County in the northern Blackland Prairie of Texas. The replicated treatments consisted of three rates of surface broadcast potassium chloride (KCl). The soil at one site tested very high in available K and the other tested medium. Unfortunately, the KCl was not incorporated at either site. Therefore, positional availability of the K fertilizer was reduced. No significant differences in yield response or leaf tissue K level were observed among treatments at either of the two locations. However, there was a trend toward substantial yield improvement with K fertilization at the site with medium soil K level. Potassium fertility research in this region of Texas is being re-established in an effort to determine the effect of K fertilization on *Alternaria* leaf spot infection, cotton yield, and quality.



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. Phone: (512) 265-9201.

Efforts to evaluate and improve the N use efficiency of cotton are important from both agronomic and environmental perspectives. The purpose of this experiment was to compare the effects of ammoniacal N supplied as ammonium sulfate (AS, 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 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.

The results from 1997 and 1998 showed no significant yield increase from N fertilization and no consistent trend in the performance of the various sources. Yields in 1997 tended to increase with N fertilization, but the increases were not significant. Due to a severe drought, water was the most limiting factor affecting yield in 1998. Therefore, there was no significant difference in lint yield due to N source or rate.

Arkansas



Characterization of Boron Use and Distribution in the Cotton Plant: Evaluation of Foliar Boron Feeding

Project Leaders: Dr. Derrick M. Oosterhuis and Adele Steger, Agronomy Department, 113 Plant Sciences, University of Arkansas, Fayetteville, AR 72701. Phone: (501) 575-3979; e-mail: oosterhu@sysb.uark.edu

A site low in Mehlich 3 soil boron (B, 0.04 lb/A) was used to evaluate: 1) the uptake and partitioning of B, 2) potential benefits of B applied at 2 lb B/A to the soil at planting, or as three 0.2 lb B/A foliar applications (one, two, and four weeks after first flower) or as a combination of soil plus foliar applications during flowering, and 3) N and B interactions under both high (100 lb N/A) and low soil-applied N (50 lb N/A). Soil plus foliar B in the high N treatment resulted in the highest total B in plants at three weeks after bloom. Yields were greater in the control treatment (1,580 lb/A lint) in the high N plots compared with the B treatments (1,310 to 1,520 lb/A lint). In the low N plots, the soil-applied plus foliar B and the foliar B treatments resulted in the greatest yields (1,460 lb/A lint). The interactions of N and B fertilization on cotton plant physiology remain unclear and deserve continued study.



Statewide Evaluation of the Double Petiole Sampling Technique for Detecting a Pending Potassium Deficiency in Cotton

Project Leaders: Dr. Derrick M. Oosterhuis and Adele Steger, Agronomy Department, 113 Plant Sciences, University of Arkansas, Fayetteville, AR 72701. Phone: (501) 575-3979; e-mail: oosterhu@sysb.uark.edu

Mr. Don Plunkett and Dr. Bill Robertson, University of Arkansas, Cooperative Extension Service, P.O. Box 391, Little Rock, AR 72203. Phone: (501) 671-2186.

Preliminary work has indicated that sampling petioles at the fourth nodal position from the plant terminal, and the position four nodes below, may improve prediction of pending K deficiency. Petioles were collected from main stem nodes four and eight weekly, beginning at pinhead square and continuing through the fifth week of flowering, in four quadrants in each of six irrigated and one non-irrigated cotton fields enrolled in the University of Arkansas Cotton Research Verification Program. Soil textures varied from silt loam to clay, Mehlich 3 soil test K ranged from 235 to 481 lb/A at 0 to 6 inches, and N rates varied from 60 to 100 lb/A. After first flower, K was consistently lower in petioles at node eight compared to node four. There was a strong negative correlation of K levels at main stem node eight with time after first flower, reflecting the natural decline in petiole K levels with maturity. The correlation of petiole K with yield was strongest at four weeks after first flower, with a trend toward higher yields with higher petiole K levels at nodes four and eight. Petiole K levels at node eight decreased more rapidly with time than petiole K levels at node four. Yet, the petiole K level at node four appeared to be more strongly associated with yields in 1998. This study should be repeated on soils testing low in K where replicated soil and /or foliar K applications can be evaluated in contrast with untreated controls.

Tennessee



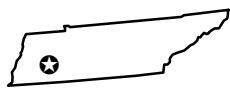
Site-Specific Management of Cotton

Project Leaders: Dr. Mike E. Essington, Department of Plant and Soil Sciences, P.O. Box 1071, University of Tennessee, Knoxville, TN 37901-1071. Phone: (423) 974-7101; e-mail: messington@UTK.edu

Dr. Donald H. Howard, West Tennessee Experiment Station.

In 1996, a 5-acre area within a larger field, with a long history of cotton production on the Milan Experiment Station, was selected to study soil chemical and physical variability and its association with cotton lint yields. The study area was expanded to 16 acres in 1997 and to 27 acres in 1998 and divided into 240 monitoring units measuring 53 by 90 feet. Cotton yields were determined using an instrumented four-row Case 2155 cotton picker in conjunction with a GPS receiver. A 0.25-acre grid appeared to provide a realistic estimate of soil fertility in the field. Spatial variability in soil fertility was relatively consistent from year to year for nutrients other than P and K. Build-up in soil P and K was observed. In 1996 and 1997, individual soil fertility parameters failed to correlate significantly with yield. Lint yield in 1997 was significantly correlated with multiple parameters [e.g. Mehlich 3 K and iron (Fe), Fe and manganese (Mn)]. Yield variabil-

ity at this site may be better related to soil physical characteristics than to fertility, since 92 percent of the monitored units tested high in soil P, and 86 percent of the units tested high in soil K. Yield data from 1998 are being converted and formatted for statistical analysis.



Evaluation of Potassium Sulfate as a Starter Material for No-Till Corn and Cotton

Project Leader: Dr. Donald H. Howard, West Tennessee Experiment Station, 605 Airways Boulevard, University of Tennessee, Jackson, TN 38301-3200. Phone: (901) 425-4748; e-mail: ddhoward@agmail.ag.utk.edu

Research was initiated in 1997 and continued in 1998 at Milan on a Memphis silt loam soil to determine the no-till (NT) corn and cotton response to fertilizer solutions made from potassium sulfate (K_2SO_4) or KCl, with and without 11-37-0 plus UAN solutions as in-furrow (IF) starters. Application of 10-10-10 IF, using K_2SO_4 as the K source, increased 1997 corn yields 18 bu/A over the 108 bu/A check and 24 bu/A over the IF starter which included K as KCl. Reducing the starters to 5-5-5 solutions resulted in comparable yields with both K sources, which were no different from the 10-10-10 solution made with K_2SO_4 . No significant differences were measured among starter treatments in 1998, possibly because of very high temperatures during silking through maturation. Corn yields (104 to 113 bu/A) were 25 percent lower than yields in 1997. In contrast to the NT corn, NT cotton yields (984 to 1,175 lb/A lint) were unaffected by the IF starter treatments either year. Preliminary results indicate that no-till corn may significantly benefit from K included in the in-furrow starter, and K_2SO_4 may be the preferred in-furrow source compared to KCl.

Alabama



Response of Cotton to Sodium and Potassium Fertilizers on Alabama Soils

Project Leader: Dr. Greg Mullins, Dept. of Agronomy and Soils, 202 Funchess Hall, Auburn University, AL 36849-5412

The objectives of this field study are to evaluate cotton response to sodium (Na) and K and to determine if part of the K requirement is replaced with Na. During 1998, seed cotton yields tended to be slightly higher with K fertilization than with Na fertilization. Essentially no yield response to K (0, 30, 60 lb K_2O/A) or Na fertilization (0, 20, 40 lb Na_2O/A) was measured in either 1997 or 1998 at the Prattville location. Yields at Belle Mina increased slightly (about 200 lb/A of seed cotton) in response to

either Na or K each year. Leaf and soil analysis data are being evaluated. Gin turn out and lint quality are being determined by the Auburn Textile Engineering Department.



Potassium Requirements for Ultra Narrow-Row Cotton

Project Leader: Dr. Greg Mullins, Department of Agronomy and Soils, 202 Funchess Hall, Auburn University, AL 36849-5412

A field study was conducted at the Prattville Experiment Field. Potassium rates of 0, 30 and 60 lb K_2O/A were evaluated with cotton planted in 36 and 7.5 inch rows using conventional and no-till systems. Due to unfavorable planting conditions, the conventional row treatments were lost for 1998. Ultra narrow-row cotton (UNRC) plots were harvested for seed cotton on November 4. Yields were higher for no-tillage (1,897 lb/A) compared with conventional tillage (1,638 lb/A). Potash increased yield of no-till UNRC from 1,407 with no K_2O to 2,278 lb/A with 60 lb K_2O . Conventional tilled cotton increased from 1,248 to 2,043 for the same treatments, respectively.



Response of Cotton to the Source and Timing of Nitrogen Fertilization on a Sandy Coastal Plain Soil

Project Leader: Dr. Greg Mullins, Department of Agronomy and Soils, 202 Funchess Hall, Auburn University, AL 36849-5412

The field study was conducted at the Wiregrass Substation in Headland, Alabama, on a sandy coastal plain soil. Nitrogen as UAN solution, ammonium thiosulfate (ATS), urea, ammonium nitrate (NH_4NO_3), and ammonium sulfate [$(NH_4)_2SO_4$] was applied at rates of 90 lb N/A. The primary purpose was to evaluate cotton response to source and timing of fertilizer N applied with and without sulfur (S) and K. Bollgard 35 was irrigated. Average lint yield was 1,418 lb/A. Lint quality was not affected by any of the N treatments.

During the 1997 season, the lowest lint yields were obtained when urea was applied preplant without S. The highest yields resulted from a combination of UAN applied preplant plus S. With UAN solution (32 percent N) applied at a rate of 90 lb/A, the addition of S increased seed cotton yield from 3,267 to 3,985 and lint yield from 1,324 to 1,618 lb N/A. The highest treatment (N plus S) yielded 3,985 lb/A of seed cotton and 1,618 lb/A of lint.

Georgia



The Potential Interactions of Nitrogen and Boron in Cotton

Project Leader: Dr. Gary Gascho, Department of Agronomy, Coastal Plain Experiment Station, P. O. Box 748, University of Georgia, Tifton, GA 31793-0748. Phone: (912) 386-3329.

The multi-state project to determine effects of B on cotton at three levels of N fertilization continued for a third and final year in 1998. In 1998, cotton lint yield was near the state average where no N was applied and nearly double with the application of 60 lb N/A. Lint yield did not significantly increase above the 60 lb N/A rate. Boron increased lint yield. No significant NxB interaction was detected.

Virginia



The Potential Interactions of Nitrogen and Boron in Cotton

Project Leader and Coordinator: Dr. A.O. Abaye, Department of Crop & Soil Environ. Sciences, Virginia Tech, Blacksburg, VA 24061-0404. Phone: (540) 231-6305; fax: (540) 231-3431.

Cotton nutrition requirements for N and B are being evaluated in a regional program involving scientists at Virginia Tech, Clemson University, University of Georgia, and North Carolina State University with Dr. Abaye at Virginia Tech as coordinator. Cotton varieties including DPL-50 and others are being evaluated for response to four levels of N (0, 30, 60, 90 lb/A) and four levels of B (0, 0.5, 1.0, and 2.0 lb/A). A split plot experimental design is used with N as whole plot and B rates as subplot treatments.

Cotton responds well to N and B region-wide. However, the extent of the response varies from year to year. During 1998, there were no NxB interactions at the Virginia or South Carolina locations. However, there was an NxB interaction for leaf and petiole N and B levels. The highest yields at both locations were obtained with the combination of 60 to 90 lb N/A and 0.5 to 1.0 lb B/A. Findings support the recommendation for B rates between 0.5 and 1.0 lb/A for high yield cotton.

North Carolina



The Potential Interactions of Nitrogen and Boron in Cotton (Multi-Regional Project)

Project Leader: Dr. Steve Hodges, Dept. of Soil & Crop Sciences, North Carolina State University, Raleigh, NC. Phone: (919) 515-7307.

Cotton lint yields during 1998 were increased from 968 to 1,574 lb/A with 90 lb N/A and no applied B. With the application of 1.0 lb B/A, lint yields were increased from 1,082 to 1,519 lb/A due to the application of 90 lb/A of N. In general, field studies over three years and across locations indicate high lint yields result from the application of about 90 to 120 lb N/A and between 0.5 and 1.0 lb/A of B.



Cotton Intensive Management with Ammonium Sulfate

Project Leader: Dr. Steve Hodges, Dept. of Soil & Crop Science, North Carolina State University, Raleigh, NC. Phone: (919) 515-7307.

The objectives are to attain high yield and quality of seed cotton and to evaluate cotton response to applied S as $(\text{NH}_4)_2\text{SO}_4$. In 1998, the project experienced severe establishment problems due to moisture stress brought on by El Niño and La Niña. The project objectives will be reviewed and the field study rescheduled for 1999.

Florida



Nutritional Requirements for Optimum Cotton Yield and Quality

Project Leaders: Dr. David Wright and Dr. Fred Rhoads, North Florida Research and Education Center, University of Florida, Rt. 3, Box 4370, Quincy, FL 32351. Phone: (904) 627-9236.

Twelve replicated treatments evaluate time, rate and method of application of N, K, magnesium (Mg), B, and S for optimum yield and quality of irrigated Paymaster 1244 cotton.

Cotton lint yields ranged from 1,337 to 1,476 lb/A during 1996. On sandy, less fertile soils, 1997 lint yields ranged from 315 to 843 lb/A. Cotton lint yields with only residual soil N averaged 325 lb/A. As N rate increased to 20, 95 and 145 lb/A, lint yields increased to 447, 662 and 843 lb/A, respectively. Under 1997 growing conditions, lint yield was not improved by potassium nitrate (KNO_3) applied in four weekly foliar applications. Although not significant at the 5 percent level, lint yields tended to be higher for treatments which included S sources such as $(\text{NH}_4)_2\text{SO}_4$ and sulfate of potash-magnesia ($\text{K}_2\text{SO}_4 \cdot 2\text{MgSO}_4$). ■