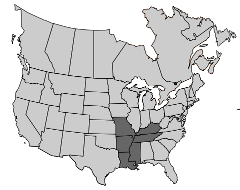
NEWS & VIEWS

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



Dr. C.S. (Cliff) Snyder,
Midsouth Director
August 1998

Research Programs in the Midsouth 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 research and extension education programs received support from PPI/FAR during the 1997 cropping season. A brief description of each project is provided.

Arkansas

Evaluation of Soybean Response to Soil Test Levels and Phosphorus and Potassium Fertilization Rates

Project Leader: Dr. W.E. Sabbe, Agronomy Department, 115 Plant Science, University of Arkansas, Fayetteville, AR 72701. (501) 575-3910.

Cooperators: Dr. Nathan A. Slaton, Dr. C.E. Wilson, Jr., and Dr. R.J. Norman.

Two studies were conducted in 1997 to determine soybean yield and leaf phosphorus (P) and potassium (K) concentration responses to 0, 0.5x, 1x and 2x times the current University of Arkansas recommended rates of P and K.

The "East" study was conducted following a 1996 soybean crop on a soil having low, medium, and high Mehlich 3 soil test levels of P (< 33, 33 to 44, and > 45 lb/A) and K (< 166, 166 to 200, and > 201 lb/A). The "West" study was conducted on plots following a 1996 rice crop on a soil with either low or high P (< 25 or > 25 lb/A) in combination with low, medium, and high K (< 135, 135 to 175, and > 176 lb/A). Soybean yield in the East study was significantly higher for the high P-high K combination compared to the low P-low K plots (38 vs. 29.5 bu/A). In plots receiving less than the 1x recommended rates of P_2O_5 and K_2O, higher yields were observed where initial soil test levels were highest. Yields increased on low P plots as initial soil test K increased. As soil test P increased, the influence of higher soil test K levels or fertilizer rate diminished. In the West study which followed rice, neither initial soil test levels nor fertilizer application rate influenced soybean yield. Soybean responses following rice to initial soil test P and K levels and to P and K applications deserve further study.

Rice Response to Phosphorus and Potassium Fertilization

Project Leader: Dr. Nathan A. Slaton, University of Arkansas, Extension Agronomist-Rice, Rice Research Extension Center, Stuttgart, AR 72160. (870) 673-2661.

Cooperators: Dr. C.E. Wilson, Jr., Dr. S. Ntamatungiro, and Dr. R.J. Norman.

Nine tests were conducted in 1997 to evaluate rice response to P and K: Three P timing tests at 0, 20, 40, and 80 lb P_2O_5/A; two K timing tests at 0, 30, 60 and 90 lb K_2O/A; three P source tests [triple superphosphate (TSP), monoammonium phosphate (MAP), and diammonium phosphate (DAP)] at 0, 40, and 80 lb P_2O_5/A with and without 1.0 lb of zinc (Zn)/A as EDTA Zn chelate; one K source test at 0, 60, and 120 lb K_2O/A with either 0 or 40 lb P_2O_5/A accompanying each K source and rate. In the K timing studies, application prior to emergence (PE), preflood (PF), or 7 days post-flood (POF) increased yields relative to the control plots, but delaying application until panicle differentiation provided no response. In the K source study, yields were not statistically different among the three sources, but numerically higher yields were obtained with KCl compared to potassium nitrate (KNO_3). Application of 120 lb/A K_2O reduced total dry matter production, but inclusion of 40 lb/A of P_2O_5 increased shoot, panicle and total dry matter production at maturity. At the 120 lb/A K_2O rate, potassium chloride (KCl) and KNO_3 reduced total dry matter yield at panicle differentiation, but potassium sulfate (K_2SO_4) did not. There was a significant K rate x P rate interaction showing that inclusion of P tended to increase dry weights of shoots, panicles, and total dry matter production where no K was applied.

Agronomic market development information provided by:
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The Influence of Nitrogen and Boron on the Physiology and Production of Cotton

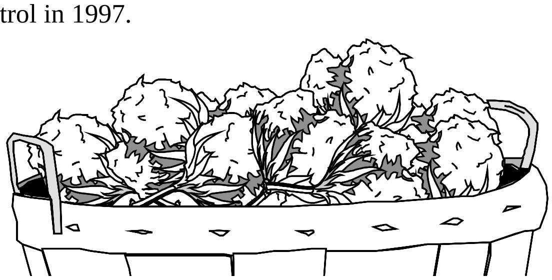
Project Leaders: Dr. Derrick M. Oosterhuis and A. Steger, Agronomy Department, 113 Plant Sciences, University of Arkansas, Fayetteville, AR 72701. (501) 575-3979.

A regional study was initiated in 1996 to evaluate the interaction of N rates and boron (B) rates on cotton yields. The 1997 Arkansas contribution involved a field study at Rohwer to evaluate: (1) The uptake and distribution of B in a representative modern cultivar (DPL 20); (2) potential benefits of B (2 lb B/A) applied (a) to the soil at planting, (b) as three foliar applications (one, two and five weeks after first flower), or (c) as a combination of soil plus foliar applications during flowering; and (3) nitrogen (N) and B interactions under both high (120 lb N/A) and low soil N (90 lb N/A) fertilization.

Cotton Response to Soil and Foliar Potassium Fertilization

Project Leaders: Dr. Derrick M. Oosterhuis and A. Steger, Agronomy Department, 113 Plant Sciences, University of Arkansas, Fayetteville, AR 72701. (501) 575-3979.

There were two studies in this project: (1) An evaluation of the effect of boll load, boll size, and soil K status on petiole K sampling and lint yield; and (2) plant response time to soil-applied and foliar-applied ESP (K_2SO_4). In the first test, low and medium Mehlich 3 soil K levels with high and low boll loads were compared. Petiole K sampling at the 4th and 8th nodes from the terminal indicated that K levels were consistently lower at node 8 except at two weeks after first flower. Sampling the petioles at node 4 may be better for plants that experience early-season stress or insect pressures that contribute to low boll loads. There was a 19 percent lint yield loss (262 lb/A) with the low soil K and high boll load treatment compared to the medium soil K and high boll load treatment, with petioles testing below 0.88 percent K two weeks after first flower in the lower yielding treatment. In the soil vs. foliar-applied K study, petiole K levels at node 4 in the soil-applied K treatment tended to be higher than in the control and the foliar-applied treatments, when averaged over three sampling dates. The single foliar ESP application failed to significantly increase lint yield or boll weight over the control in 1997.



Opportunities for Precision Nutrient Management in an On-going Regional Soybean Technology Transfer Program

Project Leader: Dr. Lanny O. Ashlock, Extension Agronomist-Soybeans, University of Arkansas, Cooperative Extension Service, P.O. Box 391, Little Rock, AR 72203. (501) 671-2278.

During the 1997 production season, three soybean fields involved in the Arkansas Soybean Research Verification Program in Chicot, Lee, and Woodruff counties were managed utilizing precision production concepts. Soil was sampled on 2.5-acre grids, and lime and/or fertilizer were applied either with a variable rate applicator (where available) or by grouping closely related areas and using conventional application equipment according to University of Arkansas soil test recommendations. At the Chicot county field, the previous best yield recorded was 38 bu/A. The field received lime and P in specific areas identified through grid sampling, using conventional spreader equipment. These same treated areas recorded the highest on-farm yield of 88 bu/A. Utilization of precision sampling and the application of lime and P resulted in a new field-average high yield of 56 bu/A.

Louisiana

Nitrogen Sources and Sulfur Fertilization of Ryegrass

Project Leader: Dr. Marcus M. Eichhorn, Hill Farm Research Station, LSU Agricultural Center, Route 1, Box 10, Homer, LA 71040-9604. (318) 927-2578.

Marshall ryegrass was planted on September 26, 1995, at the Hill Farm Research Station near Homer, Louisiana, to evaluate the effects of N sources including ammonium nitrate (NH_4NO_3), urea, and ammonium sulfate [$(NH_4)_2SO_4$], alone and in combination. Across years, the annual N-P_2O_5-K_2O rate was 275-130-395. By using the different N sources, the sulfate-S (SO_4-S) rate was varied from 0 to 280 lb S/A across years. Forage Mg concentrations were lower, and S concentrations were higher as the applied SO_4-S rate increased. Crude protein (i.e. N), P, K, calcium (Ca), aluminum (Al), Zn, manganese (Mn), iron (Fe), copper (Cu), and B concentrations in the forage were unaffected by N sources or increasing S fertilization. Urea alone proved to be the most cost-effective N source, where three applications were made per growing season to provide the desired annual N rate. Two-year average yields of 8,154 lb/A removed 278 lb N/A, 23 lb P/A, 281 lb K/A, 46 lb Ca/A, 15 lb Mg/A, and 23 lb S/A in the harvested annual ryegrass forage.

Interaction of Starter Fertilizer, Row Spacing, and Plant Population on Performance of Corn and Weed Competition

Project Leaders: Dr. H.J. "Rick" Mascagni and Dr. B.J. Williams, Northeast Research Station, LSU Agricultural Center, P.O. Box 438, St. Joseph, LA 71366. (318) 766-3769.

Row spacings of 30 and 40 inches, plant populations of 25,000 and 30,000 plants/A, starter fertilizer at 0 and 5 gallons/A of 10-34-0 applied in-furrow, and four herbicide treatments were compared in a randomized complete block, split plot, field experiment initiated in 1997 on a Commerce silt loam at St. Joseph, Louisiana. Only the main effects of row spacing, plant population, and starter fertilizer significantly affected corn yields. The starter fertilizer increased yield 4.8 percent over the control (208.9 vs. 199.4 bu/A).

Improving Efficient Use of Soil-Applied Fertilizers Using Precision Farming Technology

Project Leader: Dr. Steve Moore, Dean Lee Research Station, LSU Agricultural Center, Route 2, Box 20, 8105 E. Campus Ave., Alexandria, LA 71302. (318) 473-6520.

Field research was initiated in 1997 on a 165-acre field at the Dean Lee Experiment Station in central Louisiana to compare the profitability of site-specific application of fertilizer for soybeans to uniform application. The field was sampled on 1 and 2.5-acre grids, and a composite sample was also collected from the entire field. The field was randomly divided into 18 blocks (7.96 to 11.25 acres) to establish three replications of each soil sampling intensity/ fertilizer application treatment. Phosphorus, K and S were thought to be deficient by the cooperating private soil testing lab, and color-coded fertility and application maps were made. Fields should be yield mapped, and soil fertility maps should be compared with the yield maps before establishing treatments in large-scale tests.

Missouri

Boron Effects on Plant Nutrition and Crop Production

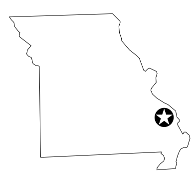
Project Leader: Dr. Dale G. Blevins, Agronomy Department, 1-87 Agriculture Building, University of Missouri, Columbia, MO 65211. (573) 882-4819.

A field test was conducted with alfalfa at Mt. Vernon, Missouri, on a Creldon silt loam to determine if B supplementation would increase alfalfa root penetration into the subsoil. This work was a continuation of greenhouse work that showed improved root penetration in a subsoil high in available Al. Soil applied B had been applied in 1996, when the alfalfa was established, at rates ranging from 0 to 10 lb B/A. Alfalfa was harvested in May, June, July, and September of 1997. No differences in forage yields were measured at any harvest during the first year of the test.

Phosphorus and Magnesium Interaction in Plants

Project Leader: Dr. Dale G. Blevins, Agronomy Department, 1-87 Agriculture Building, University of Missouri, Columbia, MO 65211. (573) 882-4819.

A study was conducted near Mt. Vernon, Missouri, to determine the effects of annual P (25 lb/A) and magnesium (Mg) (15 lb/A) fertilization on tall fescue seed production. The P (0-46-0, TSP) and Mg ($MgCl_2$) treatments were superimposed on soil P levels ranging from 20 to 133 lb of Bray 1 P/A. When the soil P level was 20 lb/A, seed yield increased from 140 to 377 lb/A, and forage yield nearly doubled with the addition of 57 lb P_2O_5/A. At the higher soil P levels, there were no large seed production increases or forage yield increases with annual P application. Applying 15 lb of Mg/A increased seed yield slightly when the soil P level was 20 lb/A, regardless of P application level. Phosphorus fertilization is important in obtaining maximum tall fescue seed yield when soil test P is below 34 lb/A. In a separate study, the interaction of soil P and soil Mg levels was evaluated. Results indicate that soil P level is much more important than soil Mg level in raising cool season, perennial forage grass leaf Mg concentrations.

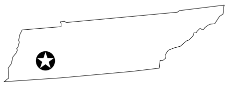


Development of Electromagnetic Induction Applications for Improved Crop Nutrient Management on Mississippi Delta Soils

Project Leader: Dr. Newell R. Kitchen, USDA-ARS, Midwest Area Cropping Systems, Water Quality Research Unit, 240 Agricultural Engineering Building, University of Missouri, Columbia, MO 65211. (573) 882-1138.

This research is evaluating the use of electromagnetic induction (EM) sensing for soil electrical conductivity as a surrogate measure of subsoil fertility. Although the majority of the soil nutrient pool is near the soil surface, subsoil levels may contribute to meeting crop needs. Three fields have been EM-surveyed in Missouri's Mississippi Delta region, and 8 to 15 sites in each field were identified as calibration points, with soil sampling to a depth of 4 feet for organic matter, pH, P, K, Ca, and Mg. When calibration points of each field were combined, there was little relationship between EM readings and P availability. Available K, Ca, and Mg in the root zone were related to soil conductivity, however.

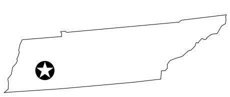
Tennessee



Soil Potassium Applications for Conventional and No-Tillage Cotton and Evaluation of Buffered Foliar Boron and Potassium Applications

Project Leader: Dr. Don D. Howard, West Tennessee Experiment Station, 605 Airways Boulevard, University of Tennessee, Jackson, TN 38301-3200. (901) 425-4748.

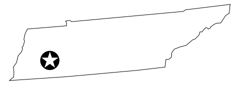
Rates of broadcast K_2O ranged from 0 to 180 lb/A in 30 lb increments at three sites which initially tested high, high, and low in Mehlich 1 extractable K, respectively. The 1997 and three-year average NT lint yields on the Lexington soil at Jackson were increased by annual K_2O applications up to 90 lb/A and by raising soil test K levels to 290 lb/A at 0 to 6 inches. Soil K appears to be concentrating in the rows over time, compared to mid-row areas, which could significantly affect no-till soil sampling strategies. If Mehlich 1 soil test K levels are low (below about 100 lb/A), annual rates of K_2O should be 120 lb/A for CT cotton and 30 lb/A higher for NT cotton. At medium to high soil test K levels, soil applied K_2O rates should range from 90 to 120 lb/A for maximum NT yields. Work on a Collins silt loam soil at Jackson to compare foliar K sprays (0, 4.4 lb of K_2O /A) with and without B, (0, 0.1 lb of B/A) and with and without spray solution pH buffering showed that foliar solutions including K tended to have higher yields than foliar B applications without K. Buffering K+B solutions to pH 4.0 tended to increase petiole and leaf K levels relative to other treatments.



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

Project Leader: Dr. Don D. Howard, West Tennessee Experiment Station.

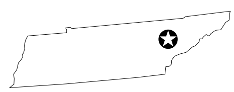
Research was initiated in 1997 at Milan on a Memphis silt loam soil to determine the no-till corn and cotton response to fertilizer solutions made from K_2SO_4 or KCl, with and without 11-37-0 plus UAN solutions as in-furrow (IF) starters. Application of 10-10-10 IF using K_2SO_4 as the K source increased corn yields to 126 bu/A compared to 108 bu/A for the check, or 102 bu/A for 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. In contrast to the NT corn, NT cotton yields were unaffected by the IF starter treatments.



Site-Specific Management of Cotton

Project Leaders: Dr. Mike E. Essington, Department of Plant and Soil Sciences, PO Box 1071, University of Tennessee, Knoxville, TN 37901-1071. (423) 974-7101; and Dr. Don D. Howard, West Tennessee Experiment Station.

In 1996, a 20-acre 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. In 1997, 16 acres were divided into 194 individual monitoring units of 40 by 90 feet. The 1997 monitoring units represented an increase in size over the 1996 units used for evaluation (182 individual units of 20 by 60 feet, 8 rows wide). Cotton yields were determined using an instrumented 4-row Case 2155 cotton picker in conjunction with a global positioning system (GPS) satellite receiver. In this study at Milan, a 1-acre grid was too large to provide an accurate assessment of soil fertility in 1996. A 0.25-acre grid appeared to provide a realistic estimate of soil fertility in the field.



Canola Response to Boron Fertilization

Project Leaders: Dr. Carl E. Sams and C. Graves, Department of Plant and Soil Sciences, P. O. Box 1071, University of Tennessee, Knoxville, TN 37901-1071. (423) 974-7101.

Nitrogen and S influence canola yield and quality. Boron may have a very important influence also. Results from greenhouse work in 1995 showed that B deficient plants produced lower quality seed with glucosinolate levels above the acceptable standard of 30 micromoles per gram. In 1996 greenhouse work, drought-stressed plants had 30 to 40 percent lower B contents in their leaves. The lower B contents were associated with a 30 percent increase in seed glucosinolate levels. Tests repeated in 1997 in root media indicated that added B was needed under the moisture stress environment to prevent an increase in glucosinolate levels. Adding B to plants under drought stress prevented increases in glucosinolate levels. ■