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, Southeast Director

July 2004
Part 2 of 2

2003 Research Program Summaries—Southeast Region: Cotton, Forages, Forestry, Citrus, and More

The Potash & Phosphate Institute (PPI) and the Foundation for Agronomic Research (FAR) provide financial and technical support for agronomic research and education projects across North America. These studies are designed to answer production agriculture questions and to provide guidance for site-specific, sustainable, high-yield management.

The summaries that follow provide a brief overview of each project. For more details, please consider contacting the research project leader. You can also view the full annual reports of each project (current and past), when available, at the website:

>**http://www.ppi-far.org/research**<.

Once at this website, click on "Continue" then click on "Expand" under North American Programs and look for projects by state abbreviation and title.

Florida

Phosphorus and Potassium Soil Test Calibration and Effects on Fresh Citrus Fruit Quality

Project Leader: Dr. Thomas Obreza, University of Florida/ IFAS, Soil and Water Science Department, 2169 McCarty Hall, Box 110290, Gainesville, FL 32611. Telephone: 352-392-1951,243, Fax: 352-392-3902, E-mail: taob@mail.ifas.ufl.edu.

Project Cooperator: Robert Rouse

This study included calibration of a phosphorus (P) soil test using Mehlich 1 and Mehlich 3 extractants, investigation of soil testing for potassium (K) to improve fertilizer K management, and determination of the main effects of P and K and interactions on yield and fresh fruit quality of grapefruit and oranges. Different P fertilizer rates prior to 2000 had established a range of soil test P levels for study. The annual K treatments were 0, 100, 200, and 400 lb K_2O/A. Soils were sampled in August each year to track soil test P and K changes. Results indicate P was "temporarily" retained by the soil, but soil test P steadily declined with time after P fertilization discontinued. The K results indicate that it is imperative that citrus growers apply K fertilizer annually to groves on these sandy soils. Tree growth, yield, and fruit quality were correlated with soil test K values or fertilizer rates. Fruit quality measurements beyond fruit size, shape, peel thickness, and juice brix/acid were expanded in 2003 to include peel color, weight loss and chilling injury during storage, juice color, and juice concentration of carotenoids and vitamin C. As K rate increased, the following increased: leaf tissue K, fruit yield, fruit diameter, a flatter and more favorable grapefruit shape, peel thickness (thinner peel is favored), juice acid, chilling injury to fruit during storage at 40° F, and grapefruit vitamin C concentration. As fertilizer K increased, beta-carotene, lycopene, and chroma concentrations of grapefruit juice declined. Low-K trees were easy to identify in the field; low-P trees were not. It was difficult to observe any detrimental effects of low soil P. A correlation between leaf P and soil test P appears to be forming. Citrus was not sensitive to P, and P fertilizer should be used judiciously. *FL-19F*

Plant Nutrition Influence on Hardlocking in Cotton

Project Leader: Dr. David Wright, University of Florida, North Florida Research and Education Center, Rt 3 Box 4370, Quincy, FL 32352. Telephone: 850-875-7119, Fax: 850-875-7148, E-mail:dlwright@mail.ifas.ufl.edu.

Project Cooperators: J.J. Marois, B. Kidd, S. Grzes, F. Borowczak, and P.J. Wiatrak

Recent research has shown that yields can be reduced by 50% or more from hardlocking in the Southeast. Fungicide

Agronomic market development information provided by:
Dr. C.S. (Cliff) Snyder, Southeast Director
Potash & Phosphate Institute (PPI)
P.O. Drawer 2440, Conway, AR 72033-2440
Phone: (501) 336-8110; Fax (501) 336-8110
E-mail: csnyder@ppi-far.org
Website: www.ppi-ppic.org/southeast

sprays during bloom decreased hardlocking and doubled cotton lint yields. Two studies were conducted on a Dothan loam at Quincy, Florida, in 2003. They evaluated the influence of: 1) calcium (Ca) applications...0 vs. 1,000 lb hydrated aglime/A...and K applications...0 vs. 180 lb K_2O/A as muriate of potash (MOP), and 2) nitrogen (N)...rates of 0, 60, 120, and 180 lb N/A as ammonium nitrate...and K applications...0 vs. 180 lb K_2O/A as MOP...on hardlock bolls in strip-till vs. harrow + turn-plow cotton tillage systems. The seedcotton (seed + lint) and lint yields of cotton decreased with the application of hydrated aglime on treatments with harrow + turn-plow tillage (934 vs. 794 lb lint/A), while yields increased with the aglime application on treatments with strip-till (864 vs. 1,040 lb lint/A). Higher seedcotton yields, over aglime and K applications, were obtained from strip-till treatments compared to harrow + turn-plow (952 vs. 848 lb lint/A). Lint yields and percentage of lint were not influenced by tillage, aglime, and K applications. Higher seedcotton and lint yields were obtained with application of 60, 120, and 180 lb N/A compared to treatments without N (894, 1,009, and 966 vs. 718 lb lint/A, respectively). Lint percentage was highest with the application of 0 and 60 lb N/A (46 and 45.3% lint vs. 44.8 or 44.6% lint, respectively). Lint yields and lint percentage of cotton were not influenced by tillage and K application. Data on the number and percentage of hardlock bolls and fiber quality are still being analyzed. *FL-20F*

Evaluation of Nitrogen-Source Fertilizer Treatment on Warm Season Grass Forage Production

Project Leader: Dr. M.B. Adjei, University of Florida, IFAS-RC Research and Education Center, 3401 Ext. Station, Ona, FL 33865. Telephone: 941-735-1314, E-mail: mba@ifas.ufl.edu.

Project Cooperators: H.K. Pant and J.E. Rechcigl

Field experiments were conducted at four sites on two warm season grasses in Florida to compare the effects of various sources of N fertilizer on forage production and tissue mineral concentrations. The five N-source treatments were: one application of 60 lb N/A on bahiagrass and two applications of the same rate (total of 120 lb N/A) on limpograss, from 1) ammonium nitrate, 2) ammonium nitrate + elemental sulfur (S), 3) ammonium sulfate (AS), 4) calcium nitrate, and 5) a control of no N. Nitrogen was applied in May and forage was harvested repeatedly on a 30 to 35 day schedule between June and November, 2003. Bahiagrass annual forage yield (5.8 to 9.4 tons/A) varied inconsistently among the N-sources, but yield was generally reduced (6.2 to 7.6 tons/A) with no N. Limpograss forage yield was consistently highest (4.5 to 5.8 tons/A, depending on site) when AS fertilizer was used compared to the other N-sources (3.6 to 4.9 tons/A), especially for the harvests immediately following N application. Limpograss yield without N ranged from 1.8 to 3.1 tons/A. Sulfur concentration in forage tissue was never altered by the inclusion of that element in the N-source, but varied among sites. Bahiagrass showed little response to S, but the results indicate that sulfate-S from AS could enhance limpograss production without deleterious increase in tissue S concentration. *FL-21F*

Georgia

Enhancing Pine Straw Production, Wood Volume, and Product Class Distribution with Fertilization of Old-field Planted Slash and Loblolly Pine Stands

Project Leader: Dr. E. David Dickens, University of Georgia, Warnell School of Forest Resources, PO Box 8112, GSU, Statesboro, GA 30460. Telephone: 912-681-5653, Fax: 912-681-0180, E-mail: ddickens@arches.uga.edu.

Project Cooperator: David Moorhead

Slash and loblolly pine growth response to fertilization [no fertilizer, N+P, N+P+K, N+P+K+magnesium (Mg)+ S+copper (Cu)+boron (B)] under intensive management was evaluated at three locations in Georgia. The 2- and 3-year growth and yield responses of slash (Dodge County and Toombs County) and loblolly (Washington County) pines to fertilization were determined in 2003. Mortality following the one-time fertilizer treatment was much greater on the fertilized plots (9 to 21%) than the control at the Dodge County site, but only slightly greater than the control plots at the Toombs and Washington County sites. Fertilization significantly improved diameter, volume per tree (Dodge County site thinned slash), and height growth (Washington County site thinned loblolly) per tree. Fertilization increased pine straw production 1 ½-years (Toombs County site, unthinned slash) and 2-years (Dodge County, thinned slash pine) post fertilization. The fertilizer benefit to pine straw production was not apparent three years after treatment at either of the slash pine sites. Initial trends are: (1) an increased diameter growth increment with NP and NPK treatments at the Dodge County site or all three fertilizer treatments at the Washington County site, (2) increased height increment for two of the three fertilizer treatments at the Dodge County site or all three fertilizer treatments at the Washington County site, (3) increased volume/tree growth increment of five (Toombs County site, NPKMgSCuB treatment), 11 (Washington County site, NP treatment), and 18% (Dodge County, NPK treatment). This study needs to be continued for at least five more years to determine the longer-term benefits of fertilizing old-field planted loblolly and slash pine. It would be premature to draw any major conclusions at this point. Diameter distribution changes will be quantified 4 and 5 years after fertilization. *GA-21F*

Agricultural and Environmental Studies between the University of Georgia and Costa Rica

Project Leader: Dr. Jerry Johnson, University of Georgia, Crops and Soil Science, 0262 Redding, Griffin, GA 30223-1797. Telephone: 770-228-7321, E-mail: jjohnso@gaes.griffin.peachnet.edu.

Project Cooperator: Ann Nunan

The goal of this Agricultural and Environmental Studies project is to provide sound, agronomic educational materials and experiences for teachers amd students. The project objectives are to develop: 1) an interdisciplinary, agricultural staff development course for teachers, and 2) effective agronomic learning resources with a "real world" and relevant perspective. The project significantly contributes to PPI/PPIC/FAR endeavors wherein teachers and students have been provided agronomic educational materials and experiences. The program provides students a factual, practical, and realistic understanding of the use of P and K in agriculture. The course emphasizes that practices concerned with sustaining agriculture with appropriate soil amendments are necessary to produce food and fiber for the increasing world population, and that these practices are environmentally friendly.

Education on industry research with soil testing and proper use of P and K helps put in perspective concerns about the "devastating" effects of agriculture on the rain forest and waterways of Costa Rica. Accomplishments include: development of an educational unit of study on the production and consumption of bananas; the collection of information and data for agricultural and environmental educational resources in Costa Rica; the development of the interdisciplinary/agricultural teaching model for providing staff development opportunities for teachers; and a presentation at the 2003 American Society of Agronomy Annual Meeting. An agricultural and environmental studies booklet concerned with an integration of Costa Rican culture and agriculture has an anticipated completion date in 2004. The "learner friendly" booklet with its real world perspective will be a high interest publication that can be used in informal, nonacademic settings. *GA-22F*

Sulfur Nutrition for Cotton in the Southeast

Project Leader: Dr. Glen Harris, University of Georgia, Crop and Soil Sciences, 0227 Rural Development Center, Tifton, GA 31793-1209. Telephone: 912-386-3194, E-mail: gharris@arches.uga.edu.

The current University of Georgia (UGA) Extension recommendation for S fertilization of cotton is 10 lb/A. The objectives of this research are to determine the optimum S application rate, timing, and source for high-yielding cotton in Georgia. Research was conducted at two locations in Georgia in 2003: 1) the Sunbelt Expo site in Moultrie, which is center-pivot irrigated on a Dothan loamy sand, and 2) the UGA Southeast Experiment Station in Midville on a Fuquay sand. The experimental treatments at both sites were: 1) 0 S/A , 2) 10 lb S/A using ammonium sulfate (AS) at planting, 3) 20 lb S/A using AS at planting, 4) 30 lb S/A using AS at planting, 5) 20 lb S/A using 5-10-15 at planting, 6) 10 lb S/A using AS at sidedressing, 7) 20 lb S/A using AS at sidedressing, 8) 30 lb S/A using AS at sidedressing, and 9) 20 lb S/A using ammonium thisosulfate at sidedressing. All plots received 26 lb N/A at planting, and the N not provided in the S treatment was made up with ammonium nitrate. Sidedressing S treatments (6-9) were made using an 8-0-0-9(S) liquid made with AS and urea-ammonium nitrate (UAN) solution. The balance of N on the treatment was made up by using 32% UAN. All plots also received 80 lb K_2O/A preplant. There was no significant yield response to S at either location in 2003, although there was a tendency for higher yields with S. Lint cotton yields averaged 1,230 lb/A at Moultrie and only 601 lb/A at the dryland Midville site. Excessive rains may have limited yield potential in 2003. Tissue S levels at Moultrie on June 27 showed a significant increase with S fertilization, but later sampling failed to show differences among treatments. *GA-23F*

Enhancing Thinned Slash Pine Volume Production and Product Class Distribution with Competition Control and Fertilization on Flatwoods Spodosols

Project Leader: Dr. E. David Dickens, University of Georgia, Warnell School of Forest Resources, PO Box 8112 GSU, Statesboro, GA 30460. Telephone: 912-681-5653, E-mail: ddickens@arches.uga.edu.

Project Cooperators: David Moorhead, Coleman Dangerfield

The effects of mid-rotation mechanical (M) and chemical (H) competition control, fertilization (F), dolomitic liming (L), and combinations of M+F, H+F, and L+F in thinned slash pine stands on common flatwoods soils will be quantified over a 5- to 8-year period (time to next thin or clearcut). Studies were established in Ware and Wayne counties in Georgia in 2002 and 2003 in thinned slash pine stands (4th or 5th row + select). All living trees in each plot were aluminum tree tagged at 4.5 ft. for consistent diameter at breast height (d.b.h). measurement, numbered, and measured for d.b.h., total height, height to base of live crown, height to fork, stem canker or other defects, and merchandised into product classes prior to treatments. Baseline soil (0 to 6 in.), foliage (three dominant trees/plot), and leaf area index estimates (digital photos and ocular) have been collected. Plot treatments were randomly assigned with blocks (three replications) by topography (soil moisture), trees/A, and basal area. The N, P, and K

treatment was 250 lb of diammonum phosphate, 465 lb of ammonium nitrate, and 100 lb of muriate of potash (200-115-60, N-P_2O_5-K_2O on February 25, 2003 in Ware County and March 8, 2002 in Wayne County). Dolomitic lime (2 t/A) was applied at the Ware County site to provide Ca and Mg. The herbicide treatment, applied in October 2001 in Wayne County and 2002 in Ware County, was 32 oz. Chopper plus 16 oz. Garlon 4. At the Wayne County site, re-measurement of all living tagged trees in each plot d.b.h., total height, and height to base of live crown, and surface soil and foliage sampling were completed. A field day was conducted in July 2003, with sponsorship by BASF and Helena, at the Ware County site. There were 20 professional foresters present. *GA-24F*

Louisiana

Potassium Requirements of Cotton Cultivars

Project Leader: Dr. Joel Faircloth, formerly with Louisiana State University, Northeast Research Station, PO Box 438, St. Joseph, LA 71366. Telephone: 318-766-3769, Fax: 318-766-4278, E-mail: jfaircl@vt.edu.

A non-irrigated study was initiated in 2001 at the Northeast Research Station at St. Joseph, Louisiana. Eight cultivars were evaluated at four annual K rates (0, 50, 100, and 150 lb K_2O/A) on a Commerce silt loam with high extractable K levels, using new plot locations each year. In 2001, abundant precipitation prior to harvest confounded results as few significant differences among treatments were observed. No K response and no cultivar interaction were obtained for yield or fiber traits. In 2002, significant yield and earliness responses to K were observed as well as cultivar interactions. Potassium rates of 50-100 lb K_2O/A optimized production in most cultivars in 2002. Potassium typically delayed crop maturity. Fiber traits were unaffected by K fertilization. Performance of cultivars 'Deltapine 428 B,' 'Stoneville 474,' and 'Stoneville 4892 BR' were optimized at 100 lb K_2O/A, whereas 'Stoneville 580' and 'Deltapine 458 BR' productivity peaked with 50 lb K_2O/A. In 2003, significant differences were observed among varieties with respect to yield, turnout, earliness, trash particle count, fiber length, fiber strength, uniformity, short fiber index, elongation, and micronaire. There was also a significant strength interaction between K and variety. Yields in 2003 were highest of all three years, with an average of 1,364 lb lint/A. In one of the three years this study was conducted, there was a significant response to K fertilization for one parameter examined. The lint strength interaction observed in 2003 was inconsistent with the observations in 2001 and 2002. The yield and fiber quality responses would likely be different if the study were conducted on a soil that had lower K fertility. *LA-19F*

Missouri

Soil-Specific Phosphorus and Potassium Recommendations – Critical Values, 2003

Project Leader: Dr. John Lory, University of Missouri, Department of Agronomy, 214 Waters Hall, Columbia, MO 65211. Telehone: 573-884-7815, Fax: 573-882-1467, E-mail: loryj@missouri.edu.

Project Cooperators: Peter Scharf, Peter Motavalli, Newell Kitchen

The soil test critical value is the target soil test level for optimum crop growth. When soil test levels are below the critical value, crop yield and/or quality may be restricted by nutrient availability in the soil. Our previous research has shown differences in soil test buildup rates among Missouri soils for both P and K. Preliminary analysis based on greenhouse data indicated that there were significant differences in the P buildup rate among the major soil regions in the state. These differences raise the possibility that there may be differences among soils in the critical value. The objective of this project is to determine if there are predictable differences in critical values for P and K among Missouri soils. If we demonstrate clear differences in soil test critical values among soils in the greenhouse, we will request support for field studies with the objective of incorporating soil specific critical values into Missouri's soil test recommendation system. *MO-21F*

Tennessee

Effect of Soil Phosphorus Level on Magnesium Content in Tall Fescue Forage

Project Leader: Dr. Gary Bates, University of Tennessee, Plant Sciences and Landscape Systems, 2431 Center Drive, Knoxville, TN 37996-4561. Telephone: (865) 972-7208, E:mail: gbates@utk.edu.

Project Cooperators: Gaylon Morgan, Hugh Savoy, Lee Ellis, Sally Mueller

Research in Missouri has indicated that adequate soil P levels may improve the Mg content of tall fescue forage. To investigate this in Tennessee, a 33-acre field of Kentucky 31 tall fescue near Knoxville was divided into 100 sq. ft. grids (about 144 grid cells). Soil samples were taken from each grid in late November/early December of 2002. Soil pH and Mehlich 1 extractable P, K, and Mg were analyzed and 45 grids were selected, based on the results, to provide grids with various combinations of P and Mg soil fertility levels. In early February of 2003, the field was fertilized with 60 lb N/A as ammonium nitrate. Forage samples were

hand-clipped from each grid in late March, and analyzed for Mg level. Regression analysis of the data was used to determine the most influential factor affecting the concentration of Mg in tall fescue forage. Data from the first year indicated that soil pH was the most influential factor associated with tall fescue tissue Mg level. This first year, the best equation to predict tall fescue Mg level was a single variable pH equation: % Mg in tall fescue tissue = -0.254 + 0.0925 x soil pH. This regression equation explained 42% of the variation in fescue Mg concentration (r^2 =0.42). Similar procedures will be followed in 2004 to collect a second year of data. Data will be combined to more successfully determine the effect of soil P on tissue Mg level. *TN-16F*

Soil Potassium Requirements for Hybrid Bermudagrass Production

Project Leader: Dr. Hubert Savoy, University of Tennessee, Biosystems Engineering and Environmental Sciences, 2506 EJ Chapman Dr., Knoxville, TN 37996-4531. Telephone: 865-974-8840, E-mail:hsavoy@utk.edu.

Project Cooperators: Gary Bates, Rick Carlisle, Marshall Smith, Debbie Joines

An experiment to evaluate K needs for production of Tifton 44 hybrid bermudagrass hay was established in April 2002 on a Loring silt loam soil at Ames Plantation Experiment Station in west Tennessee. In spring 2002, the soil (0 to 6 in.) pH was 5.6, Mehlich 1 P was very high, and Mehlich 1 soil K was 152 lb/A. Six K rates (0, 50, 100, 150, 200, 250 lb K_2O/A) were spring-applied as muriate of potash. Plots received 100 lb N/A initially and after each harvest (total of 400 lb N/A for the season) as ammonium nitrate. There were no significant differences in yields among K rates in 2002 at any of the individual harvest dates, or for the total harvested dry matter during 2002. Total dry matter yields ranged from 5.27 to 5.83 t/A. The study was repeated on the same plots with the same K rates in 2003. Forage was harvested on May 30, June 30, August 1, September 4, and September 26, 2003. As in 2002, there were no significant differences in forage dry matter yields among K rates at any of the individual harvest dates, or for the total harvested dry matter (10.89 to 12.11 t/A). Yields were higher in 2003 because of abundant rainfall. In the spring of 2003, the 0 to 6-in. Mehlich 1 soil K levels were below 120 lb/A...levels considered relatively low with an expected forage response to K fertilization. It is possible that historic use of animal manure on the site may have raised subsoil K levels, and that high subsoil K fertility may have overshadowed the influence of surface K applications. *TN-17F*

Nitrogen and Potassium Effects on Physiology and Yield of Contrasting Cotton Varieties

Project Leader: Dr. C. Owen Gwathmey, University of Tennessee, West Tennessee Experiment Station, 605 Airways Blvd, Jackson, TN 38301-3200. Telephone: 901-424-1643, E-mail: cogwathmey@utk.edu.

Project Cooperators: C.C. Craig, Jr., Carl Michaud, Tracy Bush

Modern, physiologically-determinate cotton varieties, in which bolls are set during a shorter time period, may require more K than relatively indeterminate varieties. Specific objectives of three interrelated studies conducted in 2003 were to evaluate effects of N and K nutrition on biomass partitioning and yields of contrasting cotton varieties on a Memphis-Loring silt loam at Jackson, Tennessee, using long-term no-till K fertility plots. Three experiments included: (1) variety response to K; (2) variety response to N at different K levels; and (3) response of an indeterminate variety to K fertility extremes. As expected, more biomass was partitioned to reproductive structures in the early, determinate PM 1218 BG/RR than the more indeterminate DP 555 BG/RR. While the absolute change in biomass ratio did not differ between varieties or K treatments, the relative change was higher in DP 555 BG/RR under higher K fertility. The higher K treatment (120 lb K_2O/A/yr) tended to increase total lint yield relative to 60 lb K_2O/A/yr, but there was significant K x variety interaction. Higher K fertility significantly increased total lint from PM 1218 BG/RR, but not from DP 555 BG/RR. The higher K treatment did not significantly delay maturity of either variety as measured by first harvest percentage, relative to 60 lb K_2O/A/yr. Nitrogen fertilization did not affect lint yields or earliness in this study, nor were there significant interactions with N fertility. Total lint yields of DP 555 BG/RR were higher with 150 to 180 lb K_2O/A than with 0 or 30 lb K_2O/A/yr. However, the higher K rates significantly delayed total crop maturity of this indeterminate cultivar. The later maturity induced by high K nutrition in DP 555 BG/RR did not incur a weather-related (frost) yield loss in 2003. *TN-19F* ■

RN 04076
Part 2 of 2

*Note: Additional summaries with information on various other crops in the Southeast Region appear in a separate issue of *News & Views: 2003 Research Summaries—Southeast Region: Soybeans, Site-Specific Management, and Rice*.

Potash & Phosphate Institute (PPI)
655 Engineering Drive, Suite 110
Norcross, GA 30092-2837

NEWS & VIEWS

Southeast Region
July 2004