

NEWS & VIEWS

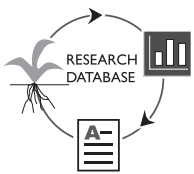
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Dr. C.S. (Cliff) Snyder,
Southeast Director
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2002 Research Program Summaries—Southeast Region Cotton and Rice

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.

Arkansas



Yield Response of Dryland and Irrigated Cotton to Potassium Fertilization: A Four-year Summary

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Project Cooperator: Dennis Coker

Cotton lint yield response to high [with recommended soil-applied potassium (K)] and low K regimes (without recommended K), were determined—under irrigated and dryland conditions, with and without foliar-applied K



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treatments at Clarkedale (250 lb/A Mehlich 3 soil K) and Rohwer (> 300 lb/A Mehlich 3 soil K) in eastern Arkansas. Foliar potassium nitrate (KNO₃) was applied for four consecutive weeks starting one week after first flower, using 10 lb of KNO₃ in 10 gal. of water/A/application. Lint yields and yield components were measured, and plant water status, growth, photosynthesis rate, and K concentration in organ tissues were monitored at pinhead square, first flower, three weeks after first flower, and five weeks after first flower.

This research has shown that the preplant soil K status should be strongly considered when making decisions about foliar K fertilization. These current studies show significant responses to foliar-applied K where preplant Mehlich 3 soil-K levels were just under 250 lb/A, in support of previous findings by these scientists. The results also show that the potential for cotton lint yield response to foliar-K feeding under dryland conditions differs little from the potential under irrigated conditions in the Mississippi Delta. Soil-applied K fertilizer was beneficial to cotton lint yields produced under irrigated but not necessarily dryland conditions where the preplant soil test K values ranged from medium to high. Hence, the use of preplant soil-applied K may be particularly important to cotton yield under irrigated conditions, whereas foliar-applied K (stimulating root uptake of soil K) can be beneficial to cotton lint yield under dryland or irrigated conditions depending on preplant soil test K values. AR-13F



Influence of Nitrogen Fertilizer Source, Application Rate, and Timing on Grain Yields of Rice

Project Leader: Dr. Rick Norman, Crop, Soil and Environmental Sciences Department, University of Arkansas, 115 Plant Science Bldg, Fayetteville, AR 72701, Telephone: 479-575-5738, E-mail: rnorman@comp.uark.edu

Project Cooperators: N.A. Slaton, C.E. Wilson, Jr., D.L. Boothe and B.R. Griggs

Many rice farmers have a difficult time getting drill-seeded fields flooded in less than 5 to 10 days after the pre-flood nitrogen (N) application. This study was

conducted to determine if ammonium sulfate (AS) is a better N source than urea (U) when applied onto the soil surface a week or more prior to flooding. Rice was grown on a Calloway silt loam (pH 7.3 to 8.3) to compare U and AS at five fertilizer rates (0, 60, 90, 120, and 150 lb of N/A) applied at four different timings: all pre-flood N either 21, 14, or 7 days before flooding, or one day prior to flooding.

The 2001 results coupled with results from 1999 and 2000 showed that if a farmer can not flood a field in a timely manner (less than 14 days) after the pre-flood N application, it would be prudent to use AS in place of U, even if at times the U application has to be increased by 30 lb N/A, because it takes too long to establish a flood. Work was continued in 2002 using U, Agrotain®, AS, AS + U, and AS + Agrotain® at three N rates (0, 60, and 120 lb/A), at three times: 10, 5, or one day before flooding. Ammonia volatilization was measured for the sources at the 120 lb N/A rate and ranged from 0 to 25% of the applied N. Volatilization losses were greatest with U, while Agrotain®, NBPY, a urease inhibitor, AS, and AS + Agrotain® had the highest grain yields and least ammonia volatilized when N was applied 5 to 10 days before flooding. *AR-18F*



Fertilizing Rice-Based Cropping Systems to Achieve Maximum Yields While Maintaining the Natural Resource Base

Project Leader: Dr. Merle Anders, Rice Research and Extension Center, University of Arkansas, P.O. Box 351, Stuttgart, AR 72160, Telephone: 870-673-2661, E-mail: rrec_manders@futura.net

A long-term cropping systems study was initiated in 1999 on a silt loam soil near Stuttgart, Arkansas. The field was leveled and 10 cropping systems (rice, corn, soybean, wheat in different combinations/rotations) were established using conventional tillage practices with four replications. In 2000, the plots within each cropping system were split into conventional tillage and no-tillage treatments. Each tillage treatment was split into two fertilizer treatments: 1) standard recommended fertilizer according to soil tests, and 2) an enhanced treatment, consisting of approximately 20% more N-P₂O₅-K₂O than the standard.

There were visual differences between the two fertility treatments in 2000, but no significant effects on yield. Enhanced soil fertility caused rice yields to increase 6 bu/A and corn yields to increase by 5 bu/A in 2001, but provided no advantage for soybeans. In 2002, the overall grain yields for the higher fertility treatment were 9 bu/A greater for full-season rice, 15 to 20 bu/A higher for short-season rice, 4 bu/A higher for wheat, 3 bu/A greater for Group IV soybeans, and 6 bu/A higher for Group V soybeans. There was an overall 3 bu/A reduction in corn grain yields when comparing the enhanced fertility with standard fertility levels across tillage and hybrid variables. However, this

loss was not consistent with tillage. There was a 10 bu/A gain in corn yield for the enhanced fertility treatment in no-till plots and a 13 bu/A loss in grain yield for the same comparison in the conventional-till plots. Yield gains from increased fertility in the no-till plots were only for the variety DKC69-70, which did not perform well in the study. Soil samples were collected from each plot in 1999 before the study, and again in 2000 and March 2002. *AR-20F*



Effect of Phosphorus Fertilizer Rate and Application Time on Rice Growth and Yield

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Project Cooperators: Chuck Wilson, Jr., Russ DeLong, Richard Norman

Three studies were conducted (one in 2001 and two in 2002) to examine drill-seeded rice growth, nutrition, and yield response to phosphorus (P) application rate and time. The three sites represent high pH silt loam soils (> 7.5) with a range (8 to 41 parts per million) of Mehlich 3 extractable P (PTBS-2001 = low, Cross-2002 = medium, and Cross-2002 = high). Significant yield responses were observed only in the 2001 study. However, tissue P concentrations have tended to increase as the time of P fertilizer application during vegetative growth was delayed at two of the three sites. This provides solid evidence that P application time is critical for efficient plant uptake of applied P fertilizer. The data clearly demonstrate that a rather complex (i.e., multiple soil chemical properties) recommendation will be needed to accurately predict where P fertilization is required to optimize plant growth and yield since responses do not follow a logical trend of the Mehlich 3 extractable P and soil pH of these study sites.

The most consistent plant growth variable that may show promise to correlate and eventually calibrate rice response to P fertilization is tissue P concentration during early-vegetative growth. When plant tissue P concentration is low (less than 0.20% P) a positive growth and yield response is more likely to occur than when tissue P concentrations are high. The critical P concentration may actually be lower than 0.20% P (less than 0.15 %). The information from these studies will be most useful when rice response to P fertilization can more accurately be predicted since efficient plant uptake will be critical under these situations. These data will also serve as valuable points in the correlation process. Until soil chemical properties are accurately correlated with tissue P concentrations, growers should continue to apply P based on current soil test recommendations at the time which best suits their crop management system. *AR-22F*



Rice and Soybean Response to Soil and Foliar Boron Applications

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Project Cooperators: Leo Espinoza, Morteza Mozaffari

Five irrigated studies were conducted in 2002 investigating boron (B) fertilization of soybean and rice in eastern Arkansas. One soybean foliar B study was located at the Pine Tree Branch Station (PTBS) near Colt, (soil pH 7.9 and Mehlich 3 B 0.9 parts per million) to evaluate effects of foliar B rate (0, 0.25, 0.50, 1.0, and 2.0 lb/A) and timing (V3/V4 and R2 growth stages) on the yield of soybean where rice was the previous crop in 2001. Solubor® was the B source and was applied in a solution at 10 gal/A. Two preplant soil-applied B studies were conducted with soybeans: one at the PTBS and the other at the Rice Research and Extension Center (RREC) near Stuttgart. The soil at the PTBS site was a Calhoun silt loam and the soil at the RREC was a DeWitt silt loam. The RREC site received 4 tons/A of aglime in March 2002, to raise the pH above 5.5. The B rates were preplant applied as foliar sprays (10 gal/A) at 0, 1, 2, 4, 6, and 8 lb B/A. One rice study was also conducted at the PTBS to evaluate four B rates (0, 0.33, 0.67, 1 lb B/A) and four timings (preemergence, pre-flood, late-tillering and late-boot stage). A second study was conducted at the RREC to evaluate the effect of B (0, 0.5, 1, 2 and 4 lb B/A) on straighthead of rice (induced by elevated soil arsenic) using Wells (moderately susceptible) and Cocodrie (very susceptible) varieties.

Although soybean yields were considered very good (more than 66 bu/A at PTBS and more than 44 bu/A at RREC), yields did not respond to foliar B rate, time of application or the interaction. Neither was there a significant response by soybeans in the two soil-applied B studies, but there was a trend for soybean yield reduction where the B rate exceeded 4 lb/A.

Boron applied to the soil at the time of seeding failed to increase rice yield compared to the unfertilized control (158 bu/A). Boron applied to rice foliage at late tillering, approximately seven days before panicle initiation, produced significantly higher yields (166 bu/A) than the unfertilized control and preplant applications, but was not significantly different than B applied pre-flood (164 bu/A) or during the boot stage (162 bu/A). The time of B application may be critical to obtain significant rice yield increases from B fertilization, but additional data are needed to verify the consistency of such a response. Boron fertilization did not influence rice yield or straighthead severity at the RREC, but, based on the PTBS results, the lack of response could potentially be attributed to the time of B application.

Plant tissue analyses are pending from these studies.
AR-23F

Florida



Influence of Tillage System, Potassium and Nitrogen on Hardlock Bolls in Cotton

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

Hardlock of cotton is a widespread problem in the southeastern U.S. Symptoms do not appear until the boll opens and the fiber does not fluff out, remaining instead compact and somewhat within the boll. Although the quality of the fiber is not severely affected, yields are reduced because conventional cotton pickers cannot harvest the fiber in the hardlocked bolls. The etiology of the disease is still undetermined. However, it is associated with high N, high temperature and humidity, high plant density, insect damage, and seed rot. Recent research has shown that yields can be reduced by 50% or more from hardlocking in the Southeast. Fungicide sprays during bloom decreased hardlocking and doubled cotton lint yields. This study was conducted on a Dothan loam at Quincy, Florida, in 2002 to determine the influence of tillage (strip-till, harrow plus turn-plow), K application (0, 180 lb K₂O/A), and N application (0,60,120,180 lb/A) on cotton nutrition, yield and hardlocking.

There were significant interactions among N, K and tillage treatments on plant nutrition at different sampling dates. In general, plant tissue K concentration tended to increase with N rate, while calcium (Ca) concentration remained similar at 0 to 120 lb N/A, but tended to decline at the 180 lb N/A/ rate. The number of open bolls at different main stem nodal positions was affected by the interaction of N and K. The K rate did not affect total number of open bolls, or open bolls at the 1st, 2nd, 3rd and 5th nodal positions. Generally, N rate did not affect total number of open bolls, except at the 5th position. The number of hardlocked bolls at the 3rd nodal position and the number of open plus hardlock bolls decreased significantly with K application. The percent of cotton lint picked at the first harvest (November 1) was significantly lowered (45.0 vs. 43.3%) with K addition, but there was no significant effect at the second harvest (December 2). The trash and yellowness values of the lint increased significantly as N rate increased above 60 lb/A. Addition of K did not significantly affect any of the lint parameters, nor was there an interaction between N rate and K rate on color grade,

leaf grade, extraneous matter, micronaire, length/staple, strength, uniformity, reflectance (color RD), and high volume instrumentation (HVI) color of the lint. *FL-20F*

Georgia



Evaluation of Potassium-Magnesium Sulfate at Varying Soil pH Levels for Providing Magnesium Nutrition to Cotton

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Long-term aglime plots on two Coastal Plain soils were used to determine the length of time required for lime to affect subsoil pH, calcium (Ca), and magnesium (Mg) when it is applied on the surface in a strip-till system. A second objective was to determine if strip-tilled cotton responds to surface applications of potassium-magnesium sulfate ($K_2SO_4 \cdot 2MgSO_4$; K-Mag) across soil pH levels. The established pH levels range from 4.6 to 6.4 (0 to 6 in. depth). The lowest pH plots on a Pelham sandy loam soil have been very yield-limiting in the past several years. In 2001, one subplot was limed with dolomite according to University of Georgia recommendations in both the no-aglime and low-aglime plots for the Pelham soil and in the no-aglime main plots on the Tifton soil.

In a period of one year, surface aglime application had no effect on soil pH, Ca, or Mg below the 6-in. soil depth. In the plots on Pelham soil, which had received no aglime in the previous 30 years, soil pH increased from 4.6 to 5.5, Ca increased from 95 to 280 parts per million (ppm) and Mg increased from 10 to 23 ppm in the top 6 in. due to the addition of 2 tons of aglime/A in 2001. However, cotton lint yield was increased only slightly by surface additions of dolomite. Yields were approximately 600 lb/A less than in the main plots maintained at higher soil pH levels for 30 years. In 2002, $K_2SO_4 \cdot 2MgSO_4$ increased leaf Mg regardless of soil or soil pH. However, some lint yield response was noted at the higher pH levels and not where pH was lower than recommended. The results suggest that neither surface-applied aglime nor $K_2SO_4 \cdot 2MgSO_4$ is a quick fix when liming recommendations have been ignored for many years. Low soil pH should be corrected by incorporating aglime prior to the beginning of strip tillage. Lint yields were increased by application of $K_2SO_4 \cdot 2MgSO_4$ for the recommended soil pH levels, but not where pH was lower than recommended. In soils with a recommended pH, $K_2SO_4 \cdot 2MgSO_4$ provides plant-available K, S, and Mg. *GA-20F*

Louisiana



Potassium Requirements of Cotton Cultivars

Project Leader: Dr. Steve Hague, (now with Bayer Crop Science) formerly with Northeast Research Station, Louisiana State University, P.O. Box 438, St. Joseph, LA 71366, Telephone: 318-766-3769

A study was initiated at the LSU Ag Center's Northeast Research Station at St. Joseph, to determine if variation existed among eight cotton cultivars for K utilization. Eight cultivars were evaluated at four K rates (0, 50, 100, and 150 lb. K_2O/A) on Commerce silt loam with a low to moderate K deficiency based on LSU soil sample analysis (180 parts per million ammonium acetate-extractable). Cotton was non-irrigated and managed according to LSU recommendations. Plots were harvested twice to determine earliness. Fiber samples were analyzed at the LSU Cotton Fiber Lab in Baton Rouge.

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. Rates of 50-100 lb K_2O/A optimized production in most cultivars. 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 . *LA-19F*



Economics of Cotton Quality Responses to Soil-applied Potassium Fertilization

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Project Cooperators: Jac Varco, Owen Gwathmey, Derrick Oosterhuis, Bill Pettigrew

Cotton growers recognize the strong K demand by cotton and the need for adequate K in producing profitable yields. In spite of the research-proven yield increases with good K management, some growers are concerned about delayed maturity, increased trash (leafiness in harvested lint), and the potential impacts on overall crop value. Recent wet and stormy harvest seasons have intensified grower concerns about timely maturity and economic returns from K fertilization. In an attempt to address these concerns, cotton yield and fiber quality response data were

collected from past and on-going K studies in Arkansas, Louisiana, Mississippi, and Tennessee. The data were initially grouped according to the applied K rate (none, medium, high). Preliminary results failed to show a significant lint response because the data were confounded by variability in the initial soil test K levels: half of the studies were conducted on soils testing high in K. Other fiber trait complications arose because of differences in ginning and cleaning of the lint among studies. As a result, it will be necessary to assume all fiber quality traits were equal except for staple, strength, and micronaire. The economic benefits associated with K fertilization across these locations and years will be evaluated after sorting the data by initial soil test K level. LA-20F



Boron Studies with Rice in Southwest Louisiana

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The effects of boron (B) rate (0, 0.33, 0.67, 1.0 lb/A) and timing (preplant, preflight, midseason) on drill-seeded rice B nutrition, panicle development, and yield were studied at two locations on silt loam soils in southwest Louisiana in 2002. Solubor® was the B source. Both sites had a soil pH above 6.9, Bray P-2 was less than 14 parts per million (ppm), and ammonium acetate extractable K was below 62 ppm. Both sites received 60 lb of P₂O₅/A and 60 lb of K₂O/A preplant incorporated. Nitrogen management was according to LSU recommendations for the Wells variety at both locations.

No clear trends in tissue B concentration were determined at panicle initiation (before the midseason application) or in the flag leaf at the late boot stage at either site. At the first site, B applied at midseason significantly increased filled grains when compared with the preplant application timing. However, the main harvest, ratoon harvest, and the total harvest yields were not significantly affected by B rate or timing. At the second site, an application of 1.0 lb B/A significantly reduced blanks in the panicle when compared with the control, but grain yield was not affected. Yields at both locations exceeded 8,400 lb/A (187 bu/A). LA-21F

Mississippi



The Influence of Phosphorus Application Rate and Deep Tillage on Rice Yields after Land-forming

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Project Cooperators: J.E. Street, W.L. Kingery, M.S. Cox, J.L. Oldham

An on-farm study was conducted in 2002 to determine the optimum rate of fertilizer P for newly-leveled rice soils and to determine the effects of deep tillage following precision-leveling on rice yields. The chiseled and non-chiseled areas served as the main plot units and the five P rates (0, 20, 40, 60, and 80 lb P₂O₅/A) served as the sub-plot units. Y-leaf and flag leaf tissue samples were collected at panicle differentiation (PD) and late boot (LB), respectively. The rate of P affected tissue-P concentrations. At both sampling times, average tissue-P concentrations were maximized when 60 lb P₂O₅/A was applied. At PD and LB, the highest average tissue-P concentration was 0.16% and 0.14%, respectively. When no P was applied, average tissue-P concentrations were 0.08% and 0.11% at PD and LB, respectively. A P rate by tillage interaction was present when comparing rice grain yields. For the chiseled area, a yield maximum of 147 bu/A was obtained with 80 lb P₂O₅/A. However, in the non-chiseled area, a yield maximum of 166 bu/A was obtained with 60 lb P₂O₅/A. MS-10F

Missouri



Rice Response to Soil and Foliar Boron Applications

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Current University of Missouri soil test recommendations call for 0.5 lb boron (B)/A when less than 0.25 parts per million (ppm) of B is found in the soil (hot water extraction). Recent soil samples at the Missouri Rice Research Farm (MRRF) contained 0.02 to 0.35 ppm and 58 of 100 rice soil samples from surrounding farms had less than 0.25 ppm hot water-extractable B. In 2002, Cocodrie rice was planted at the MRRF near Quilin, Missouri, on a

Crowley silt loam, using University of Missouri recommendations for seeding rate and other cultural practices. The effects of B rates (0, 0.33, 0.67, 1.0 lb/A) and timing (preplant, pre-flood and panicle initiation) on plant tissue B concentration and rice yield were evaluated. Solubor® was the B source and was sprayed at a volume of 10 gal/A. Neither B rate nor timing affected plant tissue B concentrations at three sampling dates (June 25, July 25, August 1), nor grain yields or milling yields. Low whole-plant tissue K deficiency (<0.95%) may have limited grain yields. *MO-23*

Tennessee



Plant Nutrition and Tillage Effects on Bronze Wilt of Cotton

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

Project Cooperators: D.D. Howard, C.E. Michaud, E.F. Robinson

Bronze wilt (BW) is characterized by bronze discoloration and wilting of the upper foliage of cotton, which can lead to yield reduction. Symptoms of BW can resemble K deficiency in some circumstances. Because BW is associated with damage to the secondary root system, we hypothesized that soil nutrient availability and tillage may affect symptom expression. Objectives of this study were to determine the influence of plant nutrition and tillage system on the incidence and severity of BW symptoms, and to quantify the injury from BW expressed as boll loss. A susceptible cultivar (PM 1218 BG/RR) was planted with different N and K fertility regimes in two Tennessee field environments in 2002. Nitrogen levels were 80 or 160 lb/A as ammonium nitrate (NH₄NO₃), while K ranged from 0 to 180 lb K₂O/A as potassium chloride (KCl) at Jackson

(no-till), and to 240 lb K₂O/A at Ames Plantation (conventional till).

Plots were monitored weekly for appearance of BW symptoms, and plants expressing secondary symptoms were flagged each week. A few plants reached this stage between early and late bloom, but incidence remained extremely low at Ames (0.14%) and Jackson (0.11%). This result is consistent with the relatively low incidence of BW throughout Tennessee in 2002. Prior to harvest, pairs of flagged and adjacent normal plants were mapped for height, fruiting-branch number, and first-position boll retention. As in earlier years, neither fertility nor tillage treatments affected BW incidence or severity, suggesting that producers are unlikely to alter the incidence or severity of BW by altering N or K fertilizer rates or tillage practices.

At Ames, plants in which symptoms appeared at early bloom were 28% shorter in height and had 79% lower fruit retention than adjacent normal plants in 2002. Differences were similar but smaller at Jackson. Boll loss was greatest when symptoms appeared at early bloom, and less when symptoms appeared later, as in previous years.

Tissue analysis showed that petioles of BW plants at Jackson averaged 18% less in K concentration than those of normal plants grown in the same fertility regimes. This finding supports the hypothesis of impaired uptake and/or translocation of K in plants with BW. However, leaves of normal and BW plants in the same fertility regimes at Jackson and Ames had similar K concentrations. The very low incidence of BW in these studies resulted in negligible impact of BW on overall lint yields, although yields of affected plants were sharply reduced by boll shed when symptoms developed during early bloom. *TN-15F* ■

*Note: Additional summaries with information on various other crops in the Southeast Region appear in a separate issue of *News & Views: 2002 Research Summaries—Soybeans, Forages, Citrus, Pine, Sugarcane and more.*

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NEWS & VIEWS

Southeast
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