ABSTRACTS
RESEARCH
CONFERENCE
VOLUME 10

November 27 and 28, 2006
Clarion Inn
Fayetteville, Arkansas

PROGRAM

Monday, November 27, 2006
10:00 a.m. Business Meeting
12:00 noon Registration

MODERATOR: Dr. Glenn Studebaker, Assistant Professor, Extension Entomologist, University of Arkansas, Cooperative Extension Service.

03:00-03:30 p.m. **Break**

03:30 p.m.** **Common Ragweed Interference in Soybean.** C.E. Brewer, L.R. Oliver, M.T. Barapour, and F.H. Lyons IV. Department of Crop, Soil, and Environmental Science, University of Arkansas, Fayetteville, AR...7

03:45 p.m. **Rynaxypyr: A Novel Insecticide for Control of Heliothines in Conventional and Bollgard Cotton.** Jarrod T. Hardke, Gus M. Lorenz, Kyle Colwell, Craig Shelton, University of Arkansas Cooperative Extension Service, and Richard Edmund, Dupont Agricultural Products……………………………………………………………….8

04:00 p.m. **Efficacy of Selected Compounds for Two-Spotted Spider Mite (***Tetranychus urticae),* **Control in Arkansas 2006.** Kyle Colwell[1], G. M. Lorenz III[1], J. Hardke[1], C. Shelton[1], R. Goodson[1],D. Johnson. [1]University of Arkansas Cooperative Extension Service………………..8

04:15 p.m.* **Efficacy of Various Insecticide for Control of Thrips/Nematodes, and Determining Thrips/Nematodes Effect on Cotton in Arkansas 2006.** C. M. Shelton, G. M. Lorenz, III[1], Department of Entomology, University of Arkansas, Terry Kirkpatrick Department of Plant Pathology University of Arkansas, T. Kring, C. K. Colwell[1], J. Hardke, Department of Entomology, University of Arkansas, Fayetteville, AR...9

04:30 p.m. **Management of Tarnished Plant Bugs in Cotton Comparing Cotton Varieties.** Glenn Studebaker, Fred Bourland, NEREC, University of Arkansas, Keiser, AR…………………………………………………….9

Tuesday, November 28, 2006

MODERATOR: Dr. Jason Norsworthy, Associate Professor of Weed Science, University of Arkansas, Fayetteville, AR.

08:30 a.m.* **Rice Cultivar Response to Low Glyphosate Rates at ¼ Inch Internode Elongation.** Jason R. Meier, Kenneth L. Smith, and Ryan C. Doherty; University of Arkansas Division of Agriculture, Monticello, AR. and Robert C. Scott; University of Arkansas Division of Agriculture, Little Rock, AR………………………………..………10

08:45 a.m.* **Prospect for Biolgical Control of Spotted Knapweed in the Ozark Mountains of Arkansas.** Dagne D. Demisse, Timothy J. Kring and Robert Wiedenmann, Department of Entomology, University of Arkansas, Fayetteville, AR…………………………………………..10

09:00 a.m.** **Evaluation of Polymer-Coated Urea as an Alternative to Preflood Urea for Delayed-Flood Rice.** Bobby R. Golden, Nathan A. Slaton, Russell E. Delong, and Richard J. Norman, Department of Crop, Soil, & Environmental Science, University of Arkansas, Fayetteville, AR……11

09:15 a.m.** **Nitrogen Stress Response in Red Rice and Rice.** Marites A. Sales and Nilda R. Burgos. Department of Crop, Soil & Environmental Science, University of Arkansas, Fayetteville, AR……………………………...12

09:30 a.m.** **Introgression of Reniform Nematode Resistance into Upland Cotton.** Carlos A. Avila[1], James McD. Stewart[1] and Robert T. Robbins[2], [1]CSES University of Arkansas, Fayetteville, AR, [2] PLPA University of Arkansas, Fayetteville, AR…………………………………………….13

09:45 – 10:15 a.m. **Break**

10:15 a.m.** **Impact of Tillage Frequency and Tuber Size on Purple and Yellow Nutsedge Shoot Regeneration and Tuber Production.** Sanjeev K. Bangarwa and Jason K. Norsworthy, Department of Crop, Soil, and Environmental Science, University of Arkansas, Fayetteville, AR…...13

10:30 a.m.** **Palmer Amaranth (Amaranthus palmeri) Resistance to Glyphosate in an Arkansas Population.** Griff M. Griffith, Jason K. Norsworthy, Robert C. Scott, Kenneth L. Smith, Lawrence R. Oliver, and Sangeev K. Bangarwa, University of Arkansas, Fayetteville, AR………………….14

10:45 a.m.* **Profitable Systems for Ultra-Early Soybean Production.** F.H. Lyons IV, L. R. Oliver, L.C. Purcell, and M.P. Popp. Department of Crop, Soil, and Environmental Science and Department of Agricultural Economics, University of Arkansas, Fayetteville, AR……………………………...15

11:00 a.m. **Control of the Tarnished Plant Bug (*Lygus lineolaris*) in Midsouth Cotton Using the Entomopathogenic Fungus, *Beauveria bassiana*, and the Insect Growth Regulator Diamond®.** Jennifer Lund, University of Arkansas AES at Arkansas State University, Tina Gray Teague University of Arkansas AES at Arkansas State University, and Donald Steinkraus, University of Arkansas Entomology Department...16

11:15 a.m.* **Evaluation of Reactions of Arkansas Soybean Cultivars to Two Viruses.** Ehsanollah Shakiba and Dr. Pingyen Chen, University of Arkansas, Fayetteville, AR…………………………………………….17

* Indicates Masters Student

** Indicates Ph.D Student

ABSTRACTS

Consultant Perspectives on Weed Management Issues in Rice.

Jason K. Norsworthy, Nilda R. Burgos, Robert C. Scott, and Kenneth L. Smith, Department of Crop, Soils, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Certified Crop Advisors of Arkansas and members of the Arkansas Crop Consultants Association were surveyed in 2006 through direct mail to assess current weed management practices and needs in rice from both a research and educational perspective. Consultants reported scouting 540,000 of the possible 1.4 million acres (39% of acreage) of rice grown in Arkansas, with 194,000 of the scouted acres being planting to Clearfield® cultivars. Some consultants lacked formal education in Weed Science and training in developing weed management recommendations. Preemergence herbicides most often recommended were clomazone (94%) and quinclorac (41%). Propanil (51%) and quinclorac (36%) were the two most commonly recommended postemergence herbicides. Thirty-three percent of the consultants stated that three or more herbicide applications are generally recommended. Sixty-two percent of the consultants thought that 91 to 98% weed control was acceptable, and 62% felt that farmer's weed control expectations were similar to theirs. An average of 38% of the fields were believed to have 'serious' or 'very serious' weed infestations, and fields were scouted for weeds on average 11 times per year. Ninety-two percent of the consultants had moderate to high concerns with herbicide-resistant weeds. As a result of the increasing problem of herbicide resistance, 54% percent believe that herbicide use in rice will increase over the next 5 years. The perceived average additional expense associated with managing a resistant weed in rice averaged $26/acre, and 20% of the respondents believe that managing a resistant weed will add $40/acre or more over current weed management costs. Fifty-six percent of respondents indicated that propanil-resistant barnyardgrass exist in the fields they scout, infesting 24% of the scouted acreage. Quinclorac-resistant barnyardgrass was reported on 7% of the scouted acreage. Numerous strategies were given for controlling these and other resistant weeds. Eighty-one percent of the respondents believe that their recommendations are centered around prevention of herbicide-resistant weeds even though most (90%) indicated they recommend the same herbicide(s) in a field when rice is grown for consecutive years. Barnyardgrass was the most problematic weed of rice followed by red rice. Northern jointvetch and smartweeds were the two most problematic broadleaf weeds. The number one research need was improvement in broadleaf weed control, and respondents indicated that research and educational efforts should continue to focus on herbicide performance and development of economical weed control programs. The information provided by the survey will be instrumental in directing future weed management research and educational efforts in rice.

Cutting Herbicide Applications to "One" in Corn.

Ryan C. Doherty, Kenneth L. Smith, Lawrence R. Oliver, Jason R. Meier. University of Arkansas, Monticello, AR.

Three trials were conducted at Rohwer Arkansas in 2006 to evaluate broadleaf and grass weed control in Roundup Ready corn. The objective was to provide data that supports a total PRE or POST single application herbicide program. Roundup Original Max at 0.75 lb ae/A plus Atrazine at 1.5 lb ai/A plus crop oil concentrate at 1% v/v applied to 2-4 inch weeds provided 99, 93, 96, and 99% control of pigweed, teaweed, morningglory, and barnyardgrass respectively, 111 DAT. Roundup Original Max at 0.75 lb ae/A plus Atrazine at 0.5 lb ai/A plus crop oil concentrate at 1% v/v applied to 2-4 inch weeds provided 100, 91, 95, and 94% control of pigweed, teaweed, morningglory, and barnyardgrass respectively, 111 DAT. Lexar at 2.8 lb ai/A applied PRE provided 85, 95, 91, and 95% control of pigweed, teaweed, morningglory, and barnyardgrass respectively, 136 DAT. Sequence at 1.64 lb ai/A applied PRE provided 77, 88, 80, and 89% control of pigweed, teaweed, morningglory, and barnyardgrass respectively, while Bicep II Magnum applied PRE at 2.7 lb ai/A provided 90, 85, 74, and 88% control of the same species respectively,136 DAT. Lexar at 2.1 lb ai/A plus Touchdown Total at 0.78 lb ai/A applied to V2 corn provided 95, 90, 85, and 90% control of pigweed, teaweed, morningglory, and barnyardgrass respectively, 136 DAT. All treatments provided yields equal to the untreated check. This data supports a total PRE or POST single application herbicide program in Roundup Ready corn.

Outcrossing between Clearfield Rice and Red Rice.

Vinod K. Shivrain[1], Nilda R. Burgos[1], Jeremy A. Bullington[1], Kenneth L. Smith[1], David R. Gealy[2], and Howard L. Black[2], Department of Crop, Soil, and Environmental Science[1], University of Arkansas, Fayetteville, AR, USDA-ARS, Stuttgart[2], AR.

Clearfield™ (CL) rice technology has proven its worthiness in terms of red rice control. However, movement of the herbicide-resistant gene into the natural red rice populations is still a legitimate concern. We hypothesize that disparity in CL cultivars, planting time, and flowering time of red rice impacts gene transfer. Our objectives in this study were to 1) evaluate the flowering behavior of red rice accessions (RRA) and CL rice cultivars with respect to planting dates, 2) to determine outcrossing rate between CL cultivars and RRA, and 3) to determine the phenotypes of hybrids between CL cultivars and RRA.

Duplicate experiments were conducted at the Rice Research and Extension Center, Stuttgart, and at the Southeast Research and Extension Center (SREC), Rohwer, AR, in the summer of 2005 and 2006. Only Stuttgart experiments are discussed in this paper. Experiments were planted in split-split plot design with three replications. Planting date (PD), CL cultivar, and RRA were main plot, subplot, and sub-subplot, respectively. In 2005, planting times were April 16 (PD 1), April 27 (PD 2), May 13 (PD 3), and May 26 (PD 4). Twelve RRA representing red rice from 10 counties in Arkansas were used. The accessions represent an assortment of characteristics: short and tall, awned and awnless, and early and late to flower. Each RRA was planted in the middle of 9-row, 14-ft-long plots with four rows of rice (CL161 or CL-XL8) on both sides. Data on emergence and flowering were recorded. At maturity, red rice seeds were collected from individual plots to determine outcrossing rate. In 2006, a sub-sample of ~ 3000 seeds from each plot was planted at SREC. Red rice seedlings were sprayed three times with imazethapyr at 0.063 lb ai/A. Leaf tissues were collected from survivors for DNA extraction and SSR Primers RM 253 and 234 were used to confirm the hybrids. Outcrossing rate was calculated based on the confirmed hybrids.

Clearfield rice and RRA in PD 1 and PD 2 took longer to flower than later planted ones. Flowering period of RRA ranged from 88 to 128, 87 to 117, 79 to 118, and 71 to 116 DAP in the first, second, third, and fourth planting, respectively. In all plantings, there was synchronization in flowering (50 %) between both CL cultivars and at least six RRA. Outcrossing rate based on various RRA varied from ~ 0 to 1.55%. PD by CL cultivar and PD by RRA interactions were significant ($P<0.05$) for outcrossing rate. However, no interaction was detected between CL cultivars and RRA for outcrossing rate, implying that the effect of RRA on outcrossing rate was similar regardless of CL cultivar and vice versa. The number of outcrosses produced differed among accessions in the same planting date. In general, CL-XL8 had a higher outcrossing rate in all planting dates compared with CL161. The phenotype of an outcross is affected by CL parent as well as red rice parent. Outcrosses between CL161 and any RRA were phenotypically uniform. On the other hand, outcrosses between CL-XL8 and any RRA segregated in terms of flowering time, height, and various other plant characteristics. This experiment demonstrates that outcrossing rate varies with CL cultivar, red rice biotypes, and planting time. Hence, red rice management strategies need to consider these factors.

Agronomic Management of Red rice (*Oryza sativa*) in Roundup Ready® Soybean.
Jeremy A. Bullington, Nilda R. Burgos, Ken L. Smith, and Vinod K. Shivrain, Department of Crop, Soil, and Environmental Science, University of Arkansas, Fayetteville, AR

Red rice (*Oryza sativa*) has always been a major weed problem for rice producers in the Mississippi River Delta. Red rice is of the same genus and species as commercial rice, which makes its removal a problem in rice culture. Commercial rice crop losses are estimated at 50 million dollars each year. Soybean crop losses from red rice cost producers more than 30 million dollars a year. Red rice is an increasing concern in soybean, but Roundup Ready® technology provides an option for red rice control. Although glyphosate usually provides effective control; high red rice density and season-long germination can lead to incomplete control. Both cultural practices and herbicides are crucial for control of red rice and to eliminate future populations.

Experiments were conducted at the Southeast Research and Extension Center; Rohwer, AR, and Rice Research and Extension Center; Stuttgart, AR, in 2005 and 2006 on a split-split plot design with four replications. Row spacing (22.5 and 7.5 in.) was the main plot, cultivar (mid-group 4 and mid-group 5) was the subplot, and glyphosate treatment (0.75 lb ae/A applied once 4 weeks after planting (WAP); sequentially at 4 and 6 WAP; and sequentially at 4 WAP and at red rice flowering) was the sub-subplot. Each cultivar was planted at 50 lb/A (175,000 seeds/A). The plots were overseeded with 40 lb/A of red rice. Parameters evaluated were visual ratings of red rice control, viability of red rice seed, red rice plant characteristics, soybean characteristics, soybean and red rice density, soybean canopy closure, and soybean yield.

In 2005, soybean yield and characteristics were not affected by any of the treatments at either location. Red rice control at 6 WAP was affected only by cultivar differences, with the taller group 5 soybean providing 90% red rice control and the shorter group 4 soybean providing 85% when averaged over row spacing and glyphosate timing. Sequential applications at 4 and 6 WAP controlled red rice 95% 8 WAP in both cultivars and row spacings.

Preliminary data for 2006 show that red rice was controlled equally (90%) at 6 WAP in both row spacings with single glyphosate application. At 8 WAP, maximum red rice control (95%) was achieved by using sequential glyphosate applications in narrow (7.5-in.) row spacing. Red rice control at both sites was maximized using the 7.5-in row spacing because canopy closure was earlier in this system. Soybean yield was not different among the plots treated with glyphosate.

Glyphosate, combined with cultural practices, can control red rice and will help reduce the weed seedbank. Excellent control of red rice in the rotational crop will deter the evolution of herbicide resistance.

Multifoliolate Soybean: Breeding and Management Strategies for Ultra-Early Production Systems in Arkansas.

Thomas M. Seversike and Larry C. Purcell, Department of Crop, Soil, and Environmental Science, University of Arkansas, Fayetteville, AR.

Growing early-season soybean cultivars is becoming an increasingly popular strategy for avoiding drought and reducing irrigation costs in the Midsouth. Ultra-early cultivars ranging from maturity groups (MG) I through II achieve similar yields to traditional full-season cultivars (MG V and VI), but in order to intercept enough light, they require substantially higher plant populations. Increasing seeding rates can make growing early-season soybean cost prohibitive for some growers. We hypothesized that at equal population densities, experimental multifoliolate varieties with 5 or 7 leaflets per leaf would intercept more light than near-isogenic trifoliolate varieties with 3 leaflets per leaf. Ultra-early, multifoliolate varieties could therefore yield the same as full-season trifoliolate varieties at relatively low population densities. The objectives of this research were to: (i) evaluate yield response to the cumulative amount of intercepted photosynthetically active radiation (CIPAR) from emergence to the full seed stage (R6) of development for 3-, 5-, and 7-leaflet soybean isolines, (ii) determine population densities required to give full yield potential, and (iii) map with molecular markers the gene that confers the 7-leaflet trait. In 2005 and 2006 at Fayetteville, AR, plots for experimental lines from MG 00 to II were split into isoline pairs and drilled at seeding rates ranging from 5 to 80 seeds m^{-2}. The fraction of light intercepted (FLI) by 3-, 5-, and 7-leaflet soybean plants was measured using digital imagery approximately every 3 days from seedling emergence to growth stage R6. The FLI values were used to estimate daily light interception, and these values were cumulated to determine CIPAR. When data for 3-, 5-, and 7-leaflet genotypes were combined, yield response to CIPAR was similar to previous research. Multiple regression analysis was used to predict CIPAR values for 3-, 5-, and 7-leaflet genotypes. In 2005, 5-leaflet genotypes had the highest CIPAR values within the earliest maturity group (MG 00), and there was little difference between 3-, and 7-leaflet genotypes in the same maturity group (10 to 50 plants m^{-2}). In the latest maturity group (MG 1.8), 7-leaflet CIPAR values surpassed those of 5- and 3-leaflet genotypes (10 to 50 plants m^{-2}). On the other hand, results from 2006 showed that 3-leaflet genotypes consistently had the highest CIPAR values within all maturity groups and at all population densities. Overall analysis of multifoliolate and trifoliolate leaf area revealed that although multifoliolate plants had more leaf area per leaf than trifoliolate plants, trifoliolate plants generally had more nodes than multifoliolate plants. This resulted in multifoliolate and trifoliolate plants having very similar total leaf area per plant. The multifoliolate plants, therefore, compensated for higher leaf area per leaf by producing fewer nodes. Consequently, multifoliolate population densities necessary to give full yield potential were similar to what was already required for trifoliolate varieties. This research suggests that ultra-early, multifoliolate genotypes do not always accumulate more light than trifoliolate genotypes, and further research is needed to explain how soybean plants balance leaflet number and node formation to intercept light. Should soybean breeders want to integrate the 7-leaflet trait into later maturing varieties, an SSR marker from the B1 linkage group was putatively identified and associated with the 7-leaflet trait that may be used for marker assisted selection.

Bermudagrass Forage Yields as Affected by Nitrogen Source and Rate.
Colin G. Massey, Nathan A. Slaton, Russell E. DeLong, Bobby R. Golden, and Trent L. Roberts, Department of Crop, Soil, and Environmental Science, University of Arkansas, Fayetteville, AR.

Ammonium nitrate (NH_4NO_3) and poultry litter (PL) have been the two major N sources used to fertilize grass forages in Northwest Arkansas. Recent restrictions on poultry litter applications involving water quality issues and concerns regarding the use of NH_4NO_3 to manufacture explosives have or will reduce the availability of these fertilizers to growers. Alternative N sources and fertilization strategies are needed to maintain the productivity of land used for hay and cattle production in Northwest Arkansas. The research objective was to compare bermudagrass yields receiving a range of N rates from four N fertilizers.

An experiment was initiated in May 2006 on a Captina silt loam (5.3 soil pH, 2.3% organic C, and 0.22% total N) with an established stand of common bermudagrass that had been used for grazing and hay production. Pelleted poultry litter (3.98% total N) and three inorganic N fertilizer sources including NH_4NO_3, urea (46% N), and urea treated with Agrotain (a urease inhibitor) were applied at season-total rates of 0, 90, 180, 270, 360, and 450 lbs N/acre. Nitrogen was applied in two (90 lb N/acre) or three (>90 lb N/acre) split applications at greenup in early May and following the first two (of three) hay harvests. The experiment was a randomized complete block design with a 4 (N source) × 5 (N rate) factorial treatment structure plus two unfertilized controls. When appropriate, mean separations were performed using Fisher's Protected Least Significant Difference method at a significance level of 0.10.

Bermudagrass yields were not affected significantly (P>0.10) by the N source × N rate interaction for any individual harvest or the sum of all harvests. Bermudagrass receiving poultry litter or inorganic-N fertilizer produced significantly greater season-total yields than the unfertilized control, which yielded 3,560 lbs/acre. Yields of bermudagrass receiving inorganic N fertilizers were similar and, on average, 12% greater than yields produced with pelleted poultry litter. Forage yields tended to increase numerically with each incremental increase in N rate, but the numerical increase was not always different statistically. Statistically the greatest forage yields (~8,000 lbs/acre) were produced by application of 450 lbs N/acre. Greater yields would likely have been produced with more frequent rainfall. The greatest increase in season total yield (50%) occurred between the unfertilized control and the lowest N rate (90 lbs N/acre). Each additional increment of N increased yields by 4 to 13% compared with the previous N rate. For 2006, on average, 620 lbs forage/acre was produced above the unfertilized control yield with each 100 lbs N-fertilizer/acre up to 450 lbs N/acre. Urea was an acceptable alternative inorganic-N fertilizer source for fertilizing bermudagrass. The urease inhibitor showed no significant benefits for increasing forage yields under the climatic conditions of 2006.

Effects of Urea Ammonium Nitrate on Regiment Efficacy.

Bree A. Pearson, Robert C. Scott, and Nilda R. Burgos. Crop, Soil, and Environmental Science, University of Arkansas, Fayetteville, AR.

Regiment(bispyribac) is a selective contact herbicide used in rice for postemergence control of grasses and broadleaf weeds, including barnyardgrass (*Echinochloa crus-galli*) and hemp sesbania (*Sesbania exaltata*). Regiment is reported to be effective for controlling these weeds in research trials, but inconsistent weed control with bispyribac has been observed in commercial rice fields. Regiment applications made under less than optimal conditions, including application to drought-stressed plants and low application volumes, add to the chance of inconsistent control.

Urea ammonium nitrate (UAN) can be used as a herbicide additive and has been found to increase the efficacy of some herbicides. Dodds et al. (2006) found that Regiment absorption into barnyardgrass increased up to 54% with the addition of UAN to a herbicide/adjuvant tank mixture. By increasing herbicide adsorption, UAN may be able to overcome or decrease the occurrence of weed control inconsistency seen with Regiment. This study was conducted using C^{14} techniques, and there are currently no published data on the effects of UAN on Regiment efficacy.

A greenhouse study was conducted in 2006 to determine how UAN affects Regiment efficacy on barnyardgrass, hemp sesbania, and broadleaf signalgrass (*Bracharia platyphylla*). Each species was planted separately in 1-quart Styrofoam cups. Herbicide application was made to hemp sesbania at 13-15 cm, broadleaf signalgrass with 4 to5 leaves, and barnyardgrass with either 3 to 4 leaves or 1 to 2 tillers. Treatment factors were herbicide and adjuvant. Regiment was applied at 17.9 and 35.2 g ai/ha, representing ½ and 1 times the field rates, respectively. Adjuvant treatments were no adjuvant, Kinetic applied at 0.125% v/v, DyneAmic applied at 0.37 L/ha, Dyne-A-Pak applied at 2% v/v, UAN applied at 2% v/v, Kinetic + UAN applied at 0.125% + 2% v/v, or DyneAmic + UAN applied at 0.37 L/ha + 2% v/v. Plants were cut at soil level and weighed 28 DAT for grasses and 21 DAT for hemp sesbania. Percentage reduction in fresh weight of each plant was determined by comparing fresh weights to the untreated check.

Barnyardgrass efficacy at both timings was increased with the addition of UAN to herbicide tank mixtures. The addition of UAN did not increase hemp sesbania control, as this species was consistently and effectively controlled with any herbicide treatment that included an adjuvant. Broadleaf signalgrass was not effectively controlled by any herbicide treatment. This was expected since Regiment/adjuvant tank mixtures do not control broadleaf signalgrass, and the addition of UAN did not help Regiment to effectively increase control of this species. None of the species were effectively controlled with treatments containing only Regiment and UAN, indicating that the use of both an adjuvant and UAN is needed.

Common Ragweed Interference in Soybean.
Chad E. Brewer and Lawrence R. Oliver, Department of Crop, Soil and Environmental Science, University of Arkansas, Fayetteville, AR.

Common ragweed (*Ambrosia artemisiifolia*, AMBEL) is a growing problem in AR soybean production. The increase in infested acres is due to the increased adoption of minimum-tillage production systems, which has increased the need for burndown herbicides, such as glyphosate. The discovery of glyphosate-resistant AMBEL in AR created a need for yield loss estimates based on full-season interference in soybean.

Field trials were established on June 23, 2005 and on June 9, 2006 in Fayetteville, AR to assess the affect of AMBEL density on soybean yield. These trials included a glyphosate-resistant AMBEL ecotype from Jackson Co. (J) and a glyphosate-susceptible ecotype from Fayetteville (F). Armor 53K3 soybean were planted on 40-inch raised beds at 156,816 seed/ A followed immediately by seed from J and F planted at 0, 1, 2, 4, and 8 seeds row/ ft. Each plot was one row wide and 10 ft long with a border row between each plot. Upon emergence soybean density was manually thinned to 10 plants/ row ft and AMBEL was thinned to the appropriate density for each treatment. Plots were maintained by manual removal of extraneous weeds and irrigated according to the Arkansas Irrigation Scheduler computer program. At crop maturity the center 3 ft from each plot were hand harvested for soybean yield and AMBEL biomass accumulation.

Comparative growth analysis was performed to explain differences in J and F interference potential. On May 23, 2005 and May 18,2006 seed from J and F were planted into sphagnum moss potting media in 5-gallon plastic pots. Plant biomass was harvested weekly from 2 to 8 weeks after emergence. At each harvest weight, height, node number, and leaf area were recorded.

AMBEL interference in soybean from 2005 indicated that 1 J AMBEL row/ ft caused a 28% yield reduction, but 3 F AMBEL row/ ft were required to reach the same yield reduction level. Data from 2006 is not available at publication deadline, but will be presented. The comparative growth analysis from 2005 and 2006 indicate that J plants attained 18% more biomass, were 16% taller, and had 32% more leaf area when averaged over harvest interval. Leaf area ratio (LAR), expressed as leaf area (cm^2) per total aboveground biomass (g) is an indication of plant biomass portioning. When averaged over harvest intervals J had a higher LAR than F, with values of 84.5 and 70 cm^2/g. These data indicate that J plants invested more resources into leaf production compared to F plants. There were no differences in node accumulation or relative growth rate for J and F plants indicating that photosynthetic efficiency was not different between ecotypes.

AMBEL populations J and F are ecotypes that differ in sensitivity to glyphosate and interference potential. Comparative growth analysis explains differences observed in interference potential by quantifying biomass accumulation and partitioning. These data will provide producers with information regarding the economic injury level that can be used to develop herbicide application thresholds based on AMBEL density.

Rynaxypyr: A Novel Insecticide For Control Of Heliothines In Conventional And Bollgard Cotton.

Jarrod T. Hardke, Gus M. Lorenz, and Kyle Colwell, University of Arkansas Cooperative Extension Service, Little Rock, AR; Craig Shelton, University of Arkansas,Fayetteville, AR; Richard Edmund, DuPont Agricultural Products, Little Rock, AR

In 2006, Rynaxypyr™ was evaluated in three studies in Jefferson County, Arkansas for control of heliothines. In the first trial, Ryanxypyr™ was applied at different rates to conventional non-bt cotton in comparison with Tracer (spinosad), Tracer and Capture (bifenthrin) tank mixed, and a Bollgard II variety. Significant differences were observed among treatments in regard to seasonal total damage and seasonal total larvae. In the second trial, Rynaxypyr™ was applied at different rates to Bollgard cotton in comparison with Asana XL (esfenvalerate), Capture and Orthene (acephate) tank mixed, Capture alone, and Tracer and Capture tank mixed. Significant differences were observed only between treatments and the untreated check. In the third trial, Rynaxypyr™ was applied at a single rate in comparison with Experimental 1, Larvin (thiodicarb), Tracer, Tracer and Capture tank mixed, Denim (emamectin benzoate), and Steward (indoxacarb). Significant differences were observed among treatments in regard to seasonal total damage, seasonal total larvae, and yield.

Efficacy Of Selected Compounds For Two-Spotted Spider Mite (*Tetranychus Urticae),* **Control In Arkansas 2005.**

Kyle Colwell[1], Gus M. Lorenz[1], Craig Shelton[1], Jarrod Hardke[1], Robert Goodson[1], Don Johnson[2], [1]University of Arkansas Cooperative Extension Service, Little Rock, AR, [2]Private Consultant.

Increasing two-spotted (*Tetranychus urticae)* spider mite populations in the mid-south have made the need for economical and effective control of these pests vital. Experiments to assess the efficacy of various pesticides to two-spotted spider mite in Arkansas cotton were conducted at 3 locations in 2006. Experimental design was a randomized complete block with four replications and data were analyzed using Agriculture Research Manager Version 7. Analysis of variance was conducted and means were separated using Duncan's New Multiple Range Test (P=0.10). While treatments differed from one another, all treatments reduced mite populations significantly when compared to the untreated check at all locations.

Efficacy of Various Insecticide for Control of Thrips/Nematodes, and Determining Thrips/Nematodes Effect on Cotton in Arkansas 2006.

C. M. Shelton G. M. Lorenz, III[1] T. Kirkpatrick, T. Kring, C. K. Colwell[1], J. Hardke[1],

There are many new technologies that are changing today's pest management strategies. The development of seed treatment insecticides/ nematicides can help growers in controlling early season pest in cotton. The new seed treatment technology involves three aspects: fungicide, insecticide, and nematicide. Data will be presented from three studies conducted in Arkansas during the 2006 growing season to test efficacy of various seed treatments compared to industry standards. Cotton plant growth and development were monitored to determine the affect of thrips and nematode on individual treatments.

Management of Tarnished Plant Bugs in Cotton Comparing Varieties.

Glenn Studebaker & Fred Bourland, University of Arkansas Northeast Research and Extension Center, Keiser, AR

The development of genetically modified cotton varieties, particularly Bt cotton and the success of boll weevil eradication have resulted in a shift in those insect pests that cause major damage to the cotton crop. The tarnished plant bug has risen to major status as a pest of cotton. Presently, insecticides are the primary line of defense in controlling this pest in cotton. However, this tactic can be costly and heavy reliance on insecticides has resulted in an increased tolerance/resistance in the tarnished plant bug to pyrethroid and organophosphate insecticides. Recently other tactics, such destruction of wild host plants early in the year have shown some success in reducing tarnished plant bug numbers later during the growing season. However, little has been done in the area of investigating host plant resistance to this pest in cotton. In 2006, a study was initiated investigating the potential resistance of several cotton lines to tarnished plant bugs. Previous studies have indicated that a nectariless line of cotton may have a high level of resistance/tolerance to tarnished plant bug. Large plots, 16 rows by 75 feet, of this line were compared with a moderately resistant and a highly susceptible variety. Plots were sampled weekly throughout the growing season. Treatments were evaluated under three action thresholds: bug free (sprayed weekly), 1 plant bug/row foot and 2 plant bugs/row foot.

Plant bug numbers were low throughout the study and the high threshold never triggered. However, the nectariless line did exhibit lower plant bug numbers than the other two varieties throughout the year. There were no significant differences in yield between insecticide treatments with the exception of the frego-bract variety have a significantly higher yield in the weekly spray treatment. Further evaluations are necessary under higher plant bug pressure to determine the utility of the nectariless line as a source of resistance.

We would like to thank Cotton Inc. for their support in this research.

Rice Cultivar Response to Low Glyphosate Rates at ¼-Inch Internode Elongation.
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Glyphosate drift in rice has become a major concern for rice producers. Each year extension specialists respond to numerous calls concerning drift injury to non-target crops, especially glyphosate drift onto rice. A study was conducted in 2006 to examine the response of ten rice cultivars to reduced rates of glyphosate at the ¼-inch internode elongation (¼ IE) growth stage. The cultivars Drew, Lagrue, Cocodrie, CL-161, CL-XL8, Wells, Bengal, Katy, Banks, and Francis were drill-seeded in a Sharkey clay soil at 101 kg ha^{-1}. Glyphosate (Roundup WeatherMax®) was applied at 0 (untreated check), 45 (1/20X) and 90 (1/10X) g ae ha^{-1}. Plant height, delayed heading, flag leaf length, and yield were evaluated. Plant height reduction at harvest increased as rate increased in Drew, Lagrue, CL-XL8, and Katy. Plant height of Cocodrie, CL-161, and Bengal was reduced by both 45 and 90 g ha^{-1}, but was not rate responsive. Plant height of Banks and Francis was reduced only with 90 g ha^{-1}. Flag leaf length decreased as rate increased in Drew, Cocodrie, and CL-161. Flag leaf length of CL-XL8 and Bengal was reduced by both 45 and 90 g ha^{-1} but was not different between the two rates. Flag leaf length was not reduced in Lagrue, Wells, Katy, Banks, or Francis. Heading of all cultivars was delayed longer with 90 g ha^{-1} than with 45 g ha^{-1}. Heading was delayed 3 d in Francis and CL-XL8 with 45 g ha^{-1} and was not delayed by this rate in any other cultivar with the exception of Bengal. The longest heading delay was observed in Bengal and was delayed 21 d with 45 g ha^{-1} and 42 d with 90 g ha^{-1}. Yield of CL-XL8 was reduced more with 90 g ha^{-1} than with 45 g ha^{-1}, and Bengal yield was reduced by both 45 and 90 g ha^{-1} but was not rate responsive. Wells and Drew yield was reduced only with 90 g ha^{-1}. Yield was not reduced in Lagrue, Cocodrie, CL-161, Katy, Banks, and Francis by glyphosate applied at the ¼ IE timing. Rice cultivars respond to glyphosate drift in different ways depending on the concentration and occurrence of the drift. In diagnosing drift problems it is important to understand these responses.

Prospects for Biological Control of Spotted knapweed in the Ozark Mountains of Arkansas.
Dagne Duguma Demisse, Timothy Kring, Robert Wiedenmann

Native to Eurasia, spotted knapweed was introduced to North America in 1893. It is a deeply tap rooted perennial plant with pinkish or purple flowers. Knapweed is a serious invasive weed species capable of rapidly invading disturbed habitats, rangelands and roadside habitats. The herbarium records at the Univeristy of Arkansas show that this plant was first found in the state in 1945. Although the weed is a serious problem in the pacific northwestern United States, knapweed has been recorded in all of the contiguous United States. Considering its enormous viable seed production capacity, germination, establishment and rapid growth, this plant may quickly take over the native plant species and pose a threat to native plant communities. Biological control of this weed has been a viable management option during the last thirty years in North America. Thus, biological control is logical alternative management choice for spotted knapweed in natural habitats such as the Ozark Mountains. Thirteen species of natural enemies belonging to Diptera, Lepidoptera and Coleoptera were previously introduced in the US to control this weed, and a few of them have demonstrated an impact on spotted knapweed populations. Although none of these natural enemies have been released in Arkansas, one of these, a flower head feeding fruit fly, *Urophora quadrifasciata* (Diptera: Tephritidae), was recovered from the spotted knapweed populations in 2006. Larval feeding of this fly causes plants to form a thin, papery gall that surrounds the larva and aborts some of the florets. We will evaluate the impact, distribution and limitations of this natural enemy of spotted knapweed in the Ozark Mountains of Arkansas.

Evaluation of Polymer-Coated Urea as an Alternative to Preflood Urea for Delayed-Flood Rice.
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Nitrogen fertilization of rice (*Oryza sativa* L.) in the direct-seeded, delayed-flood production system relies heavily on aerial application of N-fertilizer. The ability to apply N-fertilizer with ground equipment before seeding would benefit rice producers by reducing N-application costs. The research objective was to compare the effects of preplant application of polymer-coated urea fertilizers with the standard practice of preflood urea fertilizer application on growth and yield of rice in the delayed-flood production system.

In 2006, three experiments were established on Calhoun silt loams (two sites) and a Hilleman silt loam. Three polymer-coated urea fertilizers (ESN, 44% N; and Duration type III and V, 43% N; Agrium Inc., Calgary, AB, Canada) were broadcast at total-N rates ranging from 30 to 150 lbs N ac^{-1} immediately before drill seeding 'Wells' rice at 100 lbs seed ac^{-1}. Before flooding at the 5-leaf stage, urea was applied at the same total-N rates as the polymer-coated fertilizers. Total, aboveground N uptake was determined near the panicle differentiation (PD) stage and at early heading (HDG) for treatments receiving 120 lbs N ac^{-1}. Grain yield, adjusted to 12% moisture content, was determined by harvesting the middle four rows of each plot. Each experiment was arranged as a randomized complete block design with a 4 (N source) % 5 (total N rate) factorial treatment arrangement plus two unfertilized controls (0 lbs N ac^{-1}). Grain yields were initially regressed on N-rate allowing for both linear and quadratic terms with coefficients depending on N-source and site-year. Non-significant model terms were removed sequentially and the model was refit until a satisfactory model was obtained. Differences among all remaining coefficients, which varied by N source, site-year, or both were determined using single degree of freedom contrasts. Mean separations were performed for N uptake data by Fisher's Protected Least Significant Difference method.

Regression analyses indicated that the N source % N rate interaction was highly significant for grain yield. Rice grain yield increased non-linearly as N rate increased within each N source. The linear and/or non-linear slope coefficients were always similar between polymer-coated sources among site-years, but significantly lower than the coefficients for urea applied preflood. For all polymer-coated fertilizers, the nonlinear slope coefficients did not differ from zero indicating that grain yields increased linearly across the range of applied total-N rates. The nonlinear and linear coefficients for urea were significantly greater than the coefficients for all polymer-coated fertilizers. A source % site-year interaction was observed for N uptake at PD. Indicating that N uptake also differed among sources and site-years. Nitrogen uptake at PD suggested that urea was superior to all polymer-coated fertilizers at supplying N to rice. The polymer-coated urea fertilizers evaluated were not efficient N sources for flood-irrigated rice production.

Nitrogen Stress Response in Red Rice and Rice.

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Red rice is a very strong competitor of cultivated rice for nutrients and other resources. To compare the growth and physiological responses of cultivated rice and red rice at nitrogen (N) stress, two runs of a greenhouse experiment were conducted in May (Run 1) and August (Run 2) 2006. Nitrogen stress was defined as a nitrogen sufficiency index (NSI) <95% calculated from SPAD meter readings. The plants were grown by hydroponics culture until panicle initiation (PI), using Yoshida solution as nutrient source. The experiment was set up in a split plot design, with two replications for Run 1 and three replications for Run 2. The whole plot structure was a randomized complete block design with rice type as factor; the subplot factor was the N treatment. The rice types were Wells cultivar and Stuttgart strawhull red rice, while the N treatments were: T_1 (Control) – Full N; T_2 – N starvation; T_3 – 3-h or 24-h N supplementation after N starvation for Run 1 and Run 2, respectively; and T_4 – 12-h or 48-h N supplementation for Run 1 and Run 2, respectively. In Run 1, both rice types were subjected to a 3-day starvation before N supplementation. Starvation was done by preparing the nutrient solution without ammonium nitrate (NH_4NO_3), the N source. N supplementation was done by returning NH_4NO_3 to the nutrient solution. In Run 2, red rice reached the N stress level in 3 days, whereas Wells needed 5 days before NSI <95%. Data collected on growth responses were days after emergence to panicle initiation (DPI), height, tiller number, biomass, root length, and number of root tips. Physiological responses were determined from shoot tissue concentration and content of N and other essential elements as well as total sugars in the youngest, fully expanded leaf. Data were subjected to analysis of variance using SAS Proc GLM and means were compared using Fisher's protected least significant difference (LSD) at 0.05 confidence level.

In both planting dates, there was a strong evidence of rice type effect on all growth responses, with red rice having higher values in all growth measurements. In Runs 1 and 2, respectively, Wells had shorter roots (1 and 4 m) and fewer root tips (5 and 21 x 10^3), was 53 and 22 cm shorter than red rice, had fewer tillers (3) and lower biomass (0.8 and 2.1 g), and reached PI two and five days later. On the other hand, red rice was 98 and 45 cm tall, had 7- and 10-m long roots, 39 and 59 x 10^3 root tips, 10 and 7 tillers, and 4 and 5 g biomass, respectively. In Run 1, the 3-day starvation and 3- and 12-h supplementation time periods were not sufficient to cause detectable differences in nutrient uptake between Wells and red rice. For Run 2, however, sucrose and N concentrations in the shoots were significantly affected by rice type and N treatment interaction, with red rice showing an increased level of sucrose (23.0 mg/g; LSD=4.09) at N stress condition when N was at its lowest (2.78%; LSD=0.27). Sucrose in red rice was lowest at T1 (11.13 mg/g), when N concentration was highest (4.17%). On the other hand, Wells rice did not respond to the N treatments as much as the red rice, showing no differences in sucrose concentrations at all treatments (9.61 to 11.63 mg/g). Like red rice, the lowest sucrose concentration in Wells was at T1, when N concentration was highest

(3.16%). A genomic analysis of the genes responding to N stress conditions will be conducted to explain the advantages of red rice over Wells rice in terms of growth and physiological responses.

Introgression of Reniform Nematode Resistance into Upland Cotton.

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The reniform nematode (*Rotylenchulus reniformis*) causes extensive cotton (*Gossypium hirsutum*) yield losses in the southern and Mississippi Delta areas. No resistant *G. hirsutum* genotypes are available; however, resistance occurs in some diploid Asiatic cotton accessions. Our objectives were to develop hybrid materials between resistant diploid *G. arboreum* and tetraploid cultivated cotton, and develop a molecular marker linked to reniform nematode resistance for use in marker assisted selection. Three basic steps where followed: interspecific diploid (A genome) with diploid (D genome) hybridization, chromosome doubling, and introgression into upland cotton. Bulk segregant analysis of selected resistant and susceptible genotypes of *G. arboreum* from a segregating population was used to detect AFLP markers linked to the resistance trait. Hybridization of resistant *G. arboreum* with cultivated cotton has been successfully accomplished and BC_1F_2 and BC_2 populations segregating for resistance have been obtained. Selection of resistant plants is being assisted with the AFLP marker linked to resistance to accelerate the introgression period.

Impact of Tillage Frequency and Tuber Size on Purple and Yellow Nutsedge Shoot Regeneration and Tuber Production.

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Purple and yellow nutsedge are two of the world?s worst weeds, reproducing asexually from tubers. These tubers are the storage organs for carbohydrate reserves that are replenished by autotrophic shoots and exhausted by new sprouts. Based on the reproductive biology of both species, we hypothesized that shoot regeneration of purple and yellow nutsedge will decrease with increasing shoot removal frequency via tillage and decreasing tuber size. To test this hypothesis, greenhouse experiments were conducted during 2005 and 2006 to determine the effect of soil disturbance frequency and tuber size on tuber production and shoot regrowth of purple and yellow nutsedge. Five viable tubers (3 pre-sprouted and 2 non-sprouted) of four category sizes (0.1 to 0.25, 0.26 to 0.50, 0.51 to 0.75, and 0.76 to 1.0 g/tuber fresh weight) were planted in 3.8 L plastic containers and subjected to four soil disturbance frequencies (weekly, biweekly, monthly, and no disturbance) for 12 weeks with four replications. Tuber size had minimal impact on shoot growth and did not impact overall tuber production of either species. Under undisturbed soil conditions, both species exhibited a near linear pattern of shoot multiplication. The shoot multiplication and biomass assimilation rate was faster for yellow than for purple nutsedge. The root plus rhizome biomass was also greater for yellow nutsedge, but tuber number and weight followed the reverse trend in the absence of tillage, showing differential allocation of photosynthates between species - more towards tuber production in purple nutsedge and shoot and root production in yellow nutsedge. For disturbed soil, the increased frequency of disturbance resulted in reduced regrowth and decreased tuber production of both species. Yellow nutsedge was more prone to tuber degradation in soil following frequent tillage than was purple nutsedge, but even weekly soil disturbance for 12 weeks failed to eradicate all tubers. Based on these results, increasing tillage frequency does reduce the regenerative potential of purple and yellow nutsedge, which was hypothesized, but tuber size has minimal or no impact on regeneration after three or more tillage events. Purple and yellow nutsedge tuber production and regeneration vary in response to tillage due to differences in growth and reproduction biology. Implications of these findings on purple and yellow nutsedge management in crops will be discussed.

Palmer Amaranth (*Amaranthus palmeri*) Resistance to Glyphosate in an Arkansas Population.

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Over-reliance on glyphosate for weed control in glyphosate-resistant crops has resulted in the development of glyphosate-resistant species worldwide as well as in Arkansas. In April 2006, Palmer amaranth from Mississippi County, AR was reported to be resistant to glyphosate, becoming the third weed species in the state since 2003 to have developed resistance to glyphosate. Research was initiated to determine the level of glyphosate resistance in the Mississippi County biotype compared to known susceptible biotypes. Palmer amaranth seeds collected from three locations in South Carolina (Clarendon, County in 1986; Anderson, County in 1997; and Richland, County in 1997) were used as susceptible standards to determine the level of resistance in the Mississippi County biotype. The South Carolina biotypes were selected because it is believed that these biotypes were never exposed to glyphosate. Putative resistant plants evaluated in this experiment were grown from seeds collected from a single plant that had previously survived glyphosate at 8 lb ae/A applied at the 8- to 10-leaf stage. Seeds of all biotypes were sown in trays containing potting mix and later transplanted to 4-inch diameter pots containing potting mix at the cotyledon to first-true leaf stage. The experimental design was completely randomized with 11 glyphosate rates, ranging from 0.0117 to 12.0 lb/A with 8 replications and was repeated once. The lowest rate corresponds to 1/64 of a recommended glyphosate rate of 0.75 lb/A. Seedlings were treated with glyphosate (MON 78623) plus 0.25% v/v nonionic surfactant (NIS) at the 6-leaf stage. A control that was treated with NIS only was also included.   The spray applications were made inside a stationary chamber with a two-nozzle boom calibrated to deliver 10 gallons/acre. After treatment, plants were returned to a greenhouse and supplied adequate nutrients and water for an additional 28 days. Plant death (live or dead) was recorded at 14 days after treatment (DAT) and again prior to harvest at 28 DAT. Palmer amaranth biomass was harvested and oven dried for 7 days at 66 C and then weighed. The lethal dosage needed to kill 50% of each population (LD_{50}) was determined using Probit analysis. The LD_{50} values were similar among the susceptible biotypes based on 95% confidence intervals, ranging from a low of 0.0218 to a high of 0.0317 lb/A glyphosate. The resistant biotype had an LD_{50} of 2.517 lb/A glyphosate, which was 79- to 114-fold greater than the susceptible biotypes. This research further confirms that Palmer amaranth has developed resistance to glyphosate. Additional research is needed to determine sensitivity of other Palmer amaranth populations in Arkansas to glyphosate.

Profitable Systems for Ultra-Early Soybean Production.

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Rising input cost for soybean production is a major constraint for Arkansas producers; thus, lowering fuel, seed, and herbicide cost can influence a producer's profit margin. Early-maturing, conventional soybean varieties can reduce cost by avoiding technology fees associated with Roundup Ready varieties, and early-maturing conventional or Roundup Ready varieties can reduce irrigation cost. Planting these varieties at high populations (~200,000 seed/A) can also reduce herbicide cost due to earlier canopy closure. The objective of this study was to determine the influence of soybean maturity group (MG), herbicide program, and plant density on soybean yield. A final economic analysis will be performed using yield.

Experiments were conducted at Keiser, Pine Tree, and Fayetteville, AR, in 2006. The experimental design was a split plot with a 3 by 3 factorial as subplots and four replications. Main plots were maturity group selection, MG II (A2203), MG III (S31-V3), and MG IV (A4801). Subplots were planting density, 75,000, 125,000, and 200,000 seed/A, and herbicide program, which consisted of a conventional program and two Roundup Ready programs. The conventional program was a preemergence application of s-metolachlor plus metribuzin at the recommended rates for soil texture followed by a V4 application of fomesafen plus sethoxydim. The Roundup Ready programs were either Roundup WeatherMax applied at 0.75 lb ae/A at the V3 and V6 s tages or Roundup WeatherMax applied at 0.375 lb ae/A at the V2 stage and once again when the control reached less than 80%. Soybean density, growth stage, and light interception were recorded throughout the growing season. Weed size and density measurements were recorded prior to each herbicide application, and weed control ratings were taken throughout the season. Soybean yield was obtained for a final economic analysis.

Soybean at Pine Tree yielded 39 bu/A, while soybeans at Fayetteville and Keiser had yields of 53 and 46 bu/A, respectively. Soybean yield differed with each main factor. A4801 (MG IV) soybeans provided the highest yield (54 bu/A) and the two higher planting densities provided slightly higher yields and better weed control due to more rapid canopy closure. Maturity group, population, and herbicide choice varied due to weather. Weather had a major impact on yields at Pine Tree due to lack of rainfall for activation of preemergence herbicides. At Keiser, flooding of the plots due to early heavy rains caused a significant reduction in yield of A2203 (MG II) cultivar. Except for the conventional/ preemergence program at Pine Tree, the three herbicide programs were equally effective. After two years, a detailed economic analysis of results will be conducted.

Control of the Tarnished Plant Bug (*Lygus lineolaris*) in Midsouth Cotton Using the Entomopathogenic Fungus, *Beauveria bassiana*, and the Insect Growth Regulator Diamond®.

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Tarnished plant bug (*Lygus lineolaris*) (TPB) is an important pest in Midsouth cotton. Current control methods for TPB rely solely on insecticides. Insecticide resistant populations of TPB have been noted in the Delta regions (Hollingsworth et al., 1997; Snodgrass 1996). Proposed EPA regulatory constraints on organophosphate insecticide use are anticipated. New control methods are needed. The fungal entomopathogen, *Beauveria bassiana* has been found naturally infecting *Lygus spp*. in Arkansas (Steinkraus and Tugwell, 1997). Results from studies with caged insects indicate that the *B. bassiana* can effectively kill 89-100% of adult insects compared to 7-11% in controls (Steinkraus and Tugwell 1997). Nymph TPB are generally less susceptible than adults to *B. bassiana*, as a result a fungal pathogen alone might not provide adequate control of field populations. Novaluron, (tradename Diamond®) is an insect growth regulator that works by disrupting chitin development and molting in nymphs, often resulting in death.

Caged insect studies were conducted at the University Research Farm on the Judd Hill Plantation near Trumann in NE Arkansas. TPB were collected from wild plant hosts. For each cage test, 10 sleeve cages with either five nymphs or adults were secured to individual plants. There were 5 cages each of TPB nymphs and adults in each plot. Five treatments were tested: (a) water control (UTC), (b) USDA *Beauveria* strain (1×10^{13} conidia per acre), (c) Diamond 0.83 EC (12 oz/acre), (d) USDA *Beauveria* (1×10^{13} conidia per acre) plus Diamond (12 oz/acre), and (e) Centric (2oz/acre).

Fourty-eight hours after treatment, plants were cut below the cage and taken to the laboratory where TPB were removed and sorted. Dead insects were placed in moist filter paper lined chambers, and living insects were placed individually in 2 oz cups with a 1/2 inch cube of wet florist water foam and a kernel of canned corn. Living insects were held for ten days and checked daily for death. Dead insects were inspected for molting problems and outward signs of fungal infection. Results were pooled together and ANOVA statistics were used to test the effects of life stage and treatment on days to death (DTD).

A lower percentage of untreated control insects died before 10 days (74 %) then in treated insects (91% to 94% mortality). Overall there was a significant effect of treatment, stage and the interaction of the two on mean DTD (all $p < 0.0181$). Untreated control TPBs had significantly higher DTDs (7.3 days) than all other treatments (all $p < 0.0001$). Centric treatments had significantly lower DTD then all other treatments (4.2 days) (all $p>0.0001$). Beauveria and Diamond treatments alone and in combination were not significantly different from one another (5.7 to 6.1 days) (all $p > 0.05$). Treatments containing Beauveria had higher rates if infection then all other treatments (44 to 49 % as opposed to 2 to 4 % for those containing no Beauveria). No differences in molting problems were observed between any of the treatments.

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Evaluation of Reactions of Arkansas Soybean Cultivars to Two Viruses.
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Soybean mosaic virus (SMV) and *Tobacco ringspot virus* (TRSV) are considered as two important viral pathogens which cause reduction in soybean yield. SMV includes seven strains (G1 to G7). Three resistance loci (*Rsv1*, *Rsv3*, and *Rsv4*) in some varieties of soybeans have been identified. TRSV isolates of varying severity have been observed, but no genes for resistance have been reported. The objective of this study was to screen Arkansas soybean cultivars for resistance or tolerance to SMV and TRSV. A total of 303 cultivars currently grown in Arkansas were screened in the greenhouse for their reactions to SMV and TRSV. All cultivars were inoculated with two SMV strains (G1 and G7) and two TRSV isolates (mild and severe) by rub mechanical inoculation. The TRSV isolates were selected from a collection of soybean isolated from northwest Arkansas. The SMV strains were from Sue Tolin at Virginia Tech. The results of G1 inoculation reveled that 221 cultivars were susceptible(S), 31 resistant(R), 9 necrotic (N), and 42 had a mixed reaction. The G7 inoculation showed that 273 cultivars were S, 21 R, 5 N, and 4 had a mixedreaction. The 28 cultivars resistant to G1 but susceptible or necrotic to G7 carry *Rsv1* alleles for SMV resistance, whereas the 16 cultivars susceptible to G1 but resistant to G7 contain *Rsv3* alleles. The 9 cultivars necrotic to G1 may carry *Rsv1-n*, while 2 cultivars resistant to both G1 and G7 may contain *Rsv4* or two resistance genes. All cultivars were susceptible TRSV isolate, and all cultivars showed bud blight to severe isolate 10 days after inoculation. However, 52 cultivars recovered 5 weeks after inoculation (more than 80% of the plants grew out of the bud blight and formed new leaves). The recovered plants, although systemically infected with TRSV based on laboratory test, clearly showed tolerance to TRSV after initial bud blight shock reaction.