RESEARCH CONFERENCE ABSTRACTS

VOLUME 18

Arkansas Crop Protection Association

December 1 – December 2, 2014
Courtyard Marriott
Fayetteville, Arkansas

STUDENT COMPETITIONS
SPONSORED BY:

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Syngenta Crop Protection

Valent USA

Monday, December 1, 2014

12:00 noon Registration

MODERATOR: Donna L. Frizzell
Student Contest Chair: Mohammad T. Bararpour
Audio-Visual Coordinator: Jarrod T. Hardke

01:00 p.m. **Opening Remarks**

01:15 p.m. **Efficacy and Crop Tolerance of Herbicide Programs in Glytol/LibertyLink Cotton.**
M.R. Miller**, J.K. Norsworthy, C. Starkey, and C.J. Meyer. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 1

01:30 p.m. **Sensitivity of Cover Crops to Low Rates of Soil Active Herbicides.**
M.G. Palhano*, J.K. Norsworthy, C.J. Meyer, M.R. Miller, and J.K. Green. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 1

01:45 p.m. **Potassium Deficiency Effects on Nodal Seed Yield and Yield Components of an Indeterminate Soybean.**
M.R. Parvej**, N.A. Slaton, T.L. Roberts, R.E. DeLong, R.J. Dempsey, and M.S. Fryer. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 2

02:00 p.m. **How Much Heat is Needed to Destroy Weed Seed at Crop Harvest?**
Jeremy K. Green*, J.K. Norsworthy, Z.D. Lancaster, J.C. Moore, C.J. Meyer, and M.T. Bararpour. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 2

02:15 p.m. **Influence of Droplet Size on Efficacy of Engenia, Glyphosate, and Glufosinate Applications.**
C.J. Meyer[1]*, J.K. Norsworthy[1], G.R. Kruger[2], J.K. Green[1], Z.D. Lancaster[1], and J.C. Moore[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [1]Dept. of Agronomy and Horticulture, University of Nebraska-Lincoln, North Platte, Nebraska. 3

02:30 p.m. **In-Season Quick Test for Herbicide Resistance in Italian Ryegrass.**
Reiofeli A. Salas**, Nilda R. Burgos, M. Ather Nadeem, Sirichai Sathuwijarn, Silvana Spaniol-Fin, and Robert C. Scott. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 3

02:45 p.m. **Characterization of a Smartphone Application to Predict Leaf N Concentration in Maize.**
A. Rhezali*, L.C. Purcell, and T.L. Roberts. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 4

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

*Denotes M.S. Student **Denotes Ph.D. Student

Monday, December 1, 2014 (cont.)

MODERATOR: Donna L. Frizzell

04:45 p.m. **Conclude for the day**

*Denotes M.S. Student **Denotes Ph.D. Student

Tuesday, December 2, 2014

MODERATOR: Eddie Castaneda

08:00 a.m. **Validation of N-STaR for Rice on Clay Soils in Arkansas.**
Jarom Davidson*, Trenton L. Roberts, Richard J. Norman, Nathan A. Slaton, Chester E. Greub, and Jarrod T. Hardke. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 8

08:15 a.m. **The Interaction of Seeding Rate, Row Spacing, and Plant Architecture with Weed Control on Soybean Yield.**
M.D. Fuhrman*, W.J. Ross, R. Scott, L. Hamilton, and N. Pearrow. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 9

08:30 a.m. **Does CruiserMaxx Rice Alleviate Injury in Clearfield Rice from ALS-Inhibiting Herbicides?**
S.M. Martin[1]*, J.K. Norsworthy[1], R.C. Scott[1], G. Lorenz[2], J. Hardke[1], and M.T. Bararpour[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. Dept. of Entomology, University of Arkansas, Fayetteville, AR. 9

08:45 a.m. **Residual Activity of Quizalofop on Grass Weeds and Crops Relative to Other Graminicides.**
Z.D. Lancaster*, J.K. Norsworthy, M.G. Palhano, S.M. Martin, R.R. Hale, and J.C. Moore. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 10

09:00 a.m. **Assessment of Fluopyram for Management of *Meloidogyne incognita* on soybean.**
Courtney Jackson*, Travis R. Faske, Katherine Hurd, and Michael Emerson. Dept. of Plant Pathology, University of Arkansas, Fayetteville, AR. 10

09:15 a.m. **Interaction of Sharpen® with Grass Herbicides on Barnyardgrass.**
R.R. Hale*, L.T. Barber, J.K. Norsworthy, and R.C. Scott. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 11

09:30 a.m. **Cultivar and Previous Crop Effects on Methane Emissions from Rice Grown on a Clay Soil.**
Alden D. Smartt*, Christopher W. Rogers, Kristofor R. Brye, and Richard J. Norman. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 11

09:45 a.m. **Validation of Soil-Test Based Phosphorus and Potassium Fertilizer Recommendations for Rice.**
M. Fryer*, N.A. Slaton, T.L. Roberts, R.J. Norman, R. DeLong, R. Dempsey, and R. Parvej. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 12

10:00 a.m. **Break**

*Denotes M.S. Student **Denotes Ph.D. Student

Tuesday, December 2, 2014 (cont.)

MODERATOR: Eddie Castaneda

*Denotes M.S. Student **Denotes Ph.D. Student

ABSTRACTS

Efficacy and Crop Tolerance of Herbicide Programs in Glytol/LibertyLink Cotton.
M.R. Miller**, J.K. Norsworthy, C. Starkey, and C.J. Meyer. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The evolution of glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) has forced weed management decisions in cotton to be centered on controlling this troublesome weed. As this and other herbicide-resistant weeds continue to spread across the Cotton Belt, new technologies are needed to achieve effective control. The stacked trait technology present in Glytol® Libertylink ® cotton provides growers with an option to control difficult-to-control and herbicide-resistant weed species by allowing over-the-top applications of glufosinate and glyphosate. An experiment was conducted in 2014 at the University of Arkansas Northeast Research and Extension Center located in Keiser, AR to evaluate herbicide programs in Glytol® Libertylink ® cotton. A systems approach was evaluated utilizing preemergence followed by postemergence herbicide applications or total postemergence control programs for the management of glyphosate-resistant Palmer amaranth and other troublesome weeds. Preemergence treatments consisted of diuron, fluometuron, and diuron + fluometuron. Postemergence treatments consisted of glyphosate and glufosinate applied alone or in combination with current herbicide standards. The first application was made at planting, second application at the 2- to 3-leaf growth stage of cotton, third application at the 5- to 6-leaf growth stage, and the fourth application was directed at layby. Visual ratings of crop injury, broadleaf signalgrass, and Palmer amaranth control were taken 2 to 3 weeks after each application timing. Early season broadleaf signalgrass and Palmer amaranth control was the highest in programs that received a preemergence herbicide. Palmer amaranth control was 95% or higher 2 to 3 weeks after the layby application in all herbicide programs that utilized a preemergence followed by (fb) glufosinate alone or glufosinate in combination with glyphosate or S-metolachlor fb a layby application. Crop injury was less than 5% for all treatments. The use of Glytol® Libertylink ® cotton provides a valuable technological tool to growers, allowing them to implement herbicide programs capable of controlling difficult-to-manage weeds such as glyphosate-resistant Palmer amaranth. In order to achieve effective season-long control, growers should continue to apply preemergence residual herbicides prior to applying glufosinate for the best stewardship of this technology.

Sensitivity of Cover Crops to Low Rates of Soil Active Herbicides.
M.G. Palhano*, J.K. Norsworthy, C.J. Meyer, M.R. Miller, and J.K. Green. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The adequate establishment of cover crops is crucial for successful weed suppression. With the sowing of most cover crops immediately following a subsequent summer crop, there is risk that residual herbicides applied to the previous crop may persist and damage the subsequent cover crop. With some federal payments being linked to use of cover crops as a means to reduce tillage and increase weed suppression, there is widespread interest among growers to plant a wide assortment of cover crops, many of which have not been thoroughly researched in Midsouth cropping systems. Hence, a field study was conducted in the fall of 2014 at the Arkansas Agricultural Research and Extension Center in Fayetteville to evaluate the sensitivity of cover crops to herbicides that are commonly used in Midsouth summer crops. This experiment was a split plot with 16 cover crops serving as main plots and 17 residual herbicides applied at a 1/16X rate (simulated four half-lives) as subplots with four replications. After application, all the treatments received 1.3 cm of overhead irrigation to activate the herbicides. Stand accounts were taken after two weeks and injury was evaluated at two and four weeks after cover crop planting. A cover crop by herbicide interaction for injury assessments occurred at two and four weeks after treatment. The broadleaf cover crops Austrian winterpea, tillage radish, crimson clover, and hairy vetch were most sensitive to the photosystem II-inhibiting herbicides, especially Aatrex 4F. The cereal cover crops wheat, rye, oats, and triticale had greatest injury when treated with a low rate of the

chloroacetamides Dual or Harness. For each cover crop, the herbicides that have the greatest potential to cause injury will be highlighted as well as those for which complete tolerance was observed.

Potassium Deficiency Effects on Nodal Seed Yield and Yield Components of an Indeterminate Soybean.
M.R. Parvej**, N.A. Slaton, T.L. Roberts, R.E. DeLong, R.J. Dempsey, and M.S. Fryer. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The specific effect of K deficiency on yield and yield components across the nodes of soybean [*Glycine max* (L.) Merr] plants is needed to better understand the K nutritional requirement for high yield. We evaluated seed yield, selected yield components, and seed K concentration among nodes of an indeterminate soybean as affected by annual K-fertilization rate. Research was conducted at the Pine Tree Research Station (Colt, AR) in long-term K fertilization trials on Calhoun silt loam in 2012 and 2013. Armor 48-R40, an indeterminate soybean variety, was planted in plots that received 0, 75, or 150 kg K ha^{-1} yr^{-1} since 2000 or 2001. To evaluate seed yield, yield components, and seed K concentration, four representative whole plants were collected at maturity and dissected into ten node segments where each segment consisted of two nodes and internodes. Seed yield, pod and seed number, seed abortion, and seed K concentration were regressed across node segments using a model that included the linear, quadratic, and cubic node segment terms and their interaction with annual K-fertilization rate. Seed yield for soybean grown with no K averaged 16 g $plant^{-1}$ and was 24-33% lower than the yields of soybean grown with 75 or 150 kg K ha^{-1} yr^{-1}. The yield loss associated with K deficiency (0 kg K ha^{-1} yr^{-1}) was due to fewer pods (58) and seeds (133) $plant^{-1}$, and greater seed abortion (18%) compared to soybean that received 75 or 150 kg K ha^{-1} yr^{-1} (65-73 pods and 161-180 seeds $plant^{-1}$, and 7-9% total seed abortion). More specifically, seed yield, pod and seed number, and seed abortion differences among K-fertilization rates occurred on the top four (2012) to seven (2013) node segments. Soybean grown with no K produced 31-42% less yield, 12-23% fewer pods, 25-35% fewer seeds, and exhibited 33-55% more seed abortion compared to soybean grown with 75 or 150 kg K ha^{-1} yr^{-1}. Regardless of annual K-fertilization rates, seed K concentration decreased quadratically from the bottom nodes towards the top nodes. The decline was greatest between the middle and top nodes for soybean grown with no K [18.2 (bottom node)-11.5 (top node segment) g K kg^{-1}] compared to 75 (20.2-17.5 g K kg^{-1}) or 150 (21.5-19.7 g K kg^{-1}) kg K ha^{-1} yr^{-1}. Results suggest that the yield loss from K deficiency begins at the top of plant and proceeds downward as the deficiency severity increases.

How Much Heat is Needed to Destroy Weed Seed at Crop Harvest?
Jeremy K. Green*, J.K. Norsworthy, Z.D. Lancaster, J.C. Moore, C.J. Meyer, and M.T. Bararpour. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Herbicide-resistant weeds are a growing problem in the U.S. and around the world. In order to preserve the efficacy of the herbicides that are currently in use, dependence on these herbicides must be reduced. Harvest Weed Seed Control measures similar to those currently used in Australian cropping systems are being evaluated for use in U.S. soybean production at the University of Arkansas. A field experiment was conducted in 2014 at the University of Arkansas Northeast Research and Extension Center in Keiser, Arkansas to characterize the amount of heat resulting from narrow-windrow burning of soybean chaff passing through a 41-cm wide chute attached to the rear of a combine. Additionally, the effectiveness of the burn in destroying weed seed was determined. The amount of soybean chaff was varied by adjusting the swath width on the combine (10, 9, 8, 7, 6, & 5 rows respectively), and chaff was collected and weighed in 1-m of chaff row near the location in which the burn took place. Small aluminum tins (5-cm diameter) each containing 100 Palmer amaranth, barnyardgrass, johnsongrass, and pitted morningglory seeds were placed inside the windrows at the soil surface and the temperature and duration of the burn near the seed was recorded with a thermocouple. Maximum temperatures recorded during the burn, depending upon wind speed and amount of chaff present, ranged from 111 C to 680 C. The duration in which the burn was above 100 C near the seed was generally 7 to 33 minutes. Based on visual inspection, most of the Palmer amaranth, barnyardgrass, and johnsongrass were ash following the burn.

Pitted morningglory appeared to be the most resilient to burning, and seed germination and viability estimates of these seeds are ongoing. If a Harvest Weed Seed Control strategy such as narrow-windrow burning can be proven successful in U.S. soybean production, this seed destruction practice would aid resistance management by lessening the return of weed seed to the soil seedbank.

Influence of Droplet Size on Efficacy of Engenia, Glyphosate, and Glufosinate Applications.
C.J. Meyer[1]*, J.K. Norsworthy[1], G.R. Kruger[2], J.K. Green[1], Z.D. Lancaster[1], and J.C. Moore[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [1]Dept. of Agronomy and Horticulture, University of Nebraska-Lincoln, North Platte, Nebraska.

In 2015, auxin-type herbicide-resistant crops will be available in the marketplace; therefore, nozzle selection will become a highly important variable in maintaining efficacy of herbicide solutions while minimizing off-target movement. A field experiment was conducted in 2013 and 2014 at the Northeast Research and Extension Center in Keiser, Arkansas to evaluate interactions between dicamba formulated as Engenia, glyphosate (Roundup PowerMAX), and glufosinate (Liberty) applied with three different nozzle types. To supplement the field data, droplet spectra for each nozzle and tank-mix combination were determined at the West Central Research and Extension Center in North Platte, Nebraska. This experiment was arranged as a randomized complete bock design with a factorial arrangement of two factors: nozzle type and herbicide treatment. TeeJet 11004 TT, AIXR, and TTI nozzles, designated by the manufacturer as coarse, extremely coarse, and ultra coarse droplets, respectively, were used to apply the herbicide treatments. Applications were made with a tractor-mounted research sprayer at 276 kPa, 140 L ha^{-1}, and 13.4 km hr^{-1} to actively growing weeds. Herbicide treatments were labeled rates of Liberty, Roundup PowerMAX, Engenia, Liberty + Engenia, Roundup PowerMAX + Engenia, and Liberty + Roundup PowerMAX + Engenia. Percent weed control was evaluated four weeks after application for Palmer amaranth and barnyardgrass. For most treatment and nozzle combinations, Palmer amaranth control was greater than 95% in both years. In 2013, TT nozzles provided significantly greater control of barnyardgrass than with the TTI nozzle for Liberty alone, Roundup PowerMAX alone, Roundup PowerMAX + Engenia, and Liberty + Roundup PowerMAX + Engenia. In 2014, the interaction between herbicide and nozzle type was not significant; therefore, the TT nozzle provided three percentage points more control of barnyardgrass than the TTI nozzle, averaged across all herbicide treatments except for Engenia alone (control of barnyardgrass by Engenia alone was 0%). When treatments were applied to 20 to 30-cm tall barnyardgrass in 2014, compared to 8- to 15-cm tall plants in 2013, an antagonistic effect was observed when Engenia was added to Roundup PowerMAX. The weed control data correlated with the droplet spectra analysis in that as volume median diameter (Dv50) increased from TT nozzles to the TTI nozzles, efficacy tended to decrease. Changing nozzle size or mixing herbicides in solution can have a dramatic effect on the droplet spectrum and volume median diameter. For example, Liberty alone tends to decrease Dv50 relative to pure water, but when tank-mixed with Engenia or Roundup PowerMAX, a reduction in droplet size is not observed. These results suggest that nozzle selection will play a key role in maximizing efficacy of postemergence applications in dicamba-resistant crops. Additionally, evaluating droplet spectra of potential dicamba-containing tank-mixtures is critical for producing the desired droplet size to minimize off-target movement.

In-Season Quick Test for Herbicide Resistance in Italian Ryegrass.
Reiofeli A. Salas**, Nilda R. Burgos, M. Ather Nadeem, Sirichai Sathuwijarn, Silvana Spaniol-Fin, and Robert C. Scott. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Italian ryegrass (*Lolium perenne* ssp. *multiflorum*) is a major weed in wheat production fields causing significant crop yield loss. The control of Italian ryegrass infestation is a problem due to the evolution of ACCase- and ALS-herbicide resistant populations. Detection of herbicide resistance is usually conducted using whole-plant pot bioassay but this method is relatively time-consuming, laborious, and only applicable to seed material collected post-herbicide treatment at the end of the growing season. Syngenta’s Resistance In-Season

Quick (RISQ) or Petri-plate quick assay entails plating seedlings onto agar containing a discriminating dose of herbicide to detect herbicide resistance in grass weed species. The objective of this study is to investigate the correlation of whole-plant pot bioassay with Petri-plate quick assay in detecting pinoxaden resistance in 10 Italian ryegrass populations. In the RISQ assay, two-leaf stage Italian ryegrass seedlings from each population were transplanted into 16 Petri dishes containing agar with 0.4 µM pinoxaden and placed on a bench under fluorescent lights at 25°C. Each Petri dish contained four seedlings to evaluate a total of 64 seedlings per population. The experiment was conducted twice with 8 replications per run. The percentage of surviving plants was recorded 10 days after plating. In the classical whole-plant pot assay, the same Italian ryegrass populations were planted in 10-cm pots and grown in the greenhouse. Ten seedlings were maintained per pot. At the two- to three-leaf stage, seedlings were sprayed with 0, 15, 30, 60, 120, and 240 ai ha-1 pinoxaden with four replications per herbicide dose. Mortality was evaluated three weeks after herbicide application. The herbicide dose that caused 50% mortality (LD_{50}) obtained from the whole-plant pot bioassay was tightly correlated (79%) with seedling survivorship in the Petri-plate assay. In all cases, populations classified as resistant to pinoxaden in the whole-plant pot bioassay also were classified resistant in the RISQ assay. Thus, the RISQ assay provides fast, reliable, early detection of resistance to pinoxaden, allowing growers to adjust weed management decisions in the same season. Adaptation of the RISQ assay to other herbicides and weed species is currently being conducted. The RISQ assay is a simple, space-efficient, cost-effective, and robust method that can be used in detecting resistance to postemergence herbicides early in the growing season.

Characterization of a Smartphone Application to Predict Leaf N Concentration in Maize.
A. Rhezali*, L.C. Purcell, and T.L. Roberts. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Nitrogen (N) fertilization is essential in maximizing maize (*Zea mays* L.) yield. Using N efficiently requires the adoption of precise and accurate methods that can help producers determine the correct rates of N fertilizer to be applied. The dark green color index (DGCI) technology might be an effective tool to estimate maize N status. The objective of this study was to characterize leaf N concentration with greenness measurements as determined by DGCI using a camera and a smartphone application (GreenIndex Spectrum Tech) and to determine the sources leading to the discrepancies if DGCI values of the app differ from those made using the camera. Measurements of DGCI were made under laboratory conditions and were compared with N concentration of the entire leaf blade. Field experiments were conducted at two sites during summer of 2013 with N rates ranging from 0 to 360 kg N ha-1. Camera DGCI values and Leaf N were closely associated (r^2=0.70**, 0.85**), but the relationship between GreenIndex DGCI and leaf N showed more variability (0.40*, 0.67**). It was hypothesized that variability between the GreenIndex DGCI and leaf N is because camera measurements of DGCI use the whole leaf while the app determines DGCI from only the center portion of the leaf. Nitrogen concentration increased from the bottom to the top of the maize leaf, which decreased the r^2 between GreenIndex DGCI and total leaf N. Results support the need to choose appropriate leaf portion by the GreenIndex DGCI technology to predict leaf N concentration in maize.

Control of Frogeye Leaf Spot in Soybeans at Two Different Spray Volumes.
Jayson Sandine[1]* and Terry Spurlock[2]. [1]University of Arkansas, Monticello, AR. [2]Dept. of Plant Pathology, University of Arkansas, Fayetteville, AR.

Frogeye leaf spot (FLS), caused by the fungus *Cercospora sojina*, is a disease that occurs most years on Arkansas soybeans and can cause substantial yield losses if left untreated. Treatment involves application of a fungicide between R3-R5 when disease is present on susceptible varieties. In recent years, isolates of *C. sojina* have demonstrated resistance to azoxystrobin, a commonly used fungicide. Further, fungicides applied in university tests to determine product performance are applied at 10-15 gal/acre spray volumes (in accordance with fungicide label instructions) and many fields in Arkansas with active FLS are treated with azoxystrobin applied by an airplane at spray volumes below label recommendations and are likely as low as 3-5 gal/acre.

The objective of this work was to determine the efficacy of fungicide chemistries other than azoxystrobin and to determine if efficacy differed as spray volume decreased. Two separate trials, one 3 gal/acre and one 10 gal/acre spray volume, were planted adjacently in the same field with Agventure 49C9RR soybean on 38 inch beds in early June 2014 at the Southeast Research and Extension Center near Rohwer, AR. Each trial had 8 replicated treatments in plots that were 40 ft. long with 5 ft. alleys and treatments arranged in a completely random design. Treatments were Quadris (azoxystrobin), TKO phosphite (potassium phosphite), Topsin XTR (thiophanate-methyl and tebuconazole), all combinations of each product, and an untreated control. Plots were rated for percent FLS lesions (0-30%) at 14 and 28 days post fungicide application. At 14 days after application, Topsin XTR was significantly better than the untreated control in the low spray volume trial and no combination of products were significantly better than Topsin alone (P=0.05). At 28 days post application, no fungicide application provided control of FLS significantly different than the untreated controls. In the 10 gallon trial, Topsin XTR and combinations with Topsin XTR provided the best control of FLS and were significantly different than the untreated controls (P=0.05). At 28 days post application, Topsin XTR and combinations with Topsin XTR had significantly less FLS than the untreated control. Yield varied by spray volume with an approximately 5 bu/acre increase in the lower spray volume and an approximately 9 bu/acre increase with Topsin XTR at the higher spray volume over the untreated controls. Quadris alone did not provide control of FLS indicating that the population of C. sojina was resistant to azoxystrobin. The results also indicate that fungicide application at 10 gal/acre provided longer control of FLS and numerically higher yields when the two tests were compared.

Characterization of a Multiple Resistant Junglerice (Echinochloa colona) from Arkansas.
Christopher E. Rouse**, Nilda R. Burgos, Reiofeli A. Salas, and Te-Ming Tseng. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Echinochloa spp. have historically been the most common and troublesome weeds in rice production. Recent research indicates that junglerice (*Echinochloa colona*) is the most common species found in rice fields and little research has been dedicated to characterizing its influence in Arkansas. It is believed that a lack of proper identification and control has led to the evolution of unidentified herbicide-resistant populations of junglerice throughout most of the rice producing areas of the state. From 2010 to 2014, *Echinochloa* spp. have been collected from around the state to identify the species and characterize their herbicide resistance profiles. Greenhouse and laboratory experiments were conducted to evaluate a population of junglerice from Prairie County, accession 100 (collected in 2011), with resistance to three herbicides- imazethapyr, propanil, and quinclorac. Initial screening of the field-sampled populations took place in the greenhouse. Field use rates of imazethapyr (0.11 kg ha-1), propanil (4.5 kg ha-1), and quinclorac (0.56 kg ha-1) were applied to 2-3 leaf plants. At 21 days after treatment, plants that had survived the applications were identified as resistant; those that had not were considered susceptible. Accession 100 survived all three herbicides. Dose response experiments were conducted using imazethapyr (10 rates up to 24x), propanil (7 rates up to 16x), and quinclorac (8 rates up to 8x). Other ALS herbicides were also tested for cross-resistance profiling. Follow-up research included evaluation of cytochrome P-450 mediated metabolism for all of the herbicides, β-cyanoaniline synthase activity assay to inform us on resistance mechanisms to quinclorac, and ALS gene sequencing to evaluate possible target site mutations in the ALS enzyme. Cytochrome P-450 metabolism was evaluated using malathion (0.99 kg ha-1) as a competitive inhibitor of the P-450 enzyme. The dose response analysis indicated that accession 100 has a high level of resistance to imazethapyr (up to 40 fold), high resistance to propanil (>16x field use rate), and moderate resistance to quinclorac with a resistance value of 2.1. The P-450 inhibition experiments suggested a cytochrome P-450 mediated metabolism of propanil and imazethapyr. Elevated β-cyanoaniline synthase activity was also identified as a possible mechanism to detoxify cyanide following quinclorac application, although this conferred only a moderate resistance level. Preliminary analysis of the ALS gene sequence identified a mutation at Ala 122, which might contribute to ALS resistance. Accession 100 was confirmed resistant to all three herbicides evaluated in these experiments. Investigations into mechanisms of resistance indicated both non-target-site and target-site mechanisms as contributing factors in the ability of the accession to tolerate these herbicides.

Ammonia Volatilization and Rice Grain Yield as Affected by Simulated Rainfall Amount and Nitrogen Fertilizer Amendment.

R.J. Dempsey*, N.A. Slaton, R.J. Norman, T.L. Roberts, R.E. DeLong, M.S. Fryer, and M.R. Parvej. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Ammonia volatilization and denitrification are the two predominant N loss mechanisms in rice (*Oryza sativa* L.) production and each pathway may be affected differently by soil moisture conditions between preflood urea application and establishing the permanent flood. We compared the effects of simulated rainfall amounts and N-(n-butyl) thiophosphoric triamide (NBPT) urease inhibitor rate on NH3 volatilization and rice N uptake and grain yield. Three experiments were conducted during 2013 and 2014 on an alkaline Calhoun silt loam. Ammonia volatilization was measured in two trials. Urea or NBPT-treated urea (0.88 g NBPT kg-1 urea) was subjected to six simulated rainfall amounts ranging from 0 to 25 mm within 5 to 12 h after urea-N application. The permanent flood was established 8-13 d after urea-N application. Cumulative NH3 volatilization, N uptake, and grain yield were regressed on simulated rainfall amount, allowing for linear and quadratic terms with coefficients depending on N source and trial. After 11 d, cumulative NH3-N loss from NBPT-Urea ranged from 0.2 to 2.0% of the applied-N (112 kg N ha-1) and was similar across simulated rainfall amounts. Cumulative NH3-N loss from Urea ranged from 0.7 to 8.6% of the applied-N and was greatest with no simulated rainfall and decreased non-linearly (quadratic) as rainfall amount increased. Cumulative NH3-N loss from NBPT-Urea was significantly lower than from Urea when simulated rainfall was <21.8 mm. Nitrogen uptake from rice fertilized with Urea and NBPT-Urea decreased non-linearly (quadratic) as simulated rainfall amount increased (66-95 kg N ha-1 Trial A; 87-118 kg N ha-1 Trial B; 63-103 kg N ha-1 Trial C). For Trial A and C, N uptake by rice fertilized with NBPT-Urea was greater than Urea fertilized rice across simulated rainfall amounts. In Trial B, rice N uptake did not differ between N sources. Grain yield of rice receiving Urea decreased linearly as simulated rainfall increased (8,092-9,286 kg ha-1 Trial A; 7,824-8,867 kg ha-1 Trial B; 6,051-7,520 kg ha-1 Trial C) with the greatest yield when no simulated rainfall was applied. Rice grain yield fertilized with NBPT-Urea (9,101-9,451 kg ha-1 Trial A; 7,996-8,898 kg ha-1 Trial B; 7,361-8,287 kg ha-1 Trial C) was relatively constant across simulated rainfall amounts and greater than rice yields fertilized with Urea. Results suggest that the urease inhibitor, NBPT, reduced NH3 volatilization losses and delays the onset of nitrification following urea hydrolysis, which reduces N loss via denitrification when establishment of the permanent flood is delayed.

How Applicable is the Cornstalk Nitrate Test for Arkansas Corn Production?

Chester E. Greub**, Trenton L. Roberts, Nathan A. Slaton, Richard J. Norman, Kevin Lawson, and Jason Kelley. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The Cornstalk Nitrate Test (CSNT) is a post season nitrogen (N) management tool developed in the upper Midwest, used to determine if inadequate/optimal/excessive N was applied to the corn (*Zea mays* L.) crop during the current year. Corn can be considered a luxury consumer of N, with corn taking up more N than needed for maximal production with little lodging or yield loss. At maturity, corn plants that receive excess N will accumulate NO3-N in the lower portion of the corn stalk. However, corn plants that received inadequate amounts of N will remobilize NO3-N from the lower portion of the stalk and leaves to assist in grain-fill. Interpretation of CSNT results can help adjust the N recommendation for the following corn crop and help fine-tune N management for a specific field over time. The CSNT cannot directly identify how N recommendations should be adjusted depending on what category a producers field is classified in, however fields should be sampled multiple years prior to adjusting your N management strategy. Producers that are consistently in the excessive range are typically applying too much N and will likely find it profitable to reduce N rates. Due to the relatively small amount of land dedicated to corn production in Arkansas, little research has been conducted to

evaluate the applicability of the CSNT in Arkansas. The objective of this study is to evaluate how applicable the CSNT is for furrow-irrigated corn production in Arkansas.

Cornstalk nitrate samples and yield data were collected from eight corn verification fields throughout the primary corn producing areas of Arkansas, which received the standard University of Arkansas N recommendation of about 250 kg N ha-1. Our results indicate that most locations appear to have achieved near maximum yields. All locations in this study were classified in either the Low or Optimal category based on NO3-N concentration limits determined for the upper Midwest, with no fields identified in the Excessive category. Fields classified as Low had a NO3-N concentration range from 1 to 30 mg kg-1. Whereas, fields classified as Optimal had a larger fluctuation in NO3-N concentration that ranged from 1 to 3900 mg kg-1. Large variability in cornstalk NO3-N within a field was identified for fields that received near optimal N applications. With Arkansas having different management practices and N use efficiencies compared to the upper Midwest where this test was developed, further research is needed to identify differences in the interpretation of stalk nitrate concentrations in Arkansas.

Rice Cultivar Response to Midseason Nitrogen Fertilizer Timing.

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A study was conducted from 2011 to 2013 to determine the effect of midseason nitrogen (N) application timing on the grain yield of conventionally bred rice cultivars. The cultivars chosen for the study for the years 2011 and 2012 were Cheniere and Taggart. For the year 2013 the cultivars chosen were CL152 and Roy J. The locations included in the study were of silt loam and clay soil texture representative of areas commonly used in rice production in Arkansas. The treatments applied were two preflood N rates of 45 and 90 lbs N/acre and a single midseason rate of 45 lbs N/acre applied at beginning internode elongation (BIE), BIE+7 days, BIE+14 days or BIE+21 days, and a control with no midseason N application. In 2013 a single pre-flood N application (150 lbs N/acre or 120 lbs N/acre depending on soil texture) treatment was added. The treatments were managed in a randomized complete block factorial design with four replications. Analysis of variance on the grain yield data was performed utilizing SAS 9.2 (SAS Institute, Cary, NC). Means differences were compared using Fisher's protected least significant difference (LSD) procedure at a P=0.05 probability level. There was no interaction of rice cultivar x pre-flood N rate x mid-season N application timing in any site-year and the interaction of rice cultivar x mid-season N application timing was significant in only one out of seven site-years. The interaction of pre-flood N rate × mid-season N timing on rice grain yield occurred only at some locations. Rice grain yield increased similarly among the three mid-season N application times at the lower pre-flood N rate. In the locations where the two-way interaction of pre-flood N rate × midseason N timing on grain yield was not significant, there were significant main effects of pre-flood N rate and midseason N application timing on grain yield. Grain yield generally increased when the pre-flood N rate increased from 45 to 90 lbs N/acre. Application of mid-season N at any of the four application times increased grain yield similarly. A single pre-flood N application of 120 lbs N/acre or 150 lbs N/acre, depending on soil texture, resulted in similar or greater grain yields than when N was applied in split applications at preflood and midseason. At the lower preflood N rates, midseason N increased grain yield similarly across all four application timings. Recommendations for midseason N application timing between BIE and BIE+7 days are supported by data that is now almost 20 years old. Rice cultivars have changed over the last 20 years and the results from this three year study indicate the proper midseason N application timing may also have changed. A single preflood N application added the third year resulted in similar or greater grain yields than the two-way split. The three year study indicates that midseason N application timing needs to be reevaluated for currently grown rice cultivars.

Edamame Yield Response to Late-Season Nitrogen Applications.

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The recent introduction of commercial edamame [*Glycine max* (L.) Merr.] production in Arkansas has created a need for edamame fertility recommendations. To determine nitrogen fertility requirements for edamame production, a study involving nitrogen fertilizer sources and rates was conducted at two locations in Arkansas. The objective of the study was to determine the effect of nitrogen fertilizer source and rate on yield, seed quantity, seed size, and general edamame quality of two varieties. Plots at both locations were organized in randomized complete block design with four replications of each treatment. The two varieties included "8080", an imported, short stature variety developed for fresh consumption, and "4002", a tall statured, locally developed variety used for canning or dehydrating. A rate of 28 kg N ha-1 of each nitrogen fertilizer source, Ammonium sulfate and Urea with Agrotain, was applied at preplant, V6, R1 and/or R3. Fresh weight yield was measured immediately after mechanical harvesting of pods. Edamame pods were separated by variety and treatment and categorized by number of beans per pod. Quality and pod fill were also assessed after harvest. Pods in treated plots did not significantly differ from pods in the untreated control plots in yield, seed size, or pod fill within each variety. Comparisons between the two varieties showed higher fresh yield and pod fill for 4002, which can be attributed to the variety's better adaptation to the climate and environment; however, the seed size of this variety was much smaller than the ideal seed size for edamame. Results from this study indicate that fertilizer nitrogen does not provide any considerable yield or quality benefits for edamame production in Arkansas.

Validation of N-STaR for Rice on Clay Soils in Arkansas.

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The development of the Nitrogen Soil Test for Rice (N-STaR) allowed a site-specific N recommendation for rice on silt loam soils in Arkansas. Expansion of the site-specific N test into clay soils and its use in 27 counties in Arkansas necessitated the validation of N-STaR for rice produced on clay soil. In 2014, seven sites across Arkansas were selected for their wide difference in native soil-N and planted to one of three rice varieties. Stands were monitored for disease and pest pressure and yields were measured at the end of the season. Soil samples were taken at a 30 cm depth, analyzed using N-STaR direct steam distillation, and the N rates were predicted using the calibration curves for 95 and 100% relative grain yield (RGY). In the validation trial, six treatments were compared; a control (0 kg N ha-1), the N-STaR 95 and 100% RGY N rates applied in a standard two-way split application with 50 kg N ha -1 applied at beginning internode elongation and the remainder preflood, the N-STaR 95 and 100% RGY N rates applied in a single pre-flood application, and the Standard Recommendation based on soil texture and previous crop. Nitrogen rates predicted by the calibration curves ranged from 56 kg N ha-1 to 252 kg N ha-1. Rice yields from the 95% RGY plots were the same or greater as the Standard Recommendation for six of the seven locations. For the 100% RGY treatment, all of the trials indicated similar yields could be achieved when compared to the standard recommendation. This data indicates that N-STaR is able to predict site-specific N fertilizer rates for rice produced to clay soils over a wide range of environmental and production settings. Previous work with N-STaR validation on silt loam soils indicated that there was an upper limit above which there was not a significant yield response to increases in N fertilizer application. Therefore, further work is needed to refine the calibration curves in order to determine the lower and upper thresholds for fertilizer application to produce maximal and profitable rice yields on clay soils in Arkansas.

The Interaction of Seeding Rate, Row Spacing, and Plant Architecture with Weed Control on Soybean Yield.
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Weed control is a concerning factor in soybean [*Glycine max* (L.) Merr.] production. Arkansas, along with many other states, has identified an increasing number of herbicide resistant weeds. One of the most competitive and aggressive pigweed species in Arkansas is Palmer Amaranth (*Amaranthus palmeri*), commonly known as Palmer pigweed. This species has proven resistance to multiple classes of herbicides (2, 3, 5, 9, and 27).

Over the years a variety of studies have reviewed the effects of weed control, and/or the effects of agronomic practices on yield. Studies showed a field where the weed management practices have failed suffer a yield loss (Young, 2006). In a review of agronomic practices, most results show a row spacing of less than 76 cm and a seeding rate of 370,000 seed per ha1- exhibit the best results (Dana B. Harder, 2007)

The objective of this study was to determine the interaction of weed pressure with a variety of agronomic practices including seeding rate, row spacing, and plant architecture. The study was initiated in 2013 at the Newport Extension Research Station in Newport, Arkansas. The study was blocked according to row spacing and seeding rate. Treatments for weed control and plant architecture were randomized. Treatment combination consisted of three seeding rates (ranging from 271,700 to 469,300 seeds ha1-), 3 row-spacings (38, 76, and 92 cm), and 2 architectures (bushy or erect). The complete set of treatments was run using MG 4 and MG 5 soybeans.
Data was collected on a weekly basis. Plant stand counts, pictures, Palmer pigweed ratings, and plant heights were collected. Grain yield and moisture were collected at harvest. Statistical analysis was run in ARM v9.1 (Gylling Data Management, Inc. Brookings, SD) and SAS 9.3.

Results for both the MG IV and V studies showed the 38 cm row-spacing statistically had higher grain yields than the wider spacing. When the row-spacing by seeding rate interaction was evaluated, the 38 cm row-spacing statistically had higher grain yields for all three seeding-rates compared to the wider row-spacing. All weed free treatments consistently had greater grain yields than the weedy treatments. An evaluation of Palmer pigweed numbers per plot versus yield, showed that the pigweed numbers increased along with row spacing in the MG4 beans to the point of complete yield loss in the 92 cm row spacing.

Upon review of the findings, more emphasis on agronomic practices to decrease weed competition will be needed. Use of the best management practices could increase crop yield and help with weed control.

Does CruiserMaxx Rice Alleviate Injury in Clearfield Rice from ALS-Inhibiting Herbicides?
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Increased use of insecticide seed treatments in rice have brought up many questions about the added benefits of these products. In 2014, a field experiment was conducted at the Rice Research and Extension Center in Stuttgart, Arkansas and at the University of Arkansas Pine Bluff Farm in Lonoke, Arkansas to evaluate whether an insecticide seed treatment could possibly lessen injury from acetolactate synthase-inhibiting herbicides in Clearfield® rice. Two varieties were tested (CLXL 745 and CL152) with and without an insecticide seed treatment (CruiserMaxx® Rice). Four different herbicide combinations were evaluated (a non-treated check, two applications of Regiment®, two applications of Newpath®, and two applications of Newpath® and Regiment®). The first herbicide application was applied as early postemergence (1- to 2-leaf rice) and the second application was applied at prior to establishing the permanent flood (pre-flood). Crop injury was assessed at pre-flood and two and four weeks after flooding. A reduction of rice water weevil larvae was seen with use of the CruiserMaxx® Rice seed treatment. CLXL745 that received two applications of Newpath® and Regiment® had the most severe injury with a mean injury rating of 60% at Stuttgart and 55% at Lonoke. Even with this severe level of injury, rice yields within a variety were similar across seed treatments and herbicides. At Stuttgart, rough rice yields averaged over seed treatments and herbicides were 134 bu/A for CL152 and 181 bu/A for CLXL745. Similarly at Lonoke, CL152 produced 177 bu/A compared to 218 bu/A for CLXL745. The use of CruiserMaxx Rice at Lonoke resulted in an 11 bu/A increase in rough rice yield, averaged over varieties and herbicides. These results show that repeated applications of ALS-inhibiting herbicides can cause severe injury in Clearfield® rice, especially CLXL745, but rice is able to recover from this injury without an adverse effect on yield.

Residual Activity of Quizalofop on Grass Weeds and Crops Relative to Other Graminicides.
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With the evolution of weeds that have resistance to multiple herbicide modes of action, a new technology is needed to control many of these troublesome weeds. BASF is currently developing a new rice type that will be resistant to quizalofop, an acetyl coenzyme A carboxylase (ACCase)-inhibiting herbicide. A field experiment was conducted in the summer of 2014 at the University of Arkansas Agricultural Research and Extension Center in Fayetteville, Arkansas to evaluate the residual activity of quizalofop relative to other graminicides for crop injury and grass weed control. The experiment was set up as a split-split plot design assigning rainfall activation as the whole plot factor, with plant back date as the sub-plot, and herbicide treatments as the sub-subplot. This experiment was evaluated for four different crops (conventional rice, quizalofop-resistant rice, grain sorghum, and corn). Herbicide treatments were labeled and 2X rates of quizalofop (Targa), fenoxaprop (Ricestar HT), cyhalofop (Clincher), fluazifop (Fusilade DX), clethodim (SelectMax), and sethoxydim (Poast). The ½ inch rainfall event was applied with a traveling gun sprinkler system, and the plant backs were made at 0, 7, and 14 days after treatment. On all crops, injury from herbicide treatments increased with rainfall activation over no activation. At 14 to 21 days after treatment, grain sorghum and corn both had the highest injury of 19% and 20%, respectively, from the high rate of sethoxydim with rainfall activation. Conventional rice and quizalofop-resistant rice had the highest injury of 13% and 4%, respectively, from fluazifop at the high rate. Herbicides effectively controlled emerged grasses at the time of application, but had little residual grass control. Highest level of grass control occurred at 14 days after treatment, with control for all treatments declining from then on. Barnyardgrass (*Echinochloa crus-galli*) and broadleaf signalgrass (*Urochloa platyphylla*) were best controlled with the high rate of fluazifop at 98% and 96% respectively. The results of this experiment suggest that caution will need to be taken for plant back period and crop selection behind applications of certain graminicides, with environmental conditions also playing a role in potential injury.

Assessment of Fluopyram for Management of *Meloidogyne incognita* on soybean.
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The southern root-knot nematode, *Meloidogyne incognita*, is an important plant-parasitic nematode affecting soybean production. Fluopyram is an SDHI fungicide that was recently confirmed to be nematistatic to *M. incognita*. Currently, few studies have investigated the suppression of root-knot nematodes by fluopyram on soybean. Thus, the objective of this study was to evaluate the efficacy of fluopyram as a seed treatment (ST) and in-furrow (IF) application for suppression of *M. incognita* compared to other commercially available seed treatment nematicides, *Bacillus firmus* (I-1582) and abamectin. This trial was conducted in a commercial soybean field with a history of root-knot nematode near Pine Bluff, AR. The experimental design was a randomized complete block design with a low population density of root-knot nematode (100 J2/100 cc soil) at planting. Numerically, nematode reproduction based on eggs per gram of root at 30 DAP was lower for fluopyram, abamectin, *B. firmus* treated seed, and fluopyram applied IF than the non-treated control. Further, a numeric reduction in galls per root system was observed 30 DAP on abamectin treated seed compared to fluopyram applied as a ST and IF. Alternately, the percentage of root galling at 60 DAP was lower ($P = 0.05$) on fluopyram applied as a ST and IF than seed treated with a combination of fluopyram + abamectin. All fluopyram treatments had a numerically higher yield than the non-treated control. Fluopyram applied as an IF application was more associated with numeric reduction in root-gall ratings, nematode reproduction, and increased yield than fluopyram as a seed treatment. Further, the suppression of root-knot nematode reproduction by fluopyram applied IF on soybean appeared to be somewhat similar to that of abamectin and *B. firmus*. Research will continue to determine how fluopyram can benefit soybean producers.

Interaction of Sharpen® with Grass Herbicides on Barnyardgrass.
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Barnyardgrass [*Echinochloa crus-galli*] is a very problematic weed in Arkansas rice production. The physiological and biochemical capability of barnyardgrass to quickly evolve resistance continues to limit herbicide options for control. Sharpen® is a new contact herbicide labeled for broadleaf weed control in rice. When tank-mixing systemic herbicides with contact herbicides, antagonism or a reduction in efficacy is often observed. Hence, a greenhouse study was conducted in the fall of 2014 at the University of Arkansas Altheimer Laboratory in Fayetteville, AR to evaluate the interaction of herbicide combinations with Sharpen® for barnyardgrass control. This experiment was arranged in a randomized complete block design with a factorial arrangement of eight tank-mix partners applied with and without Sharpen®. Barnyardgrass was maintained under saturated conditions in pots containing potting mix. Applications were made using an enclosed spray chamber at 20 GPA. All treatments contained crop oil concentrate (COC) at 1% v/v. The herbicides that were evaluated alone and with Sharpen® included: Beyond® (imazamox), Clincher® (cyhalofop), Facet L® (quinclorac), Grasp® (penoxsulam), Regiment® (bispyribac), Ricestar HT® (fenoxaprop), SuperWham® (propanil), and Targa® (quizalofop) along with a nontreated (no herbicide). All herbicides were applied at labeled rates to 8-leaf barnyardgrass. Barnyardgrass control was visually rated at 2, 3, and 4 weeks after treatment. The addition of Sharpen® to each herbicide resulted in an additive response for barnyardgrass control at 2 weeks after treatment for all combinations, except for Regiment®, based on Colby's method for assessing interactions. For the combination of Sharpen® plus Regiment®, barnyardgrass control was 18 percentage points less for the tank-mixture compared to the expected response, which was deemed antagonistic. Different than expected, these results indicate that Sharpen® can be tank-mixed with herbicides that are routinely applied in rice for the control of barnyardgrass without fear of reduced efficacy.

Cultivar and Previous Crop Effects on Methane Emissions from Rice Grown on a Clay Soil.
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Methane (CH4) is one of the major greenhouse gases and has a global warming potential 25 times greater than carbon dioxide (CO2). Methane production occurs as a specific group of Archaea, the methanogens, decompose organic matter under anoxic conditions. Due to the anaerobic conditions that develop in soils used for flooded rice (Oryza sativa L.), along with the large global extent of rice production, it is estimated that rice cultivation is responsible for 11% of global anthropogenic CH4 emissions. The current U.S. estimates of CH4 emissions from rice are based on data from all of the major rice-growing regions; however, there is a general lack of data representing Arkansas' cultural practices. In order to adequately estimate and mitigate CH4 emissions from rice cultivation, it is important to have data representing the range of regional, climatic, and cultural variability throughout the nation. The objective of this study was to determine the effect of previous crop and cultivar on CH4 fluxes and seasonal emissions from rice grown on a clay soil in the direct-seeded, delayed-flood production system in eastern Arkansas. This study was conducted during the 2013 growing season at the Northeast Research and Extension Center (NEREC) in Keiser, Arkansas on a Sharkey clay (very-fine, smectitic, thermic, Chromic Epiaquerts). A split-plot design was used where the whole-plot factor was previous crop [rice or soybean (Glycine max L.)] and the split-plot factor was cultivar [CLXL745 (hybrid), Taggart (pure-line standard-stature), and Cheniere (pure-line semi-dwarf)]. Methane samples were collected at 20-minute intervals from 30-cm diameter, enclosed headspace chambers and fluxes were calculated from the change in headspace CH4 concentration over time. Averaged across cultivar, rice following rice as a previous crop had greater (P < 0.01) fluxes than rice following soybean on seven of 10 measurement dates resulting in emissions differences (P < 0.01) of 19.6 and 7.0 kg CH4-C ha-1, respectively. Averaged across previous crop, CH4 fluxes from Cheniere and Taggart only differed on one measurement date, while fluxes from CLXL745 were generally lower than Cheniere prior to heading and lower than Taggart following heading (P < 0.01). As a result, season-long emissions from CLXL745 (10.2 kg CH4-C ha-1) were less (P = 0.03) than emissions from Cheniere or Taggart at 15.5 and 14.2 kg CH4-C ha-1, respectively. Results of this study indicate that CH4 emissions from mid-southern rice grown on a clay soil may be substantially overestimated by the emission factor used by the Environmental Protection Agency (EPA; 177 kg CH4-C ha-1). Furthermore, Arkansas practices such as growing rice in rotation with soybean (> 70% of production) and planting hybrid cultivars (> 40% of production) may further reduce CH4 emissions from Arkansas rice production. Data from studies such as this will enable the EPA to further refine methane emissions factors to account for variables such as soil texture, previous crop, and cultivar, but it is important to continue research on emissions from mid-southern U.S. rice in order to more accurately assess the problem and to mitigate potential negative environmental aspects of rice cultivation.

Validation of Soil-Test Based Phosphorus and Potassium Fertilizer Recommendations for Rice.
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Soil testing is used by farmers to determine which type and amount of fertilizer is needed to ensure that phosphorus (P), potassium (K) and some micronutrients do not limit crop yields. Our research objective was to evaluate the accuracy of soil-test-based P and K fertilizer recommendations for flood-irrigated rice provided by the University of Arkansas Division of Agriculture. Fertilizer recommendations for 17 trials at four Arkansas Experiment Stations were determined from composite soil samples (0-10 cm) collected from the control plots before planting. Each trial contained a total of six treatments with two P2O5 rates (0 or 60 kg ha-1) and four K2O rates (0, 60, 90, 120 kg ha-1).

Single-degree-of-freedom contrasts were used to make specific statistical comparisons among treatments. The three comparisons include 1) P fertilizer alone, 2) K fertilizer alone, and 3) P and K fertilization all compared to no fertilizer. For this report, comparisons were made at two levels of significance (α = 0.10 or 0.25). False positive errors occurred most often in which the current interpretation of soil test results recommended P and/or K fertilization, but rice yield was not affected. For P, regardless of the significance level at which we evaluated the data, recommendations were 67 % accurate in correctly predicting yield response. All the error occurred in failing to predict where yield would benefit from P fertilization. For K, recommendations were 60% and 67% accurate in predicting yield response when α= 0.10 and 0.25, respectively. This shows that the level of significance at which we evaluate the data has an effect on the accuracy of the predicted rice yield response to K fertilizer. The majority of the error occurred in failing to predict when yield would benefit from K fertilization 35% and 28% when α= 0.10 and 0.25, respectively. Additional site-years of research are needed to verify the accuracy and consistency of these results.

A Pump Monitoring Approach to Irrigation Pumping Plant Testing.

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The conventional approach for evaluating irrigation pumping plant performance has been an instantaneous spot measurement approach. Using this method, the tester measures the necessary work and energy use parameters to determine overall pumping plant performance. The primary limitation of this approach has been the characterization of performance at only one point in time.

A new approach to irrigation pumping plant performance evaluation is the implementation of using high frequency, real-time data from pump monitoring systems. This method determines season-long pumping plant performance data to establish the pumping plant performance. Throughout a typical irrigation season, a single pumping plant typically operates at a wide range of total dynamic heads as a result of aquifer drawdown and/or changes in water direction through pipeline. When coupled with telemetry, this approach can provide in-season feedback to the irrigator on pumping plant performance as the system operating point changes throughout the season.

Nearly 75 irrigation pumping plants were evaluated over three irrigation seasons using a network of pump monitoring systems. Seasonal flow change, cost of water per unit volume pumped, and efficiency as a percentage of the Nebraska Pumping Plant Performance Criteria are reported. Seasonal averages and trends in pumping performance values can be used to develop recommendations to producers for improving pumping plant performance and reduce operating costs.

Effect of Fluridone Alone and in Combination with PPO-Inhibiting Herbicides on Soybean Tolerance and Weed Control.

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As a result of herbicide-resistant weeds increasing in agronomic operations, weed control programs in most Arkansas soybean fields today consist of several herbicide applications. New herbicide mechanisms with longer residual activity are needed to control weeds and reduce the risk of resistance evolving to the currently used herbicides. Fluridone is a herbicide that was tested but not developed in cotton in the early 1970’s. It has since become the most widely used aquatic herbicide in the world today. Fluridone was first used in 2012 in Arkansas under a Section 18 for the control of glyphosate-resistant Palmer amaranth in cotton. In 2014 a study was conducted to investigate the efficacy as well as crop tolerance of fluridone as a weed control option in soybean. Fluridone was evaluated at six rates (0, 0.05, 0.1, 0.15, 0.2, and 0.4 lb ai/A) in combination with three rates of Valor (0, 1, and 2 oz product/A). All treatments were applied immediately after planting soybean on a silt loam soil at the Pine Tree Research Station in Colt and on a clay loam soil at the Northeast Research and Extension Center in Keiser. Crop injury and weed control were visually evaluated at 2, 3, and 4 weeks after planting. Liberty was applied over the entire test as needed for the remainder of the year to control weeds that escaped preemergence treatments. Fluridone was more injurious to soybean on silt loam than on clay soil. On the silt loam soil where more than 50% injury was observed, the addition of Valor had a slight safening effect on fluridone, as evident by less injury to soybean. On the clay soil where less injury was observed, soybean yields were reflective of a safening effect similar to that observed on the silt loam. Overall, weed control was similar to that of crop injury in that greater control was observed on the silt loam than on the clay soil. Weeds on the silt loam soil included ivyleaf morningglory, broadleaf signalgrass, and hemp sesbania, and on the clay soil, barnyardgrass and horse purslane were present. Fluridone in combination with Valor exemplified an effective option for weed control and would provide two mechanisms of action, aiding resistance management. Future studies will continue to evaluate the best fit for fluridone and Valor in Midsouth soybean systems.

The Effects of Soybean Residue Management and Herbicide Program on Palmer amaranth Population and Seed Production.

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Amongst preventive weed control methods, crop residue management and herbicide use have been reported as effective tools in reducing weed population and subsequent seed production, hence weed soil seedbank. The objective of this work was to examine the effects of various soybean residue management schemes and herbicide programs on Palmer amaranth population and seed production. A split-plot experiment with three replications was conducted at Keiser, AR from fall of 2010 through spring of 2014. Main plot treatments consisted of six soybean residue management schemes whereas subplot treatments consisted of three herbicide programs. A straw spreader was attached to the combine in the first and second residue management scheme with a winter rye cover crop used prior to soybean planting in the latter. The straw chopper was removed in the third and fourth schemes, the residues were windrowed but were burned only in the third. In the fifth scheme the straw chopper was attached and the residues were bedded in fall whereas in the sixth straw and chaff were caught and removed from the combine. The subplot herbicide treatments consisted of Roundup PowerMax (hereafter Roundup) applied at V2 and V7 soybean growth stages at 22 oz/A; a preemergence (PRE) application of Valor at 2 oz/A followed by (fb) Roundup at 22 oz/A + Prefix at 32 oz/A (V2) fb Roundup at 22 oz/A (V7). The third herbicide program was similar to the second with Liberty at 29 oz/A substituting for Roundup. Statistically significant differences were observed between residue management schemes on Palmer amaranth population for each year with schemes 2 and 6 being more effective in lessening the Palmer amaranth population. On the contrary, the effects of residue management on Palmer amaranth seed production were not consistent among years. The inclusion of a PRE herbicide application into the herbicide program showed significant reductions on Palmer amaranth and subsequent seed production each year compared to the Roundup-only program. The presence of Liberty strengthened the herbicidal control on both PA population and seed production. The incorporation of PRE fb POST herbicide application significantly reduced PA population and seed production compared to the Roundup-only program in all crop residue programs investigated. This study demonstrated that crop residue management such as chaff removal from the combine or the use of cover crops in combination with PRE+POST herbicide programs are important management tools in reducing the Palmer amaranth population and seed production and subsequently soil seedbank. Farmers should broaden their options by incorporating Harvest Weed Seed Control strategies that target Palmer amaranth escapes at crop harvest, ultimately reducing the soil seedbank and the risk for new cases of herbicide resistance.

Acetolactate Synthase Resistance in a Yellow Nutsedge Biotype from Arkansas.

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Yellow nutsedge (*Cyperus esculentus* L.) is an invasive persistent weed common in rice and soybean rotations throughout Arkansas. In 2012, halosulfuron at a labeled field rate (1 oz/A Permit) failed to control yellow nutsedge in a rice field near Hoxie, Arkansas. Greenhouse studies were conducted to determine the response of the putative resistant biotype to halosulfuron over a range of rates and to evaluate its cross resistance to acetolactate synthase (ALS) inhibitors from four different chemical families. Alternative rice herbicide options to control the resistant biotype were evaluated. All herbicide treatments were applied to 3- to 4-leaf stage plants. A research track sprayer fitted with a boom equipped with two flat fan 80067 nozzles was calibrated to deliver 20 GPA of herbicide at 40 PSI. The resistant biotype was 2,540 fold less sensitive to halosulfuron than the susceptible biotype, and it was cross-resistant to all tested ALS-inhibiting herbicides (e.g. imazamox, imazethapyr, penoxsulam, bispyribac, pyrithiobac and bensulfuron). Control of the resistant biotype with the labeled field rate of quinclorac, bentazon, propanil, and 2,4-D was ≤ 20%, and only glyphosate resulted in 67% control. Complete control (100%) of the resistant biotype was attained with twice the labeled rate of glyphosate. This research indicates that the ALS-resistant biotype has evolved resistance to a broad suite of ALS inhibitors.

Application of the alternative herbicides tested in this study will not control the resistant biotype. Therefore, rice rotation with glyphosate-resistant soybean followed by postemergence application of glyphosate might be a temporary management option to minimize spread of the resistant biotype. Additionally, this research points to the need for additional effective herbicide options in rice.

The Effects of Soil Treatments, Deep Tillage, and Application of Gypsum, Across Various Target Irrigation Deficits, on Soil Moisture Tension and Crop Yields for Furrow Irrigated Soybeans.

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Due to the high costs associated with soybean irrigation, sustaining profitable soybean production systems in Arkansas is highly dependent on consistently high year to year yields (or high yield stability). Research has shown that delays in irrigation initiation, scheduling, and termination can limit yields. Furthermore these limiting effects can vary between maturity groups, soil types, and growing seasons. Optimizing irrigation efficiencies can ultimately lead to better understanding of the soil-plant-water relationship, which is imperative for assisting growers in optimizing irrigation management practices in turn, increasing the potential for high yields as well as establishing higher year to year yields. This study is a part of an ongoing effort to improve irrigation practices on soybeans in Arkansas. The goals are to examine the effects of deep tillage and gypsum applications on soybean yields and water available to the plants across the soil profile (as a measure of soil moisture tension) across various target water deficits in irrigation scheduling, in the pursuit of refining irrigation scheduling in furrow irrigated soybeans.