RESEARCH CONFERENCE ABSTRACTS

VOLUME 25

Arkansas Crop Protection Association

November 30-December 1, 2021

STUDENT COMPETITIONS SPONSORED BY:

BASF

Corteva Agriscience

Gowan USA

Syngenta Crop Protection

Adama USA

Valent USA

Tuesday, November 30, 2021

MODERATOR: Donna Frizzell/Garrett Felts
Student Contest Chair: Tommy Butts
Audio-Visual Coordinator: Ben Thrash

12:30 p.m. **Welcome / Introduction and Announcements**

12:45 p.m. **Effect of Adjuvants on Glyphosate Activity and Rainfastness in Common Lambsquarters.**
I.S. Werle*,[1], S. Karaikal[1], M.M. Noguera[1], P. Moore Jr[2], and N.R. Burgos[1]. [1]Dept. of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR; [2]Dept. of Poultry Science, University of Arkansas, Fayetteville, AR. 1

1:00 p.m. **Quantifying the Impact of Drill Spacing and Rice Cultivar on Weed Management.**
N. Reed*,[1], T.R. Butts[2], J.K. Norsworthy[1], J.T. Hardke[3], L.T. Barber[2], J.A. Bond[4], B.M. Davis[2], and M. Sumner[1]. [1]Dept. of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. [3]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. [4]Dept. of Plant and Soil Sciences, Mississippi State University, Stoneville, MS. 1

1:15 p.m. **Evaluation of *B*t Toxin, Cry51Aa for Control of Thrips and Tarnished Plant Bugs in Cotton.**
A.Y. Whitfield*,[1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], M. Mann[2], S.G. Felts[3], W.A. Plummer[2], J. Paul[2], C.A. Floyd[2], C. Rice[1], T. Newkirk[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. 2

1:30 p.m. **Effectiveness of Herbicides for Johnsongrass Control in Northeast Arkansas: What Works and Where?**
J.A. Fleming*,[1], J.K. Norsworthy[1], L.T. Barber[2], T.R. Butts[2], and B.L. Cotter[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. 2

1:45 p.m. **Nutrient Uptake and Accumulation in Furrow-Irrigated Cotton Varieties in Eastern Arkansas.**
C.A. Followell*,[1], T.L. Roberts[1], B. Hurst[1], M. Pessotto[1], K. Hoegenauer[1], C. Ortel[1], and A. Smart[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 3

2:00 p.m. **Evaluation of Rice Cultivar Tolerance to Warrant and Fenclorim.**
T.H. Avent*,[1], J.K. Norsworthy[1], J.A. Fleming[1], M.L. Zaccaro-Gruener[1], and T.R. Butts[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. 3

2:15 p.m. **Comparison of Transgenic *B*t Technologies in Arkansas Cotton Systems for Control of Cotton Bollworm, Helicoverpa Zea.**
Z. Murray*,[1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], W.A. Plummer[2], J.P. Schafer[2], M. Mann[2], S.G. Felts[3], C.A. Floyd[2], C. Rice[1], T. Newkirk[1], A. Whitfield[1], and T. Harris[1]. Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. 3

‡Denotes Poster †Denotes Undergraduate *Denotes M.S. Student **Denotes Ph.D. Student

Tuesday, November 30, 2021 (cont.)

MODERATOR: Donna Frizzell/Garrett Felts

2:30 p.m. **Evaluating Performance of Irrigation Timing and Efficiencies in Furrow-Irrigated Rice.**
J.P. Pimentel*[,1], and C.G. Henry[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. 4

2:45 p.m. **Effects of Early Season Applications of Dicamba on Rice.**
C.H. Arnold*[,1], J.K. Norsworthy[1], P.C. Moore[1], L.B. Piveta[1], L.T. Barber[2], and T.R. Butts[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. 4

3:00 p.m. **Break.**

3:15 p.m. **Field Evaluation of Wastewater Recovered Struvite as a Fertilizer Phosphorus Source in Flood-Irrigated Rice in Eastern Arkansas.**
N.S. Omidire**[,1], and K.R. Brye[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 4

3:30 p.m. **Impact of a Volatility Reduction Agent and Surface Type on Dicamba Volatility.**
M.L. Zaccaro-Gruener**[,1], J.K. Norsworthy[1], M.C. Castner[1], and T.L. Roberts[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 5

3:45 p.m. **Plant Productivity and Nutrient Uptake as Affected by Tillage and Site Position in Furrow-Irrigated Rice.**
D. Della-Lunga**[,1], K.R. Brye[1], C.G. Henry[2], and J.M. Slayden[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. 5

4:00 p.m. **Does the Addition of Glutathione *S*-Transferase Inhibitors Overcome Glufosinate Resistance in *Palmer Amaranth*?**
P. Carvalho-Moore**[,1], J.K. Norsworthy[1], F. Gonzalez-Torralva[1], T. Barber[2], L.B. Piveta[2], and M.L. Zaccaro-Gruener[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. 6

4:15 p.m. **Evaluation of Sampling Techniques and Insecticide Seed Treatments in Furrow-Irrigated Rice for Control of Rice Billbug, *Sphenophorus Pertinax*, in Arkansas.**
C.A. Floyd**[,1], G.M. Lorenz[1], N.R. Bateman[2], B.C. Thrash[1], S.G. Felts[2], W.A. Plummer[2], M. Mann[2], C. Rice[3], T. Newkirk[3], A. Whitfield[3], Z. Murray[3], and T. Harris[3]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. 6

4:30 p.m. **Desiccation of Cotton with the use of Reviton.**
L. Adams**[,1], T. Barber[2], J.K. Norsworthy[1], T. Raper[3], D. Miller[4], B. Pieralisi[5], and R. Doherty[6]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. [3]Dept. of Plant Sciences, University of Tennessee, Jackson, TN. [4]Dept. of Plant, Environment Management, and Soil Sciences, Louisiana State University, St. Joseph, LA. [5]Dept. of Plant and Soil Sciences, Mississippi State University, Starkville, MS. [6]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Monticello, AR. 7

‡Denotes Poster   †Denotes Undergraduate   *Denotes M.S. Student   **Denotes Ph.D. Student

MODERATOR: Donna Frizzell/Garrett Felts

4:45 p.m. **Monitoring and Correcting Potassium Hidden Hunger in Arkansas Soybean.**
C.C. Ortel**,[1], T.L. Roberts[1], N.A. Slaton[1], W.J. Ross[2], L. Purcell[1], K.A. Hoegenauer[1], M.V. Pessotto[1], C.A. Followell[1], and A. Smartt[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. 7

5:00 p.m. **What We Know: Potassium Borate as a Volatility Reducing Agent and Nutritional Additive.**
M.C. Castner**,[1], J.K. Norsworthy[1], T.L. Roberts[1], and B.L. Cotter[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 8

5:15 p.m. **End Student Competition Day 1/Begin Poster Viewing Session.**

Influence of Seeding Rate on Five New Rice Cultivars.
L.R. Amos‡,[1], J.T. Hardke[1], D.L. Frizzell[1], E. Castaneda-Gonzalez[1], T.L. Clayton[1], and G.T. Hampton[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. 8

Impact of Defoliation on Rice Growth and Yield.
S.G. Felts‡,[1], N.R. Bateman[1], G.M. Lorenz[2], B.C. Thrash[2], W.A. Plummer[2], M. Mann[2], C.A. Floyd[2], T.B. Newkirk[3], C. Rice[3], A. Whitfield[3], Z. Murray[3], and T. Harris[3]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. 9

Can Remote Sensing Technology be used to Identify Weedy Areas in Rice?
O.W. France‡,[1], A.M. Poncet[1], E.L. Sears[1], G.P. Rothrock[1], J.K. Norsworthy[1], T.R. Butts[2], and J.T. Hardke[3]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. [3]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. 9

Potential for Harvest Weed Seed Control in Arkansas Rice.
M.M. Houston‡,[1], J.K. Norsworthy[1], and L.B. Piveta[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 10

Evaluation of Palmer Amaranth Accessions for Sensitivity to Glufosinate and Dicamba.
L.B. Piveta‡,[1], J.K. Norsworthy[1], T. Barber[2], and T. Butts[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. 10

Control of Tarnished Plant Bug with Selected Insecticides in Cotton.
W.A. Plummer‡,[1], M. Mann[1], G.M. Lorenz[1], B.C. Thrash[1], N.R. Bateman[2], S.G. Felts[2], C.A. Floyd[1], T.B. Newkirk[3], C. Rice[3], A. Whitfield[3], Z. Murray[3], and T. Harris[3]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. 11

MODERATOR: Donna Frizzell/Garrett Felts

Non-target Site Resistance to Acetyl CoA Carboxylase (*ACCase*)-Inhibiting Herbicides in Barnyardgrass.
F. Gonzalez-Torralva[‡,1], J.K. Norsworthy[1], and L.B. Piveta[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 11

6:15 p.m. **End Poster Viewing Session/Conclude Day 1.**

Wednesday, December 1, 2021

MODERATOR: Mathew Mann/Chase Floyd

7:45 a.m. **Welcome / Introduction and Announcements**

8:00 a.m. **Comparison of Chrysogen Formulations for Control of Soybean Looper, *Chrysodeixis includens*, in Arkansas Soybean Production.**
C. Rice[*,1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], M. Mann[2], S.G. Felts[3], W.A. Plummer[2], C.A. Floyd[2], T. Newkirk[1], A. Whitfield[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. 12

8:15 a.m. **Integraded Weed Management Strategies for Palmer Amaranth Control in Arkansas Cotton.**
T. Smith[*,1], J.K. Norsworthy[1], L.T. Barber[2], R.B. Farr[1], M. Houston[1], and J. Fleming[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. 12

8:30 a.m. **Monitoring Potential *Lambda-cyhalothrin* Resistant Rice Stink Bugs, *Oebalus pugnax*, Populations in Arkansas.**
T. Newkirk[*,1], N.R. Bateman[2], G.M. Lorenz[3], B.C. Thrash[3], N.K. Joshi[1], S.G. Felts[2], W.A. Plummer[3], C.A Floyd[1], C. Rice[1], A. Whitfield[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. 13

8:45 a.m. **Effects of Water Quality on Insecticide Performance for the Control of Tarnished Plant Bug, *Lygus lineolaris*, in Cotton and Corn Earworm, *Helicoverpa zea*, in Soybeans.**
T. Harris[*,1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], M. Mann[2], W.A. Plummer[2], C.A. Floyd[2], C. Rice[1], S.G. Felts[3], T. Newkirk[1,] A. Whitfield[1], and Z. Murray[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR........ 13

9:00 a.m. **Coating Loyant on Urea: A Novel Approach to Reduce Herbicide Off-Target Movement.**
B.L. Cotter[*,1], J.K. Norsworthy[1], M.C. Castner[1], and L.B. Piveta[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR........ 14

9:15 a.m. **Evaluation of Warrant for Weedy Rice and Barnyardgrass Control.**
S.C. Noe[*,1], J.K. Norsworthy[1], T.H. Avent[1], M.M. Houston[1], and T.R. Butts[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 14

9:30 a.m. **Determining Cover Crops Base and Optimum Growth Temperatures.**
M.V. Pessotto[*,1], T.L. Roberts[1], C.C. Ortel[1], C.A. Followell[1], and K.A. Hoegenauer[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR........ 15

9:45 a.m. **Effects of Soil Moisture and Nitrogen Applications on Provisia Rice Tolerance to Quizalofop.**
N. Godara[*,1], J.K. Norsworthy[1], T.R. Butts[2], T. Barber[2], and T.L. Roberts[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. 15

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

‡Denotes Poster   †Denotes Undergraduate   *Denotes M.S. Student   **Denotes Ph.D. Student

Wednesday, December 1, 2021 (cont.)

MODERATOR: Mathew Mann/Chase Floyd

10:15 a.m. **Developing a Detached Leaf Assay for Screening Soybean Cultivars for Targe Spot Resistance.**
R.K. Wolf*[,1], and J. Rupe[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. 16

10:30 a.m. **Efficacy of Selected Insecticides for Control of Sugarcane Aphid in Sorghum.**
G. Marris[†,1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], W.A. Plummer[2], M. Mann[2], S.G. Felts[3], C.A. Floyd[2], T.B. Newkirk[1], C. Rice[1], A. Whitfield[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. 16

10:45 a.m. **Comparison of Seeding Rate and Bedding Methods for Furrow-Irrigated Rice.**
B.L. Wright[†,1], J.T. Hardke[1], J.L. Chlapecka[2], E. Castaneda-Gonzalez[1], D.L. Frizzell[1], T.L. Clayton[1], L.R. Amos[1], and G.T. Hampton[1]. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. Dept. of Plant Science and Technology, University of Missouri, Portageville, MO, ... 17

11:00 a.m. **Awards, Announcements, and Closing Remarks**

12:00 p.m. **Adjourn**

ABSTRACTS

Effect of Adjuvants on Glyphosate Activity and Rainfastness in Common Lambsquarters.

I.S. Werle*[,1], S. Karaikal[1], M.M. Noguera[1], P. Moore Jr[2], and N.R. Burgos[1]. [1]Dept. of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR; [2]Dept. of Poultry Science, University of Arkansas, Fayetteville, AR.

Adjuvants can improve the performance of herbicides by increasing absorption, minimizing herbicide leaching, and reducing rainfastness. In this study we investigated the use of adjuvants with glyphosate with respect to efficacy, rainfastness, and absorption in common lambsquarters (*Chenopodium album* L.). A greenhouse study was conducted with seven adjuvants and three rainfall timings. Common lambsquarters plants (15- to 20-cm tall) were sprayed with glyphosate (Roundup Weathermax®) at 772 g ae ha-1 in combination with one of the following adjuvants at 0.25% v v-1: OR-009-E, OR-494-A, OR-295-A, OR-278-F, X-VRT, X-LOO, or X-AQE.
Simulated rainfall timings consisted of no rain, rain at 30 min or rain at 2 h after herbicide application. Rainfall was applied using a rainfall simulator at an intensity of 6 cm h-1 for 10 min. Weed control was evaluated at 2 and 4 weeks after treatment (WAT). Differential absorption of C14-glyphosate was evaluated in a laboratory study with the seven previously mentioned adjuvants and three harvest times. Plants for the absorption study were cultured as described above, sprayed with glyphosate plus adjuvants and spiked with 100,000 disintegrations per minute (DPM) of 14C-glyphosate. The radiolabeled glyphosate was applied in four, 1-uL droplets, two on each side of the lamina of the youngest, fully expanded leaf. Spotted leaves were harvested at 30 min, 4 h, and 12 h after application and rinsed for about 10 s in a series of three vials containing 5-ml 5% methanol solution. The rinsates were combined in one vial, a 5-ml aliquot was added with 10 mL scintillation cocktail, and radioactivity was quantified using a liquid scintillation spectrometer. Absorption of 14C-glyphosare was calculated by subtracting the amount of radioactivity in the leaf rinsate from the total applied. Treatments of both studies were arranged in a completely randomized design with six replications. Data were subjected to ANOVA and means were compared using Student's t test (α=0.05). Weed control was strongly reduced (<35%) with rainfall at 30 min after glyphosate application regardless of adjuvant. Adjuvants OR-278-F and X-VRT improved weed control by 20% with rainfall at 2 h compared to glyphosate alone. Regardless of adjuvant, rainfall at 30 min or 2 h after glyphosate application reduced efficacy by one-half and one-third, respectively, compared to 68 and 75% control with no rainfall at 2 and 4 WAT. Adjuvant-herbicide interactions appeared to enhance 14C-glyphosate absorption. The adjuvant X-VRT increased 14C-glyphosate absorption at all harvest times. 14Cglyphosate absorption increased over time, from 65% at 30 min to 78% at 12 h after application. Glyphosate rainfastness was decreased slightly by the addition of adjuvants, but a rain-free period of more than 2 h is needed to prevent loss of glyphosate activity on common lambsquarters. Some novel adjuvants can increase glyphosate absorption, thus, enhancing its efficacy.

Quantifying the Impact of Drill Spacing and Rice Cultivar on Weed Management.

N. Reed*[,1], T.R. Butts[2], J.K. Norsworthy[1], J.T. Hardke[3], L.T. Barber[2], J.A. Bond[4], B.M. Davis[2], and M. Sumner[1]. [1]Dept. of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. [3]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. [4]Dept. of Plant and Soil Sciences, Mississippi State University, Stoneville, MS.

Weeds are problematic in field crops because of their potential to cause crop yield loss among other deleterious effects. With increased regulations on pesticide applications, as well as the evolution of herbicide resistance, there is a need for alternative strategies in managing weeds such as cultural approaches like drill width spacing and choice of competitive rice cultivars. Previous research has shown that narrower drill spacing reduces weed biomass and produces a higher grain yield more consistently than wider drill spacing. However, with the advent of hybrid rice, which is more competitive with a higher tillering capacity than inbred rice, and the increase in adoption of precision agricultural equipment, there may be a shift by farmers to drilling rice in less competitive wider spacings. As a result, the objective of this research was to investigate the effect of rice drill spacing and rice cultivar on weed management and crop canopy development. A field experiment was conducted in the summer of 2021 as a randomized complete block split-plot design to observe drill spacing and rice cultivar effects on weed management in flooded rice. Four rice cultivars [medium-grain (CLM04), long-grain in-bred (CLL16), two long-grain hybrids (RT7301 and RT7521 FP)] were drill-seeded in four drill widths (5 in., 7.5 in., 10 in., and 15 in.). Weed density was assessed at the 5- to 6-leaf stage of rice (preflood) and preharvest. Additionally, at the preharvest timing, weed seedheads were counted, collected, and threshed for seed production measurements. At flood initiation, unmanned aerial system (UAS) images were taken to assess canopy coverage. Greater weed control for barnyardgrass and large crabgrass was present in the narrower drill spacings of 5 in. and 7.5 in. compared to 10 in. and 15

in. No significant effect of weed control was present for the different cultivars used in the experiment. Yield data are being analyzed for the effects of drill width and cultivars used in the experiment.

Evaluation of *B*t Toxin, Cry51Aa for Control of Thrips and Tarnished Plant Bugs in Cotton.
A.Y. Whitfield*[,1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], M. Mann[2], S.G. Felts[3], W.A. Plummer[2], J. Paul[2], C.A. Floyd[2], C. Rice[1], T. Newkirk[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR.

Tobacco thrips and tarnished plant bug (TPB) are two of the most important pests in mid-south cotton production. Thrips are a pest in seedling cotton typically feeding on the leaf tissue of plants which can result in stunted growth, delayed fruiting, loss of apical dominance and possible stand loss. TPB is considered the number one insect pest of cotton causing square loss, deformed flowers and damaged bolls ultimately reducing yield. TPB are difficult to control and growers average 4-6 insecticide applications per year. Field studies were conducted in 2021 to evaluate Thryvon, a new transgenic trait in cotton that produces the *Bt* toxin, Cry51Aa, on the management of thrips and tarnished plant bugs in cotton. For thrips, Thryvon was as good or better than an insecticide-based approach. Thryvon cotton required fewer insecticide applications to adequately control TPB when compared to the non-Thryvon cotton. Based on our standard threshold, Thryvon required 2 applications for plant bugs compared to 5 in non-Thryvon. Yields showed that no differences were present between the sprayed and unsprayed thryvon plots. Results from this study indicate that Thryvon will be a valuable tool in controlling both thrips and TPB.

Effectiveness of Herbicides for Johnsongrass Control in Northeast Arkansas: What Works and Where?
J.A. Fleming*[,1], J.K. Norsworthy[1], L.T. Barber[2], T.R. Butts[2], and B.L. Cotter[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR.

Due to genetic similarities between johnsongrass and grain sorghum, few herbicides are available that will remove the troublesome weed effectively without injuring the crop. To combat this issue multiple new herbicide resistance technologies are being developed in grain sorghum to help producers, with some commercialized in 2021. These technologies include crop resistance to both acetyl CoA carboxylase (ACCase) and acetolactate synthase (ALS) inhibitors. To determine the effectiveness of the herbicides that will be labeled in these new technologies, accessions of johnsongrass from Arkansas were collected and a greenhouse study conducted in Fayetteville, AR in 2020. Johnsongrass seeds were collected from a total of 63 fields within 6 counties in eastern Arkansas. These accessions were threshed and then seeded in the greenhouse, where seedlings were treated with nicosulfuron, imazamox, fluazifop, and quizalofop at labeled rates. All herbicides were applied with 1% v/v crop oil concentrate. The goal was to determine which new herbicide technology would be most effective at controlling johnsongrass across a wide assortment of accessions to help producers make an informed decision when choosing a technology as well as determine if there was potential for herbicide resistance to any of the herbicides in Arkansas. Overall, the two ACCase inhibitors, fluazifop and quizalofop, showed the highest levels of control with a percent mortality of greater than 90 percent across all accessions tested. These herbicides showed very little variability in control or mortality and only one accession, collected in Crittenden County Arkansas, showed potential for resistance to fluazifop. The lowest percent mortality was for nicosulfuron, which only controlled 31% of the plants treated. Imazamox resulted in a percent mortality of 53%. Both ALS-inhibitors showed high levels of variability across all locations where accessions were collected. These findings show that ALS inhibitors will be ineffective at controlling Arkansas johnsongrass accessions in many fields. If Arkansas grain sorghum producers are planting into areas with known johnsongrass pressure, the best option is to utilize the ACCase inhibitor technologies.

Nutrient Uptake and Accumulation in Furrow-Irrigated Cotton Varieties in Eastern Arkansas.

C.A. Followell*[,1], T.L. Roberts[1], B. Hurst[1], M. Pessotto[1], K. Hoegenauer[1], C. Ortel[1], and A. Smart[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Cotton (*Gossypium hirsutum L.*) varieties grown in the Arkansas delta have undergone tremendous genetic and cultural management changes in recent years, which has led to the need to re-evaluate the nutrient requirements and accumulation in these modern cultivars. This research aims to determine the nutrient requirements, dry matter production, and accumulation of nitrogen (N), phosphorus (P), and potassium (K), of two modern cotton cultivars (Deltapine 2038 and NexGen 4936). Treatments included two rates of fertilizer applied at pre-plant (36 lb. A^{-1} N, 70 lb. A^{-1} P, 60 lb. A^{-1} K, and 45 lb. A^{-1} N, 87.5 lb. A^{-1} P, 75 lb. A^{-1} K), and at early squaring (74 lb. A^{-1} N and 92.5 lb. A^{-1} N). Research was conducted in 2020 at the Lon Mann Cotton Research Station in Marianna, AR on a Memphis silt loam soil. Preliminary results show no difference of total N, P, or K accumulation between the two fertilizer treatments or the cultivars. Research will be repeated in 2021 to determine if this is a trend. This information supports the use of the current University of Arkansas Soil Testing Laboratory recommendations for modern cotton varieties and suggests that increase fertilizer rates do not significantly increase nutrient accumulation.

Evaluation of Rice Cultivar Tolerance to Warrant and Fenclorim.

T.H. Avent*[,1], J.K. Norsworthy[1], J.A. Fleming[1], M.L. Zaccaro-Gruener[1], and T.R. Butts[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR.

Arkansas rice producers need new, effective herbicide sites of action to control problematic weeds. While chloroacetamides have been widely used in Asia, the United States has yet to adopt these herbicides for rice production. With the use of chloroacetamides in drill-seeded rice, undesirable injury may occur. But with recent research, the University of Arkansas Division of Agriculture (UADA) has demonstrated the effectiveness of a fenclorim seed treatment to mitigate injury to 'Diamond' rice caused by microencapsulated acetochlor (Warrant). Cultivar response to both fenclorim and Warrant combinations are unknown; thus, the UADA initiated an experiment to screen 16 different cultivars with and without the use of the fenclorim seed treatment (0 and 2.5 lb ai 1000 lb $seed^{-1}$) and with and without Warrant (0 and 3 pt A^{-1}). The experiment was initiated at the Pine Tree Research Station near Colt, AR April 19, 2021, and all Warrant applications were applied delayed-preemergence. Warrant applied to all cultivars without the fenclorim seed treatment resulted in >40% injury 28 days after emergence (DAE). The fenclorim seed treatment reduced injury for all cultivars, and at 28 DAE, all cultivars demonstrated commercial tolerance to Warrant with the fenclorim seed treatment. For 9 of 16 cultivars, yield was reduced by Warrant alone while the fenclorim seed treatment with Warrant never reduced yield. These findings demonstrate that Warrant applied delayed preemergence to rice treated with fenclorim has high potential for success, regardless of cultivar, but additional research over multiple site years and environments are still needed.

Comparison of Transgenic *B*t Technologies in Arkansas Cotton Systems for Control of Cotton Bollworm, Helicoverpa Zea.

Z. Murray*[,1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], W.A. Plummer[2], J.P. Schafer[2], M. Mann[2], S.G. Felts[3], C.A. Floyd[2], C. Rice[1], T. Newkirk[1], A. Whitfield[1], and T. Harris[1]. Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR.

Transgenic *Bt* technology is the most widely used method of controlling cotton bollworm (*Helicoverpa zea*) in U.S. cotton. Resistance has recently been documented in cotton bollworm to two gene cotton cultivars and supplemental foliar applications may be required in these cultivars to manage high populations of bollworm. There is some evidence that, while more efficacious against bollworm, many three gene cotton cultivars yield less than two gene cultivars. Despite this yield gap, growers could have greater profits using three gene cultivars due to lower input and production cost. Research was conducted in 2020 in Drew County, Arkansas to evaluate the efficacy of several *Bt* technologies and the economic value of Bollgard II and Bollgard III technologies. Results suggest sprayed two gene cultivars had similar levels of damage to unsprayed three gene cultivars. An economic analysis will be performed after harvest.

Evaluating Performance of Irrigation Timing and Efficiencies in Furrow-Irrigated Rice.

J.P. Pimentel*[,1], and C.G. Henry[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR.

Flood irrigation is typically the most common method of irrigation for rice, however, furrow-irrigated rice in 2019 increased 10% total planted acres. The main objective of this work was to evaluate the performance of four different irrigation timings on crop yield and irrigation efficiency in a furrow-irrigated field located at the University of Arkansas System Division of Agriculture, Rice Research and Extension Center, near Stuttgart, AR on a Dewitt silt-loam soil. A continuously or 0 day, 3, 7, and 10 day irrigation timings were studied to evaluate the irrigation performance in furrow-irrigated rice. The experiment was a strip plot design with three replications. No significant difference in yield was found. However, there was a significance difference in Water Use Efficiency (WUE) between irrigation timings, the higher WUE value was observed on 10-day treatment. Monitoring of soil moisture readings is needed to identify when high water demand is occurring, and cycle of 7 to 10 days was found to increase water use efficiency in furrow-irrigated rice.

Effects of Early Season Applications of Dicamba on Rice.

C.H. Arnold*[,1], J.K. Norsworthy[1], P.C. Moore[1], L.B. Piveta[1], L.T. Barber[2], and T.R. Butts[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR.

Dicamba is currently used in Arkansas for weed control in Xtend and XtendFlex soybean, cotton, corn, grain sorghum, and noncrop systems. Dicamba could potentially serve as an additional herbicide for broadleaf weed control in rice if proven safe to the crop. A field trial was implemented in 2021 at the Rice Research and Extension Center near Stuttgart, AR, to determine the level of rice tolerance to early season applications of dicamba. Dicamba at 0.5 (1X) and 1.0 lb ae/A (2X) was applied at three timings (preemergence, 1-leaf stage of rice, and 5-leaf stage of rice). At 2 weeks after application, the preemergence application of dicamba at a 1 and 2X rate resulted in 71 and 91% injury to rice, respectively. The injury observed from the preemergence application was partly a result of delayed emergence as evident by stand counts being 17 and 36% less than the nontreated for the 1 and 2X rates of dicamba, respectively, at 3 weeks after treatment. Injury to rice caused by dicamba deceased as applications were delayed, as evident by there being only 39 and 48% injury 2 weeks after applying dicamba to 1-leaf rice at the 1 and 2X rates, respectfully. Injury to 5-leaf rice 2 weeks after treatment caused by the 1X rate of dicamba was 8% and was 12% when applied at a 2X rate. By 4 weeks after flooding, rice recovery from the earlier herbicide application was apparent with <3% injury observed, except for the 2X rate of dicamba applied preemergence or at the 1-leaf stage of rice. Even though dicamba has been registered in some crops for more than 50 years, it has never been registered in rice likely because of the negative affect of the herbicide on the crop as seen in this research.

Field Evaluation of Wastewater Recovered Struvite as a Fertilizer Phosphorus Source in Flood-Irrigated Rice in Eastern Arkansas.

N.S. Omidire**[,1], and K.R. Brye[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Recycling phosphorus (P) from wastewater as the mineral struvite ($MgNH_4PO_4 \cdot 6H_2O$) has gained global attention because of potential P reductions discharged into receiving waters and the potential to serve as an alternative fertilizer-P source for crop production, particularly in areas with P-deficient soils, such as eastern Arkansas. A field experiment was conducted during Summer 2019 and 2020 to evaluate the effects of two struvite materials [i.e., electrochemically precipitated struvite (ECST) and chemically precipitated struvite (CPST)] relative to several other common fertilizer-P sources [i.e., triple super phosphate (TSP), monoammonium phosphate (MAP), diammonium phosphate (DAP), and rock phosphate (RP)] on the response of a pureline rice (*Oryza sativa* L.) cultivar grown under flood-irrigation in a P-deficient, silt-loam soil (Typic Glossaqualfs) in eastern Arkansas. Fertilizer-P treatments were manually applied at a rate of 24.5 kg P ha^{-1}, plus an unamended control (UC), and were replicated four times for a total of 28 field plots each year. Urea was applied to unify the N rate across all fertilizer-P treatments. In 2019, rice grain yield did not differ ($P > 0.05$) among fertilizer-P sources. In 2019, aboveground rice dry matter from CPST (13.8 Mg ha^{-1}) and ECST (14.5 Mg ha^{-1}), which was numerically largest, did not differ ($P > 0.05$) from that from TSP (13.1 Mg ha^{-1}), MAP (14.3 Mg ha^{-1}), and DAP (13.7 Mg ha^{-1}). In 2019 and 2020, above- and belowground tissue-P concentrations and aboveground and grain tissue-P uptake from ECST and CPST did not differ ($P > 0.05$) from that from TSP, MAP, and DAP. Environmental and agronomic benefits

make wastewater-recycled struvite an attractive, alternative fertilizer-P-source option for P fertilization of flood-irrigated rice.

Impact of a Volatility Reduction Agent and Surface Type on Dicamba Volatility.

M.L. Zaccaro-Gruener**,[1], J.K. Norsworthy[1], M.C. Castner[1], and T.L. Roberts[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The continued off-target movement of dicamba led the U.S. Environmental Protection Agency in fall of 2020 to require the addition of a volatility-reducing agent (VRA) to the dicamba formulations labeled for use in Xtend and XtendFlex crops. Two field experiments were conducted in 2021, at the Milo J. Shult Agricultural Research and Extension Center, in Fayetteville, AR. The objective of this research was to test the extent to which dicamba volatility was impacted by the addition of VRA to a dicamba plus glyphosate mixture applied to different target surfaces. Treatments were made to trays of soil or XtendFlex cotton seedlings that were then placed in the center of low tunnels established along two rows of susceptible soybean used as bioindicators. Air samples in the center of the tunnels were collected for 48 hours after application. Average injury to soybean was the highest (26%) when glyphosate was added to dicamba without a VRA. Treatments containing VRA resulted in 10% and 11% injury with and without glyphosate added to the solution, respectively. The analysis of the pH of solutions showed acidification provided by the addition of glyphosate to dicamba. However, the addition of VRA increased the pH of the solution above 5, even when glyphosate was present. The laboratory analysis of the air samples is not yet available; however, field results indicate that the use of VRA provided a significant reduction of dicamba volatilization; nevertheless, secondary movement of the dicamba was not eliminated.

Plant Productivity and Nutrient Uptake as Affected by Tillage and Site Position in Furrow-Irrigated Rice.

D. Della-Lunga**,[1], K.R. Brye[1], C.G. Henry[2], and J.M. Slayden[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR.

Furrow-irrigated rice (*Oryza sativa* L.) is a relatively new production system that has been shown to have increased water-use efficiency and reduced operational costs. However, due to spatial variations in soil moisture, field studies are necessary to evaluate potential resulting variations in rice growth and yield in the furrow-irrigated production system. The objective of this study was to evaluate the effects of tillage practice [conventional tillage (CT) and no-tillage (NT)] and site position (up-, mid-, and down-slope) on aboveground biomass, yield, and aboveground tissue and grain nitrogen (N) concentration and uptake from rice grown in a silt-loam soil in a direct-seeded, furrow-irrigated production system in eastern Arkansas. Field research was conducted from May to September during the 2018 and 2019 rice growing seasons. Total aboveground dry matter (DM), vegetative DM, and yield were unaffected ($P > 0.05$) by tillage or site position in either growing season. Vegetative tissue and grain N concentrations and uptake were generally at least 10% greater ($P < 0.05$) under CT than NT, but did not substantially differ by site position during the drier 2018 growing season. During the wetter 2019 growing season, vegetative and grain N concentrations and uptake were generally at least 20% greater ($P < 0.05$) at the up- than at the mid- or down-slope positions. Results suggest that different soil and nutrient management per site position may need to be considered to maximize nutrient uptake and reduce losses, thus improving the agronomic suitability of the furrow-irrigated rice production system.

Does the Addition of Glutathione *S*-Transferase Inhibitors Overcome Glufosinate Resistance in *Palmer Amaranth*?

P. Carvalho-Moore**[,1], J.K. Norsworthy[1], F. Gonzalez-Torralva[1], T. Barber[2], L.B. Piveta[2], and M.L. Zaccaro-Gruener[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR.

Resistance to glufosinate in Palmer amaranth was first reported in 2021 in Arkansas, and alternative control options for these resistant populations is a high priority. Enhanced herbicide detoxification by glutathione *S*-transferase (GST) enzymes is one of the possible resistance mechanisms responsible for glufosinate resistance. Therefore, experiments were designed to 1) evaluate if the addition of a GST-inhibitor would overcome glufosinate resistance in Palmer amaranth; and 2) quantify the number of glutamine synthetase (GS) gene copies (enzyme inhibited by glufosinate) present in resistant plants. Seedlings of the resistant (20-59) and susceptible (SS) accessions were transplanted into a field located at the Milo J. Shult Agricultural Research & Extension, Fayetteville, AR. The treatments were glufosinate applied at 10 a.m., glufosinate at 10 p.m., and glufosinate + GST-inhibitor [NBD-Cl (4-chloro-7-nitrobenzofurazan)] at 10 p.m. The rates for glufosinate and NBD-Cl were 0.585 lb ai/A and 0.11 lb ai/A, respectively. A randomized complete block design with four replicates was used with a nontreated control for comparison. The total number of plants per accession in each plot was counted prior to and two weeks after application to calculate mortality (%). Concomitantly with the field experiment, gene copy number assay was conducted with DNA extracted from nontreated plants from two different susceptible populations and glufosinate survivors from accession 20-59. GS copy number was calculated relative to two standard genes. Overall, mortality was 17% and 97% for 20-59 and SS, respectively. Mortality did not differ among treatments. Relative to two standard genes, gene copy number in the resistant accession was 85- and 86-fold. In the two susceptible accessions, it had an average of 2-fold relative to both standards used. An increase in the GS gene copy number enables resistant plants to produce enough enzyme to survive glufosinate, which explains why the addition of a GST-inhibitor had no impact on the control of glufosinate-resistant Palmer amaranth.

Evaluation of Sampling Techniques and Insecticide Seed Treatments in Furrow-Irrigated Rice for Control of Rice Billbug, *Sphenophorus Pertinax*, in Arkansas.

C.A. Floyd**[,1], G.M. Lorenz[1], N.R. Bateman[2], B.C. Thrash[1], S.G. Felts[2], W.A. Plummer[2], M. Mann[2], C. Rice[3], T. Newkirk[3], A. Whitfield[3], Z. Murray[3], and T. Harris[3]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR.

Arkansas rice producers have increased furrow irrigated rice (FIR) production acreage as a cost saving tillage and rotation practice. The elimination of a flood across the field has made rice more susceptible to rice billbug (*Sphenophorus pertinax*). Historically, this insect has been considered a minor pest in traditional flood irrigated production system, only being observed on levees or dry paddies in the field. Rice billbugs feed on the roots and tillers of the rice plants, causing dead tillers and rice panicles to abort, resulting in direct yield loss. As FIR acreage continues to increase in Arkansas, sampling and management strategies for billbug is needed.

An experiment was conducted in 2020 & 2021 to evaluate the effectiveness of insecticide seed treatments for control of rice billbug. Neonicotinoid and diamide insecticide seed treatments, alone and in combination were included in the study. Rice plots were monitored throughout the year for rice billbug damage. Multiple sampling methods were tested to correlate rice billbug damage to grain yield. When signs of billbug feeding were observed, rice was sampled by counting total tillers and damaged tiller in five linear feet per plot. After panicle emergence, the number of blank heads per five linear feet within a plot were also recorded. None of the tested sampling methods showed a relationship between damage and grain yield. Rice overtreated with NipsIt in combination with Fortenza showed significantly lower damaged tillers as well as, significantly higher grain yield when compared to neonicotinoid seed treatments. In regard to yield, plots with a seed treatment containing a neonicotinoid in combination with a diamide, resulted in yields greater than the untreated check or rice treated solely with a neonicotinoid seed treatment. Rice treated with any insecticide seed treatment resulted in greater yields when compared to the untreated check. These data suggest that in a FIR scenario, insecticide seed treatment should include the diamide chemistry to retain greatest yields from rice billbug feeding.

Desiccation of Cotton with the use of Reviton.

L. Adams**[,1], T. Barber[2], J.K. Norsworthy[1], T. Raper[3], D. Miller[4], B. Pieralisi[5], and R. Doherty[6]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. [3]Dept. of Plant Sciences, University of Tennessee, Jackson, TN. [4]Dept. of Plant, Environment Management, and Soil Sciences, Louisiana State University, St. Joseph, LA. [5]Dept. of Plant and Soil Sciences, Mississippi State University, Starkville, MS. [6]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Monticello, AR.

Cotton growers in the mid-southern U.S. region face many late season challenges imposed by adverse weather conditions that vary spatially and temporally. As a result, growers must apply the best cotton defoliation option at the correct time to maintain fiber quality and ensure a timely and efficient harvest. The objective of this research was to evaluate different rates of the newly registered cotton defoliant Reviton as a cotton harvest aid. Experiments were conducted in 2021, on-farm in Tillar, Arkansas and at the R.R Foil Plant Sciences Research Center at Mississippi State, Mississippi to evaluate Reviton as a cotton defoliant and determine the impact from different rates of Reviton on cotton defoliation, desiccation, and regrowth inhibition. Reviton rates ranging from 0.5 - 1.0 fl oz/A were applied initially when cotton reached 60% open as well in a sequential application following a standard application of Drop at 2 fl oz/A, Folex at 6 fl oz/A, and Finish 6 at 8 fl oz/A. Reviton efficacy was compared to the standard as well as to Aim at 0.75 fl oz/A. Results from the study conducted in Arkansas indicate that Reviton applied at 0.75 fl oz/a at 60% boll open resulted in the greatest percent defoliation (42%) and desiccation (50%) seven days after application. However, results from the study conducted in Mississippi indicate that Reviton applied at 0.5 fl oz/A of recommended rate at the same growth stage resulted in the greatest percent defoliation (43%) and desiccation (40%) seven days after application. In addition, visual ratings of defoliation and desiccation seven days after the second application had values greater than 98% regardless of defoliation treatment. However, following the third application, results indicate percent regrowth was lowest for the standard treatment which included thidiazuron (Drop). Reviton applied at the 0.75 fl oz/A and 0.5 fl oz/A of rate resulted in the greatest percent defoliation and desiccation seven days after application. However, these treatments also resulted in the greatest amount of re-growth 14 days after application. Initial results indicate that Reviton has a fit as an effective cotton defoliant as long as lower rates are utilized and temperatures are cool enough to prevent regrowth.

Monitoring and Correcting Potassium Hidden Hunger in Arkansas Soybean.

C.C. Ortel**[,1], T.L. Roberts[1], N.A. Slaton[1], W.J. Ross[2], L. Purcell[1], K.A. Hoegenauer[1], M.V. Pessotto[1], C.A. Followell[1], and A. Smartt[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR.

Potassium (K) deficiency is one of the most important yield limiting factors in Arkansas soybean (*Glycine max*) production and can be difficult to identify due to the lack of visual symptoms. Plant nutrient concentrations can change significantly over the course of the growing season and oftentimes provide a moving target for nutrient sufficiency. Interpretations of diagnostic tissue-K concentrations are only adequate for very specific growth stages and prevent interpretation and successful identification of hidden hunger across the growing season. These challenges lead Slaton et al. (2020) to delineate the crop response to fertilizer-K at key growth stages and develop a dynamic critical tissue-K concentration for interpretation of sufficiency from the R2-R6 growth stages. However, the rate of fertilizer-K necessary to correct the various levels of deficiency and achieve maximum yield remains unknown. Our objectives were to correlate the trifoliolate-K with relative grain yield, to calibrate the rate of fertilizer-K needed to achieve 95% relative grain yield, and to evaluate the economic viability of in-season K applications to soybean. Treatments included multiple rates of granular muriate of potash at 15 days after R1 (DAR1), 30 DAR1, and 45 DAR1. Research was conducted in 2021 across multiple fields and soil-test K levels. The results indicate that soybean responded positively to K fertilization ($P < 0.10$) at 15 and 30 DAR1 when trifoliolate-K is below the critical concentration, but not at 45 DAR1. Therefore, in-season applications are effective at maintaining yield if applied during early reproductive growth. However, a delay in application timing may jeopardize yield potential to a degree that is no longer profitable to correct. Calibrated K rates related to tissue-K concentrations for a given growth stage will enable producers to correct deficiencies in-season with the appropriate fertilizer rate to maximize yield and profit.

What We Know: Potassium Borate as a Volatility Reducing Agent and Nutritional Additive.

M.C. Castner**[,1], J.K. Norsworthy[1], T.L. Roberts[1], and B.L. Cotter[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The *N*,*N*-bis(3-aminopropyl)methylamine salt of dicamba (Engenia™) and diglycolamine (DGA) salt of dicamba with potassium acetate (XtendiMax™ with VaporGrip™ Technology) are two of three low-volatile dicamba products labeled for preemergence and postemergence control of broadleaf weeds in dicamba-resistant cotton and soybean. The University of Arkansas Systems Division of Agriculture has been evaluating and was recently granted a patent for use of potassium tetraborate tetrahydrate (potassium borate) as a dicamba volatility-reducing agent (VRA) and boron (B) nutritional with the capacity to alleviate B deficiencies that can be common in Arkansas. To evaluate the volatility-reducing properties of potassium borate compared to DGA dicamba plus VaporGrip™, two low tunnel (Fayetteville, AR) and two large-scale (Fayetteville and Newport, AR) experiments were conducted in 2020. For low tunnel experiments, six increasing concentrations of potassium borate (0.00625, 0.0125, 0.025, 0.05, and 0.1 M) were combined with DGA dicamba at 0.5 lbs ae A^{-1} plus the potassium (K) salt of glyphosate at 1.12 lbs ae A^{-1}. The large-scale experiments consisted of two treatments, DGA dicamba with VaporGrip™ plus K salt of glyphosate at 0.5 and 1.12 lbs ae A^{-1}, respectively, with and without potassium borate at a 0.1 M concentration. A positive potassium borate concentration response was observed in the low tunnel experiments for the three evaluated parameters, with 0.025- to 0.1-M showing minimal maximum and average injury and distance traveled to 5% injury compared to lower potassium borate concentrations or no additive. The large-scale experiment corresponded well to low tunnel results at both locations, indicating that 0.1 M potassium borate is sufficient to reduce dicamba volatility. Overall, potassium borate has shown promise as a VRA in small- and large-scale trials, and continued research is needed to evaluate crop tolerance and nutritional capabilities of this additive.

Influence of Seeding Rate on Five New Rice Cultivars.

L.R. Amos[‡,1], J.T. Hardke[1], D.L. Frizzell[1], E. Castaneda-Gonzalez[1], T.L. Clayton[1], and G.T. Hampton[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR.

Seeding rate studies determine optimal seeding rates for new cultivars to achieve maximum grain yields. In this study, five new rice cultivars were seeded at five different rates. Jewel, Lynx, DG263L, CLL16, and CLL17 were seeded at rates of 10, 20, 30, 40, and 50 seed/ft^2. These five cultivars were also evaluated in a similar 2020 study. The seeds were treated with fungicides and an insecticide in accordance with current rice production recommendations. The trials were planted at three locations including the Rice Research and Extension Center (Stuttgart, AR), Pine Tree Research Station (Colt, AR), and Northeast Research and Extension Center (Keiser, AR). Stand densities were determined at the 2-3 leave stage and grain yields were recorded at harvest. For all cultivars, stand density increased significantly as seeding rate increased. For all cultivars at all locations, a 20 seed/ft2 seeding rate achieved stand densities in the current recommended range to optimize grain yield. In many instances, stand densities even at the lowest seeding rate of 10 seed/ft2 were at or near the recommended range. Due to unusually high stand densities compared to previous studies, few differences in grain yield were observed between seeding rates. This research suggests that under optimal conditions for achieving stand densities, currently recommended seeding rates could be lowered considerably.

Impact of Defoliation on Rice Growth and Yield.

S.G. Felts[‡,1], N.R. Bateman[1], G.M. Lorenz[2], B.C. Thrash[2], W.A. Plummer[2], M. Mann[2], C.A. Floyd[2], T.B. Newkirk[3], C. Rice[3], A. Whitfield[3], Z. Murray[3], and T. Harris[3]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR.

Armyworms are commonly found in rice fields in the mid-southern US and have the potential to cause severe defoliation to the rice crop. The two main armyworm species observed in rice in this region are true armyworms and fall armyworm. It is common to see infestations occur at all growth stages of rice. The current threshold for armyworms in rice is based on the number of larvae per square foot. A defoliation based threshold would provide growers and consultants with a simple way to make economically sound decisions for controlling armyworms in rice. Studies were conducted from 2019 through 2021 where rice was mechanically defoliated at 0, 33, 66, and 100% with a weed eater at two-three leaf, early tiller, late tiller, and green ring growth stages across three planting dates. No yield loss was observed at the 2-3 leaf or either tillar stage. However, large amounts of yield loss were observed when plants were defoliated either 66 or 100% at the green ring growth stage. A delay in heading was also observed when plants were defoliated at 66 or 100% during any growth stage in 2019. Maturity delays were also observed in 2020 and 2021, but was not as severe as what was observed in 2019. Yield loss and delays in heading were greater for the May planting date compared to the April or June planting date. This data has helped to develop a defoliation-based threshold in rice to keep rice growers profitable.

Can Remote Sensing Technology be used to Identify Weedy Areas in Rice?

O.W. France[‡,1], A.M. Poncet[1], E.L. Sears[1], G.P. Rothrock[1], J.K. Norsworthy[1], T.R. Butts[2], and J.T. Hardke[3]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR. [3]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR.

Rice is one of the most important crops worldwide and to the U.S. midsouth, with roughly half of U.S. rice grown in Arkansas. As a flooded crop, rice presents unique production challenges, especially when it comes to weed control. Weed control is a key factor to maintaining crop yield and quality, and as dynamics such as herbicide resistance impact weed control methods, incorporation of new tools and technologies could provide a means to respond to this problem. Incorporating remote sensing technology via drone and the development of an algorithm to automatically detect weed control in rice would provide producers with a tool to improve weed management and aid decision making. A study was conducted in 2021 in Arkansas to determine the possibility of detecting weeds via drone imagery versus that of ground-truth data. Data were collected from various experimental weed-control plots at multiple agricultural research stations and from commercial production rice fields. In each location, RGB drone images were taken at multiple altitudes using a DJI Phantom 4 Pro V2.0 and a DJI Mavic Air and weed pressure was rated. Weed pressure was quantified in the field and within the collected aerial imagery according to weed composition and percent weed biomass versus crop biomass. Ratings were taken per $0.25m^2$ before flood establishment and per experimental plot afterward. A categorical rating scale from 0 to 5 was constructed to aid biomass rating. Weed biomass samples were also collected from commercial fields near harvest then compared to ground-truth and aerial image ratings. Aerial image ratings were compared to the ground-truth ratings. Accuracy and precision of ratings were modeled as a function of rice growth stage, represented weed species and image spatial resolution. The aerial image ratings strongly correlated with the ground-truth ratings at specific spatial resolutions. Results from this study provide the groundwork needed to automate remote sensing drone imagery interpretation for weed detection in rice fields.

Potential for Harvest Weed Seed Control in Arkansas Rice.

M.M. Houston[‡,1], J.K. Norsworthy[1], and L.B. Piveta[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Barnyardgrass, Palmer amaranth, and weedy rice are difficult-to-control weeds in Arkansas rice, especially with the evolving herbicide resistance issues throughout the Midsouth. Arkansas rice growers are looking for alternative methods to not only control these weeds during the growing season, but are also trying to limit soil-seedbank replenishment from escapes. The objective of this experiment was to evaluate two herbicide programs with and without the use of a Redekop seed destructor for harvest weed seed control in furrow-irrigated row rice. The experiment was initiated in Keiser, Arkansas in 2021 and will continue through the 2023 growing season. In general, the Redekop seed destructor functioned well 14 days after desiccation of rice. At this time, samples collected from the seed destructor are being processed, and results from these grow-outs will be presented. Overall, it appears that the Redekop seed destructor could be a valuable asset for rice growers, but further research on extent of seed shattering, especially for weeds like barnyardgrass and Palmer amaranth in row rice are needed. For growers looking to limit problematic weeds in rice, the addition of harvest weed seed control through seed destructors has potential to aid chemical weed control tactics.

Evaluation of Palmer Amaranth Accessions for Sensitivity to Glufosinate and Dicamba.

L.B. Piveta[‡,1], J.K. Norsworthy[1], T. Barber[2], and T. Butts[2]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR.

Palmer amaranth (*Amaranthus palmeri*) is a weed that remains at the center of row crop management concerns in the Midsouth due to the rapid growth and constant evolution of herbicide resistance. To determine the sensitivity of Palmer amaranth to glufosinate and dicamba across Arkansas, sixty-eight unique accessions were evaluated in response to both herbicides in a 2018 to 2020 screening conducted under greenhouse conditions in Fayetteville, AR. Screenings were initiated immediately following sample threshing and seed harvest. Approximately 4 to 7 days after emergence, Palmer amaranth plants from each accession were transplanted into premade 50-cell trays and separated by herbicide treatment. Palmer amaranth accessions were screened to glufosinate (Liberty at 14.5 and 29 fl oz/A) and dicamba (Clarity at 8 and 16 fl oz/A), which are a respective 0.5 and 1x of the labeled field usage rate. All herbicide applications were made when the majority of Palmer amaranth in each tray reached a height of 3 to 4 inches. Approximately 21 days after application, quantitative data in the form of live/dead counts were recorded. For adequate analysis, a minimum of 100 plants was screened for each accession inside each herbicide treatment. Overall, twenty-three Palmer amaranth accessions had greater than 10% survival to a 1x of glufosinate and thirteen of these accessions had 20% or greater survival. Of the sixty-eight total Palmer amaranth samples from 2018 to 2020, thirty-three demonstrated 1% survival or less in response to a full rate of glufosinate. For dicamba, twenty-two accessions had 10% or greater survival to a 1x rate, with eight of these accessions having 20% or greater survival. When paired with the amount of survival to a 0.5x rate of dicamba and glufosinate, it is evident that glufosinate- and dicamba-resistant Palmer amaranth is already present and could be developing quickly across Arkansas. The lack of control with both herbicides for some Palmer amaranth accessions is evidence that integration of additional strategies into current weed control programs is needed.

Control of Tarnished Plant Bug with Selected Insecticides in Cotton.

W.A. Plummer[‡,1], M. Mann[1], G.M. Lorenz[1], B.C. Thrash[1], N.R. Bateman[2], S.G. Felts[2], C.A. Floyd[1], T.B. Newkirk[3], C. Rice[3], A. Whitfield[3], Z. Murray[3], and T. Harris[3]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR.

Tarnished Plant Bug (*Lygus lineolaris*) is the number one insect pest in mid-south cotton production. Plant bug feeding causes square loss, deformed flowers, and damaged bolls, ultimately resulting in reduced yield. Growers and consultants rely on foliar insecticide applications to control plant bugs, with growers averaging 4.7 insecticide applications per acre treated. These trials are part of a regional Midsouth study conducted the past four years to evaluate the efficacy of insecticides currently labeled for control of this pest. These trials are also used to determine a base level of control to monitor for insecticide resistance to individual insecticides, and to serve as a source of data for registration of new insecticides that may become available. Also, these data are used to ensure that current recommendations of these insecticides are still viable. Insecticides evaluated include: Transform (sulfoxaflor), Centric (thiamethoxam), Vydate (oxamyl), Orthene (acephate), Brigade (bifenthrin), Bidrin (dicrotophos), Admire Pro (imidacloprid), Carbine (flonicamid) and Diamond (novaluron). Treatments were initiated when a threshold of six TPB per ten row feet was found in the test area and are reapplied when a majority of the treatments exceeded threshold after the initial application. Results indicated that Diamond and Transform performed consistently better than many of the other insecticides. Many of the insecticides tested failed to provide any consistent level of adequate control.

Non-target Site Resistance to Acetyl CoA Carboxylase (*ACCase*)-Inhibiting Herbicides in Barnyardgrass.

F. Gonzalez-Torralva[‡,1], J.K. Norsworthy[1], and L.B. Piveta[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Barnyardgrass (*Echinochloa crus-galli* (L.) P. Beauv.) is a difficult-to-control weed species in rice (*Oryza sativa* L.) cropping systems in the southern US. Two barnyardgrass accessions that survived the commercial field rate of cyhalofop-butyl (Clincher®; 15 fl oz/acre) were characterized under greenhouse conditions and found to be resistant to the herbicide. To determine if a mutation is conferring cyhalofop-butyl resistance in barnyardgrass, the *acetyl CoA carboxylase* (*ACCase*) gene was sequenced. Genomic DNA was extracted from resistant accessions and compared to a susceptible standard. Comparison of DNA sequences and their respective proteins among accessions displayed no mutation in sites previously reported in other *ACCase*-resistant weed species. These results suggest that mutations are not involved in the resistance mechanisms to cyhalofop, and that the presence of other mechanisms such as herbicide degradation is highly probable. In addition, these results suggest that an integrated weed management approach is required to avoid the dispersion of resistant accessions and decrease the risk of evolving higher resistance levels.

Comparison of Chrysogen Formulations for Control of Soybean Looper, *Chrysodeixis includens*, in Arkansas Soybean Production.

C. Rice*,[1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], M. Mann[2], S.G. Felts[3], W.A. Plummer[2], C.A. Floyd[2], T. Newkirk[1], A. Whitfield[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR.

Synthetic insecticides are the most common and reliable control method for soybean looper, *Chrysodeixis includens*. As resistance to synthetic insecticides in soybean looper increases, growers are seeking new control options that are both cost-effective and efficacious. Multiple experiments were conducted in 2020 at the University of Arkansas Lonoke Research and Extension Center to evaluate the efficacy of Chrysogen formulations on 3rd instar soybean loopers in a leaf dip bioassay and an additional field experiment was conducted in Tillar, AR.

The leaf dip bioassay was conducted using Chrysogen rates, 2.5 ($5.5x10^{11}$ OB), 3 ($6.6x10^{11}$ OB), 3.5 ($7.7x10^{11}$ OB), 4 ($8.8x10^{11}$ OB) oz/ac. Each rate was evaluated daily for leaf area consumed and mortality. Mortality occurred between 4 and 7 DAA and exceeded 75%. At 6 and 7 DAA, all Chrysogen formulations reduced leaf area consumption when compared to UTC. The field experiment consisted of purified Chrysogen treatments (2, 4 oz/ac), Intrepid Edge (6 oz/ac), and UTC. At 7 and 10 DAA, Intrepid Edge had lower looper densities when compared to the UTC and purified Chrysogen treatments. At 14 DAA fewer larvae were observed in the purified Chrysogen treatments when compared to UTC and Intrepid Edge. No differences in leaf area index were observed between treatments at any sample date. These studies will help aid Arkansas soybean producers to determine the utility, recommended dosage, and control expectation for Chrysogen on soybean looper.

Integraded Weed Management Strategies for *Palmer Amaranth* Control in Arkansas Cotton.

T. Smith*,[1], J.K. Norsworthy[1], L.T. Barber[2], R.B. Farr[1], M. Houston[1], and J. Fleming[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR.

Palmer amaranth has become one of the most troublesome weed species of crop production systems in Arkansas. Previous research showed that an integrated weed management approach is necessary to provide control. Crops such as cotton are extremely vulnerable since the delay in canopy closure provides an optimum environment for escapes of Palmer amaranth to develop. A field trial was initiated to evaluate the long-term weed management strategies for Palmer amaranth in cotton systems. This trial was initiated in fall of 2018 at the Lon Mann Cotton Research and Extension Center near Marianna, AR. The treatments combined dicamba- and non-dicamba-based herbicide systems with non-chemical strategies such as cover cropping (cereal rye), tillage, and zero-tolerance. The results presented here are those from 2021, three growing seasons after trial initiation. Results showed an 82% reduction in Palmer amaranth emergence from the adoption of cereal rye cover crop, averaged over all other strategies. Using a zero-tolerance approach to managing Palmer amaranth in the 2019 and 2020 growing seasons resulted in a 63% reduction in emergence of the weed in 2021, averaged over other strategies. For the main effect of tillage, which was a one-time use of a moldboard plow in fall of 2018, there was a 37% reduction in Palmer amaranth emergence in 2021, but the effect of tillage was not significant. Regarding the main effect of herbicide program, those containing the dicamba-based program had 63% less Palmer amaranth emergence, likely because of the residual activity of dicamba in these treatments. The lack of interaction between factors evaluated point to the fact that many of the strategies tested have an additive effect in suppressing Palmer amaranth emergence, which in turn should reduce selection for resistance to herbicides.

Monitoring Potential *Lambda-cyhalothrin* Resistant Rice Stink Bugs, *Oebalus pugnax*, Populations in Arkansas.

T. Newkirk*[,1], N.R. Bateman[2], G.M. Lorenz[3], B.C. Thrash[3], N.K. Joshi[1], S.G. Felts[2], W.A. Plummer[3], C.A Floyd[1], C. Rice[1], A. Whitfield[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR.

Rice stink bug (RSB) (*Oebalus pugnax*) is a major pest of rice, feeding on the developing grain. Few insecticides are available to rice producers for RSB management, and those labeled lack residual control. Lambda-cyhalothrin (Lambda) is the most common insecticide used to manage RSB, providing good control at low cost. Over 90% of rice acreage treated for RSB will be Lambda. Other options, such as Tenchu (Dinotefuran), are effective for control but at a much higher cost. The high level of usage of one product, and control issues in Louisiana and Texas, raises concern for resistance of RSB with Lambda. New options for RSB need to be evaluated if resistance to Lambda is documented. Efficacy field trials were conducted in 2019, 2020, and 2021 to compare labeled insecticides for efficacy and residual control of rice stink bug. Sweep net samples were taken pre-application, and every 2-3 days post-application for two weeks to monitor RSB. Additionally, assays were conducted on multiple RSB populations in 2019, 2020, and 2021 from fields where RSB were found soon after an application of Lambda. After adults were collected, Lambda was applied to petri dishes at five different rates with an untreated for comparison with 10 replications. Dishes were allowed to dry then five RSB were placed in each dish. Mortality was assessed at 8 and 24 hours after infestation. The 8-hour mortality ratings averaged 70%, with the 24-hour averaging 82% mortality.

Effects of Water Quality on Insecticide Performance for the Control of Tarnished Plant Bug, *Lygus lineolaris*, in Cotton and Corn Earworm, *Helicoverpa zea*, in Soybeans.

T. Harris*[,1], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], M. Mann[2], W.A. Plummer[2], C.A. Floyd[2], C. Rice[1], S.G. Felts[3], T. Newkirk[1,] A. Whitfield[1], and Z. Murray[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept. of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR.

Insecticide efficacy often varies from location to location and year to year. Many factors can influence an insecticides' efficacy, but an often-overlooked factor is the quality of water in an insecticide solution. Multiple experiments were conducted to evaluate the impact of water on insecticide efficacy. In the first experiment, Transform 1.5 oz/a, Orthene 0.75 lb/a, Bidrin 8 oz/a, and Centric 2 oz/a, were each mixed in three waters with hardness's of 10.9, 178, and 430 ppm, then applied to cotton for control tarnished plant bugs. In Transform the very hard water had better control than the hard water but approximately the same as soft water. In Centric the hard water had better control than the soft water. Increasing water hardness had no impact the efficacy of Acephate and Bidrin. In the second experiment, leaf dip assays were conducted with Vantacor on corn earworm using soybean leaves. Serial dilutions were used to achieve a concentration of 0.06ng/ml of chlorantraniliprole in 4 waters with hardness's of 10.9, 20, 178, and 430ppm. Larvae were place on leaves after drying and larval mortality was rated at 24 hours and 48 hours. At 48 hours there was 50% mortality in the 10.9 and 20ppm water, 40% mortality in the 178ppm water, and 30% in the 430ppm water.

Coating Loyant on Urea: A Novel Approach to Reduce Herbicide Off-Target Movement.

B.L. Cotter*[,1], J.K. Norsworthy[1], M.C. Castner[1], and L.B. Piveta[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Following commercial launch of Loyant™ (florpyrauxifen-benzyl) in 2018, frequent off-target movement of the herbicide to adjacent soybean (*Glycine max* (L.) Merr.) fields was observed. Hence, a field experiment was conducted in 2020 and 2021, in Fayetteville, AR, to evaluate the sensitivity of soybean to low-dose rates (0 to 3 fl oz A^{-1}) of Loyant as a foliar spray and coated on urea. Applications occurred at V3 stage of soybean. Soybean response to applications of Loyant in a wide-row (36 inch) soybean system was evaluated at 7, 14, 21, and 28 days after application. Maximum soybean injury observed when Loyant at 3 fl oz A^{-1} was coated on urea was 25% in 2020 and 30% in 2021. However, both years, the maximum amount of soybean injury observed from a 3 fl oz A^{-1} foliar spray application of Loyant was 100% (plant death). At all timings, equivalent rates of Loyant coated on urea caused less injury than that of foliar spray applications. No deleterious effect on yield was observed in 2020 from any Loyant coated on urea treatment when compared to the nontreated, but all foliar spray treatments caused a negative effect on soybean yield. Overall, by coating Loyant on urea, soybean injury was reduced 50 to 91 percentage points in 2020 and 55 to 96 percentage points in 2021, across all rating intervals, when compared to foliar spray applications. Coating Loyant on urea and applying it to rice will likely mitigate the risk for injury to nearby soybean that was observed following aerial spray applications of the herbicide.

Evaluation of Warrant for Weedy Rice and Barnyardgrass Control.

S.C. Noe*[,1], J.K. Norsworthy[1], T.H. Avent[1], M.M. Houston[1], and T.R. Butts[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Weed control in rice has become more complicated as problematic weeds such as barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] and weedy rice (*Orzya sativa* L.) have developed resistance to commonly used herbicides. Acetochlor has shown effective control of barnyardgrass and weedy rice. Microencapsulated acetochlor (Warrant) is a residual chloroacetamide herbicide that is labeled in corn, cotton, and soybean within the United States. Fenclorim is a herbicide safener that was first utilized in water-seeded rice with pretilachlor (another chloroacetamide) in Asia and was shown to reduce herbicide injury caused by pretilachlor. The effectiveness of acetochlor with and without fenclorim applied as a seed treatment must be evaluated its effectiveness in controlling barnyardgrass and weedy rice and mitigation of rice injury with the fenclorim seed treatment. This experiment was a three-factor randomized complete block design initiated in the Spring of 2021 to observe rice injury when used with or without fenclorim (0 and 2.5 lb ai/1000 lb seed) and control of both barnyardgrass and weedy rice based on application timing (preemergence, delayed-preemergence, spiking, and 1-leaf) and herbicide rate (1.5, 3, and 4.5 pints A^{-1} of Warrant). Data were collected at three intervals after each application (+/- 3 days) at 14, 21, and 28 days with emphasis placed on 21 days after application. As the application timing was delayed from preemergent to delayed-preemergence, herbicide injury was reduced when combined with fenclorim seed treatment. Furthermore, as application timing was delayed weed control was also reduced. Although rice injury was reduced when fenclorim was used as a seed treatment, fenclorim did not have an impact on control of barnyardgrass or weedy rice. From this experiment, a delayed-preemergence application timing with acetochlor at 3 pints A^{-1} and a fenclorim seed treatment provided > 90% barnyardgrass control and 62% weedy rice control with only 18% injury to rice.

Determining Cover Crops Base and Optimum Growth Temperatures.

M.V. Pessotto*[,1], T.L. Roberts[1], C.C. Ortel[1], C.A. Followell[1], and K.A. Hoegenauer[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Thermal units or growing degree days (GDD) are well-known parameters to predict plant growth. The basic equation for prediction is that the heat unit accumulation equals the average daily temperature minus the species base temperature. More expanded versions of this calculation will add optimum and maximum temperatures to the equation that are specific to individual plant species. Cardinal temperatures are defined for most cash crops but not for all cover crops species. The objective of this study is to determine the cardinal temperature of eight cover crop species, Austrian winter pea (*Pisum sativum*), balansa clover (*Trifolium michelianum)*, barley (*Hordeum vulgare*), black-seeded oats (*Avena sativa*), common vetch (*Vicia sativa* var. Cahaba), cereal rye (*Secale cereal*), crimson clover (*Trifolium incarnatum*), and hairy vetch (*Vicia villosa*), using a growth chamber experiment. Seven different temperature regimes from 39.2 to 93.2 degrees Fahrenheit were implemented, and the number of leaves was counted every other day from day 0 to 21. As a result, the data was regressed to estimate the base and the optimum temperature for all species. The maximum temperature for each species could not be estimated since most species continued growing at the highest temperature, and the growth chamber used does not support temperatures higher than 104°F. Therefore, the estimated base and optimum temperature for each species were, respectively, 32.9 and 81.9 °F for Austrian winter pea, 40.8 and 76.6 °F for balansa clover, 31.3 and 70.5 °F for barley, 36.7 and 69.4 °F for black-seeded oat, 25.9 and 76.3 °F for cereal rye, 36 and 73.4 °F for common vetch, 40.6 and 76.5 °C for crimson clover, and 38.4 and 80 °F for hairy vetch. The identification of cardinal temperatures for these cover crop species will allow plant growth and biomass prediction models to aid in cover crop termination decision aid tools.

Effects of Soil Moisture and Nitrogen Applications on Provisia Rice Tolerance to Quizalofop.

N. Godara*[,1], J.K. Norsworthy[1], T.R. Butts[2], T. Barber[2], and T.L. Roberts[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Lonoke, AR.

Quizalofop-resistant rice technology is a non-transgenic herbicide-resistant technology that allows for postemergence applications of quizalofop, an ACCase-inhibiting herbicide. Previous research reported that temperature, light intensity, and moisture availability had influenced the response of grass species to aryloxyphenoxypropionate herbicides and also observed that quizalofop caused significant injury to quizalofop-resistant cultivars. The objective of this research was to investigate the influence of early season soil moisture or nitrogen applications on tolerance of quizalofop-resistant cultivars to sequential quizalofop application. Experiments were conducted at Stuttgart and Colt, AR in 2021 and implemented as a three-factor, randomized complete block design with the factors including cultivar (RTV7231 and PVL02), sequential quizalofop rate (none, 1x, and 2x) applied at 2-leaf and 5-leaf rice stage, and soil moisture/nitrogen availability at 2-leaf quizalofop application (none, flush, ammonium sulfate followed by flush). At 21 days after the 5-leaf stage quizalofop application, results from both experiments showed that there were no significant differences in injury from initial quizalofop application followed by flush and followed by flush with ammonium sulfate on both cultivars at any quizalofop rate. In addition, no differences in relative groundcover was observed at 21 days after 5-leaf application at Stuttgart, AR regardless of quizalofop rate. In conclusion, growers can expect to see injury from sequential applications of quizalofop, but quizalofop-resistant cultivars recovered subsequently and no reduction in yield potential and no heading delay was observed at both locations.

Developing a Detached Leaf Assay for Screening Soybean Cultivars for Targe Spot Resistance.
R.K. Wolf*[,1], and J. Rupe[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR.

Historically, Target spot, caused by Corynespora cassiicola, was a minor fungal disease of soybean in Arkansas and the Southeast United States. However, the incidence and severity of Target Spot has increased in the last decade and was one of the most severe foliar diseases in Arkansas during 2016. Field screening for Target spot is difficult because the disease is dependent on the environment and so symptom development is highly variable between years.

To screen soybean breeding lines for resistance to Target Spot and possibly predict their performance in the field, a greenhouse inoculation of seedlings was attempted: soybean seedlings grown in the greenhouse were sprayed with a conidial suspension until runoff and then placed in a dew chamber for three days; symptoms were limited to small necrotic spots on the leaves, petioles, and stem that did not continue to progress into typical target spot symptoms.

Another approach was to inoculate detached leaves in the laboratory. Detached unifoliate leaves from greenhouse grown seedlings of the highly susceptible Credenz cultivar 'CZ4748' and the moderately susceptible cultivar 'Hutcheson' were collected and placed moist filter paper in petri dishes, two leaves per plate. An isolate of C. cassicola, Cory 20-03 collected from soybean in Arkansas during 2020 was grown on V-8 juice agar at room temperature and light for 7-10 days. Each plate was flooded with 10 ml of water, the colony scraped with a sterile rubber spatula and the resulting suspension poured through three layers of cheesecloth. The inoculum suspension was adjusted to 10^4conidia/ml. Each leaflet was wounded with a sterile at three locations and a 10-microliter drop was placed on each wound, and the plates were wrapped in plastic and placed under LED lights on a 12-hour cycle at room temperature. Symptoms began to develop in 3 days and continued to progress for up to three weeks developing into typical target spot symptoms. Digital images of each leaf were taken and used to determine percent leaf area affected using the mobile phone app BioLeaf (Upvision). Lesion development was greater in CZ4748 than in Hutcheson. Later studies found that symptom development was more consistent using inoculum concentrations of 10^5conidia/ml than 10^4conidia/ml.

This method was used to screen 39 soybean lines from a 2019 Cercospora Leaf Blight study. The cultivars were divided into four groups. Each group included CZ4748 and Hutcheson. Six unifoliates of each cultivar were inoculated. Two additional uninoculated leaflets were included. Leaf area affected was determined 7,10,14,17, and 21 days post inoculation as described and the area under the disease progress curve (AUDPC) determined. AUDPC's were compared using the Proc GLIMMIX (SAS 9.4). Each group of cultivars was tested twice.

The amount of disease varied between tests, however CZ4748 had consistently more disease than Hutcheson and there were significant differences between soybean lines in all tests. Fifteen lines had significantly less disease than Hutcheson in at least one test, four lines in both tests. This detached leaf assay promises to be an effective method to evaluate cultivar resistance.

Efficacy of Selected Insecticides for Control of Sugarcane Aphid in Sorghum.
G. Marris[†,], G.M. Lorenz[2], B.C. Thrash[2], N.R. Bateman[3], W.A. Plummer[2], M. Mann[2], S.G. Felts[3], C.A. Floyd[2], T.B. Newkirk[1], C. Rice[1], A. Whitfield[1], Z. Murray[1], and T. Harris[1]. [1]Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR. [2]Dept. of Entomology and Plant Pathology, University of Arkansas, Lonoke, AR. [3]Dept of Entomology and Plant Pathology, University of Arkansas, Stuttgart, AR.

Sugarcane aphid (SCA) is one of the most damaging insect pests of sorghum in the southern U.S. It is not uncommon for SCA to cause 100% yield loss in fields if not controlled. Although many sorghum cultivars exhibit tolerance or resistance, supplemental insecticide applications are still commonly required to keep aphid numbers below threshold. The objective of this study was to evaluate multiple insecticides both in-furrow and foliar applications for control of SCA. Insecticides included Sivanto in-furrow (4, 6, 8 oz/a), and foliar (5, 8 oz/a) and a foliar application of Transform (2.75 oz/a). In each plot the number of aphids on 10 upper and 10 lower leaves was recorded along with a honeydew rating. All tested rates of Sivanto in-furrow provided season long reduction of SCA compared to the untreated check (UTC). Both the foliar rates of Sivanto and Transform reduced SCA densities compared to the UTC. All treatments reduced honeydew presence and averaged 55% greater yield than the UTC.

Comparison of Seeding Rate and Bedding Methods for Furrow-Irrigated Rice.

B.L. Wright[†,1], J.T. Hardke[1], J.L. Chlapecka[2], E. Castaneda-Gonzalez[1], D.L. Frizzell[1], T.L. Clayton[1], L.R. Amos[1], and G.T. Hampton[1]. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Stuttgart, AR. Dept. of Plant Science and Technology, University of Missouri, Portageville, MO.

Furrow-irrigated rice (FIR) acreage is rapidly increasing across Arkansas. In 2015, FIR accounted for 11,456 of 1,286,000 total rice acres, but by 2020, this number increased to 244,198 of 1,441,000 total rice acres. The rapid increase in FIR acres has also resulted in a wide range of practices used to implement FIR. Therefore, a study was designed to assess four different methods of seeding and/or seedbed preparation for FIR. Treatments include 1) drilling seed into flat soil followed by creating water furrows post-seeding, 2) forming beds/furrows followed by drilling seed into the previously formed beds, 3) drilling seed into flat soil followed by forming beds/furrows post-seeding over top of seed, and 4) broadcasting seed on the soil surface followed by forming beds post-seeding. Trials were conducted on a silt loam soil at the Pine Tree Research Station (PTRS) and on a clay soil at the Northeast Research and Extension Center (NEREC). At the PTRS on silt loam soil, broadcasting seed followed by forming beds produced significantly higher grain yields compared to drilling flat followed by water furrows and forming beds followed by drilling. Drilling flat followed by forming beds performed similarly to the broadcast treatment. At the NEREC, drilling flat followed by water furrows resulted in significantly higher grain yields compared to all other treatments. Differences between sites could be related to soil type and/or equipment available to perform operations, but further study is needed to quantify these differences.