RESEARCH CONFERENCE ABSTRACTS

VOLUME 19

Arkansas Crop Protection Association

November 30 – December 1, 2015
Hilton Garden Inn
Fayetteville, Arkansas

STUDENT COMPETITIONS
SPONSORED BY:

BASF

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Monday, November 30, 2015

12:00 noon Registration

MODERATOR: Garrett Lee
Student Contest Chair: Mohammad T. Bararpour
Audio-Visual Coordinator: Jarrod T. Hardke

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

Monday, November 30, 2015 (cont.)

MODERATOR: Garrett Lee

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

Tuesday, December 1, 2015

MODERATOR: Donna Frizzell

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

Tuesday, December 1, 2015 (cont.)

MODERATOR: Donna Frizzell

10:30 a.m. **Assessment of Burndown Options for Cover Crops.**
M.G. Palhano*, J.K. Norswothy, M.S. McCown, R.R. Hale, and Z.D. Lancaster. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 11

10:45 a.m. **Effects of Soybean Row-Spacing and Population on Palmer amaranth Biological Characteristics and Sex Expression.**
N.E. Korres, J.K. Norsworthy, J.K. Green, J.A. Godwin, Z.D. Lancaster, and S.M. Martin. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 12

11:00 a.m. **Palmer amaranth Seed Production and Retention at Soybean Harvest.**
L.M. Schwartz, J.K. Norsworthy, and M. T. Bararpour. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 12

11:15 a.m. **Reduced Glyphosate Efficacy on ALS Resistant Yellow Nutsedge.**
P. Techranchian, J.K. Norsworthy, M.G. Palhano, and N.E. Korres. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 13

11:30 a.m. **Presentation of Awards**

11:45 a.m. **Adjourn**

ABSTRACTS

Influence of Adjuvant Selection, Application Timing, and Addition of Facet to Sharpen on Rice Tolerance.

R.R. Hale*, J.K. Norsworthy, Z.D. Lancaster, M.L. Young, and M.R. Miller. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Sharpen is a broadleaf herbicide that can be used for weed control in rice. It is beneficial to include an adjuvant in combination with Sharpen to achieve optimum weed control. Currently, Sharpen at 1 oz/A + methylated seed oil (MSO) at 1 pt/A is recommended as a burndown application before planting. Sharpen at 1 oz/A + 1% v/v crop oil concentrate (COC) can be applied in crop from the 2-lf stage through panicle initiation. Current recommendations do not include the use of MSO in crop nor the use of COC at 1 qt/A. However, this additional adjuvant may aid weed control which would be beneficial. A field study was conducted at the Pine Tree Research Station in Colt, AR to evaluate the tolerance of rice to Sharpen with COC and MSO at 1 pt/A and 1 qt/A, and when tank-mixed with Facet at 43 oz/A. Applications were made using a CO2-pressurized backpack sprayer at 15 GPA. Treatments were applied at different growth stages including: 1-lf rice, 3-lf rice, 0.5-inch internode elongation, and 3 to 4 inch joint. Only main effects of adjuvant, Facet use, and application timing were significant for rice yield. In general, adding MSO to Sharpen increased rice injury over the addition of COC to Sharpen; however, this increased injury did not translate into a reduction in yield. Rice treated with Sharpen plus COC at 1 pt/A had yields of 163 bu/A while rice yielded 155 bu/A when Sharpen was applied with MSO at 1 pt/A. The 1 qt/A rate of MSO and COC resulted in rice yields comparable to the lower use rate for each adjuvant. Applications at the 0.5 inch internode elongation stage or earlier showed no differences in rice yield which was 20 to 23 bu/A greater than when Sharpen was applied at the 3 to 4 inch joint stage. The addition of Facet to Sharpen increased yields, averaged over timings and adjuvants, which was surprising considering these were weed-free plots. Based on these results yield loss can be observed when Sharpen is applied beyond the 0.5 inch internode elongation and while MSO may increase rice injury this does not translate to a reduction in yield.

Soybean Yield as Affected by Chloride Rate and Includer/Excluder Rating.

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

Chloride toxicity is recognized as a yield limiting problem for irrigated-soybean [Glycine max (L.) Merr.] production in eastern Arkansas. While it is known that elevated levels of chloride in Soybean plants can limit yield, no critical tissue or soil concentrations of chloride during the growing season have been provided. Our research goal was to define the critical trifoliate leaf Cl concentrations during reproductive growth at which yield loss begins for soybean cultivars categorized as chloride includers or excluders. Three Cl-includer and three Cl-excluder cultivars were planted in strips and each strip received a total of 0, 250, 500, or 750 lb Cl/acre. Soybeans were planted on 30- (Pine Tree) or 38-inch (Rohwer) wide beds and furrow irrigated. A solution containing a mixture of MgCl2 and CaCl2 was applied to the furrow and bed shoulders with a CO2 backpack sprayer in five separate applications between the R1 and R5 stages. The experiment was a randomized complete block design with a split-plot treatment arrangement where Cl rate was the main plot and cultivar was the subplot. Recently mature, trifoliate leaves were collected four times during reproductive growth and analyzed for Cl concentration. For this presentation, the yields of the three cultivars belonging to each Cl-category were averaged and expressed as Cl category (subplot factor). Yield differences were interpreted as significant when $p \leq 0.10$.

The two primary questions addressed by this study are does the seed yield of Cl-includer and excluder cultivars respond similarly to Cl rate and can leaf Cl concentration be used to identify when yield reductions will occur from Cl toxicity. At Rohwer, Cl rate, Cl rating, and their interaction had no significant influence on seed yield although yield declined numerically from 50 to 46 bu/acre as Cl rate increased from 0 to 750 lb Cl/acre. At Pine Tree, the interaction between Cl rating and Cl rate was significant (p=0.0359) and showed that Cl-excluder cultivars produced numerically or statistically greater yields than Cl-includer cultivars when 250 (p=0.08), 500 (p=0.15) and 750 (p=0.0001) lb Cl/acre was added, but yields were equal (65 bu/ace) when no Cl was added (p=0.98). Within each Cl-rating group, the yield of Cl-excluder cultivars was greatest when 0 and 250 lb Cl/acre was applied and decreased with increase in Cl application rate. The Cl-excluder cultivars were equal for the 0, 250, and 500 lb Cl/acre rates before a yield decline occurred for the 750 lb Cl/acre rate. The difference in yield between the low and high Cl rates was 14 bu/acre for Cl includers and 5 bu/acre for Cl excluders. Leaf-Cl concentrations between the R2 and R5 stages were 5 to 13 times greater in Cl-includer leaves than Cl-excluder leaves suggesting that cultivars can be categorized as a Cl includer or excluder from leaf samples collected in field trials. Preliminary results suggest that yield loss begins to occur when leaf-Cl concentrations exceed 1000 ppm for Cl excluders and 4000 ppm for Cl includers. Additional research is needed to verify the accuracy and consistency of these results.

Evaluation of PGR Seed Treatments for Reducing Injury Caused by Herbicides for Volunteer Rice Control.

C. Rouse**[,1], T. Penka[1], N.R. Burgos[1], L. Schmidt[2], B. Scott[1], and J. Hardke[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR; [2]Farm Service, Inc., Pocahontas, AR.

Volunteer rice is a ‘silent thief’ weed problem of which Arkansas rice producers should be aware and should be managed to prevent yield loss and reduction of crop quality. Herbicide-resistant Clearfield rice cultivars are produced on the largest number of acres in Arkansas. Volunteer plants from such cultivars pose a potential risk to future rice crops. While there are no herbicide options for volunteer rice control in rice, Group 15 herbicides, or root and shoot inhibitors, may reduce volunteer populations. However, if applied at the wrong time, these herbicides could significantly injure the rice crop. Plant growth regulators (PGR), which can be applied as a seed treatment, may provide protection from stress imposed by these herbicides. A study was conducted at the Southeast Research and Extension Center, Rohwer and the Rice Research and Extension Center, Stuttgart to determine if PGR seed treatments can reduce the injury caused by the application of group 15 herbicides-acetachlor and pyroxasulfone. The treatments were arranged as a RCBD with 4 replications, with a two-factor factorial treatment structure; factor one being PGR (4) and factor two being herbicide (5). Prior to planting, CL151 seed was treated with a slurry of the PGRs- Ascend, Falgro, or Ascend + Falgro; a non-PGR treated seed was included. Volunteer Clearfield rice was spread at each location and lightly incorporated to simulate a typical production field. The herbicide treatments were applied preemergence (PRE) and at 2-leaf rice using standard application rates for acetachlor (1.26 kg ha-1) and pyroxasulfone (0.112 kg ha-1); a non-herbicide treated check was also included. The crop and volunteer rice populations were evaluated visually for crop injury and volunteer rice control, plant population (0.75 m2), and height (cm). Prior to harvest, panicles and stalks (0.5 m2) were counted and height was measured; yield was recorded at the end of the season. There was no significant location by treatment interaction; thus, data were pooled across locations. Rice injury was not influenced by the interaction between the PGR seed treatment and herbicide, nor was injury lessened by the use of a PGR; only herbicides had a significant effect on crop health. At 3 WAP, injury with pyroxasulfone (PRE) was greater (97%) than with acetachlor (88%). By 9 WAP, injury with pyroxasulfone (PRE) declined to 77%, but still significantly higher than all other herbicide treatments. Injury with acetachlor (PRE) declined significantly to 26% by 9 weeks. This was equivalent to the injury observed with pyroxasulfone application at 2-leaf rice (33%). Yield was not influenced by the PGR seed treatments, but was influenced by the herbicide application, with pyroxasulfone (PRE) yielding the lowest (88 bu a-1). The results of this experiment indicate that PGR seed treatments did not alleviate injury from the application of group 15 herbicides under the conditions wherein the treatments were evaluated. Further investigation is needed for verify these results. Injury caused by the application of pyroxasulfone (PRE) is unacceptable and was detrimental to rice yield. Acetachlor had less impact on rice yield, especially when applied after crop emergence; however, it becomes ineffective on volunteer rice at this timing. Acetochlor will be useful in providing residual grass control from a different mode of action if integrated in a season-long weed control program with other herbicides.

Effect of Dicamba on Pod Formation and Progeny Response.
M.S. McCown*, L.T. Barber, J.K. Norsworthy, M.G. Palhano, R.R. Hale, and J. Rose. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Commercial introduction of soybean cultivars genetically modified with resistance to dicamba will provide growers an alternative weed management option, but may expose susceptible soybean cultivars to non-target herbicide movement and tank contamination. A study was conducted to determine the effects on soybean progeny following dicamba injury. The progeny were evaluated in the greenhouse at the Altheimer Laboratory in Fayetteville, Arkansas following exposure of soybean plants to low rates of dicamba in the 2014 growing season. The purpose of this study was to determine if pod location influenced progeny growth and vigor.

In 2014, a field trial was conducted to determine the effect of soybean maturity on recovery from dicamba injury on a susceptible determinate cultivar. Two low rates of dicamba (1/64X and 1/256X) rate were applied at several growth stages (V3-R6). From a meter row of harvested plants from each plot, ten plants were chosen at random and each plant was then divided into thirds. Data were gathered on the number of total pods on the plant and the number of malformed pods in each third of the plant. Soybean seeds were collected for-grow-out in the greenhouse. Fifteen random seeds from each section of the plant were chosen. Injury resulting from the field application of dicamba was visually evaluated at second trifoliate and average heights were gathered using three randomly chosen plants from each pot. Significant difference in progeny vigor was observed between soybean growth stages. Visual estimates of injury to soybean progeny increased as dicamba were applied at later reproductive stages (R4-R6); however, injury varied depending on the location of where seeds were collected on the plants. Seeds collected from the bottom portion of the plants expressed 20-70% injury and seeds collected from the top and middle of the plant expressed 15-40% injury. Out of the total number of malformed pods on the plant, 40-60% of the malformed pods were collected from the middle of the plant, 20-30% of malformed pods were collected from the bottom and 25-35% of malformed pods were collected from the top portion of the plant. From these results we can conclude that pod location does have an influence on dicamba-like symptoms observed on progeny; however, there does not appear to be a strong correlation between pod malformation and injury to progeny. Future analysis will need to examine if pod malformation is directly correlated with injury to progeny.

Barnyardgrass and Palmer Amaranth Seed Retention in Soybean: Is HWSC a Viable Option?
J.K. Green*, J.K. Norsworthy, C.J. Meyer, M.G. Palhano, and M.R. Miller. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Narrow-windrow burning of soybean chaff is currently being evaluated by the University of Arkansas as a means of reducing the return of weed seed to the soil seed bank at soybean harvest. The success of narrow-windrow burning is dependent upon the amount of seed retained by weeds at harvest. In 2014 and 2015, experiments were conducted in Fayetteville, Arkansas to determine the retention of weed seed for barnyardgrass and Palmer amaranth over the course of a growing season when grown in conjunction with a soybean crop that was planted in late May. The weeds were evaluated in separate experiments but adjacent to one another so that the weather conditions were similar throughout the season. For the barnyardgrass experiment, barnyardgrass seeds were sown in the greenhouse on the day of soybean planting. At approximately 4 weeks after planting, barnyardgrass seedlings were transplanted into the row middles approximately 4 ft apart in the soybean field. In the Palmer amaranth experiment, seedlings were allowed to emerge naturally from the soil with the crop. Emerged seedlings were thinned to a spacing of approximately 4 ft within the soybean row. The trials were kept weed-free with the exception of the plants being used in the experiment. At reproductive development of the weeds, greenhouse trays and cups lined with fabric were placed underneath 16 randomly selected plants in each experiment in order to allow for the capture of seeds that may be released from the plant. The contents of the trays and cups were collected on a weekly basis to allow for a calculation of seed shed from the plant over time. Additionally, 10 plants were collected weekly and threshed to determine the amount of seed present on each plant over time. Visual observations of the weekly collections appear to show that barnyardgrass starts to shed seeds at a much earlier time than that of Palmer amaranth, but on the contrary, barnyardgrass appears to stay in reproductive development throughout the year by adding additional seed, essentially replacing seed that had been shed. Both weeds appear to be excellent candidates for at harvest weed seed collection and destruction based on the high percentage of seeds retained at soybean maturity.

Will Antagonism Be Expected in Xtend and Enlist Systems?

C.J. Meyer**, J.K. Norsworthy, K.L. Mills, J.K. Green, S.M. Martin, and R.R. Hale. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The commercial release of Roundup Ready Xtend and Enlist cropping systems will increase the number of herbicide products that can be applied postemergence (POST) in soybean and cotton. As POST herbicide combinations of glyphosate, glufosinate, dicamba, and 2,4-D become more common, a greater understanding of how these herbicides are interacting in-mixture is needed. Thus, field experiments were conducted in 2015 at the Northeast Research and Extension Center in Keiser, AR to evaluate potential herbicide interactions that could occur in Enlist and Roundup Xtend cropping systems. Various rates and combinations of glufosinate, glyphosate, dicamba, and 2,4-D were applied and evaluated for percent weed control. Control of Palmer amaranth, velvetleaf, prickly sida, and barnyardgrass by these herbicide treatments were evaluated 2 weeks after application (WAA) and analyzed for herbicide interactions. In the Enlist experiment, glyphosate (dimethylamine salt) at 1120 g ae ha-1 controlled barnyardgrass 92%, whereas a premix of glyphosate (1120 g ae ha-1) and 2,4-D (1054 g ae ha-1) only controlled barnyardgrass 84% 2 WAA. Similarly in the Roundup Xtend experiment, glyphosate (potassium salt) at 1542 g ae ha-1 controlled barnyardgrass 85 % and glyphosate (1542 g ae ha-1) + dicamba (561 g ae ha-1) only controlled barnyardgrass 79%. In both experiments, control of Palmer amaranth was >85% for all mixtures, control of prickly sida was > 80% for all mixtures, and control of velvetleaf was >80% for all mixtures. For the broadleaf weeds, control with mixtures of two or more products was equal to or greater than control with either product alone. Based upon these results, applying glyphosate with 2,4-D or dicamba on large (30 cm) barnyardgrass produces antagonism, compared to glyphosate alone. If Roundup Xtend or Enlist cropping systems become widely adopted, herbicide applicators need to be aware of antagonistic interactions and the implications of antagonism on herbicide resistance management.

Optimization of a Paddle Wheel Style Flowmeter Impeller for Agricultural Irrigation.

J. Mishra* and C. Henry. Dept. of Biological Engineering, University of Arkansas, Fayetteville, AR.

Flowmeters are indispensable devices in modern irrigation systems. There are different kinds of flowmeters used to measure water flow and usage in irrigated agriculture. To date most meters in use have been mechanical propeller meters. However propeller meters are not as suited for surface water applications because debris can wedge between the propeller and pipe causing inaccurate readings. Additionally there is a need for more cost effective flow meters that can be used with data acquisition equipment and pump monitors. A paddle meter has been developed by Diesel Engine Motors, a pump monitor development company and the University of Arkansas to address these current shortcomings with flow meters for surface irrigation.

Paddle meters have one significant disadvantage in that they can create excessive drag leading to underestimation of flow. Five different paddle designs were developed and tested to determine the efficiency of each paddle design. Also material selection was compared between metal and ABS plastic. Measurements were compared to a reference propeller meter calibrated to a traceable reference and to a flanged magnetic meter across a full range of expected flow rates and velocities anticipated in an irrigation system. Correction factors or “K” factors were developed and best fit was determined for each paddle design. The experiment

revealed factors that lead to less drag from both materials and paddle shape. The experiment will be used to develop more efficient and accurate paddle designs for flow meters.

Evaluation of Soybean Sensitivity to Rinskor™ Active.

M.R. Miller**, J.K. Norsworthy, G.T. Jones, C.J. Meyer, and J.K. Green. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Recently, Dow AgroSciences announced a new herbicide, RinskorTM Active, which is the second herbicide in a new structural class of synthetic auxins in the arylpicolinate family. This new herbicide provides an alternative mode of action for rice (Oryza sativa); however, in Arkansas, it is not uncommon for soybean (Glycine max) to be planted adjacent to rice resulting in concerns for drift. Historically, auxin type herbicides, such as dicamba, have concerned growers due to the high level of soybean sensitivity resulting in adverse effects on growth and yield in cases where drift occurs. Additionally, concerns for dicamba drift have been increasing as the launch of new dicamba-resistant crops near commercialization. To address these concerns a study was developed to understand the susceptibility of common row crops, such as soybean, to the new auxin herbicide. A field study was conducted during the summers of 2014 and 2015 to (1) evaluate the sensitivity of soybean to low concentrations of Rinskor Active and (2) compare soybean injury and yield following applications of Rinskor Active and dicamba across various growth stages and concentrations. Soybean were treated with 1/10, 1/20, 1/40, 1/80, 1/160, 1/320, or 1/640 of the 1X rate of Rinskor Active (30 g ae/ha) or dicamba (560 g ae/ha) at the V3 or R1 growth stage. Rinskor Active applied at a rate of 1/10 to 1/40X caused significant foliar injury and subsequent height reduction. In comparison, dicamba applied at the same rates caused similar injury and growth reductions. As drift rate of Rinskor Active decreased from 1/10 to 1/640X the level of soybean injury dissipated rather quickly. However, this was not the case with dicamba, as substantial injury was observed with rates as low as 1/640X. Soybean yield was most heavily reduced when the highest concentrations of the two herbicides were applied. Results from this study aim to serve as a starting point in the understanding of soybean sensitivity to low rates of a new auxin herbicide. Based on this research and additional trials, it is believed that the weed control benefit of Rinskor Active will outweigh the slight risks for off-target movement to soybean.

Evaluation of Very Long Chain Fatty Acid Inhibitors in Arkansas Rice.

J.A. Godwin*, J.K. Norsworthy, M.L. Young, S.M. Martin, and M.G. Palhano. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Due to the repetitive use of the same herbicide modes of action in rice, many weeds have evolved herbicide resistance. Therefore, problematic weeds such as barnyardgrass (Echinochloa crus-galli) and red rice (Oryza sativa) have become extremely difficult to control. In order obtain effective control and delay the evolution of resistant weeds in rice, it is essential that a new mode of action (MOA) be used in Arkansas rice production. The use of very-long-chain fatty acid-inhibiting (Group 15) herbicides are used in soybean and cotton for control of many grasses and small-seeded broadleaves. These herbicides would have a fit in rice if appropriate crop tolerance can be established. Four Group 15 herbicides including pethoxamid, S-metolachlor, pyroxasulfone, and acetochlor were evaluated at different application timings on a silt loam soil. Herbicide treatments included: acetochlor at 0.94 lb ai/A (Warrant), pyroxasulfone at 0.133 lb ai/A (Zidua), S-metolachlor 0.955 lb ai/A (Dual II Magnum), and pethoxamid at 0.75 lb ai/A applied at three different growth stages (delayed preemergence (DPRE), spiking, and 1- to 2-leaf rice). The greatest level of rice injury (up to 70%) was often caused by pyroxasulfone, regardless of application timing. This injury delayed heading and reduced stands, height, and yields. S-metolachor caused an unacceptable level of injury at most application timings and often reduced stands, height, heading, and yields; albeit to a lower extent than pyroxasulfone. The highest level of rice tolerance was observed for pethoxamid and acetochlor based on visible estimates of injury, plant height, stands, and yield. All pethoxamid application timings had rice yields equivalent to the weed-free control and likewise rice treated at the spiking and 1- to 2-leaf timings yielded comparable to the control. Based on this research, there appears to be sufficient rice tolerance to acetochlor and pethoxamid to warrant further investigation of these herbicides in Arkansas rice.

Spatial Examination of Soil Factors on Cotton Seedling Disease Pressure.

K. Wilson*, C. Rothrock, and T. Spurlock. Dept. of Plant Pathology, University of Arkansas, Fayetteville, AR.

Seedling diseases affect the germination, emergence, and early season growth and development of cotton resulting in low and variable stands and reduced yields. With the increasing costs of seed from the products applied to the seed and technology fees, precision planting utilizing site-specific management strategies are being implemented in order to reduce planting costs and improve stand uniformity. The objective of this study was to examine the spatial distribution of seedling diseases using seed treatment fungicides for the development of predictive models for seedling disease potential. Four row plots were established across a cotton field with each row having one of four seed treatments ipconazol + myclobutanil + metalaxyl + penflufen + prothiooconazole, penflufen, metalaxyl (2) metalaxyl, (3) PCNB , and (4) no fungicide For each plot, soil temperature and moisture was recorded 1 and 5 days after planting along with soil EC (texture). Exploratory spatial data analysis and spatial regression was used to determine distributions of stands and correlations with soil factors. The fungicide responses for the entire trial showed treatment 1 significantly improved stand over the control by 22%. Soil temperature was shown to be significantly aggregated in this field ($P<0.001$). The minimum soil temperature ranged from 20.0 – 21.4 ^{0}C. Stand improvement was significantly spatially correlated ($P<0.0001$) with sites with higher temperatures for all seed treatments. The stand difference between treated and non-treated rows was less in the sites with higher temperature. These results suggest that predictive maps for seedling disease risk are possible.

The Use of Command and Obey for Controlling Barnyardgrass and Amazon sprangletop in Late Planted Rice.

J.S. Calhoun*[,1], L.T. Barber, Z.T. Hill, R.C. Doherty, L. Collie, and A. Ross. [1]University of Arkansas at Monticello; [2]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Barnyardgrass and Amazon sprangletop are two of the most troublesome grass weeds in rice production in Arkansas. With resistance to propanil and quinclorac becoming more prevalent in barnyardgrass, other herbicides with different mechanisms of action will have to be used. Clomazone, commonly known as Command 3 ME, was introduced into rice production in 2001. Though Command can cause some injury to rice, it has quickly become the foundation for management of propanil- and quinclorac- resistant barnyardgrass in Arkansas. In late planted rice the use of Command alone or in a tank mix with quinclorac could increase the control of barnyardgrass and Amazon sprangletop when incorporated into a herbicide program. An experiment was conducted on a Sharkey clay soil at Rohwer, Arkansas to determine the use of Command alone or premixed with quinclorac, commonly known as Obey, to control barnyardgrass and Amazon sprangletop in rice. This experiment was conducted as a randomized complete block design with four replications, where herbicide efficacy was evaluated for control of barnyardgrass and Amazon sprangletop. Herbicide programs included Command at 0.4 or 0.8 lb ai/A applied preemergance (PRE), Obey at 0.8 lb ai/A PRE, Prowl H20 (pendimethalin) at 0.95 lb ai/A applied delayed PRE (DPRE), and Ricebeaux (propanil + thiobencarb) at 4.5 lb ai/A applied postemergence (POST). Prior to the POST applications, Command PRE at 0.8 lb/A provided greater control of these grass weeds than most other programs at 16 days after PRE application. By 55 days after PRE application Command at 0.8 lb/A followed by (fb) Prowl + Ricebeaux POST continued to provide > 95% control of both species. However, control was comparable to other programs that include Obey PRE fb Command at 0.4 lb/A + Ricebeaux POST and Obey PRE fb Prowl DPRE fb Ricebeaux POST. By 70 days after the PRE application, control of both species had slightly declined from all programs; however, the three previously discussed programs continued to provide > 90% control of barnyardgrass and Amazon sprangletop. In conclusion, the data suggests that using Command at 0.8 lb/A PRE fb Prowl + Ricebeaux POST, Obey PRE fb Prowl DPRE fb Ricebeaux POST, and Obey PRE fb Command at 0.4 lb/ A + Ricebeaux POST all provided ≥ 95% control of Barnyardgrass and Amazon sprangletop throughout the course of the season.

Distribution of PPO-Resistant Palmer amaranth Populations in Arkansas.

R.A. Salas**,[1], N.R. Burgos[1], J.E. Song[2], P.J. Tranel[2], and R.C. Scott[1]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR; [2]Dept. of Crop Sciences, University of Illinois, Urbana, IL.

Palmer amaranth (Amaranthus palmeri S Watson) is a major agronomic weed in the southern US. The widespread occurrence of ALS- and glyphosate-resistant weeds has led to increasing use of protoporphyrinogen oxidase (PPO)-inhibiting herbicides. The study aimed to evaluate the response of 53 Palmer amaranth and 2 tall waterhemp populations to fomesafen collected in 2014. Two-hundred plants from each population were grown in cellular trays, at 1 plant/cell, and sprayed with 0.235 lb ai/acre fomesafen when seedlings were 3-4 inches tall. Visual injury and mortality were recorded 21 days after treatment (DAT). Of the 55 populations tested, 11 Palmer amaranth populations were controlled 47-88% while the remaining populations were controlled >90%. The highest frequency of survivors (47%) was observed in a population from Mississippi County, PA-AR14-MIS-H, with injury ranging from 35-90%. Leaf tissues from the suspected samples were tested for the presence of an indel mutation that confers PPO resistance. Survivors from populations in 7 counties (Clay, Greene, Jackson, Lawrence, Lee, Mississippi, and Phillips) tested positive for the PPO indel mutation. This result confirmed the occurrence of PPO-resistant Palmer amaranth populations in 7 counties in Arkansas. The need to combat the evolution of PPO-resistant Palmer amaranth populations poses a challenge to soybean and cotton farmers. Palmer amaranth being resistant to glyphosate, ALS herbicide, and now to PPO inhibitors, only few herbicides can be used to manage multiple-resistant populations. The survivors should be prevented from producing seeds using supplemental, best management practices to delay the evolution of resistance and conserve the utility of herbicides for weed management.

Evaluation of Weed Control Programs in Inzen™ Grain Sorghum.

N.R. Steppig*, J.K. Norsworthy, J.A. Godwin, S.M. Martin, and Z.D. Lancaster. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

The state of Arkansas experienced a surge in grain sorghum acres this year, with planted acres increasing from 170,000 in 2014 to nearly 500,000 in 2015. As such, growers are looking for progressive ways to manage the crop and maintain high yields. One of the primary yield-reducing factors for any crop is competition from weeds. Grain sorghum is no different, and grassy weeds are particularly difficult to control in grain sorghum cropping systems. However, Pioneer Seed will soon introduce Inzen™ grain sorghum, a hybrid exhibiting resistance to nicosulfuron. The Inzen™ trait allows for the use of DuPont's nicosulfuron-based Zest™ herbicide, which provides control of a number of grasses, including johnsongrass (Sorghum halepense). As with any new herbicide being brought to market, the need exists for research to assess crop tolerance and spectrum of weed control. A field study was conducted in 2015 at the Lon Mann Cotton Research Station in Marianna, Arkansas to evaluate control programs for johnsongrass and other grass weeds in grain sorghum. Of particular interest in this study was an evaluation of weed control with a preemergence (PRE) application of LeadOff® herbicide followed by a postemergence (POST) application of Zest™ plus atrazine, a DuPont recommendation for season-long weed control. Preliminary results show that both broadleaf and grass weeds are controlled throughout the growing season, with the most success coming from any of the PRE applications coupled with a POST application of Zest™ plus atrazine. Crop injury after Zest™ application was negligible, suggesting that current weed control programs that incorporate the Inzen™ trait and utilize Zest™ herbicide are both safe and effective for season-long weed control. This is promising for Arkansas growers and suggests that adoption Inzen™ grain sorghum may be a tool for helping producers contend with POST control of grasses.

Evaluation of Provisia™ Rice for Arkansas Production Systems.

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With the stress that herbicide-resistant weeds put on our current production systems, new technologies are needed to control these weeds. BASF is currently developing a new non-GMO rice trait that will be resistant to quizalofop, an acetyl coenzyme A carboxylase (ACCase)-inhibiting herbicide. The Provisia™ rice system will provide an additional herbicide trait to be used in rice production systems. Multiple studies have been conducted to evaluate the best use of this technology in Arkansas. The first study was conducted in the summer of 2014 and 2015 at Rice Research and Extension Center in Stuttgart, Arkansas to determine the best rate structure for sequential applications of quizalofop when the first application is made at either the 2-leaf or 6-leaf stage of grasses. The experiment was set up as a two factor, randomized complete block design with factor-A being the growth stage at first application and factor-B being the rate structure of quizalofop. Herbicide rate structures were 80, 120, or 160 g ai/ha followed by 80,120, or 160 g ai/ha sequential application 14 days after the initial application. The highest total amount of quizalofop applied in a rate structure was 240 g ai/ha total. In 2014, the greatest control of both barnyardgrass and broadleaf signalgrass was recorded with the 120/120 g ai/ha treatment with 99 and 98% control, respectively. The 80/80 g ai/ha treatment had the least control of both barnyardgrass and broadleaf signalgrass with 89 and 90% control, respectively, with 2015 showing no significant difference in herbicide rates. Control for barnyardgrass and broadleaf signalgrass was reduced by making the first application on 6-leaf grass compared to 2-leaf grass for 2014, and the same effect occurred for red rice in 2015. The results of this experiment suggest that the most likely recommended rate structure for quizalofop based on this research will be 120 g ai/ha on 2-lf grasses followed by a subsequent application at approximately 14 days after the initial application. A second experiment was conducted in the summer of 2014 and 2015 at the 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. Data will be presented on the 2014 study, with the 2015 study compromised by heavy rainfall 3 days after initiation. On all crops, injury from herbicide treatments increased with rainfall activation over no activation. At 14 to 21 days after treatment, corn and grain sorghum 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.

Defininig the Fit for Benzobicyclon Plus Halosulfuron in Arkansas Rice.

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Rogue, a new rice herbicide, is being developed by Gowan Company for post-flood control of problematic weeds. Rogue will contain a mixture of halosulfuron (Group 2) and benzobicyclon (Group 27) herbicides and will control a broad-spectrum of grasses, aquatics, broadleaves, and sedges, including those currently resistant to Group 2 herbicides. If labeled as expected, this will be the first 4-hydroxyphenylpyruvate dioxygenase (HPPD) herbicide commercially available in U.S. rice production. A field study was conducted in 2015 at the Rice Research and Extension Center in Stuttgart and at the University of Arkansas Pine Bluff farm in Lonoke to understand if the addition of halosulfuron (Permit) to benzobicyclon would increase the level of weed control compared to benzobicyclon alone for barnyardgrass, Amazon sprangletop, ducksalad, California arrowhead, hemp sesbania, northern jointvetch, yellow nutsedge, and smallflower umbrellaflatsedge. Herbicide treatments included: halosulfuron at 35.2 and 52.5 g ai/ha, benzobicyclon at 247 and 371 g ai/ha, and a mixture of the two low rates and two high rates of both herbicides along with a nontreated. Benzobicyclon alone was effective in controlling Amazon sprangletop, ducksalad, California arrowhead, and smallflower umbrellasedge. The addition of halosulfuron to benzobicyclon generally improved control of those weeds that were marginally controlled by benzobicyclon alone. The low rate combination of benzobicyclon plus halosulfuron was often as effective as the high rate of benzobicyclon alone. The results of this study suggest that benzobicyclon premixed with halosulfuron has potential for control of problematic weeds in Arkansas rice and could be used as an additional tool for control of herbicide-resistant weeds.

Pethoxamid: Evaluation of a New Chlorocetamide in Cotton and Soybean.

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FMC is currently developing pethoxamid, a new Group 15 residual herbicide, for use in cotton and soybean, among other crops. Experiments were conducted in 2014 and 2015 at the University of Arkansas Southeast Research and Extension Rohwer Division in Rohwer, Arkansas, to evaluate pethoxamid performance in comparison to other common preemergence weed control treatments. The experiment was conducted in both LibertyLink and Roundup Ready soybean and cotton systems and was arranged as a randomized complete block design. The soybean trial consisted of 15 treatments and the cotton trial consisted of 10 treatments that evaluated the efficacy and selectivity of pethoxamid alone and in combination with other herbicides. When applied preemergence, pethoxamid (1 lb ai/acre) performed similar or better than other herbicides commonly used in soybean and cotton to control Palmer amaranth and barnyardgrass. The level of weed control provided by pethoxamid was superior to that of Warrant. At 3 weeks after application, pethoxamid provided 84% control of Palmer amaranth which was similar to the 89% control provided by Dual Magnum and Direx. When pethoxamid was applied with Harness (acetochlor) + Roundup PowerMax (glyphosate), control was increased by 20% due to the addition of the residual activity of acetochlor. The application of pethoxamid + Dawn (fomesafen) + Roundup PowerMax provided similar control to Prefix + Roundup PowerMax. Based upon this research, pethoxamid will provide Midsouth soybean and cotton producers with another very long chain fatty acid inhibitor for control of small-seeded broadleaves and grasses.

Does the Addition of Glyphosate to Dicamba Increase the Risk for Drift Induced Injury to Soybean Over Dicamba Alone?

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Soybean is highly sensitive to dicamba as even low drift rates may result in leaf and pod malformation. However, there is limited knowledge on the effect of low drift rates of dicamba plus glyphosate tank mixes on soybean – a likely mixture to be used on vast acres of dicamba/glyphosate-resistant soybean. The objective of this experiment was to examine leaf and pod malformation, along with height and yield effects when dicamba, glyphosate, or a tank mix of the two was applied. Applications were made at three growth stages (R1-initial flowering, R3-3/16 inch pod formed, and R5-beginning of seed formation) to Pioneer 95L01 soybean planted at the Arkansas Agriculture Research and Extension Center in Fayetteville, AR. Two glyphosate rates (1/64 and 1/256 the labeled rate of 870 g ae/ha) and two dicamba rates (1/64 and 1/256 the labeled rate of 560 g ae/ha) were used in the study. There was no leaf or pod injury to soybean exposed to glyphosate at either rate at any timing. Applications containing dicamba were most injurious in terms of leaf malformation at the R1 application (13 to 30% injury). The addition of glyphosate to dicamba showed increased leaf injury over dicamba alone at this timing. At the R3 application, leaf injury was not as prevalent; however, pod malformation was greatest (3 to 37% injury). Pod malformation was greater in treatments containing glyphosate and dicamba, as opposed to dicamba alone. Applications at R5 showed minimal leaf and pod injury (0 to 5%

injury). When glyphosate was included with dicamba, injury was similar or greater than that observed with dicamba alone. The greatest pod malformation at maturity occurred following the R3 application where 45% pod malformation was observed in the 1/64 X dicamba plus glyphosate treatment and only 27% pod malformation in the 1/64 X dicamba alone treatment. Height reduction was not noticed, which could have been due to lodging at early reproductive stages.

Preliminary Development of Soil Moisture Irrigation Thresholds for Arkansas Soils.
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Irrigation comes at a high cost to producers and inadequate soil moisture is one of the major factors effecting yields in crop production. Establishing soil moisture threshold and irrigation trigger points are important to ensure correct irrigation scheduling and to avoid under/over-irrigation of crop fields. Interest in use of soil moisture for irrigation has increased in the southern region. However, no current recommendations exist for its soil types. In order to safely predict maximum allowable depletions, for a given field one must know or be able to successfully predict field capacity (FC) and wilting point (WP) for that specific field's soil type. Soils were collected from 30 irrigation study sites in 2015 and analyzed for soil texture, bulk density, organic matter, field capacity and wilting point. This study compares three different methods of obtaining soil moisture content and soil matric potential set points and their suitability for use as irrigation thresholds.

This study evaluated data from soil maps and laboratory soil analysis using pseudo-transfer functions as methods to obtaining reasonable estimates that could be used to set managed allowable depletions. Different methods were evaluated using sample data to reach the objective of developing a cost effective and acceptable method of irrigation trigger levels for Arkansas soil types.

Effects of Various Insecticide Seed Treatments on Rice Tolerance to Glyphosate and Imazethapyr.
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Every year there are multiple incidences of herbicide drift in rice. With a large percentage of crops being glyphosate-resistant and approximately 50% of Arkansas rice being non-Clearfield (imidazolinone-resistant), the majority of drift complaints in rice are from Newpath (imazethapyr) or Roundup (glyphosate). In 2014 and 2015, a field experiment was conducted at the Rice Research and Extension Center in Stuttgart, Arkansas and in 2014 at the University of Arkansas Pine Bluff farm in Lonoke, Arkansas to evaluate whether or not insecticide seed treatments could reduce injury from Roundup or Newpath drift or decrease the recovery time of the rice. 'Roy J' rice was planted and simulated drift events of a 1/10X rate of Newpath or Roundup was applied to each plot. Each plot had either a seed treatment of CruiserMaxx Rice, NipSit Inside, Dermacor X-100, or no insecticide seed treatment. Seed that were not treated with an insecticide were treated with a fungicide such that all seed in the trial would be treated with a fungicide. The simulated drift event was applied at the 2- to 3-leaf growth stage of rice. Crop injury was assessed 1, 3, 5, and 6 weeks after application. Rice water weevil samples were taken 3 weeks after flood for the 2015 location. Sigma Scan photos and canopy heights were also taken throughout the growing season. As expected all insecticide seed treatments provided adequate rice water weevil control compared to the non-insecticide treated plots. In addition, the drift event of either Newpath or Roundup significantly increased the rice water weevil population. After initial injury ratings, CruiserMaxx was the only seed treatment to reduce injury from Newpath in all sites years, while Roundup induced injury was reduced by both NipSit and CruiseMaxx at Lonoke in 2014 and Stuttgart in 2015. Dermacor provided some safening only in 2014 at Stuttgart. Five weeks after application, CruiserMaxx-treated rice plots were the only ones to have recovered significantly from both Newpath and Roundup drift at all locations based on visible injury compared to the absence of an insecticide seed treatment. CruiserMaxx and NipSit protected the yield potential of the rice after Roundup drift in 2014 and Newpath drift at Stuttgart in 2014. Based on these results, CruiserMaxx Rice and NipSit Inside have potential to provide some safening against Newpath and Roundup drift whereas Dermacor X-100 will provide marginal or no safening to these herbicides.

Effect of Delaying the Flood and Preflood Nitrogen Application on Rice Yield.

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Urea-N fertilizer is typically applied at the five-leaf stage for rice (Oryza sativa L.) grown in a dry-seeded, delayed flood cultural system in Arkansas. Application of urea to a dry soil is needed to maximize rice N recovery efficiency and grain yield potential. How long the preflood-N can be delayed before yield loss occurs is poorly understood and requires additional research. Our objective was to determine the effects of delaying preflood-N fertilizer application and flooding past the five-leaf stage on growth and grain yield of rice grown on silt loam soils. Trials were established at two locations during 2015 using ‘RoyJ’ and selected other cultivars or hybrids including ‘Jupiter’, ‘LaKast’, ‘CL111’, and ‘RTXL753’. The focus of this presentation will be on the response of RoyJ rice to flood time at Pine Tree and Stuttgart locations. Urea-N fertilizer was applied at 0, 40, 80, 120, and 160 lb/acre on five or six different dates spanning 5 or 6 weeks (250 – 1640 DD50 units), depending on the research site, after beginning near the 3-5 leaf stage. Tiller number per plant and aboveground-N content at early heading were measured for RoyJ and grain yield was measured for all cultivars and hybrids. Regression analysis was performed to examine how each growth variable was affected by time expressed as growing degree units after emergence (e.g., DD50).

Stem number was a negative, linear function of preflood-N application time (DD50 units), regardless of urea-N rate. Stem number usually increased as urea-N rate increased and followed the general order of $160 \geq 120 = 80 \geq 40 > 0$ lb urea-N/acre. Aboveground-N content was a quadratic function of time with only the intercept depending on preflood urea-N rate. The predicted N content of rice peaked when preflood-N was applied 1635 (at Pine Tree) units and 775 (Stuttgart) DD50 units after rice emergence. Grain yield responded slightly different to preflood-N application time at the two sites. At Pine Tree, grain yield was a quadratic response to flood time and was characterized by a uniform quadratic coefficient with each urea-N rate having a unique intercept and linear slope coefficient. At Stuttgart, grain yield was a quadratic function of preflood-N application time described by common linear and quadratic coefficients but different intercept terms among the five urea-N rates. Maximum yield was produced when 160 lb urea-N/acre was applied 811 (Pine Tree) and 896 (Stuttgart) DD50 units after rice emergence. Rice fertilized with 160 lb urea-N/acre produced yields within 5% of the maximum predicted yield when urea-N was applied between 512-1109 (Pine Tree) and 527-1264 (Stuttgart) cumulative DD50 units. At Pine Tree, the optimal cumulative DD50 units for preflood-N application increased as the urea-N rate decreased. At Pine Tree, the aboveground-N content of rice that received no fertilizer-N increased from 16 to 57 to 75 lb N/acre as cumulative DD50 units changed from 500 to 1000 to 1500, respectively. Delaying preflood-N and flooding may decrease rice tiller formation (or retention), but the panicle-bearing stems compensate by producing a greater number of seeds per panicle. Plant development and maturity were also delayed by delaying urea-N application and flood time.

Assessment of Burndown Options for Cover Crops.

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There has been increased interest in cover crops among Arkansas farmers as a result of increasing occurrence of herbicide-resistant Palmer amaranth and federal conservation payments associated with the planting of cover crops. Despite the known benefits, widespread adoption of cover crops still remains limited due to the potential cost and management implications associated with their termination and subsequent crop establishment. Cover crop termination is vital for the success of the subsequent crop, and generally, chemical termination of cover crops is poorly understood, especially the less common cover crops. A field study was conducted in the fall of

2015 at the Arkansas Agricultural Research and Extension Center in Fayetteville to evaluate burndown options for cover crops. This experiment was organized as a randomized complete block with a strip-plot, where herbicide treatments were the main plots and cover crops were the strip-plots. Herbicide treatments were composed of 25 termination options. Cereal cover crops, such as wheat and cereal rye, were effectively terminated by glyphosate. The legumes cover crops hairy vetch, Australian winterpea, and crimson clover were better controlled when auxin herbicides were present in the tank mixture treatments. Paraquat plus metribuzin was effective in controlling both cereal and legumes cover crops, and would provide residual weed control for a grower wishing to plant soybean. Rapeseed was not well controlled by any of the termination options, which include various combinations of glyphosate, auxinic herbicides, and paraquat among others. Earlier application of burndown herbicides might be needed for control of more difficult-to-terminate cover crops; albeit, earlier termination is expected to reduce cover crop biomass production and in-crop weed suppression.

Effects of Soybean Row-Spacing and Population on Palmer amaranth Biological Characteristics and Sex Expression.

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Information about weed biology and weed population dynamics is critical for development of efficient weed management systems. Two field experiments were conducted in Fayetteville, Arkansas during 2014 and 2015 to examine the effects of crop density, Palmer amaranth emergence date, and interrow distance (i.e. 0, 9, 18 inches from the soybean row) on Palmer amaranth biological characteristics and demographics in wide-row and drill-seeded soybean. Palmer amaranth seedlings grown under greenhouse conditions were transplanted to the field at the 5- to 9-leaf growth stage at 0, 1, 2, 4, 6, and 8 weeks intervals after crop emergence (WAE) at a density of 1 plant m-2. All other weed species were controlled by the pre- and post-application of herbicides and/or hand weeding to avoid interspecific competition. In drill-seeded soybean, targeted crop densities were 0, 50,000, 125,000, and 200,000 plants acre-1 for each Palmer amaranth emergence date whereas in wide-row soybean was 130,000 plants acre-1 for each treatment of Palmer amaranth emergence date and interrow planting distance. Palmer amaranth plants, both male and female, were harvested by cutting the shoots at the soil level and aboveground biomass and height were recorded for each plant. After plant dry weight was determined, seeds were extracted from each female plant and seed production was determined by weighing five subsamples of 100 seeds from each treatment. Demographic characteristics of the Palmer amaranth population in both experiments were recorded at harvest. Differences in Palmer amaranth biomass and seed production among emergence dates and crop densities in drill-seeded soybean were evident as early as 0 and 1 WAE compared to other emergence dates. Likewise in wide-row soybean, the effects of emergence date and interrow distance on Palmer amaranth biomass and seed production were evident at 0 and 1 WAE for the first year and only at 0 WAE for the second year. Palmer amaranth emergence date had a significant effect on Palmer amaranth seed production through greater biomass production at earlier dates in both drill-seeded and wide-row soybean cropping systems. Interrow distance affected Palmer amaranth height and biomass and consequently seed production. The greater the interrow distance from the soybean row the higher Palmer amaranth height, biomass, and seed production, at 0 and 1 WAE compared to other emergence dates (i.e. 2, 4, 6, and 8 WAE). Greater interrow distance and lower crop density affected the demographic characteristics of Palmer amaranth. Decreased interrow distance and/or increased crop density are effective tools for integrated Palmer amaranth control.

Palmer amaranth Seed Production and Retention at Soybean Harvest.

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One of the most problematic weeds in Arkansas soybean production today is Palmer amaranth. This study determined the percentage of Palmer amaranth seed that was retained by the weed at soybean maturity to assess the likelihood of using at-harvest weed seed control tactics for soil seedbank management. Palmer amaranth plants were collected from fields in Arkansas, Tennessee, Illinois, Missouri, and Nebraska in 2013 and 2014. Within one week of soybean maturity, Palmer amaranth plants were harvested and the loose soil and debris beneath the plants were swept into a pan with a hand broom to collect any shattered seed. Percent seed retention ranged from 95 to 100% for all states both years. There was a strong correlation between weed biomass (g) and total seed production (# plant-1) in that the larger the plant, the more seeds it produced. However, there was no correlation between percent seed retention and weed biomass which indicates that regardless of plant size, and likely time of emergence, seed retention is high at the time of crop maturity. Overall, this study demonstrated that there is great opportunity for Palmer amaranth seed capture or destruction at soybean harvest. It is likely that nearly all of the seeds produced for Palmer amarnath passes through the combine during harvest to be returned to the soil seedbank. Thus, there is continued need for research focused on developing and testing harvest weed seed control tactics that aim at reducing the soil seedbank and lowering risks for evolution of herbicide resistance.

Reduced Glyphosate Efficacy on ALS Resistant Yellow Nutsedge.

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Yellow nutsedge (Cyperus esculentus L.) is a perennial weed in rice-soybean rotations in the southern United States and one of the world's worst weeds. Recently, a yellow nutsedge biotype in a rice filed near Hoxie, Arkansas evolved resistance to ALS-inhibiting herbicides from four chemical families (i.e. imidazolinone, pyrimidinyl benzoate, sulfonylurea, and triazolopyrimidine). Greenhouse studies were conducted to evaluate alternative herbicides (glyphosate, bentazon, propanil, quinclorac, and 2,4-D) for control of the resistant biotype. A yellow nutsedge biotype susceptible to ALS inhibitors collected from a crop field in Stuttgart, AR, was used for comparison. All plants were treated at 4- to 5-leaf stage using an automated sprayer equipped with two-nozzle boom mounted with 80067 two flat fan tips. The sprayer was calibrated to deliver 20 GPA of herbicides at 40 PSI. Based on dry weights of the treated plants relative to a nontreated control, biomass of the yellow nutsedge biotypes with the labeled rate of bentazon, propanil, quinclorac, and 2,4-D was reduced < 44%. Only glyphosate resulted in 68 and > 94% control of the resistant and susceptible yellow nutsedge biotypes, respectively. Dose response studies were conducted to characterize the effectiveness of glyphosate on the resistant biotype. Therefore, two more susceptible yellow nutsedge biotypes (from a crop field in Fayetteville, AR and Azlin Seed Company, Leland, MS) were used for comparison. Based on the dry weights, the resistant biotype was ≥ 5 fold less responsive to glyphosate compared to the susceptible biotypes. Molecular analysis exhibited no known amino acid substitution within the 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) gene of the yellow nutsedge biotypes. The susceptible biotype had lesser 14C-glyphosate radioactivity in the tissues above the treated leaf and greater radioactivity in tissues below the treated leaf compared to the resistant biotype. This study indicates that the poorer glyphosate efficacy for the resistant biotype was partially due to the reduced translocation of glyphosate in tissues below the treated leaf. The resistant biotype cannot be controlled by any of the herbicides currently labeled in Arkansas rice/soybean systems. Temporarily, monitoring the infested field to prevent spread of the resistant biotype propagules is crucial. This study illustrates the need of additional effective modes of action in Arkansas rice.