RESEARCH CONFERENCE ABSTRACTS VOLUME 28

Arkansas Crop Protection Association

November 19-November 20, 2024

STUDENT COMPETITIONS SPONSORED BY:

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Tuesday, November 19, 2024

Student Contest Chair: Nick Bateman
Audio-Visual Coordinator: Ben Thrash

11:45 p.m. **Welcome / Introduction and Announcements.**

12:00 p.m. **Effects of Pulsating Drought and Herbivory on Host and Herbivore Traits in Fast and Slow Wilting Soybean Genotypes. ***Jessica Ayala[1], Manish Gautam[1], Adriana Peissel[1], Justin George[2], and Rupesh Kariyat[1]. [1]Department of Entomology & Plant Pathology, University of Arkansas, Fayetteville, AR, 72701.[2]Southern Insect Management Research Unit, USDA-ARS, Stoneville, MS, 38776, USA. 1

12:15 p.m. **Development of a Fungicide Application Timing Model for Spring Dead Spot Using Cooling Degree-Days. ***Michael Battaglia, Wendell Hutchens. Department of Horticulture, University of Arkansas, Fayetteville, AR. Travis Roberson. School of Plant and Environmental Sciences, Virginia Tech, Blacksburg, VA 1

12:30 p.m. **Rice Response to Soil-Applied HPPD Herbicides and Diflufenican with and without Seed Treatment Safeners.** *Rhet Baxley, Jason K. Norsworthy, Tristen Avent, Lane Pierce, Pamela Carvalho-Moore, MCCR Souza University of Arkansas System Division of Agriculture, Fayetteville, AR.. 2

12:45 p.m. **Nutrient uptake timing and demand as a tool for fine-tuning fertilizer recommendations in Arkansas rice. ***Gustavo Henrique Bessa de Lima, Trenton. L. Roberts, Gerson. L. Drescher, Jarrod T. Hardke, David. A. Weisflog, T. D. McClain, Hannah E. Vickmark. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 2

1:00 p.m. **Biochar Effects on Greenhouse Gas Emissions from Cotton in Southeast Arkansas.** *Jonathan Brye, Kristofor Brye, Diego Della Lunga, and Lauren Gwaltney. Affiliated with the University of Arkansas Crop, Soil, Environmental Sciences Department. 3

1:15 p.m. **Seed treatment with cold plasma- an effective method to reduce herbivory in soybean (*Glycine max* (L.) Merrill) and sorghum- sudangrass (*Sorghum x drummondii*).** Deepak Dilip[1], Soumya *Unnikrishnan[1], Nikitha Modupalli[2], Mahfuzur Rahman[2] and Rupesh Kariyat[1]. [1]Department of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR 72701, USA. [2]Department of Food Science, University of Arkansas, Fayetteville, AR 72701, USA. 3

1:30 p.m. **Atrazine Mitigation Efforts with See & Spray™ Technology.** *Michael Dodde[1], Jason K. Norsworthy[1], Tristen Avent[1], Lane Pierce[1], Ryan Henry[2], Larry Steckel[3], Jared Buck[3], Bryan Young[4], and Marcelo Zimmer[4]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]UPL NA Inc., Fort Wayne, IN, [3]University of Tennessee, Jackson, TN, [4]Purdue University, West Lafayette, IN.......... 4

1:45 p.m. **Impact of Tarnished Plant Bug Adults on ThryvOn Cotton.** *W.A. Fletcher, B.C. Thrash, N. R Bateman., W.A. Plummer, S.G. Felts, T. Harris, P.G. Maris, J. Linn. Department of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR..... 4

2:00 p.m. **Soil Health Response to Cover Crop Species in Corn and Soybean Production Systems.** *Katherine S. French, Gerson L. Drescher, Trenton L. Roberts, Gabriela A.L. Mengez, Hannah E. Vickmark, Gustavo H. Bessa de Lima, Trevor D. McLain. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. 5

2:15 p.m. **Comparison of Single and Sequential Applications of Quizalofop on TamArkTM and Double TeamTM Grain Sorghum. ***Wesley Herrman, Jason K Norsworthy, MCCR Souza, Tristen Avent, Pamela Carvalho-Moore.University of Arkansas System Division of Agriculture, Fayetteville, AR.. 5

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

5:45 p.m. **End Oral Presentations Day 1/Begin Poster Viewing Session.**

Optimizing Seed Composition and Grain Yield Stability in Soybean Breeding: Insights from Multi-Environment Trials ‡Rafael Goncalves Marmo[1], Caio Canella Vieira[1], Andrea Acuna-Galindo[1], Liliana Florez-Palacios[1], Chengjun Wu[1], Derrick Harrison[1], Daniel Rogers[1]. University of Arkansas.

Globodera Pallida **RHA1B Protein Functions as a Meta-Effector, Manipulating the Stability of Other Pathogenic Nematode Effectors.** ‡Chandan Maurya, Joanna Kud. Department of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR, USA

Enhancing Defense Response: Exploring the Potential of Plant Elicitor Peptides. ‡Kallahan Minor, Fiona Goggin, Payal Sanadhya, Devany Crippen, Jiamei Li, Abeer Alnasrawi, Dept. of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR

Overexpression of *AtPROPEP6* enhances resistance of Arabidopsis against root-knot nematodes. ‡Sanadhya, Payal[1], K. Minor [1], J. Kud [1], A. Huffaker[2], F.L. Goggin[1]. [1]Department of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR, USA. [2] Department of Cell and Developmental Biology, University of California San Diego.

Wednesday, November 20, 2024

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

10:30 a.m. **Break**

Masters Abstracts

Effects of Pulsating Drought and Herbivory on Host and Herbivore Traits in Fast and Slow Wilting Soybean Genotypes

Jessica Ayala[1], Manish Gautam[1], Adriana Peissel[1], Justin George[2], and Rupesh Kariyat[1]. [1]Department of Entomology & Plant Pathology, University of Arkansas, Fayetteville, AR, 72701.[2]Southern Insect Management Research Unit, USDA-ARS, Stoneville, MS, 38776, USA.

Soybean (*Glycine max (L.) Merr)* is one of the most important agricultural exports in Arkansas, responsible for $911 million annually. While one of the major limiting factors for soybean production is drought- which can cause up to 80% reduction in yield - soybeans also experience herbivory from soybean looper (*Chrysodeixis includens*, SBL) and fall armyworm (*Spodoptera frugiperda*, FAW) that significantly reduce soybean yield by feeding on foliar and floral organs. Using fast and slow wilting soybean accessions, under pulsating drought and control, we examined the relationship between physiological traits associated with water use efficiency (WUE), and how they affect both herbivore and host plant growth and development. Our results show that regardless of wilting speed, soybeans displayed strong overcompensation in growth and development. While fast wilting soybean accessions produced more pods, slow wilting genotypes produced higher quality pods and seeds. Regardless of treatment, FAW fed at a significantly higher rate than SBL and gained more mass. Collectively, we show that despite fast wilting plants overcompensating in pod production and growth traits, slow wilting plants may still be better fit through seed quality. As the demand for soybean accessions with increased water use efficiency increases, it is vital we understand the intersection between WUE traits and host and herbivore traits.

Development of a Fungicide Application Timing Model for Spring Dead Spot Using Cooling Degree-Days

Michael Battaglia, Wendell Hutchens. Department of Horticulture, University of Arkansas, Fayetteville, AR. Travis Roberson. School of Plant and Environmental Sciences, Virginia Tech, Blacksburg, VA

Spring dead spot (SDS), caused by *Ophiosphaerella* spp., is a devastating root disease of bermudagrass (*Cynodon* spp.) in the transition zone of the U.S. Fungicides are applied in the fall to prevent the onset of symptoms in the spring caused by pathogen infection + freezing temperatures during the winter months. Often, fungicides are not effective due to a variety of factors, with one being improper application timing. A study was conducted at two locations in Arkansas and one location in Virginia to determine the optimal timing of fungicide applications using a cooling-degree day (CDD) model. The model is represented by the equation T_{base} - $T_{average}$ = CDD, where T_{base} is the baseline soil temperature of 23°C, $T_{average}$ is the soil temperature at a 0 to 10-cm depth, and CDD is the cooling-degree days accumulated for a given day. Accumulation of CDD began on the baseline date of 01 Sep 2023. The fungicides isofetamid (4.06 kg a.i. ha^{-1}) and tebuconazole (1.51 kg a.i. ha^{-1}) were applied at 13 - 14 timings throughout the fall of 2023 and early winter of 2023-2024. Plots were visually assessed in the spring and summer of 2024 for percent SDS. Isofetamid suppressed SDS better than tebuconazole at all locations. Peak SDS control for isofetamid was achieved between 250-350 CDD. On the other hand, tebuconazole only suppressed SDS compared to the nontreated control between 300-350 CDD. Our findings show that isofetamid is highly effective at suppressing SDS when applied during a wide range of CDD accumulations in the fall. However, tebuconazole, a more cost-effective alternative, can effectively suppress SDS only when applied during a very limited window in the fall.

Rice Response to Soil-Applied HPPD Herbicides and Diflufenican with and without Seed Treatment Safeners

Rhet Baxley, Jason K. Norsworthy, Tristen Avent, Lane Pierce, Pamela Carvalho-Moore, MCCR Souza

The sustainability of profitable rice production in Arkansas is threatened by the ongoing occurrence of herbicide resistance. Populations of key rice weed species, such as barnyardgrass and weedy rice, have evolved resistance to many of the primary herbicide modes of action (MOA's) labeled for use in the crop. Therefore, it is undoubtedly necessary to incorporate alternative, effective herbicide chemistries into rice weed control programs. In the summer of 2023, a randomized complete block design study was initiated at the Pine Tree Research Station near Colt, AR, to evaluate the effectiveness of eight potential safeners for protection of rice to herbicides that causing bleaching symptoms. The rice cultivar Rondo was treated with one of the eight safeners and was compared to treatments without a safener. The seven herbicides evaluated included topramezone, tembotrione, mesotrione, tolpyralate, diflufenican (DFF), fluridone, and clomazone were evaluated at a preemergence (PRE) application timing to determine if any of the seed treatments could provide the rice with enhanced tolerance to the herbicides. Although clomazone was the only herbicide evaluated that is labeled for rice, cosmetic injury in the form of bleaching on early season rice can occur following its use. Crop injury was assessed at 14, 21, and 28 days after rice emergence (DAE). Crop densities were recorded 14 DAE, from two one-meter sections of row per plot. At 14 DAE, each of the safeners differed in ability to reduce phytotoxicity relative to herbicides applied without a seed treatment. Two of the eight safeners provided significant reduction in injury for some of the evaluated herbicides. Likewise, the extent of phytotoxicity to rice differed among herbicides, with tembotrione and DFF causing the least amount of crop injury (≤ 5%). These results indicate that there may be potential for some of the evaluated seed treatments to safen rice to PRE-applied bleaching herbicides, and that DFF and tembotrione should be further evaluated for use in rice.

Nutrient uptake timing and demand as a tool for fine-tuning fertilizer recommendations in Arkansas rice

Gustavo Henrique Bessa de Lima, Trenton. L. Roberts, Gerson. L. Drescher, Jarrod T. Hardke, David. A. Weisflog, T. D. McClain, Hannah E. Vickmark. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR

Crop nutrient timing and demand are the primary tools used to help define fertilizer rate recommendations; however, they have not been extensively explored and established for the most recent rice cultivars. This work explored nutrient uptake timing and demand from four modern rice cultivars widely planted in the Arkansas Delta. The treatments consisted of four rice cultivars, Diamond, RT 7521 FP, CLL 16, and Titan, and were planted under two fertilizer rate recommendations. The trials were established in 2022 and 2023 at the Rohwer and Pine Tree Research Stations under a RCBD, 4x2 factorial arrangement. Samples were taken at V3, V5/6, 2 weeks post flood, 4 weeks post flood, 50% heading, and maturity growth stages. No statistical differences ($P < 0.05$) for nutrient timing and demand were observed among the treatments. Our data provides complete information regarding nutrient uptake demand and timing for all essential nutrients in rice, useful to fine-tune fertilizer recommendations.

Biochar Effects on Greenhouse Gas Emissions from Cotton in Southeast Arkansas

Jonathan Brye, Kristofor Brye, Diego Della Lunga, and Lauren Gwaltney. Affiliated with the University of Arkansas Crop, Soil, Environmental Sciences Department

Agriculture in the United States contributes about 10% of greenhouse gas (GHG) emissions to the atmosphere, but emerging conservation practices have shown potential to mitigate the impact of agriculture on the ever-changing climate. The recent emphasis and implementation of climate-smart agriculture (CSA) practices, such as reduced- or no-tillage, cover crops, and/or biochar amendment, seek to reduce agroecosystem impacts on the climate by mitigating GHG emissions and sequestering carbon in the soil. However, research that specifically quantifies GHG emissions from CSA is still limited. The objective of this on-going field study was to quantify the impact of biochar rate (i.e., 0, 2000, and 4000 kg ha^{-1}) on carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions from minimally tilled cotton (*Gossypium hirsutum*) on a silt-loam soil in southeast Arkansas. Gas concentrations were measured from a closed chamber for 5 minutes weekly during the 2024 cotton growing season. Greenhouse gas fluxes and season-long emissions differed among biochar treatments over time. Results of this study will contribute to the evidence evaluating biochar as a potential GHG mitigation strategy, which can be used by producers and policymakers to make science-based decisions on the future of biochar and CSA practices.

Seed treatment with cold plasma- an effective method to reduce herbivory in soybean (*Glycine max* (L.) Merrill) and sorghum- sudangrass (*Sorghum x drummondii*)

Deepak Dilip[1], Soumya Unnikrishnan[1], Nikitha Modupalli[2], Mahfuzur Rahman[2] and Rupesh Kariyat[1] .Department of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR 72701, USA. Department of Food Science, University of Arkansas, Fayetteville, AR 72701, USA.

Managing insect pests is crucial for agriculture, and there is a growing demand for finding alternative, eco-friendly methods to reduce the harmful impacts of excessive chemical insecticide use. Atmospheric cold plasma (CP) treatments have gained recognition as a promising alternative, primarily for their insecticidal potential. This is attributed to the reactive species generated by CP, which function as signaling molecules in defense pathways against insect herbivory. While CP treatments have been optimized in various fields, we currently lack empirical data on their effectiveness in deterring insect herbivory. By fine- tuning parameters such as the type of plasma apparatus, exposure duration, and voltage levels, researchers can achieve optimal results and minimize potential side effects. This study evaluates CP treatment effects on plant growth and insect herbivore performance by exposing soybean (*Glycine max* (L.) Merrill) and sorghum-sudangrass (*Sorghum x drummondii*) seeds to three voltage and time settings using pin-to-plate and jet plasma apparatus. The impact of CP on herbivory was assessed using fall armyworm (*Spodoptera frugiperda* J.E. Smith) on sorghum-sudangrass and soybean looper *(Chrysodeixis includens* Walker) on soybean. Our findings indicate that CP significantly boosts plant growth and development while inhibiting herbivore performance. These findings underscore the practical potential of CP treatments as a sustainable pest management strategy, highlighting the need for ongoing optimization to maximize their effectiveness in crop protection and agricultural productivity.

Atrazine Mitigation Efforts with See & Spray™ Technology

Michael Dodde[1], Jason K. Norsworthy[1], Tristen Avent[1], Lane Pierce[1], Ryan Henry[2], Larry Steckel[3], Jared Buck[3], Bryan Young[4], and Marcelo Zimmer[4]. [1]Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]UPL NA Inc., Fort Wayne, IN, [3]University of Tennessee, Jackson, TN, [4]Purdue University, West Lafayette, IN.

Atrazine is one of the most used herbicides in corn production for control of many problematic weeds. In response to environmental concerns, the Environmental Protection Agency has proposed label changes to restrict the amount of atrazine runoff from treated fields. Therefore, research was conducted in 2024 at the Northeast Research and Extension Center near Keiser, AR, the West Tennessee Research and Education Center in Jackson, TN, and the Agronomy Center for Research and Education in West Lafayette, IN to determine if the use of John Deere's See and Spray™ technology could reduce atrazine use in corn while maintaining effective weed control. A randomized complete block design experiment was established with four replications. All treatments, except for the nontreated check contained a preemergence application of amicarbazone, metribuzin, *S*-metolachlor, and paraquat. Postemergence (POST) treatments included combinations of glyphosate, atrazine, and mesotrione applied with See and Spray technology or broadcast. Weed control data for multiple species were collected for four weeks after POST treatment as well as the amount of herbicide sprayed at the time of POST treatments. On average, the See and Spray treatments sprayed 23% less area than the broadcast treatments, ranging from 15% to 32% savings. The only difference in weed control occurred with Palmer amaranth (*Amaranthus palmeri*) 4 weeks after the POST application. Plots receiving a broadcast glyphosate with a targeted atrazine application had the least Palmer amaranth control at this timing (94% control). No differences were seen at any other evaluation timings or with the other weeds evaluated. Based on these results, See and Spray technology could be an effective means of mitigating atrazine use in corn.

Impact of Tarnished Plant Bug Adults on ThryvOn Cotton

W.A. Fletcher, B.C. Thrash, N. R Bateman., W.A. Plummer, S.G. Felts, T. Harris, P.G. Maris, J. Linn. Department of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR

ThryvOn™ is the first Bt cotton technology to provide protection to tobacco thrips and tarnished plant bug, as well as several other piercing sucking insect pests of cotton. In contrast to Bt technologies aimed at controlling lepidopteran insect pests such as bollworm, this technology is low-dose for tarnished plant bug, meaning supplemental applications will likely be required to maintain control of the pest. Current research indicates this technology is more active on small nymphal plant bugs, which is in contrast to larger nymphs and adults plant bugs that are more resistant. Research also indicates thresholds for nymphal tarnished plant bugs can be doubled, but changes in the threshold with regard to adult plant bugs is still unclear. ThryvOn cotton was grown at Lon Mann cotton experiment station in Lee County, AR. Eight different thresholds were tested including combinations of different nymphal and adult thresholds as well as a square retention threshold. Plots were sampled twice a week using both sweep nets and drop cloths and square retention was recorded. When plots reached threshold they were treated with Transform 1.5 oz/ac. Depending on threshold, plots were treated 1-6 times throughout the growing season. There were no differences between yields in treated plots, but all treated plots yielded greater than the untreated check.

Soil Health Response to Cover Crop Species in Corn and Soybean Production Systems

Katherine S. French, Gerson L. Drescher, Trenton L. Roberts, Gabriela A.L. Mengez, Hannah E. Vickmark, Gustavo H. Bessa de Lima, Trevor D. McLain. Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

Soil health indicators can help us better understand the quality of soil's many chemical, physical, and biological functions and benefits to human society. The objective of this study is to identify soil health indicators that respond to cover crop presence in an ongoing agricultural study. The study is a corn-soybean (*Zea mays* L.)-(*Glycine max* L. Merr.) rotation under no-tillage management with fallow, winter cereal, and winter legume cover crop treatments that was established in 2015. Indicators such as pH, soil health scores, and beta-glucosidase enzyme activities were impacted by different cover crop treatments. There was a 46% increase from the fallow soil health score to the winter cereal cover cropped soil health score, emphasizing that cover crops can have an impact on overall soil health. Beta-glucosidase enzyme activity increased by around 80% under the presence of a winter legume cover crop treatment compared to the fallow and winter cereal treatments. Certain soil health indicators can be particularly practical in some regions, which supports gathering research from many different locations across productive agricultural regions. Techniques that generate average soil health scores can be useful, but testing more specific indicators like beta-glucosidase can lead to some insights about the biological condition of the soil. More research is needed in diverse production systems to better understand beta-glucosidase dynamics, its relationship to crop yield, and overall system productivity.

Comparison of Single and Sequential Applications of Quizalofop on TamArkTM and Double TeamTM Grain Sorghum

Wesley Herrman, Jason K Norsworthy, MCCR Souza, Tristen Avent, Pamela Carvalho-Moore.

The development of herbicide-resistant crops has revolutionized agriculture. Within the past half-decade, resistance traits have been incorporated into grain sorghum [*Sorghum bicolor* (L.) Moench] production. The Double Team™ and TamArk™ traits confer resistance to acetyl-coenzyme A carboxylase-inhibiting herbicides, particularly quizalofop-P-ethyl. In 2024, research was conducted during the summer at the Milo J. Shult Agricultural Research and Extension Center in Fayetteville, AR, to determine the effects of both single and sequential applications of quizalofop on sorghum hybrids with either resistance trait. A randomized complete block design experiment was established with four replications of four-row plots with either a Double Team or TamArk hybrid. Quizalofop rates used were 87 g ai ha^{-1} and 73 g ai ha^{-1} for the single and sequential applications, respectively. Each single and sequential application was made at the V2, V4, V6, and V8 growth stages, with the subsequent application seven days later. Visible injury ratings were taken one week after the V2 applications and continued weekly until four weeks after the final application, which was applied one week after V8. The greatest injury from the initial application occurred at 1 week after treatment, with 35% injury to both Double Team and TamArk sorghum. Sequential applications generally did not increase the risk for crop injury to either technology. By 4 weeks after final treatment of single applications, no more than 12% injury was present for both technologies, which occurred following the V6 timing. The final assessment was taken 3 weeks after the sequential application, and at that time no more than 11% injury was observed. Overall, both TamArk and Double Team grain sorghum have adequate tolerance to quizalofop and initial injury is transient with no differences between technologies. Based on differences in injury from the initial applications made from V2 to V8 growth stages, it is concluded that environmental conditions at application likely plays a role in the extent of injury observed the first few weeks following treatment.

An Economic Analysis of Soybean Monocrop and Intercrop Weed Control Programs

Smith J.T.,[1] J.K. Norsworthy,[1] M.C.C.R. Souza,[1] R. Baxley,[1] A. Ross,[1] L.T. Barber[2]
[1]Graduate Assistant, Distinguished Professor, Graduate Assistant, Graduate Assistant, Undergraduate, respectively, Department of Crop, Soil, and Environmental Sciences, Fayetteville, AR. [2]Professor and Extension Weed Scientist, Department of Crop, Soil, and Environmental Sciences, Newport, AR

Arkansas soybean growers spend more money on weed control than almost any other component of growing the crop. Strategies that reduce the amount of herbicide needed would likely reduce the final cost of crop production as well as the volume of pesticides released into the environment each year. Therefore, this study aimed to compare weed control and economics of monocrop soybean herbicide programs to relay intercropped winter wheat and soybean herbicide programs. In the fall of 2023, field trials were initiated at the Milo J. Shult Agricultural Research and Extension Center in Fayetteville, AR, and the Pine Tree Research Station near Colt, AR. The trials were designed as randomized complete blocks with four replications. Soybean monocrop programs included a burndown at planting, a burndown at planting with residual, and a burndown at planting with residual followed by a second application with residual 3-4 weeks later. Intercrop programs included a treatment with no herbicides, an application with residual at wheat harvest, and an application with residual at wheat harvest followed by a second application with residual 3-4 weeks later. Weeds evaluated included Palmer amaranth and broadleaf signalgrass at both locations, large crabgrass and yellow nutsedge in Fayetteville, and barnyardgrass and common cocklebur near Colt. At 16 weeks after soybean planting, the intercrop treatments receiving 1 or 2 applications of herbicide provided equal or better control of all weed species evaluated compared to the soybean monocrop that received 2 applications. These results supply evidence that intercropping systems can provide adequate weed control with less herbicide than a standard two pass system. An economic analysis comparing profitability of the intercrop and monocrop systems in this study is currently underway and results will be presented at the conference.

Characterization of resistance mechanisms in the PI438489B soybean accession to Southern Root-Knot nematode (*Meloidogyne incognita*)

Anmolpreet Kaur, Dr. Joanna Kud. Department of Entomology and Plant Pathology, University of Arkansas, Fayetteville, AR 72701, USA.

Plant parasitic nematodes (PPNs) are one of major concerns to global crop production, causing more than $80 billion in yield losses yearly. The Southern root-knot nematode (SRKN, *Meloidogyne incognita*) is particularly damaging to soybean growers in Arkansas. Previous reports identified QTL *Rmi1 (*Resistance *to Meloidogyne incognita* 1) on chromosome 10 as a source of protection against SRKN in resistant soybean lines, but no further research was conducted to understand the mechanism of that resistance. Here, we evaluated progress of SRKN infection using Magellan (susceptible), PI 438489B (resistant) and two nearly isogenic soybean lines (NILs) derived from a cross between Magellan and PI 438489B parents. The ratio of the different developmental stages of SRKN in all soybean genotypes was assessed at 7, 14, 21 and 28 days post infection (dpi). The highest rate of SRKN development was observed in Magellan with first females identified at 28 dpi. PI 438489B showed the slowest progression of nematode life cycle with no or few individuals reaching a female stage. Both NIL PI 438489B and NIL Magellan represented intermediate phenotypes. Galls numbers at 28 dpi and reproduction rate calculated based on the egg counts at 35 dpi showed that PI 438489B not only reduces galling but also completely inhibits SRKN reproduction within the tested time. NIL PI 438489B supported some SRKN multiplication suggesting that regions other than QTL *Rmi1* may contribute to SRKN resistance. We also tested three different isolates of SRKN from local fields, each with a unique cropping history and varying levels of aggressiveness compared to our lab-maintained control population on PI 438489B. To further evaluate the durability of this resistance source, ongoing work involves subjecting single avirulent SRKN population to repeated exposure to *Rmi1* resistance pressure over multiple nematode generations. These findings shed light on the mechanisms of SRKN resistance and aid in developing highly resistant soybean cultivars.

Evaluation of Preemergence Herbicides in Bollgard® and ThryvOn™ Cotton Technologies

J.C. Malone, L.T. Barber, J.K. Norsworthy, B.C. Thrash. University of Arkansas System Division of Agriculture.

The use of preemergence (PRE) residual herbicides applied at planting is the foundation for a successful weed control program in cotton. However, the application of these residuals can often lead to seedling injury depending on environmental conditions. The timing of thrips infestations aligning with stress from preemergence herbicides can result in delays and potential stand loss. The objective of this experiment was to evaluate potential interactions between preemergence herbicide injury and thrips damage in ThryvOn™ and non-ThryvOn™ cotton. Research was conducted in 2024 at the Lon Mann Cotton Branch Experiment Station in Marianna, AR. The experiment was designed as a factorial arrangement of treatments with cotton technology, seed treatment, and PRE herbicides as the main factors. Plots were arranged in a randomized design with four replications. Three different PRE herbicide programs were applied to treated and untreated plots of both ThryvOn™ and non-ThryvOn™ cotton seed. Herbicide Treatments included 1.0 lb ai/A fluometuron (Cotoran) applied alone, 0.75 lb ai/A fluometuron and 0.15 lb ia/A fluridone (Brake) as a tank-mixture, and 0.5 lb ai/A dicamba (XtendiMax) applied alone. The seed treatment evaluated was Gaucho at 0.375mg/seed. Necrosis, chlorosis, and thrip damage ratings were taken at 7, 14, 21, and 28 days after treatment (DAT). Node counts and plant heights were also recorded. No interaction was observed between herbicide injury and thrip populations. However, thrip damage and populations varied greatly between ThryvOn™ and non-ThryvOn™ technologies. Thrip damage in ThryvOn™ cotton was significantly lower in comparison to non-ThryvOn™ cotton. The lowest herbicide injury was recorded from an application of XtendiMax, with the highest resulting from a Brake and Cotoran tank-mix at 50% at the 3-4 leaf timing. The results observed in this experiment suggests that there is no increase in injury from PRE herbicides with the increase in thrips damage.

Rice Water Weevil Scouting Methods and the Efficacy of Foliar Insecticide Applications Applied Pre and Post Flood for Control of Rice Water Weevils

P.G. Maris[1], Bateman, N. R.[2], B.C. Thrash[3], J.T. Hardke[4], R. Kariyat[5], W.A. Plummer[3], S.G. Felts[2], T. Harris[3], W. A. Fletcher[1], J. Linn[1].1Graduate Assistant, Department of Entomology and Plant Pathology, Fayetteville, AR.2Associate Professor/Extension Entomologist and Program Associate, respectively, Department of Entomology and Plant Pathology, Stuttgart, AR. 3Assistant Professor/Extension Entomologist, Program Associate, respectively, Department of Entomology and Plant Pathology, Lonoke, AR. 4Associate Professor/Rice Extension Agronomist, Arkansas System Division of Agriculture Cooperative Extension Service, Stuttgart, AR. 5Associate Professor/ Entomologist, Department of Entomology and Plant Pathology, Fayetteville, AR.

Rice water weevil (*Lissorhoptrus oryzophilus*) is the most economically important insect pest for flooded rice production in the southern US. Current scouting methods for rice water weevils (RWW) are based on feeding by adult RWW on plant foliage or the population of RWW larvae in the root zone. Traditionally, foliar insecticide applications are recommended when 50-60% of new leaves have feeding scars or when five or more larvae are present in a four cubic inch soil core. These sampling methods are cumbersome and inefficient, which can lead to growers making applications too late to effectively control RWW. Sweep nets are used to scout for insect pests in many row crops, therefore utilizing them to scout for RWW would streamline the process and make scouting more similar to the techniques that producers and consultants are already accustomed to. A study was conducted in 2023 and 2024 at two locations in Arkansas to determine the relationship of adult RWW caught in a sweep net to plant tissue scarring, larval populations, and yield. Preliminary results suggest that there is a relationship between adult populations, larval numbers, and yield, however continued research is required to establish a sweep net threshold for RWW adults. Another study was conducted in 2023 and 2024, evaluating the efficacy of foliar insecticides applied pre and post flood for control of RWW. Overall, Endigo ZCX applied post flood and Vantacor applied pre-flood showed the greatest percent control of RWW larvae. Vantacor pre-flood and Endigo ZCX pre-flood increased yield when compared to the untreated check.

Exploring the Effect of Fluridone Application Timing on Rice Tolerance

MCCR Souza, JK Norsworthy, P Carvalho-Moore, MR Dodde, J Smith, and TH Avent. University of Arkansas System Division of Agriculture.

Crop tolerance to herbicides can be highly affected by growth stage at the time of application. In 2023, fluridone received a label for use in rice, providing a new site of action for use in the crop. To evaluate the effect of application timing on rice tolerance to fluridone, a field experiment was conducted in 2022 and 2023 at the Rice Research and Extension Center near Stuttgart, AR. The experiment was arranged as a randomized complete block design with four replications. Treatments included a weed-free control for comparison and fluridone applied at 0.15 lb ai/acre at ten different timings: 20 and 10 days preplant, preemergence (PRE), delayed-preemergence (DPRE), 1-leaf, 2-leaf, 3-leaf, 4-leaf, tillering (preflood), and immediately after flooding (postflood). Visible injury was assessed weekly, and rice canopy coverage was estimated 10 weeks after emergence (WAE). Rough rice grain yield was determined at harvest. In 2022, the highest injury observed at 3 WAE was 5%. However, in 2023, injury reached 24% by 3 WAE, caused by the PRE treatment. Following flood establishment, injury tended to increase in 2022, with the PRE and DPRE treatments causing 36% and 32% injury, respectively. In 2023, injury decreased at 10 WAE compared to the initial evaluation at 3 WAE across all treatments except for the PRE treatment, which resulted in 39% injury. In both years, the PRE treatment caused the greatest reduction in canopy coverage at 10 WAE, with a decrease of 4% and 21% in 2022 and 2023, respectively. The PRE and DPRE treatments led to yield reductions in 2022, whereas, in 2023, only the PRE application caused yield loss compared to the weed-free control. Based on these findings, application timing influences rice tolerance to fluridone, and early applications, especially PRE and DPRE should be avoided as indicated on the current label.

End-of-Season Corn Stalk Analysis as a Tool to Improve Nitrogen and Potassium Fertilizer Management

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Corn (*Zea mays* L.) requires proper nutrient management for optimal growth and tissue testing plays a key role in improving nutrient recommendations. Corn stalk nitrate test (CSNT) is commonly used to diagnose the adequacy of fertilizer-N management but a methodology to diagnose potassium (K) nutrition based on corn stalk analysis is still lacking. Potassium response trials were established in 2023 at the University of Arkansas System Division of Agriculture Milo J. Shult Agricultural Research and Extension Center (SAREC-E5), Pine Tree Research Station (PTRS-C3 and PTRS-D20), and the Northeast Rice Research and Extension Center (NERREC) to evaluate corn yield response to K fertilization (0, 40, 80, 120, 160, and 200 lb K2O/ac) and investigate deionized water as an extractant for determining K and NO3--N concentrations in corn stalks. At maturity, stalk samples (15 to 35 cm section above the soil surface) were collected, oven-dried, and ground, and then 0.5 g of the ground material was extracted with 30 mL of deionized water or 2 mol L-1 KCl. The water-extractable K concentration was determined by ICP-AES while NO3--N concentration was determined colorimetrically in both extractants. Preplant soil samples categorized soil-test K as Very Low (PTRS-C3), Low (PTRS-D20 and NERREC), and Optimum (SAREC). Significant yield increase from K fertilization was observed at the NERREC and PTRS-C3 locations, with yield increases of 90 and 172 bu/ac, respectively. No yield increase from K fertilization was observed at PTRS-D20 and SAREC. Water-extractable NO_3^--N showed a strong relationship ($R^2 = 0.98$) with the KCl-extractable NO_3^--N, indicating that deionized water can effectively be used for CSNT analysis. Additionally, water-extractable K had a moderate relationship with soil-test K ($R^2 = 0.74$) and relative corn yield ($R^2 = 0.42$). These results suggest that K is stored in corn stalks with increased K availability and that stalk K analysis can assist in diagnosing sub-optimal or excessive K fertilization but additional research is needed to build a robust dataset. Deionized water can be used for both K and NO_3^--N analysis and is an alternative tool to fine-tune fertilizer recommendations for the following season and enhance crop profitability.

Efficacy of trinexapac and herbicide mixtures on near-reproductive Palmer amaranth and velvetleaf
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Amaranthus palmeri (Palmer amaranth) and *Abutiilon theophrasti* (velvetleaf) were among the most widespread and injurious weeds for cotton in the United States. Trinexapac-ethyl is a plant growth regulator known to inhibit seed germination but its combined effect with herbicides on many problematic weed species is yet to be explored.

A field study was conducted at the Milo J. Shult Agricultural Research and Extension Center, University of Arkansas, Fayetteville in 2024 to evaluate the effect of trinexapac and herbicide mixtures on Palmer amaranth and velvetleaf. The treatments included trinexapac (0, 0.534 lb/A) mixed with the following herbicides: glufosinate (0.32, 0.64 lb/A), glyphosate (0.5, 0.75 lb/A), flumioxazin (0.031, 0.062 lb/A), topramezone (0.009, 0.018 lb/A), 2,4-D choline (0.5, 1 lb/A), trifloxysulfuron (0.0035, 0.007 lb/A), and prometryn (0.8, 1.6). The herbicide rates were generally 0.5x and 1x of recommended rates. The study was conducted using a split-plot design with four replications. Herbicides were applied during the near-reproductive stage of weeds. Weed control (%) was evaluated at 7, 14, and 21 days after treatment (DAT).

Control of Palmer amaranth ranged from 20-70%, 10-75%, and 15-75% at 7, 14, and 21 DAT, respectively. Thus, maximum herbicide activity was observed at 14 DAT. Without trinexapac, flumioxazin (0.062 lb/A) provided the highest control (75%) of Palmer amaranth. 2,4-D choline (1 lb/A) when combined with trinexapac, showed the most significant improvement in efficacy on Palmer amaranth from 40% without and 65% with trinexapac.

Control of velvetleaf ranged from 20-90%, 23-95%, and 25-95% at 7, 14, and 21 DAT respectively. Thus, maximum herbicide activity was observed at 14 DAT. Without trinexapac, trifloxysulfuron (0.007 lb/A) provided the highest control (95%) of velvetleaf. Glyphosate (0.5 lb/A) when combined with trinexapac, showed the most significant improvement in efficacy on velvetleaf from 40% without and 75% with trinexapac.

Flumioxazin, and trifloxysulfuron did not benefit from the addition of trinexapac for controlling Palmer amaranth. For velvetleaf control, prometryn, topramezone, and trifloxysulfuron did not benefit from the addition of trinexapac. Although trinexapac did not improve the efficacy of all the herbicides tested, it is possible that it can reduce weed seed production and germination capacity overall. These data are being generated.

Integration of RTK-GPS Robotics into Specialty Crop Production
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Precision agriculture and robotics have the potential to reduce inputs like labor, fertilizers, and pesticides, while maintaining yields. Novel technologies have been developed for large-scale crop systems, where extensive acreage offers greater market incentives for industry. This research investigated the utility of an unmanned ground vehicle (UGV) with real-time kinematic global positioning systems (RTK-GPS) technology for seeding and weeding crops in small-scale vegetable production. Sweetcorn (Zea mays L.) was chosen as a model crop due to its upright growth habit, which facilitates between-row cultivation. Field trials were conducted in 2024 in three locations: Fayetteville, AR, Kibler, AR, and Bridgeton, NJ, to determine optimum weeding strategies of the UGV. Weeding treatments included UGV operation at 1 wk and 2 wk intervals, a preemergence herbicide (S-metolachlor), S-metolachlor followed by a postemergence herbicide (atrazine + tembotrione) 30 days after treatment (DAT), and S-metolachlor followed by UGV operation 30 DAT at 1 wk intervals. Weedy all-season and weed-free treatments (hand-weeded) were included as controls. In the Arkansas locations, weedy plots had significantly higher weed biomass (Fayetteville: 8,400 kg ha-1; Kibler: 13,200 kg ha-1) than the UGV-only treatments (1,900 to 3,300 kg ha-1), which had greater biomass than the herbicide-treated plots (4 to 800 kg ha-1; $p<0.0001$). At the Bridgeton, NJ site, there was no significant difference in weed biomass between treatments. In all locations, weed-free plots produced the highest sweetcorn yields, and weedy plots had the lowest. Herbicide-treated plots yielded less than the weed-free plots but more than the UGV treatments. Sweetcorn ears from weedy plots were also shorter, though ear length trends varied across locations. Therefore, UGV treatments reduce weed biomass, but conventional herbicide treatments were more effective at controlling weeds and consistently resulted in higher sweetcorn yield.

Cotton Leaf- and Petiole-Potassium Dynamics in Response to Potassium Fertilization
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Establishing critical potassium (K) concentrations in cotton (*Gossypium hirsutum* L.) leaves and petioles is crucial for effective K fertilizer management, as potassium is a key nutrient for optimal cotton production. Our objective was to evaluate how K availability influences leaf- and petiole-K concentrations dynamics across cotton reproductive development. Cotton fertilizer-K rate response trials were implemented in 2023 and 2024 at the Lon Mann Cotton Research Station (LMCRS), Milo J. Shult Agricultural Research & Extension Center (SAREC), and Rohwer Research Station (RSS) in soils ranging from very low to optimum soil-test K (<61 – 175 ppm K). Fertilizer-K rate treatments (0, 40, 80, 120, 160, and 200 lb K_2O ac^{-1}) were applied preplant and incorporated, and cotton was planted on raised beds and furrow irrigated. Leaf and petiole samples were collected at the beginning of squaring, 1st flower, then weekly until boll fill, and analyzed for K concentration. Leaf- and petiole-K concentrations increased with increasing K availability (either soil or K fertilization), indicating predictability in diagnosing K deficiency. Overall, tissue-K concentrations continuously increased with increasing fertilizer-K rates, with the greatest leaf- and petiole-K concentration increase (0.71% to 1.21% and 3.76% to 7.54%, respectively) being observed at LMCRS on soil with Very Low K (53 ppm K). Additionally, leaf- and petiole-K concentrations were greater at the beginning of squaring and then consistently decreased across the season regardless of the soil-test K and fertilizer rate. These results indicate that leaf- and petiole-K concentrations are sensitive to changes in soil-K availability and can be used to develop dynamic critical tissue-K concentrations to diagnose cotton-K nutrition.

Validation of rice tissue sampling for in-season nutrient management
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Arkansas is the largest rice, *Oryza sativa* (L.), producing state in the U. S., growing nearly half of all rice produced. Fertilizers and nutrients are the largest input for a successful rice crop. Nutrient management has a direct impact on yield, with nitrogen (N) required in the highest amount. Different management practices, soil types, and producers' ability to fertilize affect nutrient management. Tissue sampling is a potential tool for providing direct plant nutrient information at a given time and growth stage in season. With N, phosphorus (P), and potassium (K) being the three most important macronutrients involved in rice growth and development and an increase interest in tissue sampling, more information is needed to validate critical plant tissue concentrations at which additional fertilizer inputs may be warranted.

The objective of this research is to validate rice plant response during reproductive growth stages to additional N, P, and K and relate these responses to plant tissue concentrations. Additionally, to evaluate and compare the yield difference associated with different fertilizer application timings. Separate trials were conducted for N, P, and K. The experimental design was a randomized complete block design with a paired plot (split block) approach consisting of seven treatments with four replications. The seven treatments consisted of an unfertilized control, a soil-test recommended rate, and five timings from panicle initiation (PI) to late boot. Each plot was split so that for a given timing, one half was fertilized and the other was not. Trials were conducted at the Rice Research and Extension Center near Stuttgart, the Pine Tree Research Station near Colt, and the Northeast Research and Extension Center near Keiser. In-season fertilizer applications utilized urea (46-0-0) treated with NBPT for the N fertilizer source, triple super phosphate (TSP) (0-46-0) for P fertilizer source, and muriate of potash (0-0-60) for the K fertilizer source. Tissue samples were collected prior to fertilizer applications from PI to PI+28 days. At approximately 50% heading, tissue samples were collected from all plots. Nutrient tissue concentration, grain yield, and milling yield are being evaluated.

Yield and Nutrient Uptake Response to Regenerative Management in Arkansas Rice
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With the global human population climbing, it is pertinent for crop producers to meet an increasing demand while maintaining healthy soil. Regenerative agriculture practices, such as conservation tillage and cover-cropping, are rising in popularity as a strategy to mitigate greenhouse gas emissions and build and maintain soil health. While extensive studies have been conducted on the effects of these regenerative agricultural practices on various crops, there is little research investigating how these practices fare in a zero-grade, flood-irrigated rice (*Oryza sativa* L.) production system. The purpose of this study is to understand the rice yield and nutrient uptake responses to the implementation of no-till, various combinations of cover crops, and biochar incorporation in an Eastern Arkansas rice production system in comparison to traditionally managed.

A randomized complete block design was established with three replications of seven treatment combinations: 1) control treatment with conventional tillage, continuous rice, and no other additions, 2) no-tillage (NT), no cover crop, and plant residues burned after harvest, 3) NT, no cover crop, and non-burned plant residues, 4) NT, black-seeded oats (*Avena sativa*) and Austrian winter pea (*Pisum sativum*) cover crop blend, and non-burned plant residues, 5) NT, legume only cover crop, and non-burned plant residues, 6) NT, black-seeded oats only as the cover crop, and non-burned plant residues, and 7) NT, black-seeded oats only as the cover crop, non-burned plant residues, and an addition of a single application of 2.5 tons acre^{-1} of biochar mechanically incorporated prior to plot establishment. Cover crop samples were collected from a 3.9 ft^2 area immediately prior to rice planting and analyzed for biomass and nutrient concentrations. Rice, cultivar RT7521 FP, was planted at a rate of 31 lbs seed acre^{-1} directly into cover crop residue using a NT drill in spring of 2023 and 2024. Samples of rice from each plot were collected at 50% and maturity from 3 ft of a bordered row and analyzed for biomass and nutrient concentrations, with grain analysis separate from leaves and stalks at the maturity sample timing. At rice harvest in fall of 2023 and 2024, measurements of plot area, grain weight, and grain moisture were collected from each plot to provide a final rough rice yield and harvest index.

The data obtained in this research has shown that after one year, there were no significant differences ($P > 0.05$) in rice biomass or rice yield across treatments. After the second year, however, data analyses indicated a significantly greater yield in the conventionally managed treatment than in the NT, cover crop combination treatment, averaging 133 and 98 bu acre^{-1}, respectively. It can be expected that yield differences will increase over the remaining course of this long-term study. The results of this research are an important step in the effort to influence Arkansas rice producers to implement cover cropping during the off-season and improve their overall soil health.

Does Preemergence Herbicide Selection Affect the Frequency of Postemergence Targeted Sprays in Cotton? Lane Pierce, JK Norsworthy, Tristen Avent, Michael Dodde, Pamela Carvalho-Moore. Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR

John Deere See & SprayTM is available in three platforms to the public: See and Spray Ultimate, See and Spray Premium, and See & Spray Select. Ultimate is a dual-tank system that broadcasts the residual herbicide while targeted-spraying the postemergence herbicide. Premium is a single-tank system that can either make targeted sprays or broadcast sprays. Both sprayers are equipped with five sensitivity settings, applying various levels of herbicide based on the weed sizes and densities. This research aimed to determine if strong or weak cotton preemergence herbicides affect the amount of weed control and postemergence-targeted sprays. In 2024, a fifteen-treatment trial with four replications was conducted at the Northeast Research and Extension Center in Keiser, AR. All the plots were sprayed with a strong or weak preemergence (PRE) on the same day as planting. After emergence, broadcast, Ultimate and Premium applications were made at early postemergence (EPOST), mid-postemergence (MPOST), and late-postemergence (LPOST). These postemergence applications included glyphosate, glufosinate, and S-metolachlor, and were sprayed using various application methods and sensitivity levels. Weed control ratings were collected at EPOST, 14 days after EPOST (DAEPOST), and 14DAMPOST. Initial Palmer amaranth (Amaranthus palmeri), prickly sida (Sida spinosa), and morningglory (Ipomoea spp.) control differed by strength of preemergence, but late season evaluations showed no differences among treatments with control >93% for all species. Herbicide savings were affected by the preemergence residual for all postemergence applications, with the strong preemergence decreasing the area sprayed by 4, 0 to 48, and 17 percentage points at the EPOST, MPOST, and LPOST application timings, respectively. However, at the EPOST timing, targeted sprays were applied to >96% of the area due to weed density, indicating little value in the See & Spray at this timing based on the conditions. Overall, See & Spray can provide herbicide savings and similar weed control compared to a broadcast application, and a stronger preemergence reduced the treated area with postemergence applications.

Ph.D. Abstracts

Three-Year Impact of Single-Tank See & Spray™ Programs in Soybean

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Targeted applications of herbicides provide the potential for producers to save input costs but pose a risk due to potentially missed weeds and increasing populations in subsequent production seasons. For the past three years, weed scientists with the University of Arkansas System Division of Agriculture have been working with a scaled See & Spray™ machine to determine the long-term impact of John Deere's targeted spray technology on weed control in soybean. Treatments compared traditional broadcast applications to targeted applications at two detection sensitivity settings where both the postemergence and residual herbicides were applied through the See & Spray boom. All treatments followed a standard herbicide program with a preemergence application followed by early-postemergence (EPOST) and mid-postemergence (MPOST) applications of glufosinate. Plots did not change from one year to the next to evaluate the changes in weed populations over time, and in season counts of weeds included Palmer amaranth, morningglory species, prickly sida, and broadleaf signalgrass. In 2022, all treatments averaged 279 weeds acre^{-1} between the EPOST and MPOST timing. Targeted applications at the low detection sensitivity setting caused increasing numbers of weeds each subsequent year at the time of applications (263 to 1120 to 3870 weeds acre^{-1}). Also, Palmer amaranth escapes increased for the low detection setting each year. In terms of savings, there are differences between targeted applications at the EPOST application timing for the high and low detection settings, with each providing 42% and 59% savings, respectively. By the MPOST application, savings were 52% and 51%, respectively. Overall, targeted applications with See & Spray could provide producers with herbicide savings. If utilizing the low detection setting, producers could experience negative impacts on weed seedbank management, subsequently increasing the risk for herbicide resistance.

Gut Bacterial Composition of Fall Armyworm, *Spodoptera frugiperda* is Plant Age Dependent While Feeding on Arkansas Rice Varieties

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Arkansas ranks first in rice production in the US and is the second most valuable commodity in the state. Among the insect pests attacking rice, the polyphagous pest, fall armyworm (FAW), *Spodoptera frugiperda* is now considered as a minor pest. However, due to changes in climatic conditions, and consequent changes in generation time, FAW has the potential to be a major concern. Similar to other insects, the gut microbiome of FAW plays an important role across life stages that helps them adapt to rapidly varying conditions. In this study, we examined whether the gut bacterial composition varies across varieties, plant age, and a commercial seed treatment. Our preliminary findings suggest that the plant age significantly affected the gut microbial composition with Enterococcaceae as the major group and are independent of varieties and seed treatment. More detailed exploration of gut bacterial composition and how the microbiome modifies the host defense and herbivore fitness are in progress.

Preemergence and Postemergence Options to Control Glufosinate-Resistant Palmer amaranth
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Glufosinate resistance in Palmer amaranth was confirmed in 2022, and few control options are available. Therefore, field experiments were conducted to determine preemergence (PRE) or postemergence/burndown (POST) row crop herbicidal options to control a glufosinate-resistant Palmer amaranth accession, MSR2. The experiments were arranged as randomized complete block with two (2023 and 2024) and three (2022, 2023, and 2024) site years for the POST and PRE studies, respectively. The PRE treatments consisted of acetochlor, atrazine, diflufenican, diuron, flumioxazin, fluridone, fomesafen, imazaquin, isoxaflutole, mesotrione, metribuzin, pendimethalin, pyroxasulfone, saflufenacil, *S*-metolachlor, or trifludimoxazin. The POST treatments consisted of 2,4-D, atrazine, carfentrazone, dicamba, diuron, flumioxazin, fomesafen, glufosinate, glyphosate, isoxaflutole, mesotrione, paraquat, saflufenacil, tembotrione, trifludimoxazin, or tryfloxysulfuron. Plant size at the POST experiment ranged from 2 to 5 inches and 1 to 6 inches in 2023 and 2024, respectively. Control relative to a nontreated was evaluated at 4 weeks after treatment (WAT) in the PRE experiment and at 2 WAT in the POST experiment, and the control data was averaged across years in both experiments. Among the PRE herbicides, atrazine, pyroxasulfone, trifludimoxazin, metribuzin, and mesotrione provided the highest MSR2 control levels, ranging from 97% to 93%. Only paraquat obtained average control levels above 90% at 2 WAT in the POST experiment. According to these findings, controlling this glufosinate-resistant Palmer amaranth accession with a single chemistry is very limited and should be avoided. Additionally, residual herbicides should be included in all applications as this accession highly compromises POST control.

Evaluating fungicide selection and application timings for control of ‘yellow tuft’ disease on zoysiagrass
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Yellow tuft of *Zoysia* spp., caused by *Sclerophthora macrospora*, is becoming a significant emerging problem on golf course fairways in Arkansas. The disease affects large acreages, causes chlorosis and excessive tillering, and currently lacks any prescribed chemical controls, posing a challenging problem for turfgrass managers. Our objective was to evaluate various fungicides and plant growth regulators (PGRs), along with various application timings, to suppress yellow tuft on the ‘El Toro’ zoysiagrass. Beginning on 15 Feb 2024 through 01 Jul 2024, fungicides including aluminum tris (O-ethyl phosphonate), chlorothalonil, cyazofamid, mefenoxam, and pyraclostrobin were applied at 2-week intervals, whereas the PGRs, prohexadione-Ca and trinexapac-ethyl, were applied at 4-week intervals. All treatments were applied with a CO_2-pressurized backpack sprayer at a carrier volume of 814 L ha^{-1}. Percent disease cover and percent phytotoxicity were measured every two weeks. Among preventive applications (15 Feb, 01 Mar, 15 Mar), mefenoxam was the only fungicide to provide greater disease reduction (88%) than the nontreated control. On 15 May, curative applications of mefenoxam also performed best among all fungicides with a mean disease reduction of 67%. Although the preventive application of PGRs caused high phytotoxicity and delayed the spring green-up of the zoysiagrass, 100% disease reduction was observed in the plots treated with prohexadione-Ca and trinexapac-ethyl on 15 May. No phytotoxicity effect of PGRs was observed after 01 Jun. Despite initial phytotoxicity, the PGRs prohexadione-Ca and trinexapac-ethyl suppressed yellow tuft very efficiently, while mefenoxam outperformed all fungicides for both preventive and curative treatments. Our data suggest that mefenoxam and PGR programs may be the most effective strategies for the chemical suppression of yellow tuft.

Can Drought And Herbivory Have Compounding Effects On Soybean Yield And Fitness?

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Soybean (*Glycine max* (L.) Merrill), an important crop in the US, faces numerous abiotic and biotic stressors including drought and herbivory. In southeastern regions of US, soybeans undergo severe water limitation as well as attack by foliage feeding herbivores such as soybean looper (SBL) (*Chrysodeixis includens* Walker). Although substantial data is available informing growers about water stress and herbivory impact on soybean, we lack studies exploring the interactive effects of water stress and herbivory on soybean yield and fitness. To address this, we conducted an experiment by simulating drought conditions followed by SBL herbivory and assessed both host and herbivore traits. We measured soybean morpho-physiological traits and SBL growth traits and behavior. We found that soybean physiological traits (photosynthesis, stomatal conductance) were significantly increased under interactive effects of simulated-drought and herbivory compared to their individual effects indicating compensation. However, this did not result in better fitness, instead we observed a greater number of empty pods (aborted pods) under simulated-drought and herbivory interaction. On the other hand, simulated drought negatively impacted SBL performance as they fed significantly less on water-stressed soybeans and were less attracted to the soybeans that experienced water stress. Collectively, we conclude that simulated-drought and herbivory have synergistic negative impacts on soybean morpho-physiology and negatively affects the herbivore performance under simulated-drought condition. This study is the first to show interactive effects of drought and herbivory on soybean yield and fitness and demonstrates the need to integrate other biotic and abiotic stressors for further understanding of interactive effects on host and herbivores.

Long-term Impact of Integrated Weed Management Practices in Cotton on Palmer Amaranth

Cory Ketchum, Jason K. Norsworthy, Amar Godar, Tom Barber, Ty Smith, Rodger Farr, Tristen H. Avent, Lane Pierce

The rise of herbicide-resistant cases in Palmer amaranth and other problematic weed species has driven producers to adopt integrated weed management strategies. Research has shown a zero-tolerance approach, cover crops, deep tillage, and diverse herbicide programs as effective practices for managing this weed. To understand how each strategy impacts Palmer amaranth in cotton production systems, a long-term study was initiated in the fall of 2018. The study was organized as a randomized complete block design with four factors. The factors were: 1) zero-tolerance (weeds were removed prior to seed production), 2) deep tillage (occurring at the start of the trial, followed by two years of no-till, then repeated), 3) cover crop (cereal rye was utilized as a cover crop), and 4) herbicide programs (utilization of dicamba in herbicide program). A conventional glyphosate-glufosinate herbicide program was utilized as a base herbicide program, with the inclusion of dicamba during preemergence applications and early-postemergence to specified plots. Plots with the base herbicide program, but none of the four weed management strategies were utilized as checks. Palmer amaranth emergence was monitored at 21, 42, 63, and 70 DAP and analyzed as total seasonal emergence. Additionally, cotton yield and economics were analyzed. In the fifth year of the study, each management component reduced seasonal Palmer amaranth emergence by over 95% compared to the check plots. Due to the high efficacy of the base herbicide program and the significant impact of the individual components, the effect of multiple strategies utilized was not distinguishable. Plots with cover crops being the only strategy utilized reduced Palmer amaranth by 70% compared to the check plots. All other strategies by themselves or in combination with other strategies reduced emergence by at least 90% compared to the check plots. While zero-tolerance did not affect cotton yield in any given year, the combination of cover crops and dicamba-based herbicide program produced a greater 5-year average cotton lint yield (11% more). In contrast, deep tillage combined with dicamba resulted in lower yield (6% less) compared to the nontreated. Zero-tolerance and cover crop combinations produced a similar 5-year average cost-adjusted cotton yield, while deep tillage-dicamba combination, and the combination of all management practices saw an 8 to 9% reduction in cost-adjusted yield. Given the effective Palmer amaranth control from the conventional weed management program, the addition of these components, alone or in various combinations, accelerates Palmer amaranth seed bank depletion in cotton without long-term economic burden.

Evaluating the Effect of Insecticide Treated Seed for Control of Rice Water Weevil (Coleoptera: Curculionidae) in Alternate Wetting Drying Rice Systems

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Alternate wetting and drying (AWD) is a novel rice water management system which reduces water-related expenses. However, limited research has been conducted investigating the effects of AWD systems on the control of rice water weevil, *Lissorhoptrus oryzophilus* Kushel (Coleoptera: Curculionidae), and the efficacy of insecticide-treated seed. To investigate the effectiveness of insecticide seed treatments a split-split plot design was initiated at the Pine Tree Research Station near Colt, AR in 2024. Whole plot effects consisted of water management systems; including, a conventionally flooded system and AWD system. Subplots were arranged in randomized complete blocks with four replications. Treatments included cultivar (CLL16, DG263L, Ozark, RT7421FP, and Taurus) and seed treatments (nontreated check, thiamethoxam (TMX), and thiamethoxam + cyantraniliprole (TMX+Cy)). Water management had no effect on larval densities, but an interaction with seed treatment was observed. The TMX+Cy seed treatment had the highest efficacy with 4.9 and 6.1 larvae per 50 in^3 in the conventional flooded and AWD systems. TMX treated seed performed similarly between both systems with densities of 12.0 and 16.4 per 50 in^3 for conventional and AWD systems. However, the TMX treatment in AWD performed similarly to the untreated checks in both water management systems which averaged around 24 larvae per 50 in^3. TMX+Cy treated seed averaged 179.5 bushels per acre, TMX performed similarly with 178.8 but did not differ from the nontreated check which averaged 173.9. Additionally, the AWD system averaged 173.8 bushels per acre which was a 4% yield reduction from the conventional system. No interaction between water management systems and seed treatment with respect to yield was observed. Overall, the AWD system did not impact rice water weevil control and decreased overall yield. Moreover, TMX-treated seed lost its effectiveness in AWD conditions which showcases limited application with respect to management of rice water weevil.

Intermittent Herbivory by Two Herbivores Affects Physiology, But Not Fitness in Soybean (*Glycine Max L. Merill*)

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Plants are frequently subjected to attacks by multiple insect herbivores, which can occur either sequentially or concurrently. However, most studies on plant-herbivore interactions have focused on pairwise comparisons, either examining one or two herbivores attacking a single crop or a single herbivore species attacking multiple crops. Although sequential herbivory is prevalent in crops, there has been limited investigation into how both plants and herbivores respond to such attacks, particularly in soybean (*Glycine max),* a globally important crop. To explore this, we conducted an experiment using two herbivores: fall armyworm (*Spodoptera frugiperda*, FAW) and soybean looper (*Chrysodeixis includens*, SBL), on two widely cultivated soybean varieties, Magellan and Black-Hawk. The primary objective of our study was to examine how soybean plants and herbivores respond to sequential attacks by FAW and SBL, either experiencing repeated attacks by the same herbivore or being alternatively attacked by each of them. After imposing these treatments, we evaluated a broad range of traits, including plant growth, physiology, fitness, and herbivore growth and development. Interestingly, we found no significant effect of sequential herbivory on soybean growth traits. However, after the first attack, physiological responses (such as photosynthesis, transpiration, and stomatal conductance) were enhanced but remained unchanged after subsequent attacks. Conversely, both FAW and SBL showed the lowest mass gain when feeding on plants initially attacked by FAW. The frass weight and the number of frass pellets collected from FAW was also higher in both first and sequential attack as compared to SBL. However, soybean yield and fitness were unaffected by sequential herbivory by either FAW or SBL. These findings suggest that, although FAW—a relatively minor pest in soybean, was able to feed more and induce higher defenses on soybean as compared to SBL, a major pest. Our results clearly show that sequential and intermittent herbivory has differential effects on host and herbivore traits but has limited impact on yield in soybean, suggesting tolerance against herbivory independent of herbivore status.

Plant age and insect herbivory induces wax with consequences for fall armyworm (*Spodoptera frugiperda*) in sorghum-sudangrass (*Sorghum x drummondii*)

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Pest management strategies have historically relied upon chemical control to mitigate insect pest pressures; however, as resistance to pesticides grows at an alarming rate, and as non-target effects are found more frequently, the search for sustainable, novel pest management strategies has become more important. Plants are equipped with diverse physical and chemical defenses against insect pests. Among these physical defenses, epicuticular waxes serve as an important first line of defense. Yet, how these chemical control methods, such as seed treatments, affect epicuticular waxes is underexplored. Sorghum-sudangrass, *Sorghum x drummondii*, is an economically important forage crop with lines that vary in their plant defense traits. This study explored how the quantity of epicuticular wax in *Sorghum x drummondii* is affected by chemical control (seed treatment), variety, phenological stages (10d, 25d, 60d), and how wax affects a polyphagous, destructive pest, fall armyworm, *Spodoptera frugiperda* (FAW). Through wax quantification, FAW feeding induction, and wax added artificial diet experiments, we show that while variety and seed treatment does not affect wax content, plant phenology significantly affects wax, and that wax is induced by FAW feeding and has negative consequences for caterpillar growth such as reduced larval growth and pupal mass, and implications for adult mass.

Undergraduate Abstracts

Evaluating the Effect of Emergence Timing on Thrips Damage in Treated and Untreated Cotton

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Tobacco thrips are a perennial pest of seedling cotton in the Mid-South. Severe thrips damage can lead to delayed maturity and yield loss. Thrips have become increasingly problematic in recent years due to insecticide resistance, poor seedling vigor, and the use of herbicides that slow cotton growth. When assessing thrips injury in cotton fields, it is very common to see plants that are seemingly untouched by thrips next to plants that have been heavily injured. It is unknown why this occurs, but one possible explanation is different emergence timings. A study was conducted in 2024 to determine the impact of emergence timing on thrips damage. Seeds were either untreated or treated with Gaucho 600 (imidacloprid) and planted at optimal depth or deeper than optimal depth to facilitate delayed emergence. Emergence dates for individual plants, damage ratings, thrips populations, and percent reduction in stand were recorded. Late emerging plants had fewer thrips per 5 plants and increased damage ratings at both sampling intervals in treated and untreated plots. Seeds treated with Gaucho 600 had fewer thrips per 5 plants, lower percent stand loss, and reduced damage ratings. This data suggests that late emerging cotton plants are more vulnerable to thrips damage in treated and untreated cotton. This allows us to conclude that thrips damage is correlated to emergence timing.

Evaluating Defoliation Thresholds and the Efficacy of Foliar Insecticide Applications for Control of Armyworms in Rice

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Armyworms are commonly found in rice fields across Arkansas and have the capability to cause severe defoliation of rice plants leading to significant yield losses. Recent studies have established a damage threshold in pure-line rice cultivars for armyworms however, hybrid cultivars have yet to be evaluated. Studies were conducted in 2022, 2023, and 2024 on pure-line and hybrid cultivars in order to establish a damage threshold for hybrid cultivars. Plots of each cultivar were mechanically defoliated to 100% using a weed eater at the two- three leaf, early tiller, late tiller, and green ring growth stages across an April, May, and June planting. Similar yield loss trends were observed at the two- three leaf and early tiller growth stages between pure-line and hybrid cultivars at all planting dates. Hybrid cultivars suffered less yield loss at the late tiller and green ring growth stages for the second and third planting dates. These data suggest that thresholds could potentially be increased in hybrid cultivars compared to pure- line cultivars. In another study in 2024, the efficacy of several insecticides was tested for control of fall army worms (*Spodoptera frugiperda*). Insecticides tested include lambda cyhalothrin 3.65 and 5.0 oz per acre, intrepid, Intrepid Edge, Denim, Beseige, Plemax, diamond, and SpearLep + Leprotec. The results of this study suggest that Intrepid, Intrepid Edge, Denim, Beseige, Plemax, and Diamond provided control of fall army worms at all sampling dates.

Determining and Interpreting the Possible Genetic Cause of Halosulfuron Failure on White Margin Sedge

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White margin sedge (*Cyperus macrostachyos*) is an increasing weed of flooded rice in Arkansas. Approaches to control this weed are needed. Following a failure to control several white margin sedge accessions with the acetolactate synthase (ALS)-inhibiting herbicide halosulfuron-methyl, three accessions were selected, and the ALS enzyme-encoding region was sequenced with the objective of identifying any mutations previously correlated with herbicide resistance. A substitution of aspartate 376 (standardized to *Arabidopsis thaliana*) for glutamate was found in the ALS enzyme of all three populations. The Asp-376-Glu substitution has been documented in several different weed species and is well understood to confer strong resistance to nearly all ALS-inhibiting herbicides. Currently, the best known postemergence control option for white margin sedge is Basagran (2pt/A) as shown by preliminary research. Basagran provided 70% control of white margin sedge two weeks after treatment under greenhouse conditions. More research on possible control options will follow in the upcoming year and screening of additional accessions for sensitivity to ALS-inhibiting herbicides will continue.

Testing in planta accumulation and ability to suppress plant defenses by the soybean cyst nematode effector HgRHA1B

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Soybean (Glycine max) is a major cash crop in Arkansas, generating about $1.7 billion annually for Arkansas farmers. Soybean Cyst Nematode (SCN) – Heterodera glycines – is the single most damaging pest negatively impacting soybean production in the U.S., with estimated 50% yield loss on affected fields. In 2022, SCN caused a loss of over 13 million bushels in the U.S. South (around $185 million dollars). Plants are able to respond to pathogens by recognizing pathogen associated molecular patterns (PAMPs) triggering an immune response called PAMP-triggered immunity (PTI). However, effectors may be used by the pathogen to counter this immune response and allow them to once again infect the host. Then, again, the host may have developed another defense mechanism that is called effector-triggered immunity (ETI), which responds to effectors and is usually displayed as a localized region of rapid cell death surrounding the infection point called a hypersensitive response (HR). Previous work with the potato cyst nematode (Globodera pallida) identified the effector GpRHA1B, essential for nematode virulence, which can overcome both PTI and ETI pathways. We have found a similar effector gene HgRHA1B in SCN. The aim of the current work is to test whether this gene contributes to SCN virulence in similar manner. To this end, Agrobacterium-mediated transient expression in Nicotiana benthamiana leaves is used to visually detect GFP-tagged HgRHA1B protein accumulation and assess its ability to suppress HR, a hallmark of ETI. Future work includes thecreation of composite soybean plants using Agrobacterium rhizogenes to induce “hairy roots” overexpressing HgRHA1B and functionally validating its role in SCN virulence using nematode infection assays. The ultimate goal of this research is to biotechnologically target essential nematode effectors to prevent SCN-triggered yield losses.

General Speakers

Effect of Soil Applied Adjuvant (Grounded) on Residual Activity of Main Preemergence Cotton Herbicide
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A field study was conducted in 2023 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate the effect of soil applied adjuvant (Grounded) on residual activity of main preemergence cotton herbicide on weed management programs. Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunose*), and broadleaf signalgrass (*Urochloa platyphylla*) seed were broadcasted and incorporated on May 16, 2023 in the entire experiment site to make sure for uniform weed distribution per plot. Cotton (ST 4550) was planted on May 16, 2023 and emerged on May 23. The experiment was designed as a randomized complete block with four replications. Plot size is 4 (40 inch) rows 13.3-ft wide by 20-ft long with 10-ft alleys between replications. All herbicide rates are in oz/a. The residual preemergence herbicide treatments as follows: 1) Cotoran (fluometuron) at 32 oz/a; 2) Direx (diuron) at 21; 3) Caparol (prometryn) at 24; 4) Brake (fluridone) at 16 oz/a; 5) Staple LX (pyrithiobac) at 1.5 oz/a; 6) Dual Magnum (*S*-metolachlor) at 24 oz/a; 7) Prowl (pendimethalin) at 32 oz/a; 8) Warrant (acetochlor) at 48 oz/a. The soil applied adjuvant (Grounded) at 16 oz/a was added to the treatments 1 through 8 as a treatment 9 through 16, respectively. The other treatments were included in the test as follows: 17) Brake + Dual Magnum + Direx + Caparol; 18) Brake + Dual Magnum + Direx + Caparol + Prowl; 19) Brake +Dual Magnum + Direx + Caparol + Prowl + Cotoran; and 20) Brake + Dual Magnum + Direx + Caparol + Grounded. A nontreated check was included.

There was no cotton injury from any herbicide application. Glyphosate-resistant Palmer amaranth control was 68, 76, 75, 76, 70, 71, 76, and 88% for treatment 1 through 8 by 6 weeks-after cotton emergence (WAE), respectively. Glyphosate-resistant Palmer amaranth control was increased to 85, 83, 84, 88, 83, and 92% when soil applied adjuvant Grounded was added to Cotoran, Direx, Caparol, Dual Magnum, Prowl, and Warrant (Trt. 9, 10, 11, 14, 15, and 16), respectively. There was no change in residual activity of Barke (Trt. 4) or Staple LX (Trt. 5) when Grounded was added. Treatment 17, 18, 19, and 20 provided 93 to 96% control of glyphosate-resistant Palmer amaranth. Pitted morningglory control was 79, 75, 81, 80, 79, 75, 76, 78, 84, 84, 81, 76, 75, 84, 83, 94, 85, 86, 94, and 92% for treatment 1 through 20, respectively. Treatment 1 through 20 provided 58, 66, 60, 56, 58, 68, 70, 63, 68, 59, 75, 66, 61, 71, 83, 83, 85, 88, 91, and 83% control of broadleaf signalgrass. Based on these results, soil applied adjuvant Grounded increased the residual activity of some preemergence herbicide application to last longer.

Overexpression of *AtPROPEP6* enhances resistance of Arabidopsis against root-knot nematodes
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Root Knot nematodes (RKNs) are major disruptive pests for worldwide agricultural crop production. The most effective nematode management relies on plant resistance, crop rotation and or chemical nematicides. However, very few sources of resistant germplasm are available for cultivated plants and use of most chemical nematicides is banned due to poor specificity and high toxicity. Thus, there is a pressing need to explore sustainable strategies to enhance nematode resistance in crop plants. Plant elicitor peptides (Peps) derived from precursor protein (PROPEPs) are damage-associated molecular patterns (DAMPs) which activate and amplify the innate immunity of plants against pathogens. There are eight PROPEP genes in *Arabidopsis thaliana* (PROPEP1- PROPEP8) which generate eight Peps (Pep1-Pep8), involved in response to biotic and abiotic stresses. The role of AtPeps is to activate and amplify plant immunity that has been widely established against different microbial pathogens. A previous study using transgenic *Arabidopsis* plants with high constitutive expression of the AtPep1 precursor gene *PROPEP1* indicated an enhanced resistance toward the root pathogen *Pythium irregulare.* In this study, we tested infection by the southern root knot nematode *Meloidogyne incognita* on transgenic lines that over-express *AtPROPEP1*, *AtPROPEP2*, *AtPROPEP3*, and *AtPROPEP6.* All the tested lines showed a reduction in total nematode counts compared to untransformed controls. The strongest reduction was observed in plants overexpressing *AtPROPEP6*, which were further investigated for nematode resistance. Overexpression of *AtPROPEP6* resulted in a statistically significant reduction in the number of galls and total number of nematodes compared to wild-type plants. This study will help us to explore the potential of Peps to enhance immunity and impart resistance against RKN in crop plants.