ARKANSAS SOYBEAN PROMOTION BOARD MEETING—DAY 1
Zoom Option

Minutes

March 6, 2025
8:30 a.m.

Members Present in Person:	Brad Doyle, Boyce Johnson, Matthew Roberson, Patrick Matt Smith, West Higginbothom
Members Present via Zoom:	BJ Royce Rogers II
Members Absent:	Josh Cureton, John Freeman, & Donald Morton JR.

WELCOME AND INTRODUCTIONS
Chairman Doyle commenced the promotion board meeting at 8:45 a.m. and welcomed all members and guests. Members and staff introduced themselves and a quorum was confirmed by the Department.

ADMINISTRATIVE & FINANCIAL REPORTS
The board then reviewed the previous meeting minutes, for meetings held on November 14, 2024, and February 27, 2025.

Motion to approve the November 14, 2024, board meeting minutes; moved by West Higginbothom, seconded by Patrick Matt Smith. Motion carried.

Motion to approve the February 27, 2025, board meeting minutes; moved by West Higginbothom, seconded by Patrick Matt Smith. Motion carried.

Chairman Doyle introduced Arkansas Department of Agriculture Chief Financial Officer Inoussa Zaki to present the board's financial report. Zaki informed the board that they needed to approve all board travel and spending for the year 2025.

Motion to approve all board travel expenses for 2025; moved by Patrick Matt Smith; seconded by Matthew Roberson. Motion carried.

BOARD FINANCIAL REPORTS
Chairman Doyle then asked Zaki to present the board's financial report.

Zaki presented the board's financial report for the period ending February 28th, 2025. The board began the fiscal year with a balance of $11,110,780. **ATTACHMENT 1**

Between July 1, 2024, and February 2025, a total of $6.8 million was collected in assessments. Of this amount, $2.7 million was transferred to the United Soybean Board (USB), and $101,693 was allocated to other qualified state soybean boards.

Treasury fees amounted to $202,000, leaving the board with a net income of $3.7 million from the assessments collected during this period. Additional income of $7,500 was reported, bringing the total output for this reporting period to $3 million.

Members sought clarification on how checkoff payments are collected.

Zaki continued to review the board's expenses, which were divided between promotion and research. Total expenditures for the reporting period amounted to $2.3 million, with $567,000 allocated to promotions and $2,699,614 in cash on hand, with outstanding obligations of approximately $668,755.

This leaves a remaining allocation for the reporting period of $2,399,199. After accounting for these expenditures and obligations, the board had $9,235,776 available to fund future projects.

Zaki invited questions from members.

Member Smith asked about the remaining obligations, and it was clarified that that funding was for projects already approved last year. Discussion ensued.

Member Smith asked if Zaki was expecting approximately $1 million in collections, and Zaki answered that he expected just over $1 million.

Zaki informed the board that they were at approximately 88% collected, which he stated was above the budgeted forecast, adding that he hoped the collections to be at around $10 million come June.

Member Smith asked about how long it takes for the collections to come in. Zaki answered that, for example, a March sale would be reported in April, with remission in May. Some discussion ensued.

Chairman Doyle asked about any rules the board had regarding a minimum reserve the board should try to retain between years. Member Higginbothom added that they traditionally ensured there were at least $500,000 in reserve, adding that at one point in the board's history they increased that amount to $1 million.

Zaki then concluded the board's financial report.

Motion to approve the Department's financial report; moved by Patrick Matt Smith, seconded by Matthew Roberson. Motion carried.

UADA RESEARCH PROPOSAL PRESENTATIONS

The board then commenced the University of Arkansas Division of Agriculture (UADA) research and promotion proposal presentations.

The first new research project proposal titled, "Designing cost-effective irrigation system for enhancing crop water productivity in soybean production in Arkansas (Year 1 of 2)," was presented before the board, requesting a total funding amount of $36,050. **ATTACHMENT 2**

Chairman Doyle inquired on what soil type the research farm has, and the presenter answered that it is a clay loom type.

Admin Bray mentioned that due to limited time to hear presentations, each presenter has approximately five minutes to present. Bray further mentioned that the board may need to consider approval of all in-progress proposals in one motion for the sake of time.

Member Smith asked Zaki to total the amount of continuing the in-progress proposals. Zaki answered that the total of the in-progress proposals would be $2,783,292.

Discussion ensued regarding the remainder of the day's schedule with the UADA.

The first in-progress research project proposal titled, "Use of gossypol to inhibit reproduction in domestic hogs as a model for feral hog control (Year 3 of 3)," was then presented before the board, requesting a funding amount of $30,000. **ATTACHMENT 3, PAGE 88**

Members asked several questions and discussion ensued.

The next new research project proposal titled, "Development, evaluation and production of agricultural biologicals for Arkansas crop production (Year 1 of 3)," was presented before the board, requesting a total funding amount of $23,857. **ATTACHMENT 3, PAGE 1**

Members asked several questions of the presenter, prompting some discussion.

The next in-progress research project proposal titled, "Optimization of fungal pathogens AF22 and AF24 as bioherbicides for palmer amaranth (pigweed) (Year 3 of 3)," was presented before the board, requesting a total funding amount of $40,000. **ATTACHMENT 3, PAGE 52**

The next new research project proposal titled, "Greenhouse gas emissions from long-term soybean with cover crops (Year 1 of 1)," which was presented before the board, requesting a total funding amount of $23,110. **ATTACHMENT 3, PAGE 5**

The next new research project proposal entitled, "Evaluating planting date decisions in the soybean/rice rotation (Year 1 of 1)," which was presented before the board, requesting a total funding amount of $30,127. **ATTACHMENT 3, PAGE 9**

Chairman Doyle asked whether seed treatments would vary in the study. The presenter responded that all seed treatments would follow the same planting dates. He also inquired about the straw management system, to which the presenter replied that while no firm plans are in place, management will remain consistent across research fields for each planting date.

The next new research project proposal titled, "Investigating the effect of growth regulators on soybean plant architecture and yield (Year 1 of 2)," was presented before the board, requesting a total funding amount of $31,306. **ATTACHMENT 3, PAGE 13**

The next new research project proposal titled, "Determination of tolerant soybean lines and their yield under multiple stressors: salinity and herbivory (Year 1 of 3)," was presented before the board, requesting a total funding amount of $54,019. **ATTACHMENT 3, PAGE 17**

Members asked a few questions of the presenter, prompting some discussion.

The next new research project proposal titled, "Identifying soybean genotypes for enhanced water use efficiency using high-throughput phenotyping (Year 1 of 3)," was presented before the board, requesting a total funding amount of $60,435. **ATTACHMENT 3, PAGE 21**

Members asked a few questions, prompting some discussion.

The next new research project proposal titled, "Evaluating the impacts of irrigation water management practices on groundwater sustainability and economic analysis in Arkansas (Year 1 of 3)," was presented before the board, requesting a total funding amount of $38,441. **ATTACHMENT 3, PAGE 31**

Member Smith asked when beta testing would begin. The presenter responded that water use data is already available, but the cost data still needs to be updated and reviewed.

The next new research project proposal titled, "Artificial intelligence for early soybean disease detection and robot implementation (Year 1 of 3)," was presented before the board, requesting a total funding amount of $67,760. **ATTACHMENT 3, PAGE 35**

Members asked the presenter several questions, prompting some discussion.

The next new research project proposal titled, "Predicting the end use performance of Arkansas soy protein using genomics (Year 1 of 3)," was presented before the board, requesting a total funding amount of $99,103. **ATTACHMENT 3, PAGE 40**

The next in-progress research project proposal titled, "Screening Arkansas Soybean cultivars for protein quality as a novel food preservative (Year 2 of 3)," was presented before the board, requesting a total funding amount of $53,235. **ATTACHMENT 3, PAGE 96**

Chairman Doyle provided a brief comment regarding how he would like to see this type of research project encompass seed oils.

The next new research project proposal titled, "Economics of automatic insecticide applications in Arkansas soybeans (Year 1 of 3)," was presented before the board, requesting a total funding amount of $43,254. **ATTACHMENT 3, PAGE 48**

Member Smith asked about the presenter's goals for planting dates. The presenter responded that they aim to target specific dates at research stations while also collaborating with growers across the state.

The next new research project proposal titled, "Educating growers and consultants on insect monitoring and control (Year 1 of 3)," was presented before the board, requesting a total funding amount of $3,000. **ATTACHMENT 3, PAGE 44**

Members asked a few questions, prompting some discussion.

The next continuing research project proposal titled, "Refining Insect Thresholds in Arkansas Soybean (Year 1 of 3)," was presented before the board, requesting a total funding amount of $67,904. **ATTACHMENT 3, PAGE 202**

The Arkansas Department of Agriculture presented the next promotion-related project proposal, titled "2025 NASDA Annual Meeting Sponsorship," requesting $2,500 in sponsorship funding for the National Association of State Departments of Agriculture's annual meeting in Little Rock, AR. **ATTACHMENT 4**

Members noted that they could contribute more to such a significant event to increase their visibility and branding. Member Roberson asked how often Arkansas has hosted this event, and it was answered that this would be the first time.

The next in-progress research project proposal titled, "Arkansas Soybean performance trials (Year 3 of 3)," was presented before the board, requesting a total funding amount of $40,754. **ATTACHMENT 3, PAGE 56**

Members asked a few questions from the presenter, prompting some discussion.

The next in-progress research project proposal titled, "Development of a turn-row soybean vegetative health analysis using UAS imagery for production decision support (Year 2 of 3)," was presented before the board, requesting a total funding amount of $19,682. **ATTACHMENT 3, PAGE 60**

Member Smith inquired about the specialty equipment needed on the drone to conduct this research, and the presenter answered that these are entry-level drones. Member Smith asked if

they intended for this information to be publicly available, and the presenter answered in the affirmative. Some discussion ensued.

The next continuation research project proposal titled “Arkansas Discovery Farms (Year 1 of 3)” was presented before the board, requesting a total funding amount of $28,220. **ATTACHMENT 3, PAGE 182**

Members asked questions from the presenter and discussion ensued.

The next in-progress research project proposal titled, “Comprehensive disease screening of soybean varieties in Arkansas (Year 2 of 3),” was presented before the board, requesting a total funding amount of $133,242. **ATTACHMENT 3, PAGE 64**

Members asked several questions, prompting some discussion.

The next in-progress research project proposal titled, “Integrated management of soybean nematodes in Arkansas (Year 3 of 3),” was presented before the board, requesting a total funding amount of $71,459. **ATTACHMENT 3, PAGE 68**

Members asked several questions, prompting some discussion.

The next continuation research project proposal titled “Monitor and management of fungicide-resistant soybean diseases in Arkansas (Year 1 of 3),” was presented before the board, requesting a total funding amount of $59,728. **ATTACHMENT 3, PAGE 189**

Members asked several questions, prompting some discussion.

Chairman Doyle then called for a lunch break at 12:05 p.m. Meeting resumed at 12:40 p.m.

The next in-progress research project proposal titled, “Phenotypic Selection Assisted by seed-level near-infrared information (Year 2 of 3),” was presented before the board, requesting a total funding amount of $52,081. **ATTACHMENT 3, PAGE 72**

Members asked questions clarifying the research project, leading to some discussion.

The next in-progress research project proposal titled, “An innovative approach to generate porous soy proteins with enhanced flavor for the plant-based industry (Year 3 of 3),” was presented before the board, requesting a total funding amount of $43,955. **ATTACHMENT 3, PAGE 153**

Member Freeman asked if the investigator was using food grade or commodity grade soybeans. The investigator answered that they were using food grade soybeans.

Chairman Doyle asked Dr. Nathan Slaton (UADA) about variety royalties. Dr. Slaton stated that for patented, commercialized lines produced by UADA for the board, the board receives 20% of the collected royalties.

The next in-progress research project proposal titled, "Developing scouting, threshold and management practices for stinkbug complex in Arkansas soybean (Year 3 of 3)," was presented before the board, requesting a total funding amount of $49,625. **ATTACHMENT 3, PAGE 80**

The next in-progress research project proposal titled, "Effects of inclusion soybean oil in beef heifer diets on heifer development, reproductive function, and calf growth performance (Year 3 of 3)," was presented before the board, requesting a total funding amount of $24,471. **ATTACHMENT 3, PAGE 84**

Chairman Doyle inquired about the heifers' daily ration. The presenter stated they received a grain supplement, one with soybean oil and one without.

The last new research project proposal titled, "Testing the range of soybean cultivars that can benefit from plant elicitor peptide treatment," was presented before the board, requesting a total funding amount of $25,767. **ATTACHMENT 3, PAGE 25**

Chairman Doyle asked if they were screening commercial checks to identify high-yielding varieties, and the presenter answered in the affirmative, stating that their panel of over 500 genomes includes key cultivars, but some important U.S. soy germplasm cultivars are missing.

The next continuation research project proposal titled "Screening for soybean tolerance to metribuzin (Year 1 of 3)," was presented before the board, requesting a total funding amount of $16,232. **ATTACHMENT 3, PAGE 194**

The next in-progress research project proposal titled, "Site specific assessment of soybean response to in field variability using remote sensing (Year 2 of 3)," was presented before the board, requesting a total funding amount of $75,000. **ATTACHMENT 3, PAGE 92**

Chairman Doyle briefly mentioned that there may be potential to collaborate with NASA Acres Program to help certain projects.

The next in-progress research project proposal titled, "Development of Data-driven recommendations for variable soybean seeding rate in Arkansas (Year 2 of 3)," was presented before the board, requesting a total funding amount of $82,886. **ATTACHMENT 3, PAGE 116**

Members asked several questions, prompting some discussion.

The next in-progress research project proposal titled, "Investigating emerging production recommendations for sustainable soybean production (Year 3 of 3)," was presented before the board, requesting a total funding amount of $229,516. **ATTACHMENT 3, PAGE 124**

The next in-progress research project proposal titled, “Science for Success (Year 3 of 3),” was presented before the board, requesting a total funding amount of $128,549. **ATTACHMENT 3, PAGE 128**

Members asked several questions; discussion ensued.

The next in-progress research project proposal titled, “Soybean research verification program (Year 3 of 3),” was presented before the board, requesting a total funding amount of $200,213. **ATTACHMENT 3, PAGE 132**

Members asked several questions, prompting some discussion.

The next in-progress research project proposal titled, “Improving technology transfer for profitable and sustainable soybean production (Year 3 of 3),” was presented before the board, requesting a total funding amount of $77,443. **ATTACHMENT 3, PAGE 120**

Members asked several questions; discussion ensued.

The next new promotion project proposal titled, “Arkansas Soybean college (Year 1 of 1),” was presented before the board, requesting a total funding amount of $14,717. **ATTACHMENT 3, PAGE 218**

The presenter clarified that they are alternating commodity colleges between rice, soybean, and corn throughout the years.

Members asked several questions, prompting some discussion.

The next continuation promotion project proposal titled, “Arkansas Future Ag Leaders Tour (Year 1 of 3),” which was presented before the board, requesting a total funding amount of $5,000. **ATTACHMENT 3, PAGE 212**

The next promotion project proposal entitled, “Soybean Science Challenge (Renewal; Year 2 of 3),” which was presented before the board, requesting a total funding amount of $85,525. **ATTACHMENT 3, PAGE 216**

Member Freeman shared a story about a woman he met whose child attended the Soybean Science Challenge. She mentioned that the program changed how her children think about food sourcing and production, impacting her entire family.

The next in-progress research project proposal titled, “Monitoring the extent of potassium deficiency and chloride toxicity in Arkansas soybean fields (Year 3 of 3),” was presented before the board, requesting a total funding amount of $39,574. **ATTACHMENT 3, PAGE 112**

Members asked several questions, prompting some discussion.

The next in-progress research project proposal titled, “Fertilization of soybean (Year 3 of 3),” was presented before the board, requesting a total funding amount of $83,176. **ATTACHMENT 3, PAGE 100**

The next in-progress research project proposal titled, “Field Based determination of chloride tolerance in soybean (Year 3 of 3),” was presented before the board, requesting a total funding amount of $51,153. **ATTACHMENT 3, PAGE 104**

Some discussion ensued regarding both research projects.

The next in-progress research project proposal titled, “Influence of cover crops and soil health in soybean (Year 3 of 3),” was presented before the board, requesting a total funding amount of $63,142. **ATTACHMENT 3, PAGE 108**

Members asked several questions, prompting some discussion.

Break was called at 2:55 p.m. Meeting resumed at 3:05 p.m.

The next continuation research project proposal titled “Economic analysis of soybean production and marketing practices (Year 1 of 3),” was presented before the board, requesting a total funding amount of $7,500. **ATTACHMENT 3, PAGE 185**

The next in-progress research project proposal titled, “Soybean weed management: a team approach for improved control and profitability (Year 3 of 3),” was presented before the board, requesting a total funding amount of $260,807. **ATTACHMENT 3, PAGE 136**

Discussion ensued regarding the research project.

The next in-progress research project proposal titled, “Developing a satellite-based field scouting tool (Year 3 of 3),” was presented before the board, requesting a total funding amount of $14,730. **ATTACHMENT 3, PAGE 145**

Member Smith asked if the investigator had any scouts using this tool, and the investigator answered that he does not.

The next in-progress research project proposal titled, “Determining the value of fungicide application using on-farm trials (Year 3 of 3),” which was presented before the board, requesting a total funding amount of $52,000. **ATTACHMENT 3, PAGE 141**

The investigator passed around a handout for members to review. **ATTACHMENT 5**

Chairman Doyle stated that this exemplifies the perfect type of project or service the board can provide to Arkansas soybean farmers.

The next in-progress research project proposal titled, "Understanding taproot decline and orange leaf spot; soybean diseases of increasing importance in Arkansas (Year 3 of 3)," was presented before the board, requesting a total funding amount of $39,075. **ATTACHMENT 3, PAGE 149**

Members asked several questions, prompting some discussion.

The next continuation research project titled, "Determining factors associated with poor grain quality in soybean and management options (Year 1 of 3)," was presented before the board, requesting a total funding amount of $55,000. **ATTACHMENT 3, PAGE 198**

Members asked several questions, leading to discussion.

The next in-progress research project proposal titled, "Development of high yielding soybean cultivars with broad resistance to stressors (Year 3 of 3)," was presented before the board, requesting a total funding amount of $191,231. **ATTACHMENT 3, PAGE 157**

The next in-progress research project proposal titled, "Fast tracking MG4 cultivars with southern root-knot nematode resistance (Year 2 of 3)," was presented before the board, requesting a total funding amount of $50,364. **ATTACHMENT 3, PAGE 161**

The next in-progress research project proposal titled, "Genomic prediction to enhance the efficiency of soybean breeding (Year 3 of 3)," was presented before the board, requesting a total funding amount of $102,730. **ATTACHMENT 3, PAGE 165**

Chairman Doyle asked the investigator about the difference between phenotypes and genotypes. The investigator answered that phenotypes are physical attributes, whereas genotypes are more genetic or DNA-related attributes.

The next in-progress research project proposal titled, "Overcoming soybean yield plateau by leveraging physiology-efficient and yield-formation traits (Year 2 of 3)," was presented before the board, requesting a total funding amount of $83,679. **ATTACHMENT 3, PAGE 169**

Members asked several questions, prompting some discussion.

The next in-progress research project proposal titled, "Soybean germplasm enhancement using genetic diversity (Year 3 of 3)," was presented before the board, requesting a total funding amount of $187,872. **ATTACHMENT 3, PAGE 173**

Members asked several questions, prompting some discussion.

The next in-progress research project proposal titled, "Utilization of winter nursery for soybean line development through back crossing (Year 1 of 3)," was presented before the board, requesting a total funding amount of $51,000. **ATTACHMENT 3, PAGE 207**

The next in-progress research project titled, "Soybean enterprises budgets and production economics analysis (Year 3 of 3), was presented before the board, requesting a proposed funding amount of $10,000. **ATTACHMENT 3, PAGE 177**

Members asked several questions, prompting some discussion.

The next new promotion project titled, "Soybean nutrition education through cooking lessons/schools," was presented before the board, requesting a proposed funding amount of $27,469. **ATTACHMENT 6**

The next new promotion project titled, "Ag Day; UADA cooperative extension service, Poinsett county, participant supplies," was presented before the board, requesting a proposed funding amount of $5,000. **ATTACHMENT 7**

Chairman Doyle emphasized the program's value in educating children about the agricultural industry in Poinsett county and encouraged other counties to adopt it.

The next in-progress research project proposal titled, "Irrigation Water Management for soybeans: moving the needle (Year 3 of 3)," was presented before the board, requesting a total funding amount of $205,620. **ATTACHMENT 3, PAGE 76**

The next continuation promotion project titled, "The Arkansas Irrigation Yield Contest (Year 8)," was presented before the board, requesting a total funding amount of $10,000. **ATTACHMENT 3, PAGE 211**

Members asked several questions of the presenter, and some discussion about the irrigation contest ensued.

Admin Bray provided brief end of day announcements.

Meeting recessed at 5:00pm.

Brad Doyle

Brad Doyle, Chairman

ARKANSAS SOYBEAN PROMOTION BOARD MEETING—DAY 2
Zoom Option

Minutes

March 7, 2025
8:30 a.m.

Members Present in Person:	Josh Cureton, Brad Doyle, John Freeman, West Higginbothom, Boyce Johnson, Matthew Roberson, Patrick Matt Smith
Members Present via Zoom:	None
Members Absent:	Donald Morton JR., BJ Royce Rogers II

WELCOME AND INTRODUCTIONS
Chairman Doyle commenced the second day of the promotion board meeting at 8:30 a.m. and welcomed all members and guests.

ADDITIONAL PROMOTION & RESEARCH PROPOSAL PRESENTATIONS
The next promotion proposal titled, "***Agricultural Learning Center***," was presented before the board, requesting a total funding amount of $20,000. **ATTACHMENT 8**

The next promotion project proposal from the ***American Soybean Association*** was presented before the board, requesting funding for the following promotional projects:

- ASA – 2026 Biomass Based Diesel Initiative ($5,000)
- ASA – 2026 Innovation to Market (I2M) Work Group Annual Membership ($7,500)
- ASA – 2026 Soybean Leadership Academy (Sponsorship Levels: $3,000 - $25,000)
- ASA – 2026 SoyStats ($600)
- ASA – 2026 ASA Corteva Young Leader Program ($9,200 for one couple, $18,400 for two couples)
- ASA – 2026 ASA Awards Celebration Sponsorship ($6,000)
- ASA – 2026 Economic Analysis and Support ($5,000)
- ASA – 2026 ASA Action Partnership (ASAAP Membership) ($6,000)

Total Minimum Requested Funding: $42,300
ATTACHMENT 9

Members discussed travel arrangements and attending certain events that ASA hosts. Discussion ensued regarding biodiesels and seed oils.

The next promotion project proposal from the ***Clean Fuels Alliance America*** was presented before the board, requesting funding for the following promotional projects:

- Market Expansion Drive ($20,000)

- OEMs Maintain and Secure Approvals for B20+ ($20,000)

ATTACHMENT 10

Member Johnson inquired about the amount of soybean oil required for biodiesel production. The presenter explained that approximately 7.5 pounds of soybean oil are needed to produce one pound of biodiesel. For renewable diesel, around 9 pounds of soybean oil are needed per pound, while sustainable aviation fuel (SAF) takes about 10 pounds per pound. Further discussion ensued.

The next promotion project proposal from the ***Arkansas Farm Bureau*** was presented before the board, requesting funding for the following promotion projects:

- Soy in the Kitchen Grant Program ($15,000)
- Elementary Agriculture Education Pilot Program – Soybean Curriculum/Materials ($20,000)
- Soybean Ag Readers Update/Printing ($5,000)

ATTACHMENT 11

The next research proposal from the ***Midsouth Soybean Board*** was presented before the board, requesting funding for the following research projects:

- Breeding Maturity Group 4 Soybean with Enhanced Resistance to Southern Root-knot Nematode by Reducing Galling and Nematode Reproduction ($15,000)
- Screening and Selecting Non-Xtend Soybeans for Dicamba Tolerance ($13,750)
- Development of functional ultra-high stearic acid soybean germplasms ($0)
- Screening soybean germplasm and breeding soybeans for flood tolerance for early and reproductive stages ($15,000)
- Spatial and temporal variation of soil sampling affect phosphorus and potassium recommendations for soybean ($7,500)
- Exploitation of weed species extracts as an effective and environmentally friendly strategy to control insects and deer in soybean ($8,750)
- How does cover crop impact soil water dynamics and soybean production in Louisiana? ($6,000)
- Improving the efficacy of double stranded RNA (dsRNA) for practical field management of soybean diseases ($11,250)
- Development of climate-smart high yield practices associated with high-end biological treatments and soybean related microbiome resiliency ($15,000)
- LADDER (Large Agricultural Database that Drives Extension and Research) ($12,500)
- Enhanced Synthetic Microbiome Communities to Managed Sudden Death Syndrome ($4,527.25)
- Leveraging Photosynthetic Efficiency traits for improving soybean productivity in the Mid-South ($7,500)
- Expanding potential market demand for and access to whole soy foods through nutrition education ($8,311.25)

ATTACHMENT 12

The presenter also provided a presentation on the promotion project from the ***Southwest Soybean Council***, requesting funding for the "Recognizing Soybean Production Excellence by the continuance of the "Grow for the Green Yield Challenge Contest" for $206,900.
ATTACHMENT 13

The next promotion project titled "***WISHH***: FY26 WISHH Markets – the Future of the New U.S. Soy Exports," was presented before the board, requesting funding for $50,000. **ATTACHMENT 14**

Chairman Doyle asked how many countries WISHH is currently active in. The presenter replied that in 2024, it was 28, while this year it is around 20, noting that the fluctuations are influenced by geopolitical forces.

The next promotion project from the ***U.S. Soybean Export Council (USSEC)*** was presented before the board, requesting funding for the following promotion proposals:

- USSEC Annual Membership ($10,000)
- USSEC U.S. Soy Promotion in Europe ($25,000)

ATTACHMENT 15

Short break was called. Meeting resumed at 10:40 a.m.

PROJECT AWARDING/FUNDING
Chairman Doyle then introduced Inoussa Zaki, Chief Financial Officer for the AR Department of Agriculture, who provided a brief financial update to the board, stating that the board had approximately $9,235,776 in reserve to fund future projects. **ATTACHMENT 1**

Member Patrick Matt Smith then mentioned that the board should discuss whether to invest or reserve money this year. Discussion ensued.

Member Freeman asked Zaki how much the board spent on research and promotion projects last year. Zaki answered that the board spent approximately $3,842,996 in total last year. Member Freeman asked Zaki what the grand total would be if all projects were funded this year, and Zaki answered that it would be $4,339,969.56.

Discussion ensued. As the board funded projects, Zaki updated his financial documents. **ATTACHMENT 16**

Motion to fund all in-progress UADA research projects; moved by John Freeman, discussion ensued. Seconded by West Higginbothom. Motion carried.

Chairman Doyle asked what business the members wanted to address next.

Motion to fund all Midsouth Soybean research projects; moved by Patrick Matt Smith; seconded by Boyce Johnson. Motion carried, with recusals from John Freeman.

Member Freeman made the comment that he believed the UADA renewal projects should continue to be supported by the board.

Motion to fund all renewal/continuation research projects at UADA; moved by John Freeman, discussion ensued. Seconded by Josh Cureton. Motion carried.

Member Patrick Matt Smith mentioned that they should continue reviewing the new research projects, asking Zaki how much it would cost to fund all the research. Zaki answered that the total would be $3,193,964. Discussion ensued.

The board then addressed the new UADA research projects one at a time, prompting discussion.

Motion to fund the new research project from UADA, "Evaluating planting date decisions in the soybean/rice rotation" for $30,127; moved by Josh Cureton, seconded by Matthew Roberson. Motion carried.

Motion to fund the new research project from UADA, "Investigating the effect of growth regulators on soybean plant architecture and yield" for $31,306; moved by John Freeman, seconded by Josh Cureton. Motion carried.

Motion to fund the new research project from UADA, "Testing the range of soybean cultivars that can benefit from plant elicitor peptide treatment" for $25,767; moved by John Freeman, seconded by West Higginbothom. Motion carried.

Member Johnson inquired about the regulatory framework for new biological products arising from research. The UADA answered that these products face less stringent regulations compared to other agricultural products.

Members continued reviewing new research projects from the UADA.

Motion to fund the new research project from UADA, "Educating growers and consultants on insect monitoring and control" for $3,000. Moved by Matthew Roberson; seconded by Josh Cureton. Motion carried.

Motion to fund the new research project from UADA, "Economics automatic insecticide applications in Arkansas soybeans" for $43,254; moved by John Freeman, seconded by Josh Cureton. Motion carried.

Members reviewed their budget with Zaki and revisited tabled projects for further discussion.

Motion to fund the new research project from UADA, "Development, evaluation and production of agricultural biologicals for Arkansas crop production" for $23,857; moved by West Higginbothom, seconded by Patrick Matt Smith. Motion carried.

The board then reviewed the promotion projects.

Motion to fund the promotion project the AR Irrigation Yield Contest (Year 8) for $10,000; moved by Patrick Matt Smith; seconded by West Higginbothom. Motion carried.

Motion to fund the promotion project the Arkansas Future Ag Leaders Tour for $5,000; moved by West Higginbothom, seconded by John Freeman. Motion carried.

Motion to fund the Soybean Science Challenge for $85,525; moved by Patrick Matt Smith, seconded by West Higginbothom. Motion carried.

Motion to fund the Soybean College for $14,717; moved by West Higginbothom, seconded by John Freeman. Motion carried.

Motion to fund the Ag Day hosted by UADA Cooperative Extension Service in Poinsett county for $4,815.06; moved by John Freeman, seconded by Matthew Roberson. Motion carried.

Chairman Doyle then requested an updated funding amount from Zaki. Zaki answered that the board had spent approximately $3,471,332.56 in funding projects.

Lunch break was called at 11:30 a.m. Meeting resumed at 12:05 p.m.

The board resumed discussions of funding certain research and promotion projects.

Motion to fund the I2M project from the American Soybean Association for $7,500; moved by West Higginbothom, seconded by Josh Cureton. Motion carried.

Motion to fund the 2026 Soybean Leadership Academy Sponsorship from the American Soybean Association for $3,000; moved by Josh Cureton, seconded by West Higginbothom. Motion carried.

Motion to fund the 2026 SoyStats sponsorship from the American Soybean Association for $600; moved by John Freeman, seconded by Patrick Matt Smith. Motion carried.

Motion to fund the Young Leader two-phase training program from the American Soybean Association for $9,200; moved by John Freeman, seconded by West Higginbothom. Motion carried.

Motion to fund the 2026 ASA Awards Celebration from the American Soybean Association for $6,000; moved by West Higginbothom, seconded by Matthew Roberson. Motion carried.

Motion to fund the 2026 Economic Analysis and Support from the American Soybean Association for $5,000; moved by Patrick Matt Smith, seconded by West Higginbothom. Motion carried.

Motion to fund the Market Expansion Drive from the Clean Fuels Alliance America for $20,000; moved by Patrick Matt Smith, seconded by Josh Cureton. Motion carried.

Motion to fund the Soybean AgReaders Update/Printing from the Arkansas Farm Bureau for $5,000; moved by John Freeman, seconded by Patrick Matt Smith. Motion carried.

Motion to fund the Elementary Agriculture Education Pilot Program Soybean Curriculum/Materials from the Arkansas Farm Bureau for $20,000; moved by Josh Cureton, seconded by Matthew Roberson. Motion carried.

Motion to fund the Arkansas 2025 Grow for the Green Yield Challenge from the Southwest Soybean Council for $206,900; moved by West Higginbothom, seconded by Boyce Johnson. Motion carried, with a recusal from John Freeman.

Note: Shortly after this motion, the Department experienced an internet outage; remainder of meeting was captured on a recording device.

Members asked Zaki for an update on how much has been spent thus far, and Zaki provided that update.

Motion to fund the FY26: WISHH Markets – the future of New U.S. Soy Exports from WISHH for $40,000; moved by John Freeman, seconded by West Higginbothom. Motion carried.

Motion to fund the Annual Membership from USSEC for $10,000; moved by John Freeman, seconded by Patrick Matt Smith. Motion carried.

Motion to fund the U.S. Soy Promotion in Europe from USSEC for $25,000; moved by Patrick Matt Smith, seconded by Josh Cureton. Motion carried.

Motion to fund the NASDA Annual Meeting Sponsorship from the Arkansas Department of Agriculture for $10,000; moved by Matthew Roberson, seconded by West Higginbothom. Motion carried.

Motion to fund the Agricultural Learning Center from the Four States Fair & Rodeo for $10,000; moved by West Higginbothom, seconded by John Freeman. Motion carried.

The board then revisited several of the tabled projects for brief discussion.

OTHER BUSINESS

Admin Scott Bray informed the board that the Communications Group was unable to present their update via Zoom due to the Department's internet outage.

Dr. Slaton from the UADA asked the board to suggest research topics from funded projects that the Communications Group could amplify in their marketing efforts.

The board discussed decided to plan another meeting to receive a detailed update from the Communications Group, prompting further discussion.

The board discussed next meeting dates, tentatively deciding on meeting in Newport, Arkansas on July 23rd, 2025.

Meeting adjourned.

Brad Doyle

Brad Doyle, Chairman

Arkansas Soybean Promotion Board

Financial Statement

ATTACHMENT 1

For The Period July 1, 2024 - February 28, 2025

	June 2023	June 2024	February 2025	Budget 2025
Beginning Balance	$ 6,231,490	$ 9,347,445	$ 11,110,780	$ 11,110,780
Revenue				
Total Collections	$ 10,663,495	$ 10,364,704	$ 6,851,182	$ 7,800,000
Less				
USB Transfer	$ 4,948,222	$ 4,688,217	$ 2,759,900	$ 3,631,680
Other QSSB Transfers	$ 438,553	$ 417,200	$ 101,693	$ 312,000
State Collection Fee	$ 317,198	$ 308,582	$ 202,343	$ 224,640
Net Transfer to the Board	$ 4,959,521	$ 4,950,705	$ 3,787,245	$ 3,631,680
Other Income	$ 4,276	$ 47,846	$ 7,967	$ 7,500
Total Revenue	$ 4,963,797	$ 4,998,551	$ 3,795,212	$ 3,639,180
Expenses				
Promotion	$ 590,162	$ 519,592	$ 567,198	$ 793,560
Research	$ 1,239,261	$ 2,702,160	$ 2,699,614	$ 3,384,611
Board Expenses	$ 18,510	$ 13,465	$ 4,206	$ 13,465
Total Expenses	$ 1,847,932	$ 3,235,217	$ 3,271,017	$ 4,191,636
Ending Balance	$ 9,347,354	$ 11,110,780	$ 11,634,975	$ 10,558,323
Remaining Allocation				
Other Liabilities	$ 46,691	$ 157,735	$ 668,755	
Research	$ 1,485,989	$ 3,213,793	$ 1,549,507	$ 4,249,121
Promotion	$ -	$ 230,937	$ 180,937	$ 428,285
Total Remaining Allocation	$ 1,532,680	$ 3,602,464	$ 2,399,199	$ 4,677,406
Funds Available	$ 7,814,674	$ 7,508,315	$ 9,235,776	$ 5,880,917

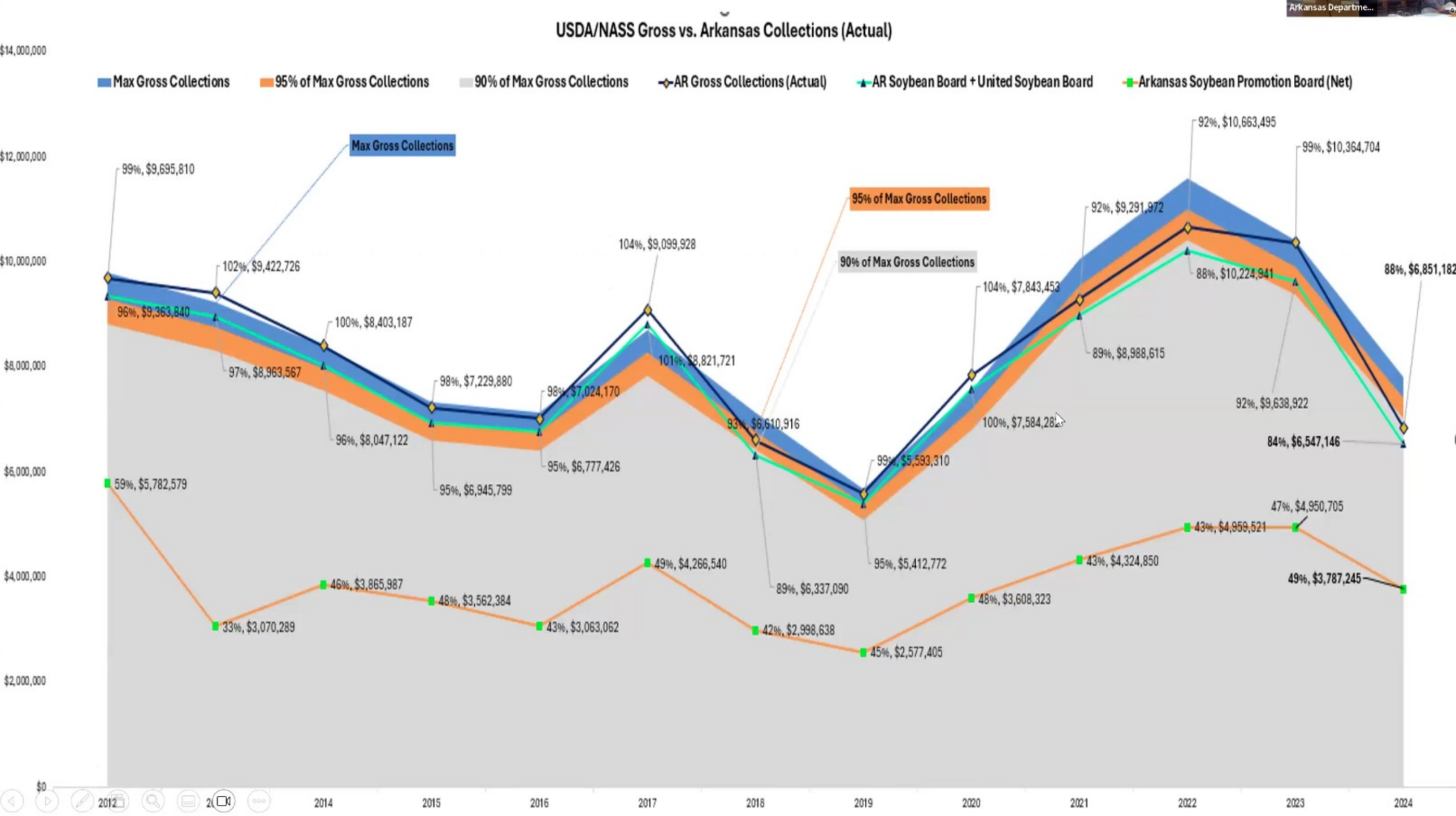
Arkansas Soybean Promotion Board
Annual Collections

	June 2023	June 2024	February 2025	Budget 2025	Estimated Budget 2025		
USDA Soybean Estimates							
NASS SOYBEANS - ACRES PLANTED	3,180,000	2,980,000	3,050,000	3,000,000	3,000,000	3,000,000	3,000,000
NASS SOYBEANS - ACRES HARVESTED	3,150,000	2,950,000	3,020,000	3,000,000	3,000,000	3,000,000	3,000,000
NASS SOYBEANS - YIELD, MEASURED IN BU / ACRE	50	53	55	52	52	52	52
NASS SOYBEANS - PROD, MEASURED IN BU	157,500,000	156,350,000	166,100,000	156,000,000	156,000,000	156,000,000	156,000,000
NASS SOYBEANS - PRICE RCVD, MEASURED IN $ / BU	$ 12.00	$ 13.10	$ 10.40	$ 10.00	$ 10.00	$ 10.00	$ 10.00
NASS Value	$ 1,890,000,000	$ 2,048,185,000	$ 1,727,440,000	$ 1,560,000,000	$ 1,560,000,000	$ 1,560,000,000	$ 1,560,000,000
Implied Checkoff Based on NASS	$ 9,450,000	$ 10,240,925	$ 8,637,200	$ 7,800,000	$ 7,800,000	$ 7,800,000	$ 7,800,000
Total Soybean Checkoff Collections For Arkansas				100%	100%	95%	90%
Assessed Bushels	151,466,018	153,516,906	131,923,248	156,000,000	156,000,000	148,200,000	140,400,000
Assessed Bushels Value	2,131,150,000	2,026,794,850	1,372,295,920	$ 1,560,000,000	$ 1,560,000,000	$ 1,407,900,000	$ 1,263,600,000
In State Collections	10,235,500	$ 9,942,016	$ 6,741,501	$ 7,487,691	$ 7,487,691	$ 6,757,641	$ 6,065,029
Out of State Collections	427,994	$ 422,688	$ 109,681	$ 312,309	$ 312,309	$ 281,859	$ 252,971
Total Checkoff Collections	10,663,495	$ 10,364,704	$ 6,851,182	$ 7,800,000	$ 7,800,000	$ 7,039,500	$ 6,318,000
Implied Price	$ 14.07	$ 13.20	$ 10.40	$ 10.00	$ 10.00	$ 9.50	$ 9.00
Net Collections for Arkansas Soybeans							
Total Checkoff Collections	$ 10,663,495	$ 10,364,704	$ 6,851,182	$ 7,800,000	$ 7,800,000	$ 7,039,500	$ 6,318,000
QSSB Transfer							
Alabama	$ 9	$ -		$ 19,173	$ 19,173	$ 17,304	$ 15,530
Colorado		$ -		$ 90	$ 90	$ 82	$ 73
Florida		$ -		$ 132	$ 132	$ 119	$ 107
Georgia		$ -		$ 71	$ 71	$ 64	$ 57
Illinios	$ 1,562	$ 1,092		$ 1,873	$ 1,873	$ 1,690	$ 1,517
Indiana	$ 288	$ -		$ 129	$ 129	$ 117	$ 105
Iowa	$ 114	$ -		$ 1,344	$ 1,344	$ 1,213	$ 1,088
Kansas		$ -		$ 213	$ 213	$ 192	$ 172
Kentucky	$ 1,758	$ -		$ 3,379	$ 3,379	$ 3,050	$ 2,737
Louisiana	$ 4,491	$ 11,675	$ 6,595	$ 7,406	$ 7,406	$ 6,684	$ 5,999
Michigan	$ 4,287	$ -		$ 1,786	$ 1,786	$ 1,612	$ 1,447
Minnesota		$ -		$ 70	$ 70	$ 63	$ 57
Mississippi	$ 192,887	$ 170,846	$ 40,558	$ 89,427	$ 89,427	$ 80,707	$ 72,435
Missouri	$ 202,526	$ 218,283	$ 22,230	$ 126,456	$ 126,456	$ 114,126	$ 102,429
Nebraska		$ -		$ 118	$ 118	$ 106	$ 95
Ohio	$ 2,449	$ -		$ 3,054	$ 3,054	$ 2,756	$ 2,473
Oklahoma	$ 265	$ 2,833	$ 9,984	$ 20,489	$ 20,489	$ 18,491	$ 16,596
Tennessee	$ 24,019	$ 5,627	$ 8,973	$ 20,045	$ 20,045	$ 18,090	$ 16,236
Texas	$ 3,645	$ 6,844	$ 13,353	$ 16,491	$ 16,491	$ 14,883	$ 13,358
Wisconsin	$ 254	$ -		$ 255	$ 255	$ 230	$ 206
TOTAL QSSB Transfer	$ 438,553	$ 417,200	$ 101,693	$ 312,000	$ 312,000	$ 281,580	$ 252,720
United Soybean Board Payment	$ 4,948,222	$ 4,688,217	$ 2,759,900	$ 3,631,680	$ 3,631,680	$ 3,277,591	$ 2,941,661
Arkansas Misc Tax Collection Fee	$ 317,198	$ 308,582	$ 202,343	$ 224,640	$ 224,640	$ 202,738	$ 181,958
Net Transfer to the Board	***$ 4,970,080.35***	**$ 4,950,705.16**	**$ 3,787,245.42**	**$ 3,631,680**	**$ 3,631,680**	**$ 3,277,591**	**$ 2,941,661**
Difference from Budget							
Net Arkansas Assessed Soybean Bushels							
Gross Transfers to the Board *less QSSB Transfers*	$ 10,235,500	$ 9,947,503	$ 6,749,489	$ 7,488,000	$ 7,488,000	$ 6,757,920	$ 6,065,280
Bushels Assessed	151,466,018	153,516,906	131,923,248	156,000,000	156,000,000	148,200,000	140,400,000
Implied Price	$14.07	$13.20	$10.40	$10.00	$ 10.00	$ 9.50	$ 9.00
NASS Soybean Production Estimate	157,500,000	156,350,000	166,100,000	156,000,000	156,000,000	156,000,000	156,000,000
Bushel Difference	6,033,982	2,833,094	34,176,752	-	-	7,800,000	15,600,000
Percent of Bushels Assessed	96.2%	98.2%	79.4%	100%	100%	95%	90%
Uncollected Checkoff	$ 424,495	$ 187,019	$ 1,777,572	$ -	$ -	$ 370,500	$ 702,000
Percent Checkoff Collected	108%	97%	78%	96%	96%	87%	78%
Remainder Due to State	$ 212,247.62	$ 93,509.25	$ 888,786.06	$ -	$ -	$ 185,250	$ 351,000

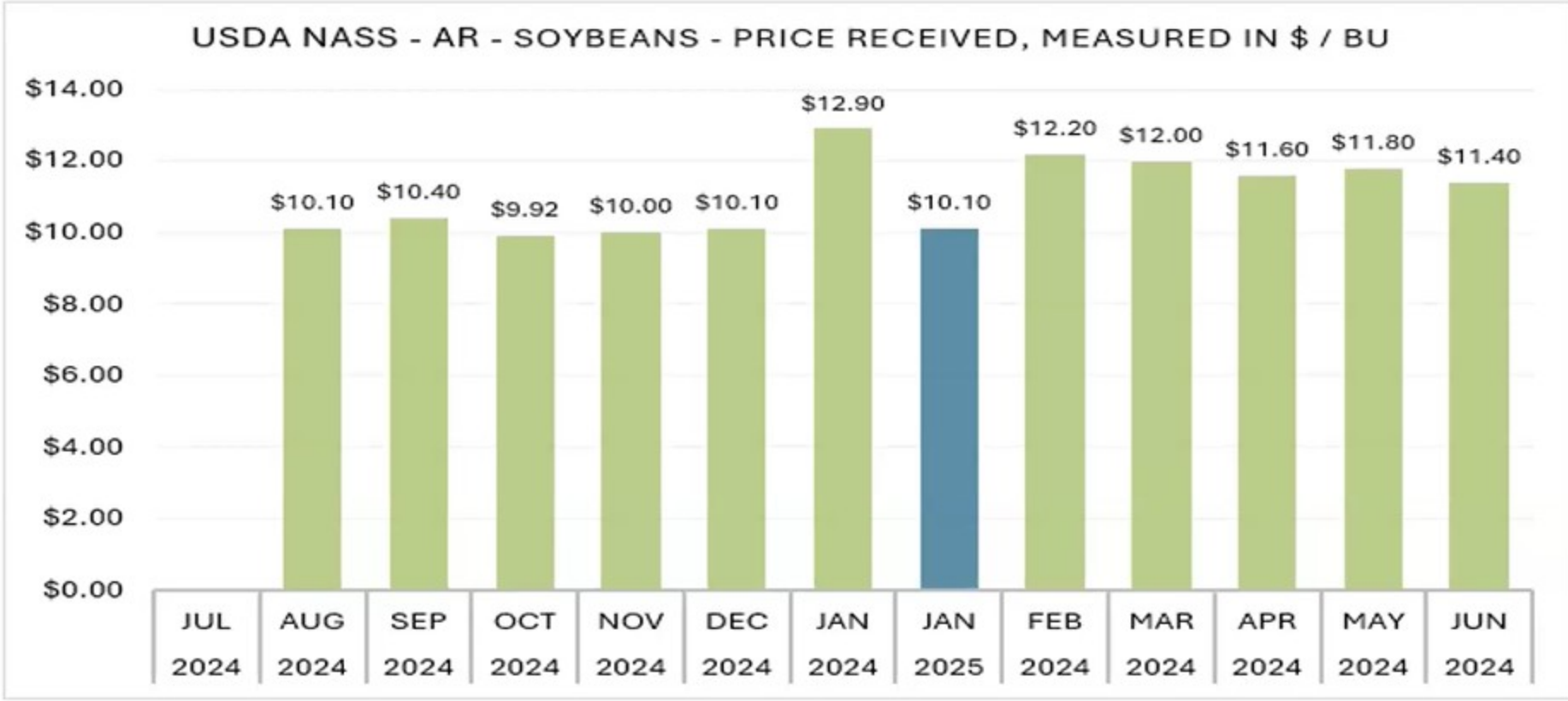
2024 Production #s from USDA NASS 2024 Forecast Data

Arkansas soybean acreage, yield, production, price, and check-off rate with estimated maximum gross collections for years 2012 to 2024

Production Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Fiscal Year, July 1 - June 30	FY-2013	FY-2014	FY-2015	FY-2016	FY-2017	FY-2018	FY-2019	FY-2020	FY-2021	FY-2022	FY-2023	FY-2024 Estimate	FY-2025 Estimate
Planted Acres	3,200,000	3,270,000	3,230,000	3,200,000	3,130,000	3,530,000	3,270,000	2,650,000	2,820,000	3,040,000	3,180,000	2,980,000	3,000,000
Harvested Acres	3,150,000	3,240,000	3,200,000	3,170,000	3,090,000	3,500,000	3,210,000	2,610,000	2,800,000	3,000,000	3,140,000	2,950,000	3,000,000
Yield, measured in bushels / acre	43.5	43.5	49.5	49	47	51	50.5	49	51.5	52	52	54	52
Production, measured in bushels	137,025,000	140,940,000	158,400,000	155,330,000	145,230,000	178,500,000	162,105,000	127,890,000	144,200,000	156,000,000	163,280,000	159,300,000	156,000,000
Price received, measured in $ / bushels	$14.30	$13.10	$10.60	$9.46	$9.83	$9.77	$8.81	$8.87	$10.50	$12.90	$14.20	$13.10	$10.00
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Total Estimated Value of Production	$1,959,457,500	$1,846,314,000	$1,679,040,000	$1,469,421,800	$1,427,610,900	$1,743,945,000	$1,428,145,050	$1,134,384,300	$1,514,100,000	$2,012,400,000	$2,318,576,000	$2,086,830,000	$1,560,000,000
Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Max Gross Collections	**$9,797,288**	**$9,231,570**	**$8,395,200**	**$7,347,109**	**$7,138,055**	**$8,719,725**	**$7,140,725**	**$5,671,922**	**$7,570,500**	**$10,062,000**	**$11,592,880**	**$10,434,150**	**$7,800,000**
95% of Max Gross Collections	$9,307,423	$8,769,992	$7,975,440	$6,979,754	$6,781,152	$8,283,739	$6,783,689	$5,388,325	$7,191,975	$9,558,900	$11,013,236	$9,912,443	$7,410,000
90% of Max Gross Collections	$8,817,559	$8,308,413	$7,555,680	$6,612,398	$6,424,249	$7,847,753	$6,426,653	$5,104,729	$6,813,450	$9,055,800	$10,433,592	$9,390,735	$7,020,000
AR Gross Collections (Actual)	$9,695,810	$9,422,726	$8,403,187	$7,229,880	$7,024,170	$9,099,928	$6,610,916	$5,593,310	$7,843,453	$9,291,972	$10,663,495	$10,364,704	$6,851,182
AR Soybean Board + United Soybean Boarc	$9,363,840	$8,963,567	$8,047,122	$6,945,799	$6,777,426	$8,821,721	$6,337,090	$5,412,772	$7,584,282	$8,988,615	$10,224,941	$9,638,922	$6,547,146
Other Qualified State Soybean Boards	$331,970	$459,159	$356,064	$284,081	$246,744	$278,207	$273,826	$180,538	$268,286	$303,357	$438,553	$417,200	$101,693
United Soybean Board (Net)	$3,273,364	$5,597,066	$3,923,480	$3,161,306	$3,497,455	$4,281,474	$3,141,139	$2,667,418	$3,731,732	$4,385,343	$4,948,222	$4,688,217	$2,759,900
Arkansas Soybean Promotion Board (Net)	$5,782,579	$3,070,289	$3,865,987	$3,562,384	$3,063,062	$4,266,540	$2,998,638	$2,577,405	$3,608,323	$4,324,850	$4,959,521	$4,950,705	$3,787,245
AR Actual Gross Collections % of MGC	99%	102%	100%	98%	98%	104%	93%	99%	104%	92%	92%	99%	88%
AR Soybean & USB % of MGC	*96%*	*97%*	*96%*	*95%*	*95%*	*101%*	*89%*	*95%*	*100%*	*89%*	*88%*	*92%*	*84%*
QSSB % of MGC	*3%*	*5%*	*4%*	*4%*	*3%*	*3%*	*4%*	*3%*	*4%*	*3%*	*4%*	*4%*	*1%*
USB % of MGC	*33%*	*61%*	*47%*	*43%*	*49%*	*49%*	*44%*	*47%*	*49%*	*44%*	*43%*	*45%*	*35%*
AR Soybean % of MGC	*59%*	*33%*	*46%*	*48%*	*43%*	*49%*	*42%*	*45%*	*48%*	*43%*	*43%*	*47%*	*49%*


USDA/NASS Gross vs. Arkansas Collections (Actual)
Max Gross Collections
95% of Max Gross Collections
90% of Max Gross Collections
AR Gross Collections (Actual)
AR Soybean Board + United Soybean Board
Arkansas Soybean Promotion Board (Net)
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
2012
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
99%, $9,695,810
102%, $9,422,726
100%, $8,403,187
98%, $7,229,880
98%, $7,024,170
104%, $9,099,928
101%, $8,821,721
93%, $6,610,916
99%, $5,593,310
104%, $7,843,453
92%, $9,291,972
92%, $10,663,495
99%, $10,364,704
88%, $6,851,182
96%, $9,363,840
97%, $8,963,567
96%, $8,047,122
95%, $6,945,799
95%, $6,777,426
89%, $6,337,090
95%, $5,412,772
100%, $7,584,28
89%, $8,988,615
88%, $10,224,941
92%, $9,638,922
84%, $6,547,146
59%, $5,782,579
33%, $3,070,289
46%, $3,865,987
48%, $3,562,384
43%, $3,063,062
49%, $4,266,540
42%, $2,998,638
45%, $2,577,405
48%, $3,608,323
43%, $4,324,850
43%, $4,959,521
47%, $4,950,705
49%, $3,787,245

Year	Period	Data Item	Value
2024	JUL	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	
2024	AUG	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$10.10
2024	SEP	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$10.40
2024	OCT	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$9.92
2024	NOV	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$10.00
2024	DEC	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$10.10
2024	JAN	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$12.90
2025	JAN	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$10.10
2024	FEB	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$12.20
2024	MAR	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$12.00
2024	APR	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$11.60
2024	MAY	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$11.80
2024	JUN	SOYBEANS - PRICE RECEIVED, MEASURED IN $ / BU	$11.40



Source USDA NASS 2024 Forecast Data

Project Title: Designing Cost-Effective Irrigation System for Enhancing Crop Water Productivity in Soybean Production in Arkansas

Principal Investigator (PI): Dr. Ajoy Kumar Saha, Ph.D.

Abstract:
Water shortage has been an important issue for Arkansas Agriculture. Soybeans are widely grown in Arkansas and usually, furrow irrigation is applied to secure higher yields. However, choice of irrigation methods and scheduling can lead to overuse of water resources. Designing and adopting a water productivity-enhancing and cost-effective irrigation system has the potential to reduce the wastage of irrigation water, enhance crop productivity, and increase profitability in soybean farming. Adopting the evapotranspiration (ET) based and precise Subsurface Drip Irrigation (SDI) method over traditional furrow irrigation practices has the potential to save water (more than 50% irrigation water), energy for pumping and total cost of soybean production. However, the cost-effectiveness of such methods are not known. The proposed research project will investigate the water savings potential for the subsurface drip irrigation (SDI) method, compared to furrow irrigation method. In addition, impact of using ET based irrigation on water and cost saving against routine irrigation will be studied. This study will be conducted in the UAPB campus farm having installed soil moisture sensors and monitored weather parameters. Using FAO-developed AquaCrop software, crop Evapotranspiration (ET_c) based irrigation scheduling will be designed from historical weather data. The irrigation amount will be applied in both systems based on the available soil moisture and weather forecast ($ET_{c\text{-}adjust}$). The quantity of applied water will be monitored and measured with flow meters. Soybean grain yield, 100-grain weight, vegetative growth (area cover), dry biomass, crop water requirement, crop water productivity, water use efficiency, and cost for irrigation practices will be investigated for each irrigation method and its effectiveness per acre of the production system. This research outcome would generate real research documentation and would facilitate Arkansas Soybean Farmers' decision-making based on evidence-based data and insights to adopt the SDI system that would be the most cost-effective and most water-saving technique for Soybean production over conventional furrow irrigation. Based on the study results, we will also provide recommendations for irrigation scheduling in soybean production in Arkansas during normal weather (rainfall and temperature prediction) and good and bad (drought) weather conditions.

1 Brief Statement of the Problem

Soybean production in Arkansas is ranked 1st among all southern states and ranked 10th nationally (Coats and Ashlock, 2000). To grow soybeans in Arkansas, farmers usually practice furrow irrigation because it is an easy method and crucial for achieving higher yields (Board and Kahlon, 2011). However, depending on soil type and infiltration capacity, conventional furrow irrigation can lead to the overuse of water resources that happens due to the unavoidable runoff losses of about 20% to 70% (Araujo et al., 2019) and deep percolation losses of about 25% (Linderman et al., 1976). According to the census of irrigation report of National Agricultural Statistics Services (NASS), the irrigated acres increased by 7.7% between 2007 to 2012 (NASS, 2013) and 12% between 2018 to 2023 (NASS, 2023). Moreover, the irrigated cropland area is expanding in Arkansas due to the uneven rainfall distribution and rise in temperatures due to climate change have increased the irrigation needs for soybeans (Zhang et al., 2019). In eastern Arkansas, about 90% of the total water comes from the Mississippi River Valley alluvial aquifer (MRVAA) (Reba and Massey, 2020). A recent study observed that this groundwater source is overexploited and excessive pumping jeopardizes the sustainability of MRVAA groundwater resources (Reba et al., 2017b, 2017a). Increasing irrigated areas, global warming and climate change are increasing pressure on both surface and groundwater

water resources. Therefore, it's becoming essential to adopt precise and sustainable strategies in Arkansas to continued agricultural production under limited water resources (Aydinsakir et al., 2021). The water scarcity, fluctuating rainfall patterns and (short and long-term) agricultural drought pose challenges for farmers' irrigation management (Jagtap and Jones, 2002). Precision irrigation water application along with weather based irrigation scheduling is the key to achieve sustainable agricultural water management (the high water productivity and ensure food security under limited water application). Therefore, it is required to investigate the feasibility of evapotranspiration (ET) based irrigation scheduling and high efficient irrigation method for Soybean crops in Arkansas as well as it's cost effectiveness for the Soybean production. Subsurface drip irrigation (SDI) methods is a well known precise irrigation practice that emit/irrigate water close to the root zone through underneath pipe systems. Usually, SDI is widely used for horticultural crops which shows excellent water-efficiency by avoiding runoff and evaporation losses. This study will investigate water saving capacity (irrigation efficiency), investment and maintenance cost per unit yield and develop a generalized irrigation schedule for both traditional furrow and precise SDI irrigation methods.

2. Research Goal/Objectives

This project's goal is to identify the optimal irrigation timing (scheduling) during the growing season for the widely used furrow and most efficient subsurface drip irrigation (SDI) method. Recent decades observed frequent agricultural drought under climate change scenarios that increased the irrigation demand for agricultural production. In Arkansas, groundwater is widely used for irrigation, and resources are diminishing more than replenishing. Therefore, it is required to apply irrigation water precisely and minimize the water losses from the edge of the field. In this study, we will develop the optimal irrigation scheduling for Arkansas's Soybean crop for furrow and SDI irrigation methods by integrating regional weather data (Evapotranspiration-based) and a specialized crop water model (AquaCrop model). Afterward, crop water productivity, water use efficiency, water saving, and detailed production cost will be compared between furrow and SDI irrigation methods. The specific aim of this study is to (1) develop a weather-based irrigation schedule for soybean crops under furrow and SDI irrigation method, (2) Soybean grain yield, 100-grain weight, vegetative growth (area cover), dry biomass, crop water requirement, crop water productivity, water use efficiency, cost for irrigation practices, and profitability comparison between the furrow and SDI irrigation methods with and without ET based irrigation scheduling.

3 Anticipated Outcomes & Potential Benefits of Arkansas Soybean Industries

Objective 1: Develop a weather-based irrigation schedule for soybean crops under furrow and SDI irrigation method.

Anticipated Outcomes and Benefit: It is anticipated that weather-based irrigation scheduling for furrow and SDI method will require less water, reduce the cost of irrigation, and, more interestingly it will decrease groundwater withdrawal. Eventually, water resources will be sustainable and saved for other uses. Farmers would be able to apply irrigation efficiently by adopting climate-smart weather-based irrigation scheduling to maximize profits while minimizing water usage. Research results will be shared with the stakeholders through extension bulletins, and peer-reviewed journal articles/reports and presentations in farmer association meetings such as Fram Bureau, Arkansas Soybean Board. Thus, the project will facilitate soybean farmers decision-making on irrigation strategies, for both traditional furrow and SDI irrigation methods. Finally, the results can guide farmers in applying optimal amounts of irrigation to maximize yields and conserving water resources in Arkansas.

Objective 2: Crop water productivity, water use efficiency, water saving, detailed production cost and profitability comparison between the furrow and SDI irrigation methods with and without ET-based irrigation scheduling.

Anticipated Outcomes and Benefit: It is anticipated that **the** precise SDI method has the potential to save a significant amount of water application by achieving higher water productivity than the traditional furrow irrigation method. Because the SDI method avoid runoff, and evaporation losses in the field and minimize deep percolation loss. It is a common understanding that furrow irrigation practices are easy and low cost whereas the subsurface drip irrigation method needs a higher initial investment cost due to the subsurface pipe system. But the per unit cost of soybean production might be different because SDI would reduce the energy cost by decreasing 50-60% less water application. Beside, this saved amount of water could be utilized for the expansion of irrigated areas that would increase the scope of yield in unirrigated acres. In addition, the SDI system would require less monitoring and less involvement during its operation. In contrast, the traditional furrow systems require higher inspection to avoid conveyance and runoff loss. Considering all possible aspects, we will make a detailed cost comparison and profitability analysis of alternate choices. Thus, the proposed project will design and promote cost-effective, water productivity enhancing irrigation system for Soybean farming in Arkansas.

4. Research Method

Scientific irrigation scheduling (applying water based on the crop's evapotranspiration demand) can boost soybean yields while conserving scarce water resources for future needs (Adeyemi et al., 2017). A standard and reliable crop water model is important for planning and managing irrigation schedules (Ewaid et al., 2019). There are several simulation models to estimate crop water use and irrigation requirements. Usually, these models use local weather data consisting of temperature, rainfall, solar radiation, humidity, etc. as inputs to calculate evapotranspiration and the soil water balance (Xu and Singh, 2005) from soil-plant-water relation. AquaCrop, a widely used and well-recognized model, uses the FAO-56 Penman-Monteith equation for estimating reference evapotranspiration ET_o (Córdova et al., 2015). AquaCrop has the option to incorporate rainfall/effective rainfall in the irrigation schedule that will be integrated into this model and adjust the ET_c with effective rainfall. The details of this research method are described below:

4.1 Site and land preparation

This research will be conducted on the UAPB campus farm during the growing season of 2025 and 2026. The land will be prepared in the month of April and research will be conducted in two plots having dimensions of 100 ft X 50 ft. Furrow will be prepared with 75 cm single-row spacing for furrow and SDI irrigation systems. The subsurface drip irrigation tape will be installed underground at 30 cm depth from the ground surface and placed between two rows 75 cm apart. Soybean seed will be sown in May and standard fertilizer dose will applied in the field during the growing season.

4.2 Soil sampling

A total of twenty soil samples will be collected from four different depths (0-10 cm, 10-20 cm, 20-30 cm, 30-60 cm) at five different points from each plot by following standard protocol. Soil's physical, chemical, and hydraulic properties such as available nutrients, soil texture, hydraulic conductivity (k), bulk density (ρ), porosity (n), water holding capacity (WHC), organic matter content (OM) and particle size distribution will be tested for each sample. Some of the soil properties (soil texture, k, ρ, n, WHC, OM and particle size distribution) will be tested in Soil and Water Lab in the University of Arkansas at Pine Bluff and a few of the properties (soil routine nutrients, organic matter, etc.) will be tested from a commercial lab by sending soil samples with proper protocol.

4.3 Soil moisture sensor

Sentek Drill & Drop Bluetooth Probes (Sensor TriSCAN/SDI-12, Model: Bluethooth1.1, FCC ID: 2ARQB-BLUETOOTH. It is 90 cm long and it's top dia. is 30 mm and bottom dia. is 25 mm) will be installed 5 different points of each plots (total 10 points in two plots of the experiment) to measure hourly soil moisture and temperature. Probes were deployed in the field during the growing season from May-November of 2025 and 2026. The sensor will be removed and reinstalled again during field operation to avoid destruction. Each sensor will monitor the dynamic soil moisture for 9 different points of 0-90 cm soil profile. Firstly, the soil profile was drilled about 90 cm with an electric drill machine, and inserted the probe into the soil profile.

4.4 Historical data

Historical weather data from 2004-2024, including daily maximum and minimum temperature, precipitation, solar radiation, and wind speed will be obtained from the website of the Air & Water Database Public Reports, NRCS, USDA (https://wcc.sc.egov.usda.gov/nwcc/site?sitenum=2083). Historical data will be collected for at least ten weather stations in Arkansas.

4.5 Irrigation Scheduling and AquaCrop Modeling

The AquaCrop model developed by FAO will be used to simulate daily soil water balance and analyze crop water requirements and irrigation needs from historical weather data. The AquaCrop model will run on a daily time-step for the entire growing season from May to October for each year of weather data. In this process, the crop coefficient curve will be collected from FAO-56 paper and crop water requirement will be estimated from the historical weather data by multiplying crop coefficient and evapotranspiration. This will develop a generalized irrigation design and plan for the field experiment to choose the inflow and supply devise and time to irrigate for the Arkansas region. For conducting irrigation events during the experimental period, effective rainfall will be considered and will be adjusted the irrigation water requirement for the ongoing weather conditions and weather forecast. Effective rainfall will be calculated using the USDA SCS Curve Number method.

4.6 Analysis

Annual and seasonal irrigation water requirements will be estimated and average values over the historical time period under different weather conditions (for example dry, wet, medium dry years according to the National Integrated Drought Information System) will be calculated. Variability in water requirements between years and different locations was analyzed using standard statistical tests. Correlation analysis was done to study the influence of climatic variables on irrigation water requirements. From field experiments during 2025-2026, the Soybean grain yield, 100-grain weight, vegetative growth (area cover), dry biomass, crop water requirement, crop water productivity, water use efficiency, and cost for irrigation practices comparison between the furrow and SDI irrigation methods.

5. How the Entity will be Accountable for Funds Use: The procurement of equipment and laboratory supplies and hiring of undergraduate students will be completed by following the University of Arkansas at Pine Bluff standard operating procedures. It will be consistent with the federal and state granting agencies' procedures, policies, and guidelines. Airfare and ground transportation for trips to the sites, meetings, and conferences will be available at the lowest possible rate during travel time. Thus, the rate of return for the dollar spent on this project will be manifold in its outcomes.

Public Value

Results will be disseminated via publications in both local and highly respected international journals. The results will also be presented to farmers and scientists at local and international conferences (American Society of Agricultural and Biological Engineers & Tri-Society Conference). This would not only contribute to agricultural scientific knowledge but also provide information on soybean and water resources research.

6. Experiences and Collaborators: Project PI Dr. Ajoy Saha is a young faculty and started to work for University of Arkansas at Pine Bluff (UAPB) since Fall 2023. He has required field experience on Soybean production system during PhD research. He recently conducted a deficit irrigation experiment in Summer 2024 in UPAB campus with collaboration with the UAPB colleague. This project will collaborate with Dr. Uttam Deb (Agricultural Economist), Jaafar Abudulridhia (Agricultural Engineer), Dr. Sixte Ntamatungiro (Soil Scientist), Dr. Tracy Dunbar (Agricultural Business Specialist) and Dr. Shahidul Islam (Plant Scientist).

Figure 1. Illustration of plot scale deficit irrigation experiment in the UAPB campus in summer 2024. In picture Dr. Ajoy Saha was applying certain volume of irrigation water in each plot that was estimated from soybean crop evapotranspiration requirement.

7. University of Arkansas at Pine Bluff (UAPB)'s audited financial statements will be found under the University of Arkansas Systems (see the link below). Please see page 8 and 58 for detailed about the UAPB. Please contact with PI if need further specific information about financial audited statement. https://arklegaudit.gov/downloadReport.php?id=EDHE14124

Budget:

Overall budget is given in Table 1, then the specific item wise detailed budget is given in following Table 2-Table 4.

Table 1. Category wise budget for this project including salaries/benefits, travel, direct costs, and research costs

Cost Category	**Year 1**	**Year 2**	**Total**
Salaries and Wages (Undergrad Students)	$10,000	$10,000	$20,000
Fringe Benefits (31% of salaries)	$3,100	$3,100	$6,200
Equipment's	$10,000	$1,000	$11,000
Supplies	$2,000	5,00	$2,500
Travel to Meetings	$2,000	$2,000	$4,000
Other (publication costs and soil testing)	$3,000	$3,000	$6,000
Total Indirect Cost (Research cost)	$30,100	$19,105	$49,700
Total Indirect Cost (59.5% of Salaries)	$5,950	$5,950	$11,900
Total	**$36,050**	**$25,055**	**$61,600**

Budget justification:

Salaries and Wages: $26,200. (Salary: $20,000 and fringe benefit: $6,200).

We are requesting funds to support two undergraduate students (of BS in Agricultural Engineering program) during the two years of project periods (especially undergrad students will work in the summer and post harvesting data collection periods, Approximately 22 weeks/student having hours rate $10 as per current university rules). Those undergraduate students could help to conduct field and laboratory experiments by collecting soil samples, and field operations (for example, irrigation, planting, harvesting, weeding, and performing lab tests. This could create opportunities for undergrad students to learn hands-on in practical classes and get preliminary guidance for their undergraduate

thesis work. *One undergraduate student:* An undergraduate student (cost per year) = $11.26/hr. x 20hr/week x 4wk/month x 5.55 months **= *$5,000.00*** (per student); Cost for 3 years = $5,000.00 (yr. 1) + $5,000.00 (yr. 2) + $5000.00 (yr. 2) = ***$10,000.00*** (per student).

Equipment: *$11,000*

Table 2. Detailed budget for the equipment of $10,000

Equipment				
Item Name	**Unit Price**	**Quantity**	**Price [$]**	**Comments**
1. Soil moisture sensor (90 cm long Sentek Bluetooth senor or Watermark soil moisture Monitoring set)	$1000	11	$11000	
Total=			**$11,000**	

Supplies: $2,500

Table 3. Detailed budget for the Supplies of $2,500

Supplies				
Item Name	**Unit Price**	**Quantity**	**Price [$]**	**Comments**
1. Sub-Surface Dripline with Copper Shield Technology	$6	1000 ft	$600	
2. LDPE Poly Tubing (pipe)	$200	2	$400	
3. Centrifugal Pumps / Industrial Pumps	$500	1	$500	
4. Flow meter (Plastic Pipeline DN80 PVC Water Flow Meter)	$185	2	$370	
5. Soybean seed (a 50 lb bag)	$45	2	$90	
6. Zip lock bags for soil sample collection (ULINE S-494)	$45	2	$90	
7. Measuring tape	$20	3	$60	
8. Stake Wire Marking Flags	$2	50	$100	
9. Regular Office supplies, including but not limited to, paper, pens, and currier charge for shipping samples)	$290	-	$290	
		Total=	$2500.00	

Note: This price is approximate based on the price listed on different websites on 01/29/2025. In this experiment, we designed our experiment layout with two treatments. A plot with Treatment 1 will be controlled (furrow irrigation). A plot with treatment 2 that will minimize water use by subsurface drip irrigation. We will collect soil samples from 4 different depths to test it soil's physical and hydraulic properties from each field.

Travel: Total $4,000

Project PI and undergraduate students will travel to attend regional workshops, seminars, and training sessions; attend society meetings (for example: American Society of Agricultural and Biological Engineers, ASABE, Arkansas Section ASABE); and present research outcomes at the conferences.

Others (Publication and Page Charges): $6,000

Editorial, composition, and related work are needed to prepare submissions for publication and cover soil and plant tissue testing for soil nutrient availability/stored and plant biomass nutrient consumption/assimilation.

Table 4. Detailed budget for the travel of $6000

Item	Rate	Quantity	Year	Tota
Publication	$2,500	2	-	$5,000
Soil samples nutrient test (Routine Soil Analysis)	$20	40/year	2	$800
Shipping cost of those samples	-	-	2	$200
			Total=	$40000.

**Plant tissue and soil test cost rate based on Ward Lab Inc. It might vary if time or lab changes.*

Note for other expenditures: Soil sampling will be collected before starting the growing season. We will collect soil samples from four different depths from two different treatments to measure soil physical: bulk density, porosity, water holding capacity, and hydraulic conductivity. Approximately 40 samples per year (4 depths: 0-10 cm, 10-20 cm, 20-30 cm, 30-60 cm).

Indirect cost: $11,900 (which is 59.5% of Salaries as per university rules)

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Ewaid, S.H., Abed, S.A., Al-Ansari, N., 2019. Crop water requirements and irrigation schedules for some major crops in Southern Iraq. Water 11, 756.

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Reba, M.L., Massey, J.H., 2020. Surface Irrigation in the Lower Mississippi River Basin: Trends and Innovations. Transactions of the ASABE 63, 1305–1314. https://doi.org/10.13031/trans.13970

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Zhang, Y., Wang, Y., Niu, H., 2019. Effects of temperature, precipitation and carbon dioxide concentrations on the requirements for crop irrigation water in China under future climate scenarios. Science of the Total Environment 656, 373–387.

Curriculum Vitae

NAME: Ajoy Kumar Saha
POSITION TITLE: Assistant Professor, University of Arkansas at Pine Bluff, AR 71601
ORCID iD: **https://orcid.org/0000-0002-2096-1592**

PRIMARY ORGANIZATION AND LOCATION:

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Bangladesh Agricultural University, Bangladesh	Bachelor	03/2008	Agricultural Engineering
Bangladesh Agricultural University, Bangladesh	Master	01/2010	Irrigation and Water Management
KU Leuven and VUB, Belgium	Master	09/2016	Water Resources Engineering
South Dakota State University, SD, USA	PhD	08/2023	Agricultural & Biosystems Engineering

Research & Professional Experience

Duration	Position details
Jul 2023-	Assistant Professor-Agricultural Engineering (tenure track), Dept. of Agriculture, University of Arkansas at Pine Bluff (UAPB), AR 71601
Apr-Jun 2023	Research Associate, Dept. of Ag & Bio. Engineering, South Dakota State University SDSU), SD 57007.
2019- 2023	Graduate Research Assistant, Dept. of Ag & Bio. Engineering, SDSU, SD 57006
2013-2019	Assistant Professor (tenure-track), Sylhet Agricultural University, Bangladesh
2011-2012	Executive Officer (Ag. Engineer), Federal Government Bank, Bangladesh
2009-2010	Extension Officer (Ag. Engineer), Dept. of Agricultural Extension (DAE), Bangladesh

Collaborators & Affiliations

SL	Affiliations	Collaborators
1	North Carolina A&T State University	Aryal, Niroj, Blessing, Masasi
2	University of Arkansas at Pine Bluff	Abdulridha, Jaafar; Badradeen, Emad Omar; Islam, Md Shahidul; Jiang, Qinglong; Raj, Vinay
3	University of Nebraska–Lincoln	Aich, Nirupam; Brown-Brandl, Tami; Lai, Rebecca; Wolf, Marilyn; Vuran, Mehmet Can
4	University of Arkansas	Atungulu, Griffiths G.; Doss, William; Ferreira, Sun; Kariyat, Rupesh; Koparan, Cengiz; Liao, Haitao; Pan, Yanjun; Rahman, Mahfuzur; Runkle, Benjamin R.; Speir, Shannon; Subbiah, Jeyam; Zhang, Shengfan; Wang, Dongyi
5	Ducks Unlimited	Allen, Jessica;
6	Boise State University	Cantley, Kurtis; Estrada, David; Lamborn, Daniel
7	University of Maryland	Dasgupta, Abhijit
8	University of Arkansas Division of Ag.	Davis, Jason

9	University of Rochester	Friedman, Eby; Gupta, Puneet
10	University of California, Los Angeles	Goorsky, Mark S.
11	McGehee Arkansas	Grain, Whitaker
12	Kansas State University	Joshi, Deepak R.
13	University of Central Arkansas	Ullah, Md Sharif

Publications (last four years and relevant)

1. Saha, A.K., McMaine, J.T., Sexton, P., Graham, C. Impact of No-Till, Cover Crop, and Tile Drainage System on Soil Moisture Dynamics within 0-120 cm Soil Profile. *Agricultural Water Management* (Under review).
2. Saha, A.K., McMaine, J.T., Sexton, P., Graham, C. 2024. Impact of no-till, crop rotation, cover crop, drainage on soil physical and hydraulic properties within the root zone. *Soil Science Society of America Journal*. https://doi.org/10.1002/saj2.20614
3. Saha, A.K., McMaine, J. T., 2023. Applicability and sensitivity of field hydrology modeling by the Soil Plant Air Water (SPAW) model under changes in soil properties. Journal of the ASABE. 66(4): 809-823. https://doi.org/10.13031/ja.15306.
4. Carcamo, P., Brugler, S., Maaz, G., Ryan, B., Saha, A. K., and Sahraei, M., 2023. Artificial Intelligence applications in agriculture need a justice lens to address risks and provide benefits to smallholder farmers. SDGS. United Nation. https://sdgs.un.org/documents/carcamo-ai-apps-agriculture-need-justice-lens-address-risks-and-provide-benefits
5. Saha, A.K., Hasan, M.M., †Khan, M.R.A., †Al-Amin, M., 2022. Prediction of spatial saturated hydraulic conductivity at the upper soil layer using soil class and terrain attributes. Model. Earth Syst. Environ. 8, 3591–3605. https://doi.org/10.1007/s40808-021-01317-y.

Synergistic Activities

1. Member of the American Society of Agricultural and Biological Engineering since 2020
2. Vice-Chair of the American Society of Agricultural and Biological Engineering-Arkansas Section 2023-2024
3. Vice-Chair, ASABE NRES 242 Surface Irrigation Committee 2023-2025
4. Member of Member the American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America since 2022
5. Member of Soil Water Conservation Society (SWCS), since 2022
6. Journal Reviewer: Journal of the ASABE; Journal of Agronomy; Water Policy, Journal of Applied Engineering in Agriculture, Earth Science, Discover Soil, Science of Total Environment
7. Academic advisor of the Agricultural Engineering program at the University of Arkansas at Pine Bluff

ATTACHMENT 3

DIVISION OF AGRICULTURE

RESEARCH & EXTENSION

University of Arkansas System

2025-2026

Arkansas Soybean Promotion Board Proposals

Submitted to

Department of Agriculture

Arkansas Soybean Promotion Board

ARKANSAS SOYBEAN PROMOTION BOARD

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Arkansas Soybean Promotion Board
Table of Contents

#	Research Proposal - New	Funded 24-25	Request 25-26
1	Development, evaluation and production of agricultural biologicals for Arkansas crop production (New-Year 1 of 3) **Bluhm, Burt**	0.00	$ 23,857.00
5	Greenhouse gas emission from long-term soybean with cover crops (New-Year 1 of 1) **Brye, Kris**	0.00	$ 23,110.00
9	Evaluating planting date decisions in the soybean/rice rotation (New-Year 1 of 1) **Chlapecka, Justin**	0.00	$ 30,127.00
13	Investigating the effect of growth regulators on soybean plant architecture and yield (New-Year 1 of 2) **Chlapecka, Justin**	0.00	$ 31,306.00
17	Determination of tolerant soybean lines and their yield under multiple stressors: salinity and herbivory (New-Year 1 of 3) **Clay, Natalie**	0.00	$ 54,019.00
21	Identifying soybean genotypes for enhanced water use efficiency using high-throughput phenotyping (New-Year 1 of 3) **Elli, Elvis**	0.00	$ 60,435.00
25	Testing the range of soybean cultivars that can benefit from plant elicitor peptide treatment (New-Year 1 of 1) **Goggin, Fiona**	0.00	$ 25,767.00
31	Evaluating the impacts of irrigation water management practices on groundwater sustainability and economic benefits in Arkansas (New-Year 1 of 3) **Huang, Qiuqiong**	0.00	$ 38,441.00
35	Artificial intelligence for early soybean disease detection and robot implementation (New-Year 1 of 3) **Koparan, Cengiz**	0.00	$ 67,760.00
40	Predicting the end use performance of Arkansas soy protein using genomics (New-Year 1 of 3) **Rahman, Mahfuzur**	0.00	$ 99,103.00
44	Educating growers and consultants on insect monitoring and control (New-Year 1 of 3) **Thrash, Ben**	0.00	$ 3,000.00
48	Economics of automatic insecticide applications in Arkansas soybeans (New-Year 1 of 3) **Thrash, Ben**	0.00	$ 43,254.00

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Research Proposal - In Progress

52	Optimization of fungal pathogens AF22 and AF24 as bioherbicides for palmer amaranth (pigweed) (Year 3 of 3) **Bluhm, Burt**	$	40,000.00	$	40,000.00
56	Arkansas soybean performance trials (Year 3 of 3) **Carlin, John**	$	40,270.00	$	40,754.00
60	Development of a turn-row soybean vegetative health analysis using UAS imagery for production decision support (Year 2 of 3) **Davis, Jason**	$	19,989.00	$	19,682.00
64	Comprehensive disease screening of soybean varieties in Arkansas (Year 2 of 3) **Faske, Travis**	$	131,863.00	$	133,242.00
68	Integrated management of soybean nematodes in Arkansas (Year 3 of 3) **Faske, Travis**	$	72,449.00	$	71,459.00
72	Phenotypic selection assisted by seed-level near infrared information (Year 2 of 3) **Fernandes, Samuel**	$	51,117.00	$	52,081.00
76	Irrigation water management for soybeans: Moving the needle (Year 3 of 3) **Henry, Chris**	$	205,620.00	$	205,620.00
80	Developing scouting, threshold and management practices for stinkbug complex in Arkansas soybean (Year 3 of 3) **Kariyat, Rupesh**	$	49,102.00	$	49,625.00
84	Effects of the inclusion soybean oil in beef heifer diets on heifer development, reproductive function, and calf growth performance (Year 3 of 3) **Kegley, Beth**	$	48,940.00	$	24,471.00
88	Use of gossypol in inhibit reproduction in domestic hogs as a model for feral hog control (Year 3 of 3) **Littlejohn, Brittni**	$	30,000.00	$	30,000.00
92	Site specific assessment of soybean response to in field variability using remote sensing (Year 2 of 3) **Poncet, Aurelie**	$	75,000.00	$	75,000.00
96	Screening Arkansas soybean cultivars for protein quality as a novel food preservative (Year 2 of 3) **Rahman, Mahfuzar**	$	50,049.00	$	53,235.00
100	Fertilization of soybean (Year 3 of 3) **Roberts, Trent**	$	80,461.00	$	83,176.00

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104	Field based determination of chloride tolerance in soybean (Year 3 of 3) **Roberts, Trent**	$	50,605.00	$	51,153.00
108	Influence of cover crops and soil health on soybean (Year 3 of 3) **Roberts, Trent**	$	60,786.00	$	63,142.00
112	Monitoring the extent of potassium deficiency and chloride toxicity in Arkansas soybean fields (Year 3 of 3) **Roberts, Trent**	$	36,870.00	$	39,574.00
116	Development of date driven recommendations for variable soybean seeding rate in Arkansas (Year 2 of 3) **Ross, Jeremy**	$	81,876.00	$	82,886.00
120	Improving technology transfer for profitable and sustainable soybean production (Year 3 of 3) **Ross, Jeremy**	$	77,846.00	$	77,443.00
124	Investigating emerging production recommendations for sustainable soybean production (Year 3 of 3) **Ross, Jeremy**	$	221,278.00	$	229,516.00
128	Science for success (Year 3 of 3) **Ross, Jeremy**	$	117,488.00	$	128,549.00
132	Soybean research verification program (Year 3 of 3) **Ross, Jeremy**	$	208,168.00	$	200,213.00
136	Soybean weed management: A team approach for improved control and profitability (Year 3 of 3) **Scott, Bob**	$	260,807.00	$	256,835.00
141	Determining the value of fungicide application using on-farm trials (Year 3 of 3) **Spurlock, Terry**	$	52,000.00	$	52,000.00
145	Developing a satellite-based field scouting tool (Year 3 of 3) **Spurlock, Terry**	$	14,860.00	$	14,730.00
149	Understanding taproot decline and orange leaf spot; soybean diseases of increasing importance in Arkansas (Year 3 of 3) **Spurlock, Terry**	$	39,243.00	$	39,075.00
153	An innovative approach to generate porous soy proteins with enhanced flavor for the plant-based food industry (Year 3 of 3) **Ubeyitogullari, Ali**	$	43,955.00	$	43,955.00
157	Development of high yielding soybean cultivars with broad resistance (Year 3 of 3) **Vieira, Caio Canella**	$	191,118.00	$	191,231.00

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161	Fast tracking MG4 cultivars with southern root-knot nematode resistance (Year 2 of 3) **Vieira, Caio Canella**	$	50,584.00	$	50,364.00
165	Genomic prediction to enhance the efficiency of soybean breeding (Year 3 of 3) **Vieira, Caio Canella**	$	102,087.00	$	102,730.00
169	Overcoming soybean yield plateau by leveraging physiology-efficient and yield-formation traits (Year 2 of 3) **Vieira, Caio Canella**	$	83,620.00	$	83,679.00
173	Soybean germplasm enhancement using genetic diversity (Year 3 of 3) **Vieria, Caio Canella**	$	187,679.00	$	187,872.00
177	Soybean enterprises budgets and production economics analysis (Year 3 of 3) **Watkins, Breana**	$	10,000.00	$	10,000.00
	Research Proposals - Renewed (New Cycle)				
182	Arkansas Discovery Farm (Year 1 of 3) Renewal **Daniels, Mike**	$	23,688.00	$	28,220.00
185	Economic analysis of soybean production and marketing practices (Year 1 of 3) Renewal **Deaton, Brian**	$	7,316.00	$	7,500.00
189	Monitor and management of fungicide-resistant soybean diseases in Arkansas (Year 1 of 3) Renewal **Faske, Travis**	$	50,498.00	$	59,728.00
194	Screening for soybean tolerance to metribuzin (Year 1 of 3) Renewal **Norsworthy, Jason**	$	16,226.00	$	16,232.00
198	Determining factors associated with poor grain quality in soybean and management options (Year 1 of 3) Renewed **Spurlock, Terry**	$	55,000.00	$	55,000.00
202	Refining insect thresholds in Arkansas soybean (Year 1 of 3) Renewal **Thrash, Ben**	$	69,116.00	$	67,904.00
207	Utilization of winter nursery for soybean line development through back crossing (Year 1 of 3) Renewal **Vieria, Cai Canella**	$	51,000.00	$	51,000.00
	Promotion Proposals				
211	The Arkansas irrigation yield contest *Year 8 **Henry, Chris**	$	10,000.00	$	10,000.00
212	Arkansas future ag leaders tour (Year 1 of 3) Renewal **Robinson, Julie**	$	5,000.00	$	5,000.00

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216	Soybean science challenge (Year 2 of 3) **Robinson, Julie**	$	78,585.00	$	85,525.00
218	Soybean college (New-Year 1 of 1) **Ross, Jeremy**		0.00	$	14,717.00
	Completed Projects Not Resubmitted				
	USDA feed kits (Year 2 of 3) **Harmon, Allison**	$	2,500.00		
	Assessment of broiler dietary least cost protein supply via soybean genotype amino acid selection (Year 3 of 3) **Kidd, Mike**	$	53,686.00		
	Lead AR 40 (2 of 3) **Robinson, Julie**	$	5,000.00		
	Impact of water quality on insects (Year 2 of 3) **Thrash, Ben**	$	20,001.00		
	Projects Not Completed				
	Economics of soil health practices for soybeans in Arkansas (Year 2 of 3) **Kovacs, Kent** (no Longer employed-not able to complete project)	$	57,838.00		
	Total	**$**	**3,291,184.00**	**$**	**3,684,297.00**

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Development, Evaluation and Production of Agricultural Biologicals for Arkansas Crop Production

Lead Investigator: Dr. Burt Bluhm

Collaborator: Dr. Kelly Cartwright

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New; Year 1 of 3

Research Areas: Physiology; Environment; Pathology

Stated Goal: This project is focused on discovery, evaluation and production of agricultural microbials (i.e., microbial biofertilizers, rhizobia, microbial pesticides, microbial protectants and related) specific to Arkansas crops and production environments. The ultimate goal is to create commercially viable microbials and the necessary production facilities within UADA to enable commercial production of these microbials tailored to benefit our Arkansas farmers. In this way, we could provide sound, novel technologies from within the state to increase yields and profitability for Arkansas agriculture. We propose a project that would be jointly, evenly funded by the Arkansas Soybean Promotion Board, the Arkansas Rice Promotion Board, and the Arkansas Corn and Grain Sorghum Promotion Board to launch this initiative.

Specific Objectives:

1. Evaluate the efficacy of commercial microbials in major Arkansas crops, including soybean production.
2. Isolate and develop novel, Arkansas-based agricultural microbials customized for our major crops, including soybean.
3. Obtain and evaluate pilot-scale equipment (biofermenters, bioreactors) to launch an Arkansas-based facility to serve as a scale up testing facility for microbial technologies and as a pilot level production center for commercial-scale, Arkansas-based production of agricultural microbials.

Background: A*gricultural microbials* (sometimes referred to as 'microbials' or 'biologicals') constitute a wide range of commercial products used to improve crop production. These include soil or root-dwelling microbes that act as plant biostimulants, biofertilizers, nodulators, biocontrol agents of various pests, and serve many other functions that promote crop plant health and increase/protect yield. Microbials have an excellent return on value for farmers. They are relatively inexpensive and have proven benefits including more efficient nutrient uptake, nitrogen assimilation, stress alleviation related to water, salt, heat and drought, and control of weeds, diseases and insects. Additionally, microbials are environmentally friendly due to their biological basis. Because of low cost, high returns, and overall safety, the agricultural microbials market is growing rapidly and is forecast to exceed $32 billion worldwide in 10 years, from roughly $7 billion today.

Ultimately, the vision here is to create the necessary program and infrastructure to discover, evaluate and finally produce commercially viable and scaled microbial products that are customized specifically for Arkansas crops and production environments. To our knowledge, there are currently no microbial scale up facilities in Arkansas today. Thus, any scale up work for microbials must be contracted out to facilities in other states even for early product evaluation. As a major land-grant university attached to one of the most productive crop production areas in the U.S., we have an opportunity to function as a microbial hub to service research efforts as well as our farming communities. Beyond the types of microbials described, a program and parallel facility as outlined can also be highly *valuable* to address specific challenges for Arkansas farmers, such as abiotic stress associated with excess soil salinity; mitigating other biotic and abiotic stresses such as unfavorable temperatures and flooding; maximizing efficient uptake of irrigation and nutrients; and other issues of high priority to our growers.

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Finally, once established, we aim to partner with the UADA's breeding programs to develop variety 'packages' entailing plant genetics partnered with customized microbials to maximize and protect yield and profitability in Arkansas production conditions.

A key requirement for this project is biofermentation, the capacity for scale-up production of rhizobacteria or other beneficial organisms. This project will require at least one benchtop biofermenter (~5 L) for pilot-scale protocol development, and a larger (~50 L) fermenter to translate pilot-scale production into sufficient biological inoculum for field testing. Subsequent commercial-scale production for Arkansas growers will require additional equipment, industry partnership, or outside investment -- a situation to be addressed as this three-year project advances beyond initial stages. To our best knowledge, there is no public or commercial agricultural fermentation facility in the state of Arkansas that can support this endeavor, and thus we seek to address this critical infrastructure gap for the benefit of multiple cropping systems in the state. It should be emphasized that, as a major research land grant University, we have developed many microbial-based technologies over the years. However, pilot or scale up production has often been a stumbling block to further develop these technologies. This project will help fill that gap.

Methods: For Objective 1, we will focus on establishing a research base by evaluating the benefit of existing, commercially available agricultural microbials on the major crops in Arkansas, including soybean. These will initially focus on yield promotion and improved agronomics. Field testing will be performed at the Fayetteville research station. As the project progresses and new biologicals continually become available, we will annually select products for field testing. For Objective 2, we will collect and isolate novel potential microbials from Arkansas soils and plants, specifically from crop plants or others that appear to thrive despite obvious stressful conditions. We envision focusing primarily on beneficial rhizobacteria but will pursue other categories of microorganisms as supported by experimental data. These novel plant-associating strains will be tested in greenhouse and outdoor plots for efficacy before scaling up production for larger, field-scale evaluations. For Objective 3, we anticipate purchasing a reconditioned bench-top fermenter in Year 1, so that initial optimization experiments for strains obtained in Objective 2 can begin in the later part of Year 1. In Year 2, we anticipate purchasing a reconditioned, larger fermenter/bioreactor capable of producing sufficient inoculum for experiments in greenhouses and outdoor plots. Together, these two fermenters will provide sufficient capacity to take newly discovered biologicals from initial research & development stages to proof of concept and will provide the footprint for commercial production and market viability.

Planned Milestones: In Years 1, 2, and 3, we will evaluate commercial microbials for efficacy on corn, sorghum, and other major field crops in the state and report results to growers through presentations at meetings and other extension activities. In Year 1, we will begin to actively isolate novel, Arkansas-sourced microbials and acquire/set up the bench top fermenter so that active testing of novel microbials can commence in Years 2 and 3. In support of this process, we will acquire/set up the larger fermenter in Year 2 to enable greenhouse and outdoor testing of novel microbials on a larger scale. By Year 3, we anticipate having a fully functional R&D fermentation facility for scale-up production of microbials.

Statement of Projected Value: Agricultural microbials specifically formulated for Arkansas production conditions have the potential to save input costs and thus substantially increase grower profitability. This is particularly important in the face of lower than desired commodity prices coupled with higher input prices -- a situation expected to continue for the foreseeable future.

Budget Justifications: Funds are requested to purchase a bench-top fermenter in Year 1 and a scale-up fermenter in Year 2, required for project success. Comparable, functional equipment is not currently available within UADA or other entities within the state of Arkansas. Funds are requested for a graduate student to perform project related activities, as well as funds for lab, field, and greenhouse work. Funds are also requested for Dr. Cartwright's participation in the project as a collaborator and consultant.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Bluhm, Burt — *Development, Evaluation and Production of Agricultural Biologicals for Arkansas Crop Production*

Year	2025/2026	**Project Year**	New
Lead Investigator	Bluhm, Burt	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Development, Evaluation and Production of Agricultural Biologicals for Arkansas Crop Production		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Bluhm, Burt				**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI	AES						
Fulltime Personnel							
Position Title / **Name** *(if position is filled)* / **% Time**	**Salaries**				**Total**	**AES**	**CES**
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Subtotal: Salaries	$0	$0	$0	$0	$0	$0	$0
Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.							
Name *(if position is filled)* / **% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
33%%	$7,000				$7,000	$7,000	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Tuition Calculator Information	$2,000				$2,000	$2,000	$0
Subtotal: Graduate Student	$9,000	$0	$0	$0	$9,000	$9,000	$0
Hourly							
	Wages				**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0
Fringe Benefits							
Fringe benefits are calculated when salary and wage amounts are entered above.							
	Benefits				**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$357	$0	$0	$0	$357	$357	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$357	$0	$0	$0	$357	$357	$0
Personnel Total	$9,357	$0	$0	$0	$9,357	$9,357	$0
Travel							
Justify out-of-state travel in proposal.							
	Travel				**Total**	**AES Portion**	**CES Portion**
In-State	$1,000				$1,000	$1,000	$0
Out-of-State					$0	$0	$0
Travel Total	$1,000	$0	$0	$0	$1,000	$1,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Bluhm, Burt — *Development, Evaluation and Production of Agricultural Biologicals for Arkansas Crop Production*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$3,500				$3,500	$3,500	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Partial cost of ferementer, Consu	$10,000				$10,000	$10,000	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$13,500	$0	$0	$0	$13,500	$13,500	$0
	Total for Proposal	$23,857	$0	$0	$0	$23,857	$23,857	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Greenhouse gas emissions from long-term soybean with cover crops

Lead Investigators: Dr. K. Brye (CSES), Dr. D. Della Lunga (CSES)

Co-Investigators: Dr. T. Roberts (CSES)

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New (Year 1 of 1)

Research Areas: Agronomy/Alternative and Fertility

Stated Goal: More than 97% of greenhouse gases (GHGs) in agricultural settings consist of carbon dioxide (CO_2, 80%), methane (CH_4, 11%), and nitrous oxide (N_2O, 6%). Soil management contributes more than 49% of N_2O emissions and are strongly associated with fertilizer application, irrigation, and soil disturbances. The nitrogen (N)-fixation capability of the soybean plant increases the N pool in the soil that can result in extra N losses if not properly managed. Soybean fields have often been described as a CH_4 sink, while CO_2 production has been correlated to soil management like tillage. To date, a complete analysis of GHG emissions in soybean fields in Arkansas has not been conducted. Agricultural practices defined as climate-smart practices can play a fundamental role in mitigating climate change through the reduction of on-farm GHG emissions from direct sources and through the enhancement of storage processes like soil carbon (C) sequestration. Among the recognized climate-smart practices, cover crops have gained substantial interest in recent years, where a non-leguminous, often grass, cover crop is planted between cash crop seasons to provide erosion control, enhance soil C sequestration and N uptake, reducing substrate for microbial activity and therefore the production of GHGs. A continuous temporal analysis of GHGs in a soybean system can provide the missing information to assess C and N cycles in a short period of time, providing essential data to quantify reliable C and N losses. Therefore, the goal of the proposed 1-year field study is to quantify CO_2, N_2O, and CH_4 fluxes and emissions from soybean production on a silt-loam soil in southeast Arkansas with and without a cover crop during the soybean growing season. This study will address and can facilitate numerous priorities for soybean production in Arkansas, such as appropriate fertilization practices, fertility and sustainability of topsoil, irrigation efficiency, and grower education. The study will also contribute to our understanding of the increasingly popular climate-smart practices in soybean production systems in Arkansas.

Specific Objectives: The specific objective of this proposed field study is to quantify and compare CO_2, N_2O, and CH_4 fluxes and season-long emissions and global warming potential with and without a cover crop under long-term no-tillage management in a furrow-irrigated soybean production system on a silt-loam soil in southeast Arkansas.

Methods: The GHG assessment that is being proposed will be conducted in conjunction with a pre-existing, long-term, production-scale field study where soybean have been managed under no-tillage and furrow-irrigation on a silt-loam soil with different cover crops that was established by Dr. Trenton Roberts over 8 years ago at the Rohwer Research Station in Desha County, AR. Cereal rye (*Secale cereale* L.) will be seeded in Fall 2024 at the recommended rate in a raised bed ~ 5 cm tall, ~ 60 cm wide at the top, and 76 cm between adjacent bed centers, previously established in an east-west orientation. A similar-sized raised bed adjacent to the area planted with cereal rye will be left fallow to represent the no-cover-crop treatment. A single, hybrid soybean cultivar will be drill-seeded in Spring 2025 at the recommended rate and fertilized according to recommended timings and rates. Polypipe will be laid out at the up-slope end of the field to deliver irrigation water down the furrows approximately every other or every third day as-needed. This irrigation approach will maintain a moist soil at the up-slope positions. Just after planting soybeans and prior to plant emergence, two gas sampling base collars, 21.34 (8.4 in)

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cm in diameter and 11.43 (4.5 in) cm tall constructed from Schedule 40 polyvinyl chloride (PVC), will be installed in each of the two treatments on top of a raised bed for a total of four base collars. Gas measurements will be conducted four times every day (i.e., 3 and 9 am and 3 and 9 pm) continuously with an automated multiplex system (Li-Cor Environmental Inc., Lincoln, NE). A multiplexer will be connected to four automated, opaque chambers, equally divided between the two treatments, and to an N_2O analyzer and a CO_2/CH_4 analyzer. The entire system will be powered by a set of four solar panels and a series of six rechargeable batteries that will maintain constant functioning of the instruments day and night. The system will also be connected to a cellular modem that will allow remote and live access to the gas data collected over time. The entire system is part of a recently awarded Federal project sponsored by the USDA Partnerships for Climate-Smart Commodities (award number NR233A750004G041). Sensors to measure soil volumetric water content and soil temperature will be connected to each of the four chambers and will record data at each sampling time. At harvest maturity, plant samples will be collected near each gas-sampling chamber to quantify aboveground dry matter production, yield, and total plant elemental uptake. Global warming potential will be calculated for the two field treatments from the measured GHG fluxes and interpolated GHG emissions for the whole growing season.

The GHG measurement system, including four long-term, automated GHG chambers, proposed to be used for this study is pre-existing, thus over $130,000 have already been invested in the in-field instrumentation and infrastructure to conduct the bulk of the proposed field project.

Planned Milestones: The initial milestone will be the direct quantification of C and N losses from soybean grown with and without a cover crop in the furrow-irrigated production system on a silt-loam soil. A subsequent milestone will be the ability to assess management practices in relation to soil health. The ultimate milestone will be to improve the long-term outlook, marketability, and environmental sustainability of Arkansas-grown soybeans with credible, reliable, and replicated field research.

Value to Soybean Industry: Soil health has been listed among the goals of climate-smart projects in agricultural systems, where the outcome is to incentivize farmers to adopt conservation management practices that can lead to the accumulation of C in the soil. Cover crops have been associated with a reduction of N_2O emissions from agricultural fields, which makes cover crops a potential management strategy for climate-smart agriculture. The addition of readily available C from the cover can alter the C:N ratio in the soil, potentially resulting in a direct and indirect reduction of GHG emissions. Assessing C and N losses through the continuous, in-field measurement of GHGs will provide, for the first time in Arkansas, highly detailed temporal data that will result in essential information to characterize best management practices in soybean systems to enhance soil health and agricultural sustainability and contribute to climate-change mitigation. One major unique feature of this proposed field study is the historic duration of no-tillage management, which has exceeded the known early equilibration period that often occurs when converting from conventional tillage to no-tillage that causes soil and plant responses to be quite variable. Conducting the proposed project and accomplishing the proposed objective will not only benefit the agricultural community in Arkansas, particularly in the row-crop-dominated region of eastern Arkansas, but rather a much broader area will be impacted. Assessing climate-smart agricultural practices for resource conservation and future sustainability will benefit Arkansas and Arkansans alike.

Budget Justifications/Explanation of Travel and Direct Costs: The four chambers already in the research team's possession will allow the establishment of a robust, reliable, and appropriate experimental design that will ensure high-quality data and meaningful results and will result in one of the first studies in the US with a detailed temporal resolution for GHG detection in a long-term, no-tillage soybean production system with and without a cover crop. The majority of the budget includes funds for initial soil analyses, plant tissue analyses, and replacement parts and maintenance supplies for the GHG measurement system. Furthermore, there are no special/out-of-the ordinary budget requests (i.e., no requested out-of-state travel) associated with this project proposal.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Brye, Kristofor *Greenhouse gas emissions from long-term soybean with cover crops*

Year	2025/2026	**Project Year**	New	**Version: 7.0 (11/01/2024)**
Lead Investigator	Brye, Kristofor	**Co-PI #1**	Della Lunga, Diego	
Co-PI #2	Roberts, Trenton	**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Greenhouse gas emissions from long-term soybean with cover crops			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

			Brye, Kristofor	Della Lunga, Diego	Roberts, Trenton		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI			AES	AES	AES				
Fulltime Personnel									
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$0	$0	$0	$0	$0	$0	$0
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$0	$0	$0	$0	$0	$0	$0
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$0	$0	$0	$0	$0	$0	$0
	Personnel Total		$0	$0	$0	$0	$0	$0	$0
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$6,720				$6,720	$6,720	$0
	Out-of-State						$0	$0	$0
	Travel Total		$6,720	$0	$0	$0	$6,720	$6,720	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Brye, Kristofor *Greenhouse gas emissions from long-term soybean with cover crops*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$14,660				$14,660	$14,660	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Soil and Plant Analysis	$1,680				$1,680	$1,680	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$50	$0	$0	$0	$50	$50	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$16,390	$0	$0	$0	$16,390	$16,390	$0
	Total for Proposal	$23,110	$0	$0	$0	$23,110	$23,110	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Evaluating Planting Date Decisions in the Soybean/Rice Rotation

Lead Investigators: Justin Chlapecka

Co-Investigators: Jeremy Ross, Jarrod Hardke, Brad Watkins

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy & Economics

Stated Goal: The goal of this research is to evaluate the optimal timing for soybean and rice planting in Arkansas.

Specific Objectives:

1. To evaluate the agronomic effect of planting date on different soybean maturity groups in Arkansas, including plant height and yield.
2. To determine the total return of planting soybean at different planting dates.
3. To examine the economic cost/benefit of planting decisions in the soybean/rice rotation system when utilizing hybrid rice any inbred varieties.

Methods:

1. Soybean will be planted at five to six planting dates at the Northeast Rice Research and Extension Center (NERREC) between mid-March and mid-June. Planting dates will correspond to Dr. Jarrod Hardke's rice planting date study that is also conducted at the NERREC. Soybean will be planted following University of Arkansas System Division of Agriculture's recommendations for optimum soybean production, other than planting date.
2. Three different maturity groups will be utilized: a late-MG III, mid-MG IV, and early-MG V. The plots will be planted as strip plots with four replications of each planting date by maturity group combination.
3. The agronomic measures that will be taken include stand counts following emergence and plant height at maturity.
4. Soybean will be harvested with a small plot combine similar to how the rice will be harvested. Yield and production data will be utilized to examine the economic cost/benefit within each time frame of planting either hybrid or varietal rice versus planting soybean.

Planned Milestones:

1. In 2025 we will establish the trial at the NERREC and will continue the location for a minimum of three years. We will plan to expand the trial to also include the Rice Research and Extension Center (RREC) in subsequent years.
2. In the Spring of 2026 we will start to analyze data and evaluate the potential for any changes in the trial protocol to increase efficiency and effectiveness of the study.
3. The project is planned to continue through at least 2027 if funding is provided for subsequent years of the study. Multiple years of data will increase the power of the dataset and allow for soybean/rice producers to make a more informed decision on when to plant soybean and rice.

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Value to Soybean Industry: Numerous studies have been conducted in both soybean and rice suggesting that earlier planting dates can lead to increase yield potential and thus increased returns. While these studies are extremely important and have given us a lot of information about when to plant, we are not aware of a study that compares planting soybean and rice on the same dates at the same location. The soybean/rice planting date study aims to answer the question that is commonly posed: "It's April 15 [or insert your particular date here] and I have a two-day planting window prior to the next rain, what should I be planting?" Having both planting date studies in sync with each other will allow for the direct comparison across crops and allow for an economic analysis of the cost/benefit of planting either crop within each planting window. This study will give rice and soybean producers a point of reference when making planting decisions.

Budget Justifications/Explanation of Travel and Direct Costs:

Personnel funding will include 20% of the cost of a Program Technician and 200 hours of an hourly student at $15 per hour to assist with data collection and crop management. Supplies purchased with funding will include crop inputs, stakes, flags, and other necessary items to conduct the trials. In-state travel will be that required to visit the trial site and to present research at local meetings. The out-of-state travel component will cover a portion of attendance to regional and national meetings such as the Agronomy Society of America's national meeting and Cotton & Rice Conference.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Chlapecka, Justin *Evaluating Planting Date Decisions in the Soybean/Rice Rotation*

Year	2025/2026	**Project Year**	
Lead Investigator	Chlapecka, Justin	**Co-PI #1**	Jeremy Ross
Co-PI #2	Hardke, Jarrod	**Co-PI #3**	Watkins, Kenton
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Evaluating Planting Date Decisions in the Soybean/Rice Rotation		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Chlapecka, Justin	Jeremy Ross	Hardke, Jarrod	Watkins, Kenton	Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	CES	CES	AES			
Fulltime Personnel								
Position Title	**Name** *(if position is filled)* / **% Time** / **Salaries**					**Total**	**AES**	**CES**
Program Technician	TBD 15%	$6,600				$6,600	$6,600	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
	Subtotal: Salaries	$6,600	$0	$0	$0	$6,600	$6,600	$0
Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)* / **% Time** / **Wages**					**Total**	**AES Portion**	**CES Portion**
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
	Tuition Calculator Information					$0	$0	$0
	Subtotal: Graduate Student	$0	$0	$0	$0	$0	$0	$0
Hourly								
	Wages					**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel	$3,000				$3,000	$3,000	$0
	Hourly-Students					$0	$0	$0
	Subtotal: Hourly	$3,000	$0	$0	$0	$3,000	$3,000	$0
Fringe Benefits								
Fringe benefits are calculated when salary and wage amounts are entered above.	**Benefits**					**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel	$1,888	$0	$0	$0	$1,888	$1,888	$0
	Graduate Students	$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel	$219	$0	$0	$0	$219	$219	$0
	Hourly-Students	$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits	$2,107	$0	$0	$0	$2,107	$2,107	$0
	Personnel Total	$11,707	$0	$0	$0	$11,707	$11,707	$0
Travel								
Justify out-of-state travel in proposal.	**Travel**					**Total**	**AES Portion**	**CES Portion**
	In-State	$3,000			$2,000	$5,000	$5,000	$0
	Out-of-State	$2,000			$1,000	$3,000	$3,000	$0
	Travel Total	$5,000	$0	$0	$3,000	$8,000	$8,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Chlapecka, Justin *Evaluating Planting Date Decisions in the Soybean/Rice Rotation*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$3,000				$3,000	$3,000	$0
	Fertilizer/Chemicals	$1,000				$1,000	$1,000	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$6,420	$0	$0	$0	$6,420	$6,420	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$10,420	$0	$0	$0	$10,420	$10,420	$0
	Total for Proposal	$27,127	$0	$0	$3,000	$30,127	$30,127	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Investigating the Effect of Growth Regulators on Soybean Plant Architecture and Yield

Lead Investigators: Justin Chlapecka

Co-Investigators: Jeremy Ross

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy

Stated Goal: The goal of this research is to determine if any of a select set of growth regulators has utility in Arkansas soybean production, particularly in the early soybean production system (ESPS). There are a number of studies from Asian and South American countries showing benefits from applying growth regulators at different growth stages and in different growing situations.

Specific Objectives:

1. To evaluate the effect of foliar application of different growth regulators on the yield of MG IV soybean.
2. To examine the utility of foliar application of different growth regulators in decreasing plant height of soybean while maintaining yield potential.
3. To determine the effect of foliar application of different growth regulators on the plant architecture of soybean.
4. To evaluate the optimum timing of growth regulator foliar spray to maximize the intended effect of each compound.
5. To identify if a particular growth regulator deserves additional attention and research on its utility in optimizing soybean production in Arkansas.

Methods:

1. Objective 1-2: Trials will be initiated at the Northeast Rice Research and Extension Center (NERREC) and the Jackson County Extension Center (Newport) to evaluate the effectiveness of a minimum of five growth regulators on increasing yield, decreasing plant height, and other desirable outcomes. The growth regulators that are planned to be utilized include jasmonic acid, salicylic acid, tri-iodo benzoic acid (TIBA), kinetin, and gibberrelic acid (GA). The center two rows of each plot will be sprayed foliarly and will be harvested with a small plot combine at maturity.
2. Objective 3: The aforementioned trials at the NERREC and Newport will be sampled at physiological maturity to determine plant height, number of branches per plant, fruiting nodes per plant, total pods per plant, seeds per pod, and seed weight.
3. Objective 4: The growth regulators will be applied foliarly at two different timings, vegetative and early reproductive (R3). The growth regulators are expected to have different outcomes when applied during vegetative and reproductive growth.
4. Objective 5: Once data is collected, analyses will reveal if any growth regulator had positive effect on the soybean yield or growth characteristics. Future studies will then be designed to look further into the application of that particular growth regulator in soybean production, including optimal timing and rate.

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Planned Milestones:

1. In 2025 we will establish the trial at two locations, the NERREC and Newport. We will replicate this trial at the two sites for two years to determine what, if any, growth regulator x timing combination produces a positive outcome for the soybean crop.
2. If any of the treatments appear to have a positive outcome on the soybean crop, future testing will be more in-depth with that product to look at different rates and timings for application.

Value to Soybean Industry: Arkansas producers are faced with narrowing margins in all crops, including soybean. Certain growth regulators have shown the potential in other countries to increase grain yield and also to positively affect other attributes such as plant height. When conducting Grow for the Green yield contest verifications as a county extension agent, it seemed that every field would leave yield on the table due to lodging. Decreasing plant height while not changing stalk strength in soybean could lead to an indirect yield increase through reduced lodging incidence, which would have a great impact on Arkansas soybean producers.

Budget Justifications/Explanation of Travel and Direct Costs:

Personnel funding will include 10% of the cost of a Program Technician and 200 hours of an hourly student at $15 per hour to process plant samples at the end of the season. Supplies purchased with funding will include the growth regulators, small plot spray supplies, stakes, flags, and other necessary items to conduct the trials. In-state travel will be that required to visit the trial sites and to present research at local meetings. The out-of-state travel component will cover a portion of attendance to regional and national meetings such as the Agronomy Society of America's national meeting and Cotton & Rice Conference.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Chlapecka, Justin *Investigating the Effect of Growth Regulators on Soybean Plant Architecture and Yield*

Year	2025/2026	**Project Year**	
Lead Investigator	Chlapecka, Justin	**Co-PI #1**	Jeremy Ross
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Investigating the Effect of Growth Regulators on Soybean Plant Architecture and Yield		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Chlapecka, Justin	Jeremy Ross			Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	CES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Technician	TBD	20%	$8,800				$8,800	$8,800	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$8,800	$0	$0	$0	$8,800	$8,800	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel		$3,000				$3,000	$3,000	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$3,000	$0	$0	$0	$3,000	$3,000	$0
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$2,517	$0	$0	$0	$2,517	$2,517	$0
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$219	$0	$0	$0	$219	$219	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$2,736	$0	$0	$0	$2,736	$2,736	$0
	Personnel Total		$14,536	$0	$0	$0	$14,536	$14,536	$0
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$5,000				$5,000	$5,000	$0
	Out-of-State		$2,000				$2,000	$2,000	$0
	Travel Total		$7,000	$0	$0	$0	$7,000	$7,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Chlapecka, Justin *Investigating the Effect of Growth Regulators on Soybean Plant Architecture and Yield*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$5,000				$5,000	$5,000	$0
	Fertilizer/Chemicals	$2,500				$2,500	$2,500	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$1,500	$0	$0	$0	$1,500	$1,500	$0
	Jackson County Ext. Center	$770	$0	$0	$0	$770	$770	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$9,770	$0	$0	$0	$9,770	$9,770	$0
	Total for Proposal	$31,306	$0	$0	$0	$31,306	$31,306	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Determination of tolerant soybean lines and their yield under multiple stressors: salinity and herbivory.

Lead Investigator: Dr. Natalie Clay

Co-Investigators: Drs. Rupesh Kariyat**,** and Ben Thrash

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New Proposal: Year 1 of 3; Amt: $54,019

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Entomology, Agronomy

Stated Goal: Determine which soybean lines produce the most yield under multiple stressors; specifically, salinity and herbivory.

Specific Objectives:
1) Screening soybean accessions from genome wide association mapping and USDA GRIN collection for resistance to multiple stressors; namely salinity and herbivory

2) Determine which of the identified lines have the highest yield under salinity and herbivory stress

Methods:
Rationale and Hypothesis: Soybean crops face multiple stressors simultaneously, yet varieties are often selected primarily based on a single stressor. One of the primary challenges for soybean crops is salinity stress, which poses major economic and logistical challenges to crop production. Natural salinity gradients and increased salinity due to climate change and inadequate drainage of irrigated land can increase salt-affected soils. Increasing global food demands often mean expanding agriculture onto marginal lands. The identification of salt-tolerant crops are the solution to meeting future human food demands. Soybean germination, emergence, and later developmental stages are particularly sensitive to increased salinity. Soybeans typically rely on ion exclusion and tissue tolerance mechanisms to respond to salinity stress. Previous research has demonstrated that salt tolerance is genetically controlled and heritable. While some salt tolerant soybean varieties exist, there is a lot of variation in soybean response. Additionally, crop plants do not live in a vacuum, and as such, experience multiple stressors simultaneously. In particular, both herbivory and salinity stress are common and important factors influencing soybean yield. Herbivores require and seek sodium and can increase in abundance and herbivory when sodium availability is higher. Consequently, soybeans that tolerate salt through the accumulation of sodium ions may experience more herbivory. In soybean, insect herbivory is a major stressor. In this proposal, we will use soybean accessions (>100) from genome wide association mapping and USDA GRIN collection that vary in their water use efficiency under salinity and herbivory test to determine which is likely to produce the highest yield under these stressors.

Objective 1 Using our previous work, we will select up to 100 soybean accessions from genome wide association mapping and USDA GRIN collection for screening against salinity and herbivory

Objective 2 Once the top lines likely to be both salt and herbivore resistant have been identified, we will perform salt-tolerance, herbivore-tolerance, and their combination assays (e.g., 3-10 lines). Fall Armyworm (FAW; *Spodoptera frugiperda*) and Soybean Looper (SL; *Chrysodexis includens*) are two major herbivore pests impacting soybean yield in Arkansas. We will use greenhouse experiment where soybean varieties will be grown across a sodium gradient matching commonly encountered soil salinity. Soybean plant characteristics will be measured to determine sodium impacts on soybean productivity and leaves will be measured for sodium content. Soybeans will then be exposed to herbivores or none as controls and herbivory and plant conditions including yield will be measured.

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Planned Milestones:
2025: Identify multiple lines likely sodium and herbivore tolerant (Obj. 1). Perform single stressor assays in greenhouse trials (i.e., expose soybean varieties to just salinity stress or just herbivory stress relative to controls) (Obj. 2).

2026: Based on the single stress trials, we will select the top 3-10 lines likely to be most salinity and herbivore tolerant and compare them to a known intolerant variety. In greenhouse trials, these varieties will be exposed to both salinity and herbivory. Soybean plants will be grown in three sodium conditions representing a low, medium, and high sodium concentration. Each of these three concentrations will then be subject to either no herbivory as a control or FAW and SL herbivores. Plant characteristics such as percent leaf consumption, growth, chlorosis, and yield will be measured (Obj. 2).

2027: We will use the variety most tolerant to both stressors as identified from greenhouse experiment in year 2 and the same known intolerant variety used in year 2 greenhouse trials in a field experiment to measure plant performance across natural and irrigation-derived salinity gradients. In unsprayed focal low-salinity soybean fields, we will augment salinity levels to match two elevated (medium, and high) sodium concentrations determined from greenhouse experiments. Plants will then be subject to three treatments: herbivore removal, herbivore addition, and unmanipulated plots. This will allow us to determine if the identified variety is also increasingly tolerant of multiple stressors in the field and likely to produce increase yields (Obj. 2).

Value to Soybean Industry: Soybean response to changes in salinity is highly variable based on varieties and few studies have examined potential interactions between salinity and herbivory. Plant tissue sodium concentrations increase on saline soils and herbivores seek out and acquire sodium from saline environments via ingestion of salty water or through their consumption of plants. **This likely renders heavily irrigated soybean fields as sodium hotspots that support increased pest populations. Thus, maximizing soybean yield and sustainable production in agroecosystems can be achieved by identifying tolerant soybeans to multiple stressors**.

This research will generate valuable data for integrated pest management and production of soybean for Arkansas. Mitigating high-salinity soils and herbivore outbreaks is costly; by identifying varieties that are likely to still produce sufficient yields under multiple stressors, soybean farmers can maximize cost-effective strategies for salinity and pest control. Project outcomes will be published in top-notch peer-reviewed journals, presented at national conferences, and disseminated to soybean farmers. We also plan to produce extension bulletins with recommendation for producers after years 1 and 2.

Budget Justifications/Explanation of Travel and Direct Costs:
Wages and Tuition: PIs Clay and Kariyat request $24000 ($12,000 each) in wages to support a full-time graduate student to conduct the research. This results in $612 as fringe benefits for the graduate student. Additionally, $8500 ($4250 each) is requested as tuition for the student for the full year. PIs Clay and Kariyat will co-advise the student, with the student performing salinity assays under Clay's supervision and herbivory assays und Kariyat's supervision. Additionally, $3,000 is requested as hourly wages for an assistant for PI Thrash to help conduct the research with $219 in fringe benefits. In total $36,943 is requested in wages, fringe benefits, and tuition.

Travel: $7500 total for travel ($2,500 each) is requested by PIs Clay, Kariyat, and Thrash to support travel to a meeting for them and a student to present the research as well as travel to and from experimental stations and greenhouses where research will be conducted.

Maintenance & Operations: PI Clay requests $4,000, PI Kariyat requests $3,000, and PI Thrash requests $2,000 in supplies for consumables and chemistry analysis costs associated with performing the experiments. $576 is requested to pay for greenhouse space. In total, $9,576 is requested in M&O.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Clay, Natalie — *Determination of tolerant soybean varieties and their yield under both salinity and herbivory stress*

Year	2025/2026	**Project Year**	
Lead Investigator	Clay, Natalie	**Co-PI #1**	Kariyat, Rupesh
Co-PI #2	Thrash, Ben	**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Determination of tolerant soybean varieties and their yield under both salinity and herbivory stress		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Clay, Natalie	Kariyat, Rupesh	Thrash, Ben		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES	CES				

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
MS Student	100%%	$12,000	$12,000			$24,000	$24,000	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information		$4,250	$4,250			$8,500	$8,500	$0
Subtotal: Graduate Student		$16,250	$16,250	$0	$0	$32,500	$32,500	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel			$3,000		$3,000	$0	$3,000
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$3,000	$0	$3,000	$0	$3,000

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$612	$612	$0	$0	$1,224	$1,224	$0
Hourly Personnel	$0	$0	$219	$0	$219	$0	$219
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$612	$612	$219	$0	$1,443	$1,224	$219
Personnel Total	$16,862	$16,862	$3,219	$0	$36,943	$33,724	$3,219

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$2,500	$2,500	$2,500		$7,500	$5,000	$2,500
Out-of-State					$0	$0	$0
Travel Total	$2,500	$2,500	$2,500	$0	$7,500	$5,000	$2,500

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Clay, Natalie — *Determination of tolerant soybean varieties and their yield under both salinity and herbivory stress*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$4,000	$3,000	$2,000		$9,000	$7,000	$2,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$576	$0	$0	$0	$576	$576	$0
	M & O Total	$4,576	$3,000	$2,000	$0	$9,576	$7,576	$2,000
	Total for Proposal	$23,938	$22,362	$7,719	$0	$54,019	$46,300	$7,719

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Identifying soybean genotypes for enhanced water use efficiency using high-throughput phenotyping

Lead Investigators: Elvis Elli

Co-Investigators: Caio Canella Vieira, Aurelie Poncet

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New (Year 1 of 3)

Research Areas: Agronomy (Crop Physiology)

Stated Goal: Drought stress in the US reduces soybean yield by up to 60% every year. Identifying soybean genotypes with enhanced drought tolerance and water use efficiency - WUE (i.e., producing more bushels of seeds per inch of water used) can sustain higher seed yield with the same amount of water, which translates into a more sustainable system with reduced farm input. Yet, little progress has been made in developing genetic materials expressing drought tolerance (Sinclair et al., 2017). One reason is the lack of fundamental understanding of key physiological mechanisms underlying drought-tolerant genotypes, and our proposal aims to fill this knowledge gap. Stomatal conductance is a valuable physiological trait that regulates plant transpiration and water use. However, determining stomatal conductance is very time-consuming and expensive. Our goal is to use high-throughput phenotyping techniques to identify genotypes with an enhanced ability to conserve water in a more efficient and cost-effective way. Selecting genotypes that stabilize or slow down transpiration rates under warm and dry environments could be of value for breeding programs to generate well-adapted cultivars that could outperform under drought conditions.

Specific Objectives:

1) Identify how genotypes differ in their stomatal conductance in response to the environment
2) Investigate the association between stomatal conductance and canopy temperature to develop a simple model that estimates stomatal conductance using drone imagery
3) Characterize a range of soybean genotypes based on traits for water use efficiency using high-throughput phenotyping

Methods:

Objective 1: We will grow ~20 soybean accessions with associated differences in WUE based on previous findings of Chamarthi et al. (2023) at field conditions under irrigated and rainfed conditions. At different growth stages (V6, R1, R3, and R5), stomatal conductance will be measured using an LI-600 porometer (Li-Cor Biosciences, Lincoln, NE, USA) at multiple times of the day to capture different conditions of light, temperature, and relative humidity. For the measurements, we will select three consecutive plants from the central rows and the first fully expanded trifoliate from the top (Sakoda et al., 2019) to ensure the evaluated leaves receive direct sunlight. The experiment will be conducted in the Fayetteville (SAREC) UADA research station in a randomized complete block design and three replications. Field plots will consist of 4 rows, 25 feet long. At physiological maturity, plots will be harvested for yield determination. Besides yields and stomatal conductance, we will take notes of canopy wilting, canopy closure, and plant establishment. We will also track the phenology of the different genotypes and rainfed vs. irrigated treatment for planning purposes.

Objective 2: Drones will be flown on all plots with a thermal camera at the same time as the stomatal conductance measurements (objective 1) to determine canopy temperature in collaboration with Dr.

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Poncet. Data generated will be combined with the stomatal conductance data and weather information at the measurement time to develop a simple model that estimates stomatal conductance using canopy temperature information. The model will be developed in year 1 and validated in year two of the proposal. Additional canopy coverage data will be collected for extension outreach and training purposes.

Objective 3: Genotypes from the USDA Germplasm Collection will be selected based on genetic diversity, and seed increase will be conducted in Fayetteville, AR, in the first year of this objective in collaboration with Dr. Vieira. In years 2 and 3, canopy temperature data will be collected from roughly 300 soybean accessions to estimate stomatal conductance based on the model previously developed from Objectives 1 and 2. In addition, this phenotype may be combined with molecular markers to understand better the genetic architecture of stomatal conductance, which may facilitate the selection of soybean genotypes with enhanced water use efficiency.

Planned Milestones:

Work Plan and Timeline	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Objective 1												
Conduct field experiments		■	■	■		■	■	■				
Collect stomatal conductance data.		■	■	■		■	■	■				
Data analysis and quality control				■	■			■	■	■		
Objective 2												
Drone flights with a thermal camera		■	■	■		■	■	■				
Imagery processing				■	■			■	■			
Model development and testing				■	■			■	■			
Objective 3												
Select Plant Materials	■	■										
Seed increase			■	■								
Drone flights with a thermal camera						■	■	■		■	■	■
Rank genotypes based on WUE and yields										■	■	■

Value to Soybean Industry:

Our goal is to select high-yielding genotypes that conserve water without compromising seed productivity, leveraging efficient, high-throughput phenotyping techniques to streamline this process. Developing soybean cultivars capable of sustaining higher yields with the same or lower water input directly supports creating a more sustainable agricultural system, reducing farm inputs and operational costs. Identifying water-efficient genotypes not only enhances crop yields and farm profitability but also contributes to mitigating aquifer depletion and ensuring the long-term sustainability of agriculture in the U.S. Mid-South.

Budget Justifications/Explanation of Travel and Direct Costs ($60,435):

Funds are requested for 100% support of a graduate student who will be assigned to this project ($22,000 base, $7,500 tuition, $1,122 benefits), and $13,000 for a visiting scholar to assist with data collection in objective 1 and with increasing seeds in objective 3 ($949,00 benefits). We request funds for 5% support of a program associate to assist with drone flights and imagery processing in objective 2 ($4,000 base, $1,144 benefits). In-state travel funds ($500,00) are requested for in-season data collection. Out-of-state travel funds ($3,000) are requested to present preliminary research findings at the 2025 Tri-society conference in Salt Lake, Utah. Supplies expenses ($5,250) are requested for lab and field supplies (e.g., envelopes, bags, stakes). A total of $1,970 is requested for research station maintenance for the three experimental sites.

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Promotion Board Budget

Elli, Elvis — *Identifying soybean genotypes for enhanced water use efficiency using high-throughput phenotyping*

Year	2025/2026	**Project Year**	
Lead Investigator	Elli, Elvis	**Co-PI #1**	Canella Vieira, Caio
Co-PI #2	Poncet, Aurelie	**Co-PI #3**	
Department			
Commodity Board	Soybean Promotion Board		
Project Title	Identifying soybean genotypes for enhanced water use efficiency using high-throughput phenotyping		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Elli, Elvis	Canella Vieira, Caio	Poncet, Aurelie		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES	AES				

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Associate	Wesley France	5%			$4,000		$4,000	$4,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$4,000	$0	$4,000	$4,000	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
MS student	100%	$22,000				$22,000	$22,000	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information		$7,500				$7,500	$7,500	$0
Subtotal: Graduate Student		$29,500	$0	$0	$0	$29,500	$29,500	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$6,000	$7,000			$13,000	$13,000	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$6,000	$7,000	$0	$0	$13,000	$13,000	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$1,144	$0	$1,144	$1,144	$0
Graduate Students	$1,122	$0	$0	$0	$1,122	$1,122	$0
Hourly Personnel	$438	$511	$0	$0	$949	$949	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$1,560	$511	$1,144	$0	$3,215	$3,215	$0
Personnel Total	$37,060	$7,511	$5,144	$0	$49,715	$49,715	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$500				$500	$500	$0
Out-of-State	$2,500		$500		$3,000	$3,000	$0
Travel Total	$3,000	$0	$500	$0	$3,500	$3,500	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Elli, Elvis *Identifying soybean genotypes for enhanced water use efficiency using high-throughput phenotyping*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$3,000	$1,500	$750		$5,250	$5,250	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$1,970	$0	$0	$0	$1,970	$1,970	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$4,970	$1,500	$750	$0	$7,220	$7,220	$0
	Total for Proposal	$45,030	$9,011	$6,394	$0	$60,435	$60,435	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Testing the Range of Soybean Cultivars that Can Benefit from Plant Elicitor Peptide Treatment

Lead Investigators: Fiona L. Goggin

Co-Investigators: N/A

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New (1 of 1)

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Plant Pathology

Stated Goal: In order to optimize plant elicitor peptide treatments for nematode management on soybean, we will evaluate whether receptivity/responsiveness to peptide treatment varies among soybean germplasm common in the Southern U.S.

Background: Plant elicitor peptides (PEPs) are compounds that are naturally produced in soybean and most other plants, and that could potentially be used for nematode management. In response to wounding or other types of stress, plants produce PEPs by cleaving longer precursors (propeptides). When the PEPs are released from a wounded plant cell, they bind to specialized receptors (PEPs receptors, or PEPRs) on neighboring cells in order to turn on the plant's induced defenses against pests and pathogens (Figure 1). Research in soybean, corn, and several other plants has shown that artificially treating plants with PEPs *in advance* of damage can provide even greater protection against pests or pathogens. My laboratory found that treating soybean seeds with three different PEPs (GmPEP1, 2, and 3) from the soybean cultivar Williams82 could significantly reduce soybean cyst nematode- and root knot nematode infection on that cultivar (Figure 2; Lee et al., 2018). We also engineered a common soil bacterium to deliver one of these PEPs (GmPEP3) to soybean seeds and roots, and we established that this could reduce soybean cyst nematode infection on the cultivar Magellan (Alnasrawi et al., 2024). These results indicate that treatment with PEPs from one soybean cultivar can induce nematode resistance in that variety and at one other cultivar.

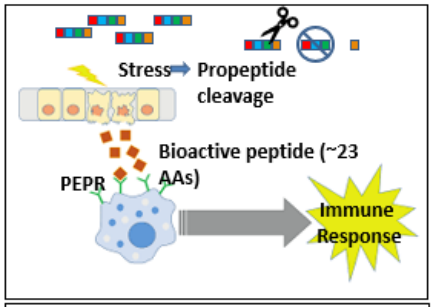

Fig. 1. Plant Defense Signaling by Plant Elicitor Peptides (Peps). Under stress, Peps (orange squares) are produced by cleavage of a longer propeptide. Released from a damaged plant cell, they bind specific receptors (PEPRs) on the surface of neighboring cells to activate defense signaling. Image modified from (Roh *et al.*, 2018).

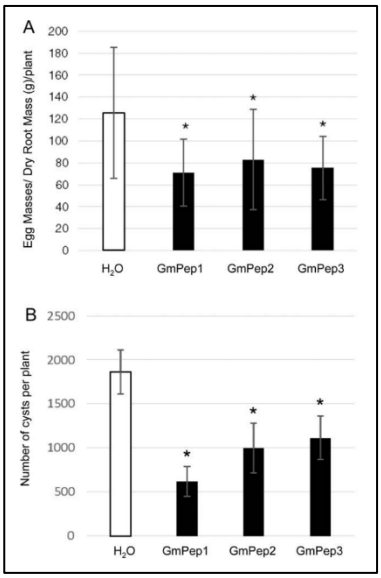

Fig. 2. Compared to water treatment (H_2O), seed treatment with soybean PEPs (GmPEP1, GmPEP2, or GmPEP3) reduces infection by root knot nematodes (A) and soybean cyst nematodes (B) on soybean (c.v. Williams82).

Knowledge Gap: While these results show promise, further work is needed to establish whether PEPs from Williams82 are applicable to the diversity of soybean cultivars grown in Arkansas. PEPs and their receptors are thought to have a lock-and-key relationship, and for a particular PEP to activate immunity in a plant, that plant must carry the matching PEP receptor (PEPRs). It's known that PEPRs vary between plant species, reducing the cross-species effectiveness of PEP treatments (Lori et al., 2015), but there are no published

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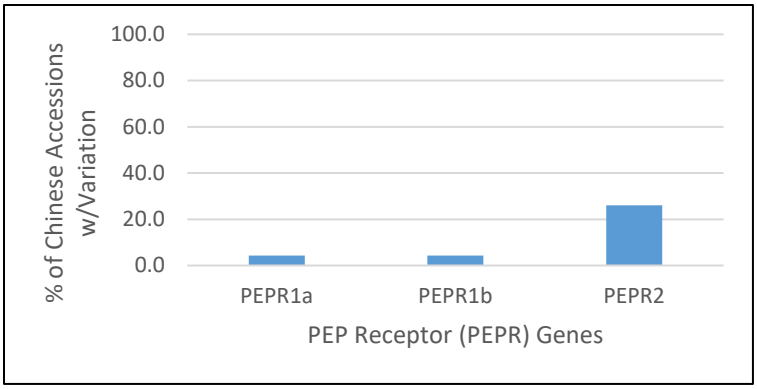

Figure 3. Genes Encoding PEP Receptors (PEPRs) vary in DNA Sequence Among Chinese Soybean Accessions. Analysis of the DNA sequence of the 3 *PEPR* genes in published genomes from 23 genetically diverse soybean accessions from China identified single nucleotide polymorphisms (SNPs) in 4-26% of the accessions.

reports indicating whether PEPRs vary among cultivars within a species or are strictly conserved within species. Thus, we do not know if a particular PEP like GmPEP3 will "work" on all varieties of a particular crop like soybean, or if PEP treatments should be selected with an eye to which PEPRs are present in that cultivar. Recently, using publicly available genomic sequences from a very genetically diverse collection of soybean landraces and cultivars from China (Liu et al., 2020), we discovered some PEPR DNA sequences that diverged from sequences in Williams82 (Figure 3). These alterations in PEPR sequences could potentially translate to variation in responsiveness to PEPs from Williams82. However, we do not know if any variation in PEPR sequences occur in U.S. soybean germplasm, which has less genetic diversity than the panel used for pan-genome sequencing in Liu et al (2020); moreover, we do not know whether this genetic variation in receptors would impact their function or their responsiveness to PEPs from other cultivars such as Williams82.

Approach: To address these knowledge gaps, we propose to develop screening methods to assess the responsiveness of soybean germplasm to PEPs, and also to determine if there is any diversification of PEPRs in cultivars grown in Arkansas and the Southern U.S. PEP seed treatment promotes increased height at the V1 stage (Alnasrawi et al., 2024), and this represents a good phenotype for high-throughput screening because it occurs early in plant growth and can be quantified rapidly and easily. Therefore, we propose to develop a screening method based on height at the V1 stage and use it to test the responsiveness to PEP treatment of key soybean accessions that represent the primary sources of genetic diversity in the southern US. In parallel, we will also use DNA sequencing to characterize PEPRs in key accessions that are widely-grown in the South and/or that contribute heavily to the parentage of many other widely-grown cultivars. If we identify any soybean germplasm that differs from Williams82 in PEPR sequence and/or the responsiveness of seedling growth to PEP treatment, we will also perform greenhouse bioassays to compare the effects of PEP treatment on nematode infection on the divergent lines with performance on treated and untreated Williams82.

Specific Objectives:

1a) Measure the effects of GmPEP3 seed treatment on seedling heights in a panel of soybean germplasm from Arkansas and the Southern US.

1b) Compare the DNA sequence of PEPRs (PEP receptors) in key soybean accessions that represent the primary sources of genetic diversity in commercial cultivars grown in the southern US.

2) Assess the effects of GmPEP3 treatment on nematode infection on any germplasm that differs from Williams82 in growth responses (1a) and/or PEPR sequences (1b).

Expected Outcomes: These parallel approaches will allow us to determine if there are correlations between a) responsiveness of seedling growth to PEP treatment; b) PEPR sequences; and c) the protective

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effects of PEP treatment against nematode infection. In other words, this work will address the question of whether the benefits of treating a particular soybean cultivar can be predicted on the basis of its early growth response to PEP treatment and/or based on the DNA sequences encoding its PEPRs. It will also provide us with information about how diverse or tightly-conserved PEPRs are in Southern soybean germplasm. If there is detectable diversity for PEPR sequences in US germplasm, we can also use our data to determine which accessions are most typical (in terms of PEPR sequence) for Arkansas cultivars and would be good alternatives to Williams82 as a source of PEP treatments.

Methods:

Choice of germplasm: The key accessions that contribute to most of the genetic diversity in the Southern US are Lee (PI 548656), Hill (PI 548654), Volsate (PI 548494), Ogden (PI 548477), and D49-2491. These accessions are thought to represent as much as 60% of the genetic diversity of modern cultivars grown in Arkansas and throughout the Southern US. Therefore, we will compare these accessions to Williams82 (the source of GmPEP3 and of the reference genome for soybean) and Magellan, another commercial cultivar for which we have already characterized responses to GmPEP3.

Growth Assay and Nematode Assay: Soybean seeds will be imbibed overnight in 1 uM GmPep3 (Lee et al., 2018) and transferred to soil, and then seedling heights will be measured at the V1 stage. It is anticipated that most (or all) germplasm will show increased seedling heights after PEP seed treatment similar to Williams82. For any accessions that lack this response, we will also assess root-knot nematode (*Meloidogyne incognita*, RKN) infection in plants with and without PEP treatment as compared to Williams82. Ten plants per group will be infected with ~8,500 RKN, and eggs will be extracted two months post-infection using a 10% bleach solution and sieves up to 25 µm. Egg counts will be performed using a McMaster Egg Counting Slide. Statistical analysis will be conducted using JMP software.

Characterization of PEP Receptor (PEP) Sequences: Accessions will be germinated in the greenhouse, and leaf samples from soybeans in the V2 stage will be collected, flash-frozen, stored at -80ºC, and genomic DNA will be extracted with a Qiagen DNeasy Plant Mini Kit. Primers for PCR amplification of *PEPR* DNA sequences will be designed based on the Williams82 PEPRs sequences downloaded from Phytozome (https://phytozome-next.jgi.doe.gov/blast-search), and *PEPR* coding regions will be PCR-amplified from genomic DNA using Phusion High Fidelity DNA Polymerase (ThermoFisher Scientific). The amplified fragments will be gel purified, cloned in pGEMT (Promega), and sent to IDT for sequencing. The bioinformatics softwares Clustal Omega and ExPASy will be utilized for cross-comparison of sequences from our different accessions and Williams82. The deduced amino acid sequences from Magellan will be further analyzed for their structure prediction and modelling with the help of Robetta software to predict the PEP and PEPR binding interactions. Accessions that show variation in PEPR predicted amino acid sequences compared to Williams82 will be included in the nematode assays described above.

Planned Milestones:

PROJECT TIMELINE	April-July 05				Aug – Nov 05				Dec 05– March 06			
Perform PEP seed treatments and measure impacts on seedling growth												
Sequence PEPRs from US soybean accessions												
Perform nematode biossays												

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Value to Soybean Industry:

Currently, there is a lack of suitable soybean cultivars that carry resistance to both of the most common nematode pests in Arkansas, root-knot nematodes and soybean cyst nematodes. Moreover, for soybean cyst nematodes, which are present in ~70% of Arkansas soybean acreage, the sources of resistance that are currently available are limited to specific races and can have considerable yield penalties. As a result, nematode management is complex and costly, and yield losses to nematodes can exceed 50% in heavily-infested fields. PEP treatments have the potential to limit these infections by "vaccinating" the plants and inducing defenses in the early, vulnerable seedling stages. Moreover, seed treatments are a convenient and economical tool for managing nematodes and other pests. Unlike genetic sources of nematode resistance, which are only available in a limited range of cultivars, seed treatments can be applied to any variety a grower desires, including maturity classes that lack genetic resistance. The decision to treat or not to treat can be made close to planting, after evaluating the results of soil tests to determine the necessity for treatment. Moreover, seed treatments can potentially provide broader-spectrum resistance than resistant cultivars can. The proposed research will help develop effective PEP seed treatments that can be used on soybean cultivars grown in Arkansas and throughout the South.

Budget Justifications/Explanation of Travel and Direct Costs: Funds are requested to provide partial support for one research associate (20% time, or $8,800 in salary) and 1 hourly undergraduate research assistant (~10h/week, $6,240 in hourly wages) to conduct the experiments, and to cover station costs associated with greenhouse rental ($3,204). We also request $5,000 in supplies to cover the cost of DNA extraction kits, Taq polymerase and other enzymes and consumable reagents for molecular cloning, DNA sequencing (IDT), custom synthetic peptide, consumable lab supplies (gloves, pipette tips, petri dishes, bacterial growth media), and greenhouse supplies (pots, irrigation tubing, sand).

References:

1. Lee, M., Huffaker, A., Crippen, D., Robbins, R.T., and Goggin, F.L. 2018. Plant Elicitor Peptides Promote Plant Defenses against Nematodes in Soybean. Molecular Plant Pathology, 19(4):858-869.
2. Alnasrawi A, Sanadhya P, Zhang L, Gleason C, Minor K, Crippen D, Goggin FL. The Effects of *Bacillus subtilis* Expressing a Plant Elicitor Peptide on Nematode Infection on Soybean. Phytopathology. 2024 Sep;114(9):2143-2150. doi: 10.1094/PHYTO-03-24-0080-R.
3. Lori, M. Van Verk, M. C., Hander, T., Schatowitz, H., Klauser, D., Flury, P., Gehring, C. A., Boller, T., & Bartels, S. (2015). Evolutionary divergence of the plant elicitor peptides (Peps) and their receptors: Interfamily incompatibility of perception but compatibility of downstream signalling. *Journal of Experimental Botany*, *66*(17), 5315–5325.
4. Liu, Y., Du, H., Li, P., Shen, Y., Peng, H., Liu, S., Zhou, G. A., Zhang, H., Liu, Z., Shi, M., Huang, X., Li, Y., Zhang, M., Wang, Z., Zhu, B., Han, B., Liang, C., & Tian, Z. (2020). Pan-Genome of Wild and Cultivated Soybeans. *Cell*, *182*(1), 162-176.e13. https://doi.org/10.1016/j.cell.2020.05.023

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Goggin, Fiona — *Testing the Range of Soybean Cultivars that Can Benefit from Plant Elicitor Peptide Treatment*

Year	2025/2026	**Project Year**	
Lead Investigator	Goggin, Fiona	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Testing the Range of Soybean Cultivars that Can Benefit from Plant Elicitor Peptide Treatment		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Goggin, Fiona				**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI	AES						

Fulltime Personnel

Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Research Associate	Jiamei Li	20%	$8,800				$8,800	$8,800	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$8,800	$0	$0	$0	$8,800	$8,800	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel					$0	$0	$0
Hourly-Students	$6,240				$6,240	$6,240	$0
Subtotal: Hourly	$6,240	$0	$0	$0	$6,240	$6,240	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$2,517	$0	$0	$0	$2,517	$2,517	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$6	$0	$0	$0	$6	$6	$0
Subtotal: Fringe Benefits	$2,523	$0	$0	$0	$2,523	$2,523	$0
Personnel Total	$17,563	$0	$0	$0	$17,563	$17,563	$0

Travel

Justify out-of-state travel in proposal.

	Travel				**Total**	**AES Portion**	**CES Portion**
In-State					$0	$0	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$0	$0	$0	$0	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Goggin, Fiona *Testing the Range of Soybean Cultivars that Can Benefit from Plant Elicitor Peptide Treatment*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$5,000				$5,000	$5,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Greenhouse space at Rosen Cer	$3,204				$3,204	$3,204	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$8,204	$0	$0	$0	$8,204	$8,204	$0
	Total for Proposal	$25,767	$0	$0	$0	$25,767	$25,767	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Evaluating the Impacts of Irrigation Water Management Practices on Groundwater Sustainability and Economic Benefits in Arkansas

Lead Investigators: Qiuqiong Huang
Co-Investigators: Christopher Henry
Status: New
Research Areas: Irrigation, Economics

Stated Goal: The project aims to evaluate the impacts of Irrigation Water Management (IWM) practices on groundwater sustainability and to perform a cost-benefit analysis of IWMs using existing datasets.

Specific Objectives:

1. Analyze the impacts of the Arkansas Irrigation Yield Contest, "Most Crop per Drop," since its inception in 2018.
2. Quantify water savings achieved through IWM practices.
3. Compare IWM investment options using net returns, considering varying irrigation water supplies and energy sources.
4. Develop a user-friendly, web-based interactive tool for irrigators to compare the cost-benefits and payback periods of IWM practices, hosted on the UADA irrigation website.

Methods:

The project will utilize multiple datasets, including those funded by the Arkansas Soybean Promotion Board (ASPB) and previously published work on IWM practices and irrigation pumping plant efficiency. This approach builds on prior projects while avoiding duplication of efforts. To address Objectives 1 and 2, data collected during the Arkansas Irrigation Yield Contests, "Most Crop per Drop," from 2018 to 2024 will be analyzed. This dataset includes detailed information on irrigation practices, application rates, and crop yields. Additionally, the project will use data from the 2016 and 2022 Arkansas Irrigated Producers Phone (AIPP) Surveys, conducted by the PIs. The 2016 survey sampled 231 producers, drawn from the Arkansas Natural Resources Commission (ANRC) water user database and Dun & Bradstreet's list of commercial crop growers. The 2022 survey used the same database as the 2016 survey, supplemented with Farm Journal data, successfully interviewing 274 producers. The project will also incorporate previously published data on irrigation pumping costs and efficiency funded by ASPB. These datasets will enable an evaluation of the on-farm performance of IWM practices, including CHS, surge irrigation, and sensors on soybean farms.

To achieve Objectives 3 and 4, we will gather data on the costs of IWM equipment through online searches and by contacting producers, retailers, and dealers who have used, purchased, or sold the equipment. Additional data will be collected on installation, labor, and operation and maintenance (O&M) costs. Irrigation energy cost data will be obtained from the Arkansas Soybean Verification Research Program (2014–2024). Furthermore, data related to irrigation costs will be sourced from the Arkansas Crop Enterprise Budgets and the 2018 and 2023 Irrigation and Water Management Surveys.

A multivariate regression analysis will be conducted to estimate the effect of IWM practices on water savings while controlling for potential confounding factors such as rainfall, farm size, and producer characteristics. This analysis will also identify the types of producers most likely to achieve reductions in pumping time and irrigation labor. Additionally, it will assess how each IWM practice (CHS, surge, sensors) or their combinations influence these outcomes, addressing Objectives 1 and 2.

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A Net Returns analysis will be conducted to compare the IWM practices across variations in different commercial soil sensors options, surge valves, and pump timers (Objective 3). Labor savings such as remote access to sensor data enabled by telemetry products will also be estimated.

We will develop a user-friendly, web-based interactive dashboard tool, accessible online at no cost, to help producers estimate the costs and benefits of various IWM practices (Objective 4). Producers will need to input minimal information, such as farm size, and select one or more IWM practices, along with combinations of irrigation pump energy and water sources (groundwater versus surface water) from a menu. The dashboard will visually compare the selected IWM options using key financial metrics such as total cost, return, net present value (NPV), and payback period. It will also display potential water savings for the chosen practices. The tool will be secure, requiring no personal information, and will undergo thorough testing before being published on the UADA irrigation website.

A journal article will be published highlighting the impacts of the Arkansas Irrigation Yield Contest. Additionally, a research series article will present the results of the Net Returns analysis on IWM equipment. Two factsheets will also be developed: one summarizing the impact of the irrigation contest and another supporting the online tool, providing information in an accessible format for soybean irrigators.

Planned Milestones:

- March - December 2025: Collect all data and complete Objectives 1 and 2.
- January – April 2026: Complete Objective 3.
- May – August 2026: Develop the web-based dashboard tool
- September - December 2026: Conduct beta testing of the dashboard, gather feedback, and make necessary revisions.
- January - February 2027: Final testing and quality assurance to ensure the tool is fully functional, and ready for public release.
- March 2027: Publish the web tool on the UADA irrigation website, along with user guides.

Value to Soybean Industry:

The findings from this project will provide valuable insights for stakeholders, including Soybean Board members, by highlighting the impacts of sponsoring the Arkansas Irrigation Yield Contest. Additionally, the results will assist policymakers updating the Arkansas Water Plan by evaluating the potential of IWM practices to address the gap between water supply and demand. Soybean producers will benefit from the cost-benefit tool and accompanying factsheets, enabling them to make informed investment decisions regarding IWM practices.

Budget Justifications/Explanation of Travel and Direct Costs ($38,441):

A total of $32,141 is requested to cover the tuition, stipend, and fringe benefits of an experienced Public Policy Ph.D. student specializing in Agricultural Policy. The student, who previously worked as a research associate and managed the 2022 AIPP Survey, will be responsible for completing all tasks related to this project. Additionally, $700 is requested for in-state travel to allow the student to visit soybean farms to assess irrigation installations and meet with the contest coordinator in Stuttgart. The amount of $2,000 is requested for Co-PI Henry for page charges. Furthermore, $3600 is requested for out-of-state travel to scientific meetings, including $1,800 for the student to present preliminary findings at the 2025 UCOWR/NIWR conference and $1,800 for PI Huang to present at the 2025 The Agricultural & Applied Economics Association (AAEA) Annual Meeting.

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Promotion Board Budget

Huang, Qiuqiong — *A Decade After the 2014 Arkansas Water Plan: Impact of Irrigation Water Management Practices on Soybean*

Year	2025/2026	**Project Year**	New
Lead Investigator	Huang, Qiuqiong	**Co-PI #1**	Henry, Christopher
Co-PI #2		**Co-PI #3**	
Department	AEAB Agricultural Economics & Agribusiness		
Commodity Board	Soybean Promotion Board		
Project Title	A Decade After the 2014 Arkansas Water Plan: Impact of Irrigation Water Management Practices on Soybean Production		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Huang, Qiuqiong	Henry, Christopher			Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	AES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
	Eva Stephani Caroline	100%	$24,000				$24,000	$24,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$6,917				$6,917	$6,917	$0
	Subtotal: Graduate Student		$30,917	$0	$0	$0	$30,917	$30,917	$0
	Hourly								
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$0	$0	$0	$0	$0	$0	$0
	Fringe Benefits								
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$0	$0	$0	$0	$0	$0	$0
	Graduate Students		$1,224	$0	$0	$0	$1,224	$1,224	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$1,224	$0	$0	$0	$1,224	$1,224	$0
	Personnel Total		$32,141	$0	$0	$0	$32,141	$32,141	$0
	Travel								
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$700				$700	$700	$0
	Out-of-State		$3,600				$3,600	$3,600	$0
	Travel Total		$4,300	$0	$0	$0	$4,300	$4,300	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Huang, Qiuqiong *A Decade After the 2014 Arkansas Water Plan: Impact of Irrigation Water Management Practices on Soybean*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication		$2,000			$2,000	$2,000	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$0	$2,000	$0	$0	$2,000	$2,000	$0
	Total for Proposal	$36,441	$2,000	$0	$0	$38,441	$38,441	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Artificial Intelligence for Early Soybean Disease Detection and Robot Implementation

Lead Investigators: Cengiz Koparan

Co-Investigators: Dongyi Wang

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy

Stated Goal: Diseases such as root rot, aerial blight and target spot are continued threats to soybean crops especially in high humidity conditions and often lead to serious yield losses [1]. To avoid these diseases, it is crucial to identify and respond to them in a rapid and precise manner. The goal of this research is to help develop a hexapod embedded with sensors and a YOLO-based object detection algorithm that will detect diseases and map.

Specific Objectives: The objective of this research is to produce image dataset combined with sensor dataset to train an Artificial Intelligence (AI) model to detect soybean diseases near stem. The AI model then will be integrated with a hexapod type robot for real time disease detection and mapping for proof-of-concept purposes.

Methods: The experiment has both greenhouse and field experiment. In the greenhouse, soybean plants will be infested with aerial blight and target spot pathogens. A total of 300 plants (100 for each disease and 100 controls) will be grown in 2.5-inch pots arranged in a "plant-weed-plant" layout. For field trials, 16 plots will be established, with 4 control plots and 6 plots per disease. The custom designed hexapod robot will be used to collect image data as well as temperature and spectral readings of the plants in both settings to develop disease detection algorithms.

The hexapod robot will be integrated with RGB camera and spectral sensor for imaging and sensing the spectral reflection. A Jetson nano will be programmed and equipped with YOLO-based object detection algorithms, utilizing the RGB camera to identify disease symptoms. Thermal sensors and ultrasonic sensors will be equipped with an Arduino uno microcontroller. An autonomous navigation system will be developed for the Hexapod which will enable uninterrupted data collection under dense canopies.

Image data will be gathered during various vegetative growth stages and labeled to distinguish between healthy and unhealthy plants for AI approach. The YOLO model will be trained on this labeled data to detect and distinguish between disease spread. Validation will be performed utilizing field data to ascertain the models' reliability. Statistical analysis will assess the dissemination of disease across plots and evaluate the effectiveness of early detection techniques using sensors and AI enabled hexapod robot.

The project aims to deliver a functional hexapod robot capable of detecting aerial blight and target spot symptoms using YOLO-based models. Additional outcomes include the creation of an annotated image dataset, statistical models predicting and mapping disease spread, and insights into integrating detection systems with robotic fungicide application.

Planned Milestones: Minimizing loss of yield and improving the quality of the crop will require timely detection of diseases [6]. The currently available methods, however, do not fully capture some of the challenges such as the rapid spread of disease under a dense canopy. The fusion of object detection models and scouting hexapod robots is an innovative solution for early detection of the soybeans under canopy diseases. One of the features of YOLO-based models is object detection in a very profound efficiency and

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accuracy which is very ideal for identifying disease symptoms [7]. Additionally, this research aligns with precision agriculture objectives which promote green farming and efficient usage of resources while growing soybeans.

Value to Soybean Industry: Two significant diseases that affect soybean crops are aerial blight and target spot and these diseases are more severe in conditions that have high humidity, especially in the lower canopy [2]. When aerial blight or target spot spread to the upper canopy, the effect on soybean is irreversible and plant cannot survive the disease. Aerial blight caused by "*Rhizoctonia solani*", which proliferates on the periphery of the stem, damage leaves, flowers, and pods, and then develops into mycelium that has a white web-like appearance detectable with the phenotyping changes [3]. On the other hand, Target spot, which is caused by "*Corynespora cassiicola*," is also a canopy disease but starts off in the lower part of the canopy and spreads around the lower part when the humidity is high for a long period of time [4]. These two diseases can be well controlled with fungicides if they are properly and timely applied.

The management of these diseases is not easy due to their often inconsistent and identified distribution in the fields making scouting labor intensive and also not reliable [5]. Sensors including optical, spectral, , thermal, and displacement combined with Artificial Intelligence (AI) offer potential solution in precise disease detection from soybean plants. Spectral sensors could determine the changes in reflectance of light with respect to the stress occurred on the plant. In addition, diseased plants or the infected parts of the plants could be identified thermally when the temperature changes. Displacement sensors provide accurate sensor measurement distance and help controls robot navigation. Optical sensors capture images with high definition which aids AI models such as You Only Look Once (YOLO)for object detection purposes, which can assist in recognizing the symptoms and contribute on developing smart treatment systems. Robotics detect and treat type systems could screen under canopy helping the plants to identify their symptoms at an early stage and could help in the site-specific application of treatment. Robotic smart scouting and treatment systems contribute to precision agriculture industry because they contribute to reducing the waste of resources as well as automated disease management solutions for soybean crop.

Budget Justifications/Explanation of Travel and Direct Costs: Graduate student salaries that includes tuition for one year. Direct expenses will include field and green house preparations and material such as soil, seeds, pods, hourly students, labor, microcomputers for prototyping, sensors, and industry expertise when needed.

References:

[1] H. Jeena, K. P. Singh, G. Rakhonde, M. Dev, K. Surbhi, and T. Aravind, "Diagnosis and Management Strategies for Soybean Diseases," in Diseases of Field Crops: Diagnostics and Management, V. K. Singh, J. Akhtar, and K. P. Singh, Eds., Singapore: Springer Nature Singapore, 2024, pp. 223–264. doi: 10.1007/978-981-97-6160-9_11.

[2] G. K. Bhamra, M. Borah, and P. K. Borah, "Rhizoctonia Aerial Blight of Soybean, its Prevalence and Epidemiology: A Review," Agric. Rev., no. Of, Sep. 2022, doi: 10.18805/ag.R-2311.

[3] O. O. Ajayi-Oyetunde and C. A. Bradley, "Rhizoctonia solani : taxonomy, population biology and management of rhizoctonia seedling disease of soybean," Plant Pathol., vol. 67, no. 1, pp. 3–17, Jan. 2018, doi: 10.1111/ppa.12733.

[4] J. P. Edwards Molina, B. L. Navarro, T. W. Allen, and C. V. Godoy, "Soybean target spot caused by Corynespora cassiicola: a resurgent disease in the Americas," Trop. Plant Pathol., vol. 47, no. 3, pp. 315–331, Jun. 2022, doi: 10.1007/s40858-022-00495-z.

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[5] M. T. Brown, “Multiple Tactics to Improve our Understanding of Soybean Diseases,” p. 1344455 Bytes, 2023, doi: 10.25394/PGS.22637305.V1.

[6] M. A. John, I. Bankole, O. Ajayi-Moses, T. Ijila, T. Jeje, and P. Lalit, “Relevance of Advanced Plant Disease Detection Techniques in Disease and Pest Management for Ensuring Food Security and Their Implication: A Review,” Am. J. Plant Sci., vol. 14, no. 11, pp. 1260–1295, 2023, doi: 10.4236/ajps.2023.1411086.

[7] U. Sirisha, S. P. Praveen, P. N. Srinivasu, P. Barsocchi, and A. K. Bhoi, “Statistical Analysis of Design Aspects of Various YOLO-Based Deep Learning Models for Object Detection,” Int. J. Comput. Intell. Syst., vol. 16, no. 1, p. 126, Aug. 2023, doi: 10.1007/s44196-023-00302-w.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Cengiz Koparan — *Artificial Intelligence for Early Soybean Disease Detection and Robot Implementation*

Year	2025/2026	**Project Year**	New	**Version: 7.0 (11/01/2024)**
Lead Investigator	Cengiz Koparan	**Co-PI #1**	Dongyi Wang	
Co-PI #2		**Co-PI #3**		
Department	AECT Agricultural Education, Communications & Tech			
Commodity Board	Soybean Promotion Board			
Project Title	Artificial Intelligence for Early Soybean Disease Detection and Robot Implementation			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Cengiz Koparan	Dongyi Wang			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
GA	100%	$26,000	$26,000			$52,000	$52,000	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$26,000	$26,000	$0	$0	$52,000	$52,000	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students	$4,000	$4,000			$8,000	$8,000	$0
Subtotal: Hourly	$4,000	$4,000	$0	$0	$8,000	$8,000	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$1,326	$1,326	$0	$0	$2,652	$2,652	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$4	$4	$0	$0	$8	$8	$0
Subtotal: Fringe Benefits	$1,330	$1,330	$0	$0	$2,660	$2,660	$0
Personnel Total	$31,330	$31,330	$0	$0	$62,660	$62,660	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$0	$0	$0	$0	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Cengiz Koparan *Artificial Intelligence for Early Soybean Disease Detection and Robot Implementation*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$5,000				$5,000	$5,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$100	$0	$0	$0	$100	$100	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$5,100	$0	$0	$0	$5,100	$5,100	$0
	Total for Proposal	$36,430	$31,330	$0	$0	$67,760	$67,760	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Predicting the end use performance of Arkansas soy protein using genomics

Lead Investigators: Mahfuzur Rahman

Co-Investigators: Caio Canella Vieira

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New (1 of 3)

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): **Post-Harvest, Breeding**

Stated Goal:

The market for plant-based foods is expanding rapidly, with soy protein isolate taking the lead in the sector of protein-rich plant-based foods. On average, soybean seeds comprise slightly over 40% protein and 20% oil on a dry basis. The development of plant-based food products like vegan meat, cheese, and eggs necessitates that soy protein exhibits certain functionalities, such as a high solubility in water, emulsion, and gelling properties. These functionalities are determined more by the quality of the protein than by its quantity. For instance, chickpeas and mung beans (approx. 20-30% protein) contain less protein than soybeans, but the quality of their protein has made them popular ingredients in the vegan cheese and egg market.

For years, the primary goal of breeding programs has been to improve the yield, which took a negative toll on seed composition and quality. Therefore, it became very important to enhance the protein quality of soybean seeds to use soy protein in novel food product development. This study will screen the soybean protein from Arkansas genotypes to understand their current functional properties and suggest vegan product applications. With the advancements in genomics and statistical models, researchers can use these data to predict the phenotype of interest (i.e. plant-based food development). This is referred to as genomic prediction and consists of setting a statistical model and estimating its parameters from a training dataset of genotyped (molecular markers) and phenotype individuals.

For instance, if a given cultivar exhibits a specific set of molecular markers that can be correlated with the production of high-quality soy protein-based meat, and another cultivar exhibits a different set of molecular markers that can be used to produce high-quality soy protein-based eggs, targeted breeding can be focused on these phenotypic traits depending on the market demand for these vegan products. The broader objective is to guide future breeding programs to produce more competitive proteins that can meet future market needs which would eventually increase the applications of Arkansas soybeans in food product development.

Specific Objectives:

1. Fractionate and analyze the protein quality of breeding lines and use them to develop food products.
2. Co-relate product development data with genomic data to develop a predictive model
3. Develop breeding materials with improved seed composition to be used in plant-based foods

Methods:

A total of 150 breeding lines developed at the UA Soybean Breeding program will be used in this study (total 50 lines/ years). The selected soybean seeds are subjected to cold oil expulsion and defatting and isolate protein using industrial method.

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The protein quality evaluation is performed for structural, molecular, biological, and techno-functional properties. The molecular properties will be analyzed using SDS-PAGE, FT-IR spectroscopy, and HPLC. The ingredient functionality of the protein isolates will be compared such as solubility, emulsifying and foaming properties, gelling properties, and water-holding capacity will be analyzed following established protocols. Other functional properties will be evaluated, such as surface hydrophobicity and intrinsic fluorescence. In vitro-protein digestibility (IVPD) will be assessed using the sequential-enzyme method, and results will be used in calculating PDCAAS.

Multiset Correlation and Factor Analysis (MCFA) will be used to manage the large number of features in genomics data relative to sample size. Machine learning techniques such as regression analysis, random forests, or neural networks will be aided in building models that predict protein quality based on genomic and proteomic data. These models can be trained and validated using the integrated data sets. Combining these genomic, proteomic, and computational approaches makes it possible to develop a comprehensive predictive model that correlates protein quality with genomics data, aiding in understanding the end-use of high-quality soybean cultivars.

Planned Milestones:

A total of 150 breeding lines will be used in this study (a total of 50 lines/ years).

2025, 2026, and 2027: Fractionate protein and analyze quality of 50 lines/ year. Selected lines will be used to develop food products. Publish the results in Arkansas Soybean Research Studies & and a peer-reviewed journal, and present data at national scientific meetings such as Institute Food Technologies.

Compare the data of all three years to select high-performer lines. Utilize the data to develop a breeding material with improved seed composition to be used in plant-based foods

Value to Soybean Industry:

In 2022, the plant-based protein market was valued at $8 billion in the U.S., experiencing a 7% increase in dollar sales compared to 2021. Soybean is the major plant-based protein, and its market is anticipated to be valued at $10.5 billion in 2024, with projections to reach $13.3 billion by 2029.

This research will help identify specific product development qualities (alternative meat and dairy) in soybean varieties grown in Arkansas. The insights gained from this research will inform future breeding programs, enabling the development of soybean cultivars with specific traits that meet the evolving demands of the plant-based protein industry. This will ensure that Arkansas soybeans remain competitive and preferred in the rapidly growing plant-based protein market.

Budget Justifications/Explanation of Travel and Direct Costs ($99,103):

Considering the number of samples, a dedicated research associate is required. A total of 67,519 $ is requested to support an associate and an hourly student who will execute the experimental plan. Additionally, $1,000 is requested for traveling to a scientific meeting to present data, and $20,000 is allocated for purchasing chemicals and supplies in PI Rahman's lab as well as for the external lab. Furthermore, a total of $8,000 is requested to support an hourly visiting scholar in Co-PI Vieira's lab. In addition, $1,000 is requested for travel to install and conduct field experiments, and $1,000 is requested for supplies, including seed composition analysis and planting and harvesting supplies. It is worth noting that the extensive cost of acquiring genomic data is already being covered by other projects supported by the Arkansas Soybean Promotion Board, hence the smaller budget for Co-PI Vieira.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Rahman, Mahfuzur *Predicting the end use performance of Arkansas soy protein using genomics*

Year	2025/2026	**Project Year**	
Lead Investigator	Rahman, Mahfuzur	**Co-PI #1**	Vieira, Caio
Co-PI #2		**Co-PI #3**	
Department	FDSC Food Science		
Commodity Board	Soybean Promotion Board		
Project Title	Predicting the end use performance of Arkansas soy protein using genomics		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Rahman, Mahfuzur	Vieira, Caio			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI		AES	AES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Research Associate	To be named		$50,000				$50,000	$50,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$50,000	$0	$0	$0	$50,000	$50,000	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
	To be named						$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel		$3,000	$8,000			$11,000	$11,000	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$3,000	$8,000	$0	$0	$11,000	$11,000	$0
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$14,300	$0	$0	$0	$14,300	$14,300	$0
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$219	$584	$0	$0	$803	$803	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$14,519	$584	$0	$0	$15,103	$15,103	$0
	Personnel Total		$67,519	$8,584	$0	$0	$76,103	$76,103	$0
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State						$0	$0	$0
	Out-of-State		$1,000	$1,000			$2,000	$2,000	$0
	Travel Total		$1,000	$1,000	$0	$0	$2,000	$2,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Rahman, Mahfuzur *Predicting the end use performance of Arkansas soy protein using genomics*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$20,000	$1,000			$21,000	$21,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$20,000	$1,000	$0	$0	$21,000	$21,000	$0
	Total for Proposal	$88,519	$10,584	$0	$0	$99,103	$99,103	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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ARKANSAS SOYBEAN PROMOTION BOARD
2025-2026 PROPOSAL

Title: Educating Growers and Consultants on Insect Monitoring and Control

Lead Investigators: Ben Thrash
Co-Investigators:, Nick Bateman, Glenn Studebaker
Status: New
Research Area: Entomology

Stated Goal: To educate growers, consultants, and other ag industry on the proper techniques for monitoring and management of soybean insect pest populations and to help provide them with the tools they need to make effective and economical decisions.

Specific Objectives:

1. Increase awareness of the impact soybean insects can have on production
2. Provide growers and other decision-makers with the proper tools to make decisions on insect pest populations in their fields
3. Overall improvement of soybean insect pest management in Arkansas and increased adoption of IPM in soybean production.

Methods:

1. Each year we provide information at turn-row meetings, field days, and seed/ ag distributor field days on proper sampling and management considerations and demonstrate scouting procedures for effective sampling methods.
2. In previous years we were able to have sweep nets donated from chemical companies such as Bayer and Syngenta, however, the last two years we have covered the costs of the sweep nets through our own funds. We have provided over 200 sweep nets to growers, consultants and other decision-makers each year, to promote proper insect management in soybeans for the last 4-5 years. This may sound like enough are already out there, but sweep nets don't last long. Some people can go through several sweep nets in a year. I'm continually amazed at meetings how many people request a sweep net.

Planned Milestones:

1. Put the sampling tools needed in the hands of our growers and other decision-makers to promote effective and economical control of insects.
2. Educate our clientele on the proper management techniques for insect control and increase awareness of Integrated Pest Management (IPM). This should promote the use of thresholds, proper insecticide choices, and conservation of beneficial insects that are so important in the soybean ecosystem. Conduct scouting schools as needed and requested by clientele (5-10/ year).
3. To document these milestones we would like to conduct a survey of growers to monitor, increased awareness of soybean insect management, what growers are spending on insect control, how decisions to control insects are made and increased adoption of IPM in soybean production in Arkansas. This data is used each year to

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represent Arkansas in the Soybean Insect Losses for the Midsouth, which is published in the Midsouth Entomologist Journal.

Value to the Soybean Industry: Margins are becoming increasingly tight and spending money controlling insect pests only when necessary is a way to increase profits for growers. Few would argue that soybean insect management has become even more important in recent years and the changes in production have resulted in a need for increased awareness of soybean insect pests. These changes in production have created a need to educate growers and other decision-makers on the proper methods for monitoring insects and increase the awareness of the proper management techniques for effective and economical insect control. We want to make sure Arkansas soybean producers money is wisely spent for insect management.

Budget Justification: All money will be used to buy sweepnets to give to stakeholders.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Thrash, Ben *Educating Growers and Consultants on Insect Monitoring and Control*

Year	2025/2026	**Project Year**	
Lead Investigator	Thrash, Ben	**Co-PI #1**	Bateman, Nick
Co-PI #2	Studebaker, Glenn	**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Educating Growers and Consultants on Insect Monitoring and Control		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Thrash, Ben	Bateman, Nick	Studebaker, Glenn		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI							
	X	X	X				

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$0	$0	$0	$0	$0	$0	$0
Personnel Total	$0	$0	$0	$0	$0	$0	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$0	$0	$0	$0	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Thrash, Ben *Educating Growers and Consultants on Insect Monitoring and Control*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$3,000				$3,000	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$3,000	$0	$0	$0	$3,000	$0	$0
	Total for Proposal	$3,000	$0	$0	$0	$3,000	$0	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Economics of Automatic Applications in Arkansas Soybean

Lead Investigators: Ben Thrash

Co-Investigators: Nick Bateman, Glenn Studebaker

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Entomology

Stated Goal: This project aims to evaluate the profitability of automatic insecticide applications at the R3 growth stage in Arkansas Soybean. A large portion of growers in Arkansas make automatic fungicide applications on soybean near the R3 growth stage. It has become increasingly common for an insecticide to be mixed in with this application for "insurance" purposes. Pyrethroids (lambda-cyhalothrin, bifenthrin) are commonly used in this practice because of their relatively low cost and broad-spectrum against many pests, however their use can inadvertently flare other pests due to them killing beneficial insects. Diamides (Besiege, Vantacor) are also commonly used because of their long residual control against caterpillar pests. However, diamides are relatively expensive, and the likelihood of a caterpillar pest infesting those fields is low much of the time, depending on location and planting date. Occasionally corn earworm still infest soybean after a diamide application leading to further control costs. Nucleopolyhedrovirus (NPV) (Heligen, Hearken) is another insecticide that is commonly used. These products are relatively inexpensive but only work on corn earworm. If earworm is not present at the time of application, the residual control provided can be extremely short depending on environmental conditions. However, NPV does not disrupt beneficial insect populations like some other insecticides such as the pyrethroids.

Specific Objectives:

1. Apply insecticides at R3 growth stage on soybean planted at various times and various locations across the state and monitor for insect populations. Compare automatic application profits to the profitability of an IPM approach of only spraying when thresholds are reached.
2. Record yields and determine the profitability of automatic insecticide applications.
3. Determine if there are specific circumstances when and where an automatic insecticide application may be warranted.

Methods: Insecticides will be applied at the R3 growth stage in large replicated strips in grower fields as well as experiment stations. Insecticides will include lambda-cyhalothrin (Warrior II), chlorantraniliprole (Vantacor), and nucleopolyhedrovirus (Heligen) and will be compared to a treat only as needed plot. On the day of application and each week thereafter plots will be scouted for insect pests and treated as necessary. Yields will be recorded at each location and will be analyzed for profitability.

Planned Milestones:

2025: Initiate trials on multiple grower fields across and research stations across the state

2026: Continue research by conducting trials across the state.

2027: Continue research, analyze data, publish findings.

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Value to Soybean Industry: With currently high production costs and relatively low commodity prices, growers are trying to find ways to increase yields and reduce inputs. Automatic insecticide applications are one area where growers may be able to increase profitability by either changing the insecticide they are using or eliminating them all together. This project will help to

Budget Justifications/Explanation of Travel and Direct Costs: Funding will cover the costs of a graduate student. Travel costs will cover graduate student travelling to a couple of conferences to present their research.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Thrash, Ben *Economics of Automatic Insecticide Applications*

Year	2025/2026	**Project Year**	New	**Version: 7.0 (11/01/2024)**
Lead Investigator	Thrash, Ben	**Co-PI #1**	Bateman, Nick	
Co-PI #2	Studebaker, Glenn	**Co-PI #3**		
Department	ENPL Entomology and Plant Pathology			
Commodity Board	Soybean Promotion Board			
Project Title	Economics of Automatic Insecticide Applications			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Thrash, Ben	Bateman, Nick	Studebaker, Glenn		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES	CES				

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
	Unfilled GA	100%	$23,600				$23,600	$0	$23,600
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$10,200				$10,200	$0	$10,200
	Subtotal: Graduate Student		$33,800	$0	$0	$0	$33,800	$0	$33,800

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$1,204	$0	$0	$0	$1,204	$0	$1,204
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$1,204	$0	$0	$0	$1,204	$0	$1,204
Personnel Total	$35,004	$0	$0	$0	$35,004	$0	$35,004

Travel

Justify out-of-state travel in proposal.	Travel				Total	AES Portion	CES Portion
In-State		$2,000	$1,000		$3,000	$0	$3,000
Out-of-State	$5,000				$5,000	$0	$5,000
Travel Total	$5,000	$2,000	$1,000	$0	$8,000	$0	$8,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Thrash, Ben *Economics of Automatic Insecticide Applications*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$100	$50	$0	$0	$150	$0	$150
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$100	$0	$100	$0	$100
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$100	$50	$100	$0	$250	$0	$250
	Total for Proposal	$40,104	$2,050	$1,100	$0	$43,254	$0	$43,254

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Optimization of fungal pathogens AF22 and AF24 as bioherbicides for Palmer amaranth (pigweed)

Lead Investigator: Burt Bluhm, UADA-Fayetteville

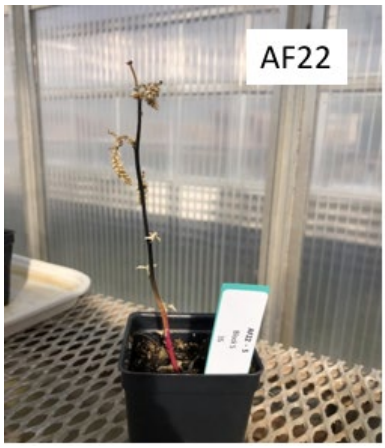
Collaborator: Kelly Cartwright, Agricultural Research Initiatives, Inc.

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Weeds

Stated Goal: Herbicide-resistant Palmer amaranth (pigweed) is one of the most frustrating management issues for Arkansas soybean production. Biological Controls (bioherbicides) based on fungal pathogens have been commercialized for some weed pests, but not pigweed. In previous work supported by the Arkansas Soybean Promotion Board, fungal pathogens were isolated from pigweed throughout Arkansas to identify viable biological control candidates. Recently, isolates AF22 and AF24 have emerged as highly promising candidates. *The goal of this project is to create commercially viable bioherbicides targeting Palmer amaranth based on fungal isolates AF22 and AF24.*

Background: In work previously funded by the Arkansas Soybean Promotion Board, we identified two fungal pathogens from pigweed (AF22 and AF24) that consistently kill young pigweed plants with a high degree of virulence (first image). Both isolates induce lethality with rapid stem colonization and necrosis, leaving a black, carbon-like residue of dead tissue. These symptoms suggested that AF22 and AF24 produce a host-specific toxin, further evidence of which is rapid wilting, foliar necrosis, and death of pigweed plants exposed to culture filtrates (within 48 hours after exposure; middle and right images). The production of a pigweed-specific toxin by AF22 and AF24 is significant for commercialization, as the pathogens could be applied directly (or in a bioherbicide cocktail) to kill pigweed, or the toxin produced by the pathogens could be used/adapted into a more conventionally formulated, host-specific chemical herbicide.



Specific Objectives:

1. *Develop isolates AF22 and AF24 as biological control agents/bioherbicides of pigweed.*
2. *Identify host-specific toxins produced by isolates AF22 and AF24 for bioherbicide development.*
3. *Actively pursue commercialization of bioherbicide products derived from AF22 and AF24.*

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Methods: *Objective 1.* We have collected promising data about the effectiveness and host specificity of AF22 and AF24. We are currently optimizing parameters critical for commercialization, including delivery method(s), product formulation, fermentation parameters for inoculum production, storage conditions, and efficacy in field conditions. We are improving commercially important traits of AF22 and AF24 through non-transgenic genome editing, and we are also using genome editing to further increase aggressiveness of both isolates. Additionally, for EPA/federal registration of biological control products, certain information needs to be collected about environmental persistence, host range of the pathogens/toxins, taxonomic identification of AF22 and AF24 via molecular analyses, and other statutory requirements. In Year 2, molecular data obtained thus far support the taxonomic identification of AF22 and AF24 as novel, undescribed fungal species. We will resolve this identification in Year 3.

Objective 2. In parallel with Objective 1, we have been working to identify the host-specific toxin(s) produced by AF22 and AF24. We fractionated secondary metabolites from culture filtrates and are determining the bioactivity of specific fractions (lethality of pigweed) so that we can perform metabolic profiling on active fractions. Metabolomic analyses are being performed with state-of-the art instrumentation at the Arkansas Statewide Mass Spectrometry facility. We will link potential toxins to specific biochemical pathways through genomic analyses. We will ultimately confirm the identity of the toxin(s) through a combination of biochemical, genetic, and molecular techniques. Upon conclusive identification, we will develop strategies for large-scale production & development as a chemical herbicide, depending on the chemical structure of the compound(s). In Year 2, we also worked to improve the genome sequence assemblies of AF22 and AF24 so that toxin biosynthetic gene clusters can be identified and characterized.

Objective 3. In the past year, we made substantial progress towards product commercialization. Our work has drawn substantial interest from numerous agricultural chemical companies such as BASF, Corteva, and Syngenta, with potential licensing discussions ongoing. We have also been in discussions with companies operating more specifically in the agricultural biologicals market. We have prepared invention disclosures for AF22/AF24 as well as the PWA isolates identified and characterized with prior support from the Arkansas Soybean Promotion Board. Proof-of-concept data obtained in Year 2 of this project positioned us to apply for follow-on funding from USDA-NIFA for $750,000 to accelerate product development (the proposal is currently in the federal review process). In 2025, we will also apply for follow-on funding from the USDA-SBIR program, which is specifically designed to accelerate commercialization of novel technologies. Bluhm and Cartwright have obtained SBIR funding on other projects & we believe we are strongly positioned to obtain additional funding for pigweed biocontrol.

Planned Milestones: In Years 1 and 2, we made substantial progress on trait development/optimization of AF22 and AF24 (Obj. 1) worked to identify the toxin (Obj. 2), and collected information required to obtain patent protection as per the invention disclosure (Obj. 3). In Year 3, we will continue to optimize AF22 and AF24 while addressing regulatory requirements (Obj. 1), conclusively identify the toxin(s) along with underlying biosynthetic genes (Obj. 2) and file invention disclosures to allow commercialization of products (Obj. 3).

Value to Soybean Industry: Herbicide-resistant weeds are the most problematic and expensive pest management issue in row-crop agriculture. Attempts to control 'super' weeds can cost $30-50 per acre, and as much as $150/acre if hand-rouging is required. Herbicide-resistant pigweed has played a large role in forcing producers to consider options such as Xtend soybeans, which potentially limits the diversity of soybean varieties available to producers, and are controversial due to off-target effects of dicamba.

Budget Justifications/Explanation of Travel and Direct Costs: Funds are requested for laboratory experiments pertaining primarily to bioherbicide development and toxin analyses. Funds for out-of-state travel are requested for project participants to present project results at one or more scientific meetings.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Bluhm, Burt — *Optimization of fungal pathogens AF22 and AF24 as bioherbicides for Palmer amaranth (pigweed)*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Bluhm, Burt	**Co-PI #1**		
Co-PI #2		**Co-PI #3**		
Department	ENPL Entomology and Plant Pathology			
Commodity Board	Soybean Promotion Board			
Project Title	Optimization of fungal pathogens AF22 and AF24 as bioherbicides for Palmer amaranth (pigweed)			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Bluhm, Burt				**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI	AES						

Fulltime Personnel

Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Associate		25%	$10,000				$10,000	$10,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$10,000	$0	$0	$0	$10,000	$10,000	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel	$5,000				$5,000	$5,000	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$5,000	$0	$0	$0	$5,000	$5,000	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	**Benefits**				**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$2,860	$0	$0	$0	$2,860	$2,860	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$365	$0	$0	$0	$365	$365	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$3,225	$0	$0	$0	$3,225	$3,225	$0
Personnel Total	$18,225	$0	$0	$0	$18,225	$18,225	$0

Travel

Justify out-of-state travel in proposal.	**Travel**				**Total**	**AES Portion**	**CES Portion**
In-State	$500				$500	$500	$0
Out-of-State	$3,500				$3,500	$3,500	$0
Travel Total	$4,000	$0	$0	$0	$4,000	$4,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Bluhm, Burt — *Optimization of fungal pathogens AF22 and AF24 as bioherbicides for Palmer amaranth (pigweed)*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$9,775				$9,775	$9,775	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Subcontract - Kelly Cartwright	$8,000				$8,000	$8,000	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$17,775	$0	$0	$0	$17,775	$17,775	$0
	Total for Proposal	$40,000	$0	$0	$0	$40,000	$40,000	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Arkansas Soybean Performance Trials

Lead Investigators: John Carlin

Co-Investigators:

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy

Stated Goal: To provide unbiased soybean variety performance data to Arkansas Soybean Producers and, regional, national, and international seed companies for use in marketing, variety placement, and variety selection.

Specific Objectives:

1. To evaluate the performance of soybean varieties and breeding lines across eight locations within the State of Arkansas
2. To measure protein and oil composition of soybean varieties entered into the Arkansas Soybean Performance Trials
3. To enable abiotic (chloride and metribuzin) and biotic (disease screening) screening of the varieties by collaborating PIs.

Methods:

The Arkansas Soybean Performance Tests are conducted at the Northeast Research and Extension Center (NEREC) at Keiser, the Vegetable Research Station (VRS) near Kibler, the Lon Mann Cotton Research Station (LMCRS) near Marianna, the Jackson County Extension Center (JCEC) near Newport, the Pine Tree Research Station (PTRS) near Colt, the Rohwer Research Station (RRS) near Rohwer, and the Rice Research and Extension Center (RREC) near Stuttgart.

To facilitate field operations and to allow for fairer comparisons between varieties and strains, entries are divided into three maturity ranges based on information provided by the originating company or institution; they are RM 4.0–4.4, RM 4.5–4.9, and RM 5.0–5.9. Within each test, entries are arranged as a randomized complete block design with three replications. Plots in all tests are 2 or 4 rows wide depending on location and 20–21 feet in length. Seeds are packaged for recommended planting rates and will planted with a cone or vacuum research plot planter.

Plots are managed with location specific cultural practices to ensure quality and uniformity. During the growing season flower and pubescence color will be collected and compared against provided phenotypic data. Prior to harvest plots will be visually rated for shattering and lodging. Shattering ratings will be carried out using the following scale: 1. no shattering 2. 1–3% shattered 3. 4–8% shattered 4. 9–19% shattered 5. 20% or more shattered Lodging ratings will be recorded on a scale from 1 to 5 based on the following criteria: 1. Almost all plants erect. 2. Either all plants leaning slightly or a few plants down. 3. Either all plants leaning moderately, or 25–50% of the plants down. 4. Either all plants leaning considerably, or 50-80% of the plants down. 5. All plants down badly. Average plant height will be recorded in inches for each plot in the first replication of each test.

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The two interior rows of each 4-row plot or the entirety of 2-row plots will be harvested for yield determination. Percent moisture will be recorded for all harvested seed, and plot weights were adjusted to 13% moisture. Plot weights of all tests will then be converted to yield in bushels per acre (bu./ac). Statistical analysis for grain yield (bu./ac) will be conducted using Duncan's Multiple Range Test (MRT) with GENOVIX® (AGRONOMIX Software).

Protein and Oil will be measured using a Q Sorter ®, measurements will be taken on samples taken from each plot from the Arkansas Soybean Performance Trial conducted at the Vegetable Station in Kibler, Arkansas. Protein and Oil measurements will be included in the final report.

Planned Milestones:

Prep-to-Planting

Call for entries will be sent out in February, experiments will be designed in March, entries will be packaged and laid in planting order in March-April. Packaged seed for collaborative test will be provided to PIs as-soon-as-possible. Early planted test will be planted the first week of April with the full season test being planted as-soon-as-possible there after dependent of the receipt of seed from participants.

Maintenance and notetaking

Plot will be walked and maintained through the growing season. Notes for flower color, pubescence, lodging, shattering and plant height will be taken prior to harvest

Harvest and Data analysis

Plots will be harvested at maturity data will be made available in excel on the AAES website. Target for publication on the website is within two weeks of harvest. A research series publication will be generated and published at end of year.

Value to Soybean Industry: Variety selection is a key component to the profitability of soybean production. The data generated by the performance trials is valuable to Arkansas soybean producers because it allows them to make informed variety selection decisions. The data by the trials is also used by Seed companies to market and place varieties appropriately.

Budget Justifications/Explanation of Travel and Direct Costs: Funds are being requested to partially (20%) support two Program Associate positions one based at the Rice Research and Extension Center in Stuttgart, Arkansas and one based in Fayetteville Arkansas. One thousand dollars will be directed to Vegetable research station to compensate for the additional labor and time needed to collect samples from each research plot.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

John Carlin *Arkansas Soybean Perfromance Trials*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	John Carlin	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	DREX Director of Experiment Stations		
Commodity Board	Soybean Promotion Board		
Project Title	Arkansas Soybean Perfromance Trials		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	John Carlin				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Associate	Jonathan McCoy	20%	$13,285				$13,285	$13,285	$0
Program Associate	Richard Bond	20%	$17,628				$17,628	$17,628	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$30,913	$0	$0	$0	$30,913	$30,913	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$8,841	$0	$0	$0	$8,841	$8,841	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$8,841	$0	$0	$0	$8,841	$8,841	$0
Personnel Total	$39,754	$0	$0	$0	$39,754	$39,754	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$0	$0	$0	$0	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

John Carlin *Arkansas Soybean Perfromance Trials*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$1,000	$0	$0	$0	$1,000	$1,000	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$1,000	$0	$0	$0	$1,000	$1,000	$0
	Total for Proposal	$40,754	$0	$0	$0	$40,754	$40,754	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2024-2025 Proposal

Title: Development of a turn-row soybean vegetative health analysis software tool using UAS imagery for production decision support.

Lead Investigators: Jason Davis, Extension Specialist in Remote Sensing and Pesticide Application

Co-Investigators:

Status: Year 2 of 3

Research Areas: Agronomy/Alternative

Stated Goal: Produce and validate a user-friendly remote sensing tool that models field health in near real-time for turnrow analysis of soybean fields using drones.

Specific Objectives:

(1) Collect drone imagery of production fields in parallel with the verification program efforts.

(2) Correlate remotely sensed measurements with ground referenced information already being collected with the verification program.

(3) Develop and release a user-friendly software package that leverages the validated workflow for producers, consultants, and agents to use.

Methods:

1. Drone imagery will be collected on multiple dates in participating verification fields. Established treatments in large plots will be imaged using an automated mission. Imagery will be collected in conjunction with verifications programs scouting events to be used as part of workflow validation.
2. A user-friendly software package (downloadable executable program) or web-tool (hosted on UAEX website) will be developed that uses the validated workflow to produce turn-row field maps and reports for field health as measured by canopy closure and relative vegetative health.
3. Imagery will be processed in both the proposed "turn-row" workflow and in a traditional workflow to compare the accuracies, computing requirements, and time demands of each.
4. Targeted mapping analysis will be relative variations in crop canopy estimates, analysis of variations in vegetative health across fields, and soil wetting uniformity.

Planned Milestones:

Year 1 (Completed) –Imagery collected and correlated with ground referenced information from verification program. Initial software framework to be established using Year 1 data and results will be presented at crop production meetings, blog postings, and other avenues of information.

Year 2 – Additional imagery will be collected and validated, updating workflow calculations as needed to reach desirable accuracy. Special consideration will be given to compatibility with non-covered foreign entity manufactured drones. The updated workflow will be coded in a further developed software framework. If software tools perform to a desirable level of accuracy, they will be released. If further development is needed, Year 3 funding may be requested.

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Year 3 – Workflow and software framework will be finalized, and tool will be made available.

Value to Soybean Industry:

Field variability often influences site-specific yield. Some variability can be minimized when robust and regular scouting routines inform production decisions enabling mitigation of water issues, early weed and disease detections, and nutrient deficiencies. However, intensive scouting of each field is time consuming and cumbersome. Current drone technology can be used to gain a whole field perspective when proper processing is applied to collected data; however, these processes require expertise and time outside of the field to locate areas of interest. A user-friendly and robust field modeling tool that processes in seconds and leverages the automated data collection capabilities of drones could significantly facilitate scouting events. If a whole field can be imaged and processed into actionable data in less than 5 minutes, then subsequent informed strategic scouting could maximize localization and, in some cases, early mitigation of field variability.

Budget Justifications/Explanation of Travel and Direct Costs:

The budget reflects personnel, travel, and some miscellaneous supplies for fieldwork and data analysis. Specifically, partial support for a program technician to assist with field work, data collection and training imagery annotation is requested. Additionally, funding for travel to and from plot locations to collect imagery and ground reference data. Miscellaneous supplies related to plot work, drone maintenance, and data storage and analysis.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Davis, Jason — *Development of a turn-row soybean vegetative health analysis using UAS imagery for production decision*

Year	2025/2026	**Project Year**	Year 2 of 3
Lead Investigator	Davis, Jason	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Development of a turn-row soybean vegetative health analysis using UAS imagery for production decision support.		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Davis, Jason				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Technician		25%	$10,250				$10,250	$0	$10,250
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$10,250	$0	$0	$0	$10,250	$0	$10,250

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$2,932	$0	$0	$0	$2,932	$0	$2,932
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$2,932	$0	$0	$0	$2,932	$0	$2,932
Personnel Total	$13,182	$0	$0	$0	$13,182	$0	$13,182

Travel

Justify out-of-state travel in proposal.	Travel				Total	AES Portion	CES Portion
In-State	$3,000				$3,000	$0	$3,000
Out-of-State					$0	$0	$0
Travel Total	$3,000	$0	$0	$0	$3,000	$0	$3,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Davis, Jason *Development of a turn-row soybean vegetative health analysis using UAS imagery for production decision*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$3,500				$3,500	$0	$3,500
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$3,500	$0	$0	$0	$3,500	$0	$3,500
	Total for Proposal	$19,682	$0	$0	$0	$19,682	$0	$19,682

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board: 2025-2026 Proposal

Title: Comprehensive Disease Screening of Soybean Varieties in Arkansas

Investigators: Travis Faske and Terry Spurlock

Co-Investigators: Michael Emerson, Amanda Tolbert, and Amanda Greer

Status: 2/3 (ongoing since 1990)

Stated Goal: To provide independent evaluation of new soybean cultivars for resistance to major diseases and nematodes and post the information on Arkansas Variety Testing Website.

Specific Objectives: (PI for each objective)

1. Screen all entries in the University of Arkansas Official Variety Testing (OVT) program for frogeye leaf spot in field plots at the Jackson County Extension Center or on-farm (Faske).
2. Screen all entries in the UA OVT program for southern stem canker using toothpicks inoculations at the Rohwer Research Station (RRS) (Spurlock).
3. Screen all entries in UA OVT program for southern root-knot at the SWREC (Greer) and in the field (Faske).
4. Provide a complete package of screening information to Jeremy Ross and other CES personnel by year-end (Emerson).

Methods:
Cultivars and experimental entries of the Arkansas OVT and advanced Arkansas breeding lines will be evaluated in a replicated design in field or greenhouse screen.

Frogeye leaf spot: Utilize our field nursery location at the NES where overhead irrigation and space are available. Inoculum to conduct the screen will be produced using laboratory facilities in the Lonoke Extension Center (LEC).

Southern stem canker: We will hand-inoculate 10-12 individual plants in single-row plots using infested toothpicks. Plots will be maintained to promote disease, and all plants will be rated for stem canker and other foliar diseases. Inoculum to conduct the screen will be produced using laboratory facilities at the SEREC. A growth chamber screen of all varieties will be added in 2025 and the results compared to the results from the field trial.

Southern Root-knot Nematode: Varieties will be screened in a greenhouse at SWREC. Inoculum to conduct the screen will be produced on-site. Varieties will also be planted in single-row plots in a field screen near Kerr, AR.

Planned Milestones: All screens will be completed, and results will be summarized, analyzed, and posted on the UAF Variety Testing website (www.aaes.uark.edu/variety-testing) and delivered to the CES soybean specialist for the Soybean Update and SOYVA.

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Value to the Soybean Industry: Most growers select cultivars based primarily on yield performance. Unfortunately, while yield potential is an important factor in cultivar selection, the yield of a cultivar may be drastically reduced by soybean diseases. In Arkansas, resistance to several common soybean pathogens is as important as yield potential in selecting an appropriate cultivar. Soybeans are grown on about 3.5 million acres in the state each year, with a value of about $500,000,000 annually. Diseases cost $25,000,000 per year in lost yield and quality statewide, by some estimates. Each year, well over 200 new soybean cultivars become available to Arkansas growers. Many of these cultivars are accompanied by little or no information on their resistance to diseases or nematodes. Since only one variety will be grown in a particular field, choosing the best variety can be a difficult decision. This program provides comprehensive information on the disease package that each new cultivar contains prior to widespread use in the state, lowering the risk of severe disease losses due to incorrect cultivar selection.

Budget Justification: Proposed funding would support personnel (full-time and hourly) to conduct disease screens at each of the three locations (LEC, SWREC, and SWREC). Greer will oversee the greenhouse RKN screen at Hope. Travel is for mileage to pick up supplies and conduct trials in the field. Supplies would include relevant materials such as sand, pots, identification tags in the greenhouse screens, materials to produce inoculum, or fuel or repairs to planters or spray equipment for field trials.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Faske, Travis *Comprehensive Disease Screening of Soybean Varieties in Arkansas*

Year	2025/2026	**Project Year**		**Version: 7.0 (11/01/2024)**
Lead Investigator	Faske, Travis	**Co-PI #1**	Spurlock, Terry	
Co-PI #2	Greer, Amanda	**Co-PI #3**		
Department	ENPL Entomology and Plant Pathology			
Commodity Board	Soybean Promotion Board			
Project Title	Comprehensive Disease Screening of Soybean Varieties in Arkansas			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Faske, Travis	Spurlock, Terry	Greer, Amanda		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI		CES	CES	CES				
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Associate			$36,000				$36,000	$0	$36,000
Program Associate				$28,000			$28,000	$0	$28,000
					$20,000		$20,000	$0	$20,000
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$36,000	$28,000	$20,000	$0	$84,000	$0	$84,000
	Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel		$7,000	$2,000	$2,000		$11,000	$0	$11,000
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$7,000	$2,000	$2,000	$0	$11,000	$0	$11,000
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$10,296	$8,008	$5,720	$0	$24,024	$0	$24,024
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$511	$146	$146	$0	$803	$0	$803
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$10,807	$8,154	$5,866	$0	$24,827	$0	$24,827
	Personnel Total		$53,807	$38,154	$27,866	$0	$119,827	$0	$119,827
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$3,000	$2,000			$5,000	$0	$5,000
	Out-of-State						$0	$0	$0
	Travel Total		$3,000	$2,000	$0	$0	$5,000	$0	$5,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Faske, Travis *Comprehensive Disease Screening of Soybean Varieties in Arkansas*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,000	$2,000	$2,000		$5,000	$0	$5,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$2,065	$0	$0	$0	$2,065	$0	$2,065
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$1,350	$0	$0	$1,350	$0	$1,350
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$3,065	$3,350	$2,000	$0	$8,415	$0	$8,415
	Total for Proposal	$59,872	$43,504	$29,866	$0	$133,242	$0	$133,242

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board: 2025-2026 Proposal

Title: Integrated Management of Soybean Nematodes in Arkansas

Investigators: Travis Faske and Joanna Kud

Co-Investigators: Michael Emerson and Amanda Greer

Status: Year 3 of 3

Research Areas: Plant Pathology

Stated Goal: To determine the significance and potential risk of plant-parasitic nematodes on soybean in Arkansas. To evaluate currently-existing methods for controlling nematodes in soybean, and to test newly emerging control technology and resistant cultivars. Encourage producers and consultants to sample for nematodes in soybean fields. Finally, develop sustainable, economically feasible nematode management strategies for Arkansas producers.

Specific Objectives:

1. Determine the efficacy and practicality of currently-labeled nematicides for nematode management in soybean; Evaluate new nematicides, including seed treatment nematicides and products that may not currently have a soybean label, for efficacy and practical (economic) potential. (Faske/Emerson)

2. Evaluate the field performance of currently available and new soybean cultivars with reported resistance to root-knot nematodes. (Faske/Emerson)

3. Characterize resistance to reniform nematodes in soybean. (Faske/Kud)

4. Promote the importance of sampling soybean fields for soybean nematodes and identify the most important species of soybean nematode that affect soybean production by offering “free” nematode assays sponsored by the SPB. (Faske and Kud/Greer)

5. Assess and extend the use of cultural practices to manage populations of soybean nematodes (Faske/ Emerson)

6. Extend and educate clientele on the distribution of important soybean nematodes in the state. Develop and deliver strategies for sustainable management of nematodes through use of existing resistance, nematicides, and crop rotation to minimize economic effects of nematodes. (Faske/Kud)

Methods:

Objective 1. Commercial fields naturally infested by economically important soybean nematodes will be used for small-plot experiments to determine efficacy (and practicality) of applying labeled seed-applied nematicides (and new soil-applied nematicides). Particular emphasis will be placed on combining nematicide treatments with a range of RKN-nematode resistant cultivars.

Objective 2. Cultivars that are reported as having nematode resistance, those identified through

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our annual cultivar screening efforts, and any cultivar that may have utility will be evaluated for field performance in infested fields in small-plot trials.

Objective 3. Conduct greenhouse trials to determine resistance to reniform nematodes in southern RKN-resistant soybean varieties and characterize the mechanism of resistance.

Objective 4. During the past six cropping seasons, the Nematode Diagnostic Lab (NDL) has promoted the need to sample for soybean nematodes by offering free assays sponsored by the soybean promotion board. This program has been very successful and well received by producers and consultants. Through these assays we are able to determine those species that are increasing in severity and the most important to producers.

Objective 5. Assess the use of crop rotation sequences for suppression of soybean nematode population densities in existing rotational studies and on-farm sites. Assess the impact of corn regrowth on southern RKN densities in soybean fields.

Objective 6. Education platform will consist of but not limited to the traditional approach with fact sheets, soybean research series, and production meetings, but also electronic delivery of information on root-knot resistant varieties on Row Crop Website, videos and raise awareness using twitter.

Planned Milestones: Each year we will report information on resistant soybean varieties on the row crops website and distribute at productions meetings. Each year we will report on the status of the ongoing survey by the Nematode Diagnostic Lab to keep sampling a priority for producers. Data from individual trials will be presented at county and regional meetings.

Value to Soybean Industry: Our study will benefit farmers in several areas. First, we will evaluate both existing and new soybean cultivars with reported resistance to the southern root-knot nematode to determine their actual level of performance in production fields. We will identify those cultivars that will mitigate nematode damage under our field environments and with local races and biotypes. We will also begin to develop an experience base as well as an experimental data base on the use and impact of nematicides in managing soybean nematodes, and we will look at an integrated approach of cultivars, chemicals and cropping systems (e.g. furrow-irrigated rice) for more effective management practices.

Budget Justification: Proposed funding would support personnel (full-time associates and hourly) to conduct field trials, collect data, harvest, and processing nematodes samples. A portion of Kud's budget is for hourlies and associate at Hope and she will oversee their portion of those funds. The student salary will be in her lab in Fayetteville. Travel is for use of university vehicle mileage to conduct field trials and transport soil samples to NDL. Supplies would include relevant materials such as but not limited to sand, fuel for equipment, plots stakes, water, bleach, bags, tags, and other general supplies for greenhouse and field trials. The direct cost consists of vouchers for 400 ($15/sample) sponsored nematode assays for Arkansas farmers and consultants to monitor soybean nematodes in a crop rotation system where soybeans are utilized. Overall, there is an increase in budget from last year due to support in travel and increase in cost for nematode assays.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Faske, Travis *Integrated Management of Soybean Nematodes in Arkansas*

Year	2025/2026	**Project Year**	
Lead Investigator	Faske, Travis	**Co-PI #1**	Kud, Joanna
Co-PI #2	Greer, Amanda	**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Integrated Management of Soybean Nematodes in Arkansas		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Faske, Travis	Kud, Joanna	Greer, Amanda		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	AES	CES				

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Associate			$25,000				$25,000	$0	$25,000
Program Associate					$5,000		$5,000	$0	$5,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$25,000	$0	$5,000	$0	$30,000	$0	$30,000

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$10,000		$2,000		$12,000	$0	$12,000
Hourly-Students		$3,000			$3,000	$3,000	$0
Subtotal: Hourly	$10,000	$3,000	$2,000	$0	$15,000	$3,000	$12,000

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$7,150	$0	$1,430	$0	$8,580	$0	$8,580
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$730	$0	$146	$0	$876	$0	$876
Hourly-Students	$0	$3	$0	$0	$3	$3	$0
Subtotal: Fringe Benefits	$7,880	$3	$1,576	$0	$9,459	$3	$9,456
Personnel Total	$42,880	$3,003	$8,576	$0	$54,459	$3,003	$51,456

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$3,000	$500			$3,500	$500	$3,000
Out-of-State					$0	$0	$0
Travel Total	$3,000	$500	$0	$0	$3,500	$500	$3,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Faske, Travis *Integrated Management of Soybean Nematodes in Arkansas*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,000	$6,500	$1,000		$8,500	$6,500	$2,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs				$5,000		$5,000	$0	$5,000
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$1,000	$6,500	$6,000	$0	$13,500	$6,500	$7,000
	Total for Proposal	$46,880	$10,003	$14,576	$0	$71,459	$10,003	$61,456

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Phenotypic Selection Assisted by Seed-Level Near-Infrared Information

Lead Investigators: Samuel B Fernandes

Co-Investigators: Caio Canella Vieira

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 2 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Breeding

Stated Goal: The successful development of superior cultivars in breeding programs depends on the maximization of the genetic variance, selection accuracy, and selection intensity, as well as on minimizing the length of breeding cycles. While optimizing those parameters has been the recipe for high genetic gain for decades, the dynamism of target environments combined with the genotype-by-environment interaction makes identifying the best line a challenging task. Thus, any breakthrough in developing a new cultivar requires the adoption of new approaches or new technology. Genomic selection (GS), i.e., the selection of lines based on molecular marker information rather than phenotypic evaluation, is an example of a groundbreaking method currently used by breeding programs of all major crops. The main point where GS is beneficial is reducing the breeding cycle, which increases genetic gain. Another advantage is the possibility of increasing the selection intensity. One recent strategy successfully applied in different crops is to use seed-level Near-Infrared (NIR) information to assist in predicting phenotypic performance. This approach relies on utilizing NIR data to estimate the similarity among individuals. Like in GS, breeders can develop a statistical model to predict the performance of lines that have not been phenotyped. The main advantage of this approach is reduced cost and labor intensity, as the NIR data can be obtained with the same machine utilized to count seeds when preparing for field trials. Given the reduced cost, the NIR-based phenotypic prediction can serve as a pre-selection prior to running GS, so resources for genotyping can be efficiently applied. Consequently, an increased selection intensity can be utilized in the selection process. Furthermore, this approach can be used in the early selection stages, where experiments with replications are not possible given the amount of seed available per family. This could potentially increase selection accuracy. In this proposal, we aim to develop a NIR-based prediction model that can be used by the UARK Soybean Breeding program alone or in combination with genomic selection to increase selection intensity and selection accuracy, resulting in an increased genetic gain. We will collect NIR data from seeds of lines that have been phenotyped in the field in 2023, as well as lines that will be tested in 2024 by the UARK Soybean Breeding program. Developing a pipeline that incorporates NIR data into the soybean selection process will be a creative alternative to increasing the rate of genetic gain while maintaining similar resource utilization.

Specific Objectives: In this proposal, our specific goals are: i) determine the efficiency of phenotypic prediction assisted by seed-level near-infrared information; ii) develop a pipeline that incorporates the near-infrared information in the selection process. The overall objective of this proposal is to provide the UARK Soybean Breeding program with a cost-effective alternative that can be utilized in combination with GS to increase the selection intensity and selection accuracy, improving the efficiency of the program.

Methods: The second year of the proposal will leverage phenotypic information from previous and future field experiments conducted at the UARK Soybean Breeding program. The phenotypic data will include yield, seed composition, and biotic and abiotic tolerance traits. The first step will be to collect near-infrared information from seeds of more than 1,000 breeding lines generated in the first year of the project

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augmented with the lines developed in 2025. This data will be obtained with a QSorter® machine, which, after delays from the factory, was finally installed and is fully operational at the UARK soybean breeding program. With this data, we will develop statistical and machine-learning models that use seed-level NIR data to predict phenotypic performance. Similar to what has been done in other crops (Robert et al., 2022), the statistical models evaluated will include a linear mixed model with a NIRs-based relationship matrix. The machine learning models will use the LightGBM approach and it will incorporate the same relationship matrix. All models will be evaluated using cross-validation, i.e., we will compare the phenotypic data already available to phenotypic predictions based on NIR and determine how accurate these predictions are. All of these models will be trained on the phenotypic data mentioned above. The next step after developing prediction models is to run individual seeds through the QSorter® and, based on the NIR reads, obtain a prediction of phenotypic performance for each individual, allowing for a selection of the best-predicted lines. Finally, the prediction obtained will be compared with the actual performance of the selected lines in the field.

Planned Milestones:

Activity Description	2025				2026			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Analyze phenotypic data available at the breeding program	**X**	**X**			**X**	**X**		
Collect near-infrared information from individual seeds		**X**	**X**			**X**	**X**	
Develop near-infrared-based prediction models	**X**			**X**	**X**			
Select the best individuals from F_2 populations based on prediction models		**X**				**X**		
Field evaluations of selected lines			**X**	**X**			**X**	**X**
Publish research results								**X**

Value to Soybean Industry: Two factors determine the efficiency of a breeding program in identifying high-quality and high-performance cultivars, namely, selection intensity and selection accuracy. Increasing the number of lines evaluated and the accuracy with which soybean lines are selected will increase the chance of developing a high-performance cultivar and, thus, will increase the probability of soybean growers.

Budget Justifications/Explanation of Travel and Direct Costs ($52,081): The majority of the budget is dedicated to an experienced graduate student ($22,000 base, $7,500 tuition, and $1,122 benefits) who will work on collecting the NIR data and developing statistics and machine-learning models. An additional $6,430 is requested for 10% of an FTE research technician. A total of $6,000 for out-of-state travel is requested to attend and present results in scientific meetings and for the student to participate in short courses relevant to this research. A total of $5,529 is requested for both a license of ASReml, state-of-the-art software for fitting linear mixed models with access to 16 cores, and additional computer resources to speed-up analysis in our computers ($2,529 for ASReml and $3,000 for computer resources) and $3,500 for supplies related to obtaining seed NIR data.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Samuel B Fernandes — *Phenotypic Selection Assisted by Seed-Level Near-Infrared Information*

Year	2025/2026	**Project Year**	Year 2 of 3
Lead Investigator	Samuel B Fernandes	**Co-PI #1**	Caio Canella Vieira
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Phenotypic Selection Assisted by Seed-Level Near-Infrared Information		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Samuel B Fernandes	Caio Canella Vieira			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
		10%		$5,000			$5,000	$5,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$5,000	$0	$0	$5,000	$5,000	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
		100%	$22,000				$22,000	$22,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$7,500				$7,500	$7,500	$0
	Subtotal: Graduate Student		$29,500	$0	$0	$0	$29,500	$29,500	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$1,430	$0	$0	$1,430	$1,430	$0
Graduate Students	$1,122	$0	$0	$0	$1,122	$1,122	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$1,122	$1,430	$0	$0	$2,552	$2,552	$0
Personnel Total	$30,622	$6,430	$0	$0	$37,052	$37,052	$0

Travel

Justify out-of-state travel in proposal.	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State	$6,000				$6,000	$6,000	$0
Travel Total	$6,000	$0	$0	$0	$6,000	$6,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Samuel B Fernandes *Phenotypic Selection Assisted by Seed-Level Near-Infrared Information*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$5,529	$3,500			$9,029	$9,029	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$5,529	$3,500	$0	$0	$9,029	$9,029	$0
	Total for Proposal	$42,151	$9,930	$0	$0	$52,081	$52,081	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Irrigation Water Management for Soybeans: Moving the Needle.

Principle Investigators: C. G. Henry, U of Arkansas, T. Spurlock, UAEX; **Collaborators:** A. Ponchet, U of Arkansas – Fayetteville; T. Burcham, NERREC; N. Newberry, NERREC
Production System: All
Status: Year 3 of 3

Goal: This project is an effort to develop and promote the use and application of irrigation water management and improve yield and yield stability for irrigated soybeans in Arkansas. The primary focus is to refine and adapt tools for mid-south soybean production.

Objectives: The objective of this project is research, document and demonstrate irrigation water management practices on working soybean farms through an Irrigation Yield Contest Demonstration. These practices include the implementation of Computerized Hole Selection, Surge irrigation, soil moisture monitoring, ET based scheduling, irrigation initiation and irrigation termination.

1. Document water savings, yield improvements, profitability improvements using an Irrigation Contest. Compare yield and water use differences to document the efficacy and improved profitability of conservation practices.
2. Deliver irrigation schools in the winter months. (new) work on a Master Irrigator Curriculum.
3. Further develop recommendations for surge irrigation and soil moisture sensors. Improve soil water information about Arkansas soils and paper and mobile app development for sensors. Test new ideas on how to improve water retention curve development methods.
4. Improve ability to measure and document water use through new cloud meter telematics. delivered to the irrigator during the season.
5. Improve implementation of CHS, through poly pipe printer development.
6. Improve cover crop crimper design for furrow irrigation.
7. (New) Test pit-less tailwater recovery water savings on paired soybean fields at NERREC

Methods:

We propose to continue our work by integrating research results with the on-farm demonstration program through the Arkansas Irrigation Yield Contest. Contestants are increasing the average water use efficiency over time. Considerable effort has been placed on documenting the water use of soybeans using sap flow. The next step is to further develop tools for growers to use this new knowledge. Focus of this project will be to further analyze the data and deliver the results through the mobile app to adjust for yield goal.

There are on average 20 contestants annual that participate in the irrigation yield contest. Many of the contestants also attended irrigation schools on surge and soil moisture sensors. The contest coupled with irrigation schools have resulted in increased awareness and implementation of IWM practices and the programs provide key data on how to achieve sustainability in the mid-south. Schools are 6 hours and include meals and this project defers the some of the cost of the supplies. Industry has responded in support of the contest by matching the cash prize donated by the board with in-kind donations making the total prize for the contest over $100,000. A comprehensive survey of the contest impact is currently underway. We will expand the irrigation contest idea into a Master Irrigator program in 2025. We are working with NRCS to develop a program that would provide additional EQIP points to irrigators who have completed a Master Irrigator Certification. The value of this idea will be studied in 2025.

A primary focus of the project will be to better document soil series retention curve differences for better resolution for irrigators when using soil moisture sensors. Soil samples at all of the major soil types in

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Arkansas have been collected and retention curves developed, but the data analysis is still on-going. A post-doc is continuing the work of the graduate student to complete the additional work recommended from the published thesis. This additional work is expected to develop or improve the methodology for relating retention curves to matric potential sensors.

We will continue to develop and improve the tools such as a new computerized irrigation scheduler under development that will interface with the poly pipe printer for a seamless on-the-fly CHS solution. We have developed a working mobile app and working prototype and will be testing it on farmer fields in 2023. Coding the of CHS tools is about 80% completed.

The program is developing a new and novel flowmeters with telemetry and analytics for irrigators, prototypes will be testing on irrigation contest fields.

A cover crop crimper has been developed for furrow irrigation, a sixth-generation design will be tested in 2024. Cover crop crimping is not currently feasible in furrow irrigated production systems, this will give growers an alternative to herbicide termination of covers.

New for 2025 is a experiment evaluating the remote valve and pit-less tailwater pump at field scale at NERREC to measure the yield and irrigation water use reduction.

The summary of the findings will be reviewed and the results will be made available to growers, consultants, and others through the mobile apps we publish, public meetings, extension and research publications, the internet, county extension training, and on-farm visits.

Planned Milestones: April 1, 2023 to March 31, 2026 (three cropping seasons). Currently requesting funding for year 1.

Value to the Soybean Industry: Consistently high soybean yields are essential for sustaining profitable soybean production systems in Arkansas. Previous research has shown that delays in irrigation initiation, scheduling, and termination can limit yields and that the effects can vary from season to season and among maturity groups and soil types. Given the substantial investments needed to irrigate soybean fields, identification of practical irrigation scheduling methods that increase the odds for higher yields and better seed quality would be in the best interests of Arkansas soybean producers. Past work with on-farm demonstration has shown a reduction in water use by 24% with no yield penalty.

Our efforts to improve and make implementation of IWM easier through a better CHS tool, ability to print the plan on the pipe real time, improving surge irrigation and flow measurement will reduce the cost and labor and improve the accurate implementation of IWM. New technology for furrow irrigators such as the cover crop crimper will allow growers to reduce tillage improving infiltration for irrigation. The cloud meter has the potential to be a real game-changer akin to yield monitors for combines.

Justifications (Budget): The budget includes labor for Henry's staff. Supplies to support the IWM contest, plot work, crimper, meter and water retention laboratory. Supplies and staff to support the CHS pipe printer project, novel meters and surge valve, mobile app development, and graduate student. Purchase of a poly pipe toolbar, supplies for meters, valves, steel, parts, machining, meals for schools, tailwater pump, plot production costs, contract services for repairs or engineering.

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Promotion Board Budget

Henry, Christopher *Irrigation Water Management for Soybeans: Moving the Needle*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Henry, Christopher	**Co-PI #1**		
Co-PI #2		**Co-PI #3**		
Department	BAEG Biological & Agricultural Engineering			
Commodity Board	Soybean Promotion Board			
Project Title	Irrigation Water Management for Soybeans: Moving the Needle			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Henry, Christopher				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Associate	Dorsa Darikendeh	70%	$43,000				$43,000	$43,000	$0
Program Specialist	Shruti Vaman	30%	$35,000				$35,000	$35,000	$0
Program Specialist	Nathan Blankenship	30%	$20,000				$20,000	$20,000	$0
Program Associate	Russ Parker	10%	$15,000				$15,000	$15,000	$0
							$0	$0	$0
	Subtotal: Salaries		$113,000	$0	$0	$0	$113,000	$113,000	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$12,000				$12,000	$12,000	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$12,000	$0	$0	$0	$12,000	$12,000	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$32,318	$0	$0	$0	$32,318	$32,318	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$876	$0	$0	$0	$876	$876	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$33,194	$0	$0	$0	$33,194	$33,194	$0
Personnel Total	$158,194	$0	$0	$0	$158,194	$158,194	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$6,000				$6,000	$6,000	$0
Out-of-State	$3,926				$3,926	$3,926	$0
Travel Total	$9,926	$0	$0	$0	$9,926	$9,926	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Henry, Christopher *Irrigation Water Management for Soybeans: Moving the Needle*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$20,000				$20,000	$20,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Steel, meals, contract work	$5,000				$5,000	$5,000	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$12,500	$0	$0	$0	$12,500	$12,500	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$37,500	$0	$0	$0	$37,500	$37,500	$0
	Total for Proposal	$205,620	$0	$0	$0	$205,620	$205,620	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Soybean Promotion Board- 2024-2025 Proposal

Title: Developing scouting, threshold, and management practices for stinkbug complex (Red banded, Green, and Brown) in Arkansas soybean

Investigators: Drs. Rupesh Kariyat, Neelendra Joshi, Glen Studebaker, Ben Thrash and Nick Bateman

Production System: Soybean

Status: Stated Goal Proposal Year 3 of 3

Specific Objectives:

Objective 1: Develop and update scouting methodology and economic thresholds for the soybean stinkbug complex (Red banded, Green, and Brown)

Objective 2: Develop soybean growth stage injury standards across commonly grown soybean varieties for the stinkbug complex

Objective 3: Estimate host plant resistance traits and their variation across soybean varieties for the three stinkbug species under laboratory conditions

Objective 4: Evaluate the nutritional quality loss due to stinkbug complex infestation on soybean pods

Methods:

The rationale for the first experiment is to update and develop better scouting and threshold standards for the three stinkbugs in Soybean. While scouting and threshold standards for other pests in row crops have been recently updated, we currently lack this for stinkbugs. We will use a combination of standard field-based assessment tools and will complement these with small scale (small plot) replicated trials in AES farm, and other locations across the state.

Accomplishments: 2 years of surveying completed, screened lines for resistance traits, one MS student graduated, two peer reviewed manuscripts published, one under re3view, and one more under prep.

Milestones and Timeline:

2023: Set up field trials and small plot experiments for objectives 1 and 2.

2024: Based on year 1, select resistant, tolerant, and sustainable soybean varieties relevant to Arkansas, and set up lab-based screening study detailed in objective 3, while continuing the field assessment studies (Obj. 1 and 2).

2025: Set up the experiments for objectives 3 and 4, based on objectives 1 and 2. And, continue the additional experiments with Fall armyworm and Soybean looper, 2 major lepidopteran pests. Finally, develop management recommendations, prepare extension publications and peer-reviewed journal articles. In additional, run the nutritional assessment experiment from varieties selected from objective 2, through the metabolomics at the Mass Spectrometry facility at University of Arkansas, Fayetteville.

Statement of projected value:

Stinkbugs have been traditionally a major pest in Soybean production, but more recently, with the sporadic onset of Redbanded Stink Bug, the possibility of severe damage across various soybean cultivars in the state has expanded. Unfortunately, unlike corn ear worm, Arkansas

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doesn't have an updated threshold recommendations and an assessment of injury levels, specific symptoms, and cultivar resistance traits for the stink bug complex (which are three different hemipteran pest species). In addition, to also examine Fall armyworm and Soybean looper, 2 major lepidopteran pests. More importantly, a long term (3 year) field monitoring on incidence, development and dispersal of these species has not been undertaken in the state. This project which combines continuous field assessment, complimented with small plot experiments (with selected varieties and replicated trials), and detailed lab-based assays will be a tremendous resource for developing integrated management practices for stink bug complex that has the potential to be a major concern for soybean producers in the state.
Approaches to accomplish project objectives are summarized below:

Objective 1: For objective 1, we will refine current scouting methods and economic thresholds by conducting field trials in different soybean growing locations across the state. To refine economic thresholds, we will conduct regular surveys to assess population densities of different stink bugs infesting soybean crop. Surveys will be conducted using sweep net collections and visual observations (timed counts) and population of stink bugs in each study site will be recorded and statistically analyzed. Findings from this study will be incorporated in stink bugs management recommendations for Arkansas soybean.

Objective 2: To accomplish objective 2, we will setup small plot and caged-pot studies to assess soybean-growth stage specific injury symptoms caused by different species of stink bugs in commonly grown soybean varieties. In small observational plot study, we will continuously monitor stink bug infestation in soybean plants to characterize growth specific injury. Similar observations will also be recorded in caged pot study where we will release a pair of stink bug inside the bug-dorm type cage containing potted soybean plants. We will conduct these experiments separately for each stink bug species. Findings from this objective will help in early detection of stink bug damage in Arkansas soybean.

Objective 3: To accomplish objective 3, we will do a comprehensive assessment of insect resistance traits in soybean cultivars grown in different regions of the state. These will include measuring leaf trichome density and types, secondary metabolites, and volatile organic compounds. In addition, we will also examine induced defenses post stinkbug feeding (same set of defense traits). Results from this objective will be the first report of differential defenses against the stinkbug complex in Soybean. More specifically, we aim to individually and in tandem, allow the three species to feed on the varieties and measure the defense traits pre and post infestation. Findings from this study objective will be helpful in developing new management strategies as well as stink bug resistance soybean varieties.

Objective 4: To accomplish objective 4, we will carry out both lab and field assessments. Briefly, we will sample stinkbug(s) infected and un-infected pods from field sites (from objective 1and 2) and also from plants grown under controlled environmental conditions in the greenhouse. The pods will then be extracted in organic solvents and will be subjected to metabolic profiling at the UA mass spectrometry center. This analysis will allow us to understand how stinkbug complex (single species and in combination) affects pod quality, and toxin build up. This will also assist us in understanding how individual species and their toxins affect the quality of soybean pods, rather than just estimating the yield loss.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Rupesh Kariyat *Developing scouting, threshold, and management practices for stinkbug complex (Redbanded, Green and*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Rupesh Kariyat	**Co-PI #1**	Joshi, Neelendra
Co-PI #2	Studebaker, Glenn	**Co-PI #3**	Thrash, Ben
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Developing scouting, threshold, and management practices for stinkbug complex (Redbanded, Green and Brown) in Arkansas		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Rupesh Kariyat	Joshi, Neelendra	Studebaker, Glenn	Thrash, Ben	Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES	CES	CES			

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
Graduate Student		$8,500	$8,500			$17,000	$17,000	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information		$5,000	$5,000			$10,000	$10,000	$0
Subtotal: Graduate Student		$13,500	$13,500	$0	$0	$27,000	$27,000	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel			$4,000	$5,000	$9,000	$0	$9,000
Hourly-Students		$500			$500	$500	$0
Subtotal: Hourly	$0	$500	$4,000	$5,000	$9,500	$500	$9,000

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$434	$434	$0	$0	$867	$867	$0
Hourly Personnel	$0	$0	$292	$365	$657	$0	$657
Hourly-Students	$0	$1	$0	$0	$1	$1	$0
Subtotal: Fringe Benefits	$434	$434	$292	$365	$1,525	$868	$657
Personnel Total	$13,934	$14,434	$4,292	$5,365	$38,025	$28,368	$9,657

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$2,000	$1,500			$3,500	$3,500	$0
Out-of-State					$0	$0	$0
Travel Total	$2,000	$1,500	$0	$0	$3,500	$3,500	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Rupesh Kariyat *Developing scouting, threshold, and management practices for stinkbug complex (Redbanded, Green and*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$4,000	$2,500	$800	$800	$8,100	$6,500	$1,600
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$4,000	$2,500	$800	$800	$8,100	$6,500	$1,600
	Total for Proposal	$19,934	$18,434	$5,092	$6,165	$49,625	$38,368	$11,257

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Effects of inclusion of soybean oil in beef heifer diets on heifer development, reproductive function, and calf growth performance

Lead Investigators: Beth Kegley, Jeremy Powell, Charles Looney, Brittni Littlejohn, Robin Cheek, and Kirsten Midkiff

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 2 of 3

Research Areas: Post-Harvest

Stated Goal: The goal of this proposed research is to assess how feeding a supplement containing soybean oil to developing heifers during the breeding season affects uterine artery hemodynamics and the growth performance of resulting calves from birth through weaning. This is a continuation of the work done in 2023 and 2024.

Specific Objectives: The objectives are to determine: 1) the effect of feeding soybean co-products to bred heifers on uterine artery hemodynamics; and 2) the effect of feeding soybean co-products to bred heifers on morphometric measurements and growth of resulting calves from birth until weaning.

Methods: – This work provides additional experimental units to data collected in heifers developed in 2023 and calved in 2024. This study will use bred heifers developed on a supplement containing soybean oil (ASPB funded project for 2024). The heifers used are from a trial with 80 heifers assigned randomly to 1 of 2 treatment groups (n = 4 pastures/treatment), being 1) control group fed an isonitrogenous and isocaloric grain supplement with no soy product; and 2) treated group fed grain supplemented with soybean oil at 2% of total diet dry matter intake. Supplements were offered beginning approximately 30 days after weaning (June 2024) and continued through the breeding season (February 2025).

Uterine Artery Hemodynamics: 43 heifers (21/39 heifers on control diet; 22/39 heifers on soybean oil diet) were confirmed pregnant by artificial insemination (AI) at 40 days of gestation. At 222 days of gestation, body weights will be taken, and an ultrasound performed on these heifers to assess uterine artery hemodynamics. An ultrasound probe used to locate the left and right uterine arteries and uterine blood flow for both will be calculated. In addition, the area of the Corpus Luteum will be measured.

Calf Performance: Beginning in August 2025, within 24 hours of birth, all calves (from any of the 78 heifers that bred) will be weighed, and date of birth, calf sex, sire of calf based on AI or natural service pregnancy confirmation will be recorded. Body weights and morphometric measurements (head length, head circumference, curved crown rump length, heart girth circumference, abdominal girth circumference, and hip height) will be taken on all calves at birth, 90 days, and at weaning (May 2026).

Planned Milestones: Reproductive efficiency of cattle can decline for many reasons, including factors relating to poor nutrition like failure to conceive or exhibit estrus, or losses of viable pregnancy. Thus, the need to determine methods to decrease the instance of these losses is imperative. Feeding supplemental fats like soybean oil can affect a variety of physiological

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processes due to the increased energy density of the diet, which has been shown to have positive effects on reproduction in cattle (Funston, 2004). However, inconsistent results with calf birth and weaning weights, and cow body condition scores (Alexander et al., 2002) have created a need for determining definitive management strategies to improve production and reproductive parameters. Additionally, there has been little investigation on how feeding soybean oil to developing heifers during the breeding season will affect blood flow or calf performance. This research could provide useful information for producers supplementing females with soybean co-products during early pregnancy, and possibly influence reproductive parameters in developing females and early embryonic development of beef calves.

Value to Soybean Industry: Soybean products, particularly soybean meal, are a primary staple for poultry diets, but the beef cattle industry accounts for only 6.8% of soybean meal use in 2019 and 2020 (ASA, 2021). Also, the market for soybean oil in livestock production is slim, with most soybean oil being used for human consumption, biodiesel and bioheat, and industrial uses like paint, plastic, and cleaner (Stowe, 2022). Much about the cattle industry is focused on the cost of inputs and the revenue that producers receive, ultimately determining if producers have the additional funds to supplement cattle during the year. Supplementation with additional fats like soybean oil may be more economical for increasing energy and performance when the prices of grains are too high (Marx, 2022). This could create a greater use of soybean products among cattle producers, where reproduction and performance are important to a producer's bottom line.

Budget Justifications/Explanation of Travel and Direct Costs: $22,071

Cattle Management (animal health products, feed, labor; estimating 62 bred heifers that will calve × 365 days × $0.70/day)	$15,841
Ultrasound Use (78 heifers × 2 times × $20/time; 43 bred heifers × 1 time × $20/time; costs include in-state travel for scientist [$1,200])	$3,980
Feed analyses	$750
Travel to Scientific Meeting (out of state)	$1,500

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Kegley, Beth *Effects of inclusion of soybean oil in beef heifer diets on heifer development, reproductive function, and calf*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Kegley, Beth	**Co-PI #1**	Powell, Jeremy
Co-PI #2	Looney, Charles	**Co-PI #3**	Littlejohn, Brittni
Department	ANSC Animal Sciences		
Commodity Board	Soybean Promotion Board		
Project Title	Effects of inclusion of soybean oil in beef heifer diets on heifer development, reproductive function, and calf growth		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Kegley, Beth	Powell, Jeremy	Looney, Charles	Littlejohn, Brittni	Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES	AES	AES			

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students	$2,000				$2,000	$2,000	$0
Subtotal: Hourly	$2,000	$0	$0	$0	$2,000	$2,000	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$2	$0	$0	$0	$2	$2	$0
Subtotal: Fringe Benefits	$2	$0	$0	$0	$2	$2	$0
Personnel Total	$2,002	$0	$0	$0	$2,002	$2,002	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State			$1,200		$1,200	$1,200	$0
Out-of-State	$1,500				$1,500	$1,500	$0
Travel Total	$1,500	$0	$1,200	$0	$2,700	$2,700	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Kegley, Beth *Effects of inclusion of soybean oil in beef heifer diets on heifer development, reproductive function, and calf*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$15,619				$15,619	$15,619	$0
	Fertilizer/Chemicals	$1,000				$1,000	$1,000	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Analytical Services	$3,150				$3,150	$3,150	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$19,769	$0	$0	$0	$19,769	$19,769	$0
	Total for Proposal	$23,271	$0	$1,200	$0	$24,471	$24,471	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Use of gossypol to inhibit reproduction in domestic hogs as a model for feral hog control

Lead Investigators: B. P. Littlejohn

Co-Investigators: C. V. Maxwell, T. Tsai

Status: Year 3 of 3

Research Areas: Misc. Projects

Stated Goal: To evaluate the use of gossypol to inhibit reproduction in domestic hogs for development of a bait for feral hog control

Specific Objectives:

1. Using domestic hogs as a model for feral hogs, conduct a series of experiments to evaluate the use of feed containing gossypol to inhibit reproductive potential
2. Obtain input from 1) state and federal agencies and 2) collaborators in wildlife biology and population management to prepare for potential future phases of the project

Methods:

Objective 1. Gossypol from cottonseed has been found to impede reproductive function in various species, including swine. Gossypol consumption has been associated with decreased sperm production and quality in males, suppressed fertility in females, and disruption of pregnancy leading to increased rates of abortion. Our *long-term goal* is to assess the potential for gossypol administration in the form of baiting to reduce wild hog populations in the state of Arkansas. To accomplish this goal, our laboratory group proposes the continuation of a series of trials evaluating the use of gossypol to suppress fertility in sexually mature boars. Trials will be sequential and conditional on each previous trial. Projects will be repeated and adjusted as necessary prior to starting subsequent trials to improve the effectiveness of methods. Our recently completed pilot study (conducted in Year 2) evaluated the use of gossypol-containing cottonseed oil added as a top dress to a standard swine diet on semen quality and health of domestic boars. Preliminary data from this pilot study showed decreased motility of sperm from boars that consumed gossypol-containing cottonseed oil for a 42-day period, with a number of boars reaching 0% motility. Due to the success of our initial pilot study, we plan to focus efforts of Year 3 on continuing this line of research in boars to improve methods and treatment effectiveness. Specifically, two primary areas requiring improvement were identified from the pilot study. Palatability issues were determined in the treatment group receiving the highest dose of gossypol-containing oil (12 mg gossypol/kg of body weight). To address this, we have started working with a commercial company to design an additive that could be mixed with the cottonseed oil to both improve palatability and attract hogs to the bait. Oil production limitations were also identified in the pilot study. We are currently pressing the oil from the cottonseed ourselves because a commercially available cottonseed oil product containing gossypol is not available, resulting in limited yields. Therefore, we are pursuing collaborations to scale up oil production capacity. We are also working to develop methods to produce an oil product with a higher concentration of gossypol. Pending implementation of necessary improvements identified in the pilot study, we plan to conduct a larger scale study in boars using these improved methods. Ultimately, novel preliminary results suggest the potential for gossypol-containing cottonseed oil to be used as a contraceptive in feral hogs and support continued research in this area. While Year 3 will focus on further developing methods to successfully use gossypol-containing cottonseed oil as a contraceptive in boars, future studies should evaluate the potential for gossypol-containing cottonseed oil to be used as a contraceptive in nonpregnant females, as well as its potential to disrupt pregnancy and offspring survival.

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Objective 2. Historically, the use of toxicants as methods of feral hog control have not been well accepted by the public and regulatory agencies of the state of Arkansas. Preliminary data support the potential for gossypol-containing cottonseed oil added to feral hog bait as a viable method to reduce populations of feral hogs. Therefore, as we move forward in this line of research it is essential to have support from state and federal regulatory agencies for future product approvals for the state of Arkansas. It is important to note that *Objective 1*, seeks to establish the *proof-of-concept phase* of this project. We will seek funding for future phases of this research to be conducted in the field with collaborators in wildlife biology and population management. Our lab group has established working relationships with these collaborators and with the Arkansas Feral Hog Eradication Task Force. We have been obtaining input from these contacts throughout the research process. Early input from collaborators in wildlife biology and population management have increased the potential for our methods to translate to field conditions, and early input from the Arkansas Feral Hog Eradication Task Force have helped ensure that there might be a place for such a product in the state of Arkansas.

Planned Milestones: Year 1 and 2 of funding have established a successful line of research supporting the use of gossypol-containing cottonseed oil as a contraceptive in boars. The third year of funding will allow us to address issues identified in the pilot study and further develop a product that can be used in a field setting. In Year 3, a palatability study will be conducted to evaluate potential feed additives to increase palatability and consumption of feed containing higher doses of gossypol-containing cottonseed oil. Oil production improvements will be evaluated with the goal to increase oil yields and increase gossypol concentrations in the oil. Pending successful implementation of necessary improvements, we plan to conduct a larger scale study in boars incorporating these modifications. As stated above, trials conducted in Years 3 will be sequential and conditional on each previous trial. Trials will be repeated and adjusted as necessary prior to starting subsequent trials to improve the effectiveness of methods. Additionally, we will continue to seek input from state and federal agencies and collaborators in wildlife biology and population management as a part of *Objective 2*. Ongoing results will be reported to the Arkansas Corn and Grain Sorghum Board on a regular basis.

Value to Soybean Industry: Feral swine are an invasive species reported in at least 35 states in the U.S., a range that has continuously expanded over the past decades. Total estimated damages to crops, habitat, and private property are valued at over 1.5 billion dollars per year in the U.S., and total estimated damage and loss of crops in the state of Arkansas is valued at over 20 million dollars per year. There is an estimated feral hog population of 200,000 head in Arkansas, and the state would need to eliminate around 70% of the population (140,000 head) each year to halt population growth. Hunting, trapping, and shooting are common control practices, but are not effective enough to control the population of feral hogs. It is also important to note that currently, Arkansas law only allows poison bait for rodent control. Furthermore, it is imperative that control measures not cause harm to humans, other wildlife, or scavengers. Gossypol is an orally active polyphenolic compound naturally found in cottonseed that has been found to inhibit male reproduction in various species including humans.

Budget Justifications/Explanation of Travel and Direct Costs: The budget for Year 3 includes funds to support salary and benefits for a postdoctoral associate to assist in conducting the proposed research. In-state and out-of-state travel will be necessary for *Objective 2* to maintain communication with state and federal agencies and collaborators in wildlife biology and population management. Out-of-state travel will also include travel to professional meetings to disseminate research results. Maintenance and operations costs will include the cost of animals, feed, sampling supplies, laboratory supplies, feed analyses, semen analyses, and laboratory analyses. Pending the need for study replication, Year 3 is estimated to require up to 50 hogs at an estimated cost of $300 per animal in feed and maintenance costs. Publication fees are included to disseminate research results.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Littlejohn, Brittni *0*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Littlejohn, Brittni	**Co-PI #1**	Maxwell, Charles	
Co-PI #2	Tsung C. Tsai	**Co-PI #3**		
Department				
Commodity Board				
Project Title				

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Littlejohn, Brittni	Maxwell, Charles	Tsung C. Tsai		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES	AES				

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Technician	Jordan Crawford	5%	$1,500				$1,500	$1,500	$0
Postdoctoral Associate		25%	$12,000				$12,000	$12,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$13,500	$0	$0	$0	$13,500	$13,500	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$1,155				$1,155	$1,155	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$1,155	$0	$0	$0	$1,155	$1,155	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$3,861	$0	$0	$0	$3,861	$3,861	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$84	$0	$0	$0	$84	$84	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$3,945	$0	$0	$0	$3,945	$3,945	$0
Personnel Total	$18,600	$0	$0	$0	$18,600	$18,600	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$200				$200	$200	$0
Out-of-State	$200				$200	$200	$0
Travel Total	$400	$0	$0	$0	$400	$400	$0

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Littlejohn, Brittni *0*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$5,000				$5,000	$5,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication	$1,000				$1,000	$1,000	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs		$5,000				$5,000	$5,000	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$11,000	$0	$0	$0	$11,000	$11,000	$0
	Total for Proposal	$30,000	$0	$0	$0	$30,000	$30,000	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Site-specific assessment of soybean response to in-field variability using remote sensing.

Lead Investigators: Aurelie Poncet, Assistant Professor of Precision Agriculture

Co-Investigators: Mike Hamilton, Extension Irrigation Instructor

Status: Year 2 of 3

Research Areas: Agronomy, Irrigation

Stated Goal: The project goal is to increase the profitability of irrigated soybean production with optimized crop management. To meet this goal, the following tasks must be completed:

A. Characterization of soybean yield response to in-field variability.
B. In-season monitoring of soybean development and health, and correlations with yield.
C. Definition of data-driven recommendations for optimized crop production.
D. Decision-support tool development and validation for delivery of data-driven recommendations.

The proposed project addresses tasks A and B. Research from 2021 to 2023 was conducted under the assumptions that most yield variability in furrow-irrigated fields occur parallel to the irrigation furrows, and that the remote sensing-based vegetation indices calculated at any one time during the crop reproductive stages correlate with yield. The results demonstrated that, as expected, significant in-field soybean yield variability occurred in commercial furrow-irrigated fields. However, the magnitude of variability and spatial distribution of yield was difficult to predict. Moreover, in-field soybean yield variability was associated with spatial changes in soil properties and crop growth, but only weak to moderate correlations were found between the yield and remote sensing-based vegetation indices computed from the beginning of pod formation (R3) to full seed (R6). These findings supported the idea that remote sensing imagery can be used to monitor soybean development in production fields, but the initial assumptions and approach should be revised to better account for the multi-dimensional nature of in-field variability and the complexity of interactions at play. The proposed approach will improve model performance by accounting for two-dimensional spatial effects, expanding the project scope to other irrigation strategies (e.g., overhead and flood irrigation), and correlating yield with temporal changes in remote sensing-based vegetation indices rather than relying on single index values.

Specific Objectives:

1. To quantify and compare in-field soybean yield variability under different irrigation systems.
2. To model relationships between site-specific soybean yield and remote sensing-based vegetation index history.
3. To compare the performance of data collection platforms and evaluate the use of drone remote sensing as an alternative to missing satellite images.

Methods:

Objective 1: In 2024, soil samples, stand counts, and leaf samples were collected in two furrow-irrigated fields to characterize spatial changes in soil pH, plant essential nutrient availability, plant population, and leaf nutrient concentrations. Field history was provided by the participating producers. Elevation and NRCS SSURGO soil survey data were downloaded from public data repositories. Ten sets of four time-domain reflectometry (TDR) sensors were installed across each field to monitor spatial and temporal changes in soil water content and temperature. The TDR data were automatically collected every 15

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minutes using a data logger. The TDR sensor depths were 6, 12, 18, and 30 inches. One set of tensiometers was also installed next to one TDR station to measure soil water potential and monitor temporal changes in the crop water stress status. The tensiometer data were automatically collected every 60 minutes using telemetry and the sensor depths were 6, 12, and 18 inches. The yield monitor data were downloaded, cleaned, and normalized to emphasize relative differences in yield within each field. The same data will be collected in 2025 and 2026 in a total of 2, 1, and 1 other production soybean fields managed using furrow, flood, and pivot irrigation, respectively. The rainfed corners from the pivot-irrigated field will be used as non-irrigated controls. Spatial statistics will be computed to characterize and describe in-field changes in soybean yield. The following metrics will be considered and used to compare results among fields: magnitude of variability, directionality, and spatial distribution pattern. Additional statistics will be computed to identify the drivers of variability, model site-specific relationships between soybean yield and field conditions, and filter out unexplained variability from the yield data.

Objectives 2 and 3: For each field, PlanetScope (10-ft resolution every 4 days), Sentinel-2 (30-ft resolution every 10 days) and Landsat-8 (90-ft resolution every 8 days) satellite images were/will be collected from planting to harvest. Drone images were/will be collected weekly from the fourth trifoliate stage (V4) to full seed (R6), and every other week from full seed to maturity. Each field was/will be divided into 90-ft grids associated with median relative yield and relevant vegetation index values computed from each available image. Spatiotemporal analysis will then be conducted to correlate the yield data with temporal changes in vegetation indices. Separate analyses will be conducted for each data source, and additional analysis will be computed to compare findings among data sources and determine if drone images can be used as a substitute for missing satellite images.

Planned Milestones:

- Characterize in-field soybean yield variability in different production systems.
- Quantify the spatial distribution of explainable in-field yield variability.
- Correlate soybean yield data with the site-specific remote sensing-based vegetation index history
- Compare model performance with different image spatial and temporal resolutions.
- Evaluation of drone remote sensing as an alternative to satellite remote sensing.

Value to Soybean Industry: Satellite and drone remote sensing technologies provide agricultural stakeholders with high spatial and temporal resolution imagery, enabling detailed monitoring of crop growth, health, and management zone delineation. These data-driven insights can be used to refine extension recommendations, enhancing both efficiency and profitability. However, producers currently lack guidance on how to effectively incorporate this information into their decision-making processes. This project aims to develop a robust framework for creating actionable, data-driven recommendations to fill this gap and unlock the full potential of remote sensing in agriculture.

Budget Justifications/Explanation of Travel and Direct Costs: Personnel funds are requested for partial support of a program associate and graduate student. Graduate student support includes stipend and tuition. Funds are also requested for the support of hourly personnel. Travel funds are requested for data collection and participation in relevant out-of-state conferences including the 2025 ASA-CSSA-SSSA Annual International Meeting and the 2025 Conference on Applied Statistics in Agriculture and Natural Resources. Supply funds and other direct costs are requested to purchase sensors, computer accessories, and miscellaneous field supplies. Funds are also requested to participate with remote sensing equipment maintenance and pay for manuscript publication fees.

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Promotion Board Budget

Poncet, Aurelie *Site-specific assessment of soybean response to in-field variability using remote sensing.*

Year	2025/2026	**Project Year**	Year 2 of 3
Lead Investigator	Poncet, Aurelie	**Co-PI #1**	Hamilton, Mike
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Site-specific assessment of soybean response to in-field variability using remote sensing.		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Poncet, Aurelie	Hamilton, Mike			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI		AES	CES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Associate	Wesley France	15%	$7,500				$7,500	$7,500	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$7,500	$0	$0	$0	$7,500	$7,500	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
	MS Student	40%	$9,000				$9,000	$9,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$4,300				$4,300	$4,300	$0
	Subtotal: Graduate Student		$13,300	$0	$0	$0	$13,300	$13,300	$0
	Hourly								
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel		$6,000	$16,750			$22,750	$6,000	$16,750
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$6,000	$16,750	$0	$0	$22,750	$6,000	$16,750
	Fringe Benefits								
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$2,145	$0	$0	$0	$2,145	$2,145	$0
	Graduate Students		$459	$0	$0	$0	$459	$459	$0
	Hourly Personnel		$438	$1,223	$0	$0	$1,661	$438	$1,223
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$3,042	$1,223	$0	$0	$4,265	$3,042	$1,223
	Personnel Total		$29,842	$17,973	$0	$0	$47,815	$29,842	$17,973
	Travel								
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$3,000	$6,000			$9,000	$3,000	$6,000
	Out-of-State		$2,000	$3,000			$5,000	$2,000	$3,000
	Travel Total		$5,000	$9,000	$0	$0	$14,000	$5,000	$9,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Poncet, Aurelie *Site-specific assessment of soybean response to in-field variability using remote sensing.*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,658	$527			$2,185	$1,658	$527
	Fertilizer/Chemicals					$0	$0	$0
	Publication	$3,500				$3,500	$3,500	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	sensor + IT supplies as needed		$7,500			$7,500	$0	$7,500
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$5,158	$8,027	$0	$0	$13,185	$5,158	$8,027
	Total for Proposal	$40,000	$35,000	$0	$0	$75,000	$40,000	$35,000

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Screening Arkansas Soybean Cultivars for Protein Quality as a Novel Food Preservative

Lead Investigators: Mahfuzur Rahman

Co-Investigators: Caio Canella Vieira

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 2 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): **Post-Harvest, Breeding**

Stated Goal:

Synthetic food preservatives are used in food processing to reduce the spoilage of food and increase the shelf life. However, the rising concerns regarding potential health risks associated with these synthetic preservatives have led consumers to exhibit hesitancy in their use. A promising solution involves the utilization of natural bioactive peptides as preservatives by preventing lipid oxidation, inhibiting pathogenic microorganism growth, and increasing the shelf life of processed foods. Genetically modified microorganisms (GMOs) have been leveraged to produce microbial peptides that serve as effective preservatives for food.

Soy protein-derived peptides have demonstrated numerous health benefits, including anti-hypertensive, anti-cancer, immunomodulatory, anti-inflammatory, cholesterol-lowering, and gut-protective effects. The utilization of these health-promoting soy protein-derived peptides to replace synthetic preservatives would be of great interest to the food processing industries. The production of these peptides from soybeans developed in Arkansas provides potential financial benefits to growers and the Arkansas soybean industry by introducing a new market for soybean-derived products. Therefore, the goal of this project is to investigate the potential of utilizing the seed protein of Arkansas soybeans as a food preservative.

Specific Objectives:

1. Conduct a comprehensive screening of soybean varieties to fractionate protein-derived bioactive peptides suitable for application as food preservatives.
2. Utilize fractionated peptides to enhance the shelf life of processed food by preventing lipid oxidation and inhibiting microbial growth.
3. Develop breeding materials with improved seed composition to be used as food preservatives.

Methods:

In the first year, eight cultivars (R05-1772, R09-3789 (UA5814HP), R11-7999, R18-10491, R18-14147, R21C-02235, R21C-02304, R98-1821 (Osage)) selected for the study. Hydrolysis was conducted with various endo- and exo-proteases, including Alcalase from *Bacillus licheniformis* and Protease from *Aspergillus oryzae*, to obtain peptide hydrolysates. Functional properties, ferrous ion chelation ability, and lipid oxidation inhibition were evaluated to identify cultivars with novel preservative peptides among each cultivar. The soybean breeding lines demonstrating the best antioxidant and antimicrobial properties will be selected for comparison against synthetic preservatives such as sodium benzoate and EDTA and natural preservatives in the second year.
In the second year, we will compare the potential of soy bioactive peptides with natural preservatives in various food products. The extracted peptides will be integrated into a liquid food (fruit juice), a viscous food (mayonnaise), and a solid food (cookies), and these formulations will be compared with synthetic

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preservatives (such as sodium benzoate and EDTA). Quality assessments, short-term storage studies, and accelerated shelf-life studies will be conducted to evaluate the effectiveness of peptides in comparison to chemical preservatives. We will correlate this data with breeding to develop soybean lines with optimal preservative performance.
Seed composition, including seed protein, oil, and amino acids, will be used as proxies to identify genetic resources with potential optimal preservative performance. Lines with superior preservative performance will be used as parental stocks to develop new breeding populations. Within developed populations, progenies will be screened for seed composition, and lines with desirable seed components will undergo preservative performance tests as described in Objectives 1 and 2.

Planned Milestones:

2024: Conduct experiments to isolate protein from 8 high-protein Arkansas soybean breeding lines. Fractionate bioactive peptides and analyze their quality, assessing their ability to prevent lipid oxidation and inhibit microbial growth. The R98-1821 cultivar exhibited the highest lipid peroxidation inhibition across all treatments compared to other samples, indicating it will provide good storage stability for lipid-rich products over extended periods. The highest ferrous ion chelation activity was 84.78% for the soy cultivar R18-1049 at only 0.2 mg/ml protein concentration.

2025: Highly functional peptides from the 2024 study will be applied as preservatives in foods and compared to chemical preservatives' shelf life. Publish the results in Arkansas Soybean Research Studies & and a peer-reviewed journal, and present data at national scientific meetings such as the Institute of Food Technologists. Communicate the outcomes to industry stakeholders, such as Solae and Kerry ingredients, who have the potential to manufacture peptides as preservatives. Continue the development and selection of high-protein breeding populations and lines, respectively.

2026: Yield test high-protein breeding lines with potential optimal preservative performance. Initiate protein isolation and peptide extraction from developed breeding lines. Validate the preservative performance of newly developed breeding lines compared with synthetic preservatives.

Value to Soybean Industry:

In 2022, the plant-based protein market was valued at $8 billion in the U.S., experiencing a 7% increase in dollar sales compared to 2021. Soybean is the major plant-based protein, and its market is anticipated to be valued at $10.5 billion in 2024, with projections to reach $13.3 billion by 2029. While soy protein is being used in food products, utilizing the same protein-derived peptides as preservatives would greatly interest the food processing industry. Protein-derived peptides are currently available in the market and are expected to experience significant growth, rising from $2.5 million in 2023 to $4.2 million by 2033. Animal-derived proteins and microorganisms serve as the primary sources for these peptides. Identifying a new application for soy protein-derived peptides, particularly in replacing synthetic preservatives with a plant-derived source, could significantly bolster the soy protein market.

Budget Justifications/Explanation of Travel and Direct Costs ($53,235):

A total of $34,187 is requested to support a graduate student and an hourly student in extracting and analyzing peptides in PI Rahman's lab. We require more chemicals and supplies this year, $6,500 is allocated to purchasing chemicals and supplies aswe all $2000 to travel to scientific meeting to present the data. Furthermore, a total of $10, 548 is requested to support an hourly visiting scholar in Co-PI Vieira's lab for seed composition analysis and planting and harvesting supplies.

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Promotion Board Budget

Rahman, Mahfuzur — *Screening Arkansas Soybean Cultivars for Protein Quality as a Novel Food Preservative*

Year	2025/2026	**Project Year**		**Version: 7.0 (11/01/2024)**
Lead Investigator	Rahman, Mahfuzur	**Co-PI #1**	Vieira, Caio	
Co-PI #2		**Co-PI #3**		
Department	FDSC Food Science			
Commodity Board	Soybean Promotion Board			
Project Title	Screening Arkansas Soybean Cultivars for Protein Quality as a Novel Food Preservative			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Rahman, Mahfuzur	Vieira, Caio			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
Sukanya Poddar	50%	$23,000				$23,000	$23,000	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information		$6,795				$6,795	$6,795	$0
Subtotal: Graduate Student		$29,795	$0	$0	$0	$29,795	$29,795	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$3,000	$7,500			$10,500	$10,500	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$3,000	$7,500	$0	$0	$10,500	$10,500	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$1,173	$0	$0	$0	$1,173	$1,173	$0
Hourly Personnel	$219	$548	$0	$0	$767	$767	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$1,392	$548	$0	$0	$1,940	$1,940	$0
Personnel Total	$34,187	$8,048	$0	$0	$42,235	$42,235	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State		$1,000			$1,000	$1,000	$0
Out-of-State	$2,000				$2,000	$2,000	$0
Travel Total	$2,000	$1,000	$0	$0	$3,000	$3,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Rahman, Mahfuzur *Screening Arkansas Soybean Cultivars for Protein Quality as a Novel Food Preservative*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$6,500	$1,500			$8,000	$8,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$6,500	$1,500	$0	$0	$8,000	$8,000	$0
	Total for Proposal	$42,687	$10,548	$0	$0	$53,235	$53,235	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Fertilization of Soybean

Lead Investigators: Trenton Roberts

Co-Investigators: Gerson Drescher and Jeremy Ross

Status: Year 3

Research Areas: Fertility

Stated Goal:

The overall mission of this research is to identify potential yield limitations via soil and plant analysis and aid in the prevention of soybean yield loss attributed to insufficient (or toxic) mineral nutrition. The specific goals addressed with this project are to 1) continue short- and long-term phosphorus (P) and potassium (K) fertilization trials, 2) continue to evaluate soybean fertilization strategies with macro and micronutrients, 3) investigate remote sensing technologies and 4) assess nutrient concentration variability at the production scale.

Specific Objectives:

1. Continue long-term P and K fertilizer rate trials established at the Pine Tree Research Station in 2000 (PTRS) and Rice Research Experiment Station in 2007 (RREC) to examine soil-test trends and crop yield responses to fertilization rates.
2. Continue to evaluate existing and develop new correlation calibration relationships between soil-test P (or K) alone and soybean yield and leaf nutrient concentration in response to P (or K) fertilization.
3. Evaluate the effects of P fertility on soybean yield, selected yield components, the pattern of leaf-P concentration across time, and seed nutrient concentration among nodes.
4. Calibrate in season leaf tissue-K concentrations to predict K fertilizer needs to maximize or recover yield during the reproductive growth stages. Assess the use of remote sensing to predict where trifoliolate leaf samples should be collected.

Methods:

1. Short- and Long-term Studies: Potassium rate studies at PTRS established in 2000 and P and K rate studies at the RREC established in 2007 will be maintained with their existing, annually applied treatments (0, 40, 80, 120, and 160 lb P_2O_5 and K_2O/acre) and grown in rotation with rice. Data will continue to be collected from the long-term corn and soybean rotational site. Soil samples will be taken annually from long-term trials and tissue nutrient concentrations and yield will continue to be evaluated. Short-term trials that evaluate new fertilizers (e.g., Aspire), evaluate nutrient application strategies, and support the needs of developing/evaluating critical leaf nutrient levels will be continued to ensure that new technology or products are fairly evaluated to advise growers on their use.

2. Replicated field trials will be established at experiment stations across the state with varying levels of soil test K to elicit varying levels of K deficiency. Treatments will include a non-treated check, a yield maximizing K rate applied preplant, and several in-season K rates applied at 15, 30, and 45 days after R1. Leaf samples will be collected at each fertilizer application to calibrate the K rate needed to maximize soybean grain yield based on tissue-K concentration.

3. The research will be performed at the PTRS within a long-term P fertility study. The trial is a

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randomized complete block design with four blocks that contain three fertilizer sources (monoammonium phosphate (MAP) without potash; MAP + muriate of potash, and MicroEssentials SZ + Aspire] with each fertilizer-P source applied at 0, 30, 60, and 120 and lb P_2O_5/acre. The site is furrow irrigated and cropped with a 1:1 soybean and corn rotation. Mature leaf samples will be collected during vegetative growth (V4-V6) and then weekly for 10 weeks beginning at the R1 stage to measure leaf-P concentrations from the MAP + muriate of potash fertilizer-P source applied at 0, 30, and 60 lb P_2O_5/acre. At maturity, six whole mature plants will be collected from an interior row, dissected (two nodes and two internodes/node section) and plant tissues from each dissected node segment will be separated into (i) stem internodes, (ii) pods, and (iii) seeds to evaluate soybean seed yield, yield components (number of pods and seeds, and seed abortion), and seed nutrient concentration responses among nodes to P fertility.

Planned Milestones:

The proposed research trials will be conducted for three years beginning in 2023. Research results will be published annually in the Wayne Sabbe Arkansas Soil Fertility Studies Research Series or Soybean Research Series to serve as a permanent, accessible record of results that will also serve to inform clientele within and outside of Arkansas. Information will also be disseminated annually via county educational meetings and at regional and international professional meetings as deemed appropriate. The outcomes of annual research results will help guide the research for subsequent years and lead to the development of new tools for Arkansas soybean producers.

Value to Soybean Industry:

Soybean fertilization costs represent about one-fifth of the total operating expenses budgeted for full-season soybean grown on silt loam soils. Accurate identification of P- and K-deficient soils and knowledge of other yield-limiting nutrients will enable recommendations to be refined so that the correct fertilizer sources and rates are applied at the times and frequency required to maximize yield and sustain soil productivity. Long-term fertilization trials are invaluable for verifying that recommended P and K fertilizer rates are sufficient for sustainable production and, as illustrated by our development of critical leaf-K concentrations for developing tissue-based interpretations to verify sufficient crop nutrition. Correlating and calibrating nutrient information from soil and tissue analyses is a long-term process that requires a large number of site-years with a wide range of soil properties to ensure soil test recommendations are as accurate and precise as possible. The ability to accurately diagnose P and K deficiency and an improved understanding of how nutrient deficiencies influence individual yield components will positively impact soybean production economics and the environment. With current advancements in remote sensing and the adaptability of new platforms to unmanned aerial systems there is the opportunity for assessing soybean nutritional status using aerial imagery. Developing tools that will allow producers to identify potential nutrient deficiencies before they can be detected through deficiency symptomology can help ensure that nutrients such as P and K are no longer yield-limiting factors in Arkansas soybean production systems.

Budget Justifications/Explanation of Travel and Direct Costs:

The out-of-state travel included in this proposal is to cover a portion of the cost for graduate students to attend professional scientific meetings which in this calendar year will include the international annual agronomy meetings in Salt Lake City, UT. Attendance at these meetings allows presentations to be made concerning the research work conducted and for increased education by attending other scientific presentations and workshops. In-state travel and salary are budgeted for field data collection. Publication is budgeted for manuscript publication in a peer-reviewed journal.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Roberts, Trenton *Fertilization of Soybean*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Roberts, Trenton	**Co-PI #1**	Drescher, Gerson
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Fertilization of Soybean		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Roberts, Trenton	Drescher, Gerson			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI		AES	AES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Associate	Joe Shafer	25%	$17,000				$17,000	$17,000	$0
Program Associate	Stephanie Williamson	10%	$6,600				$6,600	$6,600	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$23,600	$0	$0	$0	$23,600	$23,600	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
	New MS	25%	$6,000				$6,000	$6,000	$0
	New MS	25%		$6,000			$6,000	$6,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$1,700	$1,700			$3,400	$3,400	$0
	Subtotal: Graduate Student		$7,700	$7,700	$0	$0	$15,400	$15,400	$0
	Hourly								
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students		$2,000	$2,000			$4,000	$4,000	$0
	Subtotal: Hourly		$2,000	$2,000	$0	$0	$4,000	$4,000	$0
	Fringe Benefits								
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$6,750	$0	$0	$0	$6,750	$6,750	$0
	Graduate Students		$306	$306	$0	$0	$612	$612	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$2	$2	$0	$0	$4	$4	$0
	Subtotal: Fringe Benefits		$7,058	$308	$0	$0	$7,366	$7,366	$0
	Personnel Total		$40,358	$10,008	$0	$0	$50,366	$50,366	$0
	Travel								
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$4,500	$3,000			$7,500	$7,500	$0
	Out-of-State		$1,500	$1,500			$3,000	$3,000	$0
	Travel Total		$6,000	$4,500	$0	$0	$10,500	$10,500	$0

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Promotion Board Budget

Roberts, Trenton *Fertilization of Soybean*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,500	$1,000			$2,500	$2,500	$0
	Fertilizer/Chemicals	$1,000	$500			$1,500	$1,500	$0
	Publication		$1,500			$1,500	$1,500	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Lab Analysis	$3,500	$2,750			$6,250	$6,250	$0
Station Maintenance	SAREC, Fayetteville	$1,580	$0	$0	$0	$1,580	$1,580	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$7,400	$0	$0	$0	$7,400	$7,400	$0
	RIRE, Stuttgart	$1,580	$0	$0	$0	$1,580	$1,580	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$16,560	$5,750	$0	$0	$22,310	$22,310	$0
	Total for Proposal	$62,918	$20,258	$0	$0	$83,176	$83,176	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Field-based determination of chloride tolerance in soybean

Lead Investigators: Trenton Roberts and Jeremy Ross

Co-Investigators: John Carlin

Status: Year 3

Research Areas: Agronomy and Breeding

Stated Goal:

Implement a field-based assessment of chloride tolerance in soybean which will provide a more accurate representation of which soybean cultivars are classified as includers, excluders and mixed reaction types.

Specific Objectives:

1. Implement a field-based leaf sampling protocol for rating soybean varieties as an includer or excluder.
2. Provide annual evaluation of soybean cultivar reaction to chloride both as a categorical response of includer, excluder and mixed as well as a numerical rating system that indicate the relative degree of chloride tolerance amongst varieties.
3. Rate the degree of mixed reaction soybean populations so that producers can make informed cultivar selections that best fit their production systems and desired soybean characteristics.

Methods:

1. **Leaf Cl samples from field trials for categorizing variety Cl ratings:** Leaf samples will be collected from all maturity groups at a single location hosting Arkansas Soybean Variety Yield Trials (e.g., Rohwer). The leaf-Cl concentrations and uniformity among replicates and site-years will indicate whether variety leaf-Cl concentration behaves uniformly and is a good indicator or Cl inclusion or exclusion by the root system. To determine whether varieties are mixed populations of includers and excluders, individual plants (up to 16 plants per plot) will be sampled individually and the tissue analyzed for Cl. This type of sampling and analysis is needed to determine whether individual plants have the same Cl inclusion/exclusion mechanism. Once varieties are accurately characterized and 'standard varieties' identified field trials can eventually be initiated to examine management effects (row spacings, flat planted vs beds, etc…) on Cl uptake. Information will be included in the variety trial summary.

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Planned Milestones:

The proposed research trials will be conducted for three years beginning in 2023, this will be the third year of the trial. Annual chloride tolerance ratings will be provided to the Extension soybean agronomist which will be added to official variety trial results and posted online. Research results will be published annually in the Soybean Research Series to serve as a permanent, accessible record of results that will also serve to inform clientele within and outside of Arkansas. Information will also be disseminated annually via county educational meetings and at regional and international professional meetings as deemed appropriate.

Value to Soybean Industry:

Clarifying whether a variety is truly a Cl includer or excluder is important to soybeans produced on poorly drained soils in areas with irrigation water having high Cl (most of eastern Arkansas). The current greenhouse screening method does not provide a robust rating system for varieties. A field screening technique is logical, time efficient, and a method that can be easily adopted by any seed company for in-house variety screening. The data collected from these trials will be compiled with other cultivar evaluation to provide Arkansas soybean producers with reliable field-based information to make well informed cultivar section decisions.

Budget Justifications/Explanation of Travel and Direct Costs:

In-state travel and salary are budgeted for field data collections.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Roberts, Trenton *Field-based determination of chloride tolerance in soybean*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Roberts, Trenton	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Field-based determination of chloride tolerance in soybean		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Roberts, Trenton				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES						
Fulltime Personnel							
Position Title / **Name** *(if position is filled)* / **% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Tech / Carri Scott / 50%	$25,000				$25,000	$25,000	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Subtotal: Salaries	$25,000	$0	$0	$0	$25,000	$25,000	$0
Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition. / **Name** *(if position is filled)* / **% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Tuition Calculator Information					$0	$0	$0
Subtotal: Graduate Student	$0	$0	$0	$0	$0	$0	$0
Hourly							
	Wages				**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel					$0	$0	$0
Hourly-Students	$3,000				$3,000	$3,000	$0
Subtotal: Hourly	$3,000	$0	$0	$0	$3,000	$3,000	$0
Fringe Benefits							
Fringe benefits are calculated when salary and wage amounts are entered above.	**Benefits**				**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$7,150	$0	$0	$0	$7,150	$7,150	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$3	$0	$0	$0	$3	$3	$0
Subtotal: Fringe Benefits	$7,153	$0	$0	$0	$7,153	$7,153	$0
Personnel Total	$35,153	$0	$0	$0	$35,153	$35,153	$0
Travel							
Justify out-of-state travel in proposal.	**Travel**				**Total**	**AES Portion**	**CES Portion**
In-State	$5,500				$5,500	$5,500	$0
Out-of-State					$0	$0	$0
Travel Total	$5,500	$0	$0	$0	$5,500	$5,500	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Roberts, Trenton *Field-based determination of chloride tolerance in soybean*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$2,500				$2,500	$2,500	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Lab Analysis	$8,000				$8,000	$8,000	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$10,500	$0	$0	$0	$10,500	$10,500	$0
	Total for Proposal	$51,153	$0	$0	$0	$51,153	$51,153	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Influence of Cover Crops and Soil Health on Soybean

Lead Investigators: Trenton Roberts

Co-Investigators: Gerson Drescher and Jeremy Ross

Status: Year 3

Research Areas: Agronomy and Fertility

Stated Goal: To investigate the short-term and long-term benefits of cover crop implementation on corn and soybean yield, nutrient use efficiency, water use efficiency and soil health.

Specific Objectives:

1. Evaluate the effects of soil sample collection timing on soil health results and their interpretation.

2. Identify how winter cover crop species influences corn and soybean yield performance and soil physical characteristics related to water holding capacity and irrigation.

3. Monitor soil physical and chemical parameters related to soil health and productivity as influenced by a corn and soybean rotation with varying winter cover crop species.

Methods:

1. Field-scale, large-block trials will be implemented to look at the influence of cover crop species on soil health, soil physical and chemical characteristics specifically related to soil water holding capacity and irrigation. Implementation of cover crops and no-till production practices will influence the amount of soil organic matter and ultimately the crop performance and water use efficiency. Soil samples will be taken annually within the trial to gain baseline information of characteristics such as soil texture, organic C, organic N, soil organic matter via weight loss on ignition and basic soil fertility levels. During the initiation of the trial samples will be taken prior to cash crop planting each season to monitor the effects of the cover crop treatments within the corn and soybean rotations.
2. In order to gain information on the influence of winter cover crop species selection on soybean yield and irrigation efficiency data will be collected each year over the course of the experiment to determine both the long and short-term effects. Conversion to no-till and introduction of cover crops can lead to initial yield lags, but overtime often lead to yield increases.
3. Soil samples for soil health analysis will be collected each month for an entire year to determine how time of sampling impacts soil health results. Samples will be collected

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from all four of the soybean cover crop trials located across the state. Only selected treatments will be sampled, but the same treatments will be sampled at all locations.

4. Each season soil samples will be collected and compared to see how crop rotation and cover crop species influence the soil health index. Statistical analysis will help determine which cover crop treatment has the greatest influence on soil health over both the short and long-term.

Planned Milestones:

Data will be collected annually and compiled over time to compare the short-term and long-term effects of winter cover crop species selection. It may take several years for these systems to reach equilibrium due to the changes of both cover cropping and no-till management practices. Our goal is to monitor these changes to help aid producers in nutrient management for soybean through the implementation of cover crops into a corn soybean rotation and explain performance of the overall field system by describing diseases and indicators of soil health such as soil microbial communities and soil physical properties. Results will be reported each year at county and regional meetings and in the refereed scientific literature at the completion of the study.

Value to Soybean Industry: Winter cover crops have been promoted based on the environmental benefits of reduced erosion and nutrient loss. Limited work has been done to date on species selection and cultural management practices for effective use of winter cover crops in Arkansas corn and soybean rotational systems. Identifying the correct species, planting date and fertilization needs are essential for effective cover crop use and continued profitability of our soybean production systems. Costs and challenges of winter cover crops will be easily offset by: 1) the potential decrease in fertilizer needs 2) improved soil conditions that lead to better growth or reduced irrigation needs and 3) reduction in environmental impacts that threaten the long-term sustainability of Arkansas corn and soybean production. Inclusion of winter cover crops can have both short-term and long-term impacts on corn and soybean production. Understanding how cover crop species selection and cultural management practices is one of the most important steps in realizing the benefits of their effective use.

Budget Justifications/Explanation of Travel and Direct Costs: The out of state travel included in this proposal is to cover a portion of the cost for graduate students to attend professional scientific meetings which in this calendar year will include the international annual agronomy meetings in Salt Lake City, UT. The attendance at these meetings allows presentations to be made concerning the research work conducted and also for increased education by attending other scientific presentations and workshops. In-state travel and salary are budgeted for field data collections.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Roberts, Trenton *Influence of Cover Crops and Soil Health on Soybean*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Roberts, Trenton	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Influence of Cover Crops and Soil Health on Soybean		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Roberts, Trenton				**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI	AES						
Fulltime Personnel							
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Tech	Carri Scott	10%	$5,000				$5,000	$5,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$5,000	$0	$0	$0	$5,000	$5,000	$0
Graduate Student									
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
	New MS	100%	$20,000				$20,000	$20,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$6,600				$6,600	$6,600	$0
	Subtotal: Graduate Student		$26,600	$0	$0	$0	$26,600	$26,600	$0
Hourly									
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students		$2,000				$2,000	$2,000	$0
	Subtotal: Hourly		$2,000	$0	$0	$0	$2,000	$2,000	$0
Fringe Benefits									
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$1,430	$0	$0	$0	$1,430	$1,430	$0
	Graduate Students		$1,020	$0	$0	$0	$1,020	$1,020	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$2	$0	$0	$0	$2	$2	$0
	Subtotal: Fringe Benefits		$2,452	$0	$0	$0	$2,452	$2,452	$0
	Personnel Total		$36,052	$0	$0	$0	$36,052	$36,052	$0
Travel									
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$5,500				$5,500	$5,500	$0
	Out-of-State		$1,500				$1,500	$1,500	$0
	Travel Total		$7,000	$0	$0	$0	$7,000	$7,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Roberts, Trenton *Influence of Cover Crops and Soil Health on Soybean*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,500				$1,500	$1,500	$0
	Fertilizer/Chemicals	$1,500				$1,500	$1,500	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Lab Analysis	$6,000				$6,000	$6,000	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$4,150	$0	$0	$0	$4,150	$4,150	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$3,500	$0	$0	$0	$3,500	$3,500	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$3,440	$0	$0	$0	$3,440	$3,440	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$20,090	$0	$0	$0	$20,090	$20,090	$0
	Total for Proposal	$63,142	$0	$0	$0	$63,142	$63,142	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Monitoring the Extent of Potassium Deficiency and Chloride Toxicity in Arkansas Soybean Fields

Lead Investigators: Trenton Roberts and Jeremy Ross

Co-Investigators: Gerson Drescher

Status: Year 3

Research Areas: Agronomy, Fertility, Verification

Stated Goal: Determine the extent of potassium deficiency and chloride toxicity in Arkansas soybean production fields and identify potential yield gaps caused by these two yield limiting factors.

Specific Objectives:

1) Identify the magnitude and extent of potassium deficiency, including hidden hunger, across a wide range of Arkansas soybean production systems and estimate the associated yield loss.
2) Identify the magnitude and extent of chloride toxicity across a wide range of Arkansas soybean production systems and estimate the associated yield loss.

Methods:

1) Fields will be selected in conjunction with the county extension agents and Soybean Verification coordinators that have a history of "yield lag", exhibit unknown yield limitations or the producer has shown interest in using in-season tissue monitoring as a management tool. Trifoliolate leaf samples will be collected from the uppermost fully expanded leaf at the R2 and R4 growth stages. Selected fields will be grid sampled to provide additional information on the variability of both potassium deficiency and chloride toxicity. However, most fields will be sampled using a composite analysis from predetermined management zones. These zones will be delineated based on soil textural changes, yield maps or other reliable information. At least 18 trifoliolate leaves will be collected and composited from each management zone. In the event that fields are grid sampled, at least 12 leaves will be collected to form a composite sample within each grid cell. Data will be collected from the producer including but not limited to, soil texture, planting date, cultivation practices, water source, soil test values, fertilization practices, previous crop history with yield where available, cultivar planted and chloride toxicity rating. A report will be provided to the county agent as well as the producer that outlines the potential of potassium deficiency or chloride toxicity reducing their overall yield potential with an associated projected yield and profit loss. The statewide data will be combined over years to identify areas of the state where fertilization practices or cultivar selection can be altered to increase producer yield and profitability. Areas where yields are reduced by either of these two yield limiting factors will be targeted with educational programs to help mitigate their effects on soybean yield.

Planned Milestones:

The proposed monitoring project will be conducted for three years beginning in 2023, this will be the first year of the trial. Annual reports will be provided to the county extension agents, producers, and the Extension soybean agronomist. Results will be published annually in the Soybean Research Series to serve as a permanent, accessible record of results that will also serve to inform clientele within and outside of Arkansas. Information will also be disseminated

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annually via county educational meetings and at regional and international professional meetings as deemed appropriate.

Value to Soybean Industry:

Recent research has suggested that hidden hunger of potassium in soybean may be more widespread than currently thought and leading to a significant loss in soybean yield potential and producer profit. There are many areas of the state that are either not fertilized properly or are intentionally under fertilized due to budget constraints. The results of this monitoring program will help us identify the extent to which hidden hunger is costing Arkansas soybean producers and help target educational activities where they are most needed and will have the greatest net impact. In many areas where producers are not happy with their soybean yields there is a chance that chloride toxicity may be the underlying cause of their poor yields. With irrigation water quality and quantity continuing to decline across the state the problem of chloride toxicity will only continue to grow. Based on our work with hidden hunger of potassium in soybean we believe there is the potential that we are experiencing some hidden toxicity with chloride that is lowering our soybean yield potential without the obvious visual deficiency symptoms that we typically associate with chloride toxicity. The implementation of this monitoring program will help us identify problem areas of chloride toxicity, areas that may become problematic in future and provide soybean producers with some insight as to whether improved variety selection could help with their soybean yields.

Budget Justifications/Explanation of Travel and Direct Costs:

In-state travel and salary are budgeted for field data collections.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Roberts, Trenton — *Monitoring the Extent of Potassium Deficiency and Chloride Toxicity in Arkansas Soybean Fields*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Roberts, Trenton	**Co-PI #1**	Ross, Jeremy
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Monitoring the Extent of Potassium Deficiency and Chloride Toxicity in Arkansas Soybean Fields		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Roberts, Trenton	Ross, Jeremy			Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	CES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Associate	Stephanie Williamson	15%	$9,000				$9,000	$9,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$9,000	$0	$0	$0	$9,000	$9,000	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$0	$0	$0	$0	$0	$0	$0
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$2,574	$0	$0	$0	$2,574	$2,574	$0
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$2,574	$0	$0	$0	$2,574	$2,574	$0
	Personnel Total		$11,574	$0	$0	$0	$11,574	$11,574	$0
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$2,500	$5,000			$7,500	$2,500	$5,000
	Out-of-State						$0	$0	$0
	Travel Total		$2,500	$5,000	$0	$0	$7,500	$2,500	$5,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Roberts, Trenton *Monitoring the Extent of Potassium Deficiency and Chloride Toxicity in Arkansas Soybean Fields*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,500	$1,500			$3,000	$1,500	$1,500
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Lab Analysis and shipping	$13,500	$4,000			$17,500	$13,500	$4,000
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$15,000	$5,500	$0	$0	$20,500	$15,000	$5,500
	Total for Proposal	$29,074	$10,500	$0	$0	$39,574	$29,074	$10,500

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Docusign Envelope ID: D0A676D9-3363-47A8-80D5-37D3059EAA2E

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Development of data-driven recommendations for variable soybean seeding rate in Arkansas

Lead Investigators: Jeremy Ross

Co-Investigators: Aurelie Poncet and Greenway Equipment

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): 2 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy

Stated Goal: In a previously funded project, a method was developed to quantify site-specific soybean yield response to seeding rate, identify the drivers of in-field yield variability, and generate a posteriori prescription maps for variable-rate seeding (VRS). The created maps described in-field changes in the agronomic optimum seeding rate (proven to maximize site-specific soybean yield). Findings showed that:

- Soybean yield response to seeding rate varies within commercial fields.
- Some of that variability could be effectively managed using VRS if adequately implemented.
- Management decisions regarding VRS can be made using data that are already available to Arkansas soybean producers including soil test results and public web-soil survey information.

The project goal is to develop data driven VRS recommendations for Arkansas soybeans. The following next steps are needed to meet the project goal:

A. Comparison of findings across growing seasons, to generate a priori VRS prescriptions that minimize risk from weather variability.
B. Economic analysis, to emphasize profitability rather than yields.
C. Implementation of the proposed methodology in new locations, to increase the dataset size, improve the model's prescriptive capabilities, and develop more reliable recommendations.
D. On-farm validation of the created data driven VRS recommendations.

Decision-support tool (e.g., web tool) development, to make the created VRS recommendations accessible to Arkansas producers, crop consultants, and other agricultural stakeholders.

Specific Objectives: This project addresses steps A to C, and we propose the following specific objectives:

1. To develop an algorithm that computes the economic optimum seeding rate from the predicted site-specific yield response to seeding rate, cost of soybean seeds, and crop prices.
2. To evaluate the temporal stability and variability of a posteriori VRS prescription maps created from data collected in the same commercial fields and a minimum of two growing seasons.
3. To generalize findings across locations selected to bracket the typical range of field conditions found in Arkansas.

Methods: This study will be conducted on-farm. One of the fields previously used for this research, plus one new production fields, will be selected per year. The participating producers will use John Deere guidance and yield monitoring systems (preferred), and be competent with yield monitoring, yield mapping, and variable-rate technologies. They will also have a historical record of crop rotations and planting/soil testing data. Preference will also be given to growers interested in multi-year studies.

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Preferred field size will be 80+ acres. Five seeding rate treatments of 75, 100, 125, 150, and 175 thousand seeds per acre will be applied in strips to bracket the University Planting Prescription. Treatments will be replicated 4 to 5 times in a field, and each treatment strip will be created from 1 or 2 consecutive planter passes. The seeding rate treatments will be established by the growers in collaboration with the project PIs. The following data will then be collected by the project PIs: soil samples for routine soil testing and texture analysis, stand counts, and hand samples of plants. Data will be collected at a 1 sample per acre resolution. Soil mapping units will be identified using the USDA-NRCS web soil survey. Sentinel-2 satellite images will be downloaded from public data repositories (spatial resolution: 30 ft. Notes regarding plant stress and pest pressure will be taken as needed. Field elevation will be characterized using the digital elevation model gathered from the USGS public database. Flow accumulation will be computed from the field elevation data to characterize field hydrology. Yield monitor data will be collected at harvest.

Statistical analysis will be conducted:

- To characterize in-field changes in soybean yield response to seeding rate, identify the drivers of site-specific variability, and determine if VRS could be used to manage the observed variability.
- To determine the agronomic and economic optimum site-specific seeding rates and generate a posteriori prescription maps for variable soybean seeding rate.
- To assess the temporal stability and variability of the optimum site-specific soybean seeding rates and generate optimized a priori prescriptions.

Different models and computation methods will be considered. Meta-analysis of results will be computed to generalize findings and optimize model performance and computing times. Results from the meta-analysis will support the development of practical and relevant recommendations for variable soybean seeding rate in Arkansas.

Planned Milestones:

- Identify criteria on which VRS prescriptions may be based.
- Develop an algorithm that uses historical field data to predict whether VRS technology could be beneficial in a field.
- Define the most relevant method to generate prescription maps for variable soybean seeding rate.
- Automation of data analysis and processing for future implementation into a web-tool.

Value to Soybean Industry: The development of precision planting and variable-rate technologies provides new opportunities for soybean producers to control and optimize seeding densities. However, few recommendations exist to help guide growers in their variable rate seeding decisions and few studies have been conducted to evaluate which field factors most greatly influence optimum seeding rates.

Budget Justifications/Explanation of Travel and Direct Costs: Out-of-state travel funds will be used for presentation of data at national meetings. The $5,000 amount will be used for routine soil testing and soil texture analysis.

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Docusign Envelope ID: D0A676D9-3363-47A8-80D5-37D3059EAA2E

University of Arkansas System Division of Agriculture

Promotion Board Budget

Ross, Jeremy — *Development of data-driven recommendations for variable soybean seeding rate in Arkansas*

Year	2025/2026	**Project Year**	Year 2 of 3
Lead Investigator	Ross, Jeremy	**Co-PI #1**	Poncet, Aurelie
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Development of data-driven recommendations for variable soybean seeding rate in Arkansas		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Ross, Jeremy	Poncet, Aurelie			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI		CES	AES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Assoc	Randy Miller	20%	$12,000				$12,000	$0	$12,000
Program Tech	Rollins Elam	20%	$8,800				$8,800	$0	$8,800
Program Assoc	Wesley France	20%		$10,000			$10,000	$10,000	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$20,800	$10,000	$0	$0	$30,800	$10,000	$20,800
Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
Hourly								
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel		$7,500	$10,000			$17,500	$10,000	$7,500
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$7,500	$10,000	$0	$0	$17,500	$10,000	$7,500
Fringe Benefits								
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$5,949	$2,860	$0	$0	$8,809	$2,860	$5,949
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$548	$730	$0	$0	$1,278	$730	$548
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$6,496	$3,590	$0	$0	$10,086	$3,590	$6,496
	Personnel Total		$34,796	$23,590	$0	$0	$58,386	$23,590	$34,796
Travel								
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$5,000	$4,000			$9,000	$4,000	$5,000
	Out-of-State			$2,000			$2,000	$2,000	$0
	Travel Total		$5,000	$6,000	$0	$0	$11,000	$6,000	$5,000

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Docusign Envelope ID: D0A676D9-3363-47A8-80D5-37D3059EAA2E

University of Arkansas System Division of Agriculture

Promotion Board Budget

Ross, Jeremy — *Development of data-driven recommendations for variable soybean seeding rate in Arkansas*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$2,500	$2,000			$4,500	$2,000	$2,500
	Fertilizer/Chemicals					$0	$0	$0
	Publication		$4,000			$4,000	$4,000	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Soil Sample Analysis	$5,000				$5,000	$0	$5,000
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$7,500	$6,000	$0	$0	$13,500	$6,000	$7,500
	Total for Proposal	$47,296	$35,590	$0	$0	$82,886	$35,590	$47,296

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

Confidential

Docusign Envelope ID: 0F2D4B2B-572A-4722-8B52-67BEDA11456D

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Improving Technology Transfer for Profitable and Sustainable Soybean Production

Lead Investigators: Jeremy Ross

Co-Investigators:

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy

Stated Goal: To ensure that improved production practices for soybean production in Arkansas are distributed in a timely manner

Specific Objectives:

1. To ensure timely development and distribution of the Soybean Update publications as well as update computer assisted variety selection program.
2. To improve the rate of technology transfer and adaption by the implementation of educational programs that impart critical decision-making information at advisory and producer level for improved profitability for sustainable soybean production systems (non-irrigated and irrigated), including the use of weekly electronic soybean reports (e-mail and blog) and timely newsletters such as Arkansas Weekly Soybean Report.
3. Continue to coordinate state and regional meetings to facilitate the latest soybean production updates. These will include the Arkansas Soybean Research Summit, Tri-State Soybean Forum, as well as other events deemed necessary by emerging production problems.
4. To increase the awareness of county extension agents, consultants, agribusiness representatives, concerned producers of the status, direction, and value of current soybean research and Extension efforts.
5. Publication of the Soybean Research Series, which will be an on-line archive of yearly reports of the projects funded by the Arkansas Soybean Promotion Board.

Methods:

1. Procure personnel and equipment to develop and disseminate the *Arkansas Soybean Update* and the new variety selection website by December each year.
2. Assist with development of the *Arkansas Row Crops Blog*, *Arkansas Weekly Soybean Report*, and *Soybean Notes* newsletters, and other educational materials including slide sets, fact sheets, and other related soybean production materials for county Extension agents, consultants and producers.
3. Organize State and/or regional SRVP/Technology Transfer, country tours and production clinics to evaluate Soybean Research Verification Program fields, Extension demonstrations and innovative producer successes.
4. Assist with the organization of in-depth educational meetings such as the Arkansas Soybean/Corn Research Conference, Tri-State Soybean Forum, and short courses, seminars at county, area or statewide meetings.
5. PI's with projects funded by the Arkansas Soybean Promotion Board will submit articles to be reviewed and published in the Soybean Research Series. These articles will serve as yearly reports to the Arkansas Soybean Promotion Board.

Planned Milestones:

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Docusign Envelope ID: 0F2D4B2B-572A-4722-8B52-67BEDA11456D

1. Development and dissemination of the *Arkansas Soybean Update* by December 2023.
2. Develop and disseminate the Arkansas Weekly Soybean Report, Soybean Notes, and Weekly Blog Post weekly throughout the 2025 production season.
3. Assist with County Extension Agents and Agricultural Experiment Stations to provide soybean production updates, field days, and other methods of information delivery for critical production solutions throughout the 2025 production season.
4. Publish articles in the 2024 Soybean Research Series by November 2025.

Value to Soybean Industry: : In 2024, the University of Arkansas, Division of Agriculture tested over 150 different soybean cultivars in the Commercial Cultivar Test. At last count, ten soybean seed companies were either headquartered or had an invested interest in Arkansas. Each of these different companies attempt to gain their market share of the estimated 3 plus million acres each year. Due to the large economic investment and critical nature of soybean variety selection, producers need a method to compare these cultivars in a way to ensure maximum production with little risk to pests such as soybean diseases and nematodes.

The Soybean Update publications, as well as a new variety selection website, are readily accepted as a means to help producers with these decisions. Each of these reports provide a summary of yields, disease ratings, nematode evaluations, and other agronomic information for those varieties tested in Arkansas for at least two years. This is evident in the dissemination each year. Historically, these publications have been distributed to over 9,000 clientele each year through the County Extension offices throughout the State. While the success of each of these is obvious, the timeliness of producing and disseminating these materials needs to be more efficient.

Budget Justifications/Explanation of Travel and Direct Costs: $3,500 for equipment for producing and filming podcast and virtual meetings; $1,000 for software.

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Docusign Envelope ID: 0F2D4B2B-572A-4722-8B52-67BEDA11456D

University of Arkansas System Division of Agriculture
Promotion Board Budget

Ross, Jeremy — *Improving Technology Transfer for Profitalbe and Sustainalbe Soybean Production*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Ross, Jeremy	**Co-PI #1**		
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Improving Technology Transfer for Profitalbe and Sustainalbe Soybean Production			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Ross, Jeremy				**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI	CES						

Fulltime Personnel

Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Assoc	Randy Miller	10%	$6,000				$6,000	$0	$6,000
Program Tech	Rollins Elam	10%	$4,400				$4,400	$0	$4,400
Program Assoc	Amy Tallent	50%	$33,150				$33,150	$0	$33,150
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$43,550	$0	$0	$0	$43,550	$0	$43,550

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Graduate Student

Name *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel	$6,000				$6,000	$0	$6,000
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$6,000	$0	$0	$0	$6,000	$0	$6,000

Fringe benefits are calculated when salary and wage amounts are entered above.

Fringe Benefits

	Benefits				**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$12,455	$0	$0	$0	$12,455	$0	$12,455
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$438	$0	$0	$0	$438	$0	$438
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$12,893	$0	$0	$0	$12,893	$0	$12,893
Personnel Total	$62,443	$0	$0	$0	$62,443	$0	$62,443

Justify out-of-state travel in proposal.

Travel

	Travel				**Total**	**AES Portion**	**CES Portion**
In-State	$2,000				$2,000	$0	$2,000
Out-of-State	$2,000				$2,000	$0	$2,000
Travel Total	$4,000	$0	$0	$0	$4,000	$0	$4,000

Confidential

Docusign Envelope ID: 0F2D4B2B-572A-4722-8B52-67BEDA11456D

University of Arkansas System Division of Agriculture
Promotion Board Budget

Ross, Jeremy — *Improving Technology Transfer for Profitalbe and Sustainalbe Soybean Production*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$4,000				$4,000	$0	$4,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication	$2,500				$2,500	$0	$2,500
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Podcast Equip/Software	$4,500				$4,500	$0	$4,500
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$11,000	$0	$0	$0	$11,000	$0	$11,000
	Total for Proposal	$77,443	$0	$0	$0	$77,443	$0	$77,443

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Docusign Envelope ID: 506CB1E6-55B4-41F9-A902-8D58CC676F12

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Investigating Emerging Production Recommendations for Sustainable Soybean Production

Lead Investigators: Jeremy Ross

Co-Investigators: Ben Thrash and other selected Extension Soybean Commodity Committee Members

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy/Entomology

Stated Goal: To investigate new and untested management inputs to improve soybean production, maximize grain yield, and maintain seed quality

Specific Objectives:

1. Continue to initiate test demonstrations for controlling economically damaging insect pests that often impact the Early Soybean Production System. These pest complexes include Dectes Stem Borer, Grape Colaspis, Thirps, Potato Leaf Hopper, Soybean Looper, and Stink Bug.
2. Evaluate performance of soybean varieties of different herbicide technologies including Xtend, Enlist, and XtendFlex.
3. Investigate seeding rate and seed treatment interactions of soybean under a wide range of geographic regions and soil textures under different irrigation treatments. Research test will also examine the best replant options for soybean with and without seed treatments.
4. Examine the potential of using new and innovative production factors, and how they influence soybean yields and profitability. Detail research is needed to advise producers in the use of plant growth regulators, alterative fertilizer sources and other soybean production inputs currently not being tested in Arkansas for soybean production sustainability.

Methods:

1. Replicated research trials will be established to evaluate the performance of soybean varieties of the different herbicide technologies compared to popular varieties. These tests will consist of MG IV and MG V varieties at two locations. Measurements will include grain yield, lodging, shatter, and canopy structure.
2. Replicated research trials will be established to investigate the profitability of foliar applications of plant growth regulators, fertilizers, and fungicides to determine their impact on soybean yield and plant health. These data will be used in production meetings and production newsletters to either validate or refute the claims made by the manufacturer.
3. Initiate preliminary studies to determine the impact of insect pest in GMO and conventional production systems. Attempts will be made to expedite sweep sampling evaluation of various pest measures for improved pest management strategies. Additional trials evaluating new and existing insecticides and seed treatments will also be initiated. Trials evaluating the possible interaction between insecticides and commonly used herbicides will also be conducted.

Planned Milestones:

1. Research identifying the most profitable recommendations to be used for all Soybean Production System will be implemented in 2024. These research objectives are to identify

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the most productive and most profitable planting date, seeding rate, and row spacing for MG IV and MG V production systems.

2. Evaluate pest management strategies to ensure economic thresholds are established for identifiable pests regardless of sampling technique. Conduct numerous on-farm insecticide/seed treatment evaluations to determine appropriate insecticides for Arkansas soybean pests.

Value to Soybean Industry: Each year Arkansas soybean producers are encouraged by industry to implement new and often untested management inputs to improve soybean production. Many of these inputs are termed by the soybean community as "snake oils" while others may be production practices and are rarely tested under controlled non-biased research trials in order to determine their effectiveness. Many reasons exist for not conducting these trials. A major reason is that some industry members do not want to invest in this testing, but rather use these funds in advertising and marketing of their products. The lack of an effective testing program for these materials can lead to continued use of these products often based simply on "word of mouth" or observations by the manufacturer. The use of these products is often encouraged by the apparent low costs. Producers often comment that "…its only $2 an acre…" and can rarely document a yield benefit. This industry has the potential of costing the Arkansas soybean producers million of dollars each year without accurate research trials to support or refute the use of these products or practices.

Budget Justifications/Explanation of Travel and Direct Costs: Out-of-state travel will be used to attend, participate and present research data at regional and national meetings such as the ASA Annual Meeting, Tri-State Soybean Forum, and Commodity Classic. Monies in this budget category will be used to pay in part for the service contracts on research equipment, maintenance and repair cost of research equipment, and GPS subscriptions.

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Docusign Envelope ID: 506CB1E6-55B4-41F9-A902-8D58CC676F12

University of Arkansas System Division of Agriculture

Promotion Board Budget

Ross, Jeremy — *Investigating Emerging Production Recommendations for Sustainable Soybean Production*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Ross, Jeremy	**Co-PI #1**	Thrash, Ben
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Investigating Emerging Production Recommendations for Sustainable Soybean Production		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Ross, Jeremy	Thrash, Ben			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES					
Fulltime Personnel							
Position Title / **Name** *(if position is filled)* / **% Time** / **Salaries**					**Total**	**AES**	**CES**
Program Assoc — Randy Miller — 40%	$24,000				$24,000	$0	$24,000
Program Tech — Rollins Elam — 40%	$17,600				$17,600	$0	$17,600
Program Assoc — Nathan Pearrow — 40%	$27,448				$27,448	$0	$27,448
Program Assoc — Andrew Plummer — 30%		$17,000			$17,000	$0	$17,000
Program Assoc — Taylor Harris — 30%		$17,000			$17,000	$0	$17,000
Subtotal: Salaries	$69,048	$34,000	$0	$0	$103,048	$0	$103,048
Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition. — **Name** *(if position is filled)* / **% Time** / **Wages**					**Total**	**AES Portion**	**CES Portion**
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Tuition Calculator Information					$0	$0	$0
Subtotal: Graduate Student	$0	$0	$0	$0	$0	$0	$0
Hourly							
Wages					**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel	$12,000	$3,700			$15,700	$0	$15,700
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$12,000	$3,700	$0	$0	$15,700	$0	$15,700
Fringe Benefits							
Fringe benefits are calculated when salary and wage amounts are entered above. — **Benefits**					**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$19,748	$9,724	$0	$0	$29,472	$0	$29,472
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$876	$270	$0	$0	$1,146	$0	$1,146
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$20,624	$9,994	$0	$0	$30,618	$0	$30,618
Personnel Total	$101,672	$47,694	$0	$0	$149,366	$0	$149,366
Travel							
Justify out-of-state travel in proposal. — **Travel**					**Total**	**AES Portion**	**CES Portion**
In-State	$10,000				$10,000	$0	$10,000
Out-of-State	$4,000				$4,000	$0	$4,000
Travel Total	$14,000	$0	$0	$0	$14,000	$0	$14,000

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Docusign Envelope ID: 506CB1E6-55B4-41F9-A902-8D58CC676F12

University of Arkansas System Division of Agriculture

Promotion Board Budget

Ross, Jeremy *Investigating Emerging Production Recommendations for Sustainable Soybean Production*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$7,500				$7,500	$0	$7,500
	Fertilizer/Chemicals	$2,500				$2,500	$0	$2,500
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Service Contract/Equ. Repairs	$30,000				$30,000	$0	$30,000
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$22,950	$0	$0	$0	$22,950	$0	$22,950
	PTST, Colt	$3,200	$0	$0	$0	$3,200	$0	$3,200
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$66,150	$0	$0	$0	$66,150	$0	$66,150
	Total for Proposal	$181,822	$47,694	$0	$0	$229,516	$0	$229,516

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Docusign Envelope ID: C261CC8E-6DD7-449C-9536-73A4EEBC19A0

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Science for Success – Arkansas Support for National Soybean Research and Extension Program

Lead Investigators: Jeremy Ross

Co-Investigators:

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Agronomy

Stated Goal: Participate in the Science for Success program by conducting soybean production research and contributing to educational materials that will be distributed at the local, regional, and national level.

Specific Objectives: With this project, we will be able to develop and distribute research-based information to soybean farmers in Arkansas and across the U.S. on emerging best management practices (BMP's). We will contribute to the Science for Success program by expanding previously successful efforts with the continued development of soybean BMP's through both the effective summarization of existing data and the generation of new data driven information that will allow soybean farmers to increase revenue and invest in sustainable on-farm practices.

Methods:

1. Participate in national soybean research protocols to contribute data for BMP's.
2. Contribute data and expertise for Extension publications, social media releases, videos, and webinars to deliver BMP's at the local, regional, and national level.
3. Attend and participate in Science for Success virtual and in-person meetings to develop common-theme localized research efforts, Extension educational materials, and team-building activities.

Planned Milestones:

1. Conduct in-field soybean research trials to generate data for BMP's (National N Credit Study, Use of Harvest Aids/Delayed Harvest; etc.)
2. Participate in monthly Science for Success virtual meetings, attend and participate in three in-person Science for Success meeting during the year, and attend and contribute to one in-person Extension educational materials meeting in August 2025.
3. Contribute to social media outreach through posting field observations during the growing season and contributing short videos of Science for Success content.

Value to Soybean Industry: The Science for Success program is a collaborative team of Extension personnel from diverse soybean growing regions across the U.S. Individuals within this group are using grants like this one to leverage funding and support from local QSSB's to conduct the needed research to generate soybean BMP's. Through this group, we can generate research data across diverse environments in a shorter timeframe than would be possible from a single state or regional program. Since the inception of the Science for Success program, this group has generated national data that has contributed to educational materials on foliar nutrient products and additional sulfur fertility of soybean. We have also developed national publication from existing knowledge and data generated from local QSSB funding on management decisions across growth stages, soybean planting dates, soybean seeding rates, and optimal row spacing for soybean production. Research data and Extension publications are available on multiple platforms including individual state websites, the Soybean Research and Information

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Docusign Envelope ID: C261CC8E-6DD7-449C-9536-73A4EEBC19A0

Network and the Crop Protection Network. Research data and Extension educational materials generated from this project will benefit soybean growers from Arkansas to the national level.

Budget Justifications/Explanation of Travel and Direct Costs: The $10,000 in in-state travel will be used to travel to research locations throughout the growing season to conduct the needed research; the $5,000 in out-of-state travel will be used to attend meetings where Extension publications will be generated and discussion of research topics.

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Docusign Envelope ID: C261CC8E-6DD7-449C-9536-73A4EEBC19A0

University of Arkansas System Division of Agriculture
Promotion Board Budget

Ross, Jeremy *Science for Success*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Ross, Jeremy	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Science for Success		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Ross, Jeremy				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Assoc.	Randy Miller	30%	$18,000				$18,000	$0	$18,000
Program Tech.	Rollins Elam	30%	$13,200				$13,200	$0	$13,200
Program Assoc.	Amy Tallent	50%	$33,150				$33,150	$0	$33,150
							$0	$0	$0
							$0	$0	$0
		Subtotal: Salaries	$64,350	$0	$0	$0	$64,350	$0	$64,350

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$5,000				$5,000	$0	$5,000
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$5,000	$0	$0	$0	$5,000	$0	$5,000

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$18,404	$0	$0	$0	$18,404	$0	$18,404
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$365	$0	$0	$0	$365	$0	$365
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$18,769	$0	$0	$0	$18,769	$0	$18,769
Personnel Total	$88,119	$0	$0	$0	$88,119	$0	$88,119

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$10,000				$10,000	$0	$10,000
Out-of-State	$5,000				$5,000	$0	$5,000
Travel Total	$15,000	$0	$0	$0	$15,000	$0	$15,000

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Docusign Envelope ID: C261CC8E-6DD7-449C-9536-73A4EEBC19A0

University of Arkansas System Division of Agriculture

Promotion Board Budget

Ross, Jeremy *Science for Success*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$7,000				$7,000	$0	$7,000
	Fertilizer/Chemicals	$2,500				$2,500	$0	$2,500
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Equipment Repairs/Phone Char	$6,000				$6,000	$0	$6,000
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$6,730	$0	$0	$0	$6,730	$0	$6,730
	PTST, Colt	$3,200	$0	$0	$0	$3,200	$0	$3,200
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$25,430	$0	$0	$0	$25,430	$0	$25,430
	Total for Proposal	$128,549	$0	$0	$0	$128,549	$0	$128,549

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Docusign Envelope ID: 0F2D4B2B-572A-4722-8B52-67BEDA11456D

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Soybean Research Verification Program

Lead Investigators: Jeremy Ross

Co-Investigators: Chris Elkins and Coordinator to be hired

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Verification

Stated Goal: To verify University of Arkansas, Division of Agriculture recommendation for soybean production, and to maintain an economic data base of production practices on a large-scale field basis.

Specific Objectives:

1. To conduct field trials to verify that high yields can be profitably produced by coordinating the implementation of all research-based recommendations.
2. To aid researchers in identifying areas of soybean production and marketing that need further study.
3. To improve recommendations which contribute to profitable soybean production utilizing both irrigated and non-irrigated production of both early season (indeterminate) and conventional (determinate) varieties into economically sustainable soybean production systems for the Arkansas farmers.
4. To utilize the Soybean Research Verification Program (SRVP) concept to maintain and improve producers, County Extension Agents' and other crop advisors' soybean production and marketing expertise.

Methods: Farmer-cooperators are selected in soybean-producing counties and the soybean crop grown at the cooperator's expense under the technical direction of the SRVP coordinators. Computerized soil test and variety selection programs and jointly developed Research/Extension weed, insect, and disease programs are utilized. All production practices are based on current Extension Service recommendations. Complete records of field operations are maintained for economic analyses of individual fields.

Planned Milestones: The 2025 Arkansas SRVP will consist of approximately 20 fields representing different production systems for the various soybean production regions within the state. Data obtained from these studies will be evaluated against the objectives. SRVP coordinators will meet with farmer-cooperators during the winter to determine variety, pesticide, and other agronomic practices, which will be utilized during the growing season. SRVP coordinators will make weekly visits to each SRVP field during the growing season to monitor and evaluate each field's progress. Economic data collected during the growing season will be calculated and reported in a final yearly report. SRVP data will be presented at County production meetings and other meetings deemed appropriate.

Value to Soybean Industry: Soybean yields in Arkansas continue to increase but yields can increase more if Arkansas soybean farmers adopt and implement new technology. To increase the state's yield average, new technology including "Precision Agriculture" must be quickly transferred from the University researcher to the soybean producer. The SRVP allows soybean producers to observe University of recommended production practices being implemented on typical producer fields across the state. The SRVP provides for faster adoption of new and existing technology for improved soybean production efficiency for both irrigated and non-irrigated production. The SRVP also demonstrates the

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profitability of recommended production systems in “real world” high-yield (irrigated environments and also the variable non-irrigated environments and offers an opportunity to enhance cooperating producers’ and county Extension agents’ marketing expertise.

Budget Justifications/Explanation of Travel and Direct Costs: Both SRVP coordinators travel to each field on a weekly basis during the growing season. Before and after the growing season, coordinators are traveling to meet with potential cooperators and County Agents to plan the coming season and participating in State meeting by presenting SRVP data. Cooperating County Agents are provided two one-way trips to visit their SRVP field twice a week. Out-of-state travel is included in the budget to provide both SRVP coordinators the opportunity to participate in national meetings such as the Commodity Classic or ASA meetings. Additional Direct Cost are $2,000 for cell phone/MiFi charges, $5,600 for four additional soil sensor packages (Decision King Lite, 4 Watermark Sensors, and 6-month PK Link subscription), and $3,500 for cell service for soil moisture sensors**.**

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Docusign Envelope ID: 0F2D4B2B-572A-4722-8B52-67BEDA11456D

University of Arkansas System Division of Agriculture
Promotion Board Budget

Ross, Jeremy *Soybean Research Verification Program*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Ross, Jeremy	**Co-PI #1**		
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Soybean Research Verification Program			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Ross, Jeremy				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Assoc.	Chris Elkins	95%	$61,750				$61,750	$0	$61,750
Program Assoc.	TBD	95%	$57,000				$57,000	$0	$57,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$118,750	$0	$0	$0	$118,750	$0	$118,750

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$33,963	$0	$0	$0	$33,963	$0	$33,963
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$33,963	$0	$0	$0	$33,963	$0	$33,963
Personnel Total	$152,713	$0	$0	$0	$152,713	$0	$152,713

Travel

Justify out-of-state travel in proposal.	Travel				Total	AES Portion	CES Portion
In-State	$25,000				$25,000	$0	$25,000
Out-of-State	$5,000				$5,000	$0	$5,000
Travel Total	$30,000	$0	$0	$0	$30,000	$0	$30,000

Confidential

Docusign Envelope ID: 0F2D4B2B-572A-4722-8B52-67BEDA11456D

University of Arkansas System Division of Agriculture
Promotion Board Budget

Ross, Jeremy *Soybean Research Verification Program*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$5,000				$5,000	$0	$5,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Cell Service/Soil Moisture Probe	$12,500				$12,500	$0	$12,500
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$17,500	$0	$0	$0	$17,500	$0	$17,500
	Total for Proposal	$200,213	$0	$0	$0	$200,213	$0	$200,213

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

Confidential

Docusign Envelope ID: 164427C3-3097-4EE6-A4D6-A3F04EFCE6FA

Arkansas Soybean Promotion Board – 2024-2025 Proposal

Title: Soybean Weed Management: A Team Approach for Improved Control and Profitability
Lead Investigator: Bob Scott
Co-Investigators: Tom Barber, Jason Norsworthy, and Nilda Burgos
Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3
Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Weeds and Education

Stated Goal: To evaluate new and emerging weed control technologies, rapidly identify herbicide-resistant weeds, determine their distribution, determine their mechanisms of resistance, and develop viable, unbiased solutions for managing these weeds. In addition, research focused on reducing the soil weed seedbank and controlling other problematic weeds for soybean producers in Arkansas will be conducted. The identification and implementation of diversified control strategies and the rapid information exchange between the grower, Extension personnel, and researchers will be prioritized.

Specific Objectives:

1. To continue testing suspected resistant weed biotypes sent from county agents and soybean producers for herbicide resistance, particularly for glufosinate and auxin herbicide resistance, documenting the level of resistance and distribution, and determining the effectiveness of alternate herbicide modes-of-action on resistant biotypes
2. To quantify the potential of multiple herbicide-resistant Palmer amaranth and other confirmed resistant weeds to spread in Arkansas by determining control programs, ecological fitness, and geographic distribution of resistant biotypes, and resistance and dispersal mechanisms likely to cause population expansion
3. To identify and evaluate effective management programs (both short-term and long-term) for multiple herbicide-resistant Palmer amaranth including glufosinate and auxin herbicide resistance
4. To evaluate the effectiveness of various agronomic practices (double crop, cover crop, etc.) for suppressing problematic weeds of Arkansas soybean production systems
5. To determine how herbicide performance and selectivity are affected by environmental conditions (such as planting date, soil texture, climatic conditions), herbicide tank-mixture, weed species, and growth stage to develop more efficient and reliable herbicide management strategies
6. To evaluate long term programs (chemical and cultural) to reduce the soil weed seedbank. These programs will include trials designed to study methods of destroying weed seed post-harvest and evaluate new harvest weed seed destruction equipment
7. To evaluate the viability of new technologies (herbicides, traits, etc.) as they emerge for efficacy and the ability to safely apply in the agricultural and external environment
8. To evaluate fall-applied residual herbicides effectiveness on problematic Arkansas weeds (i.e., Italian ryegrass) and the resulting impact on spring burndown applications
9. To evaluate herbicide program costs and resulting soybean yields to determine profitability potential of weed management options
10. To develop RNAi technology for potential use as a novel tool for integrated weed management
11. To provide rapid transfer of weed control information to growers through multiple outreach methods such as publications, blog posts, Weeds AR Wild podcasts, videos, text messages, and many others

Methods: Approximately 100 applied research and demonstration trials will be conducted on-farm and on experiment stations at Rohwer, Newport, Stuttgart, Pine Tree, Lonoke (greenhouse), Fayetteville

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(field, greenhouse, laboratory), Keiser, Marianna, and other on-farm locations as needed to determine the most effective control options for problematic weeds in soybean production systems. Both, currently registered soybean herbicides and anticipated technologies will be evaluated. Trials will include comparisons of herbicide performance in early-season, full-season, and double-cropped soybean at all application timings. Most field trials will be 15 to 30 treatments in four-row or drill-seeded plots with four replications. Further field trials determining the effectiveness of weed seed destruction methods for long-term program approaches to weed management will be conducted. Field trials will be established to evaluate fall-applied residual herbicides to investigate their effectiveness on Italian ryegrass and the impact on required herbicides and input costs for spring burndowns. All data will be statistically analyzed, and experiments will be repeated to provide accurate results to growers. Data from these trials will be applicable across soybean production systems and will be used to update the annual MP44 publication "Recommended Chemicals for Weed and Brush Control".

Suspected resistant weeds from fields where herbicide failure occurred will be evaluated relative to known susceptible standards for resistance under controlled conditions. If failure still occurs, dose response experiments will be conducted to confirm resistance and determine the level of resistance relative to susceptible populations and labeled herbicide use rates. Laboratory experiments will be conducted to investigate herbicide absorption and translocation, metabolism, and target site mutation as possible resistance mechanisms. Determining resistance mechanisms will assist the development of management strategies to slow further resistance development. Ecological fitness experiments will also be conducted to compare the relative competitiveness of resistant and susceptible biotypes. Laboratory and greenhouse experiments will be conducted to test potential RNAi agents for weed control. These agents would provide a novel tool to aid in weed management and potential herbicide resistance solutions.

Planned Milestones: Experiments will be established, evaluated, and harvested in a timely manner in accordance with established Arkansas soybean production systems. Data will be analyzed and presented to growers through multiple outreach methods and in scientific meetings each year. Refereed journal articles will be published when deemed appropriate. Data from all trials will be incorporated into annual publications, newsletters, blog posts, Weeds AR Wild podcasts, videos, fact sheets, and text message blasts wherever appropriate. In addition, results will be published in the annual Soybean Research Series.

Value to Soybean Industry: Proper weed control accounts for a significant portion of annual budgeted production expenses. The rapid adoption and widespread use of soybean weed control information has been of great value to Arkansas growers. This project will allow growers to closely follow the discovery of herbicide-resistant and new problematic weed species through timely information which will assist with the management of these weeds on their farms. The discoveries of multiple glyphosate-resistant weed species and other herbicide resistance such as PPO-inhibitor, VLCFA-inhibitor, glufosinate, and auxin-resistant Palmer amaranth in Arkansas soybean fields has been a direct result of Soybean Board Funding. Failure to adequately control these weeds can result in total crop loss. The development of herbicide resistance to new technologies is also a concern and will be addressed by this program. Finally, identifying IWM opportunities to enhance program approaches and determining best use practices of new precision technologies will help weed control and grower profitability. If the introduction of diverse strategies and scientifically-supported recommendations generated from this research can save even $10/acre of input costs, that would provide an annual savings of $35 million total for Arkansas soybean growers.

Budget Justifications/Explanation of Travel and Direct Costs: This proposal requests $260,807 for total funding to be split between 4 PI's operating in a team. Of the total requested, $209,612 (80%) is requested for personnel expenses, including partial funding of 5 full-time program associates/technicians

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and funds for hourly workers. The personnel described is essential for the successful implementation of more than 100 field trials conducted at a minimum of 8 locations across Arkansas, as well as greenhouse experiments and resistance screenings of Palmer amaranth populations to 2 different sites-of-action herbicides plus a small sampling of other problematic weeds and herbicides as requested. Funding requested also includes $7,750 for in-state travel to cover expenses associated with the multi-location research conducted across the state. The remaining budget requested ($43,445) is for M&O including research supplies necessary to conduct the proposed research, equipment maintenance, and research station trial fees. The most efficient means to conduct an effective weed management research program in soybean is through a team approach. To facilitate the rapid development of a database for soybean herbicide recommendations, multiple project leaders at several field locations are needed to address the objectives of this weed management project.

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Docusign Envelope ID: 164427C3-3097-4EE6-A4D6-A3F04EFCE6FA

University of Arkansas System Division of Agriculture

Promotion Board Budget

Scott, Robert — *Soybean Weed Management: A Team Approach for Improved Control and Profitability*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Scott, Robert	**Co-PI #1**	Barber, Tom
Co-PI #2	Norsworthy, Jason	**Co-PI #3**	Burgos, Nilda
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Soybean Weed Management: A Team Approach for Improved Control and Profitability		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Scott, Robert	Barber, Tom	Norsworthy, Jason	Burgos, Nilda	Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES	AES	AES			

Fulltime Personnel

Position Title	Name (if position is filled)	% Time	Salaries				Total	AES	CES
Program Tech	TBD	80%	$30,000	$0	$34,000	$0	$64,000	$34,000	$30,000
Program Assoc.	Davis	25%	$15,000	$0	$0	$0	$15,000	$0	$15,000
Program Assoc.	Doherty	40%	$0	$29,000	$0	$0	$29,000	$0	$29,000
Program Tech	Hill	20%	$0	$10,000	$0	$0	$10,000	$0	$10,000
Program Assoc.	Rangani	70%	$0	$0	$0	$40,000	$40,000	$40,000	$0
	Subtotal: Salaries		$45,000	$39,000	$34,000	$40,000	$158,000	$74,000	$84,000

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name (if position is filled)	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel			$4,000		$4,000	$4,000	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$4,000	$0	$4,000	$4,000	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$12,870	$11,154	$9,724	$11,440	$45,188	$21,164	$24,024
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$292	$0	$292	$292	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$12,870	$11,154	$10,016	$11,440	$45,480	$21,456	$24,024
Personnel Total	$57,870	$50,154	$48,016	$51,440	$207,480	$99,456	$108,024

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State			$4,750		$4,750	$4,750	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$4,750	$0	$4,750	$4,750	$0

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Docusign Envelope ID: 164427C3-3097-4EE6-A4D6-A3F04EFCE6FA

University of Arkansas System Division of Agriculture

Promotion Board Budget

Scott, Robert — *Soybean Weed Management: A Team Approach for Improved Control and Profitability*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$5,000	$2,000	$9,000	$8,500	$24,500	$17,500	$7,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$1,400	$0	$1,400	$1,400	$0
	CTST, Marianna	$0	$5,475	$0	$0	$5,475	$0	$5,475
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$1,875	$0	$1,875	$1,875	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$3,125	$4,300	$0	$0	$7,425	$0	$7,425
	PTST, Colt	$0	$0	$1,290	$0	$1,290	$1,290	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$2,640	$0	$0	$2,640	$0	$2,640
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$8,125	$14,415	$13,565	$8,500	$44,605	$22,065	$22,540
	Total for Proposal	$65,995	$64,569	$66,331	$59,940	$256,835	$126,271	$130,564

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

Confidential

Docusign Envelope ID: EE014339-4F09-47C2-BECC-443A120F56CD

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Determining the value of fungicide application using on-farm trials

Lead Investigators: Dr. Terry Spurlock**,** Extension Plant Pathologist**,** Department of Entomology and Plant Pathology, Division of Agriculture

Co-Investigators: Dr. Jason Davis, Application Technology Specialist, Division of Agriculture

Status: Year 3

Research Areas: Plant Pathology, Precision AG, IPM

Stated Goal: To cooperate with farmers, consultants, and county agents to determine when and where a **fungicide application or fungicide + product(s) marketed to improve plant health** protects a soybean crop and adds value above the input cost.

1. **Specific Objectives: Work with farmers or consultants on their farms** to determine the value of product applications if applied across the entirety of their soybean acreage. **This project is targeted to early-career farmers that may struggle with these decisions.**

2. **Test products that the farmer and consultants would like to see.** They guide the test. Products will be applied within label specifications. However, individual rates will be determined by the manufacturers' and retailers' representatives. Products will be applied as they are sold.

3. **Utilize strip trials combined with spatial analysis to** allow integration of whole-field product efficacy with remote sensing technology (aerial imagery via UAVs and satellites, soil maps, and yield monitor data) to answer additional questions regarding within-field product efficacy, disease spread, and within-field difference in impacts of foliar diseases.

4. **Utilize drones** to apply products and determine efficacy against traditional ground applications both site-specifically and whole-plot.

Methods: Strip trials will be established on farms prior to R1. Trial locations will be determined by the farmers, likely based on questions regarding past field performance. Strips' width will be determined by the farmers combine header width and will likely extend the length of the field. Treatments will consist of at least an untreated control, a fungicide of the farmers choosing and a comparable standard, replicated. Trials will be approximately 30-40 acres in total size (divided into at least 9 fungicide plots). Treatments will be applied between R3-R5. Data will be collected at 10 - 20 locations per strip both by visual rating and using drones guided by GPS at application and then again at R6. Yield data will be provided by the farmer or collected using a weigh wagon. Data will be analyzed spatially after each field season and product efficacy determined by field location and within field locations. At select locations, additional treatments of the fungicide standard will be applied aerially by drone.

Planned Milestones: Each year, a report will be made available to cooperating farmers, consultants, and county agents explaining in detail the findings of the trial at their location. Results will be presented at production meetings in addition to being made available on the Arkansas Row Crops Blog and Twitter after each field season. After three more field seasons, the results will be published in refereed scientific literature. These results will also be used in a planned precision agriculture training series for crop consultants, farmers, and county agents through the Cooperative Extension Service.

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Docusign Envelope ID: EE014339-4F09-47C2-BECC-443A120F56CD

Value to Soybean Industry: This research aims to answer difficult questions asked by farmers and consultants as to the value added by foliar applications of various aggressively marketed products. It also will generate data that should be used to develop site-directed disease scouting tools making disease scouting more efficient and less expensive as well as answer questions regarding the value of fungicide application using drones.

Budget Justifications/Explanation of Travel and Direct Costs: The budget reflects personnel, travel, and supply cost to move equipment, mark strips, and apply products in 10 -12 on-farm field trial locations in 10-12 different counties. Labor dollars are the greatest expense with specific needs for field rating of diseases and UAV operations at multiple time points throughout the growing season. A graduate student stipend and tuition is included as this student will be using these trials as part of a master's project.

Confidential

Docusign Envelope ID: EE014339-4F09-47C2-BECC-443A120F56CD

University of Arkansas System Division of Agriculture
Promotion Board Budget

Spurlock, Terry — *Determining the value of fungicide application using on-farm trials*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Spurlock, Terry	**Co-PI #1**	Davis, Jason	
Co-PI #2		**Co-PI #3**		
Department	ENPL Entomology and Plant Pathology			
Commodity Board	Soybean Promotion Board			
Project Title	Determining the value of fungicide application using on-farm trials			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Spurlock, Terry	Davis, Jason			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Technician	Robert Hoyle	25%	$11,000				$11,000	$0	$11,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$11,000	$0	$0	$0	$11,000	$0	$11,000

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
MS student	50%	$11,000				$11,000	$0	$11,000
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information		$4,100				$4,100	$0	$4,100
Subtotal: Graduate Student		$15,100	$0	$0	$0	$15,100	$0	$15,100

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel		$11,500			$11,500	$0	$11,500
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$11,500	$0	$0	$11,500	$0	$11,500

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$3,146	$0	$0	$0	$3,146	$0	$3,146
Graduate Students	$561	$0	$0	$0	$561	$0	$561
Hourly Personnel	$0	$840	$0	$0	$840	$0	$840
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$3,707	$840	$0	$0	$4,547	$0	$4,547
Personnel Total	$29,807	$12,340	$0	$0	$42,147	$0	$42,147

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$3,000	$3,000			$6,000	$0	$6,000
Out-of-State					$0	$0	$0
Travel Total	$3,000	$3,000	$0	$0	$6,000	$0	$6,000

Confidential

Docusign Envelope ID: EE014339-4F09-47C2-BECC-443A120F56CD

University of Arkansas System Division of Agriculture
Promotion Board Budget

Spurlock, Terry — *Determining the value of fungicide application using on-farm trials*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,853	$2,000			$3,853	$0	$3,853
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$1,853	$2,000	$0	$0	$3,853	$0	$3,853
	Total for Proposal	$34,660	$17,340	$0	$0	$52,000	$0	$52,000

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

Confidential

Docusign Envelope ID: FCA6161D-22E6-4631-900F-10B95E87D782

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Developing a satellite-based field scouting tool

Lead Investigators: Dr. Terry Spurlock**,** Extension Plant Pathologist**,** Department of Entomology and Plant Pathology, Division of Agriculture

Co-Investigators: Dr. Jeremy Ross, Extension Soybean Agronomist, Department of Crop, Soil, and Environmental Sciences, Division of Agriculture

Status: Year 3

Research Areas: Plant Pathology, Precision AG, IPM

Stated Goal: To develop a tool that uses publicly available satellite imagery to increase scouting efficiency by locating areas in fields that should be scouted

Specific Objectives:

1. Work with farmers, consultants, and county agents to locate test fields each year. Most of these fields will be Arkansas Soybean Verification fields. We expect to scout approximately 10 fields per year.

2. Run the tool weekly on each verification field and scout areas of fields the tool locates at least once prior to V6, once at R3/R4 and once at R6.

3. Collect relevant data relating to soybean health and productivity (stand, weed populations, diseases present, insect counts, etc.) at each area the tool locates as well as soil samples from areas the tool frequently locates.

4. Test different vegetation indexes and mathematical models to determine the best single model or combination of models for field scouting.

5. Year 3 – deploy the beta version of the tool to be used by county agents, consultants, scouts, and/or farmers.

Methods: For each field, a polygon shapefile will be drawn to represent the field boundary. All fields will be joined as a single file and these data entered into the tool. The tool will be run weekly on all fields through maturity. As fields reach maturity, they will be removed from the model. The model will use multiple vegetation indexes, normalized difference vegetation index (NDVI), simple ratio (SR), optimized vegetation index (OSAVI), difference vegetation index (DVI), and others, calculated from satellite data that is downloaded weekly. From these indices, three mathematical models will be calculated, 10 points in 4 categories: high, medium high, medium low, and low, a global Moran's I, and high and low outliers calculated using the interquartile range method, to locate field areas to be scouted. After each run of the tool, a file with point data representing areas of the fields to be scouted will be created for each field. These files will then be opened, visualized, and located using a GPS enabled smart phone. For each area scouted, data will be collected within a 5-meter area. Data to be collected will be stand, percent weed coverage, diseases present, and other relevant data describing the field condition. For areas the tool repeatedly locates, a soil sample will be collected prior to harvest. Soil samples will be stored in a -80 celsius freezer for future analysis. At the time of scouting, each point will be designated as 'healthy' or 'unhealthy' to confirm that

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visual observation agrees or disagrees with the category designated by the model run. Data will be analyzed using a t-test to determine differences between what each model run located.

Planned Milestones: After each field season, a detailed and concise report will be presented to cooperating farmers, consultants, and county agents explaining the findings of the tool within their test fields. Each year, a summary of findings will be provided to the Arkansas Soybean Promotion Board as required. Required progress reports will also be provided. At the conclusion of year 2, a 'beta' version of the tool will be made available to select county offices for use and further testing in year 3.

Value to Soybean Industry: A working satellite-based scouting tool has been developed to address inefficiency in our current field scouting procedures. This project seeks to validate the tool and provide a more efficient way to learn as much as possible as quickly as possible about soybean fields on a weekly basis. As farm sizes increase and the amount of acreage consultants are required to scout increases, an updated scouting procedure is needed that will direct scouts to the most important areas of fields and allow more informed decisions to be made and decrease the likelihood of missed pest pressure or unnecessary product applications.

Budget Justifications/Explanation of Travel and Direct Costs: The budget accounts for travel to and from field locations using Monticello as a home base. We expect most field locations to be in southeastern Arkansas. The Spurlock laboratory has hired a specific person to complete data collection with experience in weed science, entomology, and plant pathology. A portion of her hourly wage (April 1 to October 1) is accounted for in the budget at an estimated 30 hours per week.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Spurlock, Terry *Developing a satellite-based field scouting tool*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Spurlock, Terry	**Co-PI #1**	Ross, Jeremy	
Co-PI #2		**Co-PI #3**		
Department	ENPL Entomology and Plant Pathology			
Commodity Board	Soybean Promotion Board			
Project Title	Developing a satellite-based field scouting tool			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Spurlock, Terry	Ross, Jeremy			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$10,000				$10,000	$0	$10,000
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$10,000	$0	$0	$0	$10,000	$0	$10,000

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$730	$0	$0	$0	$730	$0	$730
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$730	$0	$0	$0	$730	$0	$730
Personnel Total	$10,730	$0	$0	$0	$10,730	$0	$10,730

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$3,000				$3,000	$0	$3,000
Out-of-State					$0	$0	$0
Travel Total	$3,000	$0	$0	$0	$3,000	$0	$3,000

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Docusign Envelope ID: FCA6161D-22E6-4631-900F-10B95E87D782

University of Arkansas System Division of Agriculture

Promotion Board Budget

Spurlock, Terry *Developing a satellite-based field scouting tool*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,000				$1,000	$0	$1,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$1,000	$0	$0	$0	$1,000	$0	$1,000
	Total for Proposal	$14,730	$0	$0	$0	$14,730	$0	$14,730

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Docusign Envelope ID: 801EEEAB-059D-4390-8526-35F35B3363AE

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Understanding Taproot decline and orange leaf spot; soybean diseases of increasing importance in Arkansas

Lead Investigators: Terry Spurlock, Extension Plant Pathologist, UA Division of Agriculture

Co-Investigators:

Status: Year 3

Research Areas: Plant Pathology, IPM

Stated Goal: To determine management strategies for taproot decline and determine the causal agent for orange leaf spot, a disease generating questions by consultants and industry representatives

Specific Objectives:

1. Determine the regional distribution of taproot decline and determine the disease's impact on yield.
2. Determine management strategies for taproot decline (variety, seed treatment, and in-furrow fungicides).
3. Determine the causal agent of orange leaf spot and its impact on yield.
4. Train a master's student in applied plant pathology and pest management.

Methods:

1. **Determine the distribution across the soybean production area in Arkansas.** Images representative of field symptoms and signs will be made available to county agents, farmers, and consultants via email, text groups, and Twitter to identify fields with taproot decline. Samples will be collected to confirm disease. Identification of taproot decline will be conducted from fields where the disease was observed using traditional culturing on Petri dishes and coupled with PCR based methods. Fields confirmed to have taproot decline will be recorded by GPS location and marked on a larger regional map and made available on the Arkansas Row Crops Blog and Twitter.

2. **a. Determine disease severity on commonly planted varieties.** A field trial will be planted at an on-farm location in a field that has had severe taproot decline. Approximately 10 to 20 varieties will be planted in a randomized complete block and replicated 5 times. Varieties' susceptibility to taproot decline will be determined. An inoculated variety trial will also be planted at the Rohwer Research Station. If a suitable location for an on-farm trial cannot be found, the trial at Rohwer will be expanded. Stand counts, vigor, disease symptomology, and yield differences will be determined in variety trials.

   b. Determine the efficacy of seed treatment and in-furrow fungicides against the disease. Taproot decline isolates will be placed on Petri dishes containing media amended with various concentrations of fungicides and fungal growth measured against untreated controls. Fungicides significantly inhibiting growth will be moved to inoculated field trials in year 2 and 3. Field trials will be replicated treatments of soybean varieties (various levels of resistance to taproot decline, if known), inoculated and not inoculated, with various seed treatment fungicides, or with or without in-furrow fungicides.

   c. Determine the field distribution and yield impact of the disease in fields. Points (100) will be marked by GPS in a representative area in fields with taproot decline. The number of diseased plants and stand losses will also be determined at each point along with sampling to determine soil

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texture and fertility. Spatial analysis will be completed to determine if correlations exist between disease severity and yield loss using farmer provided yield data.

3. **Determine the causal pathogen for orange leaf spot.** Where the disease occurs, soybean leaf samples will be collected and transported to the lab for further testing. The pathogen will be isolated using standard testing and attempts made to inoculate healthy soybean plants in the growth chamber or greenhouse to determine the pathogen responsible for this disease.
4. **A master's student will be trained in applied plant pathology and pest management.** The student's research objectives will be focused on determining the best management practices for taproot decline of soybean.

Planned Milestones: Results will be presented at production meetings in addition to being made available on the Arkansas Row Crops Blog and social media after each field season. After three field seasons, the results will be published in refereed scientific literature.

Value to Soybean Industry: Data will continue to be collected on the regional distribution of taproot decline occurrence and yield losses. While we have found products that show some efficacy in laboratory trials and field trials, their value with respect to yield protection is still in question. Varietal recommendations are likely our most effective tool and must be made from field testing of market available varieties each year to provide up to date and relevant information to our growers. In addition, establishing an understanding of the interaction with cultivars and alternative ways that symptoms express themselves on the plant will be critical to continue characterizing the diseases or potential complex interactions. Understanding the regional distribution, commercially available seed treatment efficacy, and varietal susceptibilities are necessary for successful management of this taproot decline in Arkansas.

Additionally, a new disease of soybean, tentatively called orange leaf spot, has generated numerous questions and concerns among consultants and industry representatives. The impact to yield of this disease in unclear, as is the pathogen that causes this disease. However, in some fields it has been observed to be severe. Because of this, our preliminary testing should be to determine the pathogen that causes this disease and then, if successful, determine the varieties that are most susceptible to the disease.

Budget Justifications/Explanation of Travel and Direct Costs: Station plot and maintenance fees cover on-station trials at the Rohwer Research station. The travel and supply line items will allow for reactionary data collection when commercial fields are located with moderate to severe taproot decline. Supply also covers laboratory processing of samples including baiting of taproot decline from soil using toothpicks and Petri dishes for plating of samples on growth media, classification, and selection of emerging fungal colonies in Petri dishes, and identification by molecular methods.

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Docusign Envelope ID: 801EEEAB-059D-4390-8526-35F35B3363AE

University of Arkansas System Division of Agriculture

Promotion Board Budget

Spurlock, Terry — *Understanding Taproot decline and orange leaf spot; soybean diseases of increasing importance in Arkansas*

Version: 7.0 (11/01/2024)

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Spurlock, Terry	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Understanding Taproot decline and orange leaf spot; soybean diseases of increasing importance in Arkansas		

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Spurlock, Terry				**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI	CES						
Fulltime Personnel							
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Associate	Amanda Tolbert	25%	$14,000				$14,000	$0	$14,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$14,000	$0	$0	$0	$14,000	$0	$14,000
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
	MS student	50%	$11,000				$11,000	$0	$11,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$4,100				$4,100	$0	$4,100
	Subtotal: Graduate Student		$15,100	$0	$0	$0	$15,100	$0	$15,100
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$0	$0	$0	$0	$0	$0	$0
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$4,004	$0	$0	$0	$4,004	$0	$4,004
	Graduate Students		$561	$0	$0	$0	$561	$0	$561
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$4,565	$0	$0	$0	$4,565	$0	$4,565
	Personnel Total		$33,665	$0	$0	$0	$33,665	$0	$33,665
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$2,000				$2,000	$0	$2,000
	Out-of-State						$0	$0	$0
	Travel Total		$2,000	$0	$0	$0	$2,000	$0	$2,000

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Docusign Envelope ID: 801EEEAB-059D-4390-8526-35F35B3363AE

University of Arkansas System Division of Agriculture

Promotion Board Budget

Spurlock, Terry — *Understanding Taproot decline and orange leaf spot; soybean diseases of increasing importance in Arkansas*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$2,000				$2,000	$0	$2,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$1,410	$0	$0	$0	$1,410	$0	$1,410
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$3,410	$0	$0	$0	$3,410	$0	$3,410
	Total for Proposal	$39,075	$0	$0	$0	$39,075	$0	$39,075

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: An innovative approach to generate porous soy proteins with enhanced flavor for the plant-based food industry

Lead Investigator: Ali Ubeyitogullari

Status: Year 3 of 3

Research Areas: Post-Harvest

Stated Goal:

Soybean, a vital legume crop, has received great attention due to its protein (40-41%) and oil (20-24%) composition. Soybeans are mainly utilized as animal feed (~78%) and food for human consumption (~15%) in the U.S., where 84% of the soybean fraction used for human consumption is soybean oil. In addition, 97% of soy proteins are fed to poultry and livestock while only 3% of soy proteins are being utilized for human consumption, underestimating the full value of soy proteins. However, there is an increasing demand for plant proteins to develop alternative plant-based food products, including meat, cheese, milk, cream, and mayonnaise. Therefore, the food industry is immensely searching for alternative, inexpensive, and nutritious plant protein sources. Soy proteins can be a great alternative in meeting the demand for plant proteins since they are inexpensive, abundant, and have all essential amino acids as well as provide several health benefits, including reducing the risk of cardiovascular diseases, cancer, diabetes. Soy proteins are being increasingly accepted for human nutrition due to their unique composition and unmatched qualities resembling animal-sourced proteins. Also, soy proteins carry FDA's health claim in potentially reducing the risk of coronary heart disease. Yet, there are several hurdles preventing the widespread food applications of soy proteins. These include undesirable sensory attributes due to off-flavors such as beany, painty, metallic and bitter flavor, and the presence of trypsin inhibitors decreasing protein digestibility. Despite recent progress, however, there is much room for improvement and many untapped possibilities for innovative strategies to be developed before realizing the full potential of soy proteins in food applications.

Thus, *the goal of this project* is to generate functionalized soy protein particles with improved flavor profile using a novel SC-CO_2 technology and 3D food printing. SC-CO_2 loading of flavoring compounds (*i.e.,* dairy flavors) into soy proteins provides a unique opportunity to increase their utilization in alternative dairy products while eliminating the use of any toxic organic solvent.

In the first year of the project, a Ph.D. student was hired to work on this project. This Ph.D. student will continue conducting the experiments, collecting & analyzing the data, and writing manuscripts. Whole soybeans were obtained from Riceland Foods. The whole soybeans were ground and defatted. The SC-CO_2 extraction unit was developed to extract off-flavors from the defatted soybean flour. Four different soybean flour samples were prepared. These included (i) SC-CO_2 treatment at 40 MPa, 60 C for 4h, (ii) a sequential SC-CO_2 treatment at 40 MPa, 60 °C for 4h followed by 15 MPa, 60 °C for 2 h, (iii) hexane extraction at room temperature, and (iv) Soxhlet extraction. Similar lipid extraction yields (~20%) were obtained with SC-CO_2 and conventional hexane extractions. The volatile compound concentration of the soybean flour was reduced after SC-CO_2 extraction (0.63-1.00 µg/g) as compared to hexane extraction (1.44-1.68 µg/g). The results showed that SC-CO_2-treated soybean flour showed smaller particle sizes (<250 µm, ~70%), improved protein purity upon protein extraction, and brighter color as compared to hexane-extracted flour. These findings have been published in the journal *Future Foods*.

In the second year of the project, we dried soy proteins using an innovative SC-CO_2 drying. The dried proteins were characterized for their rheological properties, textural properties, morphology, crystallinity, chemical structure, thermal stability, and solubility. The resulting soy protein aerogels upon SC-CO_2 drying showed outstanding properties, such as surface areas of 222-278 m^2/g, pore sizes of 8-11 nm, and pore volumes of 1.88-3.13 cm^3/g. Their densities were ~0.21 g/cm^3 with high porosities of ~83%. This study is currently under review in the journal *Sustainable Food Proteins*. Currently, we are analyzing these proteins for their volatile compounds. By the end of the project's second year, we will have completed the aroma analysis of soy proteins dried using SC-CO_2.

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Specific Objectives:

1. Extract off-flavors (*i.e.,* polyunsaturated fatty acids, aldehydes, ketones, and alcohols) from defatted soybean flour using a sequential pure SC-CO_2 and ethanol-modified SC-CO_2.
2. Extract soy protein isolate from off-flavor-removed, defatted soybean flour using an alkaline extraction method, and generate soy protein micro-and nanoparticles using an SC-CO_2-assisted particle formation system.
3. Load model dairy flavoring compounds into the microstructure of the produced protein particles using SC-CO_2, and generate alternative cream cheese using the functionalized soy protein isolates and 3D food printing.

Methods:

Objective 3. Porous protein particles and a dairy flavor (*i.e.*, delta-dodecalactone) will be loaded into separate compartments of a high-pressure vessel. The loading conditions, namely temperature (40-60 °C), pressure (30-40 MPa), and time (0.5-2 h), will be optimized for the highest loading capacity. Flavor-loaded proteins will be used to generate alternative cream cheese, where the tofu-like gel will be blended with soybean oil. Soy protein pastes at different concentrations will be tested for their 3D printability for their potential plant-based food applications. Flavor-loaded proteins will be characterized for their microstructure, solubility, and flavor release. Sensory attributes of functionalized soy protein-based cream cheese will be investigated, and compared with that produced using commercial soy proteins as well as commercial cream cheese.

Planned Milestones:

In the third year, a model dairy flavoring compound will be loaded into the soy proteins, and they will be tested in cream cheese application.

Value to Soybean Industry:

The current uses of soy proteins in the food industry are limited to tofu, soymilk, and a few other food products with minimal soy protein content due to mainly the undesired flavor of soy proteins. The proposed SC-CO_2-based approach allows us to generate functionalized soy protein particles with a clean neutral flavor, enhanced digestibility, and reduced allergenicity. By SC-CO_2 loading platform along with 3D food printing, various flavors can be loaded into the porous soy protein structure for specific food applications. This can potentially increase the soy protein market share as the plant-based protein market is expected to grow from $10.3 billion in 2020 to $15.6 billion by 2026. Overall, the proposed research will maximize the utilization of soy proteins in foods, produce new health-promoting food ingredients from soy proteins, offer sustainable plant proteins for human consumption, and minimize waste generation. Considering the soybean production in Arkansas (one of the top 10 soybean-producing states), this research will contribute to Arkansas's economy by enhancing the functionality and flavor of soy proteins.

Budget Justifications/Explanation of Travel and Direct Costs:

Funds are requested to support a graduate student and cover tuition for the graduate student. Also, funds are requested for direct expenses like materials and supplies (i.e., high-pressure tubing and valves, glassware, chemicals, digestive enzymes) in the lab, and service lab usage fees (SEM, XRD, and FTIR service fees). Out-of-state travel is requested to present findings at professional conferences (e.g., IFT) in the U.S., to share the data with the food industry, and increase the visibility of the University.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Ubeyitogullari, Ali — *An innovative approach to generate porous soy proteins with enhanced flavor for the plant-based food industry*

Version: 7.0 (11/01/2024)

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Ubeyitogullari, Ali	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	FDSC Food Science		
Commodity Board	Soybean Promotion Board		
Project Title	An innovative approach to generate porous soy proteins with enhanced flavor for the plant-based food industry		

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Ubeyitogullari, Ali				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
	Sumanjot Kaur	100%	$23,000				$23,000	$23,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$6,795				$6,795	$6,795	$0
	Subtotal: Graduate Student		$29,795	$0	$0	$0	$29,795	$29,795	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$1,173	$0	$0	$0	$1,173	$1,173	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$1,173	$0	$0	$0	$1,173	$1,173	$0
Personnel Total	$30,968	$0	$0	$0	$30,968	$30,968	$0

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State	$3,000				$3,000	$3,000	$0
Travel Total	$3,000	$0	$0	$0	$3,000	$3,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Ubeyitogullari, Ali — *An innovative approach to generate porous soy proteins with enhanced flavor for the plant-based food industry*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$7,000				$7,000	$7,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs	User fees (i.e., SEM, XRD, GC, FT	$2,987				$2,987	$2,987	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$9,987	$0	$0	$0	$9,987	$9,987	$0
	Total for Proposal	$43,955	$0	$0	$0	$43,955	$43,955	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Development of High-yielding Soybean Cultivars with Broad Resilience to Stressors

Lead Investigators: Caio Canella Vieira

Co-Investigators:

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Breeding

Stated Goal: The University of Arkansas has a legacy of developing and releasing high-yielding conventional and herbicide-resistant soybean varieties, particularly determinates in MG 5. The proposal presented has the goal of maximizing the efficiency of the current soybean breeding pipeline and includes breeding operations to support the development of new high-yielding MG4 and MG5 soybean varieties with both conventional, Enlist-E3®, and XtendFlex® backgrounds. We aim to utilize data-driven solutions across all stages of the breeding pipeline, including molecular marker-assisted design hybridization schemes; off-season nursery approaches to speed up the development and advancement of breeding populations; genomic-driven breeding values to select lines to be advanced, as well as leveraging the testing network within the University of Arkansas research stations. The incorporation of modern techniques into a breeding pipeline allows the identification and selection of the most promising individuals earlier in the breeding pipeline, which not only reduce costs, time, and space but enhance genetic gain by reducing the length of the breeding cycle, increasing selection intensity, as well as allowing the breeders to have a clear knowledge of the genetics of the materials early in the pipeline. This data-driven breeding pipeline has been widely adopted by the private sector but is still not present in public programs. Our goal is to lead this transition and make the Arkansas program a national reference in modern soybean breeding.

Specific Objectives: The specific objectives of this proposal include i) hybridization with purpose based on genetic characterization of parental lines; ii) aggressive off-season nursery population development; iii) broad phenotypic and genotypic characterization of breeding lines for biotic and abiotic stressors tolerance; and iv) selective testing footprint across target environments within the University research stations' network.

Methods: The proposed breeding approach is summarized in figure 1. Overall, the goal is to have breeding lines ready to be tested and characterized in three years, which pending satisfactory yield performance across multiple locations, can be entered into an intensive testing network earlier. This pipeline can be further improved by the implementation of genomic selection in 'Progeny Rows – Year 2', which is discussed in detail in the submitted proposal 'Genomic Prediction to Enhance the Efficiency of Soybean Breeding'. In summary, parental lines will be chosen out of USDA Northern and Southern trials from Arkansas and other programs based on yield performance, as well as needs from different projects. All parental lines will be genotyped using a genome-wide marker panel to characterize their response to multiple biotic and abiotic stressors, as well as establish genetic similarities and simulate superior combinations. F_1 seeds will be sent to off-season nurseries in November of each year and quickly advance to the F_4 stage over 18 months. $F_{4:5}$ seeds will return to Arkansas to be tested in progeny rows. In this stage, UAV-based yield estimation will be combined with the breeder's notes to select lines that will compose the preliminary stage. In the preliminary stage, all lines will be genotyped using a genome-wide marker panel to characterize their response to multiple biotic and abiotic stressors and estimate breeding values based on molecular markers. These will be tested for yield across replicated trials within the UARK testing network. Lines with superior yield performance and adaptability, as well as favorable responses to biotic and abiotic

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stressors, will be moved into the advanced stage. From there, a smaller pool of genotypes will be intensively tested for yield and adaptation across locations in Arkansas and other mid-south States. Superior lines will then be entered in multiple regional trials, including the Arkansas State Variety Testing and the USDA Uniform Trials. These entries will also undergo conversion to both Enlist-E3® and XtendFlex® in an off-season nursery (details on proposal Utilization of Winter Nursery for Soybean Line Development through Backcrossing).

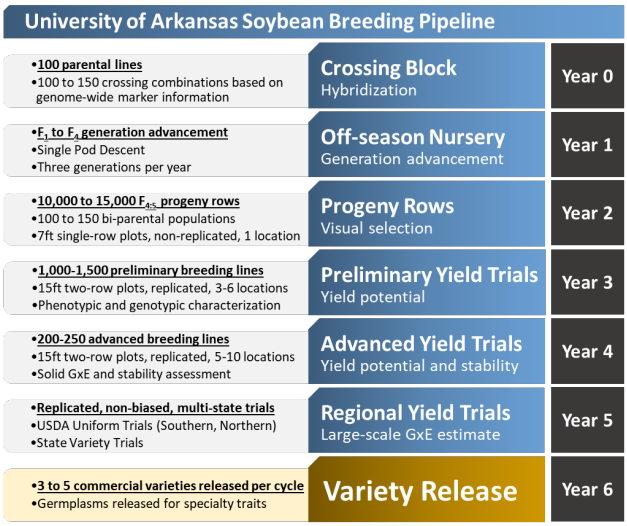

Figure 1. Summarized breeding pipeline for the University of Arkansas Soybean Breeding program.

Planned Milestones: Milestones include successfully completing the planned hybridization schemes (150-200); obtaining pure and homogeneous progeny rows from off-season nursery (10,000-15,000); selecting and conducting preliminary (1,000-1,500) and advanced trials (200-250); characterizing based on molecular markers and phenotypic assays the response to biotic and abiotic stressors as well as yield potential of breeding lines.

Value to Soybean Industry: Yield, market price, and production cost are important factors in determining the economics of soybean farming. The UA soybean breeding program provides high-yielding cultivars with low costs to growers. Such outcomes not only ensure the availability of high-yielding varieties with low seed cost for Arkansas growers but also serve as crossing germplasm for many public and private breeding programs in the US.

Budget Justifications/Explanation of Travel and Direct Costs ($191,231): It is requested $74,322 for 50% of a research associate and research technician (base plus fringe) to work on various tasks associated with the project. $24,310 (base plus fringe) plus $7,000 tuition is requested for a graduate student to work on multi-environment yield stability. $7,000 is requested for in-state travel to collect notes and conduct research plots, and $2,500 for attending the ASA-CSSA-SSSA meeting and a multi-omics conference to present research results. A total of $53,000 is requested for supplies, including $3,000 for seeds, shipping, planting boxes, tags, and stakes, $33,000 for off-season nursery fees including hybridization and generation advancement, $9,000 for a breeding software license, and $8,000 for molecular markers application including trait-specific predictions as well as characterization of biotic and abiotic stressors tolerance. In addition, a total of $23,100 is requested for land and maintenance fees across the UARK research station's network.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio — *Development of High-yielding Soybean Cultivars with Broad Resilience to Stressors*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Vieira, Caio	**Co-PI #1**	Vieira, Caio	
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Development of High-yielding Soybean Cultivars with Broad Resilience to Stressors			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Vieira, Caio	Vieira, Caio			Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	AES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Research Associate		50%	$31,600				$31,600	$31,600	$0
Research Technician		50%	$26,193				$26,193	$26,193	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$57,793	$0	$0	$0	$57,793	$57,793	$0
	Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
		100%	$23,130				$23,130	$23,130	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information		$7,000				$7,000	$7,000	$0
	Subtotal: Graduate Student		$30,130	$0	$0	$0	$30,130	$30,130	$0
	Hourly							
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$0	$0	$0	$0	$0	$0	$0
	Fringe Benefits							
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$16,529	$0	$0	$0	$16,529	$16,529	$0
	Graduate Students		$1,180	$0	$0	$0	$1,180	$1,180	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$17,708	$0	$0	$0	$17,708	$17,708	$0
	Personnel Total		$105,631	$0	$0	$0	$105,631	$105,631	$0
	Travel							
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$7,000				$7,000	$7,000	$0
	Out-of-State		$2,500				$2,500	$2,500	$0
	Travel Total		$9,500	$0	$0	$0	$9,500	$9,500	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio *Development of High-yielding Soybean Cultivars with Broad Resilience to Stressors*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$53,000				$53,000	$53,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$1,900	$0	$0	$0	$1,900	$1,900	$0
	CTST, Marianna	$5,200	$0	$0	$0	$5,200	$5,200	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$4,000	$0	$0	$0	$4,000	$4,000	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$3,200	$0	$0	$0	$3,200	$3,200	$0
	RIRE, Stuttgart	$0	$5,600	$0	$0	$5,600	$5,600	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$3,200	$0	$0	$3,200	$3,200	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$67,300	$8,800	$0	$0	$76,100	$76,100	$0
	Total for Proposal	$182,431	$8,800	$0	$0	$191,231	$191,231	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Fast-tracking MG4 cultivars with southern root-knot nematode resistance

Lead Investigators: Caio Canella Vieira

Co-Investigators: Travis Faske

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 2 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Breeding and Plant Pathology

Stated Goal: The southern root-knot nematode (SRKN) (*Meloidogyne incognita*, Kofoid & White, 1919) is the most important plant-pathogenic nematode of soybean in Arkansas. It has been detected in 32 out of 35 counties sampled from 2014 and 2018 (Ye et al., 2019) and is estimated to cause an average annual yield loss of 8.6 million bushels. Currently, resistance to SRKN is very limited in MG4 commercial soybean cultivars. Based on a recent search for MG4.0 to 5.3 soybean varieties for Arkansas, resistance to SRKN was found in only 4 out of 30 cultivars listed for Pioneer, and 1 out of 34 cultivars for Asgrow. Thus, the development and deployment of MG4 soybean cultivars with SRKN resistance adapted to Arkansas and the mid-South are essential to sustain yield under SRKN pressure. Marker assisted section is a good initial step to quickly select germplasm and breeding lines with the resistance traits; however, it is important to evaluate these selections in the field. Many companies do not have a good field screen, but one has been developed by the co-investigator and is used to evaluate commercial varieties marketed for resistance against the SRKN. Furthermore, there is some evidence that nematode reproduction may be uncoupled from galling thus some partially resistant lines may not reduce nematode densities for the subsequent cropping season. Therefore, this proposal aims to utilize marker assisted selection and field screening to fast-track the development of soybean cultivars with resistance to SRKN in maturity groups 4.

Specific Objectives: The proposal is structured around two specific objectives: i) Characterize the response to SRKN of breeding lines in the Arkansas Soybean Breeding Program using molecular markers, greenhouse pot assays, and field screenings; ii) Develop breeding populations derived from SRKN-resistant parental lines.

Methods: Objective 1: The 2025 preliminary breeding lines (~1,000) will be screened utilizing molecular markers linked to a well-known genomic region associated with SRKN resistance (Pham et al., 2013). In 2023, a total of 1,300 genotypes were screened with molecular markers and only 48 Arkansas lines showed resistance to SRKN. In 2024, 1,350 genotypes were screened and 94 showed resistance to SRKN. This emphasizes the pressing need to further develop SRKN-resistant breeding populations adapted to Arkansas and the mid-South. Furthermore, these selected entries will be screened in a SRKN-infested field near Lonoke, AR. Plots will consist of 11' single row plots with four replications per entry.

Objective 2: Between 50 to 70 new breeding populations will be developed of which at least one parent is SRKN-resistant. As mentioned in Objective 1, Arkansas germplasm lacks SRKN resistance, and substantial efforts are needed to reverse this condition. In 2023, a total of 74 populations derived from at least one SRKN-resistant parent were developed. In 2024, 87 new populations were developed. In 2025, hybridizations will be conducted in Fayetteville during the summer and populations will be advanced to reach homozygosity in an off-season nursery in Puerto Rico. $F_{4:5}$ progeny rows will return in the Summer of 2027, and selected rows will undergo molecular marker screening to confirm SRKN resistance.

Planned Milestones:

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Proposed Activities	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Obj. 1. Characterize SRKN response using molecular markers and greenhouse and field screenings												
Select Plant Materials	*X*			*X*	*X*			*X*	*X*			*X*
Greenhouse Screening	*X*	*X*	*X*		*X*	*X*	*X*		*X*	*X*	*X*	
Field Screening		*X*	*X*			*X*	*X*			*X*	*X*	
Marker-assisted Selection	*X*	*X*			*X*	*X*			*X*	*X*		
Obj. 2. Develop breeding populations derived from SRKN-resistant parental lines												
Field Hybridization		*X*				*X*				*X*		
Generation advancement	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
Grow progeny rows		*X*	*X*	*X*		*X*	*X*	*X*		*X*	*X*	*X*

Value to Soybean Industry: Developing soybean cultivars resistant to SRKN is critical for soybean production in Arkansas. Although this proposal does not cover the complete breeding cycle, typically spanning nearly a decade from crossing to product deployment, it provides a series of necessary goals to begin selecting early-maturity soybean lines with resistance to the SRKN. Such lines will be critical for improved performance and enhanced profit margins in areas where SRKN is a limiting factor for soybean production.

Budget Justifications/Explanation of Travel and Direct Costs ($50,364): A total of $30,864 is requested to partially cover two program technicians (one for each program). A total of $3,000 is requested for in-state travel, as well as $16,500 for direct costs. These include $2,000 for breeding supplies, $4,250 for nematode field screening, $5,000 for off-season nursery, and $5,250 for marker-assisted selection. It is important to note that a substantial part of the budget allocated for the development of new breeding populations and multi-environment field trials is being supported by various ongoing projects supported by the Arkansas Soybean Promotion Board, Mid-South Soybean Board, United Soybean Board, and USDA-NIFA.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio — *Fast-tracking MG4 cultivars with southern root-knot nematode resistance*

Year	2025/2026	**Project Year**	Year 2 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Vieira, Caio	**Co-PI #1**	Faske, Travis	
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Fast-tracking MG4 cultivars with southern root-knot nematode resistance			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Vieira, Caio	Faske, Travis			Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	CES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Technician		25%	$10,000	$14,000			$24,000	$10,000	$14,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$10,000	$14,000	$0	$0	$24,000	$10,000	$14,000
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$0	$0	$0	$0	$0	$0	$0
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$2,860	$4,004	$0	$0	$6,864	$2,860	$4,004
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$2,860	$4,004	$0	$0	$6,864	$2,860	$4,004
	Personnel Total		$12,860	$18,004	$0	$0	$30,864	$12,860	$18,004
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State			$3,000			$3,000	$0	$3,000
	Out-of-State						$0	$0	$0
	Travel Total		$0	$3,000	$0	$0	$3,000	$0	$3,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio *Fast-tracking MG4 cultivars with southern root-knot nematode resistance*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$12,250	$4,250			$16,500	$12,250	$4,250
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$12,250	$4,250	$0	$0	$16,500	$12,250	$4,250
	Total for Proposal	$25,110	$25,254	$0	$0	$50,364	$25,110	$25,254

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Genomic Prediction to Enhance the Efficiency of Soybean Breeding

Lead Investigators: Caio Canella Vieira

Co-Investigators: Samuel Fernandes

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Breeding

Stated Goal: The breeding efficiency of large-scale public soybean breeding programs is limited by lengthy breeding cycles, extensive allocation of resources for multi-environment testing, and the difficulty in identifying breeding targets and ideotypes for a defined environment. The advances in high-throughput genotyping combined with predictive analytics enabled the development of techniques to predict phenotypic values using marker information. This is called genomic prediction, and it has become one of the most important tools in commercial plant breeding programs. Selection of superior breeding lines based on the genomic-estimated breeding values (GEBV) can substantially shorten the breeding cycle, increase selection accuracy and intensity, and maximize genetic gains as it does not rely on extensive multi-year/environment phenotyping of quantitative traits. Public breeding programs have struggled to adopt predictive breeding, mainly due to front cost, limited data availability, and technical constraints. This research proposal aims to develop a data-driven and cost-effective soybean breeding pipeline that can reduce the length of a breeding cycle, increase selection efficiency and accuracy, and improve the rate of genetic gain. Using historical multi-environment data from the UARK Soybean Breeding program, we will integrate information on molecular markers, environmental data, and the interactions that arise between these components to identify superior genotypes early in the pipeline. The efficacy of the proposed pipeline will be evaluated by direct comparison with conventional breeding methods. Metrics of success will include the yield potential of selected genotypes for each methodology, time, labor, and cost of the cycle of each breeding approach. The validation of the proposed pipeline can substantially enhance the rate of genetic gain which translates into higher-yielding soybean varieties. In addition, it is an opportunity to transform the UARK Soybean Breeding program into a leading reference among public programs that fully adopt predictive breeding.

Specific Objectives: Specific goals of this proposal include: i) establishment of a well-curated training set based on multi-environment data from the UARK Soybean Breeding program to develop and validate prediction models; ii) development of prediction models to be implemented early in the breeding pipeline to select promising genotypes. The overall objective of this proposal is to provide a next-generation, data-driven, and cost-effective soybean breeding pipeline that can reduce the length of a breeding cycle, increase selection efficiency and accuracy, and improve the rate of genetic gain using genomics and big data analytic technologies.

Methods: The third year of the project will focus on continuing the development of a database consisting of yield and molecular marker data from thousands of breeding lines tested across Arkansas. This step is critical to 'train the computer' on how to interpret future data that will be plugged into the model. In summary, the model will be trained using both phenotypic (yield) and genotypic (genome-wide molecular markers) data of previously tested breeding lines to **predict untested lines (for instance, progeny rows) using only genotypic data.**

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In Years 1 and 2, we collected data from over 2,300 breeding lines which are currently being used to train and validate prediction models. In Year 3, an additional 1,000 breeding lines will be added to the database.

The yield potential of the progeny rows will be calculated using the developed genomic-enabled trait prediction model. Around 10% with high ranks will be selected and grown in yield trials. As opposed to a conventional breeding pipeline based on 'trial and error' preliminary, intermediate, and advanced yield trials, the proposed pipeline will consist of an elite pool of genotypes tested in a single-year, multi-environmental yield trial. Advanced G×E interaction modeling will be applied to identify superior genotypes with high-yield stability and potential. At this stage, all selected genotypes will have a superior genetic background based on multiple predictive models, a thorough assessment of biotic and abiotic tolerance based on a customized functional marker panel, complete seed composition, and approval based on specific breeder criteria.

Planned Milestones:

Activity Description	2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Develop genomic prediction models with genotypic, phenotypic, and environmental data from historical data.	X	X			X	X		
Genotype progeny rows from $F_{4:5}$ plants using genome-wide molecular markers.	X	X			X	X		
Select superior lines from the progeny rows based on the breeder's scores and the genomic prediction model.			X	X			X	X
Evaluate the selection in multi-location yield trials.							X	X
Enhance the predictive models with newly collected data from yield trials.	X			X	X			X
Peer-reviewed manuscripts based on genomic prediction	X	X			X	X		

Value to Soybean Industry: Breeding progress is often measured as genetic gain, which is fundamentally dependent on the length of a breeding cycle. The proposed work aims to shorten the traditional breeding pipeline by one year, yet the number of data points per genotype will increase by 30-40%. In summary, maximizing the efficiency of a soybean breeding pipeline will speed up the identification and delivery of superior cultivars to growers in Arkansas and the United States.

Budget Justifications/Explanation of Travel and Direct Costs ($102,730): A large portion of the budget is allocated to an associate (half-time with $30,000 base plus $8,580 benefits) with an extensive technical background in genomic prediction and data analysis, as well as a research scholar (half-time with $25,000 base plus $7,150 benefits) working with statistics and data analysis under Dr. Fernandes supervision. A total of $7,500 in out-of-state travel is requested to attend and present results in scientific meetings. $22,000 is requested to conduct genotyping of breeding lines and progeny rows using a genome-wide molecular marker panel, and $2,500 for one open-access publication.

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Promotion Board Budget

Vieira, Caio — *Genomic Prediction to Enhance the Efficiency of Soybean Breeding*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Vieira, Caio	**Co-PI #1**	Fernandes, Samuel	
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Genomic Prediction to Enhance the Efficiency of Soybean Breeding			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Vieira, Caio	Fernandes, Samuel			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES	AES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Research Associate		50%	$30,000				$30,000	$30,000	$0
Research Scholar		50%		$25,000			$25,000	$25,000	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
		Subtotal: Salaries	$30,000	$25,000	$0	$0	$55,000	$55,000	$0

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Graduate Student

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe benefits are calculated when salary and wage amounts are entered above.

Fringe Benefits

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$8,580	$7,150	$0	$0	$15,730	$15,730	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$8,580	$7,150	$0	$0	$15,730	$15,730	$0
Personnel Total	$38,580	$32,150	$0	$0	$70,730	$70,730	$0

Justify out-of-state travel in proposal.

Travel

	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State	$3,500	$4,000			$7,500	$7,500	$0
Travel Total	$3,500	$4,000	$0	$0	$7,500	$7,500	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio — *Genomic Prediction to Enhance the Efficiency of Soybean Breeding*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$22,000				$22,000	$22,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication	$2,500				$2,500	$2,500	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$24,500	$0	$0	$0	$24,500	$24,500	$0
	Total for Proposal	$66,580	$36,150	$0	$0	$102,730	$102,730	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Overcoming Soybean Yield Plateau by Leveraging Physiology-Efficient and Yield-Formation Traits

Lead Investigators: Caio Canella Vieira

Co-Investigators: Elvis Elli

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 2 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Breeding, Physiology

Stated Goal: Soybean breeding programs have achieved significant success in developing cultivars with improved yield and superior resilience to biotic and abiotic stressors. Despite remarkable advancements, current soybean yield potential is reaching a plateau resulting from limited genetic diversity and reduced possibility of breakthrough allelic combinations. This concern is particularly relevant in modern breeding programs that heavily rely on recycling elite materials through elite-by-elite hybridization schemes. Yield can be expressed as a result of three main physiological processes including cumulative solar radiation interception by the canopy (Ei), radiation use efficiency (RUE), and harvest index (HI, ratio of seed yield to total above-ground biomass). Reports of Ei in soybeans range from 40 to 70%, suggesting that a significant portion of available solar radiation is not efficiently captured by the canopy (Edwards et al., 2005; Lopez et al., 2022). Hence, improving Ei efficiency by modifying canopy architecture could substantially contribute to higher soybean yields. RUE has been reported within the range of 2.3 to 4.3% (Lee et al., 1986; Long et al., 2006; Lopez et al., 2022), which is substantially lower than the theoretical maximum RUE of 9.4% (Sinclair and Muchow, 1999). Maximizing RUE through enhancements in leaf angle (upright leaves) and reduction of antenna size (preventing the trapping of excess energy) can directly contribute to higher soybean yields. HI has been estimated within the ranges of 0.40 to 0.50 (Edwards et al., 2005; de Bruin and Pedersen, 2009; Lopez et al., 2022), leaving as much as 50% opportunity for improvement given the theoretical maximum HI of 0.60 (Austin et al., 1980). Therefore, this research proposal aims to increase soybean yield potential by identifying and incorporating physiology-efficient and yield-formation traits in a population consisting of genetically diverse soybean accessions.

Specific Objectives: The proposal is structured around three specific objectives: **i)** characterization of genetically diverse soybean accessions and modern cultivars based on yield-formation and physiology-efficient traits; **ii)** characterization of the genetic architecture of yield-formation and physiology-efficient traits; **iii)** development of breeding populations derived from high-yielding elite modern cultivars and diverse accessions.

Methods:

Objective 1: Around 250 genetically diverse soybean accessions (PI) will be phenotyped for yield-formation and physiology-efficient traits including Ei, RUE, and HI using a UAV-based image platform. These comprise a subset of the USDA Soybean Germplasm Collection. Cumulative solar radiation interception by the canopy (Ei) will be measured as the size of the canopy throughout the season as this has been reported to have a 1:1 relationship with Ei (Purcell, 2000; Kawasaki et al., 2016; Lopez et al., 2022). The time-series observation of canopy growth will be multiplied by the daily photosynthetic active radiation (PAR) available which is estimated at 48.7% of total solar radiation (Zhu et al., 2008). Solar radiation use efficiency (RUE) will be determined by assessing the ratio between dry biomass at both late vegetative and late reproductive stages and the cumulative PAR intercepted leading up to each biomass collection. Harvest

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index (HI) will be calculated as the ratio between dry seed weight (adjusted to zero moisture) and dry biomass collected at R8 (full maturity) from a single 2.1 m row.

Objective 2: The genetic architecture of each trait (Ei, RUE, and HI) will be characterized based on genome-wide association studies (GWAS). Two models will be implemented to detect significant marker-trait associations including BLINK (Huang et al., 2019) and a model that allows the inclusion of population structure in interaction with the environment (G×E) to account for variable patterns of genotype responses in different environments (Canella Vieira et al, 2022).

Objective 3: Bi-parental breeding populations including a high-yielding elite modern cultivar and a diverse accession showing superior physiology-efficient and yield-formation traits will be developed. An off-season nursery will be used to conduct hybridization schemes as well as generation advancement (three growing seasons in a year). Breeding lines with yield potential superior to the elite and PI parents will represent the first generation of physiology-efficient, high-yielding materials. These will be available for further recombination with elite materials through hybridization schemes.

Planned Milestones:

Proposed Activities	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Obj. 1. Characterize soybean genotypes based on yield-formation and physiology-efficient traits												
Select Plant Materials	*X*	*X*										
Conduct Field Trials		*X*	*X*	*X*		*X*	*X*	*X*				
Estimate Ei, RUE, and HI		*X*	*X*	*X*		*X*	*X*	*X*				
Obj. 2. Characterize the genetic architecture of yield-formation and physiology-efficient traits												
GWAS for Ei, RUE, and HI							*X*	*X*	*X*	*X*	*X*	*X*
Obj. 3. Develop breeding populations derived from high-yielding elite cultivars and diverse accessions												
Develop bi-parental populations						*X*	*X*			*X*	*X*	
Generation advancement (F_1-F_4)								*X*	*X*	*X*	*X*	*X*

Value to Soybean Industry: The historical selection of superior soybean genotypes has been largely based on highly dynamic environmental conditions of target environments. This raises the hypothesis of whether intrinsic improvements in yield-formation traits have been accomplished or breeding programs have sustained high-yielding varieties by mainly targeting stress resilience traits and genetically engineered herbicide tolerance. The main goal of this proposal is to identify genetic variation in diverse accessions associated with physiology-efficiency and yield-formation traits using genomic, phenomics, and advanced statistical analytics for a sustainable and long-term increase in soybean yield and production in Arkansas and the United States.

Budget Justifications/Explanation of Travel and Direct Costs ($83,679): It is requested a total of $16,075 for 25% of an associate ($50,000 base plus fringe), $35,365 for 50% of a post-doctoral fellow ($55,000 base plus fringe), and $9,389 for an undergraduate visiting scholar ($1,750 monthly plus benefit) to work on the project. $10,500 is requested for in-state travel to collect notes and attend scientific conferences, and $8,500 in supplies including seeds, shipping, planting boxes, tags, and stakes. It is also requested a total of $3,850 for research station maintenance and planting fees.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio — *Overcoming Soybean Yield Plateau by Leveraging Physiology-Efficient and Yield-Formation Traits*

Year	2025/2026	**Project Year**	Year 2 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Vieira, Caio	**Co-PI #1**	Elli, Elvis	
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Overcoming Soybean Yield Plateau by Leveraging Physiology-Efficient and Yield-Formation Traits			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Vieira, Caio	Elli, Elvis			Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	AES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Research Associate		25%		$12,500			$12,500	$12,500	$0
Post-doctoral		50%	$27,500				$27,500	$27,500	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$27,500	$12,500	$0	$0	$40,000	$40,000	$0
	Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel		$8,750				$8,750	$8,750	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$8,750	$0	$0	$0	$8,750	$8,750	$0
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$7,865	$3,575	$0	$0	$11,440	$11,440	$0
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$639	$0	$0	$0	$639	$639	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$8,504	$3,575	$0	$0	$12,079	$12,079	$0
	Personnel Total		$44,754	$16,075	$0	$0	$60,829	$60,829	$0
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$6,000	$2,500			$8,500	$8,500	$0
	Out-of-State		$2,000				$2,000	$2,000	$0
	Travel Total		$8,000	$2,500	$0	$0	$10,500	$10,500	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio — *Overcoming Soybean Yield Plateau by Leveraging Physiology-Efficient and Yield-Formation Traits*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$4,000	$4,500			$8,500	$8,500	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$3,850	$0	$0	$0	$3,850	$3,850	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$7,850	$4,500	$0	$0	$12,350	$12,350	$0
	Total for Proposal	$60,604	$23,075	$0	$0	$83,679	$83,679	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Soybean Germplasm Enhancement Using Genetic Diversity

Lead Investigators: Caio Canella Vieira

Co-Investigators:

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Year 3 of 3

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Breeding

Stated Goal: As a consequence of domestication and further intense trait-specific breeding (selective sweeps), modern soybean varieties have a significantly narrow genetic base. For instance, over 85% of the parentage of modern cultivars in the United States is derived from only 18 of the thousands of ancestors available. In the Southern United States, 17 ancestors contributed to over 90% of the genes in cultivars adapted to this growing region, making imperative the introduction of genetically diverse materials to improve key economically important traits such as grain quality and composition, as well as biotic and abiotic stressors tolerance. Additionally, the University of Arkansas Soybean Breeding program has historically developed MG5 determinate materials; however, we lack high-yielding, widely adapted MG4 indeterminate genetics. Therefore, the goal of this proposal is to broaden the genetic basis of the University of Arkansas Soybean Breeding program by developing breeding populations derived from the genetics from other regions and historical varieties/landraces from the USDA Soybean Germplasm Collection. These efforts serve as the engine to incorporate the necessary genetic variation to sustainably create competitive products that benefit Arkansas farmers.

Specific Objectives: This proposal is grounded in two specific objectives, including i) introduction of novel genetic background from plant introductions (PIs) and elite germplasm from other growing regions to help build a strong and sustainable genetic pool in Arkansas; ii) incorporation of unique economically important traits including grain quality and composition, as well as biotic and abiotic stressors tolerance using various breeding and selection schemes.

Methods: Previous years of this research have identified several PIs that have acceptable yield, early maturing and indeterminacy combined with unique economic-important traits under diverse genetic backgrounds. In addition, multiple high-yielding elite breeding lines from various northern states' variety testing programs and USDA-Uniform trials were used in our crossing block in combination with high-yielding Arkansas-adapted elite cultivars. Substantial efforts will continue to identify potential genetic sources with desirable traits to be implemented within the genetic pool of the Arkansas program. Leveraging historical datasets, the USDA Soybean Germplasm Collection, and well-trained prediction models, additional genotypes will be identified and implemented as parental lines in our population development pipeline. Simply put, models will be trained based on previous years of the Arkansas yield trials; the breeding values (for instance, yield) of untested genotypes will be estimated, and superior candidates will be included in our program. This will be the foundation of generating genetic diversity in our program and can be referred to as 'Discovery Breeding'. Strategies for hybridization and population development will follow as described in the proposal 'Development of High-yielding Soybean Cultivars with Broad Resilience to Stressors', focusing on the efficiency and timeframe of the pipeline to maximize genetic gain.

Planned Milestones: A major milestone is the development and validation of prediction models based on historical datasets and genome-wide molecular markers. With this, we can simply plug in the molecular

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marker information of untested genotypes to estimate their breeding values for multiple economically important traits in target environments. Additional milestones include precisely identifying and incorporating novel genetics into our program; developing breeding populations derived from these novel genetics, as well as conducting field trials to assess their superiority under real-world conditions.

Value to Soybean Industry: Our breeding program aims to develop early maturing high-yielding cultivars/germplasm with unique economically important traits and local adaptation. For instance, MG4 with RKN resistance under an Enlist background is widely desirable but rare to find. Therefore, the 'Discovery Breeding' stage of our program described in this proposal aims to generate genetic diversity that can be used to develop and further advance materials with unique traits. The work herein proposed is the engine used to incorporate the genetic variation needed in the soybean breeding program to directly support different projects and research goals.

Budget Justifications/Explanation of Travel and Direct Costs ($187,872): It is requested a total of $74,322 for half-time of a research associate and technician. $7,500 is requested for in-state travel to collect notes and conduct research plots, including planting, harvesting, and maintenance. A total of $56,000 is requested in supplies, including $3,000 for seeds, shipping, planting boxes, tags, and stakes, $43,000 for off-season nursery fees including hybridization and generation advancement, and $10,000 for molecular markers application including trait-specific predictions as well as characterization of biotic and abiotic stressors tolerance. A total of $50,050 is requested for land and maintenance fees across the UADA research stations (73 acres).

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Vieira, Caio — *Soybean Germplasm Enhancement Using Genetic Diversity*

Year	2025/2026	**Project Year**	Year 3 of 3	**Version: 7.0 (11/01/2024)**
Lead Investigator	Vieira, Caio	**Co-PI #1**	Vieira, Caio	
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Soybean Germplasm Enhancement Using Genetic Diversity			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Vieira, Caio	Vieira, Caio			Total Board Funding Requested	AES Portion	CES Portion
	Select "AES" or "CES" for each PI	AES	AES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Research Associate		50%	$31,600				$31,600	$31,600	$0
Research Technician		50%	$26,193				$26,193	$26,193	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$57,793	$0	$0	$0	$57,793	$57,793	$0
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
	Hourly								
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel						$0	$0	$0
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$0	$0	$0	$0	$0	$0	$0
	Fringe Benefits								
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$16,529	$0	$0	$0	$16,529	$16,529	$0
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$0	$0	$0	$0	$0	$0	$0
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$16,529	$0	$0	$0	$16,529	$16,529	$0
	Personnel Total		$74,322	$0	$0	$0	$74,322	$74,322	$0
	Travel								
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$7,500				$7,500	$7,500	$0
	Out-of-State						$0	$0	$0
	Travel Total		$7,500	$0	$0	$0	$7,500	$7,500	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio *Soybean Germplasm Enhancement Using Genetic Diversity*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$56,000				$56,000	$56,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$8,250	$0	$0	$0	$8,250	$8,250	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$8,000	$0	$0	$0	$8,000	$8,000	$0
	RIRE, Stuttgart	$19,600	$0	$0	$0	$19,600	$19,600	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$11,200	$0	$0	$0	$11,200	$11,200	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$3,000	$0	$0	$3,000	$3,000	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$103,050	$3,000	$0	$0	$106,050	$106,050	$0
	Total for Proposal	$184,872	$3,000	$0	$0	$187,872	$187,872	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Soybean Enterprise Budgets and Production Economics Analysis

Lead Investigators: Breana Watkins, Instructor – Conservation and Crop Budget Economist

Status: Year 3 of 3

Research Area: Economics

Stated Goal: The goal of this project is to provide enterprise budgets for crops in production across Arkansas which are easily adaptable for representing alternative production practices of Arkansas producers. The table "Costs and Returns per Acre Roundup Ready 2 XtendFlex Soybean" provides an example of the 2025 soybean enterprise budgets with a 25% crop-share lease. Costs and returns analysis utilizing the budgets are conducted by economists to provide research results for a variety of projects. The research verification coordinators utilize production economics analysis to investigate factors impacting farm profitability. The crop enterprise budgets are designed to evaluate profitability of a number of field activities associated with crop production.

Specific Objectives:

(1) Develop base representative field activities of the most common production practices of soybeans in Arkansas.

(2) Collect data for input prices and equipment costs associated with the base representative production activities.

(3) Establish and maintain a computational budget calculator for base representative production practices. The budget calculator is interactive and flexible in order to represent alternative production methods. A total of 12 soybean budgets are produced each fall and are updated throughout the production year consistent with incremental changes in input costs and crop prices received by Arkansas producers.

(4) Update the farm budget program for financial management and public policy analysis. The farm budget program includes an interactive calculator for users to represent unique farm situations and determine breakeven prices and yields for each unique budget.

(5) Create a cost estimate of various farm activities to show the expenses that are incurred for each field activity associated with production.

(6) Investigate the economics of conservation practices in Arkansas, specifically for irrigation, cover crops, and carbon sequestration.

Methods: Crop enterprise budgets will be developed in collaboration with crop and soil science specialists, weed scientists, agronomists, pathologists, and entomologists. Production procedures for base budgets will represent University of Arkansas Division of Agriculture Cooperative Extension recommendations. Unique budgets will be customized for individuals based on Extension recommendations and information from producers.

Planned Milestones: Crop budgets based on Extension recommendations are reflections of Arkansas crop production. Individual producers will utilize interactive computational capabilities for representing alternative production practices and determining profit potential with a range of commodity prices and yields. Producers and financial institutions will apply crop enterprise budgets in evaluating costs and returns for aspects of each production year. Public policies affecting producers are investigated by government organizations with crop enterprise budgets that are representative of Arkansas production.

Projected Value to the Soybean Industry: The benefits provided by the economic analysis of alternative soybean production methods provide a significant reduction in financial risk inherent in agricultural production. Arkansas producers will benefit from economic analyses of individual production activities unique to their operations. Unique crop enterprise budgets developed for individual farms are useful for determining credit requirements and planning for the upcoming crop season. Flexible crop

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enterprise budgets are beneficial for planning production methods to provide greatest potential for financial success. The crop budgets enable farm financial outlooks to be revised during the production season as inputs, input prices, yields, and commodity prices change. Thoroughness of computational methodology and straightforward application facilitates use of the budget calculator by research and extension specialists conducting economic analysis of water use efficiency, weed control, insect management, cover crops, and other aspects of crop production. The crop budget system allows for investigation of public policy changes that affect producers, such as eliminating exemptions for taxes on agricultural inputs like fuel and electricity.

	ACGSPB	CES
	dollars	
Personnel Salaries		
Breana Watkins		7,776.00
Other Personnel	7,776.00	
Benefits	2,224.00	2,224.00
Total Personnel	**10,000.00**	**10,000.00**
Total	**10,000.00**	**10,000.00**

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Estimated Costs and Returns per Acre
RoundupReady2XtendFlex Soybean
Furrow Irrigated, 12 ac-in., Arkansas, 2025

ITEM	UNIT	PRICE	QUANTITY	Total Amount	Landlord Share %	Landlord Share	Tenant Share
REVENUE							
Soybean	bu	$ 9.50	60	$ 570.00	25.0%	$ 142.50	$ 427.50
TOTAL REVENUE				$ 570.00		$ 142.50	$ 427.50
OPERATING COSTS							
LAND EXPENSE							
Crop Share Rent	acre			$ 142.50			$ 142.50
SEED/PLANTS							
Soybean Seed	thous	$ 0.51	150	$ 77.00	0.0%	$ -	$ 77.00
CUSTOM SPRAY AND FERTILIZER							
Ground App[1,2,3,4,5]	appl	$ 8.50	5	$ 42.50	0.0%	$ -	$ 42.50
Aerial App Chem[6,7]	appl	$ 10.00	2	$ 20.00	0.0%	$ -	$ 20.00
Aerial App Fert	lbs	$ 0.100	0	$ -	0.0%	$ -	$ -
FERTILIZERS							
Phosphate (0-46-0)[2]	lbs	$ 0.35	90	$ 31.05	0.0%	$ -	$ 31.05
Potash (0-0-60)[2]	lbs	$ 0.25	100	$ 25.00	0.0%	$ -	$ 25.00
Urea (46-0-0)	lbs	$ 0.26	0	$ -	0.0%	$ -	$ -
HERBICIDES							
Glyphosate[1]	qt	$ 4.38	1	$ 4.38	0.0%	$ -	$ 4.38
2,4-D[1]	qt	$ 6.25	1	$ 6.25	0.0%	$ -	$ 6.25
Metribuzin[3]	oz	$ 1.14	8	$ 9.12	0.0%	$ -	$ 9.12
Tavium[3]	oz	$ 0.42	56.5	$ 23.62	0.0%	$ -	$ 23.62
Xtendimax[4]	oz	$ 0.48	22	$ 10.56	0.0%	$ -	$ 10.56
Glyphosate[4]	qt	$ 4.38	1	$ 4.38	0.0%	$ -	$ 4.38
Liberty[4]	qt	$ 12.88	1	$ 12.88	0.0%	$ -	$ 12.88
INSECTICIDES							
Besiege[6]	oz	$ 2.75	9	$ 24.75	0.0%	$ -	$ 24.75
FUNGICIDES							
Quadris Top[7]	oz	$ 2.33	10	$ 23.30	0.0%	$ -	$ 23.30
ADJUVANTS							
HAULING							
Haul Soybean	bu	$ 0.25	60	$ 15.00	0.0%	$ -	$ 15.00
DRYING							
SUPPLIES							
Polypipe	acre	$ 16.25	1	$ 16.25	0.0%	$ -	$ 16.25
CROP CONSULTANT/SCOUTING FEE							
Soybean Consultant	acre	$ 5.00	1	$ 5.00	0.0%	$ -	$ 5.00
CROP INSURANCE							
Soybean Crop Insurance	acre	$ 16.00	1	$ 16.00	0.0%	$ -	$ 16.00
OPERATOR LABOR							
Tractors	hour	$ 14.53	0.4432	$ 6.44	0.0%	$ -	$ 6.44
Harvesters	hour	$ 14.53	0.1941	$ 2.82	0.0%	$ -	$ 2.82
IRRIGATE LABOR							
Special Labor	hour	$ 14.53	0.0399	$ 0.58	0.0%	$ -	$ 0.58
DIESEL FUEL							
Tractors	gal	$ 2.80	3.118	$ 8.73	0.0%	$ -	$ 8.73
Harvesters	gal	$ 2.80	1.996	$ 5.59	0.0%	$ -	$ 5.59
Furrow Irr.	gal	$ 2.80	14	$ 39.69	0.0%	$ -	$ 39.69
REPAIR & MAINTENANCE							
Tractors/Implements**	acre	$ 7.82	1	$ 7.82	0.0%	$ -	$ 7.82
Harvesters	acre	$ 7.29	1	$ 7.29	0.0%	$ -	$ 7.29
Furrow Irr.	acre-in	$ 0.26	12	$ 3.17	0.0%	$ -	$ 3.17
Check Off, Boards	bu	$ 0.05	60	$ 2.85	0.0%	$ -	$ 2.85
INTEREST ON OP. CAP.	acre	$ 20.66	1	$ 20.66	0.0%	$ -	$ 20.66
TOTAL OPERATING COSTS				$ 472.68		$ -	$ 472.68
RETURNS ABOVE OPERATING COSTS				$ 97.32		$ 142.50	$ (45.18)
FIXED COSTS							
Tractors/Implements	acre	$ 46.83	1	$ 46.83	0.0%	$ -	$ 46.83
Harvesters	acre	$ 32.72	1	$ 32.72	0.0%	$ -	$ 32.72
Furrow Irr.	acre	$ 28.14	1	$ 28.14	0.0%	$ -	$ 28.14
Farm Overhead	acre	$ 3.98	1	$ 3.98	0.0%	$ -	$ 3.98
TOTAL FIXED COSTS				$ 111.67		$ -	$ 111.67
TOTAL COSTS				$ 584.35		$ -	$ 584.35
RETURNS ABOVE TOTAL COSTS				**$ (14.35)**		$ 142.50	**$ (156.85)**

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Watkins, Breana *Crop Enterprise Budgets and Production Economic Analysis*

Year	2025/2026	**Project Year**	Year 3 of 3
Lead Investigator	Watkins, Breana	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	AEAB Agricultural Economics & Agribusiness		
Commodity Board	Soybean Promotion Board		
Project Title	Crop Enterprise Budgets and Production Economic Analysis		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Watkins, Breana				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Instructor	Breana Watkins	30%	$7,776				$7,776	$0	$7,776
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$7,776	$0	$0	$0	$7,776	$0	$7,776

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$2,224	$0	$0	$0	$2,224	$0	$2,224
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$2,224	$0	$0	$0	$2,224	$0	$2,224
Personnel Total	$10,000	$0	$0	$0	$10,000	$0	$10,000

Travel

Justify out-of-state travel in proposal.	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$0	$0	$0	$0	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Watkins, Breana *Crop Enterprise Budgets and Production Economic Analysis*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$0	$0	$0	$0	$0	$0	$0
	Total for Proposal	$10,000	$0	$0	$0	$10,000	$0	$10,000

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: The Arkansas Discovery Farm Program

Lead Investigators: Mike Daniels

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New, Year 1 of 3

Research Areas (Verification Program, General Agronomics, Diseases, Insects, Fertility, Irrigation, Weed Control, Misc. Projects): Miscellaneous Project to: 1) monitor runoff water quality, water use, soil health and climate change resiliency on private farms to determine nutrient, sediment losses, carbon sequestration, and greenhouse gas emissions on selected farms; 2) evaluate conservation practices and 3) verify sustainability of current production practices

Stated Goal: The overall goal of the program is to document sustainable and viable farming systems that remain cost-effective in an environmentally sound manner.

Specific Objectives: Conduct on-farm demonstration and monitoring to assess the need for and effectiveness of conservation practices.

1. Provide on-farm verification and documentation of nutrient and sediment loss reductions and water conservation in support of nutrient management planning and sound environmental farm stewardship.
2. Develop and deliver educational programs from on-farm data that will assist producers in achieving both production and environmental goals in support of sustainable farming.

Methods: The ARDF program, which presently consists of a network of 14 farms throughout Arkansas, is an effective stakeholder-driven conservation demonstration program, where extensive, state-of-the-art water quality monitoring systems are installed on private, working farms including both livestock and row-crop systems to document environmental impact and to demonstrate the potential of NRCS-approved conservation practices' on- and off-farm impacts with respect to documented water quality (Daniels et al., 2018; Daniels et al., 2019), water-use efficiency, and soil health improvements under different conservation systems.

Planned Milestones: Continue on-farm monitoring and data collection to document impact and sustainability as well as empower farmers to educate other farmers using data collected on their farm at field days and tours and educational meetings

Statement of Projected Value: The Discovery Farm Program (ARDF; Sharpley et al., 2015) has emerged as an important educational platform that has been successful in addressing water quality, water use efficiency, and improving soil health. The non-agricultural sector of society including lawmakers, the agricultural supply chain from consumers to large retailers continues to raise questions of natural resource conservation and sustainability as little data exists that documents agriculture's impact on the environment and natural resources. The continuation of this program is critical to helping agriculture document ecosystem services and sustainable use of natural resources and to demonstrate that agricultural producers are voluntarily and proactively addressing sustainability concerns

Budget Justifications/Explanation of Travel and Direct Costs: $): 0.5 FTE salary for Discovery Farm Technician at 0.5 * $43.888 = $21,944 at a fringe rate of 28.6% or $6276 for a total of $28,220.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Daniels, Mike *Arkansas Discovery Farm Program*

Year	2025/2026	**Project Year**	
Lead Investigator	Daniels, Mike	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Arkansas Discovery Farm Program		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Daniels, Mike				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Prgram Technician	Breet Cooper	50%	$21,944				$21,944	$0	$21,944
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$21,944	$0	$0	$0	$21,944	$0	$21,944

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Graduate Student

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe benefits are calculated when salary and wage amounts are entered above.

Fringe Benefits

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$6,276	$0	$0	$0	$6,276	$0	$6,276
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$6,276	$0	$0	$0	$6,276	$0	$6,276
Personnel Total	$28,220	$0	$0	$0	$28,220	$0	$28,220

Justify out-of-state travel in proposal.

Travel

	Travel				Total	AES Portion	CES Portion
In-State					$0	$0	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$0	$0	$0	$0	$0

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Daniels, Mike *Arkansas Discovery Farm Program*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$0	$0	$0	$0	$0	$0	$0
	Total for Proposal	$28,220	$0	$0	$0	$28,220	$0	$28,220

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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ARKANSAS SOYBEAN PROMOTION BOARD
2025-2026 PROPOSAL

Title: Economic Analysis of Soybean Production and Marketing Practices

Lead Investigator: Dr. Brian Deaton, Associate Professor

Status: New

Research Area: Verification Program

Stated Goal: The project will assist producers as they continue to seek opportunities for increasing incomes, decreasing costs, and reducing risks.

Specific Objectives: The overall objective of this study is to provide an economic analysis for the Arkansas Soybean Research Verification Program. Specific objectives are:

(1) Conduct an economic analysis of production practices used in the Arkansas Soybean Research Verification Program that impact profitability and verify Extension recommendations. (J. Ross and C. Elkins)

(2) Standardize the economic analysis by integrating the 2024 soybean verification program data with data from previous years. This will continue to document the long-term benefits of the Arkansas Soybean Research Verification Program. (J. Ross and C. Elkins)

(3) Provide Arkansas soybean cash market summaries for publication on the "Row Crops Blog" online newsletter.

Methods: The economic feasibility of various production management decisions suggested in the Soybean Research Verification Program will continue to be analyzed using enterprise budgets. Specific information related to field operations, inputs, irrigation, and yield will be entered into a computerized budget generator to estimate production costs. The results of this analysis will be presented at county/state/regional/national meetings.

Planned Milestones: **[Objectives 1 & 2 – Ross and Elkins]**

April 10 – Integrate the 2024 soybean verification program data into the historical database that contains data from previous years.

July 15 - Begin electronic coordinator data submission through planting for all cooperators in the Arkansas Soybean Research Verification Program from each respective field.

November 1 - Receive final SRVP production input data reports and begin computer entry. SRVP Coordinators will check items for accuracy after initial entry.

November 15 - Receive final SRVP harvest data reports and begin computer entry. SRVP Coordinators will check added items after initial entry.

December 22 - Complete first draft of SRVP economic analysis tables. SRVP Coordinators will check items after completion.

January 15 - Finish economic analysis for SRVP Report publication and distribution.

[Objective 3]

Weekly - Provide continued Arkansas soybean cash market summaries for publication through "Row Crops Blog" online newsletter outlet in cooperation with Arkansas State Soybean Agronomist. Work with Communication Group along with other media outlets to provide additional national exposure for the Arkansas soybean industry.

Monthly - Provide soybean economic presentations to county/regional meetings, state research verification tour, and research center field days in-state and otherwise as requested.

Statement of Projected Value: This project extends previous SRVP work to address

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agronomic issues. Benefits from economic analysis of alternative soybean production strategies assist producers in identifying opportunities to adjust individual costs while providing a significant reduction in the risk levels that producers face. Maintenance of a historical database of annual SRVP data provides valuable time series soybean data for extended research. The results of this analysis enable producers to make management decisions based on profit maximization rather than just maximizing yield.

Budget Justifications/Explanation of Travel and Direct Costs: Activities with state specialists, county agents, and soybean producers within the Tri-State Soybean Forum states require the requested funding for travel.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Brian Deaton *Economic Analysis of Soybean Production and Marketing Practices*

Year	2025/2026	**Project Year**	
Lead Investigator	Brian Deaton	**Co-PI #1**	
Co-PI #2		**Co-PI #3**	
Department	AFRC		
Commodity Board	Soybean Promotion Board		
Project Title	Economic Analysis of Soybean Production and Marketing Practices		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Brian Deaton				**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI	AES						
Fulltime Personnel							
Position Title / **Name** *(if position is filled)* / **% Time**	**Salaries**				**Total**	**AES**	**CES**
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Subtotal: Salaries	$0	$0	$0	$0	$0	$0	$0
Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition. / **Name** *(if position is filled)* / **% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Tuition Calculator Information					$0	$0	$0
Subtotal: Graduate Student	$0	$0	$0	$0	$0	$0	$0
Hourly							
	Wages				**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel	$4,500				$4,500	$4,500	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$4,500	$0	$0	$0	$4,500	$4,500	$0
Fringe Benefits							
Fringe benefits are calculated when salary and wage amounts are entered above.	**Benefits**				**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$329	$0	$0	$0	$329	$329	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$329	$0	$0	$0	$329	$329	$0
Personnel Total	$4,829	$0	$0	$0	$4,829	$4,829	$0
Travel							
Justify out-of-state travel in proposal.	**Travel**				**Total**	**AES Portion**	**CES Portion**
In-State	$800				$800	$800	$0
Out-of-State	$800				$800	$800	$0
Travel Total	$1,600	$0	$0	$0	$1,600	$1,600	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Brian Deaton *Economic Analysis of Soybean Production and Marketing Practices*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,072				$1,072	$1,072	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$1,072	$0	$0	$0	$1,072	$1,072	$0
	Total for Proposal	$7,500	$0	$0	$0	$7,500	$7,500	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board: 2025-2026 Proposal

Title: Monitor and Management of Fungicide-Resistant Soybean Diseases in Arkansas

Principle Investigator: Travis Faske and Terry Spurlock

Status: Year 1

Research Areas: Plant Pathology

Goal: Develop practical management strategies to manage fungicide-resistant foliar diseases (i.e. QoI-resistant frogeye leaf spot, target spot, Cercospora leaf blight). Determine the potential risk of triazole-resistance and SDHI-resistance in various fungal diseases and develop guidelines to reduce the impact of all fungicide-resistant diseases to maximum profit for the Arkansas soybean producers.

Objectives:

1. Evaluate the efficacy and timing of fungicides, labeled and experimental, to control strobilurin-resistant FLS and other foliar diseases (Faske).

2. Investigate the risk and existence of fungicide-resistance in *Cercospora* fungi and other foliar diseases to DMI and SDHI fungicides (Faske).

3. Determine the state-wide distribution of QoI-resistant *Phomopsis longicolla*, the fungus that causes Phomopsis seed decay, a disease impacting grain quality, and QoI-resistant *Septoria glycines*, the fungus that causes brown spot (Spurlock).

4. Develop fungicide-resistance management strategies to delay or prevent fungicide-resistant diseases (Faske & Spurlock).

Methods:

Objective1: Strobilurin-resistant frogeye leaf spot (S-R FLS) has been detected in nearly all soybean producing counties across the state and in the Mid-South. The chemical industry has responded by releasing numerous premix fungicides, which vary in efficacy to control S-R FLS from excellent to poor. Strobilurin resistance is also concern for Cercospora Leaf Blight and Target spot. A good example of a poor fungicide is Priaxor, which was identified to be ineffective in university trials in controlling Cercospora foliar and seed infection. Given that new fungicides are introduced into the market each year, an unbiased evaluation of fungicide efficacy is needed to prevent the use of ineffective fungicides. Additionally, some growers are using a solo triazole program to control S-R FLS; however, the timing of triazole fungicides needs to be re-evaluated as they appear more effective when applied earlier than previously recommended. The limited control by some triazole fungicides suggests that triazole-resistance is developing in our population of FLS. Finally, we will investigate the unnecessary application of fungicides applied automatically at R3 compared to an IPM approach with solo triazole and premix fungicides across several soybean varieties. Each year we have been successful in

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conducting foliar fungicide trials at the Jackson County Extension Center (JCEC) where irrigation is used to promote disease development, which promotes success in fungicide screens.

Objective 2: The use of triazole (Demethylation Inhibitors; DMI) fungicides has increased and is now the primary chemistry used to manage S-R FLS. Triazole-resistant strains of *C. sojina* and C. *kikuchii* has been reported in Louisiana, which suggest that strains of these pathogens are also present Arkansas. In field trials it has been observed that some triazole fungicides are less effective than others, which suggests the presence of triazole-resistance strains. Confirmation of triazole-resistance is a multi-year project because this resistance is quantitative rather than qualitative. Additionally, the risk of S-R in minor fungal diseases like brown spot and target spot, which have increased in severity in recent years, needs to be investigated to determine the reason for their increase in severity and to be proactive in developing a management strategy, if necessary. Finally, the newest fungicides are the succinate dehydrogenase inhibitors or SDHI, which vary in their control of S-R FLS and have a high to moderate risk for developing resistance. Baseline trials are needed to determine if and when these fungicides are losing efficacy. Fungal isolates will be collected and screened to investigate if there has been a shift toward triazole-resistance and SDHI-resistance in *Cercospora* spp. and other prominent foliar diseases. Finally, the distribution of S-R FLS will be extended to the SW corner of Arkansas where resistant strains have yet to be confirmed.

Objective 3: Brown spot (BS) is present in most soybean fields in Arkansas. This disease typically occurs in the lower to mid-canopy and is often not yield limiting. In some cases, evidence from field research trials have indicated BS moving to the upper third of the canopy and causing yield losses. Field calls to producer fields and conversations with crop consultants have sometimes indicated BS was not controlled as expected after fungicide application of pre-mix fungicides containing strobilurin chemistries. Phompsis seed decay (PSD) occurs sporadically on soybean in Arkansas each year. Severity can be variable depending on variety but the disease is more severe when heavy or prolonged periods of rainfall correspond to the timing of maturing soybean fields. Some evidence from field trials have indicated that fungicide applications can reduce PSD but certain pre-mixes, such as those containing a strobilurin, may not be as effective. State-wide surveys are needed to determine if and where strobilurin fungicide resistance exists for both diseases. Fungal isolates will be collected from leaf and grain samples from on-farm folair fungicide trials and producer fields each year and screened to determine if fungicide resistant isolates exist in these pathogen populations.

Objective 4: Applied research is needed to develop practical fungicide resistant management strategies to delay or prevent the increase of such diseases in soybean. This information will be extended to producers in a variety of deliverables, which include management strategy articles posted on the Arkansas Row Crops website, updates to the fungicide efficacy tables in the MP-154 and presentations on fungicide resistance at production meetings and field days. Results from these studies will be published in the soybean research series and used to update a fact sheet on fungicide-resistant management of foliar soybean diseases.

Planned Milestones: Several foliar fungicide trials will be established each year at the NES as outlined in objective one. Fungal isolates will be collected each year and evaluated for resistance to various fungicide chemistries at the Lonoke Extension Center and Spurlock's Lab in

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Monticello as outlined in objectives two and three. Finally, data from these studies will be used each year to extend the most current management strategies to the Arkansas producers as outlined in objective four.

Value to the Soybean Industry: Our study will benefit farmers in several areas. First, the detection and confirmation of a new fungicide-resistant disease would prevent the unnecessary application of an ineffective fungicide, thus saving money. Further, early detection of the potential pitfalls of new chemistries like SDHI with a similar mode of action to the strobilurins would help to develop baselines for fungicide efficacy, thus loss of efficacy could be confirmed and prevent fungicide failures. Multiple-years of data are needed to confirm losses to triazole fungicides, which is among the most common fungicide used in Arkansas in soybean and if ineffective would be equally important to farmers. Finally, we aim to use and deploy the information collected from these studies to provide practical solutions for the control of fungicide-resistant soybean diseases in Arkansas.

Budget Justification: The proposed budget supports personnel (full-time and hourly/students) to conduct trials/experiments, maintain, and collect data. Travel would be primarily for mileage to pay for use of university vehicle or rental car to travel to and from field locations, an overnight stay maybe necessary depending on field activities (i. e. sampling…). Supplies would include those appropriate for such experiments as described such as but not limited to stakes, tags, supplies for planter or sprayer repair, petri dishes, media, reagents, general lab supplies.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Faske, Travis — *Monitor and Management of Fungicide-Resistant Soybean Diseases in Arkansas*

Year	2025/2026	**Project Year**	New
Lead Investigator	Faske, Travis	**Co-PI #1**	Spurlock, Terry
Co-PI #2		**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Monitor and Management of Fungicide-Resistant Soybean Diseases in Arkansas		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

		Faske, Travis	Spurlock, Terry			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI		CES	CES					
Fulltime Personnel								
Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Technician			$18,000				$18,000	$0	$18,000
Program Associate	Amanda Tolbert	25%		$14,000			$14,000	$0	$14,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$18,000	$14,000	$0	$0	$32,000	$0	$32,000
	Graduate Student								
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0
			Hourly						
			Wages				**Total**	**AES Portion**	**CES Portion**
	Hourly-Personnel		$7,000	$0			$7,000	$0	$7,000
	Hourly-Students						$0	$0	$0
	Subtotal: Hourly		$7,000	$0	$0	$0	$7,000	$0	$7,000
			Fringe Benefits						
Fringe benefits are calculated when salary and wage amounts are entered above.			**Benefits**				**Total**	**AES Portion**	**CES Portion**
	Fulltime Personnel		$5,148	$4,004	$0	$0	$9,152	$0	$9,152
	Graduate Students		$0	$0	$0	$0	$0	$0	$0
	Hourly Personnel		$511	$0	$0	$0	$511	$0	$511
	Hourly-Students		$0	$0	$0	$0	$0	$0	$0
	Subtotal: Fringe Benefits		$5,659	$4,004	$0	$0	$9,663	$0	$9,663
	Personnel Total		$30,659	$18,004	$0	$0	$48,663	$0	$48,663
			Travel						
Justify out-of-state travel in proposal.			**Travel**				**Total**	**AES Portion**	**CES Portion**
	In-State		$2,000	$2,000			$4,000	$0	$4,000
	Out-of-State						$0	$0	$0
	Travel Total		$2,000	$2,000	$0	$0	$4,000	$0	$4,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Faske, Travis *Monitor and Management of Fungicide-Resistant Soybean Diseases in Arkansas*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$2,000	$3,000			$5,000	$0	$5,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$2,065	$0	$0	$0	$2,065	$0	$2,065
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$4,065	$3,000	$0	$0	$7,065	$0	$7,065
	Total for Proposal	$36,724	$23,004	$0	$0	$59,728	$0	$59,728

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Screening for Soybean Tolerance to Metribuzin

Lead Investigator: Jason K. Norsworthy

Co-Investigator: Jeremy Ross

Status: 1 of 3

Stated Goal: To evaluate commercial soybean varieties for tolerance to metribuzin and make information readily available to growers.

Specific Objectives:

1) To assess the tolerance to metribuzin of soybean varieties entered in the Arkansas OVT.
2) To provide rapid transfer of information regarding the tolerance level or sensitivity of Arkansas-grown soybean varieties to metribuzin.

Methods: All soybean varieties entered in the Arkansas OVT will be sown in a replicated experiment in the greenhouse and evaluated for tolerance to metribuzin. The experiment will be conducted using a silt loam soil, and metribuzin will be applied preemergence at 0.5 lb ai/A, which is a slightly higher than labeled rate for this soil type. This rate will ensure adequate tolerance of those varieties deemed "tolerant" or to have "slight injury". Injury to soybean will be evaluated at 14 and 21 days after treatment on a 0 to 10 scale, where 0 equals no injury and 10 equal complete soybean death. Each variety will then be placed in one of three categories based on its sensitivity to metribuzin, with these being slight injury, moderate injury, or severe injury.

Planned Milestones: Evaluations of soybean varieties will take place in the greenhouse in the fall of the year. Results from the evaluation will be made available on the Extension website (uaex.edu) prior to the first of the year and shared with growers at county and state-wide production meetings.

Value to Soybean Industry: Metribuzin (Sencor or Lexone) was used by most Arkansas soybean growers prior to adoption of Roundup Ready in the mid- to late 1990's. Metribuzin is a broad-spectrum residual herbicide that provides a high level of control of Palmer amaranth, the most problematic weed of Arkansas soybean today. Soybean varieties differ in tolerance to metribuzin; hence, annual testing of available varieties was routine prior to Roundup Ready soybean to allow growers to best match a variety with their anticipated use of metribuzin. Now that preemergence, residual herbicides are once again a major component of weed management in Arkansas soybean, screening of soybean varieties for tolerance to metribuzin is needed. In addition to metribuzin alone products, such as Metri, Metribuzin, etc., a variety of metribuzin-containing products are being promoted and used by Arkansas soybean growers. Some of these products include Canopy (metribuzin + chlorimuron), Authority MTZ (metribuzin + sulfentrazone), and Boundary (metribuzin + S-metolachlor). The metribuzin rate in these

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products is less than that which will provide effective control when metribuzin is used alone. The reason for the lower rates of metribuzin in these products is because the sensitivity of the current soybean varieties to metribuzin is unknown; hence, a low rate is applied to minimize the risk of injury to the most sensitive varieties. Soybean producers in Arkansas would greatly benefit from being able to use a full rate of metribuzin in soybean, especially considering that PPO-resistant Palmer amaranth was documented in 12 counties in Northeast Arkansas. Our field research indicates that metribuzin needs to be a major component of the preemergence weed control program on any acre for which the PPO herbicides failed, especially those north of I40. We currently recommend a full rate of metribuzin plus a chloroacetamide on every PPO-resistant pigweed acre.

Budget Justification: My program associate, Dr. Rodrigo Botelho, will be responsible for conducting and evaluating the screening. His time is budgeted at 20% of his annual salary along with fringe benefits. For supplies, which include trays and plot stakes, a total of $800 has been budgeted. The total request is for $16,232.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Norsworthy, Jason *Screening for Metribuzin Tolerance*

Year	2025/2026	**Project Year**	New
Lead Investigator	Norsworthy, Jason	**Co-PI #1**	
Co-PI #2	Ross, Jeremy	**Co-PI #3**	
Department	CSES Crop, Soil, Environmental Science		
Commodity Board	Soybean Promotion Board		
Project Title	Screening for Metribuzin Tolerance		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Norsworthy, Jason		**Ross, Jeremy**		**Total Board Funding Requested**	**AES Portion**	**CES Portion**
Select "AES" or "CES" for each PI							
	X		**X**				

Fulltime Personnel

Position Title	**Name** *(if position is filled)*	**% Time**	**Salaries**				**Total**	**AES**	**CES**
Program Associate	Rodrigo Botehlo	20%	$12,000				$12,000	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$12,000	$0	$0	$0	$12,000	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	**Name** *(if position is filled)*	**% Time**	**Wages**				**Total**	**AES Portion**	**CES Portion**
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	**Benefits**				**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$3,432	$0	$0	$0	$3,432	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$3,432	$0	$0	$0	$3,432	$0	$0
Personnel Total	$15,432	$0	$0	$0	$15,432	$0	$0

Travel

Justify out-of-state travel in proposal.	**Travel**				**Total**	**AES Portion**	**CES Portion**
In-State					$0	$0	$0
Out-of-State					$0	$0	$0
Travel Total	$0	$0	$0	$0	$0	$0	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Norsworthy, Jason *Screening for Metribuzin Tolerance*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$800				$800	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$800	$0	$0	$0	$800	$0	$0
	Total for Proposal	$16,232	$0	$0	$0	$16,232	$0	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Docusign Envelope ID: DDDF8E1F-2AE5-4DFD-B207-11514107E033

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Determining factors associated with poor grain quality in soybean and management options

Lead Investigators: Dr. Terry Spurlock and Dr. Nick Bateman, UA Division of Agriculture

Status: Year 1

Stated Goal: Determine the diseases and disorders affecting soybean grain quality and develop management strategies for growers to avoid losses from poor quality

Specific Objectives:

1. Determine differences in grain quality caused by fungal diseases and disorders among varieties in the official variety trial at Rohwer Station annually (Spurlock).

2. Establish an early and a late planted fungicide trial at Rohwer Station each year based on data collected from the previous season's official variety trial. Varieties with significantly higher diseases impacting grain quality will be chosen for these trials. The aim will be to determine the impact of various fungicide timings on varieties that have shown susceptibility to diseases and disorders negatively impacting grain quality (Spurlock).

3. Samples will be taken from on-farm fungicide trials (4 – 5 trials annually) at harvest and sent to Riceland Foods in Stuttgart for grading and the Spurlock Lab to determine levels of diseases and disorders that impact grain quality (Spurlock).

4. Grain will be sampled from multiple stink bug trials throughout the state with significantly different levels of stinkbug or other insect feeding and grain quality determined. Additionally, samples will be sent to Fayetteville for fungal pathogen identification that may be related to damage caused by insect feeding (Bateman).

Methods/Approach

Objective 1: The official variety trial is planted at Rohwer Station each year to determine susceptibility of varieties to stem canker and other foliar diseases that may occur. This trial will also be used to determine varietal susceptibility to diseases and disorders that impact grain quality. The trial will be planted very late (in June) to maximize disease pressure and limit the opportunity for herbicide drift. Plots will be planted 2-rows wide on 38-inch rows and 10ft long. Each variety will be replicated three times. Plots will be harvested with a mid-sized combine equipped with a research weigh system. During harvest, approximately 16 oz of grain will be collected from each plot just before it enters the weigh system on the plot combine. Levels of fungal diseases on grain (purple seed stain, Phomopsis seed decay, and others) and other disorders will be determined and analyzed by variety.

Objective 2: Five varieties will be chosen from the previous year's variety trial at Rohwer Station and planted in two separate trials on two different planting dates. The first trial will be planted between the last week in April and first week of May. The second will be planted mid-June. Both trials will be planted with plots 2-rows wide on 38-inch rows and 10ft long. Treatments will be 5 varieties with four fungicide timings (nontreated, R3, R5, and R3 + R5) and each treatment replicated three times in a randomized complete block. Plot harvest, sampling, and diseases and disorders impacting grain quality will be determined in a similar way to objective 1.

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Docusign Envelope ID: DDDF8E1F-2AE5-4DFD-B207-11514107E033

Objective 3: As part of another project, 10-12 large block on-farm fungicide trials (approximately 30-60 acres) are conducted in counties throughout the state and consist of 3-4 fungicide treatments, with a nontreated control and treatments replicated three times. Foliar disease levels and yields for each treatment are determined and reported back to the cooperating grower. Many of these trials have plot yields determined with a weigh wagon. At harvest, approximately one gallon of grain will be sampled from each block through the weigh wagon sample collection door. Samples will be sent to Riceland Foods in Stuttgart and graded according to their standards then sent to the Spurlock lab in Monticello where diseases impacting grain quality will be determined. These findings will be reported to each cooperating grower in addition to the foliar disease ratings and yields from each fungicide treatment.

Objective 4: Soybean plots will be established in high and low stink bug areas. Two varieties will be planted in a split-block arrangement, with one side receiving weekly sprays for stink bugs and the other side never receiving stink bug applications. After harvest, grain will be rated for stink bug damage, and samples will also be processed for pathogen presence. These studies will be repeated at an early and late planting date.

Planned Milestones:

- Determine the impact that variety alone will have on grain quality
- Observe factors impacting the most common diseases related to soybean grain quality loss
- Evaluate how stink bugs can compound seed quality issues
- Determine best management practices to protect growers from quality losses and disseminate those results at county and regional meetings
- Publish results annually in the Arkansas Soybean Research Series and at the conclusion of the three-year study, publish cumulative findings in a major scientific journal such as Phytopathology.

Value to Soybean Industry: Best management practices will be determined to avoid soybean quality losses and minimize profit loss. These practices will encompass sound IPM, including variety selection and determination of fungicide/insecticide application timing.

Budget Justifications/Explanation of Travel and Direct Costs: The budget reflects the costs of sampling and processing soybean pod samples from tests scattered around the state. Because the methods call for sampling tests planted for other objectives, the weather may present opportunities at more or fewer trial locations. Reactionary travel and labor are budgeted accordingly. Laboratory processing of samples requires typical cleaning and plating of samples, sorting emerging colonies of microorganisms in Petri dishes, and identification by microscopically observed characteristics and molecular methods. A significant portion of M/O is used for laboratory supplies to accomplish these tasks.

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Docusign Envelope ID: DDDF8E1F-2AE5-4DFD-B207-11514107E033

University of Arkansas System Division of Agriculture
Promotion Board Budget

Spurlock, Terry — *Determining factors associated with poor grain quality in soybean and management options*

Year	2025/2026	**Project Year**	New	**Version: 7.0 (11/01/2024)**
Lead Investigator	Spurlock, Terry	**Co-PI #1**	Bateman, Nick	
Co-PI #2		**Co-PI #3**		
Department	ENPL Entomology and Plant Pathology			
Commodity Board	Soybean Promotion Board			
Project Title	Determining factors associated with poor grain quality in soybean and management options			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Spurlock, Terry	Bateman, Nick			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Associate	Amanda Tolbert	25%	$15,000				$15,000	$0	$15,000
Progra Associate	Garrett Felts	25%		$15,000			$15,000	$0	$15,000
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
		Subtotal: Salaries	$15,000	$15,000	$0	$0	$30,000	$0	$30,000

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$6,000				$6,000	$0	$6,000
Hourly-Students		$3,500			$3,500	$0	$3,500
Subtotal: Hourly	$6,000	$3,500	$0	$0	$9,500	$0	$9,500

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$4,290	$4,290	$0	$0	$8,580	$0	$8,580
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$438	$0	$0	$0	$438	$0	$438
Hourly-Students	$0	$4	$0	$0	$4	$0	$4
Subtotal: Fringe Benefits	$4,728	$4,294	$0	$0	$9,022	$0	$9,022
Personnel Total	$25,728	$22,794	$0	$0	$48,522	$0	$48,522

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$2,000	$1,000			$3,000	$0	$3,000
Out-of-State					$0	$0	$0
Travel Total	$2,000	$1,000	$0	$0	$3,000	$0	$3,000

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Docusign Envelope ID: DDDF8E1F-2AE5-4DFD-B207-11514107E033

University of Arkansas System Division of Agriculture
Promotion Board Budget

Spurlock, Terry — *Determining factors associated with poor grain quality in soybean and management options*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$1,000	$1,068			$2,068	$0	$2,068
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$1,410	$0	$0	$0	$1,410	$0	$1,410
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$2,410	$1,068	$0	$0	$3,478	$0	$3,478
	Total for Proposal	$30,138	$24,862	$0	$0	$55,000	$0	$55,000

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Refining insect thresholds in Arkansas soybean
Lead Investigators: Ben Thrash
Co-Investigators: Glenn Studebaker, Nick Bateman
Status: New (continuing)
Research Area: Entomology

Stated Goal: This project aims to develop cost-effective and sustainable recommendations for the management of the major insect problems in soybean in all regions of Arkansas. Insect management continues to be a major focal point for growers and consultants in Arkansas soybean and developing sound recommendations for the most effective and economical control of insects is key to helping soybean producers maintain profitability. This project addresses various aspects of integrated management of problematic pests associated with soybean production.

Objectives:
Objective 1: Verify/refine thresholds for corn earworm, soybean looper, and the stink bug complex in Arkansas soybean.

Objective 2: Evaluate slug control methods for efficacy and cost effectiveness in Arkansas soybean.

Objective 3: Determine the more efficient sampling methods for wide row, narrow row, and drilled soybean for multiple pests.

Justification: Corn earworm, soybean looper, and the stink bug complex, are the most damaging insect pests of soybean in Arkansas. We have thresholds established for these pests; however, it is good practice to reevaluate these thresholds periodically due to changes in cultivars and management practices across the state. There may also be room for improvement in our current thresholds by adjusting them for soybean growth stage. For example, we know that soybean can compensate from corn earworm injury that occurs during R2 much better than injury occurring at R4, so the threshold could potentially be relaxed during the R2 growth stage. Additionally, the widespread use of the corn earworm virus (Heligen) seems to have brought pod injury to the attention of many growers and consultants because of how closely these fields are being inspected behind a virus application. Many growers and consultants have very low tolerance for pod injury within a soybean field even though soybean can compensate for a relatively large amount of injury from each of these pests. Preliminary research conducted by our colleagues at MS State has shown no yield losses from up to 10% pod damage from corn earworm in plots. This project aims to further improve our thresholds and understand how much pod injury and defoliation can occur before yield loss is realized.

The acreage of seedling soybean damaged by slugs over the past several years is on the rise with some growers replanting as many as three times due to stand loss from a slug infestation. This increase is due to increasingly wet spring weather coupled with the large amount of minimum till/no-till/cover crop acreage in Arkansas. There are very few effective treatments for slugs and those that are effective are very expensive. Deadline, perhaps the most used molluscicide, costs approximately $30/a at the recommended 10 lb/a broadcast rate. Iron chelate is another effective

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control option however it is currently even more expensive than Deadline. The only other currently recommended control method is tillage which is unacceptable to some growers. Another option is waiting until the weather becomes drier later in the growing season which can help to reduce slug populations, but soybean yield potential often suffers from the planting delay, and this is not always logistically possible. We have conducted some preliminary research using banded and reduced rate applications of deadline to try and make applications more affordable. In this preliminary research banded applications and reduced rates show some promise but more studies need to be conducted to evaluate their effectiveness. We also frequently receive questions on the effectiveness of using fertilizer to "salt" the slug infestation. We are fairly certain that these applications are ineffective however, without data we are not 100% sure.

With the large discrepancy in soybean production practices throughout the state, based on crop rotation and equipment availability it is important that we determine the most efficient sampling methods for these situations. We receive multiple calls every year wanting to know how best to sample beans that are lodging or best time of day for sampling different pests. We need to determine the best time of day to sample and the best tools to use for different planting arrangements to keep growers profitable.

Methods:

Objective 1. Large and small block replicated trials will be sprayed on research stations and cooperating grower fields. Insecticide application timings will be staggered to achieve various levels of injury across plots. Damaged pod counts, defoliation, and damaged seed will be recorded for corn earworm, soybean looper, and stink bugs, respectively. Yields will be recorded in all plots.

Objective 2. Large block trials will be conducted on grower fields experiencing slug injury. Banded and reduced rates of deadline will be applied and stand counts, slug injury, and yield will be recorded. With Deadline being a bait, having a 48-to-72-hour rain free period after application is the normal recommendation to achieve an acceptable level of control. We will make applications around these rainfall timings to determine the minimum rain-free period need to achieve control. The effect of tillage on slug populations will also be evaluated.

Objective 3. Sampling will be conducted using a sweepnet, drop cloth, and visual counts early in the morning, midday, and late afternoon in wide row and narrow beans at multiple planting dates. All pests will be record and correlations will be made to time of day and sampling method.

Planned Milestones:

2025: Initiate field trials for all three objectives.
2026: Field trials will be continued for all objectives.
2027: Analyze three years data and summarize findings to develop management recommendations.

Value to Soybean Industry:

With the current cost of production for soybean, it is critical to maintain profitability and ensure that when insecticide applications are made that they are justified and economical. With soybean

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ability to compensate for insect damage, it is possible that we are spraying too early in many cases. This project will verify our current thresholds on a large block infield setting that has the potential to reduce many insecticide applications and helping growers maintain maximum profitability.

Budget Justification/Explanation of Travel and Direct Costs: Money budgeted for travel will be used to get two and from research locations. Direct cost will be salaries and supplies to conduct field trials.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Thrash, Ben *Refining Insect Thresholds in Arkansas Soybean*

Year	2025/2026	**Project Year**	New
Lead Investigator	Thrash, Ben	**Co-PI #1**	Bateman, Nick
Co-PI #2	Studebaker, Glenn	**Co-PI #3**	
Department	ENPL Entomology and Plant Pathology		
Commodity Board	Soybean Promotion Board		
Project Title	Refining Insect Thresholds in Arkansas Soybean		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Thrash, Ben	Bateman, Nick	Studebaker, Glenn		Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES	CES				

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Program Associate	Andrew Plummer	40%	$15,000				$15,000	$0	$15,000
Program Associate	Taylor Davis	25%	$12,000				$12,000	$0	$12,000
Program Associate	Garrett Felts	20%		$7,000			$7,000	$0	$7,000
Program Associate	Mathew Mann	20%			$3,500		$3,500	$0	$3,500
							$0	$0	$0
	Subtotal: Salaries		$27,000	$7,000	$3,500	$0	$37,500	$0	$37,500

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$7,000	$4,500	$3,000		$14,500	$0	$14,500
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$7,000	$4,500	$3,000	$0	$14,500	$0	$14,500

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$7,722	$2,002	$1,001	$0	$10,725	$0	$10,725
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$511	$329	$219	$0	$1,059	$0	$1,059
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$8,233	$2,331	$1,220	$0	$11,784	$0	$11,784
Personnel Total	$42,233	$13,831	$7,720	$0	$63,784	$0	$63,784

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$1,600	$1,520	$1,000		$4,120	$0	$4,120
Out-of-State					$0	$0	$0
Travel Total	$1,600	$1,520	$1,000	$0	$4,120	$0	$4,120

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Thrash, Ben *Refining Insect Thresholds in Arkansas Soybean*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$0	$0	$0	$0	$0	$0	$0
	Total for Proposal	$43,833	$15,351	$8,720	$0	$67,904	$0	$67,904

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Utilization of Winter Nursery for Soybean Line Development through Backcrossing

Lead Investigators: Caio Canella Vieira

Co-Investigators:

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Breeding

Stated Goal: Most of our soybean cultivar development efforts have been primarily focused on conventional non-GMO cultivar development. In 2020, a backcrossing program to convert elite conventional breeding lines into Enlist-E3® products initiated the efforts to develop herbicide-resistant cultivars. Recently, we acquired the license to develop XtendFlex® materials. This conversion process occurs exclusively in an off-season nursery in Puerto Rico, intending to turn seven generations in three calendar years. The first Arkansas Enlist-E3® breeding lines were yield tested in 2023, and superior lines were entered into 2024 regional trials (USDA Uniform Trials and Arkansas Variety Testing). In 2025, several Enlist-E3® breeding lines will be tested in regional trials for another year and are planned to be proposed for commercial release. A sustainable backcross program for herbicide-resistant product development requires significant investments in multiple years of operations in off-season nurseries, therefore, we are seeking further assistance to supplement the development of Enlist-E3® and XtendFlex® backcrossing in off-season nurseries.

Specific Objectives: Leverage off-season nursery to convert breeding lines into Enlist-E3® and XtendFlex® to support a steady breeding pipeline of herbicide-resistant varieties.

Methods: A modified backcrossing program has been established in 2023 to support a steady and effective delivery of herbicide-resistant cultivars. As demonstrated in Figure 1, our breeding pipeline consists exclusively of conventional, non-GMO breeding lines. Materials selected to enter regional trials (USDA Uniform Trials and Arkansas Variety Testing) will undergo conversion to both Enlist-E3® and XtendFlex® in an off-season nursery. In 2025, we have initiated the conversion of an additional 14 high-yielding elite breeding lines to both Enlist-E3® and XtendFlex® backgrounds.

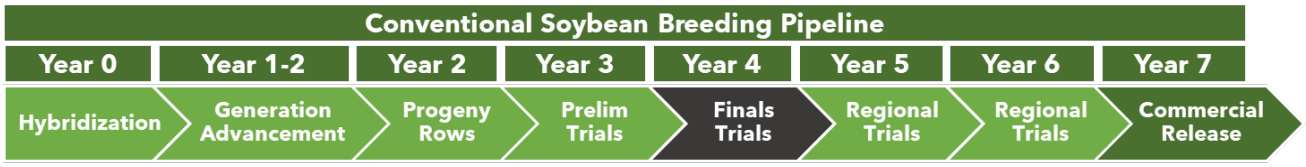

Figure 1. Scheme of the conventional (non-GMO) soybean breeding cultivar development pipeline. Advanced materials selected to enter regional trials (USDA Uniform Trials and Arkansas Variety Testing) will undergo herbicide resistance trait introgression.

The rationale behind maintaining the pipeline exclusively conventional is improved flexibility and operations efficiency. Suppose a conventional breeding line was found to be highly competitive in the Finals Trials (Year 4). With the proposed system, this breeding line can remain conventional (niche market) or be converted into either Enlist-E3® and XtendFlex®. If the breeding line was developed based on a specific herbicide-resistant trait, it would not be possible to convert it to anything else but that herbicide-resistant trait. It also improves our effectiveness in maintaining seed purity as this minimizes cross-contamination.

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Materials selected for regional trials (December of each year, for this example we will use the 2024 season) will undergo three rounds of backcrossing (January 2025 – December 2025) followed by three rounds of generation advancement (January 2026 – December 2026) (Figure 2). In each round, plants will be sprayed with either Enlist Duo (Enlist-E3®) or dicamba (XtendFlex®). Once reaching the BC_2F_3 stage, approximately 50 converted single plants per recurrent parent will undergo seed increase (January 2027 – April 2027). Lines will return to Arkansas and be tested for yield in multiple environments in Summer 2027. Superior lines will be moved into regional trials and pre-foundation seed in 2028 and may be proposed for commercial release in Spring 2029. Simultaneously, a new cycle of conversion to Enlist-E3® and XtendFlex® will start each year.

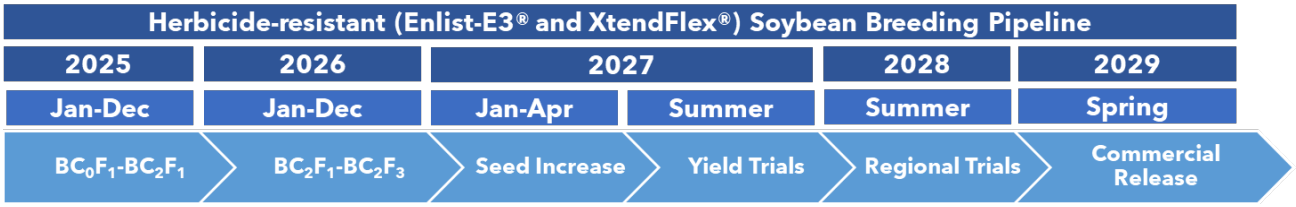

Figure 2. Scheme of herbicide resistance trait introgression. Conventional advanced materials selected to enter regional trials (USDA Uniform Trials and Arkansas Variety Testing) will undergo herbicide resistance trait introgression for two years, followed by two years of yield trials prior to commercial release.

Planned Milestones:

Proposed Activities	Year 1				Year 2							Year 3
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Obj. 1. Introgress Enlist-E3® and XtendFlex® traits into conventional (non-GMO) soybean cultivars												
Backcross BC_0F_1	*X*	*X*										
Backcross BC_1F_1		*X*	*X*									
Backcross BC_2F_1			*X*	*X*								
Backcross BC_2F_1-F_3				*X*	*X*	*X*	*X*	*X*				
Seed Increase								*X*	*X*	*X*		
Yield Trials										*X*	*X*	

Value to Soybean Industry: The University of Arkansas Soybean Breeding Program has been providing high-yielding conventional MG4 and MG5 cultivars at low costs to growers, but it needs to rapidly expand its footprint in herbicide-resistant cultivars. A sustainable and effective backcross program for herbicide-resistant (Enlist-E3® and XtendFlex®) cultivars will improve the accessibility of Arkansas genetics to local growers, allowing them to pick their cultivar of choice with their herbicide resistance package of choice.

Budget Justifications/Explanation of Travel and Direct Costs ($51,000): A total of $3,000 is requested for two visits to the off-season nursery in Puerto Rico to inspect generation advancement and overall project progress. $48,000 is requested to cover the costs of backcross BC_0F_1 to BC_2F_1, as well as one generation of advancement (BC_2F_1-BC_2F_2). This includes the conversion of selected entries from 2024 to both Enlist-E3® and XtendFlex® herbicide resistance traits.

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio — *Utilization of Winter Nursery for Soybean Line Development through Backcrossing*

Year	2025/2026	**Project Year**	New	**Version: 7.0 (11/01/2024)**
Lead Investigator	Vieira, Caio	**Co-PI #1**		
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Utilization of Winter Nursery for Soybean Line Development through Backcrossing			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Vieira, Caio				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	AES						
Fulltime Personnel							
Position Title / **Name** *(if position is filled)* / **% Time** / **Salaries**					**Total**	**AES**	**CES**
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Subtotal: Salaries	$0	$0	$0	$0	$0	$0	$0
Graduate Student							
Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.							
Name *(if position is filled)* / **% Time** / **Wages**					**Total**	**AES Portion**	**CES Portion**
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
					$0	$0	$0
Tuition Calculator Information					$0	$0	$0
Subtotal: Graduate Student	$0	$0	$0	$0	$0	$0	$0
Hourly							
Wages					**Total**	**AES Portion**	**CES Portion**
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0
Fringe Benefits							
Fringe benefits are calculated when salary and wage amounts are entered above.							
Benefits					**Total**	**AES Portion**	**CES Portion**
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$0	$0	$0	$0	$0	$0	$0
Personnel Total	$0	$0	$0	$0	$0	$0	$0
Travel							
Justify out-of-state travel in proposal.							
Travel					**Total**	**AES Portion**	**CES Portion**
In-State					$0	$0	$0
Out-of-State	$3,000				$3,000	$3,000	$0
Travel Total	$3,000	$0	$0	$0	$3,000	$3,000	$0

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Vieira, Caio — *Utilization of Winter Nursery for Soybean Line Development through Backcrossing*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$48,000				$48,000	$48,000	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$48,000	$0	$0	$0	$48,000	$48,000	$0
	Total for Proposal	$51,000	$0	$0	$0	$51,000	$51,000	$0

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: The Arkansas Irrigation Yield Contest

Lead Investigators: Chris Henry, Associate Professor, Water Management Engineer, RREC

Status: Year 8

Goal: The University of Arkansas Division of Agriculture has been demonstrating irrigation Water Management Practices on cooperator farms for five years. Experience has shown that when applied effectively water use can be reduced by 24% on average with no yield penalty. Reductions in water use of around 40% have been documented. The adoption rate of Computerized Hole Selection is over 40% indicating that this is now a mainstream practice in Arkansas. However, a significant need still exists to secure the sustainability of irrigated agriculture in Arkansas. It is still unknown and not well documented how much irrigation water use is needed for crops in Arkansas. A critical need is the documentation of the irrigation water use that is possible with a combination of IWM practices and the ingenuity of Arkansas farmers.

Approach: An irrigation yield contest is proposed. No such contest exists that incorporates the competitive nature of maximizing yield with maximizing water use efficiency. Many growers are familiar with the state and National Corn Growers Contest, National Wheat Growers contest and Arkansas's own "Go for the Green" soybean yield contest. The contest would be operated using the existing proposal supporting irrigation water management projects previously and currently proposed to these boards. Current yield contests focus only on yield, where this contest would highlight Arkansas farmer's efforts to improve sustainability and profitability, which are paramount to the future of agriculture.

Planned Milestones: What is proposed is funding directly from each commodity board of $10,000 to fund the first place award the corn irrigation contest. Essentially each commodity board would support the award for its commodity. The boards would provide the award directly to the first place winner $6,000, for second place $3,000 and for third place $1,000. The rules are similar to existing commodity yield contests, with the additional requirement of a propeller flow meter, sealed by the program and that the yield must exceed the county average irrigated yield for the county (to eliminate dryland or severe deficit entries). Contestants will be announced at the annual Arkansas Soil and Water Conservation Conference in Jonesboro, Arkansas in late January 2025.

Value to the Industry: A $10,000 award payable directly to the winner of the contest for the respective commodity is requested to provide an incentive to enter the contest. Support for the contest logistics, advertising, meter loaning, and operation of the contest will be done under the irrigation project. The contest has shown that those that know someone in the contest are have significantly more acres of IWM on their farms than those who do not. The contest has been responsible for influencing over half of the irrigators in Arkansas.

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Arkansas Future Ag Leaders Tour
Lead Investigators: Julie Robinson
Co-Investigators: Jeremy Ross
Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): 1 of 3
Research Areas: Education

Stated Goal:
A five-day professional development opportunity for undergraduate juniors and seniors enrolled in Colleges of Agriculture or are pursuing agriculture related majors across the state of Arkansas. Agriculture and agriculture related professions are the number one employer in the state. This one-week experience will enhance students' leadership and employability skills, provide first-hand networking opportunities with potential employers, and highlight the vast resources, services, and careers available through Arkansas' agriculture industry. Participants will get to interact with farmers, producers, vendors, and many others that support the agricultural industry in Arkansas. The goal of this tour is to better prepare and inform new graduates. The tour helps participants discover jobs across the state, keeping homegrown talent in-state, and local.

Specific Objectives:
- Increase participant's employability in agricultural careers.
- Acquaint participants with the vast resources, market segments, and services available through Arkansas' number one industry.
- Provide participants with a "bird's eye view" of current employment opportunities in the Arkansas agriculture industry.
- Increase student's options and opportunities by networking with future employers.

Methods:
The fourth annual Arkansas Future Ag Leaders Tour was hosted in May 2024. Ten students from six universities across the state participated. The tour was successful in connecting students with employers. To continue to provide this same professional development for future agricultural professionals, project coordinators are planning a five-day state-wide tour for undergraduate students who are in their junior and senior year of college. The call for applications will go out to all colleges with agriculture-related academic departments, including Arkansas State University, Arkansas Tech University, Southern Arkansas University, University of Arkansas – Fayetteville, University of Arkansas – Little Rock, University of Arkansas – Monticello, and University of Arkansas – Pine Bluff. The tour will begin at the Arkansas 4-H Center in Little Rock, on Monday, May 12, 2025. Participants will engage in leadership and team building activities to get to know each other and the coordinators. Participants will also participate in professional development activities related to networking, key tips for snagging the job of their dreams, and career advancement strategies. Each day, participants will travel across the state to pre-arranged tour sites to visit facilities and network with professionals. This will allow students to experience first-hand the diversity of opportunities within Arkansas' agriculture industry. Growers, producers, processors, manufacturers, educators, and research facilities will host students across Arkansas.

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Planned Milestones:

1. Formalization of a detailed project management and evaluation plan: February
2. Creation and dissemination of marketing resources: February.
3. Applications open: March
4. Coordination of the tour, scheduled for May 12 – 16, including arrangement and confirmation of tour stops including North East Arkansas, North West Arkansas, South East Arkansas, Southwest Arkansas, and Central Arkansas.
5. Communication with participants leading up to the tour: April
6. Conduct the Arkansas Future Ag Leaders Tour: May 12 – 16
7. Collaboration with news media and community partners to leverage resources. Management and utilization of program evaluation data to improve participation experience and outcomes.

Value to Soybean Industry:

The Arkansas Future Ag Leaders Tour helps create a more prepared and informed workforce that better understands the needs and dynamics of the farmers and producers that they will serve in their agricultural related careers across the state. This professional development program addresses some job readiness skills that have been identified as deficient by employers. Other states, such as Georgia and South Carolina, offer similar opportunities for undergraduates for a significant cost. By providing this opportunity for free, many students who would not be able to otherwise afford to pay their way can participate, in addition to missing a week of work in order participate. The greatest value to the soybean industry is that this provides an opportunity to inform and educate future agriculture industry professionals and leaders about challenges facing farmers and producers. In addition, touring across the state makes students aware of what jobs are available in the state and in local communities all across Arkansas.

Budget Justifications/Explanation of Travel and Direct Costs:

Coordination will be provided by the University of Arkansas System Division of Agriculture project team, led by Community, Professional, and Economic Development faculty and staff. Monetary support for this project totals in the amount of $20,000. Program coordinators are requesting $5,000 from the Soybean Promotion Board and seeking additional contributions from other commodity and industry groups to fund the total. The greatest expenses for this program are lodging, meals, and bus rental. Funds will support meals for participants and guest speakers, vehicle usage and mileage, lodging, and materials and supplies. Program coordinators will utilize a coach bus to transport participants across the state. While several meals are usually donated by some of the companies visited, not all meals are covered and there are still mileage and fuel expenses, lodging, and supplies that need to be budgeted.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Robinson, Julie *Arkansas Future Ag Leaders Tour*

Year	2025/2026	**Project Year**	
Lead Investigator	Robinson, Julie	**Co-PI #1**	Ross, Jeremy
Co-PI #2		**Co-PI #3**	
Department	CES Community, Professional, & Economical Development		
Commodity Board	Soybean Promotion Board		
Project Title	Arkansas Future Ag Leaders Tour		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Robinson, Julie	Ross, Jeremy			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
	Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$0	$0	$0	$0	$0	$0	$0
Personnel Total	$0	$0	$0	$0	$0	$0	$0

Travel

Justify out-of-state travel in proposal.	Travel				Total	AES Portion	CES Portion
In-State	$5,000				$5,000	$0	$5,000
Out-of-State					$0	$0	$0
Travel Total	$5,000	$0	$0	$0	$5,000	$0	$5,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Robinson, Julie *Arkansas Future Ag Leaders Tour*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication					$0	$0	$0
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$0	$0	$0	$0	$0	$0	$0
	Total for Proposal	$5,000	$0	$0	$0	$5,000	$0	$5,000

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Soybean Science Challenge (SSC)
Lead Investigators: Dr. Julie Robinson
Co-Investigators: Dr. Jeremy Ross
Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): Ongoing
Research Areas: Education

Stated Goal: To engage Arkansas junior high and high-school science students and teachers in "real-world" Arkansas specific soybean science education through original curriculum and a continuum of educational methods that include classroom instruction, lab instruction, teacher workshops, teacher and student mentoring, online and virtual live-streaming education, individual and small group mentoring, student-led research and award recognition, and partnerships with state, regional, and national educators, agencies, and the media.

Specific Objectives:
1. Develop and deliver original educational resources/curriculum to Arkansas junior high and high school students.
2. Increase awareness and knowledge of the value of soybeans to the Arkansas economy and potential careers supporting Agricultural sustainability.
3. Increase knowledge of the diversity of soy products and uses.
4. Increase participation in applied research by Arkansas junior high and high-school students supporting soybean production.
5. Development of state-wide educational partnerships to leverage ASPB resources.
6. Actively engage students in the "co-creation" of knowledge and reward outstanding student researchers through the Soybean Science Challenge research awards.
7. Reach out to science teachers to consider using Soybean Science Challenge online education resources and curriculum in their classroom.
8. Encourage teachers, schools, and districts to develop/expand school and community-based gardens where students learn about agricultural crops and practices, nutrition, environmental stewardship, and sustainability.
9. Working with regional and national education and teacher organizations to bring Arkansas soybean research and education into classrooms across the USA.

Methods:
The Soybean Science Challenge is first and foremost a real-life "challenge" to students. Students progress through a multi-module online interactive course requiring the successful completion of learning challenges and quizzes to move to the next level. Pre-course and post-course quizzes quantitatively measure student learning. Students who successfully complete the online challenge (with a score of 80% or greater on all module quizzes and the post-test) will qualify to participate in the research challenge. Student research will be supported by vetted science-based resources, the Soybean Seed Store, and individual consultations with science teachers and students to provide personalized mentoring support. UA Division of Agriculture scientists have been instrumental in delivering customized and age-appropriate instruction and mentoring to Arkansas student scientists. This year's proposal includes reviewing and updating the current library of lessons and developing new lessons as needed in consultation with

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teachers. Teacher workshops will also be offered. Teachers will also be encouraged to utilize local farmers as guest speakers, and/or encourage farm visits (either virtually or, when possible, face-to-face) to see first-hand the production process. The Grow Your Own Protein project will continue to be marketed to schools and community gardens and managed in partnership with the Natural Soybean and Grain Alliance to educate Arkansas students and communities about the value of soy as a food product. The PI (Robinson) will share classroom discussion resources with County Extension Agents and producers, utilizing web sites (https://uaex.edu/soywhatsup and www.themiraclebean.com). These new educational products will be marketed to teachers utilizing Constant Contact electronic newsletters, the *soywhatsup* and *themiraclebean* websites, the ARSTEM and SCIENCE listservs, the Arkansas Science Teachers Association, regional educational cooperatives, through the AG in the Classroom and the National Science Teachers Association conferences, and through various school workshops at Arkansas STEM education centers and education service cooperatives. A key success strategy for the SSC has been to produce current and relevant content annually for students and teachers, while reviewing and leveraging state and national resources. The currency of content allows students to best connect with local farmers and learn about the importance of Arkansas agriculture to their community, region, and state.

The PI (Robinson) will provide leadership for this project, program planning, alignment with Next Generation Science standards, and production of educational and marketing materials. The program coordinator and project managers will administer the day-to-day work with teachers, students, and schools. The resources invested by the ASPB in the SSC are significantly leveraged by UA CES faculty support. The program budget includes funding for: an educational coordinator; hourly support for online course management, data management; and science fair judging and awards; IT and Communications Department direct costs associated with the planning, production and management of digital and printed products; supplies and expenses for educational outreach and staffed exhibits; co-sponsorship of the Arkansas ISEF-affiliated science fairs; travel to schools and science fairs, and expenses for teacher and student research awards. The Soybean Science Challenge (SSC) utilizes a diverse range of educational methods, supported by the production of original and re-purposed educational products. These products provide a range of learning opportunities for Arkansas junior high and high school science students, their teachers, and students and teachers across the nation. This project supports Arkansas STEM education goals, is aligned with the Next Generation Science Standards (NGSS), and engages junior high and high-school students in active learning and the co-creation of knowledge through support of applied student research, and soybean-based classroom lessons. The SSC online curriculum is peer-reviewed and updated annually. The online teacher courses and resources have been approved by the Arkansas Department of Education for professional in-service credit which is renewed annually.

Planned Milestones:

1. Formalization of a detailed project management and evaluation plan: April-May.
2. Creation and dissemination of new educational resources for students and teachers: June-November.
3. Direct communication, mentoring support, and instructions for Arkansas junior high and high school science students.

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4. Coordination of the 2026 Regional Science and Engineering Fair Sponsorships/Partnerships: Management responsibilities include creation and approval of agreements with all fairs, recruitment and support for judges, preparation for and presentation of student awards, development of press packets for statewide news releases and posting on the soywhatsup and the Miraclebean.com websites, and on social media, December 2025-May 2026. Statewide Science and Engineering Fair partners locations include: Northwest Arkansas Regional Science and Engineering Fair (UAF/Fayetteville); Northeast Arkansas Regional Science and Engineering Fair (ASU/Jonesboro); Central Arkansas Regional Science and Engineering Fair (UALR/Little Rock); Southeast Arkansas Regional Science and Engineering Fair (UAM-Monticello); OMRSEF (Hot Springs), the West Central Arkansas Science Fair (ASMSA-Hot Springs), and the Arkansas State Science Fair (UCA/Conway)
5. Promote availability of SSC to participate in school-based STEM nights.
6. Support and present at state K-12 education and agriculture/commodity board conferences and meetings, including the Arkansas Science Teachers Association Conference.
7. Ongoing collaboration with news media and community partners to leverage resources.
8. Management and utilization of program evaluation data to improve products and outcomes.

Value to Soybean Industry:
The Soybean Science Challenge makes agricultural sustainability relevant and meaningful for Arkansas junior high and high-school students. The success of this project speaks to a significant void that has existed for engaging, timely, and relatable curriculum and education for students that asks them to contribute to the discussion and to actively participate in scholarship that has real meaning. The greatest value to the soybean industry is that we are now “at the table” as youth are developing and applying their knowledge and skills. Students from across our state and nation are being challenged to understand the complexity of the evolving science regarding agricultural production, and to critically think about issues regarding food, fuel, feed, research, and agricultural sustainability that will directly impact their futures. Teachers can access our website and use our free educational resources. The opportunity exists to show teachers and students the value and importance of Arkansas agriculture and soybean production.

Budget Justifications/Explanation of Travel and Direct Costs:
The project has been streamlined as much as possible, to maximize impact while being efficient with resources. A request for an increase in personnel and travel expenses is proposed to help meet a proposed expansion of the in-state program.

In addition to providing online workshops to train teachers to use the curriculum resources, the SSC staff plan to travel to regional education cooperatives to share newly developed educational resources and strategies. In-state travel requested is more than previous years. This increase in in-state travel reflects an increase in the number of agriculture and education conferences and meetings attending, an increase in the number of school-based STEM night events projected to attend, and an increase in cost of travel related expenses (fuel, hotel, etc.).

In the past, the United Soybean Board and Communications Group provided soybean-related promotion items. However, USB and the Communications Group have limited quantities reserved for trade shows, events, and other meetings approved by the board each year. This leaves the USB and the Communications Group with little extra materials to share with the

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Soybean Science Challenge for students and teachers. Promotional items are a big recognition factor for the program and a good return on investment. The request for this funding category remains the same as last year's budget.

Personnel costs have increased, as we have been able to increase capacity with a full-time employee to manage the program. We have retained our educational coordinator, the previous SSC coordinator, to continue development of associated lesson plans for teachers. As the program grows, the number of hours required to implement the program has increased. Fringe benefits for full and part-time employees have also increased, which is reflected in the budget.

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Robinson, Julie *Soybean Science Challenge*

Year	2025/2026	**Project Year**	
Lead Investigator	Robinson, Julie	**Co-PI #1**	Ross, Jeremy
Co-PI #2		**Co-PI #3**	
Department	CES Community, Professional, & Economical Development		
Commodity Board	Soybean Promotion Board		
Project Title	Soybean Science Challenge		

Version: 7.0 (11/01/2024)

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Robinson, Julie	Ross, Jeremy			Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES	CES					

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
Soybean Science Cha	Keith Harris	50%	$26,100				$26,100	$0	$26,100
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Subtotal: Salaries		$26,100	$0	$0	$0	$26,100	$0	$26,100

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.

Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
						$0	$0	$0
Tuition Calculator Information						$0	$0	$0
Subtotal: Graduate Student		$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel	$20,000				$20,000	$0	$20,000
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$20,000	$0	$0	$0	$20,000	$0	$20,000

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.

	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$7,465	$0	$0	$0	$7,465	$0	$7,465
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$1,460	$0	$0	$0	$1,460	$0	$1,460
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$8,925	$0	$0	$0	$8,925	$0	$8,925
Personnel Total	$55,025	$0	$0	$0	$55,025	$0	$55,025

Travel

Justify out-of-state travel in proposal.

	Travel				Total	AES Portion	CES Portion
In-State	$6,000				$6,000	$0	$6,000
Out-of-State					$0	$0	$0
Travel Total	$6,000	$0	$0	$0	$6,000	$0	$6,000

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University of Arkansas System Division of Agriculture

Promotion Board Budget

Robinson, Julie *Soybean Science Challenge*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies	$24,000				$24,000	$0	$24,000
	Fertilizer/Chemicals					$0	$0	$0
	Publication	$500				$500	$0	$500
	Statistical Consulting					$0	$0	$0
Other Direct Costs						$0	$0	$0
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$24,500	$0	$0	$0	$24,500	$0	$24,500
	Total for Proposal	$85,525	$0	$0	$0	$85,525	$0	$85,525

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Arkansas Soybean College

Lead Investigators: Jeremy Ross and other selected Division Soybean Commodity Committee Members

Co-Investigators:

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New

Research Areas (Agronomy/Alternative, Breeding, Economics, Education, Entomology, Fertility, Irrigation, Plant Pathology, Post-Harvest, Verification, Weeds): Education

Stated Goal: To educate soybean producers, consultants, and industry personnel with hands-on training about the newest agronomic and pest management recommendations for soybean production.

Specific Objectives:

1. Educate clientele on the latest agronomic recommendations for soybean production in Arkansas.
2. Increase awareness of the impact of soybean insects and diseases can have on soybean production.
3. Provide producers, consultants, and other decision-makers with the proper tools to make decisions on insect and disease pest in their fields.
4. Overall improvement of soybean insect and disease pest management in soybean production in Arkansas and increase the adoption of IPM in soybean production.

Methods:

1. Every three years, the University of Arkansas System Division of Agriculture holds the Soybean College to educate producers, consultants, and industry personnel on current soybean recommendation topics including irrigation management, pest identification and management, and fertility practices. The Soybean College is an opportunity to have hands-on training for our clientele.
2. If funded, this grant would provide participants in the Soybean College tools such as sweep nets, hand lens, and seed depth tools to promote proper insect/disease management and other agronomic practices.

Planned Milestones:

1. Put the sampling tools needed in the hands of our producers and other decision-makers to promote effective and economical insect/disease management decisions and other agronomic decisions.
2. Educate our clientele on the proper management techniques for insect/disease control and increase awareness of IPM.

Value to Soybean Industry: In 2016, the University of Arkansas System Division of Agriculture hosted the first Soybean College. Despite the adverse weather, 126 individuals participated in the Soybean College, and had the opportunity to experience hands-on training on multiple topics. Training areas included disease and insect identification and control, irrigation technology, soybean growth and development, new herbicide technologies, herbicide symptomology, and chloride toxicity recommendations. Participants left the College with a better understanding of current recommendations

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and soybean production in Arkansas. If funded, this grant will be used to provide tools for scouting of insects and diseases, and education publications for further education of participants.

Budget Justifications/Explanation of Travel and Direct Costs:

Proposed Budget for Arkansas Soybean College

Item	Cost	Quantity	Total $
Sweep Nets (Great Lakes IPM; 200 Sweep Nets)	$42.35	200	$8,470.00
Hand lenses (Indigo Instruments; 200 15X Magnifier w/ 2 logos)	$8.40	200	$1680
Bottle Bag (Allegra; 200 w/ logo)	$1.76	200	$352
Survival Multi Tool (Allegra, 200 w/logo)	$3.15	200	$630
Summer Bucket Hat (Allegra, 100 w/logo)	$13.75	100	$1,375
Shipping (Alegra)			$210
Publications/Printing Cost			$1000.00
		Total	**$13,717.00**

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Ross, Jeremy *Arkansas Soybean College*

Year	2025/2026	**Project Year**	New	**Version: 7.0 (11/01/2024)**
Lead Investigator	Ross, Jeremy	**Co-PI #1**		
Co-PI #2		**Co-PI #3**		
Department	CSES Crop, Soil, Environmental Science			
Commodity Board	Soybean Promotion Board			
Project Title	Arkansas Soybean College			

Budgets are requested in separate columns if separate Worktags for AES and CES will be needed.

Budget for Personnel

	Ross, Jeremy				Total Board Funding Requested	AES Portion	CES Portion
Select "AES" or "CES" for each PI	CES						

Fulltime Personnel

Position Title	Name *(if position is filled)*	% Time	Salaries				Total	AES	CES
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
		Subtotal: Salaries	$0	$0	$0	$0	$0	$0	$0

Graduate Student

Tuition to be budgeted in the same ratio as GA stipend time, e.g., full time GA stipend, full year's tuition.	Name *(if position is filled)*	% Time	Wages				Total	AES Portion	CES Portion
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
							$0	$0	$0
	Tuition Calculator Information						$0	$0	$0
		Subtotal: Graduate Student	$0	$0	$0	$0	$0	$0	$0

Hourly

	Wages				Total	AES Portion	CES Portion
Hourly-Personnel					$0	$0	$0
Hourly-Students					$0	$0	$0
Subtotal: Hourly	$0	$0	$0	$0	$0	$0	$0

Fringe Benefits

Fringe benefits are calculated when salary and wage amounts are entered above.	Benefits				Total	AES Portion	CES Portion
Fulltime Personnel	$0	$0	$0	$0	$0	$0	$0
Graduate Students	$0	$0	$0	$0	$0	$0	$0
Hourly Personnel	$0	$0	$0	$0	$0	$0	$0
Hourly-Students	$0	$0	$0	$0	$0	$0	$0
Subtotal: Fringe Benefits	$0	$0	$0	$0	$0	$0	$0
Personnel Total	$0	$0	$0	$0	$0	$0	$0

Travel

Justify out-of-state travel in proposal.	Travel				Total	AES Portion	CES Portion
In-State	$1,000				$1,000	$0	$1,000
Out-of-State					$0	$0	$0
Travel Total	$1,000	$0	$0	$0	$1,000	$0	$1,000

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University of Arkansas System Division of Agriculture
Promotion Board Budget

Ross, Jeremy *Arkansas Soybean College*

		Maintenance & Operations						
		M&O				Total	AES Portion	CES Portion
	Supplies					$0	$0	$0
	Fertilizer/Chemicals					$0	$0	$0
	Publication	$1,000				$1,000	$0	$1,000
	Statistical Consulting					$0	$0	$0
Other Direct Costs	Promotional Items/Tools	$12,717				$12,717	$0	$12,717
Station Maintenance	SAREC, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	CTST, Marianna	$0	$0	$0	$0	$0	$0	$0
	Lonoke County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	NERE, Keiser	$0	$0	$0	$0	$0	$0	$0
	NERREC, Harrisburg	$0	$0	$0	$0	$0	$0	$0
	Jackson County Ext. Center	$0	$0	$0	$0	$0	$0	$0
	PTST, Colt	$0	$0	$0	$0	$0	$0	$0
	RIRE, Stuttgart	$0	$0	$0	$0	$0	$0	$0
	Rosen Center	$0	$0	$0	$0	$0	$0	$0
	SEST, Rohwer	$0	$0	$0	$0	$0	$0	$0
	SWRE, Hope	$0	$0	$0	$0	$0	$0	$0
	VGSS, Kibler	$0	$0	$0	$0	$0	$0	$0
	FRSS, Clarksville	$0	$0	$0	$0	$0	$0	$0
	LFST, Batesville	$0	$0	$0	$0	$0	$0	$0
	CSES Greenhouse, Fayetteville	$0	$0	$0	$0	$0	$0	$0
	M & O Total	$13,717	$0	$0	$0	$13,717	$0	$13,717
	Total for Proposal	$14,717	$0	$0	$0	$14,717	$0	$14,717

Budget errors delay submission of your proposal. Any proposal submitted with errors in the budget cannot be guaranteed accurate presentation for funding. Please check budgets for accuracy.

Fringe Benefit Rates (as of 7/1/2022)				
Campus	Fulltime	Temp/Hourly	Graduate	Student
AES	28.60%	7.30%	5.10%	0.10%
CES	28.60%	7.30%	5.10%	0.10%

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Sarah Huckabee Sanders
Governor

ARKANSAS DEPARTMENT OF AGRICULTURE

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agriculture.arkansas.gov
(501) 225-1598

Wes Ward
Secretary of Agriculture

January 31, 2025

ATTACHMENT 4

Arkansas Soybean Promotion Board
Promotion Request: 2025 NASDA Annual Meeting

State the goals and objectives of the promotional activity.
The National Association of State Departments of Agriculture's (NASDA) president, Arkansas Agriculture Secretary Wes Ward, requests your support of the upcoming 2025 NASDA Annual Meeting, September 14 through September 17 in Rogers, Arkansas. NASDA is a nonpartisan, nonprofit association that represents the elected and appointed commissioners, secretaries and directors of the departments of agriculture in all fifty states and four U.S. territories. NASDA enhances American food and agricultural communities through policy, partnerships and public engagement.

During the 2025 Annual Meeting, local partners receive access to an unprecedented level of networking with over 350 agricultural leaders advancing agriculture at the state, regional and federal levels. The success of this national event is dependent upon local partners.

State the expected benefits to the Arkansas industry from the proposed promotional efforts.
Hosted in Northwest Arkansas, the 2025 NASDA Annual Meeting will provide many opportunities to highlight Arkansas agriculture and will also be a great opportunity to gain insights on critical issues affecting the agriculture industry. There will be opportunities to engage with producers and leaders from local, state and national levels. Opportunities to showcase the importance of soybean production to the state's economy and its impact on the global market.

Seek to promote generic commodity and non-specific business entities.
Arkansas is serving as the host state for this year's Annual Meeting. The team at the Arkansas Department of Agriculture is working with NASDA staff and vendors in Northwest Arkansas to highlight Arkansas products and incorporate Arkansas commodities into the menu. Our goal is to serve Arkansas grown and made whenever possible.

Include a budget and explain how the entity will be accountable for its use of the requested funds.
The Arkansas Department of Agriculture respectfully requests $2,500 in funding to support the 2024 NASDA Annual Meeting. All funds will go to the general sponsorship fund that will support the meeting. Sponsorship dollars will be used to highlight and showcase Arkansas through meals, off-site tours, regional dinners, plenary sessions, among other events. We look forward to elevating the Arkansas soybean industry and raising awareness of its impact through Arkansas and the world.

ATTACHMENT 5

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

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DETERMINING THE IMPACT OF FUNGICIDE APPLICATION ON SOYBEAN

AGENT
BRADY HARMON

COUNTY
JEFFERSON

METHODS
A large block fungicide trial was arranged in a randomized complete block design, planted on 38-inch rows with each fungicide treatment replicated three times,and a non-treated control included in each replication. Fungicides (Miravis Top @ 13.7 fl oz/A and Revylok @ 6.5 fl oz/A) were applied at R3 on 2024-06-12 with a 30ft boom mounted on a ground-driven sprayer in a total water volume of 10 gal/A at 40 psi using TeeJet XR11002VS tips at 5.0 mph. A drone sprayer was also used to apply fungicide treatments at 2 gal/A using atomizer nozzles. Five points were georeferenced approximately equidistant throughout each block for foliar disease assessments. Disease severity was based on visual observation where 0 = no disease and 9 = severe disease. Data were collected at an approximate 5-foot radius around each point. Diseases were assessed prior to treatment and through R6. The grain was harvested 2024-08-26 with a commercial combine and weigh wagon. Yields were adjusted to 13% moisture content for comparison. Seed samples were collected from the weigh wagon at harvest and stored in plastic bags, labeled by plot, and transported to the Monticello laboratory for evaluation. Grain was rated for diseases and disorders that impact grain quality as a percentage of the subsample collected (~ 600 seed) from the total grain sample (~ 1 gallon) on a percentage scale. In addition, the grain was also rated for percentages of insect damage and grain with no visual defects (normal) were recorded. Yield and all disease data were averaged within each fungicide block, and analyzed by ANOVA followed by means separation of fixed effects using Fisher's least significant difference test (LSD) at P=0.05.

RESULTS
- Cercospora leaf blight and Target spot were rated at growth stage R6. Product efficacy against these diseases can be seen in Tables 1. Plots 6 & 7 were omitted from the analysis due to a suspected irrigation issue and soilborne disease.
- Overall, foliar disease incidence and severity were low in the test area throughout the year. However, some diseases impacting grain quality were present. Fungicide numerically reduced Phomopsis seed decay and significantly reduced purple seed stain, wrinkled grain, as well as the overall levels of diseased grain (Table 2).

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- Yield averaged 78.67 across the test and was not significantly different (P = 0.8714) among treatments. There was a high degree of yield variability among treatments so the numerical differences presented here should be viewed cautiously.
- Based on these results, a fungicide application may not have added value to the crop above the application cost with respect to yield. However, the improvement in grain quality may have been economically significant.
- The results from the drone sprayer were positive, even though the product was applied at a lower than ideal water volume. More research is needed to understand the impacts of fungicide applications on foliar diseases using drone sprayers.

Table 1. Treatment effects of a SOYBEAN foliar fungicide trial conducted in JEFFERSON County in 2024 are summarized in the table below. Miravis Top was applied at 13.7 fl oz/A and Revylok was applied at 6.5 fl oz/A with a ground sprayer (MM) and drone sprayer (D).

TRT	YLD	CLB	CLB_RNK	TLS	TLS_RNK
REVYLOK_D	87.6	1.0	5.5	0.6	6.0
MIRAVIS_TOP_D	85.3	1.0	5.5	1.0	9.2
REVYLOK_MM	84.2	1.7	9.5	0.6	6.2
NONTREATED	80.0	1.8	8.0	1.3	10.5
MIRAVIS_TOP_MM	77.1	1.0	5.5	0.3	3.5
MEAN	82.3	1.3	7.0	0.8	7.0
CV	7.87	48.66	48.71	74.39	53.77
PR(>F)	0.4805	0.5868	0.7407	0.2343	0.227
LSD	11.25	1.25	6.72	0.89	5.97
MSE	42.29	0.52	15.07	0.26	11.89

Table footnotes. Abbreviations are as follows: CLB = Cercospora leaf blight, TLS = Target spot, CV = coefficient of variation (%), PR(>F) = probability of greaterF from analysis of variance (ANOVA). A value at or below 0.05 indicates that the treatments may be different.LSD = Least significant difference at P=0.05, MSE = mean squared error [a]YLD = Yield reported as bushels per acre.[b]Diseases were rated on a 0-9 scale where a rating of 9 indicates the most severe disease. [c]Rank transformationof categorical disease data. [d]Mean separation of treatment yields and disease ratings can be undertsood using the provided LSD value. Means are significantly different if their difference is greater than the LSD value. Ranks are a more precise way to determine if the treatment means for the diseases are different.

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Table 1. Treatment effects of a SOYBEAN foliar fungicide trial on diseases that impact grain quality are summarized in the table below. Miravis Top was applied at 13.7 fl oz/A and Revylok was applied at 6.5 fl oz/A with a ground sprayer (MM) and drone sprayer (D).

TRT	Phom	PSS	FLS	Insect	Wrinkled	SC Cracked	SC Split	Immature	Green	Splits	Heat	Germ	SVC	Normal	Dis	Wx
NONTREATED	1.2	2.3	0.1	5.9	18.3	1.4	4.7	1.6	0.2	1.7	0.2	0.4	0.0	61.9	3.7	24.9
REVYLOK_D	0.9	1.3	0.2	8.3	12.2	1.3	4.6	1.1	0.3	1.1	0.6	0.1	0.0	68.0	2.4	18.9
MIRAVIS_TOP_D	0.6	1.8	0.2	3.0	13.5	1.4	6.0	2.3	0.2	1.6	0.2	0.2	0.0	69.0	2.5	21.3
MIRAVIS_TOP_MM	0.6	1.1	0.1	4.5	15.6	1.2	3.2	3.0	0.0	1.6	0.6	0.5	0.0	68.0	1.9	21.1
REVYLOK_MM	0.6	1.2	0.1	4.2	9.4	0.7	4.4	2.2	0.3	1.9	0.1	0.5	0.0	74.5	1.8	15.1
MEAN	0.8	1.5	0.1	5.2	13.8	1.2	4.6	2.1	0.2	1.6	0.3	0.3	0.0	68.3	2.5	20.3
CV	127.64	70.16	203.55	73.1	45.98	74.04	66.83	72.69	187.25	50.3	160.91	130.7	0.0	10.63	67.5	27.64
PR(>F)	0.5926	0.0711	0.8835	0.0172	0.0143	0.4356	0.284	0.071	0.472	0.3436	0.1223	0.1238	0.0	0.0037	0.1038	0.0021
LSD	0.69	0.68	0.2	2.22	3.59	0.58	1.74	0.95	0.25	0.53	0.36	0.3	0.0	4.19	1.07	3.22
MSE	1.03	1.03	0.09	10.81	28.23	0.73	6.61	1.97	0.14	0.63	0.28	0.19	0.0	38.63	2.52	22.8

Table footnotes. Column headers are as follows: Phom - Phomopsis seed decay, PSS - purple seed stain, FLS - frogeye leaf spot, Insect - insect damaged, Wrinkled - seed coat wrinkled, SC Cracked - seed coat cracked, SC Split - seed coat split, Immature - not properly developed, Green - green and not mature, Splits - split grain, Heat - heat damaged, Germ - germinated, SVC - soybean virus complex, Normal - grain with no visible damage, Dis - total percentage of grain with damage, Wx - weather damaged, CV = coefficient of variation (%), PR(>F) = probability of greater F from analysis of variance (ANOVA). A value at or below 0.05 indicates that the treatments may be different. LSD = Least significant difference at P=0.05, MSE = mean squared error [a]All data reported as the percentage of the subsample (~ 600 seed) from each treatment. [b]Means are significantly different if their difference is greater than the LSD value.

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WEATHER DATA

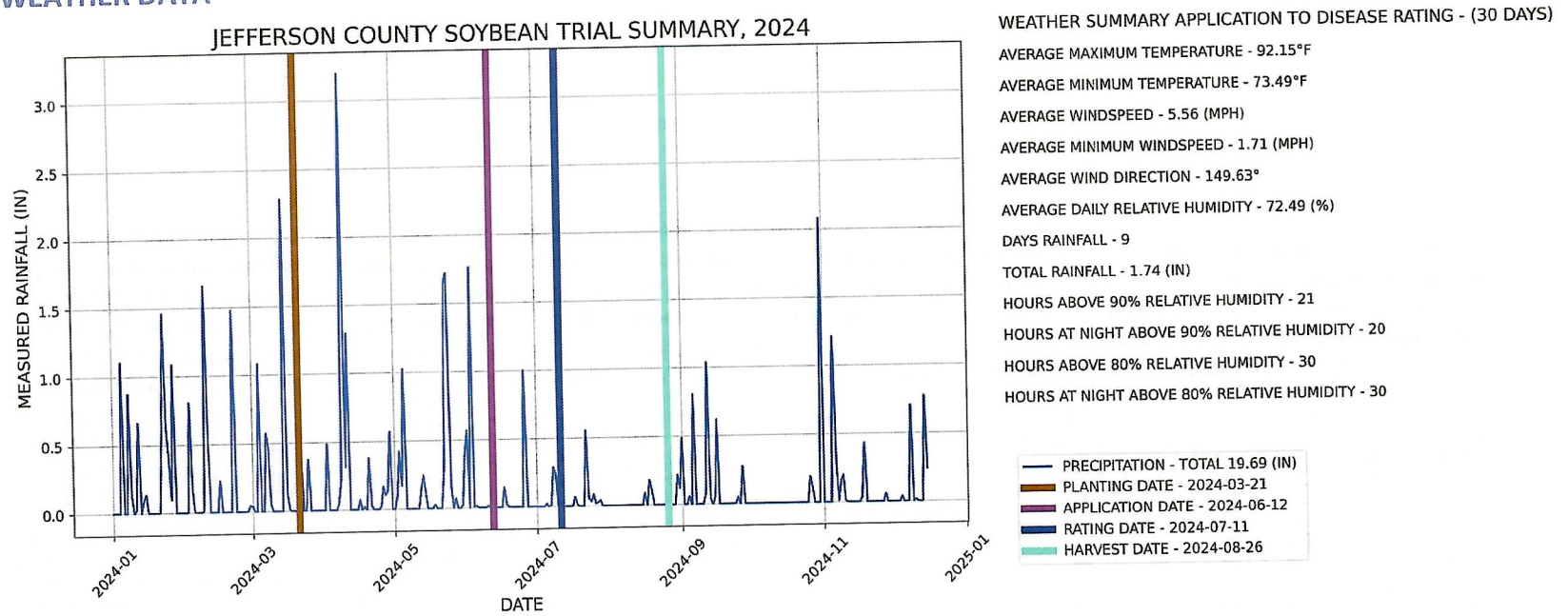

Figure 2. The field received a little over 19 inches of rainfall from the beginning of the year to the time this report was completed. Approximately 1.74 inches of that rainfall fell from the time of fungicide application to the time disease levels were determined. During this time, the prevailing wind direction was from the southeast (149.63°) with an average wind speed of 5.5 mph and minimum average wind speed of 1.71 mph. The somewhat constant air movement and low rainfall during the reproductive stages are typical of weather that is not conducive for foliar disease development. Weather data was downloaded from: https://connect.doit.wisc.edu/weather-tool/.

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IMAGES

Figure 3. Disease images. [A] Image across the top of the canopy showing scattered foliar symptoms of taproot decline. [B] Foliar symptoms of taproot decline. [C] Target spot. [D] Low levels of Cercospora leaf blight.

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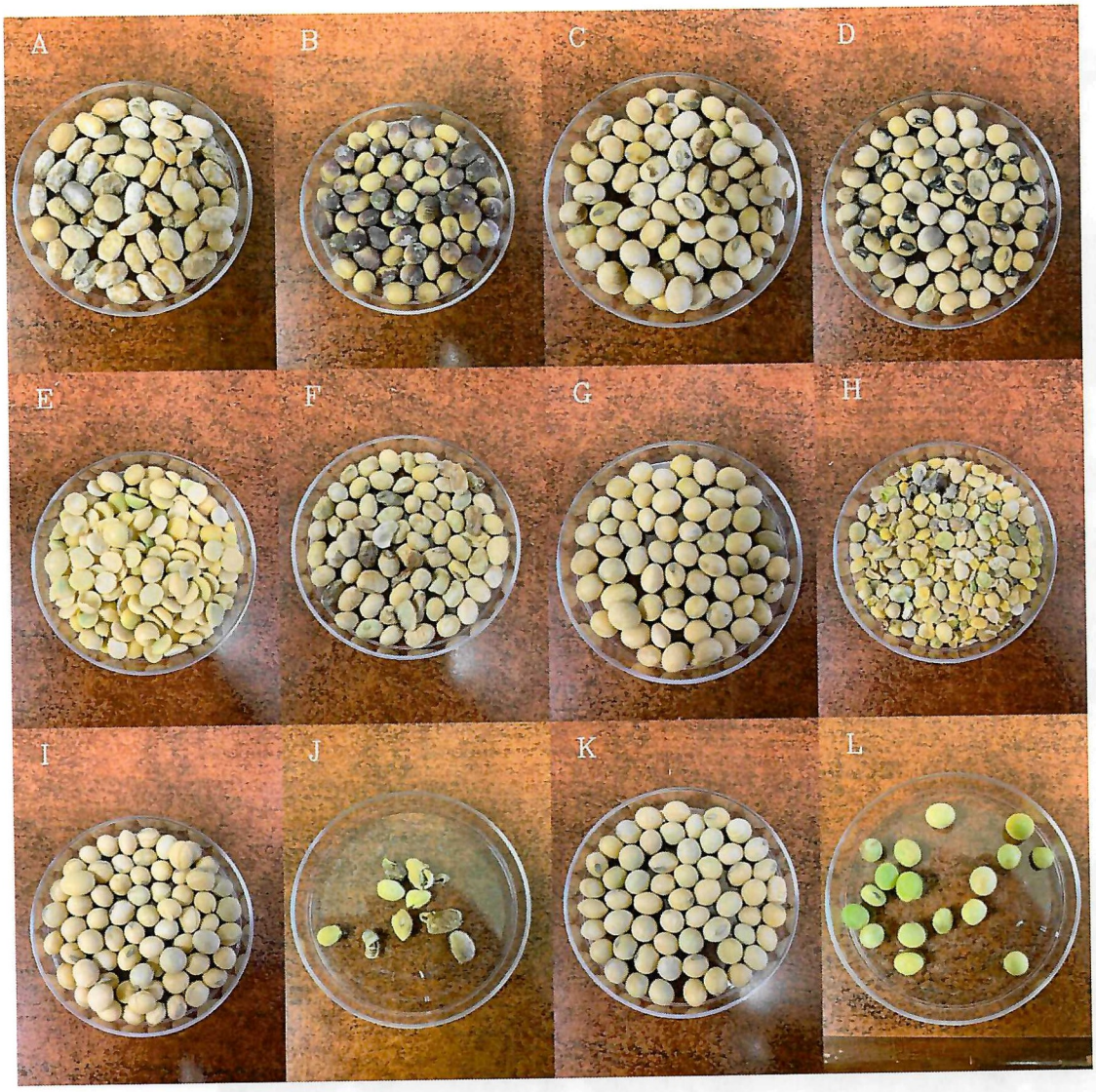

Figure 4. Images of disease and disorders of grain determined in this trial.[A] Phomopsis seed decay, [B] Purple seed stain, [C] Frogeye leaf spot, [D] Soybean virus complex, [E] split grain, [F] insect damaged, [G] heat damaged, [H] immature (not properly developed), [I] seed coat cracked, [J] germinated, [K] seed coat wrinkled, [L] green.

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PLOT MAP AND DRONE DATA

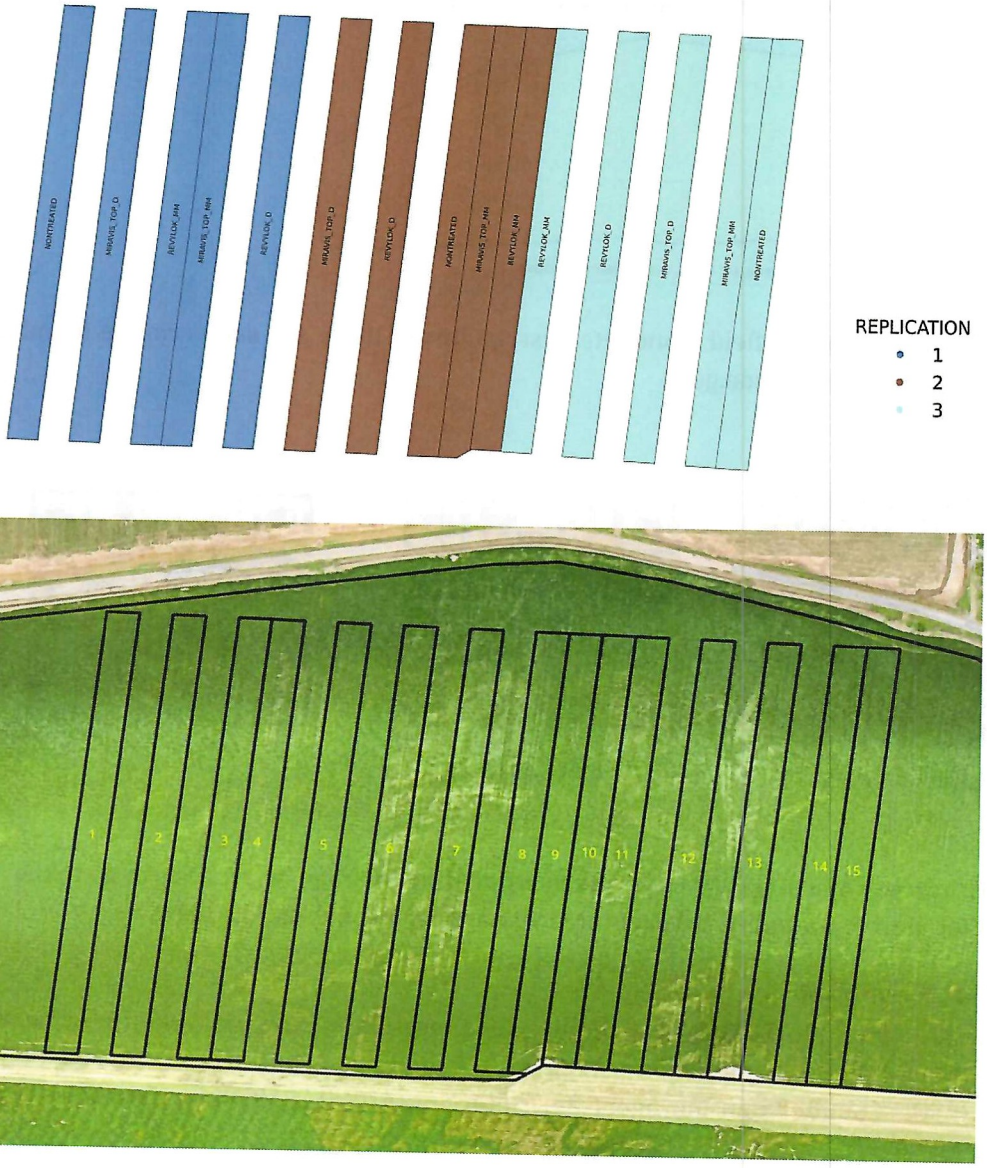

Figure 5. Plot map and drone image indicating the trial design. Buffers were placed on either side of the drone sprayed fungicide treatments. Plots 6 & 7 were omitted from the analysis due to a suspected irrigation issue and soilborne disease. There was a significant amount of taproot decline in this trial.

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SOILS DATA

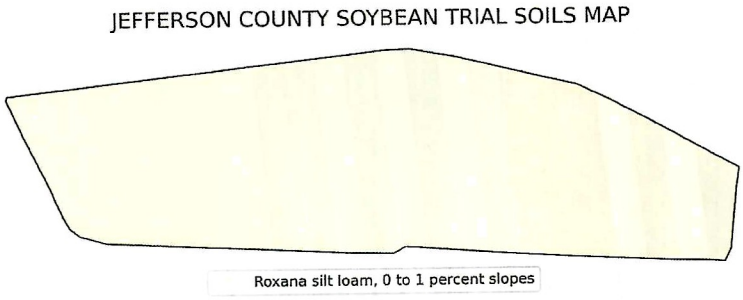


Figure 6. Soils map of the field. Complete descriptions of these soil series can be found at https://soilseries.sc.egov.usda.gov.

HELPFUL LINKS

Figure 7. Scan any one of the QR codes above using the camera on yourphone to go to the websites for more information on integrated managment of soybean diseases.

ACKNOWLEDGEMENTS

We thank SANDERS FRAZIER for providing a field location for the trial and the Arkansas Soybean Promotion Board for generously providing funding for this project. We also thank the JEFFERSON County Extension Agent-Agriculture, BRADY HARMON, for assistance with the trial.

Arkansas Soybean Promotion Board – 2025-2026 Proposal

Title: Soybean Nutrition Education Through Cooking Lessons/Schools

Lead Investigators:

Leigh Ann Bullington - Instructor lbullington@uada.edu (870)919-6109

Keith Statham-Cleek – Instructor kcleek@uada.edu (901)268-5046

University of Arkansas System Division of Agriculture Research and Extension Family and Consumer Sciences

Status (i.e., New, Year 2 of 3, Year 2 of 2, etc.): New

Promotional / Educational Activity

Stated Goal:

Potential market expansion through increased knowledge gain and acceptance of the benefits of including whole soy foods in a healthy diet.

Specific Objectives:

Expand education in support of the adoption and acceptance of preparation skills and consumption of whole soy foods in Arkansas diets

1. Increase the public's knowledge of the nutritional benefits of including soy in a healthy diet.
2. Increase confidence and develop the skills needed by home cooks to prepare and include whole soy foods in their day-to-day meal preparation.

Methods:

Dissemination of educational materials through research-based cooking schools taught by professional Extension educators and professionally produced instructional demonstration videos featuring local Extension Educators through UADA Website and Social Media Outlets

1. Creation of the research-based *Cooking Arkansas Whole Soy Foods Cooking School* lessons Cooking schools / Train the trainer with targeted UADA County Family and Consumer Sciences (FCS) Extension Agents will be held.

2. Community based cooking schools in targeted counties taught by trained county Family and Consumer Sciences (FCS) Extension Agents using the research-based *Cooking Arkansas Whole Soy Foods Cooking School* lessons

3. Production of instructional videos for a target audience of Arkansas home cooks using the research-based Cooking Arkansas Whole Soy Foods Cooking School to be housed on the UADA YouTube Channel to be linked to the Arkansas Soybean and Promotion Board Website. These professionally produced video will feature trained County FCS Extension Agents from various targeted counties.

4. Dissemination on UADA social media outlets of promotional / educational projects, materials, and events created.

5. Creation and publication of new research based nutritious and delicious whole soy food recipes with an eye for the palate of Arkansans.

Planned Milestones:

First Quarter

- Recipes and lessons will be developed and printed.
- News releases will be prepared by UADA communications department.
- UADA graphic designers will design flyers and social media templates promoting cooking schools and instructional videos.
- Promotional items (aprons, totes, etc.,) will be designed and purchased.
- Social media graphs will be developed with content relating to lesson materials

Second Quarter

- Eight (8) agents will be trained to conduct community-based programs in their counties and serve as mentors to assist neighboring counties.
- Trained agents may co-teach in pairs in each of their respective counties, a minimum of 5 and a maximum of 12 students per class in whole soy food cooking schools. Projected reach of 40 - 96 community members with a minimum of one class conducted per county.

Third Quarter

- Planning and management of community cooking schools.
- Planning and management of instructional video development.
- Planning and management of social media educational and promotional campaigns.

Fourth Quarter

- Planning and management community cooking schools.
- Planning and management of instructional video development.
- Planning and management of social media educational and promotional campaigns.
- 3-month program evaluation with cooking school participants.

Year Long

- Three (3) instructional videos will be produced, highlighting a different technique needed to prepare a whole soy food recipe.
- Process and outcome evaluations will be conducted through collection of participant data, and through social media and other digital channels metrics. Digital effectiveness will include number of views, downloads, comments, shares, and reactions and behavior change.

Value to Soybean Industry:

Showing the impact of including whole soy foods in the diets of Arkansans will be a great benefit to the soybean industry. Often the mere mention of soy foods conjures up an image of the ill tasting soy burgers we consumed as children in the school cafeteria. Soy foods are not only nutritious but are also delicious. UADA – FCS will be focused on providing that educational content and message to Arkansans to change that image.

County Family and Consumer Sciences (FCS) department and County Extension Agents (CEA) with the University of Arkansas System Division of Agriculture (UADA) are trained educators. We have the background, knowledge, and experience to conduct trusted research-based nutrition education. We have FCS programing in all 75 Arkansas Counties and our mission is to improve the quality of life of Arkansans. We have the capacity to reach Arkansas through our unique community-based volunteer networks. These volunteers regularly seek educational opportunities and trusted research-based information conducted by UADA FCS County Extension Agents. This experience and capacity will provide a great opportunity to extend and expand education and knowledge of the benefits of including whole soy foods in a healthy diet for Arkansans to a potentially large number of consumers over time.

Hands-on training opportunities have historically been one of the best received and effective educational methods conducted by UADA. County Extension Agents – FCS have long taught hands-on healthy cooking and food preparation classes on a wide variety of topics.

FCS - CEAs are accustomed to collecting data and evaluating programs on a regular basis. Evaluation results and digital metrics will be provided to measure and report the impact of cooking schools and instructional videos.

Budget Justifications/Explanation of Travel and Direct Costs:

Receipts and justifications will be provided to the Arkansas Soybean Promotion Board however requested.

Budget Category	Amount
Wages	$3,000
Fringe	$219
Personnel Total:	**$3,219**
Travel	$5,500
Supplies	$12,750
Other Direct Costs	$6,000
GRAND TOTAL	**$27,469**

Personnel: **Work only When Needed (WOWN) Worker**

Wages Subtotal = $3000

Personnel budget justification: Personnel costs were calculated for a part time work only when needed (WOWN) that will assist with project coordination including planning and promotion at local levels, correspondence and follow up, procurement assistance, event set-up, and prep.

150 hours @ $20 per hour = $3,000

Fringe Subtotal = $219

Fringe budget justification: Current UADA Fringe was calculated at 7.30% of wages

Travel*:* **Subtotal = $ 5,500**

Out of pocket expenses, per diem expenses (hotel and meals) and mileage for travel for PIs, WOWN and eight (8) FCS agents to attend and support of project planning and management, testing, education, and meetings. (e.g., including vehicle mileage at .52 per mile)

Supplies: **Subtotal=$12,750**

Food Product Supplies $5,000

Including: soy milk, tofu, soy nuts, edamame, dried soybeans, fruit, vegetables, seasoning and flavoring, bottled water, and other ingredients for training sessions and community cooking schools

Food Service / Tasting Supplies $750

Including plastic plates and utensils, tasting cups and lids, serving dishes and utensils, paper goods, cleaning, and sanitizing items for eight agents and 50 participants.

Cooking Equipment and Utensils $3,500

Including Tofu press, backing trays, silicone mats, induction burners and skillets and stock pots, misc. cooking bowls, misc. utensils, surge protectors, and storage totes for eight agents

Educational Incentives and Promotion Items $3,500

Including participant tofu presses, aprons, and totes targeting 50 participants and eight FCS agents.

Other Direct Costs:

Project Publications/Printing **Subtotal = $2,000**

Publications for Target Audiences including FCS Agents, Consumers, Farmers / Producers, and Students

Publications may include educational and promotional flyers, recipes, lesson guides, handouts, and displays

Video Production / Communications **Subtotal = $4,000**

Filming and editing 3 instructional videos on whole soy foods cooking methods. Graphic design development for educational, promotional, social media, materials, flyers, and posts.

Total Budget Requested - $27,469

ATTACHMENT 7

UADA Cooperative Extension Service, Poinsett County

Project Title: Ag Day

Project Director: Christie Wagley

Project Dates: October 14, 2025

Project Description and Details: (Background; need, location, participants, etc.)

Ag Day is held annually at the Main Street Learning Park in Harrisburg, Arkansas. Ag Day is an educational activity for 2nd and 3rd graders, hosted by the Poinsett County Extension Service which highlights local agricultural industries and practices. This event typically reaches 250-350 youth, predominately from Poinsett County.

Ag Day was developed to provide youth participants with an informal hands-on experience that educates youth about the products that our agricultural commodities provide, and the role that agricultural industry plays in our local economy. Students rotate through ten stations with activities such as hulling rice, sampling soy milk and roasted soy nuts, and getting to see and touch crops grown in Poinsett County (rice, soybeans, grain sorghum, corn, peanuts and cotton), a chance to milk a cow with the Farm Bureau cow simulator, drone demonstrations and beekeeping tips.

Project Budget Details:

(explain/justify your costs not just numbers but some narrative, provide quote as attachment)

Item	Estimated Cost	Narrative
Participant T-shirts	$3, 219.33	Each Ag Day participant will receive a screen-printed t-shirt to wear at Ag Day (with soybean and 4-H promotional messaging). T-shirts will be delivered prior to the event so that participants will have shirts to wear for Ag Day and afterwards.
Participant Water Bottles	$1,035.27	Each Ag Day participant will receive a clear water bottle (with soybean & 4-H promotional messaging) Providing clear water bottles will allow for hydration at the event and the ability to reuse water bottles in school

		throughout the reminder of the year.
Participant Goody Bags	$560.46	Each Ag Day participant will receive a goody bag (with soybean and 4-H promotional messaging) containing donated promotional items from local agricultural partners.
TOTAL	****$4, 815.06***	****quoted prices as of 1/23/25***

ATTACHMENT 8

Arkansas Soybean Research and Promotion Proposal

Mission Statement:
The Agriculture Learning Center at the Four States Fairgrounds is dedicated to promoting and educating the non-rural public on the importance of agriculture. Through engaging experiences and a focus on Arkansas Commodities, including soybeans, we highlight the significance of agriculture in our daily lives and its role in sustaining our communities.

Key Objectives:

- **Enhancing Agricultural Education:**
  Providing local schools with quality, hands-on learning opportunities to foster understanding and appreciation of agriculture.
- **Promoting Arkansas Commodities:**
  Emphasizing the economic and cultural importance of commodities like soybeans in Arkansas and beyond.
- **Connecting Communities:**
  Building a bridge between rural and non-rural audiences, inspiring curiosity and respect for the agricultural industry.

Vision for the Future:
By collaborating with educators, industry professionals, and community members, the Agriculture Learning Center aims to inspire the next generation of agricultural leaders and advocates. Our vision extends beyond food to include all aspects of life influenced by agriculture, such as housing, clothing, and sustenance. We strive to cultivate an understanding of how agriculture impacts every facet of our daily lives, from the materials that build our homes to the fibers that make our clothes, and the food that nourishes our families.

Project Overview

In 2024, the Ag Learning Center at the Four States Fairgrounds has continued to grow and thrive through strong community partnerships. These collaborations have allowed us to develop new games and hands-on activities, enriching the educational experiences we provide to young minds in our community.

We have found that engaging students through interactive, sensory-based learning helps them retain and understand the information more effectively. Our approach—"hear it, see it, do it"—ensures that students are actively involved in lessons. At the Ag Learning Center, we emphasize hands-on activities focused on rice and its by-products, teaching students about their significance in everyday life.

During classroom field trips, we explore the diverse products derived from soybeans, along with other commodities, discussing their uses and nutritional value. Students participate in activities such as identifying soybean-based products and by-products, as well as those from other key agricultural commodities. This

makes learning more dynamic and memorable. The hands-on approach has proven to be far more impactful than traditional reading-based methods, creating a fun and engaging experience for students of all ages.

From June to December 2024, we reached over 15 schools and nearly 700 students ranging from Preschool to High School, through field trips and outreach programs. Teachers have been highly responsive to these initiatives, and many have already scheduled future visits with us. The success of these programs reinforces our belief in the importance of providing interactive agricultural education.

The Ag Learning Center's dedicated staff, along with the support of community leaders and enthusiastic volunteers, is committed to the success of this program. Together, we are shaping a brighter future by fostering a deeper understanding and appreciation of agriculture among the next generation.

Project Details – Goals and Objectives

The Ag Learning Center continues to focus on promoting education about Arkansas-grown commodities, with a particular emphasis on soybeans, while incorporating hands-on activities and community involvement. Our goals and objectives for 2024 are outlined below:

Goal 1 – Educate students and adults on the importance of the soybean industry and other commodities.

- Incorporate hands-on activities and lessons.
- Develop engaging projects and educational exhibits.
- Add new interactive learning games to enhance participation.

Objective: Deliver valuable and engaging information through games, demonstrations, and diagrams that capture interest and encourage retention.

Goal 2 – Promote health and nutrition awareness in the community.

- Highlight the nutritional benefits of soybeans and its by-products.
- Use handouts, educational exhibits, and displays to inform the community about the health benefits of agricultural products.

Objective: Provide practical and accessible health and nutrition education, emphasizing the role of soybeans products and by-products in a balanced diet.

Goal 3 – Strengthen community involvement through effective volunteer participation.

- Train more volunteers to confidently and effectively lead lessons.
- Develop additional programs and activities to engage the community during events such as the fair.

Objective: Expand the volunteer base and ensure they are equipped to support the Ag Learning Center's educational mission while fostering greater community engagement.

Clientele

The Ag Learning Center serves three primary groups:

1. **Students and Educators**:
   This includes students from schools, educational organizations, youth groups, and summer camps who participate in our programs. It also encompasses the teachers and sponsors who accompany these

groups. Additionally, students engaged in our outreach program benefit from on-site presentations when visiting the Ag Learning Center is not possible.

2. **Fair Attendees and the Public**:
   These are individuals and families who experience the Ag Learning Center during the Four States Fair and other public events.
3. **Volunteers**:
   Dedicated community members who assist in delivering educational programs and supporting activities at the Ag Learning Center.

Methods

To effectively reach these groups, the Ag Learning Center employs the following strategies:

- Incorporating educational activities that align with industry partnerships into programs for students and educators.
- Developing new games and activities focused on key agricultural commodities and industry topics.
- Delivering outreach programs directly to schools and organizations, bringing our classes to students unable to visit the center.
- Hosting community educational events to highlight industry partnerships and foster greater awareness.
- Recruiting and training volunteers through outreach to local clubs and organizations, ensuring adequate support for our programs.

Staff/Administration

Kristen Larey
Director, Ag Learning Center
Kristen is a certified teacher in Arkansas and Texas with 15 years of classroom experience. This background in education is beneficial when creating engaging, hands-on lessons at the Ag Learning Center by connecting students to agriculture in meaningful ways. The Director of the Ag Learning Center is responsible for coordinating and scheduling programs with schools, educational organizations, youth groups, and clubs that visit the center for agricultural education. This includes designing, developing, and delivering engaging programs for students, educators, and the public. Additional responsibilities involve collaborating with local agencies, recruiting, training, and scheduling volunteers to assist with activities as needed.

The director also oversees the creation of educational materials such as handouts, brochures, coloring books, and pamphlets, as well as the design and development of new games and exhibits that align with the partnering industry.

Lisa Garner
Four States Fair
The Ag Learning Center operates under the umbrella of the Four States Fair. The Four States Fair team collaborates with the Ag Learning Center staff to support the creation and implementation of educational programs during the annual fair and throughout the year. They also assist with budget management and facility maintenance to ensure the center’s ongoing success.

Support System and Volunteers

The Ag Learning Center is supported by a dedicated network of over 250 volunteers from local organizations and the broader community. These volunteers play a critical role in delivering programs and engaging the public, especially during the annual fair and other community events.

Needed Resources

To ensure the continued success of our programs, the Ag Learning Center requires the following resources:

- Support for both permanent and temporary staff to coordinate and deliver educational programs.
- Assistance with facility-related costs, including necessary updates and utilities.
- Promotional items from partnering industries to enhance educational outreach.
- Supplies and funding to support events, activities, and program development.

The Ag Learning Center respectfully requests funding of $20,000 from the Arkansas Soybean Promotion Board to help sustain and expand our efforts in agricultural education. This support will enable us to continue providing impactful learning experiences for students, educators, and the community.

Evaluation Plan

The Ag Learning Center staff will be responsible for evaluating the effectiveness of all programs and activities. To ensure continuous improvement, the staff will create new and informative programs aimed at expanding our reach and educating more individuals. Evaluations will be conducted in collaboration with volunteer committees, the Four States Fair Board, and the Arkansas Soybean Promotion Board to assess the impact and success of these initiatives.

Feedback will be gathered from volunteers, community leaders, teachers, and staff members who participate in these programs. This input will help measure the educational outcomes and the effectiveness of our ongoing efforts in both regular programs and special events.

Ag Learning Center estimated total year expenses:

Category	Description	Total ($)
Facilities	Upkeep, Utilities, Office, Maintenance; Personnel Salary, Postage, Travel	65,000.00
Special Events	Kid's Day, Crossties Fall Festival, Fair; Pizza Ranch, Volunteer Meals, Ice Cream Mix, Ice Cream Cones	5,000.00
Supplies	Class Supplies, Crafting Supplies, Crayons	4,500.00
Educational Equipment	Educational Posters, Signage Displays, 3-D Educational Displays	8,500.00
Games/Activities	Games/Activities	1,000.00
Promotional	Backpacks, Totes, Brochures, Coloring Books; Staff Logo Shirts, Signage	15,000.00
Barnyard	Shavings, Feed, Weed/Insect Control, Maintenance, Repairs	800.00
Special Entertainment	Agricultural Live Programs and Guest Speakers	5,000.00

Total Estimated Expenses: $104,800

ATTACHMENT 9

2026 ASA Awards Celebration

Arkansas Soybean Promotion Board Proposal

The American Soybean Association has a long and storied history of achievements and leadership. The annual Awards Celebration, held during the Commodity Classic Convention and Trade Show, is an opportunity to recognize the achievements and contributions made by soybean farmers and industry leaders.

The awards program, attended by approximately one thousand soybean growers and industry leaders, is truly a night that soybeans shine, as achievements in research, conservation, and leadership are recognized. This celebration of achievements inspires innovation, enhances collaboration, and builds both confidence and pride in our industry.

Objectives

The ASA Awards Celebration is a special soybean-focused evening designed to showcase the industry and recognize:

- Honor leadership achievement and outstanding service by soybean growers, state volunteers and industry leaders
- Achievements in soybean production and research
- Highlight key soybean industry initiatives including those of conservation, sustainability and best management practices
- Inspire innovation and drive future soybean industry growth

Investment

A $6,000 investment in the 2026 Awards Celebration will provide the Arkansas Soybean Promotion Board with preferred seating through one reserved table. Additionally, Arkansas will be positioned as industry leaders through recognition in:

- Banquet publicity, table signage and the program booklet
- State sponsors will be recognized by name in the banquet video and verbally by the event Emcee and ASA President

The 2026 ASA Awards Celebration will be held in conjunction with Commodity Classic, February 26-28, 2026, in San Antonio, Texas.

2026 Economic Analysis and Support Project Proposal

ASA and the Arkansas Soybean Promotion Board have been long-time collaborators, working together to enhance the position of soybean farmers as providers of high quality, dependable and competitive soybean-derived products with key influencers and decision makers through the soybean value chain, the agricultural community and in the global marketplace.

Economic Analysis and Support Objectives

ASA's Economics Department serves a critical role for decision makers in the soybean industry by providing analysis of policies, markets, and trends. The ability to quantify outcomes helps to provide insight into the impacts of potential policies on soybean farmers. Furthermore, the economics work positions U.S. soybean farmers interests with influencer groups through various tactics. This includes writing articles explaining pertinent issues in the soybean sector, delivering presentations and communicating with other economists about the positioning of the soybean industry.

Support from the Arkansas Soybean Promotion Board will provide the ASA Economics Department with additional tools and resources to further demonstrate the strength and importance of U.S. soy as a diverse oilseed crop on a global level. The tactics outlined below provide varied ways to support, reach, interact and engage with individuals who have direct and indirect impacts on the way farming is done.

Economic Analysis and Support Sponsorship Benefits

Sponsorship of the ASA Economics Department ensures that economic threats and opportunities to Arkansas soybean farmers will be well-understood, discussed and responded to by our Chief Economist and the Economics Department. Likewise, the work of the ASA Economics Department positions U.S. soybean farmers interests with influencer groups through various tactics including but not limited to:

- Economic analysis
- Continued analysis how pesticide policies affect soybean growers
- Work in renewable fuels, transportation and trade
- Ongoing review and support related to the farm safety net, including crop insurance
- Interactions with other economists related to baseline analysis for markets, conservation programs and safety net spending
- Communicate soybean issues and policy impacts to audiences

Sponsorship creates the opportunity for further interaction with the ASA Economics department via:

- Virtual or in-person briefings at Arkansas Soybean Promotion Board meetings and events by an ASA Economist as requested subject to schedule
- Quarterly threats and opportunities report for the soy industry
- Early copies of economic reports generated by ASA
- Consultations with the ASA Economists
    - Discussions of impacts of state or national policy
    - Suggestions for potential researchers to conduct the research/analysis
    - Suggestions on project scope and design, etc.

A $5,000 investment will support this crucial work, providing both qualitative and quantitative support to help drive not only future success but growth in in the U.S. soybean industry. The work will aid in the positioning the importance of soybean production, soy components and products to the U.S. economy and in global trade.

ASA proposes the Arkansas Soybean Promotion Board fund $5,000 in Economic Support and Analysis in 2026.

2026 ASA Action Partnership (ASAAP)
Membership Proposal

The ASA Action Partnership (ASAAP) is a collaborative effort between all soybean industry sectors with a stake in the growth and profitability of the industry. The forum provides the opportunity for state and national checkoff organizations, ASA state affiliates, industry partners and national grower leaders to engage in work to preserve and protect the interests of the soybean industry.

ASAAP Objectives

- Identify and address challenges and issues facing the soybean industry
- Enhance collaboration between soybean growers, soybean organizations and industry
- Impact overall soybean industry strategy and allocate necessary resources to achieve strategic objectives and goals

Meeting Overview

ASAAP meets formally twice a year. The first is a one-day meeting in March. The annual ASAAP retreat in late summer provides an opportunity for in-depth discussions and industry-wide collaboration.

Member Benefits

Membership in ASAAP allows two participants from Arkansas to participate and engage in ASAAP's annual meetings, attended by soybean industry and grower leaders. Additional membership benefits include:

- ASAAP Updates
- Focus group/farmer advisory council opportunities with members and leaders
- Special recognition of ASAAP Members and Industry Supporters in ASA communications to show appreciation for their support.

ASAAP Funding – ASA State Affiliates and QSSB's*

Membership in ASAAP by ASA's state affiliates and QSSB's is based on the state's annual soybean production.

State Soybean Production	ASAAP Funding Level
40 million bushels of soybeans or greater	$6,000 annual membership
39.9 million bushels of soybeans or less	$1,500 annual membership

ASAAP exists as a collaborative effort to unite industry leaders, grower organizations and soybean grower leaders in creative and forward-thinking dialogue to ensure a secure future for the soybean industry.

The Arkansas Soybean Promotion Board membership in ASAAP, based on the dues formula above is $6,000 for 2026.

**ASAAP membership dues invested by the Arkansas Soybean Promotion Board are applied to meeting operational expenses including speaker fees, room rental, audio visual equipment, food and beverage and meeting materials. Funds are not used for lobbying or advocacy.*

Arkansas Soybean Promotion Board
Biomass-based Diesel Initiative (BBDI) Funding Request
FY 2026

Introduction

Over several decades, soybean farmers single-handedly created and led the investment in growing soybean oil demand through an innovative new use – biodiesel. This has now turned into a global industry that has expanded to renewable diesel and sustainable aviation fuel.

The farmer-built soy biomass-based diesel industry is now under attack on multiple fronts. Critical issues are converging against the industry, putting millions of combined checkoff investments in soy biomass-based diesel at risk.

Assaults against soy biomass-based diesel have broad-reaching implications well beyond soybean farmers. Soybean processors, agriculture suppliers and manufactures, as well as downstream stakeholders such as livestock producers, will all feel the pain if the soy biomass-based diesel industry stumbles.

To further complicate matters, a new Administration is rethinking overall energy policies, and we need to make sure that soy biodiesel has a favorable environment in which to thrive. Given recent elevations of consumers and policy influencers concerns with seed oils for food use, the entire soy oil value chain is under fire.

The time to act is ***now*** – before we reach a turning point that makes redemption unattainable.

State Checkoffs and state policy organizations have separate but complementary roles when it comes to helping ensure a robust soy biomass-based diesel industry. The BBDI offers the forum by which to coordinate these efforts across stakeholders.

Why a Biomass-based Diesel Initiative

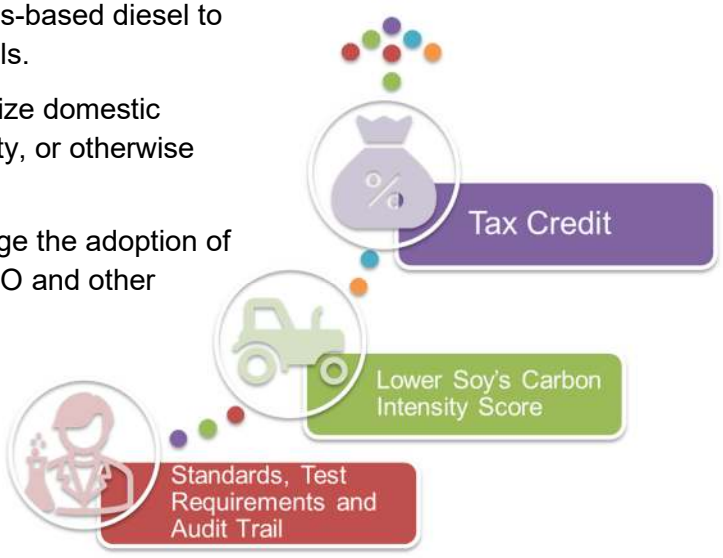
Soybean state organizations have called for – and are supporting -- a highly coordinated, dedicated effort to address the challenges to soy biomass-based diesel.

1. State soybean organizations have asked ASA to lead an effort to coordinate the good work already underway by the checkoff and NOPA to develop standards, testing, and audit requirements for used cooking oil (UCO), and urge appropriate federal and state agencies to implement these standards.
2. Likewise, state soybean organizations have asked ASA to lead and coordinate work to lower soy's carbon intensity (CI) score and develop more appropriate scores for UCO and imported waste feedstocks.

3. ASA must take the lead on efforts to ensure that the taxpayer-funded Clean Fuel Production Credit (45Z) benefits domestic feedstocks, not imported feedstocks.
4. Farmer voices are the most powerful voices when it comes to biofuels issues. ASA can impact polices related to soy BBD. No other national policy entity solely focuses on soybean farmer interests as they relate to BBD.
5. ASA will work closely with the soy checkoff at the national and state levels on this initiative where the use of checkoff funds is compliant, as well as work closely with National Oilseed Processors Association (NOPA) and its soybean-processor members who align on these issues.

Urgent Needs:

- Educate the new administration on the importance of domestically produced soy biomass-based diesel to achieve energy independence goals.
- Advocate for tax credits that prioritize domestic feedstocks, provide feedstock parity, or otherwise protect SBO market access.
- Lower soy's CI score and encourage the adoption of more appropriate CI scores for UCO and other products.
- Develop and then get industry and government support for a uniform definition, standards, test requirements, and audit trail requirements for UCO and other imported waste feedstocks.



Initiative Objectives:

- Lead and coordinate industry wide efforts to support soy-derived biomass-based diesel
- Protect the interests of soybean farmers related to biodiesel, renewable diesel and sustainable aviation fuels (SAF)
- Ensure a robust crush industry that supports a favorable market environment for soybean farmers
- Close gaps in addressing biofuels issues where CFAA and the soy value chain have different objectives.
- Lead and coordinate industry wide efforts to lower CI scores for soy biodiesel and renewable diesel.
- Increase ASA's advocacy resources to address the rapidly growing list of policies associated with soy-derived biomass-based diesel

Critical Issues that Require will Remain Important!

Key Stakeholders Include:

- ASA – Leader and coordinating organization, staff provider, strategic direction, program formation, implementation
- State QSSBs and Associations – collaborators, strategic input, checkoff compliant funding (QSSBs), unrestricted funding (Associations)
- USB – collaborator, strategic input, potential checkoff compliant project implementor, potential checkoff funder
- NOPA – collaborator, strategic input, unrestricted funding, potential project implementor
- SABR—collaborator, strategic input, unrestricted funding
- CFAA – collaborator, strategic input, potential funding
- Industry Partners (soybean processors, potentially select seed company and equipment manufacturers) – unrestricted funding, input
- Others as appropriate

BBDI Workgroup

A workgroup of biomass-based diesel experts from key stakeholders will be formed to provide counsel and ensure coordination among key players. The workgroup will be split into subgroups that develop and oversee projects to serve BBDI objectives. The entire workgroup will address priorities and strategy for overall efforts. Early projects will include economics studies and work on modeling for LCFS and CI scoring.

Purpose of Workgroup

- Provide expertise and counsel
- Avoid duplication across organizations
- Prioritize programming
- Optimize programs to maximize progress

- Continuously push forward efforts by various organizations
- Assess and rectify roadblocks to progress

Restricted vs. Unrestricted Funding

With challenges to soy biomass-based diesel coming from multiple fronts, a variety of workstreams will be needed. This means a variety of funding resources will also be needed.

The state and national checkoffs represent a robust resource to fund non-policy, checkoff-compliant workstreams.

Meanwhile, a major force behind this initiative will be to create a policy environment that supports a robust soy biomass-based diesel industry. Unrestricted funding sources for these efforts include soybean processors, other industry partners, state soybean associations, and other stakeholder associations such as the National Oilseed Processors Association.

The Initiative must be nimble and have the ability to react quickly to a rapidly changing market and policy environment. This means funds need to be available and ready for use for a variety of purposes. Efforts that require unrestricted funds include:

Resource Needs

- Staff – biodiesel initiative oversight and coordination
- Advocacy support/consultants
- Technical expertise and consultation
- Market Data and Economic Analysis
- Resources to support work in non-soybean producing states
- Checkoff Compliant projects
    - Economic & technical studies/work
    - Market studies
    - State by state data
- Communications (Checkoff Compliant)
    - PR/news releases
    - Fact sheets, one-pagers, documentation
    - Social media
    - Washington, D.C. advertising campaign/NPR
- Policy Communications (Unrestricted Funding)
    - Issue Alerts
    - Position Papers
    - Outreach to States and Stakeholders regarding policy activities
- Meeting and Travel Expenses (Checkoff Compliant)
    - Related travel for meetings and stakeholder engagement
- Travel Expenses (unrestricted)
    - Hill and Administration Visits

Initial Timeline:

The BBDI was requested by the states in the fall of 2024, presented to the states at ASA State Staff in October, and revised and launched in November 2024. A flurry of activity kicked off right away to address issues including 40A, 45Z, Indirect Land Use, Carbon Intensity and regulatory issues in California and other states. These complex issues continue to need a significant amount of attention and back up data.

We are moving forward with all possible speed. The search for additional advocacy expertise is nearly complete. The search for a Checkoff Compliant Initiative Workgroup Leader is also underway. The first Workgroup meeting was held in November and multiple conversations on collaborative coordination of existing efforts is also underway.

The Initiative must be nimble and provide the ability to react quickly to a rapidly changing market and policy environment. This means funds need to be available and ready for use for a variety of purposes as needed. Time and energy should be devoted to accomplishing objectives rather than continuous fundraising efforts. ASA is asking for robust upfront contributions for the overall initiative, categorized as either restricted or unrestricted, that can be leveraged as needed to achieve objectives.

Initiative Funding

Unrestricted (Advocacy) FY26 Budget Projection – *shown here only to provide full transparency into the overall effort*

Sources: State Associations, NOPA, SABR and other industry stakeholders

Advocacy Support – Additional Personnel Resource - Additional Government Affairs advocacy personnel to enable appropriate coverage of biofuels issues in areas such as tax policy, sustainability and conservation, energy, feedstocks, imports and more. - Ability to cast a wider net of engagement and intelligence gathering with like-minded stakeholders as well as those with opposing views like environmentalists and activists.	$250,000
Advocacy Support – Contractor Expertise for special services such as: - Contract lobbyists with specific expertise to address special issues, such as: tax structure and implications, RVOs, Indirect Land Use, Carbon Intensity Scoring, etc. - Specialized boots on the ground in states such as CA, WA, OR and NM. Farmer Fly Ins - Three Fly Ins during FY 2025 with funding for 33 individual trips @ $1,200 each (3 fly ins with 11 farmers/staff each)	$200,000 $39,600 $20,400

- Materials and leave behinds for farmer fly ins	
Advocacy Communications - 1-pagers, white papers, issues briefs, news releases, farmer advocacy preparation resources	$50,000
Total Unrestricted (Advocacy) funding	**$490,000**

Checkoff Compliant (Restricted) Funding

Sources: State QSSBs, USB

Restricted (Checkoff Compliant) FY26 Budget Projections

Initiative Leader and ILUC Modeler - Director level, leader of the BBDI, workflow project manager Indirect Land Use Change – Consultant Fees for ILUC modeling work (The model that currently most benefits soy is a California model that has existed for a long time. The environmental justice community is working to adopt other models that deliver much worse ILUC numbers for soy.) - Conduct post-mortems on the strengths and weaknesses of existing models (ADAGE, GCAM, GTAP, GLOBIOM, GREET) and document the shortcomings/strengths of each. - Comparison of existing ILUC modeling methodologies to understand how each model impacts soy as a biofuels feedstock - Unpacking of the methodology behind each model to understand the underlying assumptions and data used. - Identify ways to make the case for improving the score of soy in these models - Develop reports, strategic positioning and talking points related to findings - Purchase of existing data, studies and models needed to execute analysis	$280,000
Economic Studies and Data Support specific to BBDI objectives	75,000
BBD Initiative Workgroup - Regular Zoom meetings (TBD by group, weekly or bi-weekly) - One in-person, 2-day meeting in Washington, D.C. for 50 people - Includes meeting space, food and beverage, meeting planning, materials, signage, group ground transportation to offsite dinner - Other operating costs for workgroup (printing, postage, incidentals)	$0 $45,000 $5,000
Travel and Conferences - Travel expenses for ASA Staff (Chief Economist, BBDI Leader, CEO, IR Executive Director, Meeting Planner and others as needed) to biofuels industry meetings, industry stakeholder meetings (15 total trips @ $1,200) - Conference Fees to attend 4 modeling conferences and stakeholder meetings $12,000 ▪ CARB ILUC Modeling Work Group	$18,000 $12,000

▪ Potential EPA workshops on biofuels and greenhouse gas modeling ▪ CFAA Annual Conference ▪ Biofuels and Feedstocks Americas ▪ Other conferences as applicable	
Total Restricted (Checkoff-compliant) funding	**$435,000**

Current Funders FY25:

Unrestricted Funding:
Iowa Soybean Association
Missouri Soybean Association
Ohio Soybean Association
Indiana Soybean Alliance
Kentucky Soybean Association
North Dakota Soybean Association
National Oilseed Processors Association (NOPA)
Sustainable Advanced Biofuel Refiners (SABR)

Restricted (Checkoff Funding)
Indiana Soybean Alliance
Tennessee Soybean Promotion Board
Kentucky Soybean Board
Minnesota Soybean Research and Promotion Council
South Carolina Soybean Board
Virginia Soybean Board

We are still in the early phases of fundraising efforts for FY25. Many states are currently still considering the association and checkoff allocations. Corporate entities will be approached as part of this process.

FY26 Arkansas BBDI Checkoff Funding Request: $5,000

The soybean industry is facing a daunting task to address the significant headwinds bombarding soy biomass-based diesel. We must address these issues with all possible speed, and with the full force of the combined resources of our state and national checkoffs and association, soybean processors, industry organizations and corporate partners. We appreciate your consideration of adding $5,000 to your ASA funding to support soybean oil markets by helping ensure we have a strong soy biomass-based diesel industry.

2026 ASA Innovation to Market (I2M) Work Group Membership Proposal

The Innovation to Market (I2M) Work Group serves as a consultative forum with a goal to facilitate the domestic and international introduction, commercialization and market acceptance of new innovations in seed and crop protection products. The group accomplishes this through interactions with key industry partners, including biotech trait developers, crop protection registrants and developers of gene-edited soybeans and other plant breeding innovations and farmer leaders representing ASA, USB and USSEC.

I2M Objectives

The primary objectives of the Innovation to Market Work Group are:

- Identify and address challenges and issues impeding the development, commercialization and market acceptance of seed and crop protection products. Examples may include adventitious presence, U.S. and foreign regulatory systems, trade and market barriers, stewardship concerns and education needs.
- Enhance collaboration between soybean growers, soybean organizations and industry partners.
- Create a forum to identify strategies for addressing long-term issues that continue to threaten innovation and productivity in the agriculture industry.
- Identify action areas of mutual interest where soybean growers can work with developers and registrants/member companies to improve the regulatory and market environment for new technologies, both domestically and in overseas markets.
- Facilitate a productive dialogue between developers and registrants and other essential stakeholders to help ensure a stable market environment, trade prospects and greater profit opportunities for U.S. soybean farmers.
- Seek to address asynchronous approvals and making consistent standards and regulatory processes throughout all key export countries.

Meeting Overview

The I2M Work Group meets in person twice a year, with at least one meeting being held in Washington, D.C. Meetings are traditionally held in the winter and late summer.

Member Benefits

Membership in the I2M Work Group allows two participants from Arkansas to participate and engage in the I2M Work Group's annual meetings.

Additional membership benefits include:

- Interaction with industry leaders to become more informed on specific challenges facing developers of seed and crop protection products.
- The opportunity to work with industry representatives and members of the soy family to identify strategies to ensure innovations in seed and crop protection remain available to farmers.
- Recognition as an organization that supports the significant work of the I2M Work Group as it protects farmers access to key seed and crop protection tools that enhance their productivity and profitability.
- I2M member organizations are recognized in ASA's communications related to the group's activities.

I2M Work Group Annual Membership – Arkansas Soybean Promotion Board: $7,500

**I2M Work Group membership dues invested by the Arkansas Soybean Promotion Board are applied to meeting operational expenses including speaker fees, room rental, audio visual equipment, food and beverage and meeting materials. Funds are not used for lobbying or advocacy.*

2026 Soybean Leadership Academy
Arkansas Soybean Promotion Board
Proposal

Soybean Leadership Academy is an elite educational program designed to provide tools and techniques that enable state and national soybean Board and Association leaders to be more effective, efficient and inspired leaders.

Working with top leadership trainers, facilitators and industry experts, **Soybean Leadership Academy** will provide:

- Targeted training to state and national soybean board leaders and top staff, increasing their effectiveness as leaders and as boards
- Enhanced collaboration between state affiliate and national soybean organizations, strengthening the voice of U.S. agriculture
- Interaction between senior soybean leadership and newer board members creating strong peer networking opportunities

Soybean Leadership Academy will provide two training tracks, one for senior level grower board members and staff leaders and the other for beginning/intermediate board members and managerial level staff. Joint training sessions and networking functions will build camaraderie and further strengthen the soybean industry.

The 2026 **Soybean Leadership Academy** will be held January 7-9, 2026, in Bonita Springs, Florida. The program format is as follows (all times subject to change):

<u>January 7, 2026 – Day #1</u>
Participants Arrive
6:00 p.m. Welcome Reception & Dinner at Hotel

<u>January 8, 2026 – Day #2</u>
8:00 a.m. Breakfast
9:00 a.m. General Session
9:45 a.m. Break
10:00 a.m. Breakout Sessions
Track #1 – Beginning/Intermediate Level Grower Board Members and Managerial Staff
Track #2 – Top State and National Farmer Leader(s) and Executives Session
12:00 p.m. Lunch with Speaker
1:30 p.m. Breakout Sessions – continuation of morning sessions
4:15 p.m. Break
4:30 p.m. General Session

<u>January 9, 2026 – Day #3</u>
8:00 a.m. Breakfast
9:00 a.m. General Session
12:00 p.m. Adjourn

Investment

Soybean Leadership Academy is designed for participation by grower leaders and staff. Participating in the program is an investment in both your organization and leadership team.

State and national soybean Boards and Associations are encouraged to invest in Soybean Leadership Academy, providing training for senior level grower leaders, including the state president and chair, as well intermediate level board members with a desire to advance in their leadership journey. Senior and managerial staff participation at the state and national level is also encouraged.

The funding tiers provided below are suggested investment levels. The monies invested will provide for programming, meals, meeting materials and networking activities. Travel and hotel costs will be the responsibility of the participating organization.

2026 Soybean Leadership Academy Funding Tiers

Sponsorship Level	Investment	Suggested Number of Participants
Platinum	$25,000 and above	Ten or more participants
Gold	$12,000	Eight (8) participants
Silver	$6,000	Four (4) participants
Bronze	$3,000	Two (2) participants

Under the guidelines established through the adoption of ASA's 2016 Strategic Plan, state affiliates are provided representation on the ASA's Board through a base-level investment. Investment in the **Soybean Leadership Academy** will be counted by ASA towards additional grower representation on ASA's Board of Directors

Sponsors will be recognized throughout the event in program related materials and promotions.

ASA respects the responsibility and authority of the Soybean Promotion, Research and Consumer Information Act (7 U.S.C. 6301-6311) (the "Act") and the Soybean Promotion and Research Order (8 CFR Part 1220) (the "Order") and as such can assure state organizations that the checkoff dollars given and used to fund these programs are not used for lobbying, advocacy or membership generating activities.

2026 SOYSTATS®
A REFERENCE GUIDE TO IMPORTANT SOYBEAN FACTS

PROGRAM SUMMARY

SoyStats®, a Reference Guide to Important Soybean Facts & Figures, provides a reliable source for immediate and accurate soybean-specific statistics and information. Designed for use by industry, university researchers, media, state affiliates and soy customers including international customers, this annual Guide has proven to be an invaluable and trusted resource for those involved with soybean-related businesses.

SoyStats is distributed to soybean and soy product customers in the United States and in more than 80 countries around the world. It is also made available to many more online at www.SoyStats.com.

Objectives:

- Collect and analyze annual soybean production and utilization data
- Distribute accurate soybean-specific statistics and information
- Publish a printed guide that can be distributed to growers or customers
- Publish information on www.SoyStats.com, expanding the reach of the project globally

A premier soybean industry publication, *SoyStats* affords its investors many valuable promotional opportunities through its publication, online presence and distribution.

***SoyStats* Investors Receive:**

- Printed guides for distribution at their discretion. (Number of guides dependent on investment.)
- Recognition on the back cover of the guide and on the website, www.SoyStats.com
  - SoyStats.com receives approximately 10,000 visits annually from countries around the globe.
- Recognition in ASA's communication vehicles
  - *eBean News*
  - Social Media including Facebook and Twitter
- Additionally, *SoyStats* is distributed broadly to key influencers and media during various events

***SoyStats* Target Audiences:**

- State Affiliates
- Soybean Customers, including international customers
- Industry Representatives
- Media

ASA Requests $600 from the Arkansas Soybean Promotion Board for the 2026 *SoyStats®, a Reference Guide to Important Soybean Facts & Figures.*

Investment Levels

Gold Level—$3,000

- **Receive 600 copies of *SoyStats***
- **Receive Gold sponsor recognition on back cover**

Silver Level—$1,500

- **Receive 300 copies of *SoyStats***
- **Receive Silver sponsor recognition on back cover**

Bronze Level—$600

- **Receive 100 copies of *SoyStats***
- **Receive Bronze sponsor recognition on back cover**

Direct Purchase:
A state QSSB or association can purchase a box of 50 *Soy Stats* Guides at $325.00 or $6.50 each.

2026 Young Leader Program
Arkansas Soybean Promotion Board Proposal

In 1984 the Young Leader Program was started to help identify and train leaders for the soybean industry. Forty years later, the program continues to be a groundbreaker, recognizing the value both partners play in a farming operation and training them equally, encouraging and emphasizing the importance of diversity in the soybean industry. Today, the Young Leader Program continues to set the bar for leadership training in agriculture, identifying and training innovative and engaged growers to serve as the voice of the American farmer (actual age is not a factor).

Structure

The *ASA Corteva Agriscience™ Young Leader* two-phase training program challenges and educates participants. Phase I of the training takes place at the Corteva headquarters in Johnston, Iowa in early December 2025. The program continues in February of 2026 with training held in conjunction with the annual Commodity Classic Convention and Trade Show in San Antonio, Texas. A third phase of training is available for a select number of participants from the current class. This third-phase program, scheduled for July 2026, includes participation in the ASA July Board meeting. Traditionally the third phase of training has been limited to 10 members of the current class and interested participants are asked to apply for the limited program spots. Participants for the *Young Leader* Program are sourced from the twenty-six soybean state affiliates and Canada. Each year approximately 45 - 50 growers take part in the program.

Program Goals and Outcomes

Each phase of the *Young Leader* program is designed to meet specific training goals and deliver clear program objectives. Phase II of the training incorporates feedback from the class to deliver a custom educational experience that reflects the needs of the participants.

Phase I Objectives – 100% Compliant

- Communications Training – including public communication, interpersonal interaction and business leadership including DiSC training
- Soybean industry overview including USB and ASA Updates
- Soybean Industry and Technology Pipeline
- Peer relationship development

Phase II Objectives – 75% Compliant

- Soybeans in the international marketplace
- Soybean and issues updates – provided in part through participation in Commodity Classic
- Business specific training including advanced communications, multi-generational farming
- Personal and Professional Development

Phase III Objectives – 25% Compliant

- Board policies and protocols
- Soybean Issues Update – provided through participation in the ASA Legislative Forum
- An introduction to policy and Hill visits
- Crop Protection Pipeline and Technology

(*See addendum for past program agendas.*)

The *Young Leader* program provides newly identified and upcoming soybean leaders with critical leadership training. Through sessions on communications, organizational leadership and soybean industry updates, participants are better prepared to address state level issues while understanding their national implication. This is especially important as growers assume seats on regional, state and national checkoff and association boards. Additionally, the Young Leader program provides each participant with a peer group of other innovative and progressive farmers. These networks help aid collaboration regionally and nationally and provide solid sounding boards regarding business decisions both for state soybean organizations and their individual farming operations.

Most *Young Leaders* become active members of their state organizations and many take advance leadership positions on their state and national boards and allied grower organizations. Former Young Leaders who have been formerly or are currently engaged in national leadership include Arkansas's very own Brad Doyle, 2022 ASA President and current ASA Board Member, and Philip Good, current USB chairman from Mississippi. Many other recent program graduates are in service for both the state and national soybean organizations.

(See addendum for a complete listing of past Young Leaders currently serving national soybean organizations.)

Investment

In 2026 ASA and Corteva Agriscience are again offering the opportunity for state affiliates to partner on the program by providing scholarships via matching funds to cover tuition costs. This option is at the request of state affiliates made during the development of the ASA strategic plan. QSSB involvement in the program will provide the Arkansas Soybean Promotion Board with the opportunity to send additional grower couple(s) as participants in Phase I and Phase II of the *Young Leader* training until the program reaches a total of 52 participants.

2026 ASA Corteva Agriscience Young Leader Budget

The total compliant portion of the budget for the 2024 ASA Corteva Agriscience *Young Leader* Program is $209,000 (inclusive of travel, lodging, meals, meeting materials, speaker's fees, networking events, and program implementation for Phase I, Phase II and 25% of Phase III of the training). ASA and Corteva will continue to fund the non-compliant portion of the program and all compliant portions of the program not matched by QSSBs. Tuition cost estimates per attendee are based upon an average of 45 attendees.

We ask the Arkansas Soybean Promotion Board to invest $9,200 tuition per couple in the 2026 ASA Corteva Young Leader Program. *

A financial expense summary will be provided at the conclusion of the training detailing the expenses and costs as outlined above.

*QSSB's may provide tuition funding for up to two couples in the program.

*ASA respects the responsibility and authority of the Soybean Promotion, Research and Consumer Information Act (7 U.S.C. 6301-6311) (the "Act") and the Soybean Promotion and Research Order (8 CFR Part 1220) (the "Order") and as such can assure the soybean growers of **(State Soybean Organization)** that the checkoff dollars given and used to fund these programs are not used for lobbying, advocacy or membership generating activities.*

ATTACHMENT 10

Clean Fuels
ALLIANCE AMERICA

January 28, 2025

Mr. Scott Bray
Arkansas Department of Agriculture (Arkansas Soybean Promotion Board)
1 Natural Resources Drive
Little Rock, AR 72205

Dear Scott,

Once again, it's proposal season. Thank you for being a generous partner in the past. The mission of Clean Fuels Alliance America (Clean Fuels) is to advance the interests of its members by creating sustainable biodiesel, renewable diesel and sustainable aviation fuel industry growth. Clean Fuels serves as the industry's central coordinating entity and is the single voice for its diverse membership base. Industry growth will be achieved through public affairs, communications, technical and quality assurance programs. We are dedicated to inclusiveness and integrity.

We have included the entire scope of work for each project and the entire project budget as well. This will give your board an idea of the work plan and level of talent we are putting together to move this work forward. Clean Fuels has consistently demonstrated its ability to leverage funding from numerous funders to secure the total funding needed for a project. Therefore, we would welcome any level of financial commitment your organization can make toward the success of this project.

Thank you!

Brad Shimmens
Director of Operations and Membership
Clean Fuels Alliance America

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800.841.5849

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PROJECT DESCRIPTION 1 of 2

Market Expansion Drive - $20,000

Biodiesel, renewable diesel and sustainable aviation fuel find themselves at a pivotal juncture, poised for unprecedented growth yet confronted by historic challenges. The industry's trajectory toward expansion is propelled by the increasing embrace of state and regional carbon policies, net-zero carbon commitments, sustainability pledges from Fortune 100 corporations, stable federal regulations and other notable achievements. Additional diesel fuel markets, including rail, shipping, heating, construction and agriculture are demanding additional clean fuels at an affordable price. Equipment manufacturers are considering higher blends of biodiesel. These factors may catalyze a market surge, potentially exceeding six billion gallons even sooner than the industry's envisioned target of 2030.

As the industry anticipates this growth, concurrent communications projects are laying the groundwork and ensuring the essential upkeep of the reputation of biodiesel, renewable diesel and sustainable aviation fuel in key markets. Simultaneously, the Market Expansion Project adopts an offensive stance. Key tactics for success will involve increasing highly targeted regional paid-advertising campaigns, outreach initiatives directed at crucial stakeholder groups such as environmental organizations, soybean farmers, and audiences involved in animal agriculture. Coordination among influential groups will also play a pivotal role.

In this proactive, targeted approach, the emphasis will be on branding and education, a critical initiative in narrating the brand story and seizing the momentous opportunity ahead. This project will utilize a combination of advertising, media relations with industry reporters, social media activity and other tactics to promote data on the quality and competitive cost of clean fuels, which will lead to more demand in diverse sectors.

How does this project benefit Arkansas soybean farmers?

Investing in the Market Expansion Drive Project provides Arkansas soybean farmers with unparalleled opportunities to access new and expanding markets. As industries like on-and off-road transportation, rail, maritime and home heating increasingly seek low-carbon fuel solutions, the demand for soybean oil as a critical feedstock continues to grow. Clean Fuels Alliance America leads efforts to promote biodiesel, renewable diesel and sustainable aviation fuel (SAF), ensuring these fuels remain highly visible and widely adopted.

The Market Expansion Project plays a crucial role in ensuring this growth benefits soybean farmers. Through targeted advertising campaigns, outreach to key stakeholders, and efforts to promote the quality and cost-effectiveness of biodiesel, renewable diesel and SAF, this project is helping to

catalyze demand in new markets. By positioning clean fuels as a reliable and affordable alternative, the project supports farmers in securing long-term profitability and expanding their customer base. This project ensures Arkansas soybean farmers are well-equipped to thrive in a rapidly evolving energy landscape while fueling industries nationwide.

Growth of biodiesel and renewable diesel use has been key to increasing net income at the soybean producer level as well as throughout the value chain. As a soybean producing state, Arkansas has benefited directly from increased production and use of biodiesel and renewable diesel. The United Soybean Board (USB), calculation reviewed by USDA-Agricultural Marketing Service, conducted an enterprise value analysis to uncover the share of the value of United States (U.S.) soybean production that can be attributed to biodiesel and renewable diesel over time. It utilized data from the USDA for crop production and prices and the USB on the breakdown of meal and oil consumption by end use. It took a top-down approach to allocate the value of the crop production to soybean oil sold into biodiesel and renewable diesel production. Of the $52.6 billion in total value in marketing year 2023/24, $17.8 billion was generated from soybean meal production, $11.5 billion was generated from production of soybean oil and remaining amounts for the export and other markets. Since approximately 47% of the soybean oil produced in the U.S. was used for biofuels in MY2023/24, biodiesel and renewable diesel accounted for about 10% of the total production value generated by U.S. soybean farmers. Stated differently, biodiesel and renewable diesel accounted for $1.30 of the value of a bushel of soybeans in marketing year 2023/24. This estimate attributes a portion of the soybean oil's value to biofuel demand, highlighting the significant role of biofuels in soybean pricing. However, this $1.30 is an attribution rather than a direct causal effect; if biofuel demand were to cease, soybean prices would not automatically decrease by this amount. Market dynamics such as supply adjustments and demand elasticity would instead lead to a new price equilibrium.

In 2023, Arkansas produced approximately 159 million bushels. Based on this, biodiesel and renewable diesel accounted for $207.1 million in value for Arkansas producers. At the farm level, biodiesel and renewable diesel accounted for almost $35,100 of value for a grower with 500 acres of soybeans. In addition, the U.S. biodiesel and renewable diesel industry now supports more than 75,000 jobs nationwide. In Arkansas, this translates to $795 million in economic activity, almost 1,920 jobs supported, and more than $96 million in wages.

Looking forward, this project, and others being proposed by Clean Fuels, will help ensure year-over-year growth needed to meet the Clean Fuels vision to use six billion gallons by 2030 with significant increases in the use of soybean oil as the industry’s primary feedstock for production biodiesel, renewable diesel, sustainable aviation fuel and Bioheat® fuel. The planned outcome of the overall Clean Fuels effort will be to increase 2025 soybean oil use in these markets by more than 800 million pounds from 2024 usage, as benchmarked by federal data sources such as USDA and DOE’s Energy Information Administration.

Project Budget – Market Expansion Drive – $20,000

Clean Fuels Time		
Program Staff	2,100 hrs @ $150/hr	$ 315,000
Support Staff	325 hrs @ $110/hr	$ 35,750
Advertising		
Nation Branding and education campaign; Brownfield or similar fueling conversations; QSSB publications		$ 1,297,630
Sponsorships		$ 10,000
Subcontractors Time and Expense		
Paulsen or similar		$ 121,700
Cosmic Sauce or similar		$ 26,700
High 5		$ 66,740
Distilled Communications		$ 31,680
MCMH		$ 45,000
TBD		$ 40,000
Coordinating meetings including food and facility		$ 11,500
Printing		$ 8,000
Supplies/shipping		$ 8,000
Travel-Clean Fuels Staff or Ambassador/Speaker	14 trips @ $1,700/trip	$ 23,800
Total		**$ 2,041,500**

PROJECT DESCRIPTION 2 of 2

OEMs Maintain and Secure Approvals for B20+ – $20,000

Clean Fuels Alliance America has worked diligently over the years to increase the number of vehicle and engine manufacturers that support blends up to B20, realizing that most diesel fuel has been consumed by heavy-duty vehicles. Those same original equipment manufacturers (OEMs) are now under increasing pressure to support decarbonization efforts through development of battery electric, fuel cell, and hydrogen propulsion systems while at the same time dealing with a significant tightening of diesel engine emission regulations. This global push for low carbon liquid fuels is applicable to all diesel-fueled applications, including on-road and off-road, rail, marine, heating oils, and power generation, and to all types of engine manufacturers. New market requirements have been passed that will lower particulate matter and NOx emission requirements by 90%, doubling the full useful life of compression-ignition engines that must meet the new emissions standards. The new requirements will also add a new light-load duty cycle and new on-board diagnostic requirements. Many OEMs are still unsure what engine and aftertreatment technology they will use in 2027 and beyond to meet the stricter requirements, while some may discontinue their diesel engine production entirely due to the stricter diesel emissions requirements and shifting of efforts to the battery electric, fuel cell, and hydrogen technologies. These impacts are compounded by new proposals that may outlaw the sale of internal combustion engines in the next decade.

Over the last several years, a shift in the demand for low carbon propulsion systems has emerged. Discussions on new fuels such as methanol, ammonia, hydrogen, and dimethyl ether (DME) have emerged, which would all require changes and investments in new fueling infrastructure. State policies are making moves to strongly encourage electric vehicles and/or set goals for completely fossil free transportation options. The federal government, through the Inflation Reduction Act, is spending billions of dollars to do the same and investing funds in ways to decarbonize the hard to electrify transportation markets that use traditional petroleum distillate fuels such as marine, rail, and aviation. A growing number of major private companies are setting carbon reduction and ESG goals to reduce their carbon footprint by 40% to 75% by 2030 and net zero carbon by 2050. These moves have had a corresponding and dramatic effect on the low carbon liquid fuel market. The carbon reductions provided by blends of low carbon liquid fuels like biodiesel or renewable diesel are simply not enough. As such, several fleets and initiatives are looking at B100, or 100% renewable fuels to meet their carbon reduction goals.

With the high interest in carbon reductions, and limited existing solutions, some vehicle and engine manufacturers have begun to approve higher blends. The Truck and Engine Manufacturers Association (EMA), in coordination with their member organizations, have drafted a potential B100 specification for biodiesel to be used as a finished fuel. This draft specification is different from

the current allowances for B100 used in the Optimus Technologies "Vector" system. These differences are being evaluated for expectations in performance. Future projects under this program will help determine potential limits and parameters in a new ASTM specification for biodiesel as a fuel.

As the time draws closer towards the tightening regulations, Cleans Fuels is becoming more selective with our partner organizations and producers of new Ultra-Low Emission Diesel Engines (ULEDEs) on our engine projects. While not all OEMs currently approve of B20 in all their engine offerings, more progress is being made with manufacturers that realize that biomass-based diesel fuels offer them and their customers the best solutions in their decarbonization efforts. Such projects include evaluation of higher blends in the new engine and emissions aftertreatment technologies, especially after aging, to ensure that the new emissions aftertreatment systems still perform as designed after more than 800,000 miles. Additional considerations may be the development of advanced engine calibrations with higher biodiesel blends to take advantage of some of the properties of biodiesel to improve performance and fuel economy. New calibrations could be automatic if the development of new blend sensors continues that would differentiate fuels based upon the biodiesel content.

With an eye toward the future, we also anticipate cooperative efforts on other novel, future platforms such as the new ducted fuel injection technology currently in progress at Sandia National Laboratories. This work will position the biodiesel and renewable diesel fuel industry to be *the* low carbon fuel choice in 2030 and 2050 needed to achieve the 6-billion and 15-billion gallon volume goals the industry has set.

How does this project benefit Arkansas soybean farmers?

As the best, and lowest cost options to help decarbonize, and with growing market share, the biomass-based fuels industry will need to continue to work alongside engine manufacturers to help justify their continued development of internal combustion engines that utilize liquid renewable fuels. Most engine manufacturers realize that electrification is not a single solution that will be available to most consumers. Biomass-based diesel fuels offer OEMs the ability to continue to produce internal combustion engines while still supporting carbon reductions and health benefits under the pressure of tightening limits and regulations.

Growth of biodiesel and renewable diesel use has been key to increasing net income at the soybean producer level as well as throughout the value chain. As a soybean producing state, Arkansas has benefited directly from increased production and use of biodiesel and renewable diesel. The United Soybean Board (USB), calculation reviewed by USDA-Agricultural Marketing Service, conducted an enterprise value analysis to uncover the share of the value of United States (U.S.) soybean production that can be attributed to biodiesel and renewable diesel over time. It utilized data from the USDA for crop production and prices and the USB on the breakdown of meal

and oil consumption by end use. It took a top-down approach to allocate the value of the crop production to soybean oil sold into biodiesel and renewable diesel production. Of the $52.6 billion in total value in marketing year 2023/24, $17.8 billion was generated from soybean meal production, $11.5 billion was generated from production of soybean oil and remaining amounts for the export and other markets. Since approximately 47% of the soybean oil produced in the U.S. was used for biofuels in MY2023/24, biodiesel and renewable diesel accounted for about 10% of the total production value generated by U.S. soybean farmers. Stated differently, biodiesel and renewable diesel accounted for $1.30 of the value of a bushel of soybeans in marketing year 2023/24. This estimate attributes a portion of the soybean oil's value to biofuel demand, highlighting the significant role of biofuels in soybean pricing. However, this $1.30 is an attribution rather than a direct causal effect; if biofuel demand were to cease, soybean prices would not automatically decrease by this amount. Market dynamics such as supply adjustments and demand elasticity would instead lead to a new price equilibrium.

In 2023, Arkansas produced approximately 159 million bushels. Based on this, biodiesel and renewable diesel accounted for $207.1 million in value for Arkansas producers. At the farm level, biodiesel and renewable diesel accounted for almost $35,100 of value for a grower with 500 acres of soybeans. In addition, the U.S. biodiesel and renewable diesel industry now supports more than 75,000 jobs nationwide. In Arkansas, this translates to $795 million in economic activity, almost 1,920 jobs supported, and more than $96 million in wages.

Looking forward, this project, and others being proposed by Clean Fuels, will help ensure year-over-year growth needed to meet the Clean Fuels vision to use six billion gallons by 2030 with significant increases in the use of soybean oil as the industry's primary feedstock for production biodiesel, renewable diesel, sustainable aviation fuel and Bioheat® fuel. The planned outcome of the overall Clean Fuels effort will be to increase 2025 soybean oil use in these markets by more than 800 million pounds from 2024 usage, as benchmarked by federal data sources such as USDA and DOE's Energy Information Administration.

Project Budget – OEMs Maintain and Secure Approvals for B20+ – $20,000

Clean Fuels Time		
Program Staff	390 hrs @ $150/hr	$ 58,500
Support Staff	25 hrs @ $110/hr	$ 2,750
Subcontractors Time and Expense		
Marc-IV		$ 117,000
NREL, SWRI, CeCert, outside labs, Universities, Engine Companies, Turbine Companies, Railroad Companies, or Major fleets		$ 924,000
JenMotion, Randy Jennings or similar		$ 298,000
Membership Dues		$ 20,000
Miscellaneous-fuel quality testing		$ 8,250
Supplies-fuel purchases		$ 40,000
Sponsorships		$ 10,000
Tradeshows		$ 8,000
Conference registrations		$ 3,000
Travel-Clean Fuels Staff	6 trips @ $1,750/trip	$ 10,500
Total		**$ 1,500,000**

Clean Fuels ALLIANCE AMERICA

UNITED STATES

Good for the *Economy*
Good for the *Environment*

CLEAN FUELS: AMERICA'S ECONOMIC ENGINE

U.S. Economic Impact (2021)

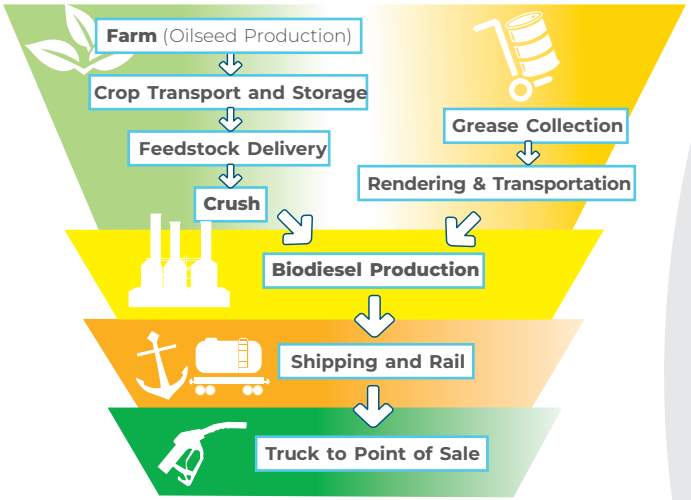
3.1 billion
Gallons

75,200
Jobs

$3.6 billion
Wages Paid

$23.2 billion
Total Economic Impact

The Clean Fuel Value Chain



PRODUCING MORE CLEAN FUEL ADDS MORE VALUE TO THE U.S. ECONOMY

Increasing homegrown biodiesel and renewable diesel production to meet future demands:

Producing a total of **6 billion** gallons of biodiesel and renewable diesel would support:

187,000 full-time/full-time equivalent jobs

$8.8B wages

$61.6B total economic impact

PLUS the short-term temporary impact ofincreasing supply:

144,500 full-time/full-time equivalent construction jobs

$5.8B wages

$4.3B total economic impact

Current Clean Fuel Production Impact by Sector

Farm Sector
(Oilseed Production)

$7.41B **30%** of total impact
28,236 jobs
$1.36B wages

Crush Sector
(Oilseed Processing)

$4.97B **21%** of total impact
6,000 jobs
$380M wages

Clean Fuel Production Sector
(Biodiesel and Renewable Diesel)

$9.57B **41%** of total impact
17,120 jobs
$880M wages

Sources: LMC International, Economic Impact of Biodiesel onthe US Economy 2022, New York: September 2022.

cleanfuels.org
biodiesel.org
mybioheat.com

DC 1331 Pennsylvania Ave., NW Suite 505 Washington, DC 20004 **888-246-3437**

MO 605 Clark Avenue PO Box 104898 Jefferson City, MO 65110 **800-841-5849**

MA 36 Jonspin Road Suite 235 Wilmington, MA 01887 **781-361-0156**

CA 1415 L Street Suite 460 Sacramento, CA 95814 **916-760-8870**

Materials supported by United Soybean Board, soybean farmers and their checkoff.

Arkansas Ag in the Classroom
Funding Proposal for the Arkansas Soybean Promotion Board
January 31, 2025

Submitted by:
Donette Spann, Director, Ag in the Classroom

The Arkansas Ag in the Classroom program engages and educates students and teachers about the importance of agriculture in Arkansas. We collaborate with schools in urban and rural communities, as well as county and state organizations. We also present in workshops and through community partnerships. Last year, our educational materials and programs reached over 175,000 people.

Arkansas Ag in the Classroom programs aim to educate youth and adults about the various commodities produced in the state. Since Arkansas is a significant soybean-producing state, we see a valuable opportunity to raise awareness and educate specifically about this commodity through various methods. We are asking the Soybean Promotion Board to consider funding three projects that will benefit the soybean industry through promotion and engagement.

Soybean Ag Readers

Since 2023, over 75,000 ag readers have been distributed to students, schools, and other organizations. The *Arkansas Ag in the Classroom Soybean Ag Reader* is one of the most popular offerings in the Ag Reader series. To highlight the connection between soybeans and other commodities, we also include soybean messaging in the poultry and beef ag readers, as soybeans are a vital part of livestock diets. We plan to update these ag readers in 2025 and request $5,000 for these updates, which will allow us to print new soybean ag readers. It's noted that these are printed with soy ink. Our goal is to offer these resources at no cost to schools.

Elementary Agriculture Education Pilot Program – Soybean Curriculum

The Arkansas Legislature passed Act 243 in 2023, establishing the Elementary Agriculture Education Pilot Program. This three-year pilot program aims to introduce kindergarten through 6th grade students to agriculture by utilizing a curriculum to be developed by the National Council of Agricultural Literacy (NCAL) in collaboration with the University of Utah. The lessons will highlight commodities grown in Arkansas, with soybeans featured in at least one lesson for each grade level, totaling seven lessons. The curriculum is scheduled to be released and presented during professional development workshops for designated teachers this summer to begin use in the 2025-26 school year.

We are seeking $20,000 to develop the curriculum and acquire supplies and materials for hands-on STEM projects featuring soybeans in the classroom at pilot schools.

***Soy in the Kitchen* Grant Program**

The *Soy in the Kitchen* grant program seeks to create opportunities for students to discover new foods, particularly by introducing them to soy products in the kitchen. Family and Consumer Science (FCS) teachers in high school, junior high school, and middle school can apply for $100 grants to purchase soy products and experiment with new foods alongside their students. These products may include edamame, tofu, soy milk, soy sauce, and soy nuts, among others.

For the 2025-26 school year, we aim to award 100 teachers $100 grants. We are seeking $15,000 in funding. The remaining funds will be used to procure and print soybean recipes, fact sheets, and cover postage for mailing checks and materials to the teachers.

Applications will open in early September, and funds will be distributed in time for Arkansas Soybean Month in November. Awarded teachers are required to complete an evaluation after using the funds and submit receipts for their purchases.

In 2023, the soybean checkoff sponsored the grant program that provided $100 grants to 107 teachers, benefiting over 11,000 students.

Investment

Soybean Ag Readers Update/Printing	$5,000
Elementary Agriculture Education Pilot Program – Soybean Curriculum/Materials	$20,000
Soy in the Kitchen Grant Program	$15,000
Total Requested	**$40,000**

Reporting

A progress report for each project will be available for presentation in the fall of 2025.

Contact:
Donette Spann
Director, Ag in the Classroom
Arkansas Farm Bureau Federation
501-228-1222
donette.spann@arfb.com

REQUEST FOR FUNDING OF RESEARCH
2025 FUNDING CYCLE

TITLE: Spatial and temporal variation of soil sampling affect phosphorus and potassium recommendations for soybean

INVESTIGATORS:
Principal Investigator (PI):
Md. Rasel Parvej, Assistant Professor, Louisiana State University Agricultural Center – Scott Research and Extension Center, 212-A Macon Ridge Road, Winnsboro, LA 71295. Phone: (318) 435-2908. E-mail: mrparvej@agcenter.lsu.edu

Cooperators:

Melissa W. Cater, Regional Director – Northeast Region, Louisiana State University Agricultural Center – Scott Research and Extension Center, 212-B Macon Ridge Road, Winnsboro, LA 71295. Phone: (318) 435-2903. E-mail: mcater@agcenter.lsu.edu

Nathan A. Slaton, Assistant Director, Agricultural Experiment Station, University of Arkansas System Division of Agriculture, 1371 W Altheimer Drive, DTAS 217, Fayetteville, AR 72704. Phone: (479) 502-9804. E-mail: nslaton@uark.edu

Gerson L. Drescher, Assistant Professor, University of Arkansas System Division of Agriculture, 1366 W Altheimer Drive, Fayetteville, AR 72704. Phone: (479) 575-3912. E-mail: gldresch@uark.edu

Jagmandeep Dhillon, Assistant Professor, Mississippi State University, Plant and Soil Sciences, Mail Stop 9555, Mississippi State, MS 39762. Phone: (662) 325-2762. E-mail: jagman.dhillon@msstate.edu

PROGRAM AREA (check all that apply):
___ Management of weeds, to include resistance management and economics
___Irrigation/water management
___Quality of harvested seed—Phomopsis/Seed rot
___ Disease Management/Control
_X_ Fertility needs (especially P and K) for optimum and economical yield
___ Insect management/Control, especially late-season populations
___ Harvest aids
___ Iron Chlorosis
___ Nematode management/control
___ Rotations using soybeans
___ Research Validation or Demonstration
_X_ Producer Communications
___ Variety Trials
___ Economics
___ Other (*Identify*)

PROJECT STATUS:
New ____ *(Indicate planned length of project–1 of 2, 1 of 3, etc.)*

Renewal __X (Year 3 of 3)

Stand alone ___ or cross-commodity _X__ (*additional funding from other sources?*)

2025 FUNDING REQUEST _$30,000_

BUDGET FOR 2023 MSSB RESEARCH PROJECT			
CATEGORY *(see below for guidelines)*		ORIGINAL	
A.	Personnel (No Permanent Salaries)		
	1. Salaries (See Addendum B)	-	
	2. Wages (hourly workers)	$5,000	
	3. GRA (include tuition)	-	
B.	Fringe Benefits (% *used to calculate*)	$383	
C.	Travel (*miles and meetings*)	-	
D.	Contractual Services	-	
E.	Subcontracts	-	
F.	Commodities *(Lab supplies)*	$617	
G.	Publication Costs	-	
H.	Other Costs *(Soil and plant analysis)*	$24,000	
TOTAL COST		$30,000	
(MSSB does not allow indirect costs/overhead charges)			

Personnel: Show number of hours x hourly rate for each category. GRA cost to include tuition and books. MSSB does not pay salaries of principal investigators or cooperating scientists (USB Compliance Manual, Sect. 17, Part 2-D).
Fringe Benefits: Amount and rate for indicated salaries, wages, and GRAs must be shown.
Travel: Out-of-pocket and per diem expenses (hotel and meals) for site visits, travel to and from meetings (e.g. airfare, vehicle mileage not to exceed the IRS rate), etc.
Contractual Services: External lab fees, consultants, etc.
Commodities: Expenses related to the conduct of the project (e.g., seed, fertilizers, pesticides, lab supplies).
Additional Details: Provide for each budget category in addendum if necessary.
Reminder: All payments for project activities are on a reimbursable basis based on an itemized invoice submitted to MSSB each quarter along with a progress report.
Budget Transfers: The MSSB follows USB guidelines, which state "The PI may transfer funds amongst budget categories only with MSSB's prior written consent if (i) the amount transferred exceeds 10% of any one general budget category (per annual period) or (ii) the funds transferred are travel related. PI shall request permission from MSSB for all budget reallocations and account for them in his/her financial report."
Additional Instructions: See Addendum B.

TECHNICAL SUMMARY

Most Mid-South soils are depleted in fertility, organic matter, and nutrient holding capacity due to continuous mono-cropping and conventional tillage systems and often require both phosphorus (P) and potassium (K) fertilizers to maximize soybean (*Glycine max* L. Merrill) yield and profitability. Both P and K fertilizers are generally recommended based on soil-test P and K concentrations from soil samples collected after summer crop harvest. Since soil-test P and K concentrations fluctuate spatially and temporally, investigating the effects of soil sampling time and method across different crop rotations, soil types, and soil management practices will help develop better soil-test-based P and K fertilizer recommendations that reduce fertilizer recommendation errors and maximize soybean yield and profitability. Research trials will be conducted at the LSU AgCenter – Macon Ridge Research Station (MRRS) and/or Northeast Research Station from 2025 to 2026 across different crop rotations, soil types, and soil management practices in Louisiana with the additional research sites in Arkansas and Mississippi during 2025. We expect to develop research-based soil sampling guidelines for optimum P and K fertilizer recommendations that maximize soybean yield and profit. In addition, we expect to develop a regression model to predict the temporal variation of soil-testing values following summer crop harvest and tillage management practices. The outputs of these research trials will help producers adjust their fall soil-test values with the predicted maximum values from summer crop harvest to the next summer crop planting, which will minimize fertilizer input and cost and reduce associated offsite overfertilization impacts. Results of each year's trial will be summarized and presented in local, state, regional, and national extension and professional meetings and published in extension newsletters, blogs, and web-based ag news to improve knowledge and awareness of producers, crop consultants, and industry personnel about the best time and method of soil sampling that result in optimum fertilizer recommendations and maximum soybean yield across Mid-South states. The final results will be published in a peer-reviewed journal.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

The continuous mono-cropping and conventional tillage system in most Mid-South states has depleted soil fertility [especially phosphorus (P) and potassium (K) content], soil health (organic matter), and overall productivity. Phosphorus and K are essential plant nutrients that negatively affect soybean (*Glycine max* L. Merrill) yield if grown in P and K deficient soils, respectively. Most Mid-South soils often require both P and K fertilizers to optimize soybean yield and sustain soil fertility and productivity. The amount of P and K fertilizer required for maximum yield is determined by routine soil testing. Most land-grant universities developed soil-test-based P and K fertilizer recommendations based on soil samples collected typically from late winter months (January-February) to before summer crop planting. However, the time for soil sampling from producer fields has recently changed greatly. Nowadays, crop consultants or farm-service reps prefer to collect soil samples mostly within a few weeks after summer crop harvest (August-November, depending on the type of summer crop) due to the chances of rain in the early to late winter months (December-January), increased number of soil collection over time, and use of ATV's or autosamplers in dry soil conditions. Since soil-test P and K concentrations are reported to fluctuate spatially and temporally, the recent change in soil sampling time may influence the current soil-test-based P and K fertilizer recommendations for soybean production in Mid-South states.

Recent research conducted on silt loam soils in Arkansas showed that soil-test P and K concentrations changed temporally from October through March and the temporal change was affected by the previous summer crop. Researchers found that soil-test P concentration remained constant across time following the rice (*Oryza sativa* L.) harvest but declined very slowly with time following the soybean harvest. However, soil-test K concentration increased quadratically with time and peaked by 22 ppm in late December to early January following the rice harvest and remained constant across time following the soybean harvest. Results from the 2023 LSU AgCenter trial showed that Mechlich-3 soil K concentration was 45-50 ppm higher in December compared to right after harvesting corn and rice and corn and rice straw released around 60 and 35 lb K2O/acre, respectively from harvesting to mid-January (Figure 1). Researchers suggest that since K is not a part of the cell wall or any molecular structures, it is slowly being leached from crop residues by rainfall following harvest, resulting in increased soil-test K concentration in December-January compared to September-October and lower

recommended fertilizer rates for samples collected in the late winter months. In addition, high-residue crops such as rice and corn hold a greater amount of K in vegetative plant parts and eventually release more K across time after harvest compared to a low-residue crop such as soybean. Ongoing research on silt loam soils in Arkansas showed that soil moisture content during sampling may influence soil sampling depth, soil core integrity, and P and K concentrations. Together these results suggest that the effects of soil moisture, sampling time and position, and previous summer crop on the spatial and temporal variation of soil-test P and K concentrations across different soil types and management practices need to be characterized and fertilizer recommendations need to be adjusted accordingly to maximize soybean yield and profit and minimize nutrient losses. Detailed research to evaluate the spatial and temporal influences of soil sampling on soil-test P and K concentrations is needed to understand and identify whether the current soil sampling practices result in temporal and spatial variances that can significantly influence soil-test-based P and K fertilizer recommendations and if so, to develop the best time and method of sampling for optimal fertilizer recommendations that maximize soybean yield and profit.

OBJECTIVE(S):

The objective of this study is to characterize the effects of soil sampling time and position, rotational crop, and soil management practices on soil-test P and K concentrations and fertilizer recommendations for soybean production in Mid-South states.

APPROACH AND EXPERIMENT CONDUCT:

Research trials will be conducted at the LSU AgCenter – Macon Ridge Research Station and/or Northeast Research Station from 2025 to 2026 across different crop rotations, soil types, and soil management practices in Louisiana with the additional research sites incorporated in Arkansas and Mississippi in 2025. Crop rotations will include three rotation systems: corn (*Zea mays*) – soybean, cotton (*Gossypium hirsutum* L.) – soybean, and rice (*Oryza sativa* L.) – soybean systems. Research trials for each rotation system will be conducted on the same soil type. Silt loam soils will be preferred, but clayey soils may be included if they have low to near optimal levels of P or K. Trials for each rotational crop will be designed as a strip-plot treatment structure with four replications including soil management practices as a strip plot. Soil management practices will include no-tillage and tillage systems. No-tillage is referred to as a completely undisturbed bed and tillage is completely tilled the bed after summer crop harvest followed by heaping to make new beds sometime in the

winter or before planting. Tillage and minimum-tillage practices for each rotation and soil type will be established after the summer crop harvest.

A series of soil samples at a state-specific recommended depth (either 0- to 4-inch or 0- to 6-inch) will be collected from each plot of each replication using a regular *AMS* soil probe (7/8-inch diameter) starting immediately after summer crop harvest and continued on a 15-day interval until the next year-soybean planting. Each composite soil sample will consist of at least 8 soil cores. Soil samples will be collected from the top of the bed (around 6 inches apart from the crop row) and the middle of the furrow for the furrow-irrigated system. For flood-irrigated rice–soybean systems with <15-inch row spacing, soil samples will be collected only from the middle of crop rows since there is minimum spatial variation. A detailed description of each research site including soil texture, fertilizer rate, crop variety, seeding rate, row spacing, irrigation, and summer crop yield will be recorded.

Each composite soil sample will be collected using a gallon-size plastic bag with proper labeling. Each composite sample will be air-dried and sent to the LSU AgCenter Soil Testing and Plant Analysis Laboratory, Baton Rouge, LA for Mehlich-3 routine soil analysis (pH, Mehlich 3 extractable P, K, Ca, Mg, Na, S, Fe, Mn, Zn, Cu, B). Besides soil sampling, summer crop residue from each no-tillage plot of each replication will also be collected at harvest and continued on 3-4 weeks intervals until the next year's soybean planting. The harvested crop residue will be dried and analyzed for nutrient concentrations (P, K, Ca, Mg, Na, S, Fe, Mn, Zn, Cu, B) at LSU AgCenter Soil Testing and Plant Analysis Laboratory, Baton Rouge, LA to determine the amount of nutrient release from crop residue following summer crop harvest. A mean difference of soil and residue P, K, and other nutrient (S and Zn) concentrations for each sample time will be calculated by subtracting the soil and residue nutrient values from initial soil and residue nutrient values of soil and plant samples collected at summer crop harvest. The mean difference of soil and residue nutrient values will be regressed across sampling time (days after summer crop harvest, DAH) using a GLIMMIX procedure of SAS by including both linear and quadratic terms of DAH as fixed effects and site-year as random effects. For soil nutrient values, the fixed effects of both linear and quadratic terms of DAH will also be allowed to interact with sampling positions and soil management practices. The final model will be developed by eliminating all non-significant ($P > 0.10$) model terms using a stepwise backward elimination technique.

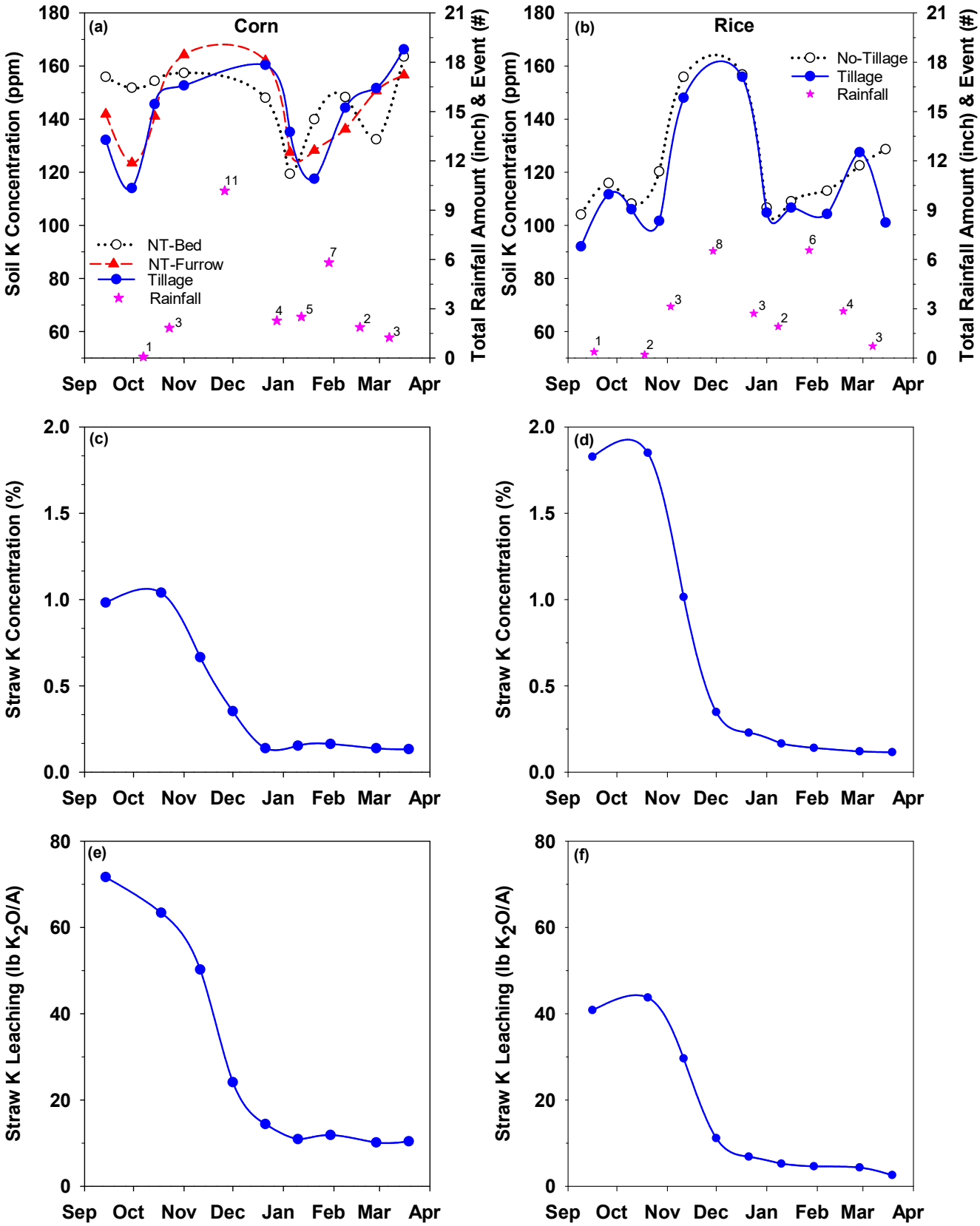


Figure 1. Mehlich-3 soil K concentration (a-b), straw K concentration (c-d), and amount of K leaching from straw (e-f) across time after corn (left) and rice (right) harvest for research trial conducted at LSU AgCenter – Macon Ridge and Northeast Research Station in 2022 to 2023 for corn–soybean and rice–soybean rotations.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

The outcomes of this study will directly benefit Mid-South soybean production by developing the best time and way of soil sampling across crop rotation, soil types, and soil management practices for optimum fertilizer recommendations that maximize soybean yield and profit. In addition, the outputs of these research trials will help producers adjust their fall soil-test values with the predicted maximum values from summer crop harvest to the next summer crop planting. The results of this study will also be summarized and presented in local, state, regional, and national extension and professional meetings and published in extension newsletter and web-based ag news to improve knowledge and awareness of producers, crop consultants, and industry personnel regarding how soil sampling timings and methods influence P and K recommendations for soybean production in Mid-South states.

Soybean is grown in about 11.4 million acres of land across Mid-South states (AR, LA, MS, & MO). Around 25% and 51% of the Mid-South acres (2.9 to 5.8 million acres) have soil-test P and K concentrations less than 15 ppm P and 94 ppm K, where P and K fertilization is recommended to maximize soybean yield and profit. Another 38% and 20% (2.3 to 4.3 million acres) of Mid-South soybean acreages have soil-test P and K concentrations, respectively, in the medium range (15-30 ppm P and 94-128 ppm K) where soybean yield response to fertilization is likely. Recent USDA-ERS fertilizer use statistics show that about 39% and 49% of Mid-South soybean acreage (4.5 to 5.6 million acres) were fertilized with, on average, 59 pounds of phosphate (P_2O_5) and 85 pounds of potash (K_2O) per acre, respectively. The expected outcomes of improved soil sampling and fertilizer recommendation guidelines and whether the recommended fertilizer rates need to be adjusted based on sampling time and method will directly benefit approximately 5.6 million acres of Mid-South soybean that receive fertilization, with the possibility of another 4.3 million acres of soybean, having medium soil-test P and K concentration, most likely will require fertilization within a short period. In addition, P and K fertilization cost for Mid-South soybean represents approximately $345 million ($159 million for P and $186 million for K), and the expected outcomes of timely and accurate soil sampling and fertilizer recommendations will directly reduce fertilizer amount and cost and offsite environmental impacts from overfertilization.

EXPECTED END PRODUCT(S)

We expect to develop research-based guidelines regarding the best time and method of soil sampling and P and K fertilization for maximum soybean yield with optimum fertilizer usage. In addition, we expect to develop a regression model to predict the temporal variation of soil-testing values following summer crop harvest and tillage management practices, which will help producers adjust their fall soil-test values with the predicted maximum values from summer crop harvest to the next summer crop planting, minimize fertilizer input and cost, and reduce associated offsite overfertilization impacts. Results from each year's trials will be summarized and presented in local, state, regional, and national extension and professional meetings and published in extension newsletter, ag magazine, blog, social media, and web-based ag news to improve knowledge and awareness of producers, crop consultants, and industry personnel regarding the best soil sampling and P and K fertilization strategies for maximum soybean yield and profitability. The final results will be published in a peer-reviewed journal. Outcomes from this study could also be published as "soil sampling and fertilizer recommendation guidelines" in each State Soybean Production Handbook.

APPENDICES A

Explanation/justification of budget categories for clarification or detail.

A. Salary

- *Hourly worker for collecting, grinding, and processing soil and plant samples ($10.00/hour x 500 hours) = $5,000*
- ***Total Salaries: $5,000***

B. Fringe benefits

- *5,000 x 7.65% = $383*
- ***Total Fringes: $383***

F. Commodities (Lab supplies)

- *AMS Soil Probe & Fertilizers: = $617*
- ***Total lab supplies: $617***

H. Other Costs (Soil and plant analysis)

- *Soil analysis: 2 locations x 4 crop rotations x 2 tillage practices x 2 soil positions x 4 reps x 15 times = 1920 samples*
  - *1920 samples x $10 Basic Soil Diagnostic Package (pH, Mehlich 3 extractable P, K, Ca, Mg, Na, S, Fe, Mn, Zn, Cu, B) = $19,200*
- *Plant analysis: 2 locations x 4 crop rotations x 4 reps x 10 times = 320 samples*
  - *320 samples x $15 Basic Plant Diagnostic Package (P, K, Ca, Mg, Na, S, Fe, Mn, Zn, Cu, B) = $4,800*
- ***Total soil and plant analysis: $24,000***

2025 MIDSOUTH SOYBEAN BOARD

PROPOSAL TITLE: How does cover crops impact soil water dynamics and soybean production in Louisiana?

INVESTIGATORS:

Dr. Xi Zhang, Assistant Professor, Louisiana State University-Ag Center
Email: xizhang@agcenter.lsu.edu, Phone: (318) 408-0983

Dr. Changyoon Jeong, Associate Professor, Louisiana State University-Ag Center
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Dr. Gary Feng, Research Soil Scientist, USDA-Agricultural Research Service at MS State
Email: gary.feng@usda.gov, Phone: (662) 320-7516

PROGRAM AREA (check all that apply):

___ New Uses of Soybean
___ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
_X_ Irrigation/Water Management
___ Seed Quality
___ Disease Management and Control
___ Fertility Management
___ Insect Management/Control
___ Harvest aids
___ Nematode Management/Control
___ Rotations using soybeans
_X_ Research Validation or Demonstration
___ Producer Communications
___ Variety Trials
___ Economics
_X_ Other (Drought Management)

PROJECT STATUS:

New ____ Expected research length (yr)_____

Renewal _X_ (Year _3__ of _3__)

Stand alone _X_ or cross-commodity ___ (*additional funding from other sources? Name all other sources and amounts co-funded.*)

2025 TOTAL FUNDING REQUEST $ 27,540

2025 MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)	$18,000	4 months
	2. Wages (hourly workers)	0	
	3. GRA (include tuition)	0	
B.	**Fringe Benefits** (% *used to calculate*)	$9,540	53%
C.	**Travel**		
D.	**Contractual Services**		
E.	**Subcontracts**		
F.	**Commodities**		
G.	**Publication Costs**		
H.	Other Costs *(Define)*		
TOTAL COST		$27,540	
(MSSB does not allow indirect costs/overhead charges)			

***Personnel**: One postdoctoral scholar (~4 months time effort) will work on this project to perform fieldwork and data analysis. The salary is $18,000 (4 months x $4,500/month).*
***Fringe Benefits:** Per LSU-AgCenter policy, the fringe benefit rate for postdoctoral research is 53%. The fringe benefit is $9,540 ($18,000 x 53% = $9,540).*
***Travel**: N/A*
***Contractual Services**: N/A*
***Commodities**: N/A*
***Additional Details**: N/A*
***Budget Transfers**: N/A*
***Additional Instructions:** See Addendum B.*

TECHNICAL SUMMARY

Soybean is highly susceptible to extreme weather conditions (e.g., drought). However, the mid-southern U.S. is experiencing increasing variability in rainfall, which can lead to more frequent soil water deficits during the growing seasons and increase the risk of yield losses. To close soybean yield gaps, it is critical to develop management practices that buffer against short-term water stress and sustain crop production. Cover crops have been gaining attraction as rotational crops because of their potential contributions to soil and water conservation. However, the amount of water consumed by cover crops and the water availability for succeeding crops have recently been raising concerns. Cover crops transpire water for their growth, and conserve soil water when they are terminated if the residues are retained on soil surface. The overall impacts of cover cropping on soil water storage, availability, and recharge for cash crop and thus yield depend on climate, soil, and management conditions of the area. Existing studies were conducted mainly in temperate mid-western regions. Quantitative analysis of cover cropping and soil water dynamics interactions in the mid-southern areas is essential for evaluating the benefits of cover cropping for soybean production in humid subtropical regions. This 3-year project integrates lab analyses, field sensors and crop models to evaluate the effects of cover cropping on soil water dynamics and soybean yield at fields with different soils (coarse- and fine-texture) in Louisiana and Mississippi. Soil moisture in cover cropped and bare ground fields will be collected during the winter months and summer growing seasons to monitor soil water status and crop water use. Crop parameters will be measured throughout the study period to estimate cover crop and soybean growth. Expected results are (1) soils may experience some or no extra consumptive water losses due to cover cropping through evapotranspiration, which depends on soil types; (2) the adverse effects of cover cropping on soil water availability can be offset by its positive effects on soil water retention and does not impact soybean growth. This research provides a basis for optimizing site-specific cover cropping management to improve water use efficiency, mitigate drought stress, sustain and enhance soybean production in the mid-south, and simultaneously boost producers' economic well-being and quality of life.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

The mid-southern United States is one of the nation's leading commodity crop planting regions due to its intensive crop production systems. Soil water status, which is closely related to nutrients transport/availability and photosynthesis, has strong impacts on crop growth and production. Soybean (*Glycine max*) is a common conventional cropping system in Louisiana (LA) and Mississippi (MS), where this crop is often not limited by water resources because annual rainfall in the region is approximately 1,450 mm. However, the hot and humid mid-southern region is experiencing increasing seasonal and annual variability in rainfall, which leads to more frequent soil water deficits and periodic severe droughts during the growing seasons and threatens crop production (Nouri et al., 2018). Drought adversely affects crop production and may reduce >50% of the soybean yields (Dubey et al., 2019). For example, the devastating drought in 2012 and 2022-2023 growing seasons. Based on the analysis of historical weather trends and climate model projections, the dry events during growing season in the region are predicted to increase in the next decades (National Oceanic and Atmospheric Administration). In Louisiana and Mississippi, ~50% of cropland is rainfed. The predicted changes in rainfall will impact soil water storage, water use efficiency, and thus, soybean yield. *Therefore, it is critical to develop scientifically sound management practices that buffer against short-term water stress, improve drought resilience, minimize yield losses, and sustain soybean production in the agricultural ecosystem*.

To minimize the impact of drought, soil needs to capture a high percentage of rainfall and maximize the storage of water for crop use. Cover cropping has been gaining attraction as rotational crops due to their potential contributions to soil and water conservation. Cover cropping, which plants crops during fallow periods between cash crops, can increase soil organic matter, reduce surface evaporation when residues are retained on the soil surface, improve soil structure and rainfall capture, and enhance cash crop access to water held in deep soil layers by opening root channels through soil (Unger et al., 1998). Integration of cover crops seems to be an approach to potentially mitigate the

adverse effects of agronomic drought on crop yield. While cover cropping is increasingly considered to improve soil service, cover crops do require water to grow and may have negative effects on soil water availability for the following cash crops (Ogilvie et al., 2019). Fields with cover crops may experience extra consumptive water losses through evapotranspiration during winter and reduce soil moisture content and available soil water reserves for the following cash crops (DeVincentis et al., 2022; Hunter et al., 2021). Although several studies have shown higher soybean yields when a cover crop is grown during the winter, grain yields can be reduced when a cover crop uses too much soil available water (Blanco-Canqui et al., 2015; Cherr et al., 2006). The ability of cover cropping to mitigate drought stress and maintain grain yields depends on whether it can potentially increase soil infiltration and water retention sufficiently to offset the cover crop water use, which is mainly influenced by local climate, cover crop species, and soil conditions (Kaye et al., 2017). A meta-analysis based on 93 paired observations showed that planting cover crops significantly increased water retained at field capacity and this favorable effect was more obvious in relatively drier climate (Basche et al., 2017). However, a 5-year study conducted in California showed a negative water balance in soil under cover crop treatments compared with fallow during the active cover crops growth period (Mitchell et al., 2015). In the dry year of 2012, rye cover crop did not change water storage in Indiana silt loam soil but increased water storage in Iowa clay loam soil (Daigh et al., 2014). These regional responses may therefore have limited applicability towards understanding soil water dynamics under cover cropping. *It is unclear whether the impacts of cover cropping on water balance can be offset by improved soil water retention to reduce drought-induced grain yield losses. The actual effects of cover cropping on mitigating drought stress in the following cash crop is still not well understood.*

Despite the emergence of cover cropping as a sustainable agricultural management practice, its adoption remains limited in the mid-southern region. This hesitancy may stem from the uncertainties about the effects of cover cropping on soil water storage and subsequent crop yield, and the costs associated with establishing and maintaining cover crops (Acharya et al., 2019). A better understanding

of cover crops water use as well as their impacts on soil water balance is therefore crucial for the development of cover crops management guidelines. Research on the effects of cover cropping on soil water dynamics and crop production under different geographic regions is ongoing and increasing; however, many of the existing studies on cover cropping were performed in the temperate regions of the mid-western United States. The integration of cover crops in mid-south humid subtropical production systems is still recent, and there is only limited and inconclusive research in this region. *How the soil water balance and crop production in the mid-southern fields are affected by cover cropping practices remain elusive. Producers who consider using cover crops want to be sure that the extra effort and expense will provide tangible benefits in their operations, so any such ambiguities may limit cover cropping adoption. More information is needed to enable effective decision making by producers.* As a result of predicted recurrent drought conditions in the mid-south, there is a need to quantify how winter cover cropping affects soil water balance on agricultural production fields. This is a critical step in understanding the water-related implications of winter cover cropping and barriers to adopting this sustainable farming practice in humid subtropical rainfed/irrigated systems in the mid-south.

OBJECTIVE(S):

The proposed work addresses a knowledge gap in understanding the effectiveness of cover cropping in enhancing soil system adaptability to weather extremes and improving soybean production under humid subtropical climate in the mid-southern regions. *The overarching goal of this project is to provide a more comprehensive and translatable cover cropping assessment on soil resilience to drought, crop productivity, and producers' overall profitability in the context of soil variability*.

Objective 1: Estimate soil water improvements by different cover crops in diverse soils to demonstrate and quantify the short- and long-term agronomic impacts of cover cropping on soil water storage and availability in soybean fields.

Objective 2: Assess soybean performance in fields with and without cover crops to investigate the impacts of soil water balance changes due to cover cropping on crop production.

APPROACH AND EXPERIMENT CONDUCT:

The 3-year study is conducted on rainfed no-till fields (4-acre each) with contrasting soil characteristics (coarse- and fine-texture) at the LSU-AgCenter Red River Research Station (N 32°25', W 93°38') and MSU Pontotoc Ridge-Flatwoods Branch Experiment Station (N 34°08', W 89°00'). The region has a humid subtropical climate with mean annual precipitation of 1,400 mm and mean annual temperature of 18.5 °C. Soils of the fields are Caplis sandy loam (LA), Moreland silty clay loam (LA), and Falkner silt loam (MS). In each field, the treatments (subplots) are cover crops and no cover crops with three replicates. The treatments are arranged in a randomized complete block design. Nonlegume (e.g., rye) and legume (e.g., winter peas) cover crops with high biomass are planted in October and terminated by herbicides in April of the following year. Soybean is the subsequent cash crop.

Objective 1: The changes in soil water status during cover crops and soybean growing seasons are monitored continuously by volumetric soil moisture sensors, which are installed at two depths (i.e., 8 and 16 inches) in each subplot (Daigh et al., 2014). Intact soil samples are taken from each subplot at two depths (i.e., 0-8 and 8-24 inches) to measure soil porosity, infiltration and water retention capacity (Basche et al.,2016). Field data and lab analysis are integrated to estimate the actual effects of cover cropping on soil water dynamics. Crop models (e.g., DSSAT) are calibrated and validated with field experiments data to evaluate the long-term effects of cover cropping on water storage and availability.

Objective 2: Soybean leaf area index is measured at different growth stages with ACCUPAR LP-80 for estimating crop growth. Soybean nutrient content is determined for leaf tissue and grain (Acharya et al., 2019). Soybean grain yield will be determined by harvesting the center two rows of each subplot with a combine harvester. These data will be used to estimate the impacts of cover cropping on soybean production. Also, cover crop biomass is determined from 1 m^2 quadrats clipped at the level of the soil before termination. Cover crop nutrient content is measured for the whole aboveground biomass.

Together, the outcomes untangle the mystery of whether cover cropping can enhance soil resilience to drought and sustain soybean production by shaping water dynamics under diverse soils.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

In recent years, soybean has become a major crop in LA and MS. According to the USDA-NASS report, soybean planted areas in LA and MS were 1.03 million and 2.18 million acres, respectively; and the productions were 39.2 million and 119 million bushels, respectively in 2023. The soybean production values were 521 million and 1.60 billion dollars, which contributed 19% and 51% to the total value of production for field crops in LA and MS, respectively in 2023. This project, though focused on LA and MS, is applicable to similar soybean fields in the mid-south and beyond and provides research-based information to mid-south producers to develop scientifically-sound production practices that make farms more resilient in extreme weather, improve soybean production, and enhance long-term profitability.

EXPECTED END PRODUCT(S)

Research-based information will be delivered to the producers through field days, newsletters, extension publications and on-farm demonstrations (expect 1 extension article and 1-2 field days), and to the academic communities through publications in peer-review journals (expect 1 manuscript) and presentations at professional conferences (expect 1-2 posters at ASA-CSSA-SSSA meeting). We expect the findings based on a whole-systems approach to benefit the development of cover crops management guideline, which will improve soil system adaptability to weather extremes, enhance soybean production, and boost producers' economic well-being and quality of life in the mid-south.

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2025 MIDSOUTH SOYBEAN BOARD

PROPOSAL TEMPLATE *(Limit the final document to 8 pages)*

PROPOSAL TITLE: **Development of climate-smart high-yield practices associated with high-end biological treatments and soybean-related microbiome resiliency.**

INVESTIGATORS:
Principal Investigator (PI): Woo-Suk Chang, Professor, University of Texas-Arlington, Tel: 817-272-3280, e-mail: wschang@uta.edu
[Cooperators]: 1. James Grichar, Senior Research Scientist, Texas A&M AgriLife Research, Tel: 361-293-8815, e-mail: james.grichar@ag.tamu.edu. **2. Paul (Trey) Price**, Assistant Professor, Louisiana State University AgCenter, Tel: 318-235-9805, e-mail: pprice@agcenter.lsu.edu. **3. Shawn Clark**, Resident Director of Pine Tree Research Station, University of Arkansas, Tel: 870-633-5767, e-mail: sdc01@uark.edu. **4. Tessie Wilkerson**, Assistant Research Professor, Mississippi State University (Stoneville, MS), Tel: 662-686-3205, e-mail: thw76@msstate.edu. **5. Feng Lin**, Assistant Professor Soybean Breeding, Fisher Delta Research Extension and Education Center, University of Missouri, Tel: 573-379-5431, e-mail: flbn7@missouri.edu

PROGRAM AREA (check all that apply):

___ New Uses of Soybean
___ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
___ Irrigation/Water Management
___ Seed Quality
___ Disease Management and Control
___ Fertility Management
___ Insect Management/Control
___ Harvest aids
___ Nematode Management/Control
___ Rotations using soybean
_V_ Research Validation or Demonstration
___ Producer Communications
___ Variety Trials
___ Economics
_V_ Other (*Identify*)

PROJECT STATUS:

New ____ *(Indicate planned length of project–1 of 2, 1 of 3, etc. Note that projects are only approved on a yearly basis.)*

Renewal __V__ (Year _3__ of _3__)

Stand alone __V__ or cross-commodity ___ (*additional funding from other sources? Name all other sources and amounts co-funded.*)

2025 TOTAL FUNDING REQUEST $ _____$60,000_____

2025 MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)	$18,900	
	2. Wages (hourly workers)		
	3. GRA (include tuition)	$9,442	
B.	**Fringe Benefits** (% *used to calculate*)	$1,890 (10%)	
C.	**Travel**	$9,750	
D.	**Contractual Services**	$0	
E.	**Subcontracts**	$15,000	
F.	**Commodities**	$4,518	
G.	**Publication Costs**	$500	
H.	Other Costs *(Define)*		
TOTAL COST		$60,000	
(MSSB does not allow indirect costs/overhead charges)			

***Personnel**: Show number of hours x hourly rate for each category. GRA cost to include tuition and books. MSSB does not pay salaries of principal investigators or cooperating scientists (USB Compliance Manual, Sect. 17, Part 2-D).*
***Fringe Benefits:** Amount and rate for indicated salaries, wages, and GRAs must be shown.*
***Travel**: Out-of-pocket and per diem expenses (hotel and meals) for site visits, travel to and from meetings (e.g. airfare, vehicle mileage not to exceed the IRS rate), etc.*
***Contractual Services**: External lab fees, consultants, etc.*
***Commodities**: Expenses related to the conduct of the project (e.g., seed, fertilizers, pesticides, lab supplies).*
***Additional Details**: Provide for each budget category in addendum if necessary.*
***Reminder**: All payments for project activities are on a reimbursable basis based on an itemized invoice submitted to MSSB each quarter along with a progress report.*
***Budget Transfers**: The MSSB follows USB guidelines, which state "The PI may transfer funds amongst budget categories only with MSSB's prior written consent if (i) the amount transferred exceeds 10% of any one general budget category (per annual period) or (ii) the funds transferred are travel related. PI shall request permission from MSSB for all budget reallocations and account for them in his/her financial report."*
***Additional Instructions:** See Addendum B.*

TECHNICAL SUMMARY

Climate change, with its abiotic stressors and biotic interactions, presents a significant obstacle in understanding and predicting soybean production. This concern has led to a growing interest in developing heat, drought, or flood-tolerant soybean cultivars. In addition to these climate-smart soybean varieties, researchers have been working on trying to develop better inoculants which are nitrogen-fixing soybean symbiont bacteria, to aid in the fight against climate change. As a bioinoculant, *Bradyrhizobium japonicum* has been well established to help plant growth with its ability to fix atmospheric nitrogen into ammonia, thereby increasing root nodulation, plant biomass, and crop yield without the need for climate-deleterious synthetic fertilizers. No-till farming has also been used to maintain healthy soil, including preventing moisture loss, retaining organic matter, and facilitating nutrient cycling. Thus, combining bioinoculants and no-till farming as climate-smart farming practices can positively buffer the rhizosphere microbiome and promote more resilient soils by acting as a prebiotic that attracts other beneficial organisms. Hence, creating a repository of the soybean microbiome will aid in understanding the effects of bioinoculants on the rhizosphere soil microbial communities in different soil profiles across different regions.

In the previous MSSB project titled "Evaluation of a novel drought-tolerant inoculant on soybean yield in the Mid-South", we examined our novel drought-tolerant inoculant (i.e., *Bradyrhizobium* spp. TXVA strain) for its impact on soybean yield in the Mid-South. As a result, we found that the TXVA strain enhanced root nodulation, nitrogen fixation, and soybean yield, specifically under the non-irrigated condition. The genome of the TXVA stain has since been published, and the fact sheet is available to all soybean growers in the Mid-South. More importantly, it has been in the commercialization process through the Innovation and Commercialization Department at the University of Texas-Arlington. However, one missing part relating to climate-smart practices such as no-till farming and bioinoculant use is elucidating the application mechanisms to help farmers be aware of climate changes, greenhouse gas (GHG) emissions, and carbon credits. Therefore, the following should be considered to optimize bioinoculant-involved no-till climate-smart practices: no-till vs. conventional tillage, bioinoculant amounts, and application strategies (e.g., in-furrow, seed coating, or soybean-inoculant mixture before planting). The objective of this proposal is to provide farmers in the Mid-South with i) documented performance data for the climate-smart practices associated with no-till farming and the drought-tolerant inoculant in soybean production under climate changes and ii) biological information (e.g., metagenomics data and microbiome repositories) to encourage them to adopt the bioinoculant involved no-till climate-smart practice.

For the third-year trial (Year 2025), we plan to continue evaluating no-till and conventional tillage for GHG emissions and the rhizosphere microbiome while developing fact sheets on climate-smart bioinoculant practices. We will use a portable gas analyzer (i.e., Gasmet GT-5000 Terra FTIR) to measure emissions of CO_2, CH_4, and N_2O, the three major GHGs. Additionally, 16S rRNA sequencing will be conducted to analyze the rhizosphere microbiomes. By comparing three inoculant treatments (drought-tolerant TXVA inoculant, a commercial inoculant, and no inoculation) across drought-prone sites in the Mid-South, including AR, LA, MO, MS, and TX, we will develop fact sheets to assist farmers in implementing inoculant-involved no-till climate-smart practices. The planting and sampling strategy will follow the approach outlined in Objective #1.

At the completion of the proposed research, we expect to provide optimized drought-tolerant-involved no-till climate-smart practices on soybean profitability and aid Mid-South producers in better understanding the potential benefits of adopting this application. We believe that providing such information allows soybean producers to advance the management of soybean plants with economic and ecological benefits.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

Bradyrhizobium has presented itself as a versatile model organism to study plant-microbe interactions due to its dual lifestyles as free-living soil organisms and endosymbionts of many valuable legume crops, especially soybean. The abundance of this genera in the rhizosphere indicates functional importance via biogeochemical cycling and agricultural production. The plant growth-promoting mechanisms vary from nutrient management, such as biological nitrogen fixation (BNF) and phosphorus solubilization, to rhizospheric interactions using quorum sending and phytohormone production. Farmers have been manipulating the soybean-*Bradyrhizobium japonicum* mutualism for several decades to revitalize marginal soils, aid the yield, and establish a climate-friendly, sustainable agricultural approach by mitigating the use of synthetic fertilizers. However, more must be focused on practical applications of climate-smart practices associated with *B. japonicum,* whose cultures have been applied as inoculants (i.e., biological fertilizers) to the field.

The use of inoculants has profound economic benefits by reducing the financial cost of nitrogen fertilizers. Currently, the average U.S. farm prices of nitrogen fertilizers are as follows: anhydrous ammonia, $1,100; nitrogen solution (30%), $475: urea, $592; ammonium nitrate, $890 per ton, where price has increased in each category in recent year. In addition, enhancement of biological nitrogen fixation has significant biological benefits by reducing the use of synthetic nitrogen fertilizers that are a significant source of GHG emissions and cause degradation of water sources ranging from groundwater, where derivatives of nitrogen cause “baby-blue” syndrome, to oceanic systems where increased nitrogen leads to hypoxia (lack of oxygen) and large scale “dead zones” (e.g., in the northern Gulf of Mexico).

No-till farming is an agricultural practice for growing crops without soil disturbance. In general, no-till agricultural practices can i) reduce soil erosion, ii) increase microbial activities in soil, and iii) increase soil organic carbon, which results in carbon sequestration. Thus, combining the use of inoculants and the no-till method could reduce greenhouse gas (GHG) emissions with sustainable soybean production. With the use of a climate-smart drought-tolerant inoculant, soybean crop production is shown to improve in the Mid-South. We previously developed the drought-tolerant *Bradyrhizobium* strain (TXVA strain) using our laboratory's novel molecular marker system. The TXVA strain was tested for its symbiotic efficiency and effect on soybean crop production in drought-prone regions across South Texas, the Mid-South, and Sandhills, NC. Using this drought-tolerant inoculant improved soybean yield compared to no treatment and a commercial inoculant (e.g., Cell-Tech). The best insight into the action of TXVA was at the Sandhills Research Station NC, where its application improved yield by 3% in the irrigated portion and 10% in the rainfed. By its application, approximately 77% less nitrogenous fertilizer would be used to generate this output and therefore relaxes supply line requests and is climate-smart in nature (Herridge *et al.,* 2008). **By applying the bioinoculant-involved no-till practice in the Mid-South states, we expect to improve soybean crop yields while bringing attention to climate-smart practices to reduce GHG emissions.**

Based on previous work in our lab, the soybean rhizosphere under inoculant (i.e., biofertilizer) application shows more resilience than untreated plots, especially in non-irrigated conditions, which are typically more viable in climate changes. Establishing climate-smart microbiome repositories will help us identify the key to verifying integral species that are essential for sustainable plant growth promotion in the face of climate change. This research will also help identify the drivers that alter microbial communities with the expectation of increasing diversity and creating more resilient soils.

OBJECTIVE(S):

The **objective of this proposal** is to provide farmers in the Mid-South with i) documented performance data for no-till climate-smart practices associated with the drought-tolerant inoculant (i.e., the TXVA strain) in soybean production under drought and ii) biological information (e.g., metagenomics and microbiome data) to support farmers to gain carbon credit by applying this practice.

To accomplish the objective of this proposal, we will pursue three specific objectives:

1. **Practice climate-smart applications associated with no-till and drought-tolerant inoculants and determine the effects of climate change on the efficiency of the symbiosis and soybean yield (maturity group [MG] IV) at drought-prone sites in AR, LA, MO, MS, and TX (Year 1, completed).**
2. **Practice climate-smart applications associated with no-till and drought-tolerant inoculants and determine the effects of climate change on the efficiency of the symbiosis and soybean yield of five varieties (from MG III, IV, V, and drought-resistant varieties) at drought-prone sits in AR, LA, MO, MS, and TX (Year 2, in progress).**
3. **Measure emissions of CO_2, CH_4, and N_2O, analyze the rhizosphere microbiome in no-till fields, and provide the Mid-South soybean industry with fact sheets on climate-smart bioinoculant practices to assist farmers in implementing inoculant-involved no-till climate-smart practices (Year 3).**

We are well positioned to undertake this proposed research because Chang's group has isolated several drought-tolerant rhizobia in TX and developed a novel molecular marker system and a team capable of extensive field testing to evaluate drought tolerance of rhizobial inoculants. In addition, collaborators (Shawn Clark, Trey Price, Grover Shannon, Tessie Wilkerson, and James Grichar) in the Mid-South will help test these inoculants on soybean yield and adopt bioinoculant-involved no-till climate-smart practices in drought-prone fields. Chang's group has many years of experience in testing drought-tolerant inoculants in soybean fields across the nation. In 2016-2018, field trials were performed at Rio Farms in the lower Rio Grande Valley of TX, in which our drought-tolerant inoculants were first evaluated for their impact on soybean growth and yield. From 2019-2021, the MSSB enabled our research in the Mid-South, while the USB under Dr. Tommy Carter enabled the irrigated/non-irrigated plots in Sandhills, NC. Through our interactions with the US soybean farming community via community outreach and workshops, many underserved producers across the Mid-South have been recruited to participate in climate-smart practices that include bio-amendments like beneficial microorganisms.

APPROACH AND EXPERIMENT CONDUCT:

Objective #1 (completed). Practice climate-smart applications associated with no-till and drought-tolerant inoculants and determine the effects of climate change on the efficiency of the symbiosis and soybean yield (one variety, maturity group [MG] IV) at drought-prone sites in AR, LA, MO, MS, and TX (Year 1)

No-till and conventional tillage fields will be prepared before planting. Drought-tolerant (TXVA) and commercial (TagTeam®) inoculants will be applied to one soybean variety during planting time for each location. Novozymes produced the commercial product and used a combination of specially selected nitrogen-fixing rhizobia in combination with a phosphate-solubilizing microbe, *Penicillium bilaie*. For planting, buffer rows and alleys will be implemented between treatments to prevent cross-contamination of inoculants. Inoculants (cell density [e.g., 10^9 cells/ml], growth requirements [e.g.,

mid-log phase], application [e.g., 1 liter per acre], etc.) will be adjusted and standardized across all treatments and locations. In addition, three different additives (sucrose, trehalose, and mannitol) will be added to the culture medium, respectfully, preparing 3 different TXVA inoculants. The plot layout is described as follows: for one set of the experiment, soybean will be planted approximately 8*10 seeds/ft^{-1} (which establishes a plant stand of approximately 150,000) on 4 x 20-30 ft rows with 5-foot alleys. Each row is ca. 30-38 in apart. There will be 3 treatments (TXVA, TagTeam®, and no inoculation), and plots will be rainfed. In addition, there will be a minimum of 5 sets (i.e., 5 biological replicates) per treatment for the planned trials. At planting, randomized soil samples will be collected directly from the rows planted in to establish a baseline for soil physiochemical properties and microbial community abundance.

Project Locations: Below are the experimental locations of each state:

AR: University of Arkansas, Pine Tree Station, Colt, AR
LA: LSU AgCenter, Macon Ridge Research Station, Winnsboro, LA
MO: University of Missouri-Delta Center, Portageville, MO
MS: USDA-ARS, Stoneville, MS
TX: Texas A&M AgriLife Research Site, Corpus Christi, TX

At approximately V6/R1 soybean growth stage, samples will be collected to evaluate nodulation, plant height, and plant dry weight. Mature nodules can be observed best ca. 6-8 weeks after planting. Sampling will be carried out by taking 5 technical replicates from the outside rows of each plot so as not to interfere with the yield analysis of the inner 2 rows. The samples will be taken by digging selected plants and carefully loosening the soil ball before removing the plant. Once removed from the larger soil ball, the remaining rhizosphere/roots will be placed in a bag and shaken to remove all the loosely attached rhizospheric soils while monitoring the integrity of fine roots. Samples will immediately be kept and transported on ice and then stored at -80°C. This will be used for physiochemical analysis and microbial community abundance as data described in Objective #3 to compare the effects of climate change across regions and soil profiles. Plant roots will be immediately washed with sterilized deionized distilled water, cut, then placed into jars with 30% glycerol, stored in ice for transport, then stored at 4°C. The number of nodules per plant will be counted, and nodule size will be measured respectively. At harvest, a final yield analysis will be conducted. In addition, a final set of bulk and rhizosphere soil samples will be collected to connect and correlate microbial abundance and nutrient utilization across the growing season under different treatments (TXVA, TagTeam®, and no inoculation). Each location's climate and weather factors (e.g., precipitation, temperature, and humidity) will be monitored when evaluating the effects of varying nutrient levels and microbial abundance on plant growth and production.

Objective #2 (in progress). Practice climate-smart applications associated with no-till and drought-tolerant inoculants and determine the effects of climate change on the efficiency of the symbiosis and soybean yield of 5 varieties (from MG III, IV, V, and drought-resistant varieties) at drought-prone sites in AR, LA, MO, MS, and TX (Year 2).

We plan to evaluate the same features described in Objective #1 with 5 different soybean varieties (MG III-VIII). We will also include climate-smart soybean cultivars (i.e., slow-wilting [S11-20242C], fast-wilting [S14-90017R], and a flood-tolerant) to examine the synergetic or compensatory effect on plant growth, production, and nutrient utilization. The same experimental procedure and sampling strategy will be applied for each soybean variety as described in Objective #1.

We will determine the economic return of soybean production expense and the impact of bioinoculant-involved no-till climate-smart practices for native vs. commercial inoculation in the Mid-South. The results obtained in this objective will be used to compare performance, including yield

(bushels/acre), oil content, and nodulation properties such as nodule numbers per plant, nodule distance from the ground, and N-fixing ability between soybeans with commercial strains and those with drought-tolerant inoculant. The nutrient utilization efficiency combined with microbial abundance data of the climate-smart practices will be analyzed by co-occurrence network analysis. Identification of hub species across specific soil profiles and environmental gradients is a key element in this study because it can aid in producing more region or soil-specific climate-smart biofertilizers. Additionally, we will determine the economic return on soybean production expense per acre and the impact of this application on climate by calculating the reduced amount of synthetic fertilizers.

Objective #3. Measure emissions of CO_2, CH_4, and N_2O, analyze the rhizosphere microbiome in no-till fields, and provide the Mid-South soybean industry with fact sheets on climate-smart bioinoculant practices to assist farmers in implementing inoculant-involved no-till climate-smart practices (Year 3).

No-till and conventional tillage fields will be prepared before planting, and we will follow planting, mid-sampling, and harvest strategies outlined in Objective #1. To provide the soybean industry in the Mid-South with fact sheets, we will obtain GHG emission values and biological information on climate-smart practices associated with no-till and drought-tolerant inoculants. GHG measurements will include emissions of CO_2, CH_4, and N_2O, while biological information will encompass metagenomics and microbiome analysis.

a) GHG measurements: We will use a portable gas analyzer (i.e., Gasmet GT-5000 Terra FTIR) to monitor and compare emissions of CO_2, CH_4, and N_2O (the three major GHGs) between no-till and conventional tillage fields. Emissions will be measured before planting, at the V6/R1 stage, and at harvest. Specifically, N_2O emissions will be compared among three inoculant conditions (TXVA, TagTeam®, and no inoculation) since the major source of N_2O is synthetic nitrogen fertilizers.

b) 16S rRNA sequencing: Using High-throughput sequencing technology, we will directly sequence the 16S ribosomal RNA (rRNA) genes from the rhizosphere and bulk soils sampled. Distinguishing features of the 16S rRNA gene include its ubiquitous nature, a high degree of functional plasticity, larger base pair size with more extensive domains, and mutations at varying rates, making it the ultimate timekeeping for the evolution of bacterial life. Using the raw sequencing reads from these samples, specialized bioinformatic pipelines originally developed at the Joint Genome Institute (JGI) and modified in our lab will be used to analyze microbial abundances and richness. This will result in identifying special groups of plant-growth-promoting rhizobia (PGPR) and GHG-mitigating bacteria (e.g., nitrification-inhibiting bacteria).

c) Microbiome analysis: the metagenomics sequences resulting from years of field trials will be used to comprehensively evaluate the microbial diversity and predicted functions of microbial communities in the soybean rhizosphere under climate fluctuations. By combining the soil physiochemical properties with the microbial community influx, we will compare across regions to find a dominant *genus* or *species* and shared PGPR in the soybean rhizosphere. In addition, the microbial repository will be used to define principal component analysis, Alpha/Beta diversity analysis, linear discriminant analysis (LDA), and co-occurrence networks. For example, we previously compared microbial communities in the soybean rhizosphere between a high-yielding state (Nebraska) and a low-yielding state (Oklahoma). The resulting analysis showed a difference in co-occurrence networks and variance in community composition at physiochemical, taxonomic, and predicted functional levels. We expect to reveal healthy microbiomes in the rhizosphere when bioinoculant-involved no-till climate-smart practices are applied to the Mid-South soybean fields.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

Preliminary data for rhizosphere soil microbiomes and co-occurrence networks in the drought-tolerant inoculant-treated soils, a useful repository can be expected to build with bioinoculant-involved no-till climate-smart practices. Adopting these regenerative agricultural practices can provide positive effects on mitigating GHG emissions, along with aiding Mid-South producers better understand potential soil health benefits and sustainable soybean production. Soybean farmers in the Mid-South will have experience and knowledge in the practical and optimal application of climate-smart practices associated with bioinoculants. Therefore, providing such information will allow them to advance in managing soybean plants and inoculants for economic and ecological benefits while reducing GHG emissions.

EXPECTED END PRODUCT(S)

Expected outcomes for the proposal research:

- Fact sheets to assist farmers.
- Oral and poster presentations at related conferences (e.g., ASM conferences).
- Journal publications.
- Oral and poster presentations at UTA Discover Symposium.

APPENDICES *(Add as needed)*

A. Explanation/justification of budget categories - where needed for clarification or detail.

A1. Salaries: A graduate student will get paid $2,100 per month for 9 months: (9 x $2,100 = **$18,900**). This is the typical rare for either a graduate research assistant (GRA) or graduate teaching assistant (GTA) in the Department of Biology at the University of Texas at Arlington (UTA).

A3. GRA: Tuition for a graduate student is **$9,442** per year.

B1. Fringe Benefits: 10% of salary for graduate students (**$1,890**).

C. Travel: I plan to attend one meeting with a graduate student. In addition, there will be 3 visits to each experimental site for planting, sampling, and harvesting, respectively. With 5 states, there will be 15 trips.

-Meeting registration fees (2 people, 1 meeting): 2 x $300 = $600
-Airfare (2 people, 1 trip): 2 x $400 = $800
-Truck rental and gas (for 15 trips): 15 x $150 = $2,250
-Hotel (2 people, 18 nights): 2 x 18 x $100 = $3,600
-Meals (2 people, 25 days): 2 x 25 x $50 = $2,500
Thus, $600 + $800 + $2,250 + $3,600 + $2,500 = **$9,750**

D. Contractual Service: N.A.

E. Subcontractors: $15,000 (to the 5 cooperators; $3,000 each)

F. Commodities: Lab and field work supplies (**$4,518**)

G. Publication Costs: $500

B. Special considerations–items not covered in prior sections.

2025 MIDSOUTH SOYBEAN BOARD
PROPOSAL TEMPLATE

PROPOSAL TITLE: ***Enhanced Synthetic Microbiome Communities to Managed Sudden Death Syndrome***

INVESTIGATORS:

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CoPI: Scott A. Mangan, PhD
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PROGRAM AREA (check all that apply):

___ New Uses of Soybean
___ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
___ Irrigation/Water Management
___ Seed Quality
__X_ Disease Management and Control
___ Fertility Management
___ Insect Management/Control
___ Harvest aids
___ Nematode Management/Control
___ Rotations using soybeans
___ Research Validation or Demonstration
___ Producer Communications
___ Variety Trials
___ Economics
___ Other (*Identify*)_____

PROJECT STATUS:

New __X__ *(Indicate planned length of project–1 of 2, 1 of 3, etc. Note that projects are only approved on a yearly basis.)* Expected research length (yr)___1 of 2_____

Renewal ____ (Year ____ of ____)

Stand alone __X_ or cross-commodity ___ (*additional funding from other sources? Name all other sources and amounts co-funded.*)

2025 TOTAL FUNDING REQUEST $ ____$18,109 for 2025_ (year 1 of 2)

2025 MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)	$0	$0
	2. Wages (hourly workers)	$2,880	$2,880
	3. GRA (include tuition)	$0	$0
B.	**Fringe Benefits** (% *used to calculate*)	$229	$229
C.	**Travel**	$1,000	$1,000
D.	**Contractual Services**	$0	$0
E.	**Subcontracts**	$0	$0
F.	**Commodities**	$10,000	$15,000
G.	**Publication Costs**	$0	$2,000
H.	**Other Costs - ABI User Fees**	$4,000	$4,000
TOTAL COST		$18,109	$25,109
(MSSB does not allow indirect costs/overhead charges)			

TECHNICAL SUMMARY

Background: Sudden Death Syndrome (SDS) in soybeans, caused by *Fusarium virguliforme*, leads to significant yield losses, impacting the Mid-South region's agriculture. Traditional management strategies like fungicides and tolerant cultivars often show variable effectiveness. **Research Justification and Rationale:** Recent findings suggest beneficial soil microbes can enhance soybean resistance to SDS. This research aims to explore the use of these beneficial microbes in Synthetic Microbial Communities (SynComs) as a novel management strategy. **Objectives and approaches:** In Year 1, we aim to isolate and identify beneficial bacteria and fungi from the soybean rhizosphere and evaluate their antagonism against *F. virguliforme in vitro*. In Year 2, we will assemble SynComs from effective strains and test them in greenhouse and field conditions for disease suppression. **Expected Results and Impact:** SynComs are anticipated to offer more reliable SDS control, enhancing soybean yield and quality in the Mid-South, thereby promoting sustainable agriculture by reducing dependency on chemicals.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

Sudden Death Syndrome (SDS) in soybeans, caused by the fungal pathogen, *Fusarium virguliforme*, is a significant threat to soybean production, particularly in the Mid-South region. This disease has resulted in losses of more than 326 million bushels (3.4 billion dollars) to U.S. farmers over the past decade (Crop Protection Network). The impact on this region's agricultural productivity and economic stability underscores the urgency of developing effective management strategies. Traditional management approaches, such as using fungicides and developing SDS-tolerant cultivars, provide only partial and variable disease control[1]. The limitations of these methods highlight the need for alternative or complementary strategies that can provide more consistent and sustainable protection against SDS.

There is increasing recognition of the role beneficial microbes' in have enhancing plant disease tolerance, offering a sustainable alternative to conventional disease management practices. Our preliminary research demonstrates that an SDS-tolerant soybean cultivar can recruit beneficial

microbes, leading to reduced pathogen growth under greenhouse conditions compared to a susceptible cultivar (Fig 01). Further supporting this, recent studies found that *Trichoderma* isolates, especially *T. harzianum*, inhibited SDS pathogen growth by up to 92%[2]. Additionally, *Bacillus subtilis* GB03 and *Streptomyces griseoviridis* K61 have effectively inhibited the mycelial growth of various pathogen isolates[2]. These findings underscore the potential of using beneficial microbes as a sustainable strategy for managing SDS and enhancing plant health.

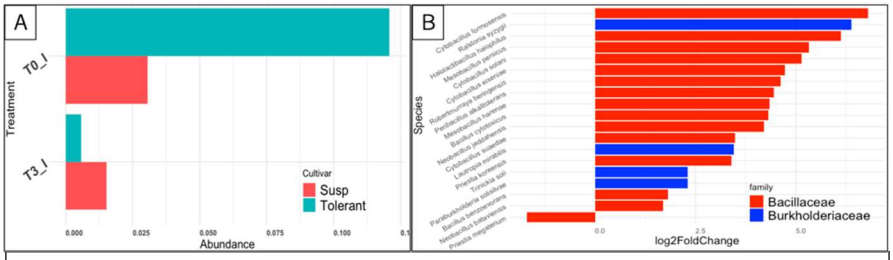

Figure 01. *A). F. virguliforme* abundance reduced faster in the SDS-tolerant cultivar from inoculation (V3: T0_I) to R6 (T3_I) stage, compared to the susceptible cultivar. *B).* The SDS-tolerant cultivar's rhizosphere, two bacterial families, Bacillaceae and Burkholderiaceae, known to boost plant health, were more prevalent than in the susceptible cultivar.

However, studies have demonstrated that microbes can suppress pathogen activity through various mechanisms such as competition for nutrients, production of antimicrobial compounds, and induction of plant defense responses[3]. Assembling a consortium of beneficial microbes with various modes of action into Synthetic Microbial Communities (SynComs) has emerged as a promising strategy for managing soil-borne diseases. SynComs are purposefully designed groups of microbial species that stably coexist and benefit their host organisms overall. For instance, across-kingdom SynComs, combining bacteria and fungi, have proven more effective than single-kingdom communities in suppressing diseases like Fusarium wilt and enhancing plant immunity[4]. Similarly, SynComs have significantly reduced disease incidence in wheat and bananas, outperforming some commercial biocontrol agents in the latter[5,6].

In certain soil types, the presence of *F. virguliforme* does not result in disease, suggesting that the microbial composition of these soils may contribute to disease suppression[7]. Identifying the specific microbes responsible for this suppressive effect could lead to novel management strategies. To address this, we propose developing SynComs derived from SDS-suppressive soils, a novel approach that aims to clarify the roles of specific microbial taxa or combinations in disease suppression. While our

preliminary studies have identified potential species for these communities (Fig. 01), this approach has not yet been explored as a strategy for managing this devastating disease.

OBJECTIVE(S):

We hypothesize that these SynComs, when combined in a specific ratio, will manage SDS more effectively and provide better protection than individual strains. By leveraging SynComs derived from beneficial microbes, the study aims to reduce reliance on chemical treatments and improve soybean yield and health. **1).** Isolate and identify beneficial bacteria and fungi from the soybean rhizosphere that can enhance plant health and disease resistance. **2).** Evaluate these bacteria and fungi for their ability to inhibit *F. virguliforme*, *in vitro*. **3).** Assemble selected beneficial bacteria into SymComs and test them in the greenhouse to assess their effectiveness in suppressing SDS.

APPROACH AND EXPERIMENT CONDUCT:

1. For the first objective, we will plant an SDS-tolerant variety, XO3752 (received from BASF), in 40 pots. Each pot will contain five seeds, and the soil for these pots will be obtained from fields known to either suppress or not suppress SDS (Fig. 02). We will culture bacteria from rhizosphere soil extracts by suspending 3-week-old roots in distilled water and shaking overnight. After centrifuging and filtering soil slurry, we will use a portion of this soil with R2A, R2A-SE, and LB media to isolate bacteria (The Wijeratne lab has already tested this method and has isolated 250 bacterial isolates as a preliminary study). Fungal species will be isolated from the second portion of the soil by diluting the suspensions and plating on four different media (1/10th strength PDA, one-fourth strength Richard's Broth Medium, one-fourth strength Corn Meal Agar, and one-fourth strength Malt Extract Agar) to cater to diverse fungal growth requirements. Fungal colonies will be selected based on morphology and will be subcultured for further analysis. Bacterial and fungal genomic DNA will be extracted using Quick-DNA Fungal/Bacterial Kits (Zymo Research). The 16s or 18s rRNA genes will be amplified and sequenced on an Oxford Nanopore (ONT) Flongle flow cell. The taxonomy will be assigned using Minimap2 against the NCBI database. Unique strains will be stored in 50% glycerol at −80°C.

2. Our second objective will test bacterial and fungal isolates' ability to fight *F. virguliforme in vitro* dual culture assays on 1/4 TSA or R2A medium. Control Petri dishes will be inoculated with pathogen-colonized agar discs. We will compare the pathogen's radial growth in bacterial and fungal-inoculated petri dishes to control Petri dishes and calculate the percent inhibition of radial growth.

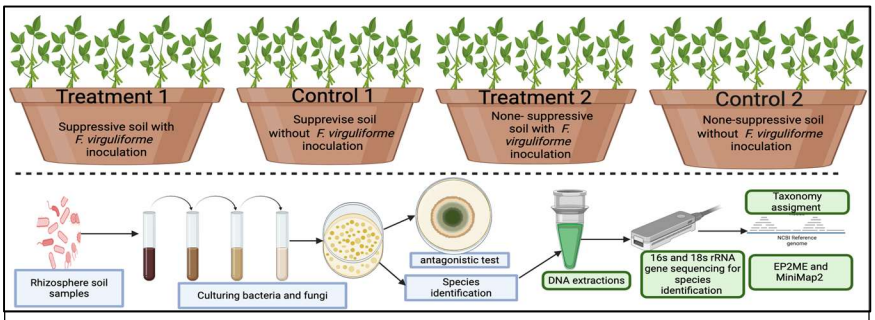

Figure 02. Steps of the proposed steps for Obj 1 and 2.

3. During our second year, for our third objective, we will create four different SynComs with bacterial and fungal isolates showing antagonism and their co-occurring taxa (information derived from our previous study) from each of the above treatments and controls (Fig. 02). Another two communities that will serve as control will also be created using randomly selected bacterial and fungal isolates from our collection or combining all taxa used in the above four SymComs. All six SynComs will be evaluated for their ability to suppress *F. virguliforme in vitro* using a similar approach described in Objective 2. Two of SymCom with the highest antagonistic activity and the two control SynComs will also assess their ability to suppress SDS under greenhouse conditions. We will use the SDS-tolerant variety, XO 3752, and the susceptible variety, XO 4132 (obtained from BASF), and half of the seeds will be coated with two SynComs while the other half will be coated with media to serve as controls. This seedling will be planted in pots containing sterilized soil. Each treatment will be replicated five times for reliability, with random pot assignments to minimize positional environmental effects. Seedlings will be inoculated with *F. virguliforme* zoospores or media seven days after planting. To assess community dynamics, rhizosphere soil will be collected 3 and 8 weeks after inoculation for 16S and 18S rRNA sequencing using ONT sequencing. In addition, we will extract DNA from surface-sterilized root samples and assess the pathogen load in roots to evaluate the pathogen's ability to infect the roots. Disease symptoms will be rated weekly, and plant growth parameters will be measured regularly, including height, leaf number,

and biomass. Final yield assessments will include pod number, seed number, and total biomass.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

SDS can cause up to 40% yield loss, costing about $350 per acre. Effective SynComs could significantly reduce this loss. Delaying SDS symptoms by one week can save about 3.5 bushels per acre. SynComs could extend this delay by suppressing pathogen activity and increasing savings. SynComs can enhance soybean growth, nutrient uptake, and stress resilience, reducing the need for synthetic fertilizers and pesticides. This leads to improved yields, cost savings, and environmental benefits.

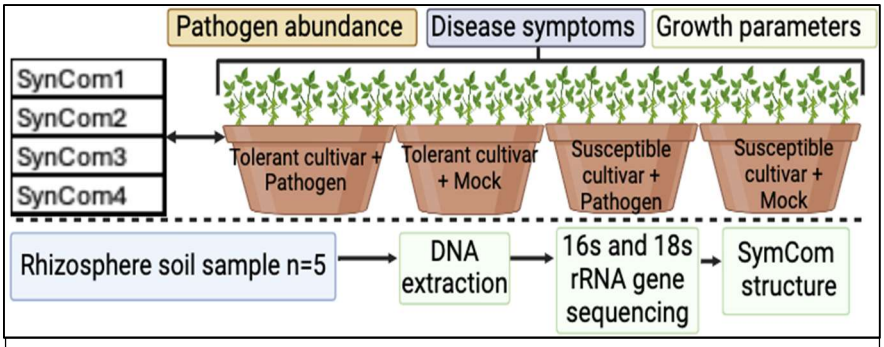

Figure 03. Steps of the proposed Obj 3 project.

EXPECTED END PRODUCT(S)

The project will produce a comprehensive catalog and database of beneficial bacteria and fungi isolated from the soybean rhizosphere. *In vitro* testing reports will document the antagonistic effects of these bacteria and fungi against *F. virguliforme*. Greenhouse reports will provide detailed findings on the effectiveness of selected bacteria and fungi in suppressing SDS. A shortlist of effective biocontrol candidates will highlight bacterial and fungal strains with proven inhibitory effects, offering a foundation for future biocontrol solutions and potential intellectual property opportunities. We expect to produce presentations and posters for The Midsouth American Phytopathological Society. In addition, we hope to publish our research in peer-reviewed journals. The protocols, data analytical pipelines, and bacterial and fungal isolates will be available for other researchers to use as valuable tools.

APPENDICES

Wages: Ms. Ashley Flory works as a part-time lab assistant in the Wijeratne lab, manages finances, and oversees orders. Therefore, wages of $20/hr, 3 hrs/week for 48 weeks are requested for $2,880 per year ($5,760 total for both years). **Fringe Benefits** are requested for Ashley Flory at the part-time

non-student rate of 7.94% for $229 per year ($458 total for both years). **Travel:** $2,000 ($1,000 per year) is requested for PIs and a student to attend conferences. **Commodities:** The request for $25,000 (Year 1: $10,000 and Year 2: 15,000) to cover the purchase of the following: chemicals (e.g., buffers and organic solvents, etc.), bioreagents (e.g., kit for sample preparation for high-throughput sequencing, PCR, primers, etc.), and consumables (e.g., centrifuge tubes, filter pipette tips, and gloves, culture media etc.). **Other Costs (ABI Facility User Fee):** $8,000 ($4,000 per year) is requested to access instruments in the genomic core, high-speed centrifuges, clean bench hood, greenhouse growth chamber, etc. **(Total: $43, 218**)

Reference:

1. Rodriguez, M. C., Sautua, F., Scandiani, M., Carmona, M. & Asurmendi, S. Current recommendations and novel strategies for sustainable management of soybean sudden death syndrome. *Pest Manag. Sci.* **77**, 4238–4248 (2021).
2. Xing, L. & Westphal, A. Inhibition of Fusarium virguliforme by prokaryotes in vitro. *Subtrop. Plant Sci.* **59**, 24–29 (2007).
3. Ayaz, M. *et al.* Bacterial and Fungal Biocontrol Agents for Plant Disease Protection: Journey from Lab to Field, Current Status, Challenges, and Global Perspectives. *Molecules* **28**, 6735 (2023).
4. Zhou, X. *et al.* Cross-kingdom synthetic microbiota supports tomato suppression of Fusarium wilt disease. *Nat. Commun.* **13**, 7890 (2022).
5. Synthetic microbial consortia derived from rhizosphere soil protect wheat against a soilborne fungal pathogen - PubMed. https://pubmed.ncbi.nlm.nih.gov/36118206/.
6. Prigigallo, M. I., Gómez-Lama Cabanás, C., Mercado-Blanco, J. & Bubici, G. Designing a synthetic microbial community devoted to biological control: The case study of Fusarium wilt of banana. *Front. Microbiol.* **13**, (2022).
7. Todorović, I., Moënne-Loccoz, Y., Raičević, V., Jovičić-Petrović, J. & Muller, D. Microbial diversity in soils suppressive to Fusarium diseases. *Front. Plant Sci.* **14**, 1228749 (2023).
8. Chaudhary, D. K., Khulan, A. & Kim, J. Development of a novel cultivation technique for uncultured soil bacteria. *Sci. Rep.* **9**, 6666 (2019).
9. Hale, B., Watts, C., Conatser, M., Brown, E. & Wijeratne, A. J. Fine-scale characterization of the soybean rhizosphere microbiome via synthetic long reads and avidity sequencing. *Environ. Microbiome* **19**, (2024).

2025 MIDSOUTH SOYBEAN BOARD

PROPOSAL TEMPLATE *(Limit the final document to 8 pages)*

PROPOSAL TITLE: Improving the efficacy of double stranded RNA (dsRNA) for practical field management of soybean diseases

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INVESTIGATORS: *Zhi-Yuan Chen, Professor, Department of Plant Pathology and Crop Physiology, Louisiana University Agricultural Center, Baton Rouge, Tel 225-578-7850; email: zchen@agcenter.lsu.edu*

PROGRAM AREA (check all that apply):

___ New Uses of Soybean
___ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
___ Irrigation/Water Management
___ Seed Quality
__x_ Disease Management and Control
___ Fertility Management
__x_ Insect Management/Control
___ Harvest aids
__x_ Nematode Management/Control
___ Rotations using soybeans
___ Research Validation or Demonstration
___ Producer Communications
___ Variety Trials
___ Economics
___ Other (*Identify*)_____

PROJECT STATUS:

New __x__ Expected research length (yr)_____3_____

Renewal _____ (Year _____ of _____)

Stand alone __x_ or cross-commodity ___

2025 TOTAL FUNDING REQUEST $ __48,324_____

2025 MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)	$20,800 ($20hr for 20 hr/wk)	
	2. Wages (hourly workers)		
	3. GRA (include tuition)		
B.	**Fringe Benefits** (53% *used to calculate*)	$11,024	
C.	**Travel**	$3,000	
D.	**Contractual Services**		
E.	**Subcontracts**		
F.	**Commodities**	$12,000	
G.	**Publication Costs**	$1,500	
H.	Other Costs *(Define)*		
TOTAL COST		$48,324	
(MSSB does not allow indirect costs/overhead charges)			

***Personnel**: Show number of hours x hourly rate for each category. GRA cost to include tuition and books. MSSB does not pay salaries of principal investigators or cooperating scientists (USB Compliance Manual, Sect. 17, Part 2-D).*
***Fringe Benefits:** Amount and rate for indicated salaries, wages, and GRAs must be shown.*
***Travel**: Out-of-pocket and per diem expenses (hotel and meals) for site visits, travel to and from meetings (e.g. airfare, vehicle mileage not to exceed the IRS rate), etc.*
***Contractual Services**: External lab fees, consultants, etc.*
***Commodities**: Expenses related to the conduct of the project (e.g., seed, fertilizers, pesticides, lab supplies).*
***Additional Details**: Provide for each budget category in addendum if necessary.*
***Reminder**: All payments for project activities are on a reimbursable basis based on an itemized invoice submitted to MSSB each quarter along with a progress report.*
***Budget Transfers**: The MSSB follows USB guidelines, which state "The PI may transfer funds amongst budget categories only with MSSB's prior written consent if (i) the amount transferred exceeds 10% of any one general budget category (per annual period) or (ii) the funds transferred are travel related. PI shall request permission from MSSB for all budget reallocations and account for them in his/her financial report."*
***Additional Instructions:** See Addendum B.*

TECHNICAL SUMMARY

Soybean production in the southern U.S. faces some unique and potentially devastating diseases caused by several species of Cercospora fungi, such as cercospora leaf blight (CLB), purple seed stain (PSS), and frogeye leaf spot (FLS). Losses caused by these diseases can reach as high as 30% on susceptible varieties and our soybean farmers are faced with limited choices of varieties they can plant and the lack of effective fungicides. In addition, nematodes and insects can also cause serious yield losses to soybean production in the south. With the prior funding support from MSSB, our laboratory has identified several dsRNAs with sequence homology to their pathogen genes were found effective in reducing FLS and Asian soybean rust (ASR) symptoms in growth chamber and greenhouse studies. Building upon these progresses, the PI attempts to move this dsRNA based approach for soybean disease management one step closer to practical application through testing several adjuvants and nanoparticles in increasing the effectiveness of these dsRNAs in managing soybean diseases under field conditions. The specific objectives of this new project are to: 1) Evaluate the potential of different nano-materials in prolonging the effectiveness of dsRNA in protecting soybean plants from various fungal diseases; 2) Examine different adjuvants in increasing the effectiveness of dsRNA in disease suppression under greenhouse and field conditions; and 3) Determine the combined effect of adjuvants and nanomaterials in managing FLS, CLB, and PSS under field conditions. The long-term goal is to eventually achieve a simultaneous management of various soybean diseases through this dsRNA based approach, which will increase the sustainability of soybean production in the southern U.S., and greatly reduce environmental pollution associated with fungicide and pesticide applications.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

In Louisiana and other southern states, soybean production is under constant threats of various fungal pathogens, such as *Cercospora* cf. *flagellaris,* a close relative of *C. kikuchii* and the causal agent of CLB and PSS, *C. sojina*, causal agent of FLS. CLB and FLS were ranked as top #3 and #5 diseases of soybean in the southern U.S. in 2019 (Bradley et al., 2021). In addition, ASR caused by *Phakopsora pachyrhizi* can also cause serious yield losses if we have continuous mild winters. However, the management options are limited due to lack of disease resistant commercial soybean varieties and the development of fungicide tolerance in the pathogen populations. Therefore, there is an urgent need to develop more effective, sustainable and integrated approaches to manage these diseases.

Recent published studies found that spray application of dsRNAs targeting key fungal genes resulted in reduced Fusarium disease symptoms on the barley leaves (Koch et al., 2016) and white stem rot symptoms in canola by *Sclerotinia sclerotiorum* (McLoughlin et al., 2018). Published studies from our laboratory also demonstrated that foliar application of dsRNA targeting the expression of an ACE gene from *P. pachyrhizi* and that of the Avr4 effector gene from *C.* cf. *flagellaris* significantly reduced soybean rust infection and cercosporin production on soybean, respectively (Hu et al., 2020; Rezende et al., 2020). These applied dsRNAs can be taken up by soybean leaves, travel to the inside of the invading fungal pathogens, bind specifically to their target sequences, and initiate a sequence specific degradation, leading to suppression of disease development. In the past three years, our laboratory has identified several additional dsRNA that were effective in reducing FLS or ASR symptoms. We have also found mixing dsRNA with certain adjuvants or coating these dsRNAs onto FeMg based nanoparticles can further enhance the effectiveness of these dsRNAs in reducing disease symptoms or extend the protection against fungal infection under growth chamber studies. This RNA interference (RNAi)-based spray induced gene silencing (SIGS) approach utilizes the genetic information carried in the dsRNA sequences instead of toxic chemicals of conventional pesticide to achieve disease

management, which can significantly reduce the environmental pollution and toxic side effects to human and other non-targeted organisms.

OBJECTIVE(S):

Here, the specific objectives for this new proposal are: 1) Evaluate the potential of different nano-materials in prolonging the effectiveness of dsRNA in protecting soybean plants from various fungal diseases; 2) Examine different adjuvants in increasing the effectiveness of dsRNA in disease suppression under greenhouse and field conditions; and 3) Determine the combined effect of adjuvant and nanomaterial in managing FLS, CLB, and PSS under field conditions. The long-term objective of this proposal is to develop a cost-effective, sustainable, and comprehensive dsRNA based alternative to fungicides/insecticides to effectively and simultaneously manage various soybean diseases that are causing major yield losses in the southern U.S.

APPROACH AND EXPERIMENT CONDUCT:

Experiment (i): Evaluate the potential of different nano-materials in prolonging the dsRNA protection of soybean plants from various fungal diseases. The main challenges to adopt dsRNA for practical application are that dsRNA is susceptible to degradation by RNase in the environment and UV radiation. Several different types of nanoparticles (NP) have been reported to either enhancing the delivery of dsRNA into plants or protecting the dsRNA on the leaf surface from harsh environment, such as mesoporos silica nanoparticles, FeMg nanoparticles, and quantum carbon dots. PI's lab has established technical skills to synthesize FeMg nanoparticles of 35 nm to 75 nm and quantum carbon dots. To examine FeMg based NP protection of dsRNA from UV degradation, and its impact on dsRNA delivery, 16 pots with 32 soybean plants will be used for the following four treatments (4 pots per treatment): ACE dsRNA alone, dsRNA+NP, NP alone, and water control. Each plant will be sprayed with either 1 ml of ACE dsRNA at 100 μg/ml mixed with 2 ml of water (ACE dsRNA alone), 1 ml dsRNA

combined with 2 ml nanoparticles (dsRNA+NP), 2 ml nanoparticles alone + 1 ml of water (NP alone), or 3 ml of water (control). These treatments will be applied to a total of 5 sets of soybean pots. These treated pots will be kept outside under direct sun exposure for: 20, 15, 10, 5 and 0 days before the plants are moved back to greenhouse and inoculated with *P. pachyrhizi*. The rust disease symptoms and fungal growth will be evaluated 12 days after rust inoculation to assess the differences in disease symptoms visually and using real-time PCR quantification to measure fungal growth within the soybean leaves from each treatment to determine whether NP can protect the dsRNA and extend its effectiveness in disease control. We will repeat this study with other NP, such as quantum carbon dots.

Experiment (ii): Examine different adjuvants in increasing the effectiveness of dsRNA in disease suppression under greenhouse and field conditions. The other challenge in using SIGS for practical plant disease management is the poor uptake of applied dsRNA by plants. Adjuvants can help chemicals to stick to leaf surface longer and penetrate leaf cuticle and wax layers better. We have previously examined several commercial non-ionic adjuvants and found one of them was able to reduce the amount of dsRNA required by 2.5-fold to achieve successful FLS and ASR disease suppression under growth chamber conditions. In this study, we would like to examine several other commercial adjuvants as well as a new formulation from a chemical company. **(A),** these adjuvants will be examined in greenhouse to determine their effectiveness in reducing the amount of ACE dsRNA needed for controlling ASR. We intend to mix each of these adjuvants with 4 different concentrations (50, 75, 100, 150 µg/ml) of ACE dsRNA to determine the minimum concentration of ACE dsRNA that is needed to achieve 50% reduction of soybean rust disease (pustule density and fungal biomass) in the presence and absence of different adjuvants. This study will have 4 treatments for each adjuvant: buffer-treated, ACE dsRNA only with four different concentrations, adjuvant only, and ACE dsRNA (with the same four different concentrations)+adjuvant. Six pots (12 plants) will be sprayed with 1 mL/plant of each concentration of dsRNA or dsRNA+adjuvant or controls. ASR symptoms and pathogen growth will be evaluated as described above. This experiment will be repeated for each of the adjuvants to identify the

best adjuvant that allows the lowest concentration of ACE dsRNA to significantly suppress the soybean rust disease in comparison to the ACE dsRNA only. **(B),** similar study will be conducted under field conditions using Avr4 dsRNA for each of these adjuvants. The same four treatments with the same four different concentrations of dsRNA will be used. Thirty milliliters of each treatment will be applied onto one plot consisted of 30 soybean plants in a 20 ft row. Each treatment will be replicated five times. The first dsRNA application will be done when soybean plants reach the R1-R2 stage, and the same soybean plants will be treated with the same dsRNA two more times, with 10 days apart between the treatments. FLS symptoms will be evaluated in each of the plots at R6-R7 stages and leaf samples will be collected and quantified for fungal growth to determine whether adjuvants increase the efficacy of dsRNA in reducing FLS symptoms and or pathogen growth. The above two studies should ensure the identified adjuvant performs the best consistently among different dsRNAs.

Experiment (iii): Determine the combined effect of adjuvant and nanomaterial in managing FLS, CLB, and PSS under field conditions. In the third year of this project, we plan to develop a new dsRNA formulation by combining the most effective nanoparticles and the best adjuvant identified in Exp I and II, and conduct the Exp II (B) using this new formulation under field conditions to see whether we can further enhance the effectiveness of Avr4 dsRNA in managing FLS, CLB, and PSS.

The major obstacle in using dsRNA for plant disease management is the cost. To reduce the cost, we have developed a bacterial system to produce dsRNA for all of our studies. However, lack of stability and poor uptake of dsRNA by plants are the other two challenges this proposal is trying to address so less amount of dsRNA will be needed to further reduce the cost. The objective 1 attempts to determine whether we can use nanoparticles to enhance dsRNA stability and protect it from UV degradation; and the objective 2 is to identify a suitable adjuvant that can reduce the amount of dsRNA we have to apply to achieve a satisfactory disease suppression. The objective 3 is to determine whether combining NP and adjuvant can synergistically reduce the dsRNA concentration further to make this SIGS finally feasible at a cost that is comparable to the conventional pesticides.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

In completing these above proposed studies, we expect to develop a more practical, safer, sustainable, and economically more feasible dsRNA based formulation to manage major soybean fungal diseases in the mid-South. This approach can also be used to manage soybean nematode and insect diseases with different dsRNAs. In addition, it allows our farmers to manage multiple diseases in one application. This RNAi based soybean disease management reduces our reliance on toxic fungicides/pesticides, reduce the pollution to our natural environment, and increase yield and sustainability of soybean production in the long run. This novel RNAi based approach can also effectively reduce the pathogen/pest populations that are resistant toward the existing fungicides/pesticides, which can further enhance the effectiveness of the existing pesticides and reduce the production cost. Therefore, this will increase the sustainability of soybean production in the mid-south areas, and hence our farmers' profitability. The long term monetary impact to our region can be very significant.

EXPECTED END PRODUCT(S)

The expected end products of this proposed study will include: 1) identification of nanoparticle materials that can protect the dsRNA on soybean leaves from UV degradation so the effectiveness of dsRNA in disease suppression can be extended; 2) identification of the most effective adjuvants that can not only increase the uptake of dsRNA by soybean plants, but also can make applied dsRNA more rain-fast; 3) development of a formulation with nanoparticles and adjuvants to make this dsRNA based soybean disease management approach more economically feasible; 4) powerpoint and poster presentations at national scientific or commodity meetings; 5) filing intellectual property disclosures on the new formulations in soybean disease management; 6) leveraging additional funding support from national or federal funding agencies with the data collected through this support, and 7) developing a path to commercialization of the new formulation through establishing possible industrial partnerships.

APPENDICES *(Add as needed)*

A. Explanation/justification of budget categories - where needed for clarification or detail.

An $20,800/year salary fund is requested. A research associate or visiting scientist with MS or Ph D degree will be recruited and assigned to work on this project half-time (20h/week at $20/hour) to produce high quality dsRNA in large quantities.

A $2500 for travel is budgeted to allow the PI and/or the RA to attend regional and national meetings and present our research updates to the scientific community.

A $12, 500 for supply fund is request to purchase airbrushes, air compressors, medium for dsRNA productions, and chemicals for dsRNA purification and formulation.

A $1,500 is request for publishing manuscript in scientific journals to share our findings in using dsRNA for soybean disease management.

B. Special considerations–*items not covered in prior sections.*

N/A

2025 MIDSOUTH SOYBEAN BOARD

PROPOSAL TEMPLATE *(Limit the final document to 8 pages)*

PROPOSAL TITLE: _Expanding Potential Market Demand for and Access to Whole Soy Foods through Nutrition Education_____

INVESTIGATORS:

Leigh Ann Bullington, Instructor – State FCS Educator, University of Arkansas Division of Agriculture (UADA) (870)919-6109 lbullington@uada.edu ; Keith Stathan-Cleek, Instructor – State FCS Educator, UADA (901)268-5046, kcleek@uada.edu ; Amber Hairston, Couty Extension Agent (CEA) Family and Consumer Sciences (FCS) – Ashely County, UADA, (870)853-2080 ahairston@uada.edu ; Christie Wagley, CEA-FCS Poinsett County, UADA, (870)578-4490, cwagley@uada.edu ; Julian Carpenter, CEA-FCS Independence County, UADA, (870)793-8840, jmcarpenter@uada.edu ; Christine Sasse, Program Associate - SNAP-Ed Policy System Environmental Change Coordinator, UADA, (501)671-2079 csasse@uada.edu ; Sarah Wood, Assistant Extension Professor - State Nutrition Specialist, University of Missouri (MU), (573)882-6432, woodsarah@health.missouri.edu ; Hannah Whittaker, - MU Field Specialist in Nutrition and Health, 417-345-7551, hwhittaker@missouri.edu Rachel Livesay, MU Field Specialist in Nutrition and Health, 816-324-3147, rachellivesay@missouri.edu, Evan Holley - MU Field Specialist in Nutrition and Health, 573-663-7343, evanholley@missouri.edu, Kathi Mecham - MU Field Specialist in Horticulture, 660-542-1792, mechamk@missouri.edu

PROGRAM AREA (check all that apply):

___ New Uses of Soybean
_X_ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
___ Irrigation/Water Management
___ Seed Quality
___ Disease Management and Control
___ Fertility Management
___ Insect Management/Control
___ Harvest aids
___ Nematode Management/Control
___ Rotations using soybeans
_X__ Research Validation or Demonstration
_X__ Producer Communications
___ Variety Trials
___ Economics
_X__ Other (*Identify*) Soy nutrition education curriculum development and increasing access to and demand for whole soy foods

PROJECT STATUS:

New __X__ *(Indicate planned length of project–1 of 2, 1 of 3, etc. Note that projects are only approved on a yearly basis.)* Expected research length (yr)____3 years_____

Renewal _____ (Year _____ of _____)

Stand alone _X__ or cross-commodity ___ (*additional funding from other sources? Name all other sources and amounts co-funded.*)

_____

2025 TOTAL FUNDING REQUEST $ _33,245_____

2025 MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)	$7500	
	2. Wages (hourly workers)		
	3. GRA (include tuition)		
B.	**Fringe Benefits** (28.6% *used to calculate*)	$2145	
C.	**Travel**	$5000	
D.	**Contractual Services**		
E.	**Subcontracts**	$13000	
F.	**Commodities**		
G.	**Publication Costs**	$1000	
H.	Other Costs *(Other Supplies)*	$6600	
TOTAL COST		$33245	
(MSSB does not allow indirect costs/overhead charges)			

TECHNICAL SUMMARY

Soybean farmers are uniquely poised to provide for – and profit from – the growing number of Americans turning to plant-based foods. The reasons for this dietary trend are numerous and not necessarily motivated by traditional reasons for avoiding meat. For example, Alpha-gal syndrome, a tick-borne disease that can cause allergies to milk and certain meats, is increasing by about 15,000 cases yearly with Arkansas, Missouri, and Kentucky leading in new infections (Ref 1). This emerging problem, combined with food allergies, lactose intolerance, and increased interest in the health benefits of plant-forward diets is likely to drive consumer demand for meat and dairy alternatives among people who would not otherwise choose a plant-based diet.

Fortunately, soybean farmers can offer a solution. Foods like soy milk, tofu, food-grade soybeans, and other soy foods provide an ideal alternative to animal protein, yet many Americans are unaware of the many flavors and recipes in which soy can be used. Whole soy foods remain drastically underutilized, with very few acres in the United States dedicated to food-grade soybeans. This systemic problem may present a competitive edge for farmers of food-grade soy, as specialty varieties of soybeans can be especially lucrative (Ref 2) and food-grade soybeans continue to sell at premium prices.

This proposed research aims to expand the market for specialty soybean crops, beginning the process of integrating minimally processed soy foods into food culture in the Midsouth. The research will further the success of the multi-state *Soy Chef* collaboration and build on the contributions of B & B Legacy Farms.

Through education, outreach, and connecting new consumers to the market, this project aims to increase use of soy as a staple of a healthy and delicious diet, ultimately driving demand and income for food-grade soybean farmers.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

Expanding the previous work done by Dr. Karen Ballard of B & B Legacy Farms, this project will increase the appeal of, access to, and demand for regionally grown, food-grade soybeans as a nutritious, delicious addition to a healthy diet through a multi-system approach that includes consumer research and education about the benefits of soy.

OBJECTIVE(S), APPROACH AND EXPERIMENT CONDUCT:

Objective 1. Increase awareness about soy milk and whole / minimally processed (w/mp) soy foods in school and early childcare centers through a multipronged intervention involving taste tests and work with educational influencers.

Approach: To increase awareness of soy milk and (w/mp) soy foods as choices within the National School Lunch Program and for early childcare centers and expand knowledge about the use of soy as a healthy alternative for youth with allergies, lactose intolerance, or those who choose plant-based diets, the team will offer soy milk and (m/wp) soy food tastings within schools. These tastings will also provide an experiential learning opportunity regarding (w/mp) soy foods and soy milk's flavor profile and versatility. The team will explore options to provide resources and continuing education to school personnel and early childcare providers. Explore how Supplemental Nutrition Assistance Program Education – Policy, Systems, and Environmental Change Programming (SNAP-Ed PSE) can remove barriers to accessing healthy food options.

Objective 2. Improve access to soy milk and (w/mp) soy foods in school and early childcare centers.

Approach: Work with schools and childcare centers to ensure compliance and availability of soy milk as an option for children who need or choose an alternative to dairy milk. Provide education, recipes and help connect to sources to gain access to whole soy foods to potentially include in the school or center menus.

Objective 3. Increase the availability of soy foods in local food systems while exploring viable connections between producers and consumers.

Approach: Research strategies and opportunities to increase access to food-grade whole soybeans through local food systems including but not limited to small-scale growers, hobbyists, current soybean farmers, community gardens, and community-supported agriculture (CSA) programs. This will help expand market entrepreneurship opportunities for small and mid-sized soybean farmers and expand markets for large soybean growers in the Midsouth. Educational materials will be developed and provided to educators working with local farmers markets. Work with Extension agriculture educators holding educational sessions for local growers to learn about growing soybeans to sell them at farmers markets or local grocery stores.

Objective 4. Increase appeal and demand for soy foods through education that includes local demonstrations for consumers and producers.

Approach: Building upon the successful Soy Chef grant, each year of the project will include unique education opportunities for consumers and producers. Extension educators will provide demonstrations, presentations, and taste tests of soy recipes accompanied by research-based health and nutrition information about the benefits of soy. The team will explore interest in integrating edible soybean gardening and other hands-on classroom experiences into already used curricula and develop new educational materials for audiences across the lifespan. Educational materials will focus on soy as a significant but overlooked source of a “complete protein” that contains plant-based nutrients important to biological functions and health maintenance. Activities will include education and outreach tailored to the interests of midsouth households and farmers in soybean-producing counties. Existing partnerships and programs facilitated by local Extension educators will be leveraged for maximum reach and impact.

Summary: Cooperative Extension has the outreach expertise and experience to provide nutritional education on the benefits of including whole soy foods in the diet to a variety of consumers and to link

producers with the market. Nutrition education is essential to increase the market demand for the inclusion of food-grade soybeans in food systems such as farmers markets and school lunch programs. The project aims to increase the use of soy as a staple of a healthy and delicious diet, ultimately driving demand – and income -- for food-grade soybean farmers. The project will include parallel processes targeting multiple audiences, educators, and influencers in groups of multiple market gatekeepers.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

Increased knowledge and access to regionally grown soybeans to consumers across the lifespan will support the bridge to market for regionally grown, food-grade soybeans. The impact of food demonstrations and tastings will increase the appeal and acceptance of soy milk and soy foods in the school lunch program. Acceptance in the school lunch program has the potential to increase the demand for food-grade soybeans exponentially not only across the mid-south but possibly across the nation. Local food systems such as farmers markets could be a viable market option for small-scale producers in the mid-south. Connecting consumers and producers through education to this market source will increase the production needs of regionally grown food-grade soybeans.

EXPECTED END PRODUCT(S)

Possible End Products suitable for posting on midsouthsoybeans.com or the national website:

- Fact sheets
- Educational Materials
- Recipes

Possible Conference Presentations, Posters, and Staffed Educational Exhibits:

- The 28th Annual National Conservation Systems Cotton & Rice Conference, the Southern Soybean & Corn Conference, the Southern Precision Ag Conference and the Delta States Irrigation Conference - January 27-28th 2025

- National Extension Association of Family and Consumer Sciences (NEAFCS) – Oct. 20-23. 2025 or 2026
- Society for Nutrition Education and Behavior - 2025 or 2026
- National Health Outreach and Engagement Conference - 2025 or 2026
- American Association of Family and Consumer Sciences
- Mid-South Farm and Gin Show
- Commodity Classic
- Arkansas Farm Bureau State Conference / Missouri Farm Bureau State Conference
- Arkansas Women in Ag Conference / MO Women in Agriculture Regional Events
- Arkansas Farm Bureau Women's Leadership Conference
- MO State Fair
- Missouri Soybean Festival
- Great Plains Growers Conference
- University of Missouri Extension and Engagement Week Conference

Possible Journal Articles:

- Journal of Nutrition Education and Behavior
- Journal of Extension
- Journal of NEAFCS

Educational Materials and additions to current curricula:

- High School Family and Consumer Sciences Teacher Lessons
- Soybean Nutrition Lesson for current gardening lessons
- Soy Nutrition lesson for Current Soybean Science Challenge Curricula
- Extension Homemakers Leader Guides
- Master Gardener Lesson

APPENDICES *(Add as needed)*

Appendix A

Budget Justification

A. Personnel: Salaried Worker **Wages Subtotal = $7500**

Personnel budget justification: Personnel costs were calculated for a part-time data management assistant who will assist with project coordination including planning and scheduling, correspondence and follow-up, educational product development, data entry, and management of data for the meta-analysis, project accounting, record keeping, sub-contractor communication, and reporting.
15% FTE ($50,000 salary base) = $7,500

B. Fringe **Subtotal = $ 2,145**

Fringe budget justification: Fringe was calculated at 28.6% of wages

C. Travel: **AR Subtotal = $ 5400**

Travel: Out-of-pocket expenses, per diem expenses (hotel and meals) and mileage for travel for PI and grant collaborators across the Mid-South in support of project planning and management, testing, education, and meetings. (e.g., including vehicle mileage not to exceed the IRS rate), etc. Two – three to attend the 28th Annual National Conservation Systems Cotton & Rice Conference, the Southern Soybean & Corn Conference, the Southern Precision Ag Conference and the Delta States Irrigation Conference - January 27-28, 2025,

D. Contractual - NA

E. Subcontracts

University of Missouri: **Subtotal: $13,000**

1. **Travel: $5000** - Calculated at $0.65/mile, plus per diem costs as needed for driving to events throughout the state in support of Experiential education with consumers.

2. **Publications: $1000** - Handouts, recipes, and promotional flyers to be used for presentations.
3. **Project Supplies: $ $3500** – Food tasting supplies including ingredients and serving items needed for tastings.
4. **Other Costs Defined: $3500** – Conference booth fees - $3000 and Awards for Soybean Festival Soy Science Fair - $500

F. Commodities – NA

G. Publication Costs

Project Publications/Printing **AR Subtotal=$1000**

- Publications for Target Audiences including Department of Education, School Nutrition Directors and Personnel, Farmers / Producers, FCS Agents, Consumers, and Students
- Publications may include promotional flyers, recipes, lesson guides, and handouts.

H. Other Costs Defined: **AR Subtotal=$6600**

1. **Project Supplies:**

Food Product Supplies $4000

Including: soy milk, fruit, seasoning and flavoring, bottled water, and other ingredients

Food Service / Tasting Supplies $1000

Including plastic plates and utensils, tasting cups and lids, serving dishes and utensils, paper goods, cleaning, and sanitizing items

Small Appliance - Heavy Duty Blenders $1200

To be used for making smoothies for tastings.
4@ $300 each

Project Management Supplies $400
Including postage, paper, and toner cartridges.

Appendix B

Planned and Current Activities

AR Planned Activities

Objective #1 - Increase awareness about soy milk and whole / minimally processed (w/mp) soy foods in school and early childcare centers through a multipronged intervention involving taste tests and work with educational influencers.

Current 2024: Soy Milk and Soy Food Tasting in schools 3 districts in 3 counties,

Year 1 – target 6 different districts in 6 different counties tasting activities

SNAP-Ed PSE exploration for the first year

Policy System Environmental (PSE) -work with school wellness committees to ensure compliance and awareness about soy milk as an alternative for children who need or choose an alternative to dairy milk and the nutritional value of adding soy food options to the school lunch menu.

Year 2 – 11 districts in 11 additional counties tasting activities

Incorporate soy nutrition lessons and tastings into the BestCare curriculum teaching early childhood providers the importance of soy in the diet.

Year 3 – additional districts added to current counties with the option of adding more counties and districts if interest is shown in tasting activities.

Each year can add additional school districts in previous counties and/or a possible breakfast alternative of soy smoothie using shelf-stable soy milk, ice, and a fruit as a follow-up and continued outreach to the school districts that have tasted the soy milk the previous year.

Objective 2. Improve access to soy milk and (soy foods in school and early childcare centers.

Year 1 - SNAP-Ed PSE exploration for the first year

Policy System Environmental (PSE) -explore working with early childhood childcare providers to ensure compliance and awareness about soy milk as an alternative for children who need or choose an alternative to dairy milk and the nutritional value of adding soy foods options to menus.

Year 2 - Incorporate soy nutrition lessons and tastings into the BestCare curriculum teaching early childhood providers the importance of soy in the diet.

Objective 3. Increase the availability of soy foods in local food systems while exploring viable connections between producers and consumers.

Provide educational information and exhibit and tasting to the Arkansas Farmers Market Association

Provide Farmer's Market tool kit to Extension Educators to work with local farmer's markets.

Objective 4. Increase appeal and demand for soy foods through education that includes local demonstrations for consumers and producers.

Field days/production meeting education to be expanded to more counties. Staffed display, educational material development and tasting depending on the location to be used.

Current 3 counties

Expand to

Year 1 - 9 field days

Year 2 – 18 field days

Year 3 – have updated material for all

Years 1-3 Educational experiences for consumers and producers including conference presentations and staffed educational exhibits. (Including, Annual National Conservation Systems Cotton & Rice Conference, the Southern Soybean & Corn Conference, the Southern Precision Ag Conference and the Delta States Irrigation Conference, NEAFCS, Master Gardener Conferences, Child Nutrition Directors, Area Educational Cooperatives, Arkansas Farm Bureau State Meeting Others?)

Year 2 - Create soy nutrition lessons for FACS teachers to include in their curriculum and in the current Arkansas Soybean Science Challenge Curriculum

MO Planned Activities

Objective #1 - Increase awareness about soy milk and whole / minimally processed (w/mp) soy foods in school and early childcare centers through a multipronged intervention involving taste tests and work with educational influencers.

Year 1: Target 4 districts in 4 different counties to provide tasting activities for students and school faculty and staff.

SNAP-Ed PSE exploration for the first year

Policy System Environmental (PSE) Initiative: Work with school wellness committees to ensure compliance and awareness about soy milk as an alternative for children who need or choose an alternative to dairy milk and the nutritional value of adding soy food options to the school lunch menu.

Year 2: 6 districts in 6 additional counties tasting activities

Incorporate soy nutrition lessons and tastings into potential clock hours for early childhood education and childcare providers.

Year 3: Additional districts added to current counties with the option of adding more counties and districts if interest is shown in tasting activities.

Each year can add additional school districts in previous counties and / or a possible breakfast alternative of soy smoothie using shelf stable soy milk, ice, and fruit as a follow up and continued outreach to the school districts that have tasted the soy milk the previous year.

Objective 2. Improve access to soy milk and w/mp soy foods in schools and early childcare centers.

Year 1: SNAP-Ed PSE exploration for the first year

Policy System Environmental (PSE) Initiative: Work with school districts and childcare providers to ensure awareness about soy milk as an alternative for children who need or choose an alternative to dairy milk and the nutritional value of adding soy foods options to menus. Assist schools with accessing soy milk or w/mp soy food as needed.

Year 2: Incorporate soy nutrition lessons and tastings into potential clock hours for early childhood education and childcare providers.

Objective 3. Increase the availability of soy foods in local food systems while exploring viable connections between producers and consumers.

Years 1-3: Work with MU Extension ag business and horticulture specialists to hold educational sessions for growers to learn about growing soybeans for the intended purpose of selling them at farmers' markets.

Years 1-3: Develop a soybean education track for producers to attend during the Great Plains Growers Conference. Participants will receive education and encouragement to grow food-grade soybeans and will learn avenues for getting them to paying customers.

Objective 4. Increase appeal and demand for soy foods through education that includes local demonstrations for consumers and producers.

Years 1-3: Educational and tasting experiences at the following events:

- Norborne, Missouri Soybean Festival – Cooking demonstrations with tastings, activities for kids, education for growers, soy science fair for teens
- Missouri State Fair – Soy Cooking Challenge and Demonstration
- Missouri Extension research farm field days
- Women in Agriculture regional events

Years 1-3: Make recipes that feature w/mp soy foods and soybeans available for the following existing University of Missouri Extension curricula and programs:

- Cooking Matters
- Eat Smart, Move More

- Eating from the Garden
- Healthy Plants, Healthy Bodies
- Master Gardener lessons
- Community gardens

Years 1-3: Educational experiences at conference presentations and staffed educational exhibits. (Including Missouri Academy of Nutrition and Dietetics, National Association of Extension Family and Consumer Sciences, Great Plains Growers Conference, Missouri Farm Bureau Commodity Conference, Missouri Organic Association's Mid-America Organic Conference, National Health Outreach and Engagement Conference, University of Missouri Extension and Engagement Week Conference, University of Missouri Extension Health and Human Sciences Conference)

Years 1-3: Provide roasted soy nuts as an option for our annual Missouri Crunch Off Challenge. The Crunch Off Challenge is meant to encourage people to enjoy Missouri-grown produce. Extension nutrition educators organize "Crunches" in their classes, in their communities, or at large events like football games providing samples of food and education about Missouri-grown produce. We will now make roasted soy nuts an option.

Year 1: Develop produce education toolkit to be used at farmers markets. The toolkit will include a lesson on soybeans.

Year 2 -Share the current Arkansas Soybean Science Challenge Curriculum with high school teachers and work with Arkansas to create new soy nutrition lessons.

2025MIDSOUTH SOYBEAN BOARDPROPOSAL TEMPLATE(Limit the final document to 8 pages)

PROPOSALTITLE: Leveraging Photosynthetic Efficiency traits for improving soybean productivity in the Mid-South

INVESTIGATORS:
PI: Feng Lin, Assistant Professor, University of Missouri, Email: flbn7@missouri.edumailto:shannonjg@missouri.edu

PROGRAM AREA (check all that apply):

___ New Uses of Soybean
___ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
_X__Irrigation/Water Management
___Seed Quality
___Disease Management and Control
___ Fertility Management
___ Insect Management/Control
___ Harvest aids
___ Nematode Management/Control
___ Rotations using soybeans
__X_ Research Validation or Demonstration
_X__ Producer Communications
___ Variety Trials
___ Economics
_X__ Other (*Identify*): Improving soybean productivity via Photosynthesis

PROJECT STATUS:

New _X___ *(*Expected research length three years (36 months)

Renewal _____ (Year _____ of _____)

Stand alone ___ or cross-commodity ___ (*additional funding from other sources? Name all other sources and amounts co-funded.*)

_____

2025 TOTAL FUNDING REQUEST $30,000

2025MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)		
	2. Wages (hourly workers)		
	3. GRA (include tuition)	19,518	
B.	**Fringe Benefits** (% *used to calculate*)	1,303	
C.	**Travel**	2,156	
D.	**Contractual Services**		
E.	**Subcontracts**		
F.	**Commodities**	2,000	
G.	**Publication Costs**	1,000	
H.	Other Costs *(Plot Fees)*	4,023	
TOTAL COST		30,000	
(MSSB does not allow indirect costs/overhead charges)			

Personnel: *GRA, new to this project, to be appointed 0.25 FTE on this project effort. Remaining effort up to half-time will be appointed on another project contributing to their thesis. Medical cost is reported in Fringe Benefit. Tuition ($6,038; prorated by half) is included in this category. Salary rate starting of $12,875 for quarter-time appointment.*
Fringe Benefits: *Amount for medical insurance subsidy for one GRA ($1,303), prorated by half for quarter-time appointment basis.*
Travel*: Domestic travel ($2,156) for the PI for site visits, travel to and from agency meetings, or conferences to disseminate project findings. Per diem is limited by university policy to $54.00 and the rate for personal vehicle mileage is $0.655/mile.*
Contractual Services*: none*
Commodities*: Funds ($2,000) for consumable supplies directly related to the conduct of the project (e.g., seed, fertilizers, pesticides, lab supplies).*
Publication Costs. *Funds requested ($1,000) will be at the rate charged by the publishing agent, journal page-charges, or for in-house printing/publishing of a specifically identified publication resulting from the project.*
Additional Details*: Other Direct Costs: Funds are requested for plot fee expenses ($4,023) for growing periods, including space and management.*

TECHNICAL SUMMARY

Soybean [*Glycine max* (L.) Merr] is a vital U.S. crop, providing a major source of vegetable oil and protein globally. To meet rising demand and increase U.S. farmers' profitability, enhancing soybean seed yield is essential. Photosynthesis, the process by which plants convert sunlight into energy, is crucial for soybean growth and yield, yet improving photosynthetic efficiency for seed yield enhancement remains underexplored. Recent studies (De Souza et al., 2022; Montes et al., 2022; Hu et al., 2024) have shown significant yield gains and positive correlations between photosynthesis-related traits and seed yield. This project aims to build on these findings by exploring the genetic and environmental factors affecting photosynthetic efficiency and their impact on seed yield. The goal is to identify traits and candidate genes related to photosynthetic efficiency that correlate with high seed yield, ultimately developing a predictive breeding pipeline to release high-yield soybean varieties.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

Soybean is a major U.S. crop, accounting for over 60% of global vegetable oil and protein consumption. Increasing soybean yield is crucial to meet rising demand and boost U.S. farmers' profitability. Photosynthesis, the process by which plants convert sunlight into energy, is fundamental for soybean growth and development. Studies have shown significant yield improvements by enhancing photosynthetic performance, with De Souza et al. (2022) reporting a 33% yield increase. Despite this potential, photosynthetic efficiency remains underexplored in soybean breeding. This project aims to investigate the genetic and environmental factors influencing photosynthetic traits and their impact on yield. We will evaluate various soybean varieties in different environments, conduct genome-wide association studies (GWAS) to identify key genes, and integrate photosynthesis data into breeding programs to select high-yield varieties.

OBJECTIVE(S):

1. Identify the photosynthesis related traits strongly correlated with higher seed yield in soybean
2. Identify candidate genes for photosynthetic efficiency traits correlated with high seed yield in soybean
3. Develop a predictive breeding pipeline in soybean using photosynthetic efficiency towards the release of soybean varieties with high yield potential

APPROACH AND EXPERIMENT CONDUCT:

Objective 1: We will quantify the photosynthetic variations present in approximately 300 diverse soybean germplasm accessions and breeding lines for different photosynthetic traits using an advanced instrument (MultispeQ, 30 sec per-measurement). We will grow these accessions at up to three different locations in Missouri, representing distinct environments (soil, weather, management), and environmental conditions will be monitored from local weather stations. Then, we will collect photosynthetic measurements during different growth stages: mid reproductive stage (R4-R5) and record final seed yield for each line and variety. We will then perform a diversity analysis to observe the extent of variation for photosynthetic performance in our soybean breeding lines and evaluate how beneficial that variation is associated with the improved yield potential of our elite varieties. To do so, we will study the correlation between different photosynthetic traits and the seed yield of corresponding soybean lines. Significant positive correlations will help understand what photosynthetic traits are correlated to the final seed yield in soybean. Photosynthesis data will be collected from multiple environments in Missouri by our team. The results will help understand the impact of the environment (E) on photosynthesis and yield performance of each line (genotype, G) and the combined effect of the environment and genotype on photosynthesis (GxE). The GxE experiment will show how genetics and environment are shaping these photosynthetic traits and seed

yield in the elite breeding material in our program. We will also evaluate 10 selected soybean lines or accessions representing high and low yielding potentials using greenhouse studies. The controlled conditions in the greenhouse (*e.g.* temperature, light intensity, day length, and humidity) will help minimize extraneous variation caused by environmental fluctuations and assist evaluation of true photosynthetic performance. Greenhouse studies are important when evaluating soybean yield potential, as near-optimal conditions can be simulated and stressors can be more controlled, compared to field conditions where complex abiotic and biotic stressors may influence results. These greenhouse experiments will provide additional validation for the relative performance, specifically photosynthetic traits, of commercial soybean varieties. Comparing results from the field and greenhouse experiments will help further understanding of the role of environmental factors in regulating photosynthesis and corresponding yield potential. Soybean seeds have significant market importance for oil and protein. The relationship between seed quality and composition traits (seed oil, protein, amino acids, stearic acid, sucrose, stachyose) and photosynthetic efficiency in selected 20 soybean varieties will be analyzed by both labs. These selected soybean varieties will have different trait combinations (*e.g.*, high protein, high oil, or high protein and oil varieties), and the results will provide us valuable information on how different seed compositional traits correlate with photosynthetic performance. In other words, it will indicate if photosynthetic performance of a soybean variety can also influence seed composition traits. In summary, our team will collaboratively analyze all the soybean performance data collected from multiple locations and environmental conditions mentioned above. The results from greenhouse and field studies will provide a correlation matrix between different traits of seed yield, seed composition, and photosynthetic parameters that can help identify any correlations among these traits. Finally, photosynthetic traits strongly linked with high seed yield potential will be identified for further genetic improvement.

Objective 2: Improving the genetics of photosynthesis is necessary to develop more productive soybean varieties with greater yield potential. To do so, we will perform genetic mapping to pinpoint candidate genes associated with high photosynthetic efficiency using data from objective 1. This experiment will inform us of significant associations between genetic markers and genomic locations regulating these traits controlling high yield potential through superior photosynthetic performance. Ultimately, the results from this experiment will facilitate the development of molecular markers that are useful for efficient and effective selection of superior lines in our soybean breeding program.

Objective 3: We will use the data collected with MultispeQ and drones over multiple locations to develop robust models for predicting seed yield from photosynthetic traits. Our team will perform the data analyses and interpretation for predictive modeling for soybean yield. Additionally, we will determine the accuracy of drone-collected measurements by comparing photosynthetic traits measured by drones and on-ground measurements by MultispeQ in the field conditions. This technology would improve selection accuracy and intensity in our soybean breeding program, thus making our selection decisions more robust and accurate. The predictive breeding pipeline developed will be deployed in the MU-FDREEC soybean breeding program led by PI Lin, to efficiently develop and release high yielding soybean varieties to benefit the Mid-South U.S. farmers.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

Upon successful completion of the project, we anticipate a substantial increase in soybean seed yield and productivity across the Mid-South region, further enhancing soybean acreage in this agriculturally productive area. This improvement could result in significant economic benefits, potentially boosting farm productivity by several million dollars annually. Additionally, the development of high-yielding soybean varieties adapted to the regional environments will enhance the competitiveness of Mid-South soybean farmers in both national and global markets. This will ensure a stable supply of high-

quality soybean products for consumers and industries. The project will also strengthen the resilience and sustainability of soybean production in the region, providing long-term benefits to farmers and the agricultural community.

EXPECTED END PRODUCT(S)

- Identification of superior soybean germplasm and releasing varieties with higher photosynthetic efficiency, greater yield performance and enhanced on-farm yield potential
- Development of prediction models for yield estimation
- Discovery of molecular markers for higher selection accuracy in breeding program
- A PhD dissertation
- Dissemination of impactful publications and scientific knowledge via poster presentations at national and international conferences

APPENDICES *(Add as needed)*

A. Explanation/justification of budget categories -.

Graduate Student Assistantship ($20,821 includes salary, medical, and tuition)
Funds are requested for a PhD Student to conduct proposed research activities at the University of Missouri – Fisher Delta Research Center in Portageville under the supervision of Dr Feng Lin. A total of $13,480 (6 months) of salary is requested for the PhD Student. Medical insurance rate of $2,605 per year per GRA is pro-rated by half for a quarter-time appointment type. The tuition fee of $6,038 represents 23 credit hours per year, pro-rated by half for a quarter-time appointment..

Domestic Travel ($2,156)
Funds in amount of $2,156 are requested for travel for conference to present research and disseminate findings.

Publication cost ($1,000)
A total amount of $1,000 are requested for publication fees related to journal article page fees.

Commodities and other Costs ($6,023)
Funds are requested in the amounts of $2,000 for materials & supplies and $4,023 for plot fees.

2025 MIDSOUTH SOYBEAN BOARD

PROPOSAL TEMPLATE *(Limit the final document to 8 pages)*

PROPOSAL TITLE: **Screening soybean germplasm and breeding soybeans for flood tolerance for early and reproductive stages**

INVESTIGATORS:
PI: Feng Lin, Assistant Professor, University of Missouri, Email: flbn7@missouri.edu
CO-PI: Francia Ravelombola, Research Scientist, University of Missouri, Email: srnmv@missouri.edu
Cooperators: Caio Canella, University of Arkansas
David Moseley, Louisiana State University
Tessie Wilkerson, Mississippi State University

PROGRAM AREA (check all that apply):

___ New Uses of Soybean
___ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
_X_ Irrigation/Water Management
_X_ Seed Quality
___ Disease Management and Control
___ Fertility Management
___ Insect Management/Control
___ Harvest aids
___ Nematode Management/Control
___ Rotations using soybeans
_X_ Research Validation or Demonstration
_X_ Producer Communications
_X_ Variety Trials
___ Economics
_X_ Other (*Identify*) Breeding for flood tolerance

PROJECT STATUS:

New ____ *(Indicate planned length of project–1 of 2, 1 of 3, etc. Note that projects are only approved on a yearly basis.)* Expected research length (yr)_____

Renewal __x__ (Year __4__ of __4__)

Stand alone ___ or cross-commodity ___ (*additional funding from other sources? Name all other sources and amounts co-funded.*)
_____

2025 TOTAL FUNDING REQUEST $171,302_____

2025 MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)	45,698	
	2. Wages (hourly workers)		
	3. GRA (include tuition)		
B.	**Fringe Benefits** (% *used to calculate*)	14,920	
C.	**Travel**	3,710	
D.	**Contractual Services**		
E.	**Subcontracts**	104,252	
F.	**Commodities**	1,722	
G.	**Publication Costs**		
H.	Other Costs *(Plot fees)*	1,000	
TOTAL COST		171,302	
(MSSB does not allow indirect costs/overhead charges)			

Personnel ($45,698)
Funds are requested for a Research Specialist II to conduct proposed research activities at the University of Missouri – Fisher Delta Research Center in Portageville under the supervision of Dr Feng Lin. A total of $45,698 of salary is requested for the Research Specialist II. Employee benefits are estimates using the composite rates agreed upon by University of Missouri. Current benefit rate is estimated at 32.65% for the Research Specialist II with a total amount of $14,920.

Foreign Travel ($3,710)
Funds in amount of $3,710 are requested for travel to the winter nursery locations in Costa Rica and Puerto Rico.

Subawards ($104,252)
Three subawards will be provided. University of Arkansas - $44,252; Louisiana State University - $30,000.; and Mississippi State University - $30,000.

Commodities and other Costs ($2,722)
Budgets in amount of $1,722 and $1,000 are requested for materials & supplies and plot fees.

TECHNICAL SUMMARY

Flooding stress during the early and mid-seasons has become increasingly severe due to more frequent heavy rainfall in soybean-growing regions, leading to significant reductions in soybean yield. To sustain soybean production, this research aims to identify flood-tolerant genetic resources to accelerate the development of high-yielding, flood-tolerant soybeans, addressing yield loss from water-logging and saturated soil conditions. Utilizing genetically diverse, tolerant soybean germplasm is key to achieving flood tolerance and developing resilient cultivars. A large-scale screening different soybean lines and germplasm will help identify new flood-tolerant genetic resources. These resources can be used in breeding programs to develop new soybean cultivars with both flood tolerance and high yield potential. The ultimate goal of the research is to safeguard soybean growers' profits through the introduction of improved cultivars with enhanced tolerance to flooding and water-logging conditions. Research strategies include screening state commercial varieties, advanced breeding lines, and exotic soybeans. The goal is to incorporate flood tolerance into elite high-yielding soybean lines through conventional breeding and subsequently convert these flood-tolerant lines into Enlist/XtendFlex varieties.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

Soybean [*Glycine max* (L.) Merr] is the world's largest source of animal protein feed and the second-largest source of vegetable oil for humans, comprising about 90% of US oilseed production. In the USA, soybean production was more than 4.5 billion bushels on approximately 36.1 million ha in 2018. However, flooding can cause a big yield reduction (~40%) in US soybean production rendering significant economic losses to the growers and soybean business. Estimates of the average losses due to flood in the US are approximately $1.5 billion/year. Severe flooding stress in early and mid-seasons occurs in soybean growing areas because of an increased frequency of heavy rainfall, excess irrigation, or rainfall that occurs after an irrigation event. Water-logging or saturated soil conditions are more problematic to soybean production in heavy clay and poorly drained soils, typical of flat land in the mid-south. Due to climate change, by 2030, an alarming 30% increase in heavy precipitation events is expected. To support sustainable soybean production, the proposed project aims to identify flooding-tolerant genetic resources and use them for the development of flooding-tolerant and high-yielding varieties to protect yield from damage due to excess water. Enhanced genetics and diversity in flooding tolerance of soybean germplasm can also be expected with the utilization of exotic and wild resources

OBJECTIVE(S):

1. Screening soybean germplasm and commercial cultivars for flooding tolerance and implementing UAVs imaging
2. Breeding for flood tolerance and incorporate of flood tolerance into elite cultivars
3. Incorporated herbicide trait Enlist and XtendFlex into flood tolerance lines

APPROACH AND EXPERIMENT CONDUCT:

Objective 1*: The objective of this project is to differentiate flood-tolerant and sensitive cultivar in a waterlogged or flooded environment. Seeds of recently developed soybean cultivars (MG-4 and MG-5) from the State Variety Testing programs in MO, AR, MS, and LA, advanced breeding lines and elite breeding from breeding programs in AR and MO will be used for screening. The test lines will be subjected to 1-2 inches of water above the soil for 5- 7 days during V2/V4 (vegetative stages) and 3-5 inches of water above the soil surface for 5-7 days during R1/R2 (flowering stages) growth stages*

(See Appendix A Fig. 1). It is important to highlight that the treatment at vegetative and reproductive are two separate treatments. Lines will be rated for flood injury visually (1 to 5 = 1 no injury green and 5 plant death, see Appendix A Fig. 2). and using also UAVs imaging after 5-7 days after the water is removed (See Appendix A Fig. 3). The most tolerant and sensitive genotypes will be determined. We will grow the selected extreme (tolerant/sensitive) sets at multi-state locations to confirm flood tolerance and stability across variable environments. The study with extreme sets (tolerant vs. sensitive) will help assess the effect of flooding stress on seed quality and seed composition. In 2023, during field flood tolerance screening in Missouri, seven varieties developed by private seed companies and Missouri lines showed pretty good flood tolerance (See Appendix A Table 1). These screening tests indicate that some commercial varieties have good flood tolerance although this is not their intended focus. So, we will continue testing commercial varieties. In 2023 flood screening, R16-45, S12-1362 S17-1146 showed a good flood tolerance. Both lines have been released as flood tolerance. R16-45 has been registered in Journal of Plant Registrations. S17-1146 will be submitted soon for the Journal of Plant Registration. Also, S17-1146 has been sent to Puerto Rico for increase and purification.

***Objective 2**. The main objective of this proposed research is to identify flood-tolerant varieties and germplasm and to incorporate flood tolerance into the high-yielding elite soybean lines. In 2023, in the Missouri location, we evaluated soybean lines developed by University of Missouri MG-4 and MG-5 breeding lines under flooding stress conditions (V2/V4 and R1/R2 stages) for seed yield and flood tolerance. A total of 4 MG-5 lines (S19-14307, S19-14797, S20-1435, and S20-1492), had yield from 26.6 to 33.0 b/a (average flooded at V2/V4 and R1/R2) with a very strong flood tolerance (injury score FDS<2.00), while the commercial checks mean yield were 24.0 b/a (MG-5) with mean flooding injury score of 3.1 (See Appendix A Table 2). Five MG-4 lines (S17-17644, S19-12409, S19-12459, S19-14284, and S20-7117) were identified as potential flood toleran (FDS<2.00) (See Appendic A Table 2). Those selected have been screened for the season 2024.*

***Objective 3**. The goal is to convert identified flood tolerant lines into Enlist/XtendFlex. Identified flood tolerant for 2024 will be sent to Puerto Rico for herbicide trait incorporation.*

***Plan of activities**: Flood tolerance screening will be conducted on current commercial cultivars and collected germplasm, including recently developed breeding lines from Missouri (MO) and Arkansas (AR). The identified AR and MO lines with extreme responses to flooding will be re-evaluated at multiple locations in AR, MO, Mississippi (MS), and Louisiana (LA). The test genotypes will be assessed for their response to flooding at the V2/V4 and R1/R2 stages. Additionally, new commercial cultivars included in state variety testing programs will be tested.*
Breeding lines that have demonstrated high flood tolerance and good yield under flooding stress conditions in the past two years will be re-tested for flood tolerance and yield in both flooded and non-flooded fields. The goal is to select lines for release as flood-tolerant cultivars with high yield potential and valuable germplasm. Promising advanced breeding lines included in the Southern Uniform Trials (UT) will also be tested under flooding stress to expedite the release of any flood-tolerant lines as cultivars.
New crosses will be made using flood-tolerant germplasm/lines and elite high-yielding cultivars from the southern region. These new breeding populations are being advanced in our winter nurseries in Costa Rica. $F_{4:5}$ progenies from a significant number of crosses will be grown in the 2025 season in progeny testing nurseries in Missouri and Arkansas to select high-yield potential lines, which will be evaluated for yield and flood tolerance in 2026. Lines derived from flood-tolerant sources in AR and MO will be used as bridge materials in breeding cycles to enhance flood tolerance and yield.
A conventional breeding scheme will be followed: making new crosses, growing and identifying hybrids, advancing generations from F_2 to F_4 using the modified single-pod descent method,

evaluating progeny rows, selecting pure lines, and testing selected lines in preliminary and advanced trials for flood tolerance and yield potential. All yield evaluation trials will follow a randomized complete block design (RCBD). Identified flood-tolerant lines will be converted into Enlist/XtendFlex in Puerto Rico.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

In the mid-south soybean growing areas, waterlogging, or flooding can be caused by inadequate drainage of soils after intense rainfall or excessive irrigation, or a rising water table. Yield losses up to 50% due to waterlogging are common because of heavy clay soils, poor surface, and internal drainage, occasional high rainfall amounts, and cropping practices (especially the rice-soybean rotation system). Breeding for waterlogging tolerance in soybean is a relatively new goal of breeders. There has been no report on releasing a soybean cultivar possessing flood tolerance. Using a tolerant variety to maintain a greater percentage of the yield under stress is the most feasible strategy to combat flooding. When dealing with potential losses to stresses, many growers have to decide whether or not to grow the highest-yielding cultivars or to grow cultivars that are the most stable when stresses are encountered. This project will identify cultivars with flood tolerance so that specific recommendations can be made to producers. This project will also identify new sources of flood tolerance from diverse germplasm and intend to incorporate such tolerance into high-yielding backgrounds.

EXPECTED END PRODUCT(S)

- *Identification of MG 4 & 5 flood-tolerant varieties and breeding lines/plant introductions (PIs) with extreme responses to flooding.*
- *Confirmation of flood-tolerant varieties and extreme genotypes across multiple locations in four southern states; assessment of flood tolerance impact on yield, seed quality and composition; determination of flood timing and duration to devise breeding strategies.*
- *Recommendation of flood-tolerant varieties to soybean producers; evaluation of new lines and populations for flood tolerance/yield.*
- *Enhancement of genetic diversity on flooding tolerance in mid-south US cultivars.*

KEY PERFORMANCE INDICATORS (KPIS)

- *About 3-5 new advanced breeding lines/cultivars with high yield and flooding tolerance are expected to be identified.*
- *At least 3-5 soybean germplasm lines with strong flood tolerance are expected to be identified which could be used in new crosses.*
- *Identification of 3-5 commercial varieties of MG 4 and MG 5 with high flood tolerance.*
- *Convert 3-5 identified flood tolerant lines into Enlist/XtendFlex*

2025 MIDSOUTH SOYBEAN BOARD

PROPOSAL TITLE: LADDER (Large Agricultural Database that Drives Extension and Research)

INVESTIGATORS:

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PROGRAM AREA (check all that apply):

___ New Uses of Soybean
___ Food Grade Soybean
___ Soybean Fuel
___ Soybean Breeding and Genetics
___ Weed Management
_X_ Irrigation/Water Management
___ Seed Quality
___ Disease Management and Control
_X_ Fertility Management
___ Insect Management/Control
___ Harvest aids
___ Nematode Management/Control
_X_ Rotations using soybeans
_X_ Research Validation or Demonstration
_X_ Producer Communications
___ Variety Trials
_X_ Economics
___ Other (*Identify*)_____

PROJECT STATUS:

New ____

Renewal _X_ (Year _2_ of _3_)

Stand alone _X_ or cross-commodity ___ (*additional funding from other sources? Name all other sources and amounts co-funded.*)

2025 TOTAL FUNDING REQUEST $55,625

2025 MSSB RESEARCH PROJECT PROPOSED BUDGET			
CATEGORY *(see below for guidelines)*		**ORIGINAL**	
A.	**Personnel** (No Permanent Salaries)		
	1. Salaries (See Addendum B)	$39,445	
	2. Wages (hourly workers)	$0	
	3. GRA (include tuition)	$0	
B.	**Fringe Benefits** (% *used to calculate*)	$16,180	
C.	**Travel**	$0	
D.	**Contractual Services**	$0	
E.	**Subcontracts**	$0	
F.	**Commodities**	$0	
G.	**Publication Costs**	$0	
H.	Other Costs *(Define)*	$0	
TOTAL COST		**$55,625**	
(MSSB does not allow indirect costs/overhead charges)			

TECHNICAL SUMMARY

Big data capture and analytics may be foundational to addressing a multitude of the Mid-South Soybean Board's priority research and Extension areas. Analysis of large-scale agricultural data can be used to determine the effects of agronomic practices, management philosophies, and environment on crop productivity and profitability. Therefore, we propose to collect, process, and securely store geospatially specific agronomic and environmental data for the purpose of addressing the MSSB's primary research and Extension concerns. Specifically, the objectives of this project are: 1.) Determine the effects of environment, i.e., CEC, pH, slope, climatic data, and agronomic practices including irrigation, precision ag technology, nutrient management, planting systems, and tillage systems on soybean productivity and profitability at the farm scale; and 2.) Deliver research-based Extension programing to soybean producers in the Mid-South to stimulate the adoption and proper implementation of geospatially specific agronomic practices that improve grain yield, net returns, and sustainability. We will inform growers on the benefit of an ever-evolving aggregated database that spans across the landscape while being reassured of the security and anonymous nature in which this data will be presented. Digital data and agronomic field notes will be collected directly from growers, machinery, retailers, online platforms, or any other method approved by the producer. These data will be analyzed to determine the economic influence of specific agronomic practices and environments. Aggregated results from this project will be presented to growers through Extension publications and programs and used to help formulate future research projects that will benefit soybean producers in the Mid-South. Collecting geospatial data in Delta regions, non-Delta regions, and across various management strategies will allow for more opportunity to analyze the economic impact of different practices/inputs. Information from this project is expected to not only validate results from traditional small plot replicated research, but also encourage the adoption of innovative sustainable practices that increase soybean yield and profitability.

OUTLINE OF RESEARCH

RATIONALE/JUSTIFICATION FOR RESEARCH:

Large data capture and analytics is a novel approach to Extension and research as it relates to a university. Small-plot research along with larger demonstration plots are an invaluable part of a university's ability to provide cutting edge data and recommendations to producers. However, data analysis at a landscape level offers scientists the advantage of assessing an immense amount of data in one growing season. With a multitude of various management practices and environments in Mid-Southern states, data from just one growing season can offer expedited answers to numerous problems. It is common for growers to be apprehensive about implementing a certain management practice with experimental small-plot data only. The LADDER program proposes to alleviate this hesitation by collecting, safely storing, and analyzing farm-scale digital data for the purposes of answering prevalent questions while verifying and guiding research.

OBJECTIVE(S):

1. Determine the effects of environment, i.e., CEC, pH, slope, climatic data, and agronomic practices including irrigation, precision ag technology, nutrient management, planting systems, and tillage systems on soybean productivity and profitability at the farm scale.
    - Soil, application, and yield geospatial point data to be obtained from growers.
    - Perform analytics on large, aggregated database to determine the effects of agronomic practices and environment on soybean productivity and profitability.
2. Deliver research-based Extension programing to soybean producers in the Mid-South to stimulate the adoption and proper implementation of geospatially specific agronomic practices that improve grain yield, net returns, and sustainability.
    - Anonymous aggregated data will be presented at meetings, face to face, or in documentation that is disseminated to growers.
    - Participating growers will be individually presented with entity specific results along

with comparisons to the anonymous community data.

APPROACH AND EXPERIMENT CONDUCT:

Objective 1: Determine the effects of environment, i.e., CEC, pH, slope, climatic data, and agronomic practices including irrigation, precision ag technology, nutrient management, planting systems, and tillage systems on soybean productivity and profitability at the farm scale.

As previously stated, the environmental and agronomic data will be collected and analyzed on a field, farm, and landscape scale. Data will be collected directly from growers, machinery, retailers, online platforms, or any other method approved by the producer. Data to be captured will include but not be limited to: geospatial application and yield data, geospatial soil data, and other documentation approved by growers for sharing such as satellite imagery. Compiled data will be stored, calibrated, cleaned, and queued for analysis. Data will be subjected to analysis of variance (ANOVA), analysis of covariance (ANCOVA), and regression techniques. Examples of analysis could range from how a specific soybean variety yields across a certain soil type in Arkansas to a multi-factor analysis in which soybean yield and profitability are assessed as a function of sulfur applications/soil test levels across the Mid-South. Locations for data collection in this project will span across the Mid-South including Mississippi, Louisiana, Arkansas, and Missouri. We have verbally expressed the importance of analyzing aggregated data with growers in the Mid-South spanning from the bootheel of Missouri down to northeast Louisiana. To date, we have collected 350,000+ acres of geospatial grower data with soybeans as part of their crop rotation for the purposes of gaining agronomic knowledge across the landscape. The goal of collecting and building the LADDER program is to benefit producers by providing a database that can answer a wide array of questions from farm-scale data.

Objective 2: Deliver research-based, Extension programing to soybean producers in Mid-Southern states to stimulate the adoption and proper implementation of geospatially specific agronomic practices that improve grain yield, net returns, and sustainability.

The LADDER program aims to be a catalyst for the adoption of novel production practices that improve soybean grain yield and net returns. Traditional and innovative Extension programming will be implemented to promote the adoption of profitable production systems. First, we will meet face-to-face with producers in conjunction with regional Extension agents to provide a holistic examination of their current agronomic practices and offer recommendations that should improve profitability based on the aggregated data. Second, we will present aggregated data at county, state, and regional meetings that demonstrate how altering production practices as a function of environment affects soybean productivity and profitability. Third, we will promote adoption of successful practices through electronic dissemination platforms including crop blogs, podcasts, Extension publications, and other means. This approach will rapidly increase the adoption of site-specific production practices that improve soybean production in Mid-South USA.

PROJECTED IMPACT OF RESULTS ON MID-SOUTH SOYBEAN PRODUCTION

The acreage and monetary impact of the LADDER program in the Mid-South has potential to be substantial. As adoption and acreage of the program increases, the scope of influence will also increase. Results from these aggregated data will benefit Delta and non-Delta producers alike, encompassing millions of acres in the Mid-South. We project that results from this program will lead to changes in agronomic practices or management that increase profitability. With input prices continuing to increase, stewardship of these resources is particularly important. Managing inputs by using historical data such as a seed and fertilizer has shown profits that exceed $30/acre. The LADDER program will examine these historical data and take a holistic approach to increase profit which could potentially far exceed benefits from analyzing one input alone.

EXPECTED END PRODUCT(S)

Results from this project will be distributed through a variety of channels. Small group data exchange will be accomplished through in person or virtual meetings with project investigators, local Extension agents, and growers. Other avenues of data exchange will include 1) oral presentations to

producers, consultants, researchers, and others at local, state, regional, or national meetings and 2) written or published materials such as crop blogs, podcasts, and Extension publications. The goal of the LADDER program is to have constant data communication between soybean producers and universities across the Mid-South. This exchange will provide relative and immediate results which influences management while increasing soybean yield and profitability.

ADDENDUM B
Budget Guidelines for MSSB Grants

Personnel.

- **Salaries: ($39,445)** Funds will be used to pay a portion of the salary for a research or extension associate, data manager, or research engineer.

Fringe Benefits. **($16,180)** The fringe rate changes at the beginning of the new fiscal year, July 1, thus projects funded by MSSB will overlap multiple fiscal years resulting in different fringe rates being applied over the life of the contract. However, at the time budgets are submitted only the FY2024 fringe rate is known, thus budgets are based on the rates effective 7/1/2024. MSU budgets based on an average fringe rate for a salary of $40,000/year. Actual fringe incurred and invoiced is a sum of multiple sub-rates, some of which are fixed, some vary directly in proportion to salary. Consequently, actual fringe rate varies with salary. Salaries below $40,000 have higher incurred fringe rates, higher salaries have lower incurred fringe rate.

$39,445 @ 41.02% = $16,180

Travel. none

Contractual Services. none

Subcontracts. none

Commodities. none

Publication Costs. none

Other Costs. none

Total Direct Costs: $55,625

Arkansas Soybean Promotion Board Funding Request-2025

TITLE: Recognizing Soybean Production Excellence by the continuance of the "Grow for the Green Yield Challenge Contests"

INVESTIGATORS: Arkansas Soybean Association – Appointed Committee

PRODUCTION SYSTEM: Alternative

STATUS: Existing

STATED GOAL: To recognize Arkansas soybean producers that obtain very high grain yields and encourage other Arkansas soybean producers to strive for increased grain yields.

OBJECTIVES:

1. To recognize and award Arkansas producers who have developed management programs that result in very high grain yields by region.
2. To obtain detailed information from participating Arkansas producers regarding management practices employed to obtain exceptionally high soybean grain yields with differing production systems.
3. The development of a high yield soybean production database program that would be available to producers.
4. To share top grower management practices for the various soybean production systems with other Arkansas soybean producers.

APPROACH: This enhanced and expanded proposal builds on the foundation of interest and participation generated by the former "**Race for 100**" Yield Challenge and the current ASPB funded Arkansas "**Grow for the Green Yield Challenge"** contests. This proposal, if funded, will continue to reward Arkansas soybean producers who are able to obtain exceptionally high soybean grain yields with cash and other awards. There will be special recognition to the top three contest participants within the 7 major Arkansas soybean production regions and the conventional producers.

Management of this program is handled by the Arkansas Soybean Association but the research and knowledge of the University of Arkansas Division of Agriculture personnel is vital in assisting the producers.

Information Dissemination: Beginning In 2013 the ARSA **summarized the production practices** of the winners and all of the participants from across the state in a booklet format entitled" 2013 Race for 100 Bushels/Acre Soybean Yield Contest and the 2013 "Grow for the Green Soybean Yield Challenge". This booklet format was also used in all contests since (2014-2024) and the data provided by the participants competing in the "Grow for the Green Soybean Yield Challenge" was distributed at the Arkansas Soybean Association annual meeting, ASPB Soybean/Corn Conferences, MidSouth Farm & Gin Show and placed on both the ASPB and the ARSA websites in January of 2025. A discussion and overview discussion by Dr. Jeremy Ross of

the management practices utilized by these outstanding soybean producers was included in the booklets and again this information is also available on both websites.

Based on the continued interest by Arkansas soybean producers and to enable these producers to assess the new innovations in soybean production as it develops with the state, the ARSA is proposing the following 2025 ASPB Proposal entitled "**The Arkansas 2025 Grow for the Green Yield Challenge".**

Divisions are:
District 1 = Northeast Delta (East of Crowley's Ridge);
District 2 = Northeast (West of Crowley's Ridge)
District 3 = White River Basin;
District 4 = Central & Grand Prairie;
District 5 = East Central Delta;
District 6 = Southeast Delta
District 7 = Western (remaining production regions within the state);

Non-GMO Statewide category = Producer(s) who utilizes a non-GMO soybean variety (without regard to production region)

Champion of Champions – 100 bushel winners (43 members) compete against each other

The monetary prize for placing first, second or third within each Division (1-7 and non-GMO) is as follows: 1st place - $7,500, 2nd place $5,000, 3rd place $2,500.

The Champion of Champions division consists of those producers who have achieved the 100 bu/a. A competition among the best in the state. This budget shows that the Champion division prize is $5000. Additional funds will be used to recognize the 100 bushel club members with a dinner. (Dinner was held in January 2025 – 5 attended and were awarded their watches).

Any producers who obtain soybean grain yields of 100.00 Bu/A or greater for the 1st time will be inducted into the 100 Bushel Club (receive a 100 bushel plaque & watch) and will be eligible to split $5000. Note: *any producers who are new additions to the 100 Bushel Club will be eligible for an expense paid trip for 2 (travel/economy airfare, housing- 2 nights, registration) to Commodity Classic.*

Producers who turn in their harvest report and do not place in their division will receive $200. The goal is to get additional producers to report their harvest yields. Currently about ½ of the entries turn in harvest yields. In 2024, the 58% of those entered turned in their harvest information

INFORMATION GATHERED: Details such as entry dates, field location, agronomic information and grain yield certification will be included on the harvest form. A very detailed template was

created electronically in 2020 for each contestant to complete to gather the information other producers need to achieve the high yields.

The data obtained from this form (template) will be analyzed and/or evaluated by the Arkansas Soybean Association, University of Arkansas Division of Agriculture and the Arkansas Soybean Research and Promotion Board (ASPB) to further assist the soybean producers of this state. Funds provided for this project were authorized by the ARSPB from the soybean check-off program.

Arkansas Soybean Promotion Board (ASPB) Sponsorship

a. ASPB financial sponsorship of "Grow for the Green Challenge
b. Producer Recognition
    I. ARSA Web Site
    II. ASPB Web Site
    III. Publicity (Local, State and Regional Publications)
    IV. Presentations at conferences (National Conservation Tillage Meeting) by state agronomist-Dr. Jeremy Ross and top-producers.
c. Distribute production practices information of high yielding soybean producers

PLANNED MILESTONES: Each year this project (yield contest) will be evaluated based on grower participation and grain yields obtained and reported to the Soybean Promotion Board. Yield levels for the various soybean production systems and monetary awards will be evaluated and may be tweaked by Arkansas Soybean Association Yield committee (rules have not been evaluated for 2025 yet).

VALUE TO SOYBEAN INDUSTRY: Arkansas soybean producers are constantly faced with economic and agronomic challenges. These challenges require continual improvement by the grower to obtain increased soybean grain yields and to adopt or utilize new and more efficient technological production practices. This project will help document the present grain yield potential of each production system and provide economic incentive to strive for maximum grain yields regardless of system.

Budget -attached

TOTAL YIELD CONTESTS FUNDING REQUEST - $206,900

BUDGET NOTES:

1. This budget contains $8,000 to be provided to the U of A System Division of Agriculture to use for travel expenses to field plots for the involved county agent and/or county agent trip to Commodity Classic as the Division sees fit. Additionally, this budget contains a

request of $400 to be made available to pay designated yield certifying officials at $50 a plot. Approved Contest Officials (ACO) would not be eligible for the award on a field they are the paid consultant or have a conflict of interest with (seed company, chemical company rep etc.).

2. For 2025 – we would like to hold another dinner to create interaction between the 100 Bushel Club membership.

3. Since 2023 we have worked with the Communications Group on printing and advertising. They create and place ads for the program and assist in the creation/printing of entry forms and harvest booklet. This helps create consistency across the board since ASPB is the sponsor of the program.

4. The ASPB is presented with invoices and documentation for reimbursement to the AR Soybean Association for direct costs and expenses.

ATTACHMENT 14

Arkansas Soybean Promotion Board Proposal

PROJECT TITLE: WISHH FY26: WISHH Markets – The Future of New U.S. Soy Exports

BUDGET REQUESTED: $50,000 **FISCAL YEAR**: FY26 **PROJECT END DATE**: June 30, 2026

Objective(s):

The WISHH objective is to ultimately expand the number of international markets beyond those we have today by adding new markets that successfully position Arkansas and U.S. soy as a vital ingredient for commercial feed and food manufacturers to use to solve their Developing and Emerging countries' protein and food supply challenges.

Introduction:

In a time of record soybean production and escalating competition coming out of South America, partnering with WISHH to expand into new overseas markets becomes an even more strategically important investment in increasing new trade opportunities and improving the bottom-line potential for Arkansas, and other U.S. soybean farmers. WISHH's portfolio of 28 countries have been selected using criteria which include, among others, the developing and emerging countries having long-term, robust population growth projections and high global rankings on protein deficiency and food insecurity. These population data are generally linked to growing trajectories for food demand and the number of prospective consumers that would benefit from soy in their diets for decades to come. We know the regions in which WISHH works to be regions with some of the highest global venture capital investment activity in the last 5 years, as well as being home to encouraging, long-term urban growth forecasts. All of which combined, generally stimulate improvements in infrastructure and the cold chain. Those improvements are important because they ensure supply and value chains can advance and accommodate growing end-consumer demand for soy.

Benefit(s):

Arkansas soybean producers leveraged WISHH's export market expansion work in markets currently under construction. New U.S. soy trade has taken root in WISHH countries over the last 10 years. Soy exports into WISHH program countries grew at a compound annual growth rate of 7.08%. By positioning Arkansas and U.S. soy as a vital ingredient for feed and food manufacturers in developing and emerging countries, WISHH can offer soy as a solution to those countries' protein/food supply challenges.

Investing in WISHH in fiscal 2026, would put Arkansas soybean farmers in the position to leverage well over $10 million in funding from more than 20 other QSSB investors, multiple USDA/Foreign Agricultural Services grants, and the United Soybean Board. Over the past five years, FY26 budgets have not been determined or developed yet, but the FY25 budget is summarized and used as an example here:

Funding Source	Amount requested/awarded
USDA/Foreign Market Development and Market Access Program FY25 Projects (Requested)	$5.9 Million
USDA Regional Agricultural Program/FY24-29 (Awarded)	$5.1 Million
USDA Regional Agricultural Promotion Program/FY25-30 (Requested)	$25 Million
USDA Food for Progress grant: Commercialization of Aquaculture for Sustainable Trade ($17.1 M for FY19-FY23 and $1.6 M in a 2-year merit-based extension) (Awarded)	$3.3 Million
USDA Emerging Market Program (Awarded)	$418,928
United Soybean Board FY25 Projects (Awarded)	$2.4 Million
20+ other QSSB Investments (Requested)	$1.9 Million

Every year WISHH aggressively seeks non-check off funding sources and submits grant proposals to a variety of federal programs to leverage U.S. soybean farmer checkoff investments in the WISHH Program. Over the last seven years, WISHH has successfully leveraged U.S. soybean farmer checkoff investments 6 to 1. The total WISHH budget for fiscal year 2025 is $10 million, with QSSB base funding making up $1,333,000 of that total. A FY2026 $50,000 investment by the ASPB would equate to approximately a 4% share of FY25 WISHH QSSB funding. [*Please see Appendix 1 for the example of FY25 QSSB General Funding Budget for WISHH*.]

PROJECT WORK PLAN – SOYBEAN PROMOTION: WISHH works on three continents and in twenty-eight developing and emerging countries that have long-term, robust population growth projections and high global rankings on protein deficiency and food insecurity. These data equate to very promising demand for protein rich food for decades to come. In addition, over the last five years the regions in which WISHH works have had some of the highest global venture capital and funding investment activity in the logistics/transportation, energy, and financial technology sectors. This matters because these investment sectors help ensure supply and value chains can advance and accommodate growing end-consumer demand for soy.

WISHH will be opening and expanding new export markets in (sub-Saharan Africa) Benin, Burkina Faso, Ethiopia, Ghana, Guinea, Guinea- Bissau, Ivory Coast, Kenya, Mali, Nigeria, Senegal, Sierra Leone, Tanzania, Togo, Uganda, Zambia, (Asia) Cambodia, Myanmar, Sri Lanka, Uzbekistan, Kazakhstan, and (Latin America) Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Our approach involves working with prominent entrepreneurs and influencers in the feed, aquaculture, and food industries. What WISHH has found working exclusively in developing and emerging markets is that before prospective buyers in brand-new markets will import U.S. soy, they must be confident that soy works in their operations, their customers want it, and their businesses can profit from it. Within the

feed and food industries in WISHH countries, our demand building tactics are customized for the cultures in which we work and include (1) in-country, U.S. soy representation; (2) providing mentoring and customized technical assistance to support the adoption and use of soy in poultry, pork and aquaculture feed, and in food applications; (3) supplying prospects, new customers, and influencers with in-depth educational experiences that inform and emphasize the intrinsic and extrinsic value of U.S. soy; (4) hosting feed/food technology, marketing or nutrition events which promote and demonstrate the benefits of utilizing U.S. soy; and (5) generating opportunities and fostering business connections between U.S. soy exporters, prospective buyers, Arkansas and other U.S. soybean farmers.

A big part of the 'how' WISHH moves our work forward in developing and emerging countries is by being very intentional with our networking and leveraging of over 60 partners worldwide. Equipment companies, soy protein ingredient suppliers, a stable of feed and food industry experts and mentors, in-country influencers and local associations, and other U.S. commodity promotion organizations enable us to amplify the U.S. soy brand and soy in human health messaging. By working with USDA/FAS country offices, land grant universities and their overseas' sister universities, in-country non-governmental organizations, machine fabricators, and others, we can leverage their in-country work to complement our new soy demand building efforts.

MEASURABLE PROJECT MILESTONES: The following quarterly project activities and timeline which may be adjusted due to changes in U.S. and other target country governments trade policies; conflicts arising within target countries; or travel obstacles such visa issues, human health alerts, highly pathogenic avian influenza (HPAI) and U.S. soy's African Swine Fever travel protocols.

WISHH FY26 Global Activities Timeline (Tentative)	Q1	Q2	Q3	Q4
Securing technical expertise needed & finalizing customized technical assistance consults	X	X	X	X
In-country technical consultant visits	6	14	2	15
Planning and conducting WISHH educational events	2	6	4	2
Trade team planning and member recruitment	X	X	X	X
Escorting trade teams to in-depth technical training/educational events	2	7	7	9

PERFORMANCE METRICS: Using generally accepted marketing research best practices, the following WISHH Program Key Performance Indicators will be tracked throughout the year to measure progress and success. Measurements will be collected from participating target audiences utilizing surveys via a web-based application used to manage and describe output and outcomes. The FY26 program Key Performance Indicators and goals for WISHH Developing and Emerging country market sectors will likely be similar to the FY25 KPI and goals listed here:

- 73% of the target audience will continue or expand their use of U.S. soy products.
- 66% of the target audience not currently using U.S. Soy, will indicate they will use U.S. soy products within the year.
- 87% of the target audience will understand the nutritive, economic, or functional benefits of using soy as an ingredient.

- 87% of the target audience will commit to further product research and development incorporating soy.

DELIVERABLES:

- WISHH will provide ASPB quarterly narratives and financial reports: January 31, April 30, and July 31. A Final Report summarizing completed work, results and conclusions will be sent by October 31, 2026. The reports will summarize the progress made on the activities undertaken as well as updates on Key Performance Indicator goals.
- In-person/virtual presentation to update the ASPB on the progress of the WISHH Program.
- Providing Arkansas soybean farmers with ASA/WISHH activities results through a variety of news outlets such as LinkedIn; ASA/WISHH YouTube Channel; WISHH.org; ASA eBean; ASA Magazine; media releases provided to news services, and through the USDA/FAS.
- Upon request and in collaboration with ASPB, additional reports or information will be provided.

BENEFITS TO SOYBEAN GROWERS: WISHH's leveraging efforts will continue throughout Fiscal 2026, with the same goal we have had over the last seven years – to bring in at least an average of an additional $6 for each Qualified State Soybean Board (QSSB) invested dollar received to support U.S. soy's long-term market development work. In addition, the WISHH Program provides opportunities for farmers to travel to frontier markets in sub-Saharan Africa, Asia, and Latin America to gather first-hand proof of the diverse soy trade opportunities under construction in these new U.S. soy destinations.

PROJECT TEAM MEMBERS: WISHH's implementation team has 87 combined years of international business/market development experience, with 83% having lived in countries such as those WISHH currently works in such as Guatemala, Ghana, Nigeria, Senegal and Zambia. As a result, the WISHH program staff leverages an extensive and vibrant network of USDA Foreign Agricultural Service staff, international and U.S. industry experts, universities, other U.S. commodity export advocating organizations, as well as non-government organizations. All play key partnership roles throughout the program year – supplying such support as technical short courses/labs; seminar speakers; mentoring; and donating time to build relationships with new customers.

Appendix 1: FY25 QSSB GENERAL FUNDING BUDGET FOR WISHH

FY25 Budget Project Listing		
Project Description	**QSSB Budget Detail**	**Proposed Budget**
Contractual Services		**$110,000**
Contractual services include consultant contracts with KCE Communications, (Senior Advisor), Website maintenance, M&E and Regional Support; Contractual services for strategic planning, Annual Report Video, new project exploration, program implementation and potential new funding proposal development.	110,000	
Meetings, Workshops and Conferences		**$60,800**
Participation in events held by others that share our objectives	17,000	
Committee meeting costs include travel, facility rental, AV, F&B, governance consultant, printing, and postage.	43,800	
Travel		**$24,300**
Travel to domestic destinations for events and Committee meetings including Washington, DC, and other locations to meet with PVOs, multilateral aid and development institutions and funding sources. Travel to international destinations: three trips for current project management, market prospecting and research for future activities and funding.	24,300	
General Program & Project Development		**$234,090**
Project development activities including PVO MOU servicing, exploratory trips, cooperative agreements with PVOs to implement pilot projects, proposal/budget development	234,090	
Project Match Support		**$777,193**
Project Match Support for Market Development Funding that WISHH receives from USDA that requires a participant contribution match. The funding programs include the Emerging Market Program (EMP), Foreign Market Development Funding (FMD, Market Access Funding, (MAP), Global Broad-Based Initiative Funding (GBI), Cochran Program, and RAPP funding.	777,193	
General Project Administration Expenses		**$126,617**
Compensation	88,000	
Office supplies, printing, computers, software, maintenance, postage, professional development, communications,	26,417	
Other Costs: bank fees, interest, insurance costs, audit fees, dues and subscriptions, website hosting	12,000	
Total		**$1,333,000**
Arkansas Soybean Promotion Board Percentage of QSSB General Budget		
	$50,000	4%

The WISHH QSSB general project implementation budget is approximately 8.4% of the total WISHH Program 2025 budget of $15.9 Million.

ATTACHMENT 15

Project Title: 2025 USSEC Membership

Contact Person: Brianna Metts – Industry Affairs Manager, U.S. Soybean Export Council
bmetts@ussec.org
16305 Swingley Ridge Road
Suite 200
Chesterfield, MO 60317
314-920-0806

Funding Request: $10,000

Project Timeline: January 1 – December 30, 2025

Project Overview (Summary): This proposal is to retain membership in the U.S. Soybean Export Council for CY 2025. USSEC works on behalf of our members by helping to build a preference for U.S Soy through various projects, programs, and events. As a member of USSEC, Arkansas Soybean Promotion Board will have access to member only resources including free or discounted registration to regional events, access to subject matter experts and USSEC in-country representatives, as well as access to resources including industry updates, QSSB specific content, and weekly and monthly market insights.

Project Background: USSEC has been a primary contractor supporting U.S. soy international marketing needs for 20 years. The organization employs and partners with some of the world's premier marketing and technical experts serving all areas of soy utilization. Partnering and collaborating with various U.S. soy stakeholders (including USB, ASA, QSSBs, exporters and other industry professionals), USSEC develops strategic goals and plans specific to each international marketing and utilization need. USSEC's networking ranges from domestic and international industry, academia, media, government affairs, logistics, other NGOs supporting U.S. and global agriculture, and most other influences of soy usage and trade.

Benefits to Arkansas Soybean farmers: USSEC works on behalf of our members by helping to build a preference for U.S Soy through various projects, programs, and events. As a member of USSEC, Arkansas Soybean Promotion Board will have access to member only resources including free or discounted registration to regional events, access to subject matter experts and USSEC in-country representatives, as well as access the resources including industry updates, QSSB specific content, and weekly and monthly market insights.

What is the anticipated economic return to soybean farmers or return on investment from this proposal? USSEC has been working to support U.S. soy in the global marketplace for 20 years. The organization employs and partners with some of the world's premier marketing and technical experts serving all areas of soy utilization. Partnering and collaborating with various U.S. soy stakeholders (including USB, ASA, QSSBs, exporters and other industry professionals), USSEC develops strategic goals and plans specific to each international marketing and utilization need. In the most recent economic analysis completed by the United Soybean Board, for every $1 invested in the soybean checkoff, there is a return on investment of $12.30, across all categories of investment by the United Soybean Board.

QSSB Proposal Title: U.S. Soy Promotion in Europe

Contact Person: Brianna Metts – Industry Affairs Manager, U.S. Soybean Export Council
bmetts@ussec.org
16305 Swingley Ridge Road
Suite 200
Chesterfield, MO 60317
314-920-0806

Budget Request: $25,000

Project Description: This project supports regional events and programs focused on the sustainable solution that U.S. soybeans can provide to the European animal production industry. This project will focus on educating customers on the impacts of predicted market changes and dynamics and how to take advantage of using U.S. soy to improve efficiency and sustainability of animal production. Europe has remained one of the top markets for U.S. soybeans and as European countries continue to push producers to find more sustainable sources, the U.S. is poised to meet this demand. By capitalizing on the sustainable practices that U.S. producers already implement, we can engage with European customers to highlight how U.S. soy can improve animal nutrition while meeting the needs of the market for sustainable solutions.

Background: Sustainability is an important part of U.S. soy advantage and has been an area of interest in Europe for over a decade. USSEC has utilized technical seminars, workshops and one-on-one discussions with key accounts and academia to explain how U.S. soy can be a sustainable, nutritious and economical source of protein. This program focuses on educating customers on how U.S. Soy can help achieve their long-term goals for sustainable and profitable animal production.

List your project objective(s) and goals:

These initiatives will provide the following opportunities:

- Engage buyers/users of soy in opportunities to better understand the U.S. soy advantage.
- Educate buyers/users of soy on soy and feed processing, value-added soy ingredients, and sustainability
- Leverage relationships with academia, industry professionals, and other "assets" in Europe, or elsewhere (e.g. U.S.), to ensure the appropriate experts and resources are being utilized to achieve goals.

The target audience for this project includes commercial soy and feed related business, animal producers, academia, associations, and opinion leaders within Europe.

Benefits to Arkansas Soybean farmers: By supporting animal agriculture training, education, and awareness needs in Europe, this initiative builds upon existing efforts and create new opportunities for U.S. soy utilization. Through networking, education, and facilitation of various activities, U.S. soy regularly positions itself as the "product of choice" for many soy users in Europe. Due to Arkansas' proximity to the river system and the Gulf, many of the whole beans harvested in the state are not only

the first to hit the river but are also the first to head out of the Gulf to markets like Europe. 97 percent of Europe's whole bean imports originate out of the Gulf, meaning that Europe serves as a natural destination for Arkansas soybeans. Promotion of U.S. soy will provide opportunities for soy users to better understand the qualities of U.S. soy and, ultimately, demand more U.S. soy in the region, utilizing positive scientific information supporting the claims of the U.S. soy advantage.

ATTACHMENT 16

Sum of Funded Projects	Column Labels		
Row Labels	Promotion	Research	Grand Total
American Soybean Association (ASA)	$ 31,300.00		$ 31,300.00
Clean Fuels Alliance America	$ 20,000.00		$ 20,000.00
Farm Bureau	$ 25,000.00		$ 25,000.00
Four States Fair & Rodeo	$ 10,000.00		$ 10,000.00
Midsouth Soybean		$ 125,088.50	$ 125,088.50
Southwest Soybean	$ 206,900.00		$ 206,900.00
The World Initiative For Soy in Human Health (WISHH)	$ 40,000.00		$ 40,000.00
U.S. Soybean Export Council	$ 35,000.00		$ 35,000.00
UofA Division of Agriculture	$ 120,057.06	$ 3,226,187.00	$ 3,346,244.06
UofA Pine Bluff (UAPB)		$ -	$ -
Arkansas Department of Agriculture	$ 10,000.00		$ 10,000.00
Grand Total	**$ 498,257.06**	**$ 3,351,275.50**	**$ 3,849,532.56**

Row Labels	Sum of Funded Projects	
Promotion	$	498,257.06
Research	$	3,351,275.50
Grand Total	**$**	**3,849,532.56**

#	Presentation Order	Requester	Proposals	Project Title	Funded 24-25	Request 25-26	Funded Projects	Text2
211	17	UofA Division of Agriculture	Promotion Proposals	The Arkansas irrigation yield contest *Year 8 Henry, Chris	$10,000.00	10,000.00	10,000.00	Promotion
218	24	UofA Division of Agriculture	Promotion Proposals - New	Soybean college (New-Year 1 of 1) Ross, Jeremy	$0.00	14,717.00	14,717.00	Promotion
212	25	UofA Division of Agriculture	Promotion Proposals	Arkansas future ag leaders tour (Year 1 of 3) Renewal Robinson, Julie	$5,000.00	5,000.00	5,000.00	Promotion
216	25	UofA Division of Agriculture	Promotion Proposals	Soybean science challenge (Year 2 of 3) Robinson, Julie	$78,585.00	85,525.00	85,525.00	Promotion
300	40	Four States Fair & Rodeo	Promotion Proposals	Agriculture Learning Center Larey, Kristen	$0.00	20,000.00	$10,000	Promotion
301	41	American Soybean Association (ASA)	Promotion Proposals	2026 ASAAP Annual Membership	$6,000.00	6,000.00	-	Promotion
302	41	American Soybean Association (ASA)	Promotion Proposals	2026 Awards Celebration Sponsorship	$6,000.00	6,000.00	6,000.00	Promotion
303	41	American Soybean Association (ASA)	Promotion Proposals	2026 Economic Support and Analysis Sponsorship	$5,000.00	5,000.00	5,000.00	Promotion
304	41	American Soybean Association (ASA)	Promotion Proposals	I2M (Innovation to Market) Work Group Annual Membership	$7,500.00	7,500.00	7,500.00	Promotion
305	41	American Soybean Association (ASA)	Promotion Proposals	2026 SoyStats (Sponsorhsip)	$600.00	600.00	600.00	Promotion
306	41	American Soybean Association (ASA)	Promotion Proposals	2026 Soybean Leadership Academy Sponsorship	$6,000.00	3,000.00	3,000.00	Promotion
307	41	American Soybean Association (ASA)	Promotion Proposals	Young Leader two-phase training program tuition	$9,200.00	9,200.00	9,200.00	Promotion
308	41	American Soybean Association (ASA)	Promotion Proposals	2026 Biomass Based Diesel Initiative	$0.00	5,000.00	-	Promotion
309	42	Clean Fuels Alliance America	Promotion Proposals	Market Expansion Drive	$20,000.00	20,000.00	20,000.00	Promotion
310	42	Clean Fuels Alliance America	Promotion Proposals	OEM(Original Equipment Manufacturers) Maintain and Secure Approvals for	$20,000.00	20,000.00	-	Promotion
311	43	Farm Bureau	Promotion Proposals	Soybean Ag Readers Update/Printing	$0.00	5,000.00	5,000.00	Promotion
312	43	Farm Bureau	Promotion Proposals	Elementary Agriculture Education Pilot Program – Soybean Curriculum/Materia	$0.00	20,000.00	20,000.00	Promotion
313	43	Farm Bureau	Promotion Proposals	Soy in the Kitchen Grant Program	$0.00	15,000.00	-	Promotion
327	45	Southwest Soybean	Promotion Proposals	Recognizing Soybean Production Excellence by the continuance of the "Grow for the Green Yiel		206,900.00	206,900.00	Promotion
328	46	U.S. Soybean Export Council	Promotion Proposals	2025 USSEC Membership		10,000.00	10,000.00	Promotion
329	46	U.S. Soybean Export Council	Promotion Proposals	U.S. Soy Promotion in Europe		25,000.00	25,000.00	Promotion
330	47	The World Initiative For Soy in Human Health (WISHH)	Promotion Proposals	WISHH FY26: WISHH Markets – The Future of New U.S. Soy Exports		50,000.00	40,000.00	Promotion
331	48	Arkansas Department of Agriculture	Promotion Proposals	NASDA Annual Meeting Sponsorship		2,500.00	10,000.00	Promotion
220	31	UofA Division of Agriculture	Promotion Proposals - New	Ag Day Wagley, Christie	$0.00	4,815.06	4,815.06	Promotion
221	31	UofA Division of Agriculture	Promotion Proposals - New	Soybean Nutrition Education Through Cooking Lessons/Schools Bullington, Leig	$0.00	27,469.00	-	Promotion
88	1	UofA Division of Agriculture	Research Proposal - In Progress	Use of gossypol in inhibit reproduction in domestic hogs as a model for feral hc	$30,000.00	30,000.00	30,000.00	Research
52	2	UofA Division of Agriculture	Research Proposal - In Progress	Optimization of fungal pathogens AF22 and AF24 as bioherbicides for palmeram	$40,000.00	40,000.00	40,000.00	Research
96	9	UofA Division of Agriculture	Research Proposal - In Progress	Screening Arkansas soybean cultivars for protein quality as a novel food presen	$50,049.00	53,235.00	53,235.00	Research
56	11	UofA Division of Agriculture	Research Proposal - In Progress	Arkansas soybean performance trials (Year 3 of 3)Carlin, John	$40,270.00	40,754.00	40,754.00	Research
60	12	UofA Division of Agriculture	Research Proposal - In Progress	Development of a turn-row soybean vegetative health analysis using UAS imag	$19,989.00	19,682.00	19,682.00	Research
64	14	UofA Division of Agriculture	Research Proposal - In Progress	Comprehensive disease screening of soybean varieties in Arkansas (Year 2 of 3)I	$131,863.00	133,242.00	133,242.00	Research
68	14	UofA Division of Agriculture	Research Proposal - In Progress	Integrated management of soybean nematodes in Arkansas (Year 3 of 3)Faske, T	$72,449.00	71,459.00	71,459.00	Research
72	15	UofA Division of Agriculture	Research Proposal - In Progress	Phenotypic selection assisted by seed-level near infrared information (Year 2 o	$51,117.00	52,081.00	52,081.00	Research
153	16	UofA Division of Agriculture	Research Proposal - In Progress	An innovative approach to generate porous soy proteins with enhanced flavor f	$43,955.00	43,955.00	43,955.00	Research
76	17	UofA Division of Agriculture	Research Proposal - In Progress	Irrigation water management for soybeans: Moving the needle (Year 3 of 3)Hen	$205,620.00	205,620.00	205,620.00	Research
80	18	UofA Division of Agriculture	Research Proposal - In Progress	Developing scouting, threshold and management practices for stinkbug comple	$49,102.00	49,625.00	49,625.00	Research
84	19	UofA Division of Agriculture	Research Proposal - In Progress	Effects of the inclusion soybean oil in beef heifer diets on heifer development,	$48,940.00	24,471.00	24,471.00	Research
92	22	UofA Division of Agriculture	Research Proposal - In Progress	Site specific assessment of soybean response to in field variability using remote	$75,000.00	75,000.00	75,000.00	Research
100	23	UofA Division of Agriculture	Research Proposal - In Progress	Fertilization of soybean (Year 3 of 3) Roberts, Trent	$80,461.00	83,176.00	83,176.00	Research
104	23	UofA Division of Agriculture	Research Proposal - In Progress	Field based determination of chloride tolerance in soybean (Year 3 of 3) Robert	$50,605.00	51,153.00	51,153.00	Research
108	23	UofA Division of Agriculture	Research Proposal - In Progress	Influence of cover crops and soil health on soybean (Year 3 of 3) Roberts, Tren	$60,786.00	63,142.00	63,142.00	Research
112	23	UofA Division of Agriculture	Research Proposal - In Progress	Monitoring the extent of potassium deficiency and chloride toxicity in Arkansas	$36,870.00	39,574.00	39,574.00	Research
116	24	UofA Division of Agriculture	Research Proposal - In Progress	Development of date driven recommendations for variable soybean seeding rat	$81,876.00	82,886.00	82,886.00	Research
120	24	UofA Division of Agriculture	Research Proposal - In Progress	Improving technology transfer for profitable and sustainable soybean productic	$77,846.00	77,443.00	77,443.00	Research
124	24	UofA Division of Agriculture	Research Proposal - In Progress	Investigating emerging production recommendations for sustainable soybean p	$221,278.00	229,516.00	229,516.00	Research
128	24	UofA Division of Agriculture	Research Proposal - In Progress	Science for success (Year 3 of 3) Ross, Jeremy	$117,488.00	128,549.00	128,549.00	Research
132	24	UofA Division of Agriculture	Research Proposal - In Progress	Soybean research verification program (Year 3 of 3) Ross, Jeremy	$208,168.00	200,213.00	200,213.00	Research
136	27	UofA Division of Agriculture	Research Proposal - In Progress	Soybean weed management: A team approach for improved control and profita	$260,807.00	256,835.00	256,835.00	Research
141	28	UofA Division of Agriculture	Research Proposal - In Progress	Determining the value of fungicide application using on-farm trials (Year 3 of 3)	$52,000.00	52,000.00	52,000.00	Research
145	28	UofA Division of Agriculture	Research Proposal - In Progress	Developing a satellite-based field scouting tool (Year 3 of 3) Spurlock, Terry	$14,860.00	14,730.00	14,730.00	Research
149	28	UofA Division of Agriculture	Research Proposal - In Progress	Understanding taproot decline and orange leaf spot; soybean diseases of increa	$39,243.00	39,075.00	39,075.00	Research
157	29	UofA Division of Agriculture	Research Proposal - In Progress	Development of high yielding soybean cultivars with broad resistance (Year 3 o	$191,118.00	191,231.00	191,231.00	Research
161	29	UofA Division of Agriculture	Research Proposal - In Progress	Fast tracking MG4 cultivars with southern root-knot nematode resistance (Year3	$50,584.00	50,364.00	50,364.00	Research
165	29	UofA Division of Agriculture	Research Proposal - In Progress	Genomic prediction to enhance the efficiency of soybean breeding (Year 3 of 3)	$102,087.00	102,730.00	102,730.00	Research
169	29	UofA Division of Agriculture	Research Proposal - In Progress	Overcoming soybean yield plateau by leveraging physiology-efficient and yield-	$83,620.00	83,679.00	83,679.00	Research
173	29	UofA Division of Agriculture	Research Proposal - In Progress	Soybean germplasm enhancement using genetic diversity (Year 3 of 3) Vieria, C	$187,679.00	187,872.00	187,872.00	Research
177	30	UofA Division of Agriculture	Research Proposal - In Progress	Soybean enterprises budgets and production economics analysis (Year 3 of 3) V	$10,000.00	10,000.00	10,000.00	Research
314	44	Midsouth Soybean	Research Proposal - In Progress	Breeding Maturity Group 4 Soybean with Enhanced Resistance to Southern Root-knot Nematod		15,000.00	15,000.00	Research
315	44	Midsouth Soybean	Research Proposal - In Progress	Screening and Selecting Non-Xtend Soybeans for Dicamba Tolerance		13,750.00	13,750.00	Research
316	44	Midsouth Soybean	Research Proposal - In Progress	Development of functional ultra-high stearic acid soybean germplasms not funding		-	-	Research
317	44	Midsouth Soybean	Research Proposal - In Progress	Screening soybean germplasm and breeding soybeans for flood tolerance for early and reprodu		15,000.00	15,000.00	Research
318	44	Midsouth Soybean	Research Proposal - In Progress	Spatial and temporal variation of soil sampling affect phosphorus and potassium recommendati		7,500.00	7,500.00	Research
319	44	Midsouth Soybean	Research Proposal - In Progress	Exploitation of weed species extracts as an effective and environmentally friendly strategy to cc		8,750.00	8,750.00	Research
320	44	Midsouth Soybean	Research Proposal - In Progress	How does cover crop impact soil water dynamics and soybean production in Louisiana?		6,000.00	6,000.00	Research
321	44	Midsouth Soybean	Research Proposal - In Progress	Improving the efficacy of double stranded RNA (dsRNA) for practical field management of soyb		11,250.00	11,250.00	Research
322	44	Midsouth Soybean	Research Proposal - In Progress	Development of climate-smart high yield practices associated with high-endbiological treatmen		15,000.00	15,000.00	Research
326	44	Midsouth Soybean	Research Proposal - In Progress	LADDER (Large Agricultural Database that Drives Extension and Research)	$13,907.00	12,500.00	12,500.00	Research
0	0	UofA Pine Bluff (UAPB)	Research Proposal - New	Designing Cost-Effective Irrigation System for Enhancing Crop Water Productivity in Soybean Production in Arkansas Principal Investigator (PI): Dr. Ajoy Kumar Saha, Ph.D.	$0.00	61,600.00	-	Research
1	2	UofA Division of Agriculture	Research Proposal - New	Development, evaluation and production of agricultural biologicals for Arkansa:	$0.00	23,857.00	23,857.00	Research
5	3	UofA Division of Agriculture	Research Proposal - New	Greenhouse gas emission from long-term soybean with cover crops (New-Year	$0.00	23,110.00	-	Research
9	4	UofA Division of Agriculture	Research Proposal - New	Evaluating planting date decisions in the soybean/rice rotation (New-Year 1 of	$0.00	30,127.00	30,127.00	Research
13	4	UofA Division of Agriculture	Research Proposal - New	Investigating the effect of growth regulators on soybean plant architecture and	$0.00	31,306.00	31,306.00	Research
17	5	UofA Division of Agriculture	Research Proposal - New	Determination of tolerant soybean lines and their yield under multiple stressor	$0.00	54,019.00	-	Research
21	6	UofA Division of Agriculture	Research Proposal - New	Identifying soybean genotypes for enhanced water use efficiency using high- th	$0.00	60,435.00	-	Research
31	7	UofA Division of Agriculture	Research Proposal - New	Evaluating the impacts of irrigation water management practices on groundwat	$0.00	38,441.00	-	Research
35	8	UofA Division of Agriculture	Research Proposal - New	Artificial intelligence for early soybean disease detection and robot implement:	$0.00	67,760.00	-	Research
40	9	UofA Division of Agriculture	Research Proposal - New	Predicting the end use performance of Arkansas soy protein using genomics (N	$0.00	99,103.00	-	Research
44	10	UofA Division of Agriculture	Research Proposal - New	Educating growers and consultants on insect monitoring and control (New-Yeai	$0.00	3,000.00	3,000.00	Research
48	10	UofA Division of Agriculture	Research Proposal - New	Economics of automatic insecticide applications in Arkansas soybeans (New- Ye	$0.00	43,254.00	43,254.00	Research
25	20	UofA Division of Agriculture	Research Proposal - New	Testing the range of soybean cultivars that can benefit from plant elicitor pepti	$0.00	25,767.00	25,767.00	Research
324	44	Midsouth Soybean	Research Proposal - New	Enhance Synthetic Microbiome Communities to Managed Sudden Death Syndrome		4,527.25	4,527.25	Research
325	44	Midsouth Soybean	Research Proposal - New	Leveraging Photosynthetic Efficiency traits for improving soybean productivity in the Mid-South		7,500.00	7,500.00	Research
323	44	Midsouth Soybean	Research Proposal - New	Expanding potential market demand for and access to whole soy foods through nutrition educa		8,311.25	8,311.25	Research
202	10	UofA Division of Agriculture	Research Proposals - Renewed (New Cycle)	Refining insect thresholds in Arkansas soybean (Year 1 of 3) Renewal Thrash, B	$69,116.00	67,904.00	67,904.00	Research
182	13	UofA Division of Agriculture	Research Proposals - Renewed (New Cycle)	Arkansas Discovery Farm (Year 1 of 3) Renewal Daniels, Mike	$23,688.00	28,220.00	28,220.00	Research
189	14	UofA Division of Agriculture	Research Proposals - Renewed (New Cycle)	Monitor and management of fungicide-resistant soybean diseases in Arkansas (	$50,498.00	59,728.00	59,728.00	Research
194	21	UofA Division of Agriculture	Research Proposals - Renewed (New Cycle)	Screening for soybean tolerance to metribuzin (Year 1 of 3) Renewal Norswort	$16,226.00	16,232.00	16,232.00	Research
185	26	UofA Division of Agriculture	Research Proposals - Renewed (New Cycle)	Economic analysis of soybean production and marketing practices (Year 1 of 3)	$7,316.00	7,500.00	7,500.00	Research
198	28	UofA Division of Agriculture	Research Proposals - Renewed (New Cycle)	Determining factors associated with poor grain quality in soybean and manage	$55,000.00	55,000.00	55,000.00	Research
207	29	UofA Division of Agriculture	Research Proposals - Renewed (New Cycle)	Utilization of winter nursery for soybean line development through back crossi	$51,000.00	51,000.00	51,000.00	Research