2023 Arkansas Checkoff-Funded Research Report

ARKANSAS SOYBEAN PROMOTION BOARD

Who's the No. 1 protein source in chicken feed? YOU are. That's right. You're winning.

All soybean farmers, including you, are really big in poultry and livestock feed. How? By pooling your resources through your soy checkoff. Learn how your soy checkoff is bringing tangible returns back to you and your operation at unitedsoybean.org/hopper.

Moving Soy Forward.
Moving You Forward.

OUR SOY CHECKOFF™

YOUR CHECKOFF INVESTMENT

When high-yielding harvests are not enough to secure success for today's soybean producers, checkoff dollars help ensure a strong, profitable future for producers by driving demand at home and abroad.

Administered by the *United Soybean Board*, producers invest 0.5% market price per bushel, known as a checkoff, into a fund. Used for research, market development, promotion and expansion, the *Arkansas Soybean Promotion Board* manages half of all checkoff dollars collected in the state and the USB adds the rest to the national checkoff fund.

Led by 78 volunteer farmers and directors, the USB is based in St. Louis, Missouri with activities monitored by paid staff. Nominated by their state's soybean board, or Qualified State Soybean Boards, they are appointed by the U.S. Secretary of Agriculture. Three members of the USB's board of directors hail from Arkansas.

SOYBEANS IN ARKANSAS

Traditionally one of the largest agriculture enterprises in the state with more than 3 million acres of soybean fields in 56% of the counties, Arkansas ranks 11th in soybean production in the country.

- Animal agriculture is the number one customer of soybean, 98% of soybean meal feeds livestock and poultry.
- Broiler chickens consume about 40% of the domestic supply of soybean meal.
- Approximately 30% of soybeans are considered a double crop. Following spring's wheat harvest, soybeans are planted, allowing the harvest of two row crops in one year.
- Optimum planting in Arkansas is between May 5 – July 5 and soybeans will be harvested between October 15 and November 20.
- Irrigation-furrow via flood and sprinkler is common practice across more than 2 million acres of soybeans.

Meet the Board Members

JOHN FREEMAN, CHAIRMAN

When John Freeman said goodbye to his hometown of Dumas, Arkansas and hit the road to attend college almost eight hours away, he had little interest in careers outside of farming. He grew up on a farm and helped his dad in high school. And as the saying goes, "Farming gets in your blood." In 1989, after graduating from the University of Arkansas with an ag business degree, he planted his first crop.

His dad wasn't the best at yields, but he instilled a great farm ethic in John. John also credits Phil Tacker and Lanny Ashlock for influencing his approach to farming. But most of what John learned came from hands-on experience in the fields. He said, "It's one thing to sit in a class. It's another to apply textbook and practical knowledge."

DOUG HARTZ, VICE CHAIRMAN

For those in the soybean industry, the Hartz name started it all. For Doug Hartz, his last name means the tradition his grandfather, Jacob Hartz Sr., started 95 years ago when he planted the first soybean crop in Arkansas. Doug says, "It's pretty awesome to know your grandfather introduced soybeans to Arkansas in 1926."

In college, Doug majored in agronomy and minored in business. After graduating, he worked in the family seed business, Hartz Seed Company, before moving to Hartz Agriculture Services, the family's farm management and real estate business. Farming the land the family owned and the land they managed, Doug served as a field agronomist and salesman.

Today, Doug is keeping the family business going and keeping the Hartz name in Arkansas soybeans by serving as the eyes and ears of the land and assets Hartz Agriculture Services manages.

JOE THRASH, SECRETARY

Joe Thrash said he spent his childhood on the farm with his dad, wearing the paint off the fenders of a few tractors. A third-generation farmer, he didn't know what else there was to do, but after high school, Joe packed up and headed to the University of Arkansas to pursue a career in agronomy. It didn't take long for him to realize home is where the farm is.

DONALD MORTON JR.

Donald Morton Jr. never wondered about the path he would take. Farming was a part of his past, and he wanted it for his future. A third-generation farmer, Donald started on his own in 1992 with 800 acres. After 29 years, his operation has grown 275% to 3,000 acres. He shares it with his wife, their children and their grandchildren. Donald hopes to see farming continue in his family.

BOARD MISSION

The Arkansas Soybean Promotion Board consists of soybean producers nominated by various producer organizations within Arkansas and appointed by the governor.

The Arkansas Soybean Promotion Board was established to improve the sustainability and profitability of the soybean industry in Arkansas. This board is responsible for distributing funds from the checkoff.

RUSTY SMITH

Rusty Smith was raised with respect for agriculture, but he didn't grow up on a farm. His father worked for the University of Arkansas Division of Agriculture Extension Service, and Rusty earned his bachelor of science in agronomy. After graduation, he began working in chemical sales with a regional company. In 1989, Rusty found his love of farming and he's followed that path every day since with his wife Sarah, who is a third-generation farmer.

JOSH CURETON

As a sixth-generation farmer, Josh Cureton has been working alongside his family on their property near Cash, Arkansas his whole life. According to him, farming is in his blood, and it is something he's known he has wanted to do since a very early age.

Josh gained the practical skills it takes to grow a crop from his father, and supplemented that knowledge with a bachelor's degree in agriculture he earned at Arkansas State University, where he graduated cum laude.

For Josh, his interest in agriculture stems from his love of growing things and watching new life emerge. This extends to his family, to which he says his work is dedicated, remarking how his efforts allow him to provide his wife and children a good life and opportunities for the future.

WEST HIGGINBOTHOM

West Higginbothom is a third-generation farmer who returned to his family's Marianna farm in 2009. When he graduated from the University of Arkansas, West wasn't ready to return to farm life, and his father encouraged him to try a career outside of agriculture.

After college, he took his degree in business finance and insurance to a Washington, D.C., mailroom. He paid his dues and was eventually called up to work in ag policy for three different senators, including Arkansas's Blanche Lincoln. He then helped Georgia's Zell Miller with the 2002 Farm Bill before working exclusively for Mississippi's Thad Cochran.

Time ticked by, and the clock struck 10 years. West and his wife, who met in D.C., were ready to start a family and decided to move closer to their own. West got to keep his fingers in agriculture through farm bills, but he was ready to rejoin his father on the farm.

DEREK HELMS

When it comes to understanding the complexity of the agriculture industry, Arkadelphia dairyman and soybean producer Derek Helms is one of the most well-versed advocates around. Managing a diversified operation in Clark County has given Derek valuable insight into the many ways in which soybeans are marketed and utilized; from livestock feeds to biodiesel and everything in between. As a member of the Arkansas Soybean Promotion Board, Derek's goal is to facilitate a greater connection between our farmers, researchers, and consumers while promoting opportunities that showcase the versatility of soybeans.

Derek holds an ag business degree from Southern Arkansas University and is a board member of his local Farm Bureau and the Clark County Cattlemen's Association. He enjoys educating people about the soybean industry as much as he does learning about the latest research and advancements in soybean production. However, his favorite part about being a soybean producer is harvesting his crop and reaping the reward of his hard work each year.

SHANNON DAVIS

Shannon Davis is a soybean grower from Bono, Arkansas. Davis has served on the Arkansas Soybean Promotion Board for nine years and is active in a variety of leadership roles in his community.

Shaping the Future of Agriculture: Innovations in Soybean Research

Five University of Arkansas scholars are making significant strides in soybean research to spur innovation in traditional farming practices. The Arkansas Soybean Promotion Board, in conjunction with the University of Arkansas System Division of Agriculture, provides fellowships to master's and doctoral students pursuing agricultural degrees. Eligible candidates' educational focus must be anchored in soybean production, including animals, plants, soils, pest management, food and feed sciences, or engineering. Each scholar utilizes their unique areas of expertise to advance soybean cultivation, address challenges, advance the future of farming, and foster a more sustainable and efficient agricultural industry.

TRISTAN AVENT utilizes John Deere See and Spray™ Ultimate, a technology using advanced computer vision, artificial intelligence, and high-speed sprayer technology to combat weeds among row crops. His work contributes to the development of soybean cultivars that can withstand changing climates, ensuring stable yields and securing food production during climate change. By conducting unbiased studies and analyzing the impact on soybean fields, Tristan provides essential data to producers, showcasing the impact of See and Spray™ in offering an effective solution without hindering crop growth.

SAVANNAH WELLS CRAFTON Savannah Wells Crafton explores innovative approaches to improve poultry nutrition, poultry production efficiency, and sustainable feed alternatives. She also contributes to meeting the growing demand for poultry in a resource-constrained world. Crafton conducts research trials to establish energy and lysine requirements in broilers. One of her experiments compared soybeans bred for enhanced nutritional content to conventional soybeans, observing improved feed conversion efficiency in birds fed the improved soybeans. Through her research, she aims to redefine precision poultry nutrition and tackle the challenges of nourishing an expanding world.

CARRIE ORTEL Carrie Ortel aims to provide Arkansas soybean producers with crucial knowledge to maximize both yield and profit by addressing hidden potassium deficiencies. Ortel optimizes soybean production by assessing leaf potassium concentrations and recommending site-specific fertilizer rates. Her findings underscore the importance of proactive sampling and water availability in mitigating deficiencies. Moreover, Ortel develops precise fertilizer recommendations to correct potassium deficiencies effectively. Doing this ensures optimal crop nutrition while considering the cost-effectiveness of applications, aligning farmers' interests with profitable outcomes. Ortel's research paves the way for enhanced agricultural productivity and prosperity in Arkansas and beyond.

NOAH REED Investigates the use of fall residuals for Italian ryegrass control before planting soybeans which offers an alternative to traditional spring burn-down options. Additionally, he studies nozzle coverage, examining different types of nozzles and addressing challenges faced by farmers in the field. This helps optimize herbicide application and enhance weed control efficacy. Lastly, he explores crop rotations between rice and soybeans, particularly evaluating drill row width spacing effects to facilitate easier transitions between the two crops for effective weed control. This research offers a new approach that can potentially reduce herbicide resistance and improve soybean crop yields, thus improving the Arkansas soybean industry.

COLE WOOLARD focuses on integrating soybean-based feed formulations, precision feeding techniques, and livestock monitoring technologies to improve feed efficiency, animal welfare, and overall farm profitability. He modifies specific genes in soybean plants to enhance desired traits, increasing the likelihood to accelerate the development of superior soybean varieties with improved agronomic characteristics and nutritional profiles. Woolard's work furthers the sustainability and productivity of livestock operations associated with soybean farming by optimizing soybean feed composition and monitoring livestock health and performance.

The fellowship program provided by the Arkansas Soybean Promotion Board and the University of Arkansas System Division of Agriculture is a catalyst for agricultural innovation and breakthroughs in soybean research. Each fellow reshapes the future of farming by harnessing their unique expertise. Their contributions advance soybean production and utilization and foster a sustainable and efficient agricultural industry. This program is a driving force behind a brighter and more prosperous future for the world of farming.

Learn more about the University of Arkansas System Division of Agriculture and the Arkansas Soybean Promotion Board's fellowship program by visiting TheMiracleBean.com.

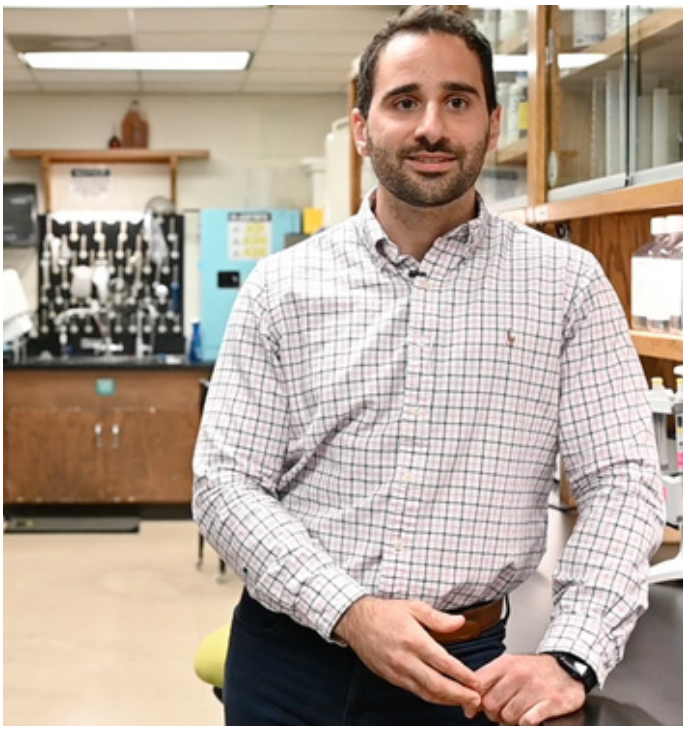
RESEARCH FEATURE

Revolutionizing Soybean Breeding: Uncovering the Secrets of Genetic Potential

Transcending the soybean fields, a transformative force is at work, quietly shaping the future of soybean production. Caio Canella Vieria, an assistant professor of crop, soil, and environmental sciences at the University of Arkansas, leads innovative research to unlock new horizons for the row crop. With funding from the Arkansas Soybean Promotion Board, Canella Vieria develops resilient varieties to enhance nutritional properties. His work not only addresses challenges faced by local farmers but also sets the stage for sustainable agricultural advancements in Arkansas and other Mid-South states.

"We believe we're making a good impact on local farmers by making better varieties available for them," Canella Vieria said. "But on a larger scale, we are also training the next generation of scientists."

Canella Vieria's research aims to enhance the resistance of soybeans to both biotic and abiotic stresses. By employing breeding techniques and leveraging the power of genetics, Canella Vieria develops soybean varieties that withstand pests and diseases, reducing the need for chemical interventions and promoting sustainable farming practices.



His research combats producer struggles by identifying genetic traits associated with drought and flood tolerance with the goal of refining soybean varieties that thrive in challenging environmental conditions. This safeguards farmers' livelihoods and contributes to the stability and sustainability of soybean production.

The value of his research exceeds the functional qualities of the crop. His team strives to raise the crop value through seed composition by increasing the protein and oil content of soybeans, as well as modifying the oil profile to meet specific market demands.

"We want to make soybeans with higher protein, higher oil, and modified oil profiles. So, with high oleic and low linoleic, we try to change the amino acid content in soybeans," he remarked. "So, we really try to improve the crop as a whole."

Increased environmental endurance and value-added traits, combined with a high-yielding genetic background, can substantially maximize production and the bottom line. Canella Vieria unlocks new avenues for soy utilization in various industries, including food, feed, and biofuels, by enhancing the nutritional and functional properties of soybeans.

Additionally, Canella Vieria integrates data science and predictive modeling into his research to accelerate the breeding process and improve efficiency. His team predicts the performance and potential of soybean lines before extensive field testing by harnessing genetic information and employing advanced analytics. This enables a faster, more targeted selection of promising varieties that reduces the time required to bring new soybean products to market.

"Breeding is pretty fascinating to the point that you really can improve anything about a crop," Canella Vieria added. "The ability that you can transform something that once was bad into something that is really good is really what drives me in this field. If you think about it, there are endless opportunities of things you can do."

Canella Vieria's passion and dedication to soybean breeding significantly impacts the industry, adding value to Arkansas soybean producers. His groundbreaking research holds immense potential to impact the broader agricultural community and positions the University of Arkansas at the forefront of agricultural innovation. As the possibilities for soybeans seem boundless, Canella Vieria's work exhibits the transformative potential of the miracle bean. Learn more about Canella Vieria and his work by visiting TheMiracleBean.com.

The Arkansas Discovery Farm Program

INVESTIGATORS:
Mike Daniels

GOAL: Document sustainable and viable row-crop farming systems on real, working farms that promote agricultural profitability and natural resource protection.

VALUE TO SOYBEAN INDUSTRY: Little to no data exists that addresses natural resource sustainability associated with row crop agriculture in Arkansas. Documenting environmental impacts of Arkansas farming systems, as well as evaluating the efficacy and cost-effectiveness of alternative practices, will bridge a knowledge gap that now keeps farmers, natural resource managers and decision-makers alike from confidently taking effective actions that ensure both economic and environmental sustainability.

Developing Profitable Irrigated Rotational Cropping Systems for Arkansas

INVESTIGATORS:
Jason Kelley, Jeremy Ross

GOAL: Evaluate economics and feasibility of 8 rotational cropping systems under irrigated conditions at the Lon Mann Cotton Branch Station near Marianna.

VALUE TO SOYBEAN INDUSTRY: Long-term crop rotation studies involving corn-soybean rotations have primarily been confined to the Midwest. In Arkansas and the Mid-South region, most of the crop rotation studies in past years have focused on cotton. Past research typically has shown a 5-15% greater cotton yield the year following corn. Reasons listed for increased cotton yields generally involved reduction in reniform nematodes, less disease pressure and/or increased soil fertility, or unknown reasons. As cotton acreage declines and soybean, corn, grain sorghum and wheat are planted on those acres, and as corn acreage expands into typical rice/soybean rotation systems, more information is needed for producers on which crop rotation sequence produces the greatest yields and profitability under Mid-South irrigated conditions.

Field-based Determination of Chloride Tolerance in Soybeans

INVESTIGATOR:
Trenton Roberts

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.

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 selection decisions.

Influence of Cover Crops and Soil Health on Soybeans

INVESTIGATOR: Trenton Roberts

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.

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.

Improving Technology Transfer for Profitable and Sustainable Soybean Production

INVESTIGATOR: Jeremy Ross

GOAL: To ensure the timely development and distribution of the Soybean Update and other soybean production publications. Improve the rate of technology transfer and adaption by the implementation of educational programs that impart critical decision-making information. Continue to coordinate state and regional meeting to facilitate the latest soybean production updates. Publication of the Soybean Research Series.

VALUE TO SOYBEAN INDUSTRY: Each year, the University of Arkansas Division of Agriculture test over 200 different soybean varieties and experimental lines. Timely distribution of this information is vital for producer decision making of varieties. Every three years, Arkansas hosts the Tri-State Soybean Forum, which brings in soybean producers and industry personnel from Arkansas, Louisiana, and Mississippi to hear current research results. The Arkansas Soybean Research Series is a repository for yearly research results from projects funded by the Arkansas Soybean Promotion Board.

Investigating Emerging Production Recommendations for Sustainable Soybean Production

INVESTIGATORS: Jeremy Ross

GOAL: Investigate new and untested management inputs to improve soybean production.

VALUE TO SOYBEAN INDUSTRY: Each year Arkansas soybean producers are encouraged by industry representatives and salesmen to implement new and often untested management

inputs to improve soybean production. The lack of an effective testing program for these materials can lead to uninformed applications. This project seeks to test products and agronomic practices, develop production recommendations, and provide scientifically tested results to soybean growers for considerations on their own operations.

Development of High-yielding Soybean Cultivars with Broad Resilience to Stressors

INVESTIGATOR: Jeff Edwards

GOAL: Develop high-yielding MG 4-5 conventional and herbicide-tolerant soybean varieties adapted to Arkansas' various environments and production systems. Conduct all breeding operations to support the development of new high-yielding MG4 and MG5 soybean varieties, both conventional and converted into Enlist-E3® herbicide technology.

VALUE TO SOYBEAN INDUSTRY: Yield, market price, and production cost are important factors in determining the economics of soybean farming. The UA breeding program provides high-yielding cultivars with low costs to growers. The program has a strong track record of variety releases and has just made available an indeterminate MG5.4 glyphosate-tolerant cultivar and an MG4.6 conventional cultivar. Such outcomes not only ensured the availability of high-yielding conventional varieties with low seed cost for Arkansas growers but also served as crossing germplasm for many public and private breeding programs in the US.

Soybean Germplasm Enhancement Using Genetic Diversity

INVESTIGATOR: Jeff Edwards

GOAL: To introduce genetic diversity for yield from exotic plant introductions (PIs) and from elite germplasm into high-yielding lines adapted to Arkansas environments. Incorporate unique traits of interest, including grain quality, disease and stress tolerance, and early maturity and indeterminacy from diverse germplasm into elite Arkansas cultivars and lines using various breeding and selection schemes.

VALUE TO SOYBEAN INDUSTRY: Increase yield potential by developing locally-adapted cultivars/germplasm with diverse genetic traits for yield, maturity, increased adaptation, stress tolerance, pest and disease resistance, and quality attributes.

Utilization of Winter Nursery for Soybean Line Development through Back-crossing

INVESTIGATOR: Jeff Edwards

GOAL: To utilize winter nurseries to convert MG4 breeding lines into Enlist-E3® or other herbicide technologies to support MG4 variety development.

VALUE TO SOYBEAN INDUSTRY: The UofA soybean breeding program has provided high-yielding conventional MG5 and MG4 cultivars at low costs to growers, but it needs to expand rapidly the footprint in traited herbicide-resistant cultivars. Supplementing the breeding efforts by generating a fourth wave of conversions into Enlist-E3® will enable the program to build a pipeline of traited materials without further straining the genetic gain realized in the conventional breeding program.

Evaluation and Identification of Early-Maturing Soybean with Drought and Heat Tolerance

INVESTIGATORS:
Larry Purcell

GOAL: Develop breeding lines from populations segregating for drought tolerant traits. Evaluate yields of elite lines selected for high water use efficiency and high germinability. Introgress heat tolerance, high germinability into the UA Soybean Breeding program.

VALUE TO SOYBEAN INDUSTRY: Early-planted and early-maturing (MG 3 and 4) soybean have a demonstrated track record for having high yields and decreased irrigation requirements compared with full-season soybean, but seed from early-maturing varieties often has poor germination and wrinkled seed that may be docked. The research proposed is a long-term effort to develop drought tolerant MG 4 varieties that produce high-quality seed when maturing under these stressful conditions.

Fast-tracking MG4 and early MG5 Cultivars with Southern Root-knot Nematode Resistance

INVESTIGATORS:
Jeff Edwards,
Travis Faske

GOAL: To characterize SRKN resistance in soybean and fast-track the development of soybean cultivars with resistance to SRKN in MG4 and early MG5.

Value to Soybean Industry: Developing soybean cultivars with resistance 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 goals needed 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.

ECONOMICS

Economic Analysis of Soybean Production Practices

INVESTIGATOR:
Brian Deaton

GOAL: Conduct an economic analysis of production practices used in the Arkansas Soybean Research Verification Program. Standardize economic analysis by integrating 2021 verification data with data from previous years and make interstate comparisons. Provide economic assistance and

interpretation of agronomic results for projects previously funded by or proposed to ASPB. Conduct economic analysis of potential impacts of proposed 2023 Farm Bill provisions specific to AR soybeans.

VALUE TO SOYBEAN INDUSTRY: Benefits from economic analysis of alternative soybean production strategies assist producers in identifying opportunities to adjust individual costs and incomes 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. Economic analysis of Board-funded production projects adds value to the projects and increases the return for check-off dollars invested. Results enable producers to make management decisions based on profit maximization rather than just maximizing yield.

Soybean Enterprise Budgets and Production Economic Analysis

INVESTIGATORS:
Breana Watkins

GOAL: Provide soybean enterprise budgets that are flexible for representing alternative production practices of Arkansas producers. Costs and returns analyses with budgets are extended by production economics analysis to investigate factors impacting farm profitability.

VALUE TO 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 gain value from economic analyses of individual production activities unique to their operations. Flexible crop enterprise budgets are beneficial for planning production methods to provide greatest potential for financial success. Flexible 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 certain agricultural inputs.

Soybean Science Challenge (SSC)

INVESTIGATORS:
Julie Robinson

GOAL: To engage Arkansas (and nationwide) 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; personal mentoring, student-led research and award recognition, and partnerships with state and national educators, agencies and the popular media.speaks to a significant void that has existed

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 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 we are now "at the table" as the attitudes of our youth are being shaped.

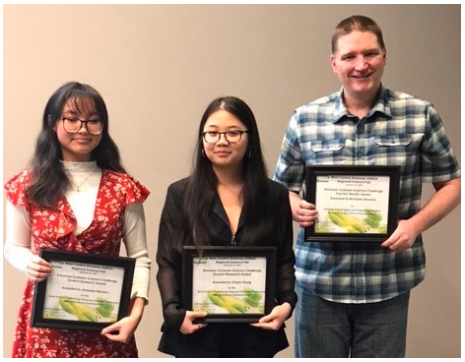
Students from across our state and nation are being challenged to understand the complexity of the evolving science undergirding production agriculture and to critically think about issues regarding food, fuel, feed, research, and agricultural sustainability that will directly impact their futures. Teachers from across the state and nation can access our website and use our free educational resources. We now have the opportunity to show teachers and students nationwide the value and importance of Arkansas agriculture/ soybean production.

Soybean science challenge 2023 AWARD WINNERS

Justus Osbon, 16, a sophomore at Fayetteville Christian School

Siddharth Snidharan, 15, a freshman at Central High School

Sanjay Iyer, a seventh grader at Forest Heights STEM Academy



Charis Xiong and Amanda Navarro, 17, both seniors at the Arkansas School for Math, Science, and the Arts

Sydney Wolf, 16, a junior at The Academies at Jonesboro High School

Alyssa Thompson and Drew Thomas, 17, seniors at Arkansas School for Mathematics, Science and the Arts

WE ARE U.S. SOYBEAN FARMERS

SUSTAINABILITY NEVER GOES OUT OF SEASON

PEST MANAGEMENT

Customers prefer U.S. soy because it's sustainable. But demands for sustainability continue rising. Carefully managing crop protection technologies increases their long-term effectiveness and decreases your need for additional pest control. Adopting this practice is another step forward in improving your sustainable footprint. Show your commitment to sustainability with a free truck magnet available at unitedsoybean.org/sustainability

OUR SOY CHECKOFF™

The Miracle Bean

Checkoff's Legacy of Research Creates New Value for Soybean Producers

For nearly a century, soybeans have played a pivotal role in Arkansas agriculture, serving as the complete nutritional package for livestock and poultry. Packed with protein, high in energy, and rich with amino acids, the state's top row crop provides a plentiful and locally sourced feedstuff that has helped underpin the proliferation of the Arkansas poultry industry. In an exciting new development, research scientists at the University of Arkansas are beginning to understand the unique healing and restorative properties of soybeans that could potentially help to holistically improve herd health and add yet another reason for cattle producers to consider supplementing their feed rations with soybeans.

"Soy products have been used in cattle diets for decades.. ."

"Soy products have been used in cattle diets for decades," said Dr. Beth Kegley, professor of animal science with the University of Arkansas System Division of Agriculture (UADA). "If soybean meal or soy oil is giving this additional benefit that we haven't detected, that could make it more valuable to use in these diets when the cattle are stressed."

Dr. Kegley is leading this project investigating the impact of soy products in cattle nutrition. Preliminary research by her team suggests that the use of soybean meal or soy oil in mixing cattle feed can potentially have positive effects in the health and performance of cattle by benefitting their growth and improving their inflammatory response as well as their ability to deal with environmental stresses. If her team's hypothesis is correct, this study could benefit both the cattle and the soybean industries by reducing the impact of bovine respiratory disease in the beef supply chain and by adding new value to soybeans.

Research like this is one of the primary reasons the soybean industry in Arkansas has been so success-

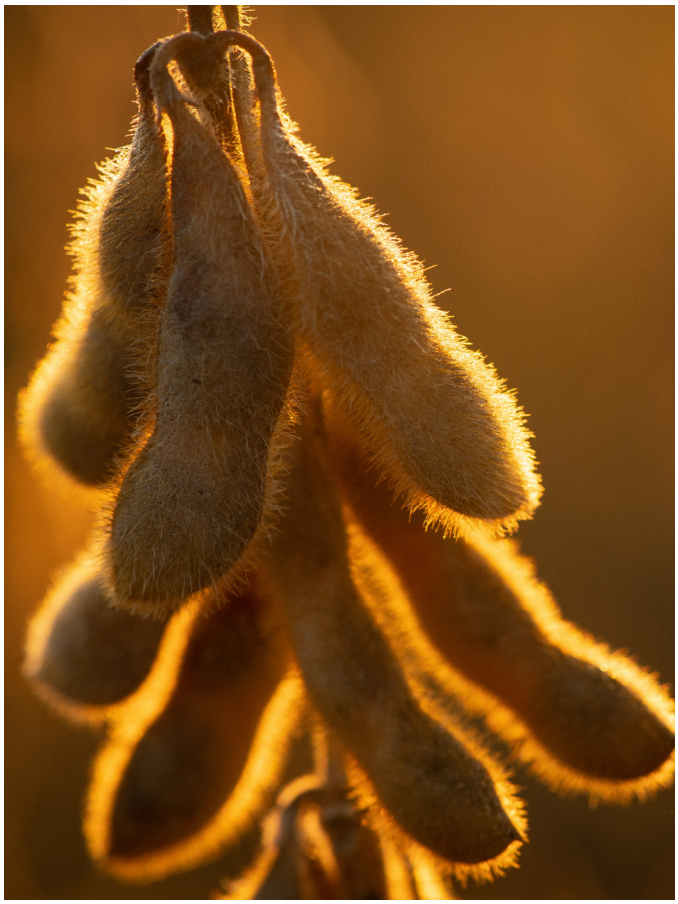
ful. It is a prime example of how producers' checkoff investments support the industry and create new value through research funding. Research has remained a top priority for the Arkansas Soybean Promotion Board since it was formally established in 1971. Fifty years later, that legacy continues to benefit the producers who support the Arkansas Soybean Checkoff in a variety of ways. In addition to improving production practices, market opportunities, and producers' bottom lines, the checkoff's support for soybean research is also helping develop the industry's next generation of leaders who will ensure the success of the industry in the future. The checkoff is accomplishing this by funding a program administered by UADA called the Soybean Science Challenge which encourages junior and high school students in Arkansas to learn about soybeans as well as current soil, water, seed, disease, and insect issues that impact production outcomes and agricultural sustainability.

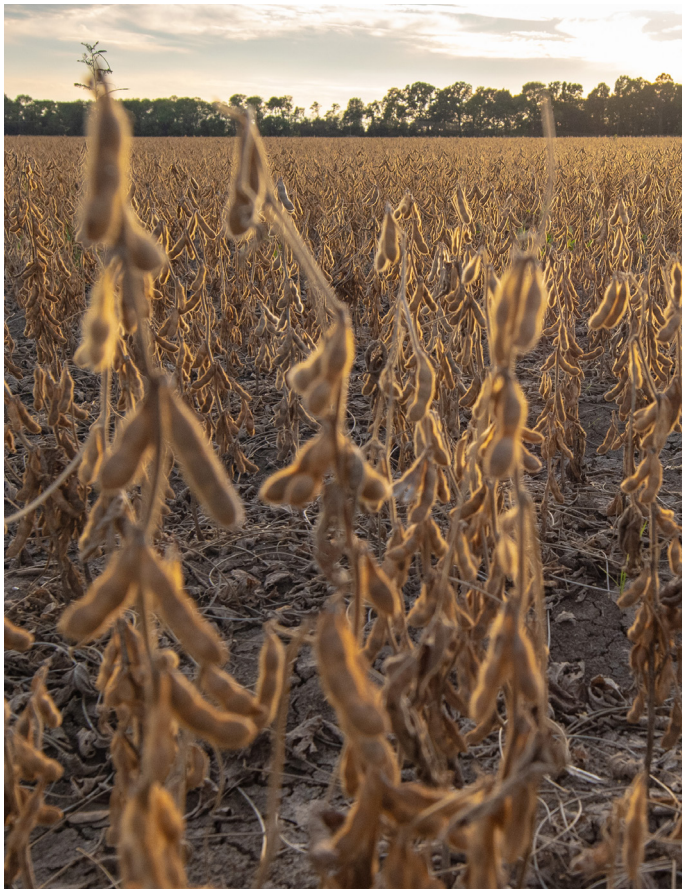
'.. you don't have to be a farmer in order to work in agriculture ... "

"This is an opportunity for students to not only win some money but to view agriculture as a science they can be interested in," said Julie Robinson, administer of the Soybean Science Challenge and UADA associate professor. "They discover that you don't have to be a farmer in order to work in agriculture. There are tons of research opportunities available to them."

Thirteen students were named Soybean Scholars in 2022 after their projects won the Soybean Science Chai lenge at district and state science fairs. The projects covered plant science, earth and environmental science, energy and transportation, and plant systems.

By funding these and other research projects, the checkoff brings new discoveries and continued relevancy to the soybean industry. Therefore, the industry is able to expand and benefit more people and more agricultural sectors, demonstrating its value to producers and consumers. This work could not be done without the support of soybean producers who understand the industry's importance to Arkansas.



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ENTOMOLOGY

Educating Growers and Consultants on Insect Monitoring and Control

INVESTIGATORS:
Ben Thrash,
Nick Bateman

GOAL: To educate growers, consultants, and other agricultural industry members 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.

VALUE TO SOYBEAN INDUSTRY: Soybean production has changed drastically in the past 10-15 years. The adoption of reduced tillage, Roundup Ready and early season soybean production has also caused changes in soybean insect management. Few would argue 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.

Development of Integrated Management Strategies for Insects in Soybeans (Soybean Insect Management)

INVESTIGATORS: Ben Thrash, Neel Joshi, Glenn Studebaker, Nick Bateman

GOAL: Develop cost-effective and sustainable recommendations for the management of the major insect problems in soybeans in different growing regions in Arkansas. Insect management continues to be a major focal point for growers and consultants in Arkansas soybeans, and developing sound recommendations for the most effective and economical control of insects is key to helping soybean producers be profitable. This project addresses various aspects of integrated management of problematic pests associated with soybean production.

VALUE TO SOYBEAN INDUSTRY: New pesticides are being released for bollworms, soybean loopers, and fall armyworms. These are viruses that are specific to the particular caterpillar and have been found to be effective with a good residual. The treatments containing these products are competitively priced as compared to chemical insecticides. Conducting on-farm trials to determine level of control, for developing a data set to help us make recommendations on use, will be important.

An increasing number of growers are adopting cover crops across the state. Soybean seed treatments and foliar insecticide applications, as well as cultural control methods, need to be evaluated in cover crops for control of commonly associated insect pests.

Fertilization of Soybean

INVESTIGATOR:
Trenton Roberts

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.

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 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.

With current advancements in remote sensing and the adaptability of new platforms to unmanned aerial systems, here 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 nutrients such as K are no longer yield limiting factors in Arkansas soybean production systems.

Promoting Irrigation Water Management for Soybeans

INVESTIGATORS:
C.G. Henry, M. Ismanov, P.B. Francis, L. Espinoza, T. Spurlock

GOAL: Demonstration and technology transfer of Irrigation Water Management Practices on grower fields. Compare yield and water use differences to document the efficacy and improved profitability of conservation practices. Develop recommendations for surge irrigation and soil moisture sensors. Disseminate information to growers, consultants, and end users through U of A Extension meetings and workshops.

VALUE TO SOYBEAN INDUSTRY:
205 participants have attended the surge schools and 230 attended the soil moisture schools for a total of 1025 contact hours. Surge irrigation respondents reported moderate to substantial learning (99%) in hands on exercises. In the soil moisture sensor schools, 87% reported moderate to substantial learning on how to assemble and install soil moisture sensors.

Respondents reported 40% of their irrigated acres are using CHS while 42% of their acres could use surge irrigation where they planned to use it on 19% of their acres. This is a very high adoption rate because unlike CHS ,surge valves have a high capital cost ($3500 per 80 acres).

Those that attended our schools reported using CHS on 41% of their acres in 2018 but in 2020, doption increased to 65%. In 2018 attendees used surge irrigation on 3% of their acres, but in 2020, participants reported they use surge irrigation on 3.4% of their acres. Soil moisture sensors were used on 12% of their acres in 2018 and participants reported usage on 19% of their acreage in 2020.

Soil moisture sensor schools resulted in substantial learning, 87% reported moderate to substantial learning on how to assemble and install soil moisture sensors. Using the mobile app to interpret sensors resulted in 89% of respondents reporting substantial learning about this key skill. Participants were using sensors on 15% of their acres before the workshop and indicated they could be used on over 32% of their acres. Since most have rice in a rotation, this could be interpreted to mean a good portion all of their corn, cotton and soybean acres in 2019. They planned to use soil moisture sensors on 13% of their acres.

To supplement the interpretation of soil moisture sensors, a mobile app was developed. Over 374 irrigators are using this app to interpret soil moisture sensor readings and manage their irrigation. A 100% increase in app downloads in 2020. The sap flow component of this project is providing key data that is being used to provide better termination recommendations for soybeans. Poly printer has been developed to aid implementation of CHS.

In the soybean category in 2020, 7 contestants achieved over 4 bushels per inch, in 2019 there were 3, and in 2018 there were none. On average contest participants are improving their WUE over time. In soybeans especially there is a clear and defined trend of increasing WUE over time. Contest participants are increasing their adoption of IWM practices, in 2018 only 50% of the participants used soil moisture sensors, in 2021, 87% used them. Computerized hole selection adoption has increased from 43% to 97%. In 2020, the winner used only 23% of the anticipated irrigation needs for soybeans. WUE increased, in previous years only one person had achieved 4 bu/in, in 2020 seven contestants and in 2021 three contestants exceeded this bar.

Comprehensive Disease Screening of Soybean Varieties in Arkansas

INVESTIGATORS:
Travis Faske,
Terry Spurlock

GOAL: To provide independent evaluation of new soybean cultivars for resistance to major diseases and nematodes and deliver this information in a timely manner on the Arkansas Variety Testing Website.

VALUE TO SOYBEAN INDUSTRY:
This program provides comprehensive information on the disease package each new cultivar contains prior towidespread planting of the cultivars in the state, lowering the risk of severe disease losses due to incorrect cultivar selection.

Development of an Effective Program to Manage Fungicide-Resistant Diseases of Soybean in Arkansas

INVESTIGATORS: Travis Faske, Alejandro Rojas

GOAL: Develop practical management strategies to manage fungicide-resistant foliar diseases. Determine the risk of DMI- and SDHI-resistance in various fungal diseases and develop guidelines to reduce the impact of all fungicide-resistant diseases to maximize profit for the Arkansas soybean producers.

VALUE TO SOYBEAN INDUSTRY: The detection and confirmation of a new fungicide-resistant diseases would prevent the unnecessary application of an ineffective fungicide, thus saving money. Furthermore, field studies are used to provide information of fungicide efficacy against fungicide-resistant diseases of soybean. 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.

Integrated Management of Soybean Nematodes in Arkansas

INVESTIGATORS: Travis Faske, Michael Emerson, Amanda Greer

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

VALUE TO SOYBEAN INDUSTRY: We will evaluate both existing and new soybean cultivars with reported resistance to the southern root-knot nematode to determine their level of performance in the field. We will identify those cultivars that will mitigate nematode damage under our field environments and against local biotypes. We will evaluate the toxicity of nematicides and bionematicides in the lab/greenhouse and assess their field efficacy and profitability in nematode infested fields. We will evaluate the practical use of an integrated approach with the use of cultivar resistance, nematicides, and crop rotation sequences to develop effective management strategies for the Arkansas soybean farmer.

Cover Crops and the Control of Soybean Diseases

INVESTIGATORS:
John Rupe and Alejandro Rojas

GOAL: Compare the effects of seed treatments on stands and yields of soybeans planted no-till into established cereal rye cover crops terminated at different times before planting. Evaluate the effect of cereal rye cover crops on soil health including soil chemical and physical characteristics, soil microbial communities, and soil-borne pathogens including nematodes.

VALUE TO SOYBEAN INDUSTRY: Cover crops change the soil environment. These changes may reduce some pathogens, but may increase seedling diseases especially if soils remain cool and wet due to increased biomass. Growers terminate cover crops at different times generating different amounts of biomass. This study determines the effects of cover crops alone or in combination with seed treatments on seedling diseases, soybean cyst nematode and yield over several years of no-till and cover crop use.

Determining the Impact of Disease and Stinkbug Feeding on Soybean Quality

INVESTIGATORS: Terry Spurlock, Nick Bateman, Alejandro Rojas, John Rupe

GOAL: Determine the major factors affecting soybean seed quality and develop management strategies for growers to avoid quality losses.

VALUE TO SOYBEAN INDUSTRY: Soybeans were subjected to major rain events in 2017 and 2018, and timely harvest was not obtainable.

Major dockage for poor seed quality was observed during both of these years. During 2017, high densities of redbanded stink bug were observed in the central and southern regions of Arkansas. These areas were already having issues with seed quality due to the stink bug infestations, and when hurricane Harvey made landfall quality issues nearly doubled. We observed this stink bug alone could cause upwards of 20% damaged seed in an untreated environment with no rainfall events. With poor weather conditions, percent damaged seed increased to 35-40%, and was likely compounded by fungal disease.

Soybean seed quality has been a reoccurring issue over the past several years, with some of the losses being related to disease, insects, weather, or a combination of all three. Our growers need a set of best management practices for protecting themselves against soybean seed quality loss. This project will allow best management practices to be determined to help avoid soybean quality losses and minimize profit loss. These practices will encompass sound IPM, including variety selection and determination of fungicide/insecticide application timing.

Determining the Value of Fungicide Application on Regional, Field Level, and Within-field Scales

INVESTIGATORS:
Terry Spurlock

GOAL: 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.

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 will also generate data that should be used to develop site-directed disease scouting tools making disease scouting more efficient and less expensive.

Understanding Taproot decline; a soybean disease of increasing importance in Arkansas

INVESTIGATOR: Terry Spurlock, Alejandro Rojas

GOAL: To determine the conditions where Taproot decline (TRD) is most severe and implement strategies to effectively manage the disease

VALUE TO SOYBEAN INDUSTRY: The regional distribution of disease occurrence and yield loss is unclear currently. However, it has been found as far north as Craighead Co. and some farmer and consultant reports indicate losses could be as high as 10 bu/A in fields. In MS and LA, losses have been significantly greater. Currently, we do not have consistent control from seed treatment or in-furrow fungicides. 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 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 disease in Arkansas.

VERIFICATION

Soybean Research Verification Program

INVESTIGATORS: Jeremy Ross, Chad Norton, Chris Elkins

GOAL: To verify University of Arkansas System Division of Agriculture recommendation for soybean production, and to maintain an economic database of production practices on a large-scale field basis.

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 Soybean Research Verification Program (SRVP) allows soybean producers to observe Division of Agriculture-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 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' soybean production knowledge and marketing expertise.

Arkansas ROW CROP VERIFICATION

UofA DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System

WEEDS

Accelerated Development of Bioherbicides to Control Palmer Amaranth (Pigweed)

INVESTIGATORS: Burt Bluhm, Kelly Cartwright

GOAL: Create novel, highly aggressive bioherbicide products, through unique molecular genetic approaches, that specifically and effectively suppress Arkansas populations of pigweed.

VALUE TO SOYBEAN INDUSTRY: Herbicide-resistant weeds are the most problematic and expensive management issue in row-crop agriculture. Weed problems, particularly pigweed, are more pronounced in Southern states such as Arkansas, where producers have witnessed more rapid increases in resistant weeds, especially in soybean, cotton, rice, and corn. Attempts to control such "super" weeds lead to as much as an extra $30-50 of input costs per acre. In some cases, extra costs can exceed $150/acre if hand-rouging is required. These costs, coupled with yield losses directly from competition, cause more than $1 billion in losses throughout the Mid-South and South in soybeans, corn and cotton.

A Team Approach to Weed Management in Soybean

INVESTIGATORS: Thomas R. Butts, L. Tom Barber, Jason K. Norsworthy, and Nilda R. Burgos

VALUE TO SOYBEAN INDUSTRY: Proper weed control accounts for a significant portion of annual budgeted production expenses. In addition, yield loss from even moderate weed infestations can be greater than 25%. The rapid adoption and widespread use of soybean weed control information has been of great value to growers.

The project allows growers to closely follow the discovery of resistant and new weed species through timely information for the control and management of these weeds on their farms. Over the past 10 years, the discoveries of the existence of glyphosate-resistant horseweed, common ragweed, giant ragweed, Palmer amaranth, and johnsongrass and most recently, PPO-, VLCFA-inhibitor-, and glufosinate-resistant pigweed, in Arkansas soybean fields has been a direct result of Soybean Board Funding. With continued reliance on glyphosate for weed control in soybean, these resistant biotypes have become more widespread and additional weeds may develop resistance to glyphosate. Although glyphosate-resistant common ragweed, giant ragweed, and johnsongrass currently appear somewhat isolated, glyphosate-resistant horseweed now infests the entire Mississippi Delta region of Arkansas, and glyphosate/PPO-resistant Palmer amaranth has now been confirmed in all major field crop counties.

Glyphosate-resistant Palmer amaranth populations are also known to be resistant to ALS-inhibiting herbicides, which comprise the largest family of soybean herbicides. A further concern is that some of these resistant biotypes are also resistant to multiple herbicide modes of action such as metolachlor in the Group 15 herbicide family. Failure to adequately control any of these weeds can result in total crop loss. The further development of herbicide resistance to new technology, such as glufosinate and auxin chemistry, is also a concern and continues to be addressed by this program. Research from this funding has provided best management practices for Palmer amaranth control and has resulted in a shift in pre-emerge herbicide selection to include metribuzin as a key component for multiple-resistant pigweed control.

Results have also shown multiple herbicide modes of action are necessary at planting. Soybean producers have adopted these recommendations for pigweed at a high rate across the state. Additionally, research from this funding has helped to identify diverse integrated weed management tactics and developed strategies to successfully implement them across Arkansas soybean acres.

Screening for Soybean Tolerance to Metribuzin

INVESTIGATORS: J.K. Norsworthy, J. Ross

GOAL: The goal of this project is to screen all varieties entered in the Arkansas OVT for tolerance to metribuzin, allowing growers to make informed decisions as they select varieties and develop robust weed control programs.

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 1990s. Metribuzin is a broad-spectrum residual herbicide that provides a high level of control of Palmer amaranth, the most problematic weed for Arkansas soybean

growers today. Soybean varieties differ in tolerance to metribuzin; hence, annual testing of available varieties was routine prior to Roundup Ready soybeans 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 again 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 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 Arkansas.

Our field research indicates 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 I-40. We currently recommend a full rate of metribuzin plus a chloroacetamide on every PPO-resistant pigweed acre.

RESEARCH NOURISHES NUTRIENT MANAGEMENT

As soybean yields increase, regional checkoff-funded research provides fertility and nutrient management recommendations that maximize the potential of today's high-yielding varieties.

SOYBEAN RESEARCH & INFORMATION NETWORK

PHOSPHORUS P

Soybeans use phosphorus (P) in root development, photosynthesis and energy transfer. Response to P fertilizer varies, although soybeans do appear to effectively pull P from the soil. Research into requirements and availability across geographies fine-tunes tips for high-yield environments.

POTASSIUM K

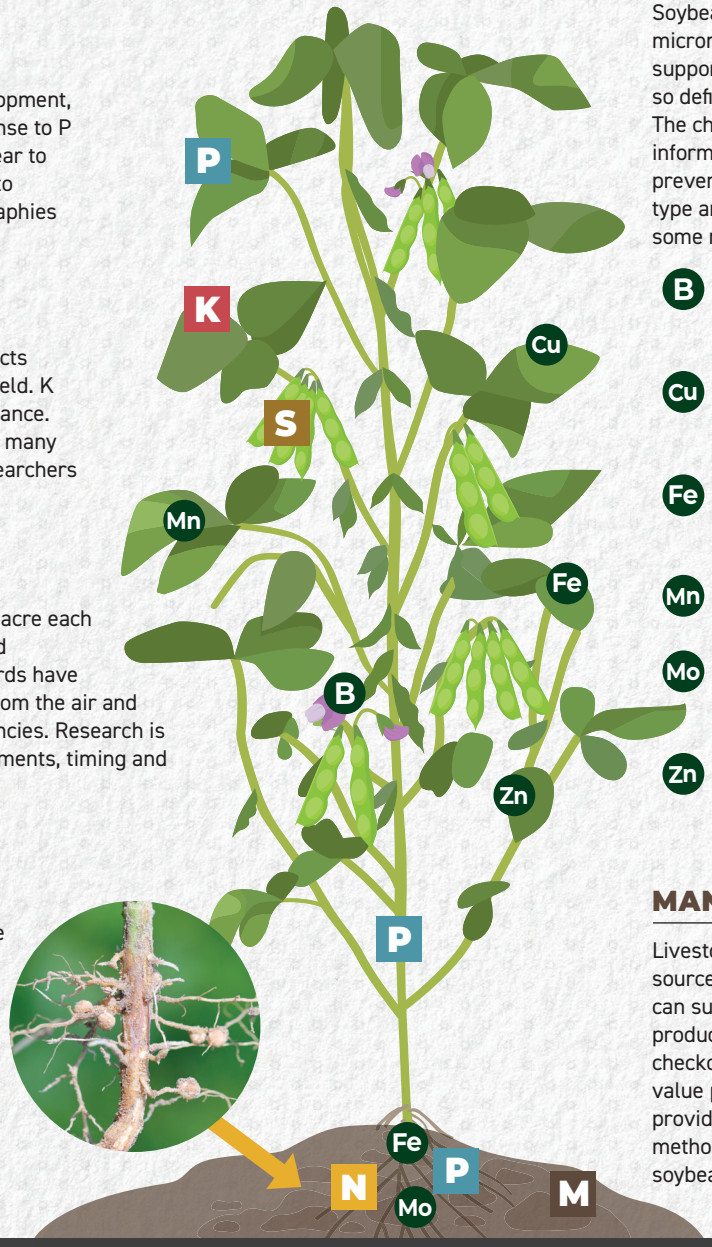
Potassium (K) availability in soybeans impacts biomass production, stress tolerance and yield. K can improve plant health and disease resistance. But as soybean acres and yields increase in many areas, K deficiencies are appearing. So, researchers are studying K needs and uptake.

SULFUR S

Soybeans use 20 to 25 lbs. of sulfur (S) per acre each season to enhance amino acids cysteine and methionine. Changing air emissions standards have reduced how much S is deposited in soils from the air and some regions now report soybean S deficiencies. Research is exploring S fertilization in different environments, timing and delivery to determine the right solutions.

NITROGEN N

Soybeans require 4 to 5 lbs. of nitrogen (N) per bushel. Nodules on soybean roots house bacteria that fix about half of that N for the plant. Research advances efficient nitrogen use by investigating when N becomes a yield-limiting factor in high-yield environments, soybean response to N fertilizer, plant availability of N from crop residue and cover crops and more.



MICRONUTRIENTS

Soybeans need small amounts of key micronutrients to thrive. These nutrients support essential physiological functions, so deficiencies can noticeably cut yields. The checkoff supports research to provide information and recommendations that prevent yield limitations. For example, soil type and pH both factor into availability of some micronutrients.

- B **BORON (B)** supports node number, plant height, flowering, pollen viability, pod and seed set.
- Cu **COPPER (Cu)** is used for photosynthesis, respiration, lignin production and metabolism.
- Fe **IRON (Fe)** supports chlorophyll for photosynthesis and root nodule formation to fix N.
- Mn **MANGANESE (Mn)** plays a key role in photosynthesis.
- Mo **MOLYBDENUM (Mo)** is an important part of the enzyme root nodule bacteria used to fix nitrogen.
- Zn **ZINC (Zn)** is critical for early vegetative growth, chlorophyll and carbohydrate production.

MANURE M

Livestock and poultry manure is a valuable source of fertilizer and organic matter and can supply nutrients soybeans need to produce high-quality protein for feed. With checkoff support, researchers analyze the value poultry, swine and dairy manure provide to soybeans along with application methods, timing and rates to ensure soybeans use manure nutrients efficiently.

GET THE 411 ON SOYBEAN RESEARCH AT SOYBEANRESEARCHINFO.COM

The Soybean Research and Information Network (SRIN) is a joint effort of the North Central Soybean Research Program and United Soybean Board. The online resource contains checkoff-funded soybean production challenge research findings with direct links to the respective underlying scientific studies housed in the National Soybean Checkoff Research Database.

BOARD MISSION

The Arkansas Soybean Promotion Board consists of soybean producers nominated by various producer organizations within Arkansas and appointed by the governor.

The Arkansas Soybean Promotion Board was established to improve the sustainability and profitability of the soybean industry in Arkansas. This board is responsible for distributing funds from the checkoff.

For a digitally immersive experience into this research funded by the soy checkoff, explore this report online by unlocking this QR code with your phone's camera to access links to additional content and videos.

ARKANSAS SOYBEAN PROMOTION BOARD