

# 2020 ARKANSAS CHECKOFF-FUNDED RESEARCH REPORT



ARKANSAS  
SOYBEAN  
PROMOTION BOARD  
[TheMiracleBean.com](http://TheMiracleBean.com)

## 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.*



THE MIRACLE BEAN.COM





# 2020 ARKANSAS SOYBEAN PROMOTION BOARD RESEARCH ALLOCATIONS

## YOUR CHECKOFF INVESTMENT

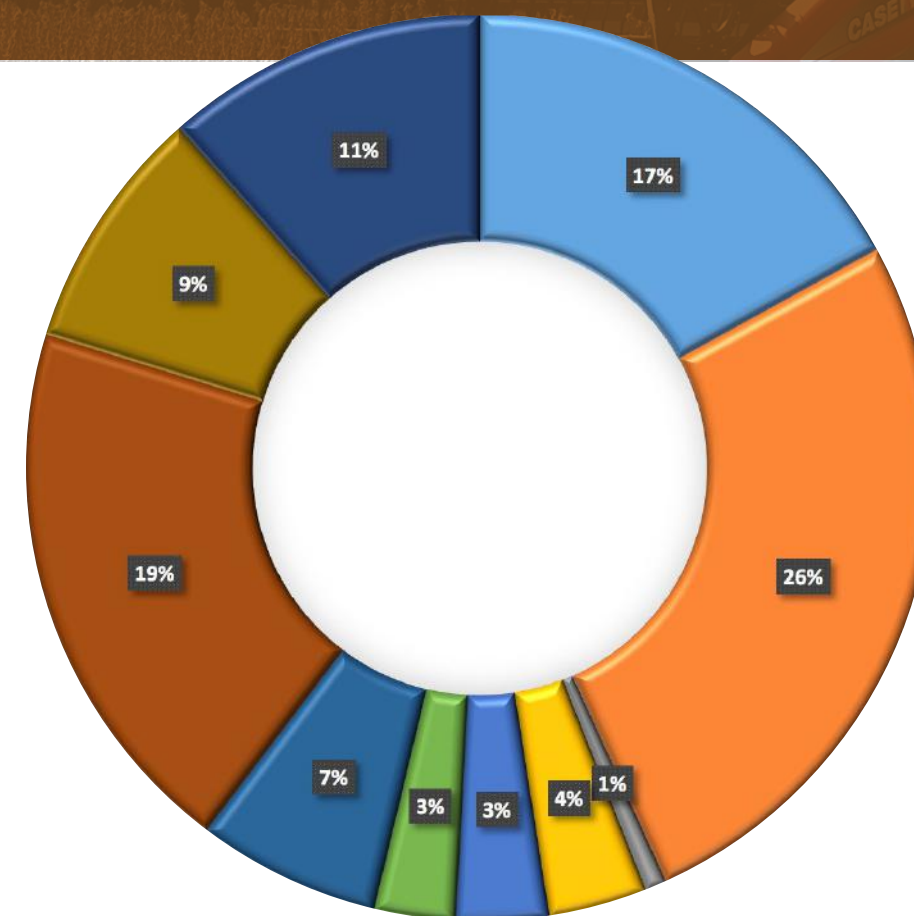
When high-yielding harvests are not enough to secure success for today's soybean producers, checkoff dollars help ensure a strong, profitable future for producers by driving demand at home and abroad.

Administered by the *United Soybean Board*, producers invest 0.5 percent 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.

Run 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 percent of the counties, Arkansas is one of the top 10 soybean producing states in the country.



Agronomy	\$384,370
Breeding	\$595,551
Economics	\$17,300
Education	\$79,582
Entomology	\$74,995
Fertility	\$65,644

Irrigation	\$148,504
Plant Pathology	\$441,169
Verification	\$197,448
Weeds	\$260,438
Research Total	\$2,265,001

Approved March 2020

- Animal agriculture is the number one customer of soybean, 98 percent of soybean meal feeds livestock and poultry.
- Broiler chickens consume about 40 percent of the domestic supply of soybean meal.
- Approximately 30 percent 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



**RUSTY SMITH, CHAIRMAN**  
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.



**DONALD MORTON JR., VICE CHAIRMAN**  
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 25 years, his operation has grown 275 percent to 3,000 acres. He shares it with his wife, their children and their grandchildren. Donald hopes to see farming continue in his family.



**JOHN FREEMAN, SECRETARY**  
When John Freeman said goodbye to his hometown of Dumas 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.”



**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.

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**DOUG HARTZ**  
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 93 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.



**WEST HIGGINBOTHOM**  
West Higginbotham 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 Agriculture 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.



**JOE THRASH**  
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.



**SHANNON DAVIS**  
Shannon Davis is a soybean grower from Bono, Arkansas. Davis has served on the Arkansas Soybean Promotion Board for 8 years and is active in a variety of leadership roles in his community.



The Arkansas Discovery Farm Program



**INVESTIGATORS:** Mike Daniels, Andrew Sharpley

**GOAL:** Document sustainable and viable row-crop farming systems on real, working farms that promote agricultural profitability and natural 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 eight 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 percent 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 CI 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.



AGRONOMY

**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.

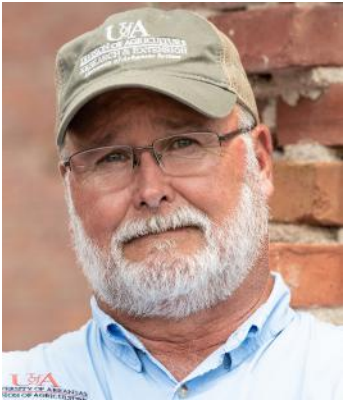
Available at: <http://www.arkansas-crops.com/2020/01/22/selection-performance-available/>



Investigating Emerging Production Recommendations for Sustainable Soybean Production

**INVESTIGATORS:** Jeremy Ross, Gus Lorenz

**GOAL:** Investigate new and untested management inputs to improve soybean production using the Full Season Soybean Production System.



**VALUE TO SOYBEAN INDUSTRY:** Each year Arkansas soybean producers are encouraged by the industry 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 recommended applications and provide scientifically tested results to growers for consideration on their own operations.



Purification and Production of Pre-Foundation Seed of UA Soybean Lines

**INVESTIGATORS:** Leandro Mozzoni and Glenn Bathke

**GOAL:** Purify and maintain seed of released cultivars and germplasm lines for foundation seed production. Purify and increase breeder seed of promising breeding lines in preparation of release.



**VALUE TO SOYBEAN INDUSTRY:** Maintain the genetic purity of UA soybean breeding lines and cultivars, and provide high-quality products to seed dealers and Arkansas farmers.

BREEDING

Assessment of Soybean Varieties in Arkansas for Sensitivity to Chloride Injury

**INVESTIGATORS:** Steve Green, Matt Conatser

**GOAL:** Provision of chloride injury ratings in soybeans through established protocol.

**VALUE TO SOYBEAN INDUSTRY:** This project will evaluate and rate soybean varieties for their physiological reaction to increased concentrations of chloride salts. The data provided by these ratings will be used by Arkansas soybean growers who farm land having soil that contains elevated concentrations of chloride, and who wish to select soybean varieties that are suitable and genetically adapted to this condition.

Utilizing Chloride-Tolerance Markers and Phenotypes to Develop Improved Varieties

**INVESTIGATORS:** Ken Korth, Leandro Mozzoni

**GOAL:** Develop tools and soybean breeding materials that will result in improved selection of existing varieties, and/or development of new varieties, with enhanced tolerance to environmental stresses such as chloride toxicity.

**VALUE TO SOYBEAN INDUSTRY:** Breeding lines have been regularly screened for chloride uptake and salt sensitivity, and the best evidence for impact has been the release of multiple varieties that are chloride-excluders for commercial production. Our recent work on DNA markers should help us determine the accuracy of variety designations as includer vs. excluder, and to know the level of salt-tolerance variation within populations.





B R E E D I N G



Breeding New and Improved Soybean Cultivars with High Yield and Disease Resistance

INVESTIGATOR: Leandro Mozzoni

**GOAL:** Develop high-yielding MG 4-5 cultivars (conventional and glyphosate tolerant) adapted to various environments and production systems in Arkansas. Develop new varieties and germplasm with resistance to soybean cyst nematode (SCN), root knot nematode (RKN), sudden death syndrome (SDS), stem canker (SC), frogeye leaf spot (FLS).

**VALUE TO SOYBEAN INDUSTRY:** UA breeding program provides high-yielding cultivars with low costs to growers and seeds for the conventional and GT (RR1) cultivars can be saved and re-used for planting. UA soybean releases have also served as crossing materials for public and private breeding programs.

Breeding Soybean Under Reduced Irrigation Conditions

INVESTIGATORS:  
Leandro A. Mozzoni,  
Larry C. Purcell,  
Christopher G. Henry

**GOAL:** Assess if different irrigation conditions at reproductive stages influence the breeding decisions of prioritizing populations and selection within breeding populations.



**VALUE TO SOYBEAN INDUSTRY:** Help breeders understand how to better breed and select for soybean cultivars adapted to various water regimes, and to develop a practical genomic selection tool that allows for the effective selection for yield and drought traits that are controlled by a large number of genes.



Soybean Germplasm Enhancement Using Genetic Diversity

INVESTIGATOR: Leandro Mozzoni

**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, 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 Chile for Winter Nursery Progeny Rows to Supplement MG4 Soybean Variety Development

INVESTIGATOR: Leandro Mozzoni

**GOAL:** To utilize a winter nursery in Chile for growing MG4 progeny rows and reselection rows to support the transition into 80 percent MG4 commodity variety development by 2021.



**VALUE TO SOYBEAN INDUSTRY:** The UA soybean breeding program has been providing high-yielding MG5 cultivars at low costs to growers, but it needs to rapidly expand the footprint in early maturities. Utilizing a winter nursery for progeny rows will enable us to perform two cycles of selections on a given calendar year, thus reducing the number of years it takes to bring MG4 soybean varieties to the market.

B R E E D I N G



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

INVESTIGATORS:

Larry Purcell, Leandro Mozzoni

**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 MG4 varieties that produce high-quality seed when maturing under these stressful conditions.

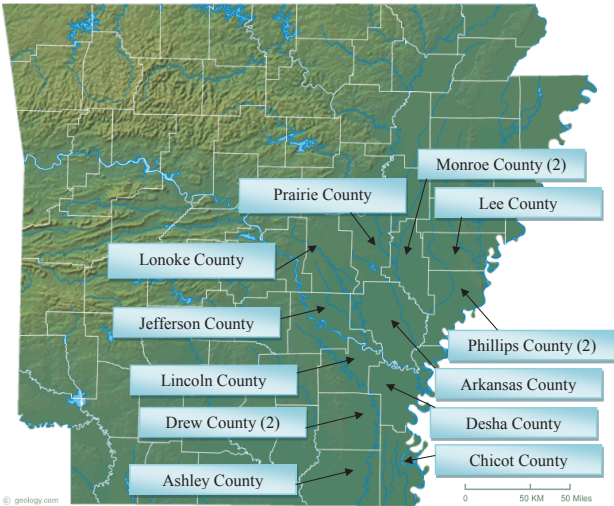


ECONOMICS

Economic Analysis of Soybean Production Practices

**INVESTIGATOR:** C. Robert Stark, Jr.

**GOAL:** Conduct an economic analysis of 2019 SRVP production practices. Standardize economic analysis by integrating 2018 verification data with data from previous years and make interstate comparisons. Expand current economic assistance and interpretation of agronomic results for projects previously funded by or proposed to ASPB. Conduct economic analysis of 2018 Farm Bill provisions specific to Arkansas soybeans.



**VALUE TO SOYBEAN INDUSTRY:** This 2020 project extends previous SRVP work to address requested irrigation and weed control issues. 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:** Profitability is always on the mind of soybean producers. Because of the complexities of inputs and markets, tools need to be developed beyond the “back of the envelope” calculations. This budget template allows the collection costs of machinery and other inputs and allows producers to determine the benefit of alternative practices. Monthly reports of market fundamentals that determine commodity price outlook are also produced. Whole farm budgets are produced for financial and public policy fundamentals.

EDUCATION

Soybean Science Challenge

**INVESTIGATORS:** Julie Robinson, Karen Ballard



**GOAL:** To engage Arkansas high school science students and teachers statewide in “real world” Arkansas-specific soybean science education through original curriculum and a continuum of educational methods that include: classroom instruction, lab instruction, 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.

ENTOMOLOGY

**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 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. This research is intended to ensure Arkansas soybean producers’ money is wisely spent for insect management.



**VALUE TO SOYBEAN INDUSTRY:** Students from across our state are being challenged to understand the complexity of the evolving science undergirding production agriculture and to critically think about issues regarding food, fuel, feed and agricultural sustainability that will directly impact their futures. We are now present “at the table” as the attitudes of our youth are being shaped.

ENTOMOLOGY

Educating Growers and Consultants on Insect Monitoring and Control



**INVESTIGATORS:** Gus Lorenz, 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.

Development of Integrated Management Strategies for Insects in Soybeans

**INVESTIGATORS:** Ben Thrash, Gus Lorenz, 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.



A wide-angle photograph of a lush green soybean field stretching to the horizon. The sky is filled with soft, white clouds, suggesting a bright but slightly overcast day. The plants are dense and healthy, with some small white flowers visible. The overall scene conveys a sense of agricultural productivity and natural beauty.

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ENTOMOLOGY

**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 determine 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 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. 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 K are no longer yield-limiting factors in Arkansas soybean production systems.

IRRIGATION

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:** To date, 122 participants have attended the surge school and 149 attended the soil moisture schools for a total of 840 contact hours. Surge irrigation respondents reported moderate to substantial learning (99 percent) in hands-on exercises. In the soil moisture sensor schools, 87 percent reported moderate to substantial learning on how to assemble and install soil moisture sensors. Over 180 irrigators are using this app to interpret soil moisture sensor readings. 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.

PLANT PATHOLOGY

Comprehensive Disease Screening of Soybean Varieties in Arkansas



**INVESTIGATORS:** Travis Faske, Terry Kirkpatrick

**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 that each new cultivar contains prior to widespread planting of the cultivars in the state, lowering the risk of severe disease losses due to incorrect cultivar selection.

PLANT PATHOLOGY

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



**INVESTIGATORS:** Travis Faske, Alejandro Rojas

**GOAL:** Develop practical management strategies to manage fungicide-resistant foliar diseases. 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 maximize profit for the Arkansas soybean producers.

**VALUE TO SOYBEAN INDUSTRY:** This information was extended to producers, which prevented the unnecessary use of this fungicide to control S-R FLS, thus saving producers the cost of an unnecessary fungicide application across the state. We will also begin to develop multiple years of data in regards to the usefulness of fungicides to control S-R FLS and how our threshold needs to be adjusted to maximize the use of new and existing triazole fungicides. Finally, the information collected from these studies will be used and deployed to provide practical solutions for the control of fungicide-resistant soybean diseases in Arkansas.



Integrated Management of Soybean Nematodes in Arkansas

**INVESTIGATORS:** Travis Faske, Terry Kirkpatrick, 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 economic nematodes to determine their actual level of performance in production fields. This study will identify those cultivars that will provide mitigation of nematode damage under field environments and with local races and biotypes of the pathogens. Research teams will also begin to develop an experience base as well as an experimental database on the use and impact of nematicides in managing soybean nematodes, and will examine novel chemicals and strategies for existing chemicals in more effective management.

Cover Crops and the Control of Soybean Diseases

**INVESTIGATORS:** John Rupe and Alejandro Roja

**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, John Rupe, Robert Stark



**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 stinkbug were observed in the central and southern regions of Arkansas. These areas were already having issues with seed quality due to the stinkbug infestations, and when hurricane Harvey made landfall, quality issues nearly doubled. Scientific observation revealed that this stink bug alone could cause upwards of 20 percent damaged seed in an untreated environment with no rainfall events. With poor weather conditions, percent damaged seed increased to 35-40 percent, and was likely compounded by fungal disease. Soybean seed quality has been a reoccurring issues over the past several year, with some of the losses being related to disease, insects, weather, or a combination of all three. Growers need a set of best management practices for protecting themselves against soybean seed quality loss.

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

**INVESTIGATOR:** 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.



Understanding Charcoal Rot and Taproot Decline; A Soybean Disease of Increasing Importance in Arkansas

**INVESTIGATORS:** Terry Spurlock, John Rupe

**GOAL:** To better understand and implement effective management practices for theses diseases.

**VALUE TO SOYBEAN INDUSTRY:** Charcoal rot, reportedly caused by the fungus *Macrophomina phaseolina*, appears to be a serious yield limiting disease for Arkansas soybean production. Areas affected by charcoal rot are clustered in fields. Within the clusters of disease, plants defoliate and mature early, pod fill is poor and many pods are aborted. There are no commercially available varieties that have demonstrated resistance to charcoal rot. Further, chemical control applied as a seed treatment or in-furrow has shown little efficacy. The disease appears to be stress related. However, the vast regional area affected by charcoal rot each year suggests the stresses may be common. Understanding the relationship of field-level variability (soil factors relating to plant stress, drought stress, nutrient deficiencies, and other diseases) would provide farmers an opportunity for a more integrated approach to manage the disease each year.

Recently, a group of scientists from the University of Arkansas, Mississippi State University, and Louisiana State University have characterized a new disease of soybean prevalent in our three states, Taproot decline (TRD). The regional distribution of disease occurrence and yield loss is unclear at this time. 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 2016, fields in Mississippi and Louisiana suffered substantial yield losses from this disease. Currently, we do not have seed treatment fungicide or varietal recommendations for growers to combat TRD. Understanding the regional distribution, commercially available seed treatment efficacy, and varietal susceptibilities are necessary for successful management of this disease in Arkansas.



VERIFICATION

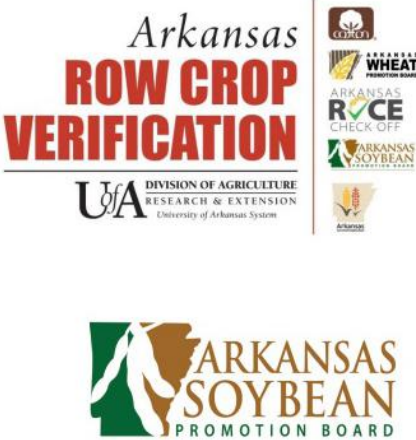
Soybean Research Verification Program



**INVESTIGATORS:** Jeremy Ross, Chad Norton, Chris Elkins

**GOAL:** To verify University of Arkansas, 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 SRVP allows soybean producers to observe University of Arkansas-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’ marketing expertise.



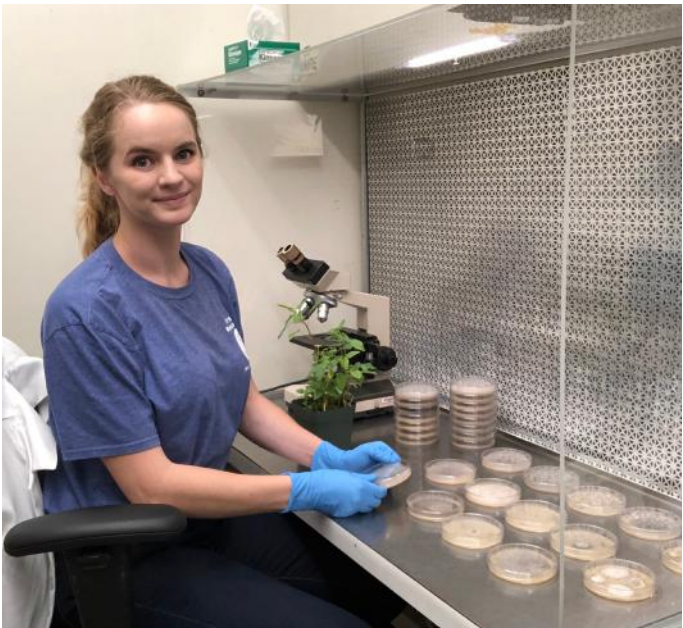
WEEDS

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.



WEEDS

A Team Approach to Weed Management in Soybeans



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

**GOAL:** To evaluate new and emerging technologies, rapidly identify herbicide-resistant weeds, determine their distribution, determine their mechanisms of resistance, and develop viable, unbiased solutions for managing herbicide-resistance in Arkansas. In addition, research focused on reducing the soil-weed seedbank and controlling other problematic weeds for soybean producers in Arkansas. A major goal will be providing a rapid information exchange between the grower, extension personnel, and researchers.

**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 percent. The rapid adoption and widespread use of soybean weed control information has been of great value to growers. The project will allow 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 most recently johnsongrass and PPO 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 agricultural counties in the NE. A further concern is that some of these resistant biotypes are resistant to multiple herbicide modes of action. For instance, some glyphosate-resistant Palmer amaranth populations are known to be resistant to ALS-inhibiting herbicides, which comprise the largest family of soybean herbicides. Failure to adequately control any of these weeds can result in total crop loss. The further development of herbicide resistance to new technology is also a concern and will be addressed by this program.





W E E D S

# Screening for Soybean Tolerance to Metribuzin



**INVESTIGATORS:**  
J.K. Norsworthy,  
Jeremy 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 soybeans, 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 soybeans, 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 I-40. We currently recommend a full rate of Metribuzin plus a chloroacetamide on every PPO-resistant pigweed acre.



## REDUCING SPRAY DRIFT

**WIND** → **DRIFT**

**Spray drift is the movement of herbicides and other crop inputs away from intended target sites through the air. Several factors play a role in reducing spray drift, but farmers should pay particular attention to these four:**

1

**NOZZLE SELECTION** – The nozzle’s intended use determines the type of nozzle needed.

- Examine current and future application requirements for your fields
- Prepare several sets of nozzles for different application needs
- Consult herbicide labels and nozzle catalogs to help calibrate sprayer systems for individual field needs.

2

**DROPLET SIZE** – When boom or nozzle pressure is increased, a higher percentage of droplets are small. The smaller the droplet, the greater the chances of off-target drift.

3

**APPLICATION SPEEDS** – Maintain reasonable speed. Higher speeds often result in smaller droplets, which are more likely to remain suspended in the air and can move long distances.

4

**ADDITIONAL OPTIONS** – Carefully select drift-reduction nozzles and additives to control drift.

*For more information, visit*  
[www.TakeActionOnWeeds.com](http://www.TakeActionOnWeeds.com)

**Take ACTION**  
Herbicide-Resistance  
Management

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## 3 TIPS TO HELP YOU PREVENT HERBICIDE RESISTANCE

Herbicide resistance is a growing problem that can impact your bottom line. Follow these guidelines to manage weeds threatening your soybean crop and minimize the risk of herbicide-resistant weeds appearing on your farm:


**1 TARGET WEEDS.** Know the weeds in your fields and get them while they're little. Tackle weeds before they reach 3 to 6 inches in height to prevent them from becoming a serious threat to your soybean crop. Target those weeds with an appropriate herbicide program that includes more than one mode of action.

**2 DON'T CUT CORNERS. APPLY THE LABELED RATE.** Herbicides are most effective when applied at their recommended rate. Do it right the first time to avoid the expense of a follow-up herbicide application and reduce the chance of developing herbicide-resistant weeds.

**3 DOCUMENT HERBICIDE RESISTANCE.** Herbicide-resistant weeds are a serious threat to your crops. Know what resistance has been documented on your farm and surrounding farms to better prepare next year's herbicide program. Plan to use multiple modes of action when applying herbicides to prevent widespread resistance.

For more information, visit  
[www.TakeActionOnWeeds.com](http://www.TakeActionOnWeeds.com)



Brought to you by the soy checkoff. 

# BATTLING BILLION-DOLLAR YIELD ROBBERS?

## Don't Worry. We're On It.

Sudden death syndrome, stink bugs, soybean cyst nematodes and many other yield-robbing pests and diseases. It's a rough world out there, costing soybean farmers billions of dollars every year. Fortunately, your state soybean checkoff is on the job with research projects to develop effective traits and practices to get back as much of your yield as possible.

LEARN ABOUT THESE PROJECTS AND MORE AT  
[SOYBEANRESEARCHINFO.COM](http://SOYBEANRESEARCHINFO.COM)



## THE HARD WORK BEHIND YOUR HARD WORK

FUNDED WITH SOYBEAN CHECKOFF DOLLARS THROUGH THE UNITED SOYBEAN BOARD AND NORTH CENTRAL SOYBEAN RESEARCH PROGRAM







# DREDGING THE LOWER MISSISSIPPI RIVER

## Our Future Is Riding on It

### WHY DREDGING THE LOWER MISSISSIPPI RIVER MATTERS

The current depth of the lower Mississippi River is 45 feet. At that depth, standard Panamax vessels are loaded to 66,000 metric tons — 70,000 metric tons max. Sometimes, the river is dredged to 47 feet, so vessels don't hit the bottom. But even then, larger Panamax vessels can only be loaded to 77,000 metric tons.

That sounds like a lot. But consider this:

- Since Panama Canal expansion, it can now handle vessels loaded to 99,000 metric tons.
- China and other Asian buyers want larger volumes and the resulting lower freight rate.
- Six of the 10 largest ports in the world are in China and have drafts that exceed 50 feet, accommodating vessels in excess of 80,000 metric tons.
- Nine countries have the capability to harbor vessels carrying nearly 80,000 metric tons.

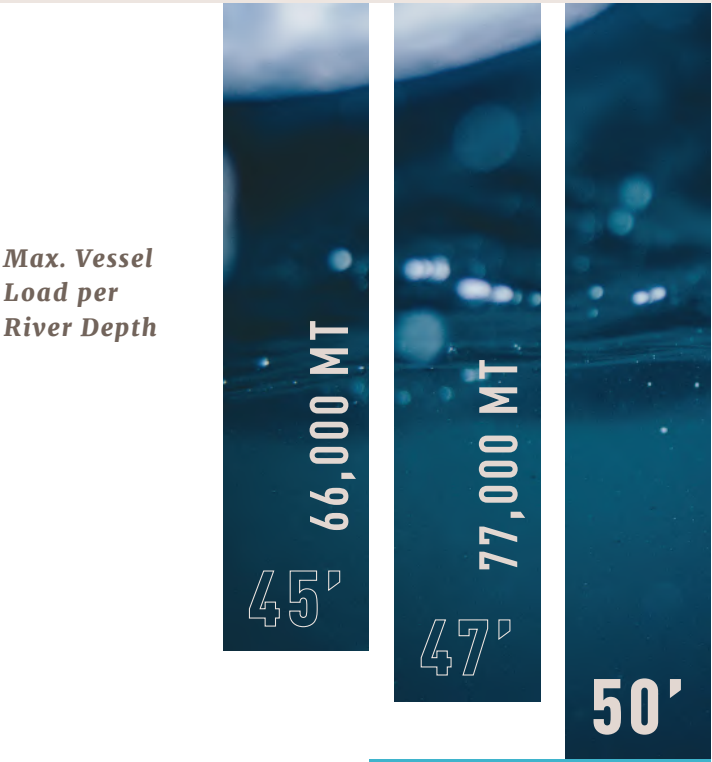
*Add it all up, and we need to make the lower Mississippi deeper — 50 feet deep, to be exact.*

Sure, export countries will benefit from the bigger loads and lower freight. But guess what? *U.S. farmers will benefit, too.*

### DREDGING PAYS UP TO 13¢ MORE PER BUSHEL

The draw area is the crop acres required to supply the export markets. Increasing to 78,000 metric tons per load will extend the draw area to 245 miles. Cash basis will improve 13 cents per bushel for 205 miles from the river and pay out less until 246 miles, impacting 72% of U.S. soybean production. *The deeper depth of the lower Mississippi River will increase farmers' soybean revenues by close to a half billion dollars annually.*

Even farms farther away will benefit from the increased modal competition between rail and barge. When modal competition increases, a downward pressure on shipping rates will often occur, which means more basis.



WE ARE U.S. SOYBEAN FARMERS



## SUSTAINABILITY NEVER GOES OUT OF SEASON

### WATER MANAGEMENT

Customers prefer U.S. soy because it's sustainable. But demands for sustainability continue rising. Adopting a common practice like incorporating grass filter strips to help slow runoff and keep waterways clean is another step forward in improving your sustainable footprint. Show your commitment to sustainability with a free truck magnet available at [unitedsoybean.org/sustainability](https://unitedsoybean.org/sustainability)

