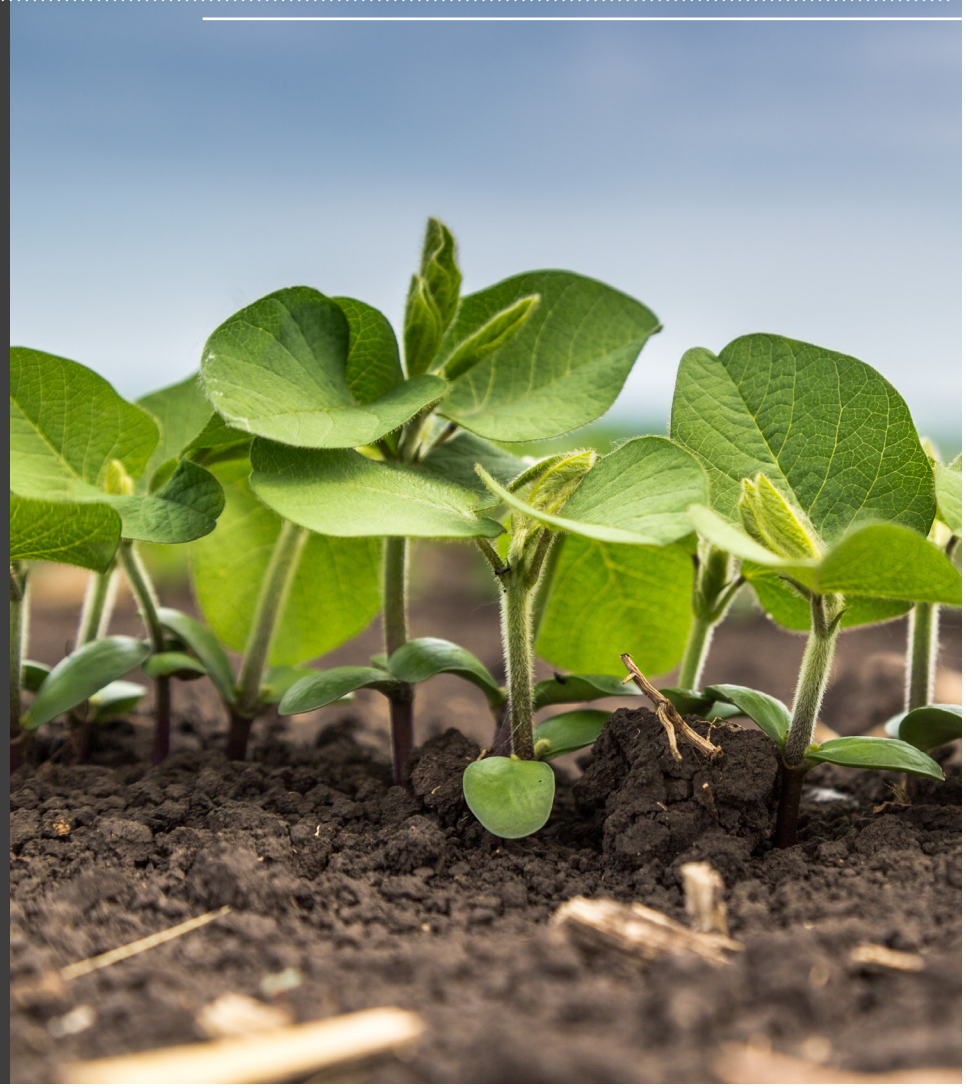
www.LSUAgCenter.com

THE LOUISIANA
Soybean & Grain
RESEARCH & PROMOTION BOARD

2025 REPORT

CONTENTS



Artificial intelligence may be new tool in battle against pests

Artificial intelligence could soon become the latest tool in the battle against redbanded stink bugs and other soybean pests.

A pair of projects led by Ivan Grijalva, an LSU AgCenter assistant professor in precision pest management, in collaboration with Jeff Davis and Kevin Hoffseth, focuses on developing decision-support tools. These tools are designed to help recognize insect damage to soybean seed and also to detect and number insects for more efficient field sampling.

Drones, smartphone cameras and other technologies have the capacity to capture high-resolution images, Grijalva said; however, artificial intelligence — particularly machine learning models — must still be taught to recognize insects and crop damage.

"We have the technology and the sensors capable of detecting small insects," Grijalva said. "We need to develop the model so it can be deployed to a decision-support tool. For example, a model trained with drone imagery will be able to process the imagery and tell you that in a specific area there are 20 stink bugs, and then you can decide if you make an insecticide application or not."

Both artificial intelligence projects are in their first year of development.

One of the first goals for the insect detection project is to create a model that can potentially monitor the top of the crop canopy with drones and under the canopy with smartphone cameras until redbanded stink bugs reach target populations.

Using an artificial intelligence approach known as machine learning, computer systems can then recognize the shapes and pixel features of these insects and how they appear in the field. This process helps the model refine its decisions about determining which shapes and features are stink bugs and which are not.

Images, such as these annotated photos of soybean seed, are used to train insect damage detection models. Photo by Saurav Upadhyaya and Peyton A. Falterman

Grijalva plans to create a prototype application that soybean producers can use to upload images and detect stink bug presence.

"You gather all this information, then the machine learning model makes an insect detection," Grijalva said. "You apply a lot of image analysis, preprocessing, train the model and then you test it in different images that the model didn't see before."

One goal, Grijalva said, is to develop a smartphone application for producers to use while scouting fields instead of manual insect counts. Eventually, Grijalva envisions creating a robotic vehicle that can crawl through fields and scout for insect populations and make management decisions.

"The farmer can invest their time in other activities instead of sampling," he said.

Grijalva is working on a second artificial intelligence project with AgCenter engineer Kevin Hoffseth to develop a machine learning model that will assist soybean inspectors in assessing insect damage on soybean seeds. Hoffseth said that Grijalva's work complements the objectives of Hoffseth's lab.

Continued on Page 2

From the Louisiana Soybean and Grain Research and Promotion Board

Louisiana's checkoff system is alive and well thanks to you — the soybean, corn, wheat and milo growers who contribute. As a board of farmers, we know the struggles many have faced in the challenging cycle that production agriculture is facing. It is times like these, however, that the long-term investment and foresight of the checkoff system truly shines. While balance sheets are tight and trade deals remain uncertain, farmers continue to farm forward. We continue to feed the world.

Louisiana's checkoff system is a bit unique, as our Louisiana Soybean and Grain Research and Promotion Board combines four crop checkoffs into one governing board made up of 12 farmers from around the state. The beauty of this system is we all serve at the nomination of our fellow growers. I am particularly proud of this group — which over the past few years has come together to push for more applied research to get answers for growers faster while also investing in a legacy project of two professorships in the LSU AgCenter to provide research leadership for years to come. Through this balanced approach, our board will continue to do our best to be a good steward of Louisiana farmers' investments and seek ways to get the results of that work back to our stakeholders.

With such a diverse crop mix overseen by our board, we supervise a wide array of projects each year. That is why the involvement and feedback of our fellow farmers is so important. We need to hear from you about your production concerns and yield-robbing variables. We've also sought the guidance of agricultural crop consultants in recent years to integrate their expertise.

This board goes beyond just research. With contributions to organizations like the United Soybean Board, National Corn Growers Association and the U.S. Grains Council, our dollars are helping promote our products across the globe. With the need for better commodity prices and more demand, our board will be focusing on what we can do better to achieve a more competitive market for the yields we are consistently producing.

There is no question, though, that research is our top priority. Through partnership with the LSU AgCenter and other universities and organizations, we want to see reduced risk and variability, and improved yields and sustainability of the Louisiana family farm. Profitability is always top of mind, and we thank you very much for consistently and unanimously investing in our mission through your checkoff dollars.

While budgets may be tight, we know Louisiana farmers remain committed to the future. Your research and promotion contributions and volunteer leadership are bettering our industry for the long term. Thank you for your partnership, and may God bless you in this next cropping season.

Sincerely,

Charles Cannatella
Chairman, Louisiana Soybean and Grain Research and Promotion Board

Soybean and Grain Research and Promotion Board members *front row from left, Scott Wiggers Jr., Charles Cannatella, Joey Boudreaux and Wil Miller; and back row from left, Joey Olivier, Kody Beavers, Burch Pierce, Darrell VandeVen and Kellon Lee.*

Charles J. Cannatella
Chairman
Melville

Kellon Lee
St. Joseph

Joey Olivier
Arnaudville

Darrell VandeVen
St. Joseph

Kody Beavers
Extension

Garrett Marsh
Tallulah

Burch Pierce
Jonesville

Scott Wiggers Jr.
Secretary-Chairman
Winnsboro

Joey Boudreaux
Vice Chairman
Lebeau

Wil Miller
Ferriday

Luke Sayes
Deville

Andy Brown
Executive Director
Baton Rouge

This image of stink bugs is used to help train artificial intelligence models detect insects. Photo by Joshua Broussard

Continued from Page 1

In 2020, Hoffseth began developing software and hardware to assist soybean inspectors with the Federal Grain Inspection Service who grade soybeans and other grains postharvest. Hoffseth does not think computers can replace inspectors, but they can improve the process, he said.

"If you can make their life easier by automating a lot of the process, but leaving the grading decision up to the person that's been trained, then I think that's a really good goal," Hoffseth said. "That's what I'm trying to work towards."

Grading grains is difficult work, Hoffseth and Grijalva said, and inspectors often consult photographs while performing their work.

"We want to apply these approaches because most of the visual inspections of soybean seeds are performed by humans, and that takes a lot of time," Grijalva said. "It's very time consuming and very subjective. When you apply machine learning, you can automate this process, and then you can be more efficient in sampling. Also, it will be more accurate and faster."

The proposed machine learning model would be used to identify and categorize insect-damaged seeds. The first step in the process will involve teaching the model to recognize patterns of insect damage. Eventually, the research team would create an internet-based pilot tool that inspectors could access while working in the field. **Kyle Peveto**

LSU AgCenter moves hog bait toward market

Feral hogs continue to pose challenges for Louisiana's agriculture sector, and scientists are conducting studies aimed at getting a bait that is lethal to the animals on the market.

LSU AgCenter and LSU Department of Chemistry researchers spent years developing a sodium nitrite-based bait as a control method for feral hog populations, which have soared in recent years and caused extensive damage to crop fields. They were awarded a patent for their product in August 2023.

Since then, they've turned their attention to environmental testing, shelf-life studies and bait delivery methods. This ongoing research is critical to the bait ultimately being released to the public, as it first needs a stamp of approval from the U.S. Environmental Protection Agency, which is rigorously reviewing the bait and data from studies on it.

"We are in the process of engaging an EPA consulting firm to guide us through obtaining an Experimental Use Permit for initiating field trials," said Glen Gentry, interim director of the Louisiana Agricultural Experiment Station. An animal scientist, Gentry has been deeply involved in the AgCenter's research on feral hogs and potential control methods.

After much trial and error, Gentry and his colleagues landed on a bait that entices hogs with a fishy taste. It contains sodium nitrite — a compound that is used as a preservative in foods like bacon and is deadly to hogs. Once they eat the bait, hogs become sleepy and die within three hours.

The bait, which is shaped into golf ball-sized spheres, has a gummy bear-like texture. That's significant because it keeps the bait from crumbling. And, because sodium nitrite eventually breaks down into benign compounds, there is minimal impact on nontarget species and the environment.

Farmers in Louisiana and throughout rural areas of the U.S. have long sought a solution to feral hogs, which root up crops and cause other problems. AgCenter experts have estimated that the animals are responsible for $91 million in damage annually in Louisiana.

Feral hogs' rapid reproduction rate has limited the success of other control methods, such as hunting and trapping. Sows can have two litters of about six piglets every year. **Olivia McClure**

Scientists advance dsRNA fungicide for soybean

In the third year of a three-year project aimed at developing RNA-based alternatives to traditional fungicides, Zhi-Yuan Chen and his team have made promising progress in improving the delivery and stability of double-stranded RNA (dsRNA) treatments for soybean diseases in their field trials at the LSU AgCenter's Central Research Station.

One of the biggest challenges has been the poor delivery of dsRNA into soybean plants. To address this, the team tested various chemical adjuvants — additives used in commercial fungicides — to help the dsRNA stick to the leaf surface and penetrate the waxy cuticle.

"Last year, we were mainly testing different dsRNAs with or without adjuvants." Chen said. "Basically, we needed to reduce the amount of dsRNA sprayed in the field for effective disease management by boosting their uptake by plants through the use of adjuvants to make it more economical."

He found two of the agents helped the dsRNA get into the leaf based on the analysis of samples they completed recently.

"From last year's limited small-scale field trials, we saw that dsRNAs with these adjuvants helped suppress pathogen growth and reduce symptoms," Chen said.

The other major challenge is the instability of dsRNA under field conditions.

"The weather conditions, like rain, wash off things that are sprayed on the plants," Chen explained. "The UV sunlight and microbes on the leaves really destroy the dsRNAs we sprayed onto soybean in a matter of days."

During the winter, the team also explored the use of magnesium ferric and other nanoparticles to encapsulate the dsRNA, protecting it from environmental degradation. The latter nanomaterials were obtained through collaborating with a professor in the LSU Department of Chemistry.

"The idea is that the nanoparticles act as a physical barrier. When UV light shines on them, it doesn't get to the dsRNA. But with enough moisture, the dsRNA is slowly released," he said.

Graduate student Sunira Marahatta conducted the greenhouse trials to test the effectiveness of these nanoparticles.

She had soybean plants growing in the greenhouse, sprayed with dsRNA — some mixed with nanoparticles — and after two weeks, she collected the leaves to compare disease symptoms. She then extracted DNA from the leaves to see any differences in fungal growth among soybean leaves treated with dsRNA with or without nanoparticles.

Using a specialized DNA quantification machine, Marahatta was able to measure the amount of fungal DNA in the soybean tissue.

"That machine can tell us how much fungal DNA is inside the total DNA of the soybean," Chen said. "Statistically, we should be able to separate them. If it's effective, we should see less fungal growth inside the soybean leaves compared to the controls."

Chen noted that the greenhouse results were inconclusive.

"The help from nanoparticles is not very clear," he said. "Statistically, we did not see a difference between with and without nanoparticles."

Graduate student Sunira Marahatta is working with LSU AgCenter plant pathologist Zhi-Yuan Chen to improve the delivery and stability of double-stranded RNA (dsRNA) for practical management of soybean fungal diseases. Marahatta stands next to a specialized DNA quantification machine that she uses to accurately measure the amount of fungal growth in the soybean tissue. Photo by Tobie Blanchard

He said that the lack of environmental stressors in the greenhouse may have limited the nanoparticles' effectiveness. New field trials planned will test their performance under real-world conditions.

Soybeans were planted at the Central Research Station in early May, with additional plantings scheduled through June to capture different stages of disease development.

"That way we can catch the soybean disease in different stages and do the treatments," Chen said.

Ultimately, the goal is to develop a cost-effective, environmentally friendly alternative to fungicides. **Tobie Blanchard**

Producers provided with up-to-date tools from the LSU AgCenter

As farmers face economic instability every year, the need for accurate and up-to-date information about their production, yield and management costs remains of the highest importance. To help farmers face these challenges, the LSU AgCenter provides spreadsheets, newsletters and information on changes and trends in the economics of agriculture.

One of these spreadsheets gives a farm management planning tool on Microsoft Excel where they can put in their own projected prices, yields and costs for a year, and the spreadsheet will show them their expected revenue and other cost estimates. These spreadsheets are updated throughout the year as they are dealing with volatile information.

This data also can be used in a farm financial benchmark analysis that comes out every fall. For Michael Deliberto, an AgCenter economist, these tools are important because they offer farmers a chance to calculate this information for themselves. Deliberto developed the tool in response to rising energy costs and supply chain disruptions so producers can better evaluate costs and returns of soybean and feed grain crops.

"It lets producers look at break-even returns, return on investment levels, where it allows them to compare the upcoming crop year to what they did last year or two years," Deliberto said.

In the newsletters sent out from the AgCenter, Deliberto tries to keep producers up to date with changes in the economy or politics that could impact their prices or costs. One of these is a monthly crop market report that covers information on corn, cotton, soybeans and rice. In this newsletter, he goes over the latest U.S. Department of Agriculture supply and use estimates, price projections, futures prices and some other market dynamics so that farmers know how the market is doing.

Deliberto also puts out a quarterly newsletter that is more focused on agriculture policy. He follows changes in legislation or rules and tells farmers how it will most likely impact them.

"I'm trying to provide growers with a little bit of what's going on from a policy standpoint that they could find interesting and helpful. We also advertise here different workshops or meetings that may be coming up and things like that," Deliberto said. "It's a good way to stay connected to the markets."

AgCenter economists also put out spreadsheets to help producers make decisions on whether they should participate in government programs like the agricultural risk coverage program and the price loss coverage program.

The AgCenter also works with lawmakers and other stakeholders to make educated decisions around agriculture and how changes to laws and regulations could impact producers and consumers. Deliberto works with institutions like the Farm Bureau and the Louisiana Cotton and Grain Association to give them helpful and insightful information about Louisiana agriculture.

"A big reason why we're able to deliver those policy pieces as quickly as we do is because we have the funding to update those costs every year," Deliberto said. "We're very in tune with what the markets are doing, and we do the policy newsletter every quarter. When there's a need to get that information out in a timely manner, we can do that." **Anthony Bailey**

LSU AgCenter researchers test biostimulants to create a 'library' of data

For farmers, there is almost nothing more important than the soil they plant their crops in. It is of the highest importance that they can keep their soil fertile and productive, not just in their lifetime but for generations to come.

A new and increasingly popular way to do so is by adding biostimulants on plants or the soil. Biostimulants are biological materials that can encourage disease resistance and enhance crop nutrient absorption, growth and yields.

Brenda Tubaña, a professor and soil fertility specialist in the LSU AgCenter School of Plant, Environmental and Soil Sciences, began experimenting in the past year with different commercially available biostimulants to create a database that will let farmers know the outcomes and effectiveness of using each one.

"The idea is to build a 'library' of biostimulants information on their performance based on field testing to give guidance to producers as to which product is working to which crop. If I'm growing wheat or corn or soybeans, which biostimulant product will guarantee returns? We would like to have documentation to answer [this] question from producers," Tubaña said.

To do this, Tubaña has been testing anywhere from eight to 14 specific biostimulants for soybeans, wheat and corn every year. The testing looked at yield, plant nutrient concentrations and soil nutrient availability. The approach is that testing will continue next year without the lowest performing biostimulants and replace them with new products as the research project tries to get the most robust information for the library.

The researcher conducted tests this past year to ensure that the AgCenter's recommendations on fertilization and other soil fertility management practices have remained the same. Based on the data gathered so far, Tubaña sees no significant changes in the recommendations.

Tubaña also worked on an experiment using biochar and cover crops to improve soil health, enhance nutrient recycling and sustain soil productivity. The long-term plan of the project is to record how these additions of plant materials will impact organic matter buildup and how this will subsequently contribute to the health of soil and the crop we plant in it.

"Organic matter serves as a cementing agent for individual mineral particles in the soil and helps stabilize them forming larger and water-stable aggregates," Tubaña said. "These aggregates have more resistance to destruction from rainfall impact compared to soil that has less stable aggregates, allowing the field to hold more moisture and nutrients." **Anthony Bailey**

Top Right: *School of Plant, Environmental and Soil Science visiting scholar Alisson Camargo applies foliar sprays of biostimulant to corn.* ***Bottom Right:*** *School of Plant, Environmental and Soil Science visiting scholars Leonard Nuugulu, left, and Abigail Audije collect soil samples after wheat harvesting for soil nutrient and microbial indices analysis. These plots received soil and foliar applications of biostimulants. Photos by Brenda Tubaña*

Small grains breeding program is developing varieties for food and cover crops

Working as a team, Steve Harrison and Noah Dewitt are moving the LSU AgCenter's wheat breeding program in the right direction.

An example of their success is the release of the wheat variety LA19333, which was licensed this year.

"It is one of the top four lines in the USDA Uniform Southern Wheat Trials across 11 states," Harrison said. "It averaged 83 bushels an acre and has a good test weight and has done especially well from Georgia to Texas."

Harrison said the program is benefitting from technology that is cutting down on the time it takes to develop a variety. A "speed breeding" protocol allows breeders to grow two or three generations in one year, thus speeding up the timeline for developing new varieties.

The AgCenter small grains breeding program continues to play an integral part in the SunGrains program, which is an agreement with seven southeastern universities to improve the efficiency of small grain variety research. A summer SunGrains nursery in Montana of crosses made in the spring greenhouse saves a year in the breeding cycle.

Oat development is another focus of the breeding program. It has released an oat variety that will be grown in both Brazil and Uruguay as a forage crop. Harrison expects to release another variety within the next year that will be used primarily for deer food plots.

Harrison is undertaking work with a group of scientists from Texas and Mexico examining the development of oat varieties for oat milk production.

Harrison is excited about the program's work with triticale, a hybrid of wheat.

"Rye naturally suppresses weeds and is easy to plant, but seed is expensive," Harrison said. "Triticale is an affordable option with lower seed cost and has potential to be used as a cover crop or food plot."

There are three regional nurseries throughout the South where work in this area is being conducted: Chase, Louisiana; Plains, Georgia; and Quincy, Florida.

"I expect we will have a release in the next two years as a cover crop," Harrison said. "At Ben Hur and Winnsboro, we had yields up to 90 bushels with triticale compared to 40 bushels with rye."

Wheat acres across Louisiana have been relatively low for two reasons: low prices and several years of disease pressure, primarily from scab. Because of the low acreage, many chemical companies are not investing in any fungicide trials across the state.

Trey Price, an AgCenter plant pathologist at the Macon Ridge Research Station in Winnsboro, said there is little growers can do to prevent scab.

"The best thing to do is plant resistant varieties," Price said. "Growers typically will spray at flowering as another layer of protection, but it is not going to rid the field of disease, especially if disease pressure is high."

Another factor to consider for growers considering planting wheat is what crop preceded it.

"We are growing a lot of corn in the northeast, and corn is also a host for the pathogen that helps spread the disease," Price said. "Because of the large corn acres, disease is going to be an annual issue for wheat."

Fortunately for corn growers, disease pressure on corn has been light across the state. Like wheat, many farmers will put out a fungicide application when corn is near tasseling, but they may not be getting a return on that application because it may not be necessary.

"If a producer is clean at the R2 stage, they should be OK at that point," Price said. **Craig Gautreaux**

LSU scientists test resistant varieties, cover crops for nematode management

LSU AgCenter nematologist Tristan Watson is working on projects aimed at helping soybean farmers manage various species of nematodes — tiny roundworms that feed on plant roots, reducing yields.

Reniform nematode

Watson is evaluating soybean varieties for resistance to the reniform nematode, which he estimates is in 60% of Louisiana soybean fields, and hopes to make recommendations to growers soon.

"We have demonstrated that deploying host resistance can be an effective tool to reduce reniform nematode populations and improve yield," he said.

In 2024, the reniform nematode was responsible for a 1.95% reduction in Louisiana soybean yields. This amounted to a loss of more than 1.1 million bushels and $11.75 million.

Despite these significant impacts, it can be challenging to diagnose infestations of the reniform nematode, Watson said. It reduces the size of soybean root systems but does not cause obvious root deformation like other nematode species.

One calling card of the reniform nematode is high variability in plant height, giving rows a wave-like appearance. It tends to be broadly dispersed in infested fields — another distinction from other nematodes, which usually have a patchier distribution.

"Although the overall damage on an individual plant is only moderate under severe infestations, the cumulative impact of reniform nematode feeding across an entire field results in serious yield losses for Louisiana growers," Watson said.

In a related project, doctoral student Lucy Kiarie is trying to identify genes associated with host resistance and characterizing their resistance mechanisms.

Southern root-knot nematode

The Southern root-knot nematode represents another major threat to Louisiana soybean production.

Watson believes a multipronged approach is necessary to manage this nematode. He's studying whether winter cover crops can suppress its activity. He also is evaluating new, in-furrow nematicides. And, with help from AgCenter soybean specialist David Moseley, he has set up trials across Louisiana to evaluate resistant varieties.

The Southern root-knot nematode is present in about 20% of soybean fields in the state, Watson said. It causes root galling, stunts plants and can even lead to plant death.

The nematode diminished Louisiana soybean yields by 2%, or 1.2 million bushels, in 2024. That translates to an economic loss of about $12 million.

Iris Aguilar, a doctoral student, is playing a key role in this project.

Nematode yield losses, damage thresholds

Watson is working to put a dollar amount on yield losses that result from nematode damage. He has established plots in soybean and corn fields statewide where he'll monitor yields and nematode damage.

"This is critical to direct research priorities and aid in leveraging federal and private investment in development of effective management tactics," he said.

In addition, Watson also is recalibrating the damage thresholds used by the AgCenter Nematode Advisory Service to accurately diagnose nematode issues in Louisiana. **Olivia McClure**

A reniform nematode-infested soybean field in Tensas Parish showing stunted plant growth associated with nematode feeding. Photo provided by Tristan Watson

2025 Soybean and Grain Research and Promotion Board-funded projects

Agricultural Economics and Agribusiness.....$33,000

Economic Analysis of Farm Programs and Commodity Costs and Returns for Soybean and Grain Production in Louisiana, *Michael Deliberto*

Engaging Farmers in Climate-Smart Agriculture Through Outreach and Education, *Naveen Adusumilli*

Biological and Agricultural Engineering.....$58,829

Improving Automatic Soybean Quality Analysis, *Kevin Hoffseth*

Lignin-Based Nanoparticles to Protect Photolabile Pesticides for Soybean Treatment, *Cristina Sabliov*

Communications.....$7,500

2025 Soybean and Grain Research and Promotion Annual Report and Web Portal, *Frankie Gould*

Dean Lee Research Station.....$358,137

Developing Soybean Disease Management Programs in Central and South Louisiana, *Boyd Padgett*

Developing Disease Management Strategies for Corn, Grain Sorghum and Small Grains in Central and South Louisiana, *Boyd Padgett*

Determining the Critical Period of Weed Control in Soybean, *Daniel Stephenson*

Soybean On-Farm Demonstration Program, *David Moseley*

Louisiana Soybean Production Agronomic Best Management Practices: Decrease Risk and Increase Profits, *David Moseley*

Development of Sprayer and Remote Sensing Drone Technologies for Soybean, Corn, Wheat and Sorghum Crops, *Randy Price*

Refining Insect Pest Management Approaches for Field Corn in Central Louisiana, *James Villegas*

Enhancing Management Strategies for Key Insect Pests Affecting Soybeans in Central Louisiana, *James Villegas*

Management Strategies for Sugarcane Aphids and Headworm Complex in Grain Sorghum, *James Villegas*

Strategies to Optimize Soybean Growth and Yield in Louisiana: A Biological and Nutritional Study, *Saulo Castro*

Evaluation of Weed Management Practices in Louisiana Soybean, *Daniel Stephenson*

Weed Control Strategies in Louisiana Feed Grains, *Daniel Stephenson*

Entomology.....$154,248

New Tools and Tactics for Soybean IPM, *Jeffrey Davis*

Artificial Intelligence for Stink Bug Detection in Precision Pest Management, *Ivan Grijalva and Michael Stout*

Detecting Insect-Damaged Soybeans with Artificial Intelligence Solutions, *Ivan Grijalva and Michael Stout*

Bob R. Jones-Idlewild Research Station.....$40,000

Environmental Testing of Toxicant to Control Feral Swine in Soybean Fields, *Glen Gentry*

Macon Ridge Research Station.....$316,603

Corn On-Farm Demonstration Program, *Shelly Kerns*

Enhancing Soybean Insect Pest Management Strategies for Northeast Louisiana, *Dawson Kerns*

Integrated Corn Disease Management, *Trey Price*

Integrated Wheat Disease Management, *Trey Price*

Integrated Soybean Disease Management, *Trey Price*

Insecticide Application Strategies for Stink Bugs in Soybean, *Dawson Kerns*

Monitoring and Management of Stink Bugs on Non-Crop Hosts and Soybean, *Dawson Kerns*

Evaluation of NDVI Use for Early Detection of Disease and Prescriptive Management of Fields Using Spray Drones, *Shelly Kerns*

Northeast Research Station.....$60,000

Soybean Weed Management Research in Northeast Louisiana, *Donnie Miller*

Plant Pathology and Crop Physiology.....$328,272

The Potential of Adjuvants and Nanoparticles in Enhancing the Effectiveness of dsRNA in Managing Soybean Fungal Diseases, *Zhi-Yuan Chen*

A Genetic and Effector-Based Approach to Manage Fungal Diseases in Soybean, *Jonathan Richards*

Screening of Soybean Core Block Varieties for Resistance to Aerial Blight, *Sara Thomas-Sharma*

Integrated Approaches to Southern Root-Knot Nematode Management in Soybean, *Tristan Watson*

Characterization and Validation of Reniform Nematode Resistance in Soybean, *Tristan Watson*

Integrating Developments in Taproot Decline Pathology to Minimize Yield Loss, *Vinson Doyle*

Characterizing the Environmental Factors and Host Genetics That Influence CLB Disease Severity to Improve Epidemiological Modeling and Cultivar Selection, *Vinson Doyle*

Implement Plant-Derived Natural Molecules to Manage Important Fungal Diseases in Soybeans, *Chien-Yu Huang*

Identifying Weather Predictors Associated with Airborne Spores and Disease Outbreak in Cercospora Leaf Blight of Soybean, *Sara Thomas-Sharma*

Nematode Associated Yield Loss and Damage Thresholds in Soybean and Grain Crops, *Tristan Watson*

School of Plant, Environmental and Soil Sciences.....$235,310

Small Grain Breeding, Variety Development and Testing, *Stephen Harrison and Noah DeWitt*

Improving Nutrient Availability and Uptake Efficiency in Field Crops Production using Biostimulant Technology, *Brenda Tubaña*

Soil Nutrient and Fertilization Research for Sustainable Grain and Soybean Production in Louisiana, *Brenda Tubaña*

Integrated Weed Management Solutions in the Assence of Dicamba for Mitigating Herbicide Resistance in Louisiana Soybean and Grain Crops, *Prashant Jha*

Total Funding for 2025: $1,591,889

AgCenter researchers look to improve genetic resistance for soybean varieties

While Jonathan Richards' team in the LSU AgCenter Department of Plant Pathology and Crop Physiology focus on all kinds of diseases impacting crops in Louisiana, recently there's been one pathogen that has taken up much of their attention.

"I'd say the biggest focus in our last year's work is looking at differences in gene expression between different soybean varieties in response to infection by *Cercospora sojina*, which causes frogeye leaf spot," Richards said.

Richards, an associate professor, has been working on ways to capitalize on genetic and molecular variation in soybean plants to develop resistance to dangerous pathogens, like *Cercospora sojina* and *Xylaria necrophora*, the fungus that causes taproot decline.

Richards has been researching which genes are activated in soybean varieties that are resistant to these fungi and which ones are not in varieties that are highly susceptible. This will shed light on which genes could have a beneficial effect by being deployed in new varieties.

In the past year, Richards has also begun researching how applying flavonoids onto plants may change their ability to resist infection after studies showed that older leaves are less susceptible to infection than younger leaves.

The older leaves showed an increase in gene expression of several molecular pathways, including those that produce different flavonoids, and so Richards began experimenting with the application of flavonoids onto younger leaves with the hopes of inducing resistance. From these experiments there was not a clear indication that the application of flavonoids was helpful, but scientists are still experimenting with different application methods to see if that changes their effectiveness.

They are also going to run more experiments around the differences in gene expression between younger and older leaves to find out what genes may be impacting this change in resistance in the older leaves.

Taproot decline, caused by *Xylaria necrophora,* is also an emerging threat of soybeans. Richards plans on using similar genetic and molecular methodologies to investigate resistance to this disease, too.

"The Doyle lab has done a lot of work on developing the screening methods that we can use to identify resistant or susceptible soybean varieties to taproot decline," Richards said, referring to plant pathologist Vinson Doyle. "That project is still ongoing, and we're hopeful that we'll be able to apply some of those methods to understand what the differences are in terms of resistance to taproot decline among different soybean varieties and eventually pinpoint specific resistance genes."

More recently, Richards and his team have begun researching which genes are conserved among soybean fungal pathogens and predicting their virulence functions. Their idea is that if they can find and silence those genes, they may be able to develop a strategy that will reduce infections greatly.

"The idea here is that we might have a very conserved gene that's present in different species of fungi that all can infect soybean," Richards said. "So then if we can target the same gene as part of a novel management practice, that might be able to help control several different diseases at once. We have identified several promising candidates and are now close to testing their functions" **Anthony Bailey**

‘Hidden hunger,’ potassium, deer repellent studies accompany soybean variety trials

Soybean continues to be important to many Louisiana farmers, with approximately one million acres dedicated to the crop. The LSU AgCenter uses official variety trials (OVTs) and on-farm demonstrations to provide research that can help growers increase crop efficiency and maximize yield.

In 2024-2025, official variety trials at seven AgCenter research stations included small plot tests for almost 100 varieties. For the core block on-farm variety test program, 21 soybean varieties were entered by seed companies. This test featured 25 demonstrations conducted in 11 different parishes.

“For the maturity group 4.5 to 4.9 core block, the top three yielding varieties had an above average yield for six to seven locations out of eight,” said LSU AgCenter soybean specialist David Moseley. “This indicates the varieties had good yield potential and were stable across locations.”

The on-farm demonstrations were divided by three maturity group sections. Data from these trials were published in the LSU AgCenter 2025 Soybean Variety Yields and Production Practices publication.

“The soybean varieties tend to change year after year, so it’s important to check the new yield book every year to see how the new varieties are performing,” said Moseley.

AgCenter researchers also conducted root-knot nematode resistance screening trials (13 varieties planted in two parishes) where nine varieties yielded between 8-24 bushels higher than the root-knot nematode-susceptible check variety.

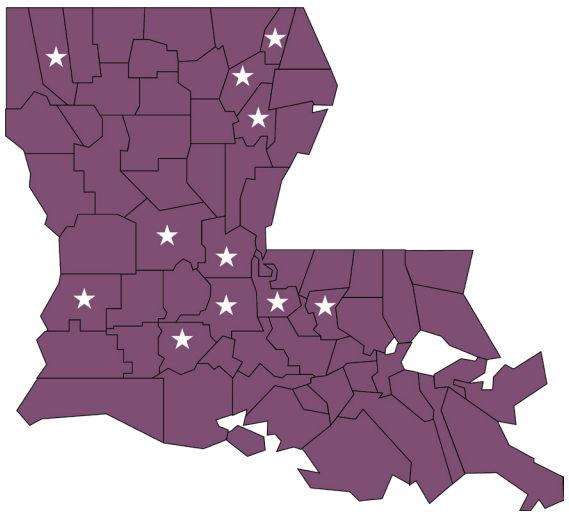
In addition, a conventional soybean variety demonstration was conducted in two parishes.

On-farm soil fertility rate and timing trials included:

- Potassium (Beauregard Parish)
- Potassium, phosphorous and sulfur (Franklin Parish)
- Phosphorus, sulfur and manganese (Catahoula Parish)
- Phosphorous (Natchitoches Parish)

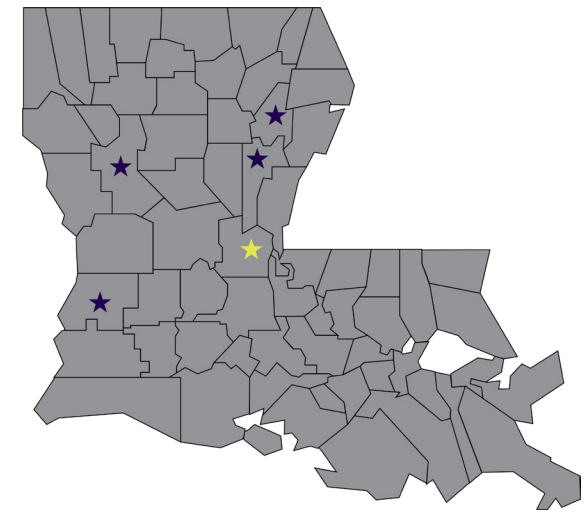
AgCenter researchers are also looking at a problem called “hidden hunger,” caused by a deficiency in potassium. Healthy looking leaves can fool farmers into believing all is okay.

Continued on Page 8



Soybean core block locations

Acadia, Avoyelles, Beauregard, Bossier, East Baton Rouge, Franklin, Pointe Coupee, Rapides, Richland, St. Landry, West Carroll



Fertility trial locations

Beauregard, Catahoula, Franklin, Natchitoches

Deer repellent trial

Avoyelles

For more than 100 years, on-farm demonstrations have been the bread and butter of ag research

Shelly Pate Kerns, the LSU AgCenter corn, grain sorghum and cotton specialist, is continuing a tradition that many agricultural scientists across Louisiana and the country have done since the turn of the 20th century — the on-farm demonstration plot. Nearly all agronomic crops have these vital research tools, and farmers across the country have greatly benefited from them.

For Kerns, this is her first full year to oversee the corn core block trials. When she started with the AgCenter in 2024, the sites had been chosen and planted prior to her arrival. This year, she has 13 sites across the state representing various soil types, different seed companies and each farmer’s own unique cultivation techniques.

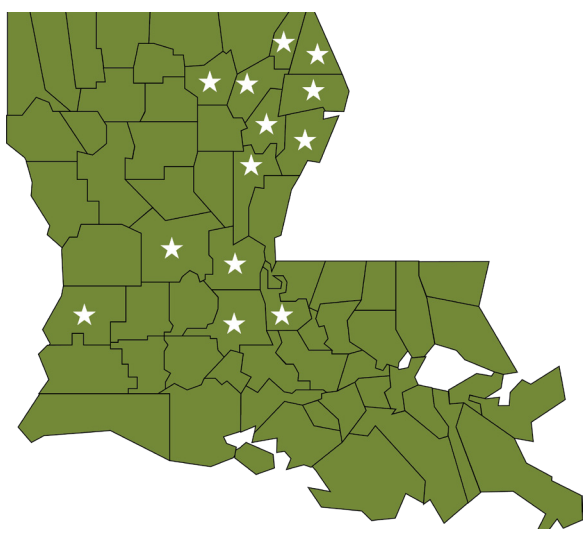
“These demonstrations are data driven,” Kerns said. “The seed companies take this data and are able to see how well their hybrids perform across many different environments.”

The farmers also have incentives. According to Kerns, farmers can see for themselves the many different hybrids. “For new farmers, seeing them up close can be extremely beneficial,” she said.

Kerns said many of the participants are graduates of LSU and feel this is one way they can give back to the university.

There are several data points collected throughout the studies. Of course, yield is always the No. 1 factor to consider. But there are several others that provide important information to growers, scientists and seed companies.

Irrigated versus nonirrigated is examined. Investing in an irrigation system is a big-ticket item for producers, and if a hybrid performs well without irrigation, a farmer may be able to avoid a costly input item.



Corn core block locations

Avoyelles, Beauregard, Catahoula, East Carroll, Franklin, Madison, Ouachita, Pointe Coupee, Rapides, Richland, St. Landry, Tensas, West Carroll.

Another major input cost is fertilizer. Not all demonstrations will use the same rates and timing of applications. These differences may provide clues that help the hybrids perform their best.

“Another big factor is soil types,” Kerns said. “Louisiana has so many different soil types, and they can vary from one site to another. Seeing which ones perform best in specific soil types is invaluable.”

While Kerns is new to the program, she is not the only newbie. “We have six new agriculture and natural resource agents in the northeast part of the state,” Kerns said. “I really enjoy walking the fields with them, and in many ways, learning right alongside them.”

Many farmers volunteer on an annual basis to be a site. Seeing how each hybrid performs on their farms gives them information they could not get elsewhere. More importantly, they are tested using the techniques farmers use across their operations.

David Smith, a Beauregard Parish farmer, has held demonstration plots on his farm for more than 25 years. He has participated in demo plots for corn, soybean, milo and wheat. In 2025, he has a corn hybrid trial, a fertility study with soybean and a fungicide trial with soybean.

A primary reason for his willingness to participate is the knowledge he gains from the demonstrations and how it relates specifically to his farm.

“Where I farm, it is really helpful to see how these hybrids perform on the land I actually farm,” Smith said. “It is very applicable to me.”

He also enjoys working with the different individuals associated with each crop and the agents who are involved with the program.

“I feel that getting to know these people helps me when I start to experience a problem on my farm,” Smith said. “I know who to contact, and I believe they are willing to work with me to help overcome the problem.”

Since 2015, a total of 136 corn hybrids have been tested statewide, providing crucial information to growers across the state. Kerns said some farmers have kept some of their older equipment operational so that they can continue to participate in the on-farm demonstrations. She believes this speaks to the value of the research.

A publication entitled Corn Hybrids for Grain is published annually with data from the plots and can be found on the AgCenter website. **Craig Gautreaux**

Several insect pest management tools tested on soybeans

Insect pests cost Louisiana soybean producers more than $44 million in lost revenue, according to LSU AgCenter researchers.

A team of AgCenter entomologists continually researches means of controlling these pests to cut spending on insect-related inputs and crop losses.

Each year, the Louisiana Soybean and Grain Research and Promotion Board funds several insect pest management studies.

"We are trying to find solutions that are economical but also science-based," said LSU AgCenter entomologist James Villegas. "These are practical solutions for our producers to combat their insect pest issues and try to provide different management tools."

Redbanded stink bug adult. Photo by James Villegas

Insecticide studies

Entomologist Jeff Davis is embarking on a three-year study to evaluate untested commercial insecticides for redbanded stink bug control, and he will work with Daniel Swale, a former AgCenter scientist now at the University of Florida, to design and develop new insecticide options to combat stink bugs.

Stink bugs are highly tolerant of insecticides, and most insecticides that fight them are broad spectrum and affect many insects, Davis said. With the expected ban of the insecticide acephate for agricultural use by the Environmental Protection Agency, additional insecticides labeled for use in soybeans will be needed. Davis, Villegas and entomologist Dawson Kerns are studying other options.

"Reassessing all the insecticides, new labels are going to be had," Davis said. "They might be removing some, like acephate. One of the first things we're doing is trying to look for new products that don't hurt bees because we want to keep all our pollinators around."

Davis has three products to test from the class of insecticides known as N-arylamides and one product from a group of chemicals called pyrones.

In another study, Villegas is evaluating commercial and experimental insecticides against redbanded stink bugs and soybean loopers. Previous trials found that tank mixes of bifenthrin with acephate or clothianidin provided the best control and longer residual effects, and acephate or bifenthrin alone provided good control depending on the infestation level.

"Doing all these efficacy trials in the field allows us to see what products continuously work against these pests," Villegas said. "These products vary in modes of action but also, from an economic standpoint, they vary in price."

Plinazolin — the trade name of Isocycloseram — is expected to be registered soon and has provided excellent control with long residual effects, Villegas' team found.

"It has a very long residual, so we're looking at when you can apply that to take advantage of that residual control and maybe you can reduce the total number of applications," said Kerns, who is also working with the insecticide.

Insecticidal seed treatment studies

Villegas and his team are assessing the effectiveness of commercially available and experimental insecticidal seed treatments (ISTs) in conventional production systems and double-cropped wheat and soybean production systems.

Neonicotinoid ISTs, such as Cruiser, Gaucho and Poncho, have been accepted in soybean production and have increased yields in the majority of field trials. Producers rely on these seed treatments more often when planting in early spring, Villegas said. Small-field plot trials conducted at the AgCenter Dean Lee and Macon Ridge research stations will collect data on insect infestation levels, seedling vigor and plant stands.

Kerns is also studying commercial and experimental ISTs to enhance soybean insect management strategies for northeastern Louisiana. At the Macon Ridge station, Kerns will test whether producers will see the same value in the seed treatments when planting later in the season.

"The soil temperature is going to be warmer, the seedlings will be more vigorous and a lot of times they can outgrow the damage they receive," Kerns said.

Spray drone research

With AgCenter precision agriculture expert Randy Price, Villegas and his team also will collect data on the effectiveness of sprayer drones in soybean insect pest management. Previous small-plot trials found that sprayer nozzle types had no effect on redbanded stink bug control, and spraying at 2 to 5 gallons per acre provided better control. Also, the optimal spraying heights were found to be between 10 and 20 feet.

"What we've seen so far is there's really not much of a difference whether you're using a drone or sprayer rig," Villegas said.

This year they will expand the trials to larger fields that reflect the size commercial producers would use.

Additional trials

Davis will also test whether the harvest aid paraquat increases stink bug feeding. Paraquat mobilizes carbohydrates into simpler sugars, Davis said, and it may attract more insects.

"One of the things we are interested in is when our growers go out and put out paraquat, are they then enhancing these pods to be more attractive to stink bugs?" Davis said.

He will also assess the effects of a sublethal dose of the diamide insecticide Vantacor on redbanded stink bug reproduction and survival. Research from Brazil has shown that another species of stink bug survived and produced more eggs after a sublethal dose of the insecticide. Davis aims to reproduce the research on redbanded stink bugs in greenhouse and field settings. **Kyle Peveto**

Louisiana Soybean Insect Pests Identification Guide

Earlier this year, Villegas published the Louisiana Soybean Insect Pests Identification Guide with entomologist Jeff Davis and extension associate Daniel Barbosa. This 32-page guide was funded in part by the Louisiana Soybean and Grain Research and Promotion Board and is available at https://www.lsuagcenter.com/articles/page1747767820544.

Continued from Page 7

"In cases of medium potassium deficiency there can be a lack of symptoms, but the plant may still be deficient enough in potassium to lose yield," said Moseley. "The purpose of this on-farm screening effort is to show people that if your soil test is anywhere near the threshold for deficiency, you need to look at tissue samples, not just an eye test."

AgCenter researchers are also analyzing randomized potassium (K) application trials to find the most economical rate of potassium application in K-deficient soils, and if in-season applications can capture full yield potential.

It's part of trials conducted by several universities and funded by a United Soybean Board grant. The national research group is called Science for Success.

"Can you apply in-season and still get the same yield as you would if you applied potassium at planting?" Moseley asked. "Data shows that you can and we're just trying to verify that data from another state."

"We're looking at data for the same thing across the nation, so that gives even more power to the results," Moseley said.

"For on-farm trials, we have variety trials and fertility trials based on the soil test in different parishes," Moseley said. "Another one that everyone seems to be excited about is a deer repellent trial in Avoyelles Parish."

Deer can destroy a soybean field in a couple days. The follow-up tests from 2024, conducted in Avoyelles Parish (in collaboration with other universities), include numerous repellent products — for instance, ones with salts, fatty acids or animal blood — that deer can smell and that taste bad to them.

Planting date trials were another important aspect of soybean research. One study looks at data that points to when plants may flower, as some plants seem to flower earlier than expected.

"We published an article in Agronomy Journal that helps define optimum planting date windows for the northeast, central and southwest regions of Louisiana," Moseley said. "Planting at these times can help farmers achieve 99% yield potential, depending upon the region and maturity group."

Another study looked at planting dates and population of soybean plants. In the past, farmers worried if they had less than 120,000 plants per acre there would be a yield decrease, because of too much space between plants, according to Moseley.

"But research year after year shows if you finish with at least 75,000 plants you can still achieve full yield depending on the planting date," he said.

Moseley and his team of researchers are also looking at different potential harvest aids to complement the commonly used paraquat. "Results from last year help confirm previous LSU AgCenter data that harvest aids did not decrease seed quality or yield when applied at the appropriate growth stage," Moseley said. **Randy LaBauve**

Entomologist seeks solutions for insect pests in grain sorghum and field corn

LSU AgCenter entomologist James Villegas is investigating insect management approaches in field corn in central Louisiana and management strategies for sugarcane aphids and the headworm complex in grain sorghum.

Field corn faces several threats from insects, Villegas said. Insecticide seed treatments and caterpillar-resistant corn hybrids that express *Bacillus thuringiensis* (Bt) proteins are effective at controlling lepidopteran pests. In a continuing study, Villegas and his team are assessing registered and new insecticidal seed treatments against early season pests, such as cutworms, wireworms, seed corn maggots and sugarcane beetles.

"The idea is to look at whether seed treatments are necessary for corn, and for the past couple of years, we have seen an increase of wireworm infestations and sugarcane beetle as well," Villegas said. "It used to be that we didn't see the value of seed treatments, but in those instances, that is really where seed treatments could have helped very well."

Villegas will also evaluate Bt corn hybrids that are pyramided, which means they combine two or more Bt traits that combat the same pest and compare the performance with non-Bt corn

"We have seen really good non-Bt corn that are yielding pretty similar to Bt hybrids, and talking to our extension agents, some producers in the northeast are actually planting a lot more non-Bt corn," Villegas said. "Right now, the economic side is a little hard. When you're planting, when you put more technology in the seed, the more expensive seeds are."

Grain sorghum producers have regularly called Villegas with problems related to sugarcane aphids and seven lepidopteran species, including the fall armyworm, sorghum webworm and corn earworm.

Products in the marketplace, such as Sivanto and Transform, remain effective against sugarcane aphids, Villegas said, and products containing chlorantraniliprole still work against the headworm complex pests. This year Villegas has concentrated on reproducing conditions in fields to study these pests.

Villegas advises grain sorghum producers to consider seed treatments.

"For sugarcane aphids, seed treatments are necessary if you have historically high sugarcane aphids," he said. **Kyle Peveto**

Corn earworm. Photo by James Villegas

Corn wireworm. Photo by James Villegas

Three new hires to advance pest, disease and crop-yield solutions at LSU AgCenter

Grijaiva

Ivan Grijalva

Grijalva is an assistant professor of precision pest management in the Department of Entomology. He specializes in using machine learning, geographic information systems (GIS) and remote sensing technologies to detect insects, weeds and diseases. He has published research on using machine learning to automate object detection — a significant contribution to the advancement of automation across diverse disciplines. Grijalva earned his doctorate in entomology at Kansas State University, where he studied precision pest management and digital agriculture. He later worked as a postdoctoral fellow at K-State, developing machine learning-based computer vision models and digital tools to automatically detect pests in field crops using remote sensors. His appointment is 80% research and 20% teaching.

Huang

Chien-Yu Huang

Huang, an assistant professor in the Department of Plant Pathology and Crop Physiology, hopes to delineate plant defense mechanisms and develop effective, environmentally friendly strategies for crop disease management and improved yields. Huang is exploring the master regulators of defense response against important soybean fungal diseases, including Cercospora leaf blight and aerial blight. She also is developing new tools for managing fungal and bacterial diseases with plant-derived antimicrobial molecules. Huang's doctorate in plant biology is from the University of California, Riverside. She studied the structure, function and evolution of lipid droplets in primitive and advanced plants and engineered lipid droplets to enhance plant lipid production. She continued her work there as a postdoctoral research associate, examining plants' disease resistance responses. In addition to her research responsibilities, Huang teaches a graduate-level course on plant molecular biology.

Castro

Saulo Castro

Castro is an assistant professor focusing on agronomic issues in soybeans and sugarcane. His multifaceted research program includes work on biostimulants and biological products. He wants to see what effects they have on plant tolerance to abiotic stress, root growth, nutrient availability and nitrogen fixation. A native of Brazil, Castro grew up in a farming family, which sparked a passion for agriculture. "Therefore, my scientific career was and continues to be dedicated to finding solutions to farmers' problems," he said. Castro holds a doctorate in agronomy from the Luiz de Queiroz College of Agriculture at the University of São Paulo, where he studied foliar nitrogen applications in sugarcane. He also has worked as a postdoctoral fellow at the University of Copenhagen. Castro is domiciled at the Dean Lee Research and Extension Center, and he has additional responsibilities at the Iberia Research Station. His appointment is 75% research and 25% extension.

Research targets higher soybean yields with biostimulants

Left: *Soybean trials in the clay soil at the Dean Lee Research and Extension Station near Alexandria were planted using seeds treated or sprayed in-furrow with microbial biostimulants designed to help improve root growth and yield. Photo by Saulo Castro* ***Right:*** *Soybean seeds are planted at the Dean Lee Research and Extension Station. As the seeds go into the ground, they are sprayed with microbial biostimulants. This is part of Saulo Castro's research aimed at increasing soybean yields. Photo by Saulo Castro*

Saulo Castro, a sugarcane and soybean agronomist with the LSU AgCenter, is leading a new research initiative focused on enhancing soybean yields through the use of microbial biostimulants. Originally from Brazil, Castro brings a wealth of experience in biological products, soil science, and plant nutrition and physiology, and he's applying that expertise to Louisiana's unique agricultural landscape.

Since joining the AgCenter in September, Castro has been investigating the potential of beneficial microorganisms — specifically *Bradyrhizobium* and *Azospirillum* — to improve soybean productivity. These microbes, commonly used in Brazil, are largely underused in Louisiana, despite their potential to increase yields and reduce reliance on synthetic fertilizers.

"Most producers here aren't using microorganisms in their systems," Castro said. "But they're relatively inexpensive and can offer multiple benefits not just to the plant, but also to the soil and the environment."

One of the key innovations Castro is testing is the method of microbial application. Castro said while seed treatments are common, they often expose microbes to high temperatures and chemical compounds that reduce their viability. He is looking at an in-furrow application method, where microbes are sprayed directly onto the seed during planting. This approach, widely adopted in Brazil, was shown to increase microbial viability by 50%–75% and boost yields by 25%–35%.

To evaluate this method in Louisiana, Castro has established four multi-year trials across two AgCenter research stations — Dean Lee and Iberia. These trials span different soil types (clay and silt loam) and soybean maturity groups (4.0 and 5.4), allowing researchers to assess how soil and genotype influence microbial performance.

"We're trying to build a microbial colony in the soil over time," Castro explained. "You might not see the full benefits in the first year, but with repeated applications, the microbes can establish and begin to significantly impact plant health and yield."

The research also explores the effects of combining *Bradyrhizobium*, which is already present in Louisiana soils, with *Azospirillum,* a microbe originally isolated in Brazil. Together, these organisms can enhance root growth, increase nodule formation and improve nitrogen fixation, all key factors in plant development and yield.

Another important aspect of Castro's work is the role of nickel, a micronutrient for plants, which is essential for the enzymes involved in nitrogen metabolism.

Castro said nickel was only recognized as a plant micronutrient in 2005, and recent studies in Brazil and China have shown that nickel supplementation can improve nodulation and nitrogen use efficiency.

Castro aims to determine whether Louisiana soils exhibit nickel deficiencies and, if so, what application rates would be most effective.

"Nickel is critical for enzymes like urease, which help convert nitrogen into forms the plant can use," Castro said. "Too little nickel can limit nitrogen fixation, while too much can be toxic. It's a delicate balance."

Ultimately, Castro's research is focused on improving belowground plant health — root development, nodulation and microbial interactions — with the goal of increasing yields and reducing the need for synthetic fertilizers.

"This is all about building a more sustainable system," he said. "If we can improve root growth and nutrient uptake, we can help farmers get better yields while using fewer inputs."

The trials will continue for at least three years, with researchers monitoring both immediate and long-term effects on soybeans. **Tobie Blanchard**

Lignin nanoparticles show promise in prolonging pesticide effectiveness on soybeans

A study investigating how lignin-based nanoparticles can keep pesticides from degrading in sunlight is continuing in Cristina Sabliov's lab. Sabliov, a professor in the Department of Biological and Agricultural Engineering, has been conducting research on lignin-based nanoparticles for several years.

This year her research focuses on whether nanoparticles with entrapped fungicides can improve disease control, plant stands and yields.

"The goal is to take a natural agrochemical and entrap it in nanoparticles such that you can protect it from UV degradation with the help from lignin," Sabliov said.

The nanoparticles would help to keep the agrochemical effective longer, allowing soybean producers to spray their fields less often, saving costs and reducing environmental effects.

Sabliov has been working with the agrochemical azadirachtin. Entomology graduate student Celeste Mejia Gonzalez, working under the direction of entomologist Jeff Davis, is carrying on the research to see if the formulation works both in the lab and in the field.

This year, Gonzalez was using five different treatments on the soybean plants in the field in addition to the untreated control — lignin with just the polymer, poly(lactic-co-glycolic) acid or PLGA, lignin PLGA with neem oil, just neem oil, and the azadirachtin product, AzaMax.

"We spray the soybeans and collect soybean leaf tissues at the top of the plant and two center rows at four different times — zero days after treatment, two days after treatment, seven days after treatment and 14 days after treatment," Gonzalez said.

The leaves are brought into the lab and placed in petri dishes with soybean loopers. Gonzalez checks them for five days to see the feeding behavior and mortality of the loopers.

"We found that mortality declined over time in all treatments, but lignin-PLGA neem oil showed the highest and most consistent residual effect," Gonzalez said.

She also found that the pure neem oil had strong immediate toxicity, but lost efficacy rapidly and the AzaMax provided moderate stable control.

Sabliov said the study demonstrates that the nanoparticles are having their anticipated results — the agrochemical entrapped in the nanoparticle lasted longer in the field.

The research will also look at plant growth, plant stands and yields throughout the soybean growing season.

Also working on this research is biological and agricultural engineer Carlos Astete and plant pathologists Trey Price and Vinson Doyle. **Tobie Blanchard**

Can NDVI technology allow producers to get ahead on disease issues in corn?

With commodity prices depressed and the passage of a new farm bill lingering, farmers are having to sharpen their pencils with razor-like precision to remain economically viable. Simply put, they are looking to reduce input costs and protect their yield as much as possible.

Shelly Pate Kerns, LSU AgCenter corn specialist, is working on what she believes may be an answer to some of these issues. She is investigating whether Normalized Difference Vegetation Index technology can be used for early detection of diseases and developing a prescriptive management plan via the use of spray drones.

NDVI technology has proven to be useful as a pest management tool, and Kerns believes it has potential for monitoring and mapping foliar diseases.

"This is the first year of the study, which involves two on-farm sites in Franklin Parish," Kerns said. "Most farmers tend to spray a preventative fungicide at tassel, R1 or right before tassel, but growers sometimes do not get that return on investment because the whole field might not need an application and disease pressure varies year to year."

According to Kerns, when corn is close to entering the dent stage it is probably not economically feasible to treat disease symptoms unless disease pressure is extremely high.

Another problem incurred when fighting diseases is the physical constraints on a maturing cornfield. Later applications typically must be flown on because of the height of the corn, adding a cost to the application. Physical constraints also limit the ability to scout the whole field.

Here is where NDVI and drones may become part of the answer.

"Using NDVI technology will allow you to get a more complete field view because of the difficulty scouting a tasseled, tall corn field," Kerns said. "Drone services could provide both scouting and spraying options, especially if the disease is limited to a very small area."

Kerns said farmers are showing more interest in using drones for scouting and spraying because of the difficulty of spraying cornfields. Some farmers are considering buying drones for both purposes. Farmers also have the option of hiring a drone service to perform these tasks.

In Kerns' study, she is using five different spray strategies to evaluate their economic impacts based on NDVI imaging. The strategies are:

1) An automatic spraying of the entire field at tasseling
2) A threshold treatment, meaning spraying the entire field when disease severity has reached the recommended level to warrant a treatment
3) An aggressive fungicide application spraying entire field at first sign of disease
4) An aggressive "hot spot" plan treating only those areas when the disease appears
5) An aggressive threshold treating only the hot spots as shown by NDVI that have reached the recommended level for treatment

The corn trials will be harvested with yields being measured, and disease ratings and number of fungicide treatments will be recorded. An economic analysis will be performed among each of the spray strategies to determine if fungicide cost and yield associated with NDVI prescriptive sprays had any economic benefits.

She also will be able to do a cost analysis of a spray drone application versus an aerial or spray rig fungicide application.

While there are some encouraging signs during the first year of the study, Kerns is quick to admit she has found some issues regarding using NDVI technology.

"Curvularia can be harder to pick up early with NDVI because the lesions are small," Kerns said of one type of fungus. "Sometimes it will not be noticed until lesions overtake the leaves."

Kerns said that northern corn leaf blight would be more likely to be picked up by NDVI because of the larger lesions associated with it.

"Another use for NDVI technology could be providing a whole-field view of any possible fertility issues that could be missed during scouting," Kerns said. "If the issue is isolated then it could be possible to use a drone to help alleviate the issue."

As with any research project in agriculture, some variables are beyond controlling for.

"Late-season disease development and small lesion size at first appearance led to some applications not being triggered," Kerns said. **Craig Gautreaux**

Unraveling Cercospora leaf blight: LSU AgCenter researchers target fungus

Cercospora leaf blight (CLB) continues to challenge soybean growers across the southern U.S., but researchers at the LSU AgCenter are making strides in understanding and managing this complex disease.

Plant pathologists Vinson Doyle and Sara Thomas-Sharma are leading efforts to identify the pathogens responsible, track their spread and develop more effective control strategies.

Doyle, who has studied CLB since 2014, explained that early assumptions about the disease's cause were incomplete.

"We assumed that it was a single species, *Cercospora kikuchii*," Doyle said. "What my research has turned up is that there are actually many different species of Cercospora that cause the disease Cercospora leaf blight."

This discovery has reshaped how researchers approach the disease. Doyle said there are different fungi that cause the same set of symptoms, and it isn't easy to distinguish just by looking at the plant or the symptoms.

His team has since focused on identifying these species and understanding their biology.

"We started doing some studies to try to understand whether the pathogens that cause the disease could be found on other host plants and how they might be transmitted," he said.

One major breakthrough came with the development of reliable inoculation protocols.

"We were able to generate spores in vitro and do the inoculations," Doyle said. "Now we can finally start to understand or identify resistant germplasm."

Thomas-Sharma's work complements Doyle's by focusing on the timing and environmental conditions that influence disease outbreaks.

"We have spore trappings that we do on a regular basis which we then analyze to see when we get peaks of the spores of the pathogen," she said. "If we can try to predict when the spores might be in the air, we could potentially target our fungicide applications."

Traditionally, fungicides are applied based on plant growth stages, but Thomas-Sharma's research suggests a more precise approach. If fungicides can be applied before a predicted spore peak, the crop may be better protected.

Spore traps have been deployed at three AgCenter research stations — Macon Ridge, Dean Lee and Doyle Chambers Central Station.

She noted that the traps pick up *Cercospora flagellaris* in the highest numbers and most frequently during the season. Other species like *Cercospora sigesbeckiae* and *Cercospora kikuchii* appear less frequently and in lower numbers.

Despite these advances, challenges remain with fungicide efficacy and whether high levels of spores will mean high levels of disease in the field.

Soybean leaves symptomatic of Cercospora leaf blight in a soybean field at the LSU AgCenter Macon Ridge Research Station in Winnsboro. Photo by Sara Thomas-Sharma

To address this, the team is moving into growth chamber studies.

"We want to confirm that if there is a known source of spores, the spore traps are picking it up, and if you put healthy plants there, will it get diseased if you gave the right conditions?" she said.

Doyle emphasized the importance of these controlled studies.

"We can infect leaves that are present and as the plant continues to develop, and we can still find the fungus there," he said. "We can find the fungus in the seed later in development, which suggests that this fungus is just growing through the plant."

The new growth chamber facility on campus will allow researchers to simulate specific environmental conditions.

"If the humidity is 65%, do we get infection? Yes or no?" Doyle said. "Do we get more infection when humidity is 85%? If we maintain wetness on the leaves for 48 hours versus 24 hours, what is the impact?"

Both researchers agree that understanding the environmental triggers and identifying resistant varieties are key to long-term management. **Tobie Blanchard**

Controlling grain diseases remains top priority for LSU AgCenter researchers

Grain crops face any number of hurdles in achieving yields that growers desire. After all, you can't sell what you can't grow. When it comes to plant diseases, LSU AgCenter plant pathologists Boyd Padgett, Trey Price and Chien-Yu Huang are fighting to protect producers' bottom lines across the state.

When it comes to soybeans, Padgett stays busy evaluating varieties entered in AgCenter Official Variety Trials (OVTs) at the Dean Lee research and Extension Center in Alexandria where he is also the site coordinator of wheat OVTs. He also conducts fungicide evaluations on wheat at the Doyle Chambers Central Research Station in Baton Rouge.

Padgett and state soybean specialist David Moseley currently are conducting two trials at these locations: one is treated with fungicide and the other is not. This allows stakeholders to evaluate each variety for the effectiveness of the fungicide.

Diseases like Cercospora leaf blight have been a bane to soybean farmers in the Midsouth region of the United States for decades. Aerial blight and Fusarium head blight are also harmful diseases that can significantly lower yield.

Every year, Padgett evaluates fungicides — both commercial and experimental — for disease man-agement. He says that his current trials show promising results in managing Cercospora leaf blight and Fusarium head blight in soybeans with a combination of genetic resistance and fungicides, while aerial blight is being controlled by fungicides alone.

"I'm collecting disease data on corn through fungicide and hybrid trials," he said. "Right now, the soybean is very young, but we just put out a fungicide sorghum trial and are getting ready to assess disease in a hybrid trial."

Padgett said his wheat trials are completed and that he will soon begin planning for next year on that front.

Padgett's colleague Price conducts the majority of his work at the Macon Ridge Research Station near Winnsboro, where he studies corn diseases like rust, northern corn leaf blight and Curvularia leaf spot.

Price has three projects that the AgCenter is conducting. In addition to soybeans, he is also re-searching diseases affecting corn and wheat. For the corn project, Price is working in a continuous corn, no-till field, which he says increases the chances of naturally occurring foliar disease.

Compared to the 2023 growing season, which was plagued with drought, Price said last year's trials dealt with more precipitation, but there was minimal change on the disease front.

"We had more rain in 2024 but very little disease other than Curvularia leaf spot in corn," Price said. "I also had some frogeye and Cercospora leaf blight in soybean trials."

A recent AgCenter hire who works out of Baton Rouge, Huang is an assistant professor in the LSU Department of Plant Pathology and Crop Physiology. She specializes in delineating the plant response mechanism in plant-microbe interaction and developing effective and environmentally friendly strategies for crop disease management.

Aerial blight is commonly managed by fungicides. Crop rotations and genetic breeding have proven ineffective in controlling the disease. Photo provided by Boyd Padgett

Cercospora leaf blight is one of the most damaging diseases to soybeans, adversely affecting yields for producers. Photo provided by Boyd Padgett

Frogeye leaf spot starts as small dark spots on leaves before getting worse if untreated. Photo provided by Boyd Padgett

Her recent research has been in developing alternative tools using novel plant-derived natural molecules to manage Cercospora leaf blight and aerial blight. She has screened and tested naturally occurring plant-derived lipid inhibitors and peptides with antimicrobial activities and defense priming effects to suppress Cercospora leaf blight and aerial blight.

"In this first year of the project, I am focusing on determining the optimal dosage for efficacy tests with soybean plants," she said.

She and her colleague Sara Thomas-Sharma are planning to start small-scale field tests in the second year of the project in the growing season of 2026.
V. Todd Miller

Price receives Louisiana Soybean and Feed Grains Distinguished Professorship

LSU AgCenter plant pathologist Paul "Trey" Price is the recipient of the Louisiana Soybean and Feed Grains Research and Promotion Board Distinguished Professorship.

Price is an associate professor and soybean and feed grains disease specialist, located at the Macon Ridge Research Station. He is the first recipient of the professorship.

This distinguished professorship is awarded to a faculty member whose research program enhances the economic viability of Louisiana soybeans. This award supports the advancement of soybean research and the promotion and dissemination of consumer and industry information.

The Louisiana Soybean and Grain Research and Promotion Board established the endowment of $480,000 at LSU for the distinguished professorship in February of 2024. This grant qualifies for state matching funds from the Board of Regents.

"I'm very grateful for the support and hope to finish my career at the AgCenter one day," Price said. "My goal is to keep producers in business by saving them money by reducing disease issues in crops."

"The Louisiana Soybean and Feed Grains Research and Promotion Board has long looked to our LSU AgCenter faculty to carry out research projects that have advanced our yields and increased our sustainability," said Charles Cannatella, board chairman. "Now, by investing in this professorship, we are creating a legacy in perpetuity to allow that to carry forward for generations to come."
Frankie Gould

Trey Price, center, receiving the Professorship from Charles Cannatella, Soybean Board chair, left, and Matt Lee, LSU interim president. Photo by Olivia McClure

LSU AgCenter researchers refine procedures to limit taproot decline

LSU AgCenter plant pathologist Vinson Doyle has long been studying taproot decline, a disease primarily seen in Louisiana soybeans. Promising new findings from research led by his graduate assistants, Richard Rush and Geona Miles, and former research associate Marcos Urquia show that their research could be nearing a breakthrough.

Caused by the pathogen *Xylaria necrophora*, taproot decline interferes with root development, killing crops before they emerge and limiting yields of any surviving infected plants. Last year, Doyle and his team looked at refining inoculation methods to better understand the problem at hand, and now they are seeing the fruits of their labor through a clearer lens.

Refined inoculation procedures allow the researchers to better understand the mechanism by which the fungus infects plant roots and afford them the opportunity to evaluate control measures that may limit infection.

"While taproot decline does still affect emergence, by quantifying the reduction in root growth between inoculated and uninoculated plants, we are able to study the interactions between the pathogen and plant roots," Doyle said.

This is allowing the team to begin to understand the mechanism by which the fungus infects the roots, the genetic tools used by the pathogen to infect the roots, the genetic tools the plants used to resist the infection and to identify germplasm potentially resistant to *Xylaria necrophora*. These refined inoculation procedures are also allowing the team to evaluate control measures that may limit infection.

"We have long suspected that the pathogen infects the roots and is restricted to that organ, while the secondary metabolites that are toxic to the plant are transported from the roots to the leaves," Doyle said. "Richard's transcriptomic analyses of plants inoculated under controlled conditions and in the field have provided evidence that *Xylaria necrophora* is restricted to the root system of its hosts, as mRNA derived from the pathogen is not detected in leaf samples."

According to Doyle, further analyses of the data aim to characterize the defense mechanisms employed by both cotton and soybean plants as well as host plants that appear resistant to taproot decline.

The way that the team aims to determine this is by studying host reactions to the metabolites produced by *Xylaria necrophora*. These reactions are being tested by exposing roots to cell-free culture filtrates and extracting mRNA from them.

"This experiment aims to untangle the host response to metabolites from the response to fungal colonization of the roots," Rush said.

Doyle added that because taproot decline is likely disseminated on debris, the team has been searching for ways to limit the persistence of the disease on soybean debris and prevent infection of the root system.

Three bacterial isolates separated from debris have shown promising results in inhibiting the growth of *Xylaria necrophora*. Experimental inoculations of soybean roots treated with the bacterial isolates are being performed to validate the inhibiting effects as the pathogen interacts with its host.

"These bacteria present an opportunity to develop biocontrol agents against taproot decline, but there is a lot of research yet to be done in this area," Rush said. **V. Todd Miller**

Soybean taproot with black tissue of Xylaria necrophora. Fungal cultures are isolated from roots displaying this sign of Xylaria necrophora. Photo provided by Richard Rush

Soybean leaves exhibiting interveinal chlorosis and necrosis characteristic of taproot decline. Photo provided by Richard Rush

Soybean scanning and monitoring setup in Kevin Hoffseth's lab. Photo by Randy LaBauve

Using shortwave infrared imaging to discover hidden qualities of soybeans

LSU AgCenter researchers are fine-tuning a soybean quality assessment machine that uses shortwave infrared reflectance (SWIR) imaging to capture hidden information about the makeup of harvested soybeans.

For several years, LSU AgCenter engineer Kevin Hoffseth and his team of students have been working on an advanced computer vision-based approach to assist with grading bean quality. This complex imaging system is being designed mainly to determine color, texture, shape and any notable damage to the beans as well as oil and protein content

"We are trying to use this imaging to see what compounds are there," Hoffseth said. "In addition to what we see on the surface, we want to see deeper into the bulk of the soybean."

When harvested soybeans are brought to the silo for sale, they are given one of five different grades after inspection and evaluation, primarily based on visually assessed damage categories. Currently, for information on harvested soybean oil and protein content, soybean samples must be sent away for laboratory-based testing. These new AgCenter technologies offer tools to increase speed and reduce variance in evaluating damage in soybeans with comparison to oil and protein content from soybean to soybean.

There is minimal prior application of SWIR area scan imaging for the purpose of soybean evaluation, particularly at the oil and compound level. The SWIR approach is being integrated with existing AgCenter machinery to help standardize and automate the assessment process and reduce load on inspectors and technicians.

"We've developed these image processing algorithms for visible spectrum light, but we're figuring out how to apply these same algorithms to the infrared light," Hoffseth said.

"It's practical engineering development that we're doing this year," he said. "How can we get the same thing as spectroscopy? How do we go from conventional 2D images to where you get more spatial information?"

A crucial part of the project's future success will be the creation of a large database of soybean images used alongside big data applications.

"That becomes super valuable because there's this immediate need of building a database of our locally grown varieties in Louisiana and understanding the trends," said Hoffseth. "When people in the industry have these stored images, they can run analysis on them, keep them for future reference and then run them on future applications."

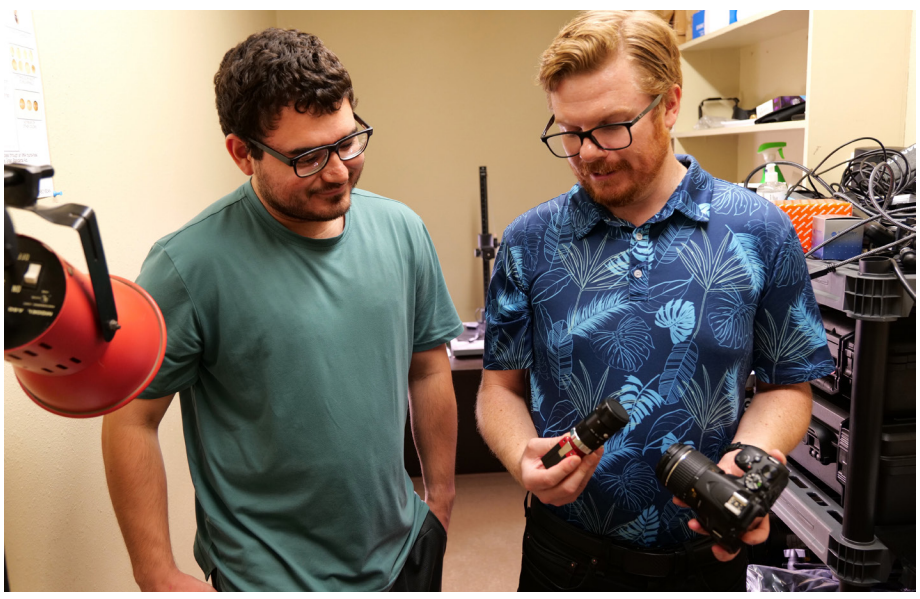
Another research application of this new technology is to analyze the impacts extreme weather has on the quality of soybeans. Hoffseth is working with a team of other scientists on a project that seeks to better understand the overall damage caused by these disruptive events.

"We're going to use our approach to determine what sort of grain is produced by plants under extreme weather," Hoffseth said. "So, as we continue to develop our technology, we can apply it to help out in other research areas like this."

Louisiana harvested 1 million acres of soybeans in 2024. Although extreme weather events like drought in 2023 and Hurricane Francine in 2024 caused a decline in yields, the biggest financial hit to producers has been the reduced quality of their soybeans.

A patent for Hoffseth's soybean assessment technologies is now pending. He and his team hope the optimization of this promising technology will ultimately benefit the entire soybean industry.

Randy LaBauve



Professor Kevin Hoffseth, right, and graduate assistant Nestor Alvarez look at a specialized shortwave infrared camera. Photo by Randy LaBauve

A shortwave infrared camera for inspecting soybeans. Photo by Randy LaBauve

Greenhouse screening trials shed light on aerial blight resistance in soybeans

Efforts to identify soybean varieties resistant to aerial blight are underway at the LSU AgCenter, with plant pathologist Sara Thomas-Sharma leading a greenhouse screening project aimed at improving management of the disease.

Thomas-Sharma screened 24 core block soybean varieties selected from the annual variety trials and germplasm screenings. The varieties were tested under controlled greenhouse conditions to assess their resistance to aerial blight.

"We did the trial twice. Unfortunately, there was a lot of variability between the two trials, and none of the varieties showed up as being consistently resistant," Thomas-Sharma said.

The trials, conducted in December and January, may have been affected by colder temperatures despite the greenhouse setting.

"The greenhouse is fairly weatherproof, but I think when it's really cold outside, the temperatures do drop inside," Thomas-Sharma said.

To address this, the next trials are being conducted during the summer to minimize environmental variability.

Aerial blight, caused by a soilborne pathogen, presents unique challenges for field screening because of its patchy distribution.

"When you do screening in the field, it's very patchy, so you don't get uniformity of the inoculum," Thomas-Sharma said. "The purpose was really to remove that out by having a greenhouse assay where you can control that you're putting a uniform amount of inoculum on all the plants."

While no resistant varieties were identified, the research provides valuable insights for growers in high disease pressure areas.

"If you've had a history of the disease, it's most likely going to come back, because it's in the soil," she said. "You could use this information to see if maybe between two varieties you could use a different variety."

Resistance screening for aerial blight is established in a greenhouse at the Plant Material Center in Baton Rouge. Sprinklers mimic the wet conditions that favor the pathogen. Photo provided by Sara Thomas-Sharma.

Fungal structures found on an infected soybean plant will fall to the ground to allow the aerial blight pathogen to survive in the soil. Photo provided by Sara Thomas-Sharma

Fungicide resistance in the pathogen population further complicates management.

"There is a fungicide resistance problem with this pathogen population," Thomas-Sharma said. "We have done a much smaller study, and we have picked up resistance to commonly used fungicides, but we've not confirmed it across the state."

Ultimately, the goal is to support integrated disease management.

"In plant pathology, we always talk about integrated management where you're not relying on just one tool," Thomas-Sharma emphasized. "Host resistance or growing a variety that's resistant to a particular disease is a big component of integrated management." **Tobie Blanchard**

Aerial blight appears in a field of soybeans after canopy closure. Photo provided by Sara Thomas-Sharma

Researchers optimizing Italian ryegrass control

Italian ryegrass has become a serious problem for Louisiana producers and if left uncontrolled can reduce crop yield. LSU AgCenter weed scientists Donnie Miller and Daniel O. Stephenson have been focused on stopping the spread of ryegrass for years and are making progress.

Miller, who works out of the Northeast Research Station in St. Joseph, said that ryegrass is currently the most troublesome winter species in corn, cotton and soybean.

"If growers can't control the grass, it becomes a tremendous competitor with crops, especially those planted early, such as corn, which reduces yield for producers," he said. "The weed may also host insect populations, which is doubly problematic."

Miller went on to say that often attention is not focused on later-emerging spring populations or earlier misses in control until it's too late. The size of the ryegrass, along with resistance development to once effective postemergence herbicide options, limits effective control at that time.

Stephenson agreed that glyphosate-resistant ryegrass has become a major problem. He and Miller have completed a three-year project evaluating different programs to control ryegrass.

Initiated in fall of 2022, their research in ryegrass management expanded in the fall of 2023 and 2024. Findings have shown that the use of cover crops and/or soil residual herbicides applied in the fall after harvest can be effective tools in combatting spread.

"Cereal rye at a seeding rate of 80 pounds per acre can effectively compete with emerging ryegrass and limit tiller and seedhead production," Miller said.

"Ryegrass tiller number reduction in both years was good to moderate (43% and 81%) in spring with only cereal rye planted in fall and reduced 50% and 45% with only s-metolachlor applied in the fall at 1.33 pints. The combination of the two, however, resulted in a 95% and 97% reduction by spring."

According to Miller, seedhead production was significantly reduced only by the combination (93%) in spring of 2024 but was reduced by the cereal rye (81%) and s-metolachlor (41%) in 2025 in addition to the combination treatment (97%).

A second part of this approach is identifying optimum timing for herbicide application in relation to cover crop and ryegrass emergence, Miller said.

"Unfortunately, these species often emerge simultaneously," he said. "So having the herbicide out as early as possible is most beneficial."

Research initiated in the fall of 2023 and repeated in 2024 has shown that some residual herbicides, such as s-metolachlor or pyroxasulfone, can be applied at the spiking stage (80% or greater cereal rye or black oat plants emerged through soil), while others such as metribuzin and clomazone are much better tolerated when applied two weeks after emergence to one- to two-leaf plants. Plant injury with these two herbicides, however, is greater than with s-metolachor and pyroxasulfone at this timing as well.

"A noninjurious soil residual herbicide applied soon after cover crop emergence in fall offers producers an effective program for managing ryegrass during winter and spring months ahead of planting," Miller said. "In addition to weed management, agronomic and soil benefits associated with cover crops are realized."

Ryegrass control four weeks prior to soybean planting in spring with a cereal rye cover crop treated over-the-top with Dual Magnum two weeks after emergence in the fall. Photo by Donnie Miller

Continued on Page 16

Ryegrass population four weeks before soybean planting with no treatment or cover crop used in the fall. Photo by Donnie Miller

Continued from Page 15

Miller went on to say that this combination offers a one-two punch approach to ryegrass management, allowing the soil herbicide to eliminate or limit emergence of ryegrass during late fall and early winter months while the cover crops limit spring emergence and competition from plants not controlled in fall due to prolific biomass production in spring. **V. Todd Miller**

Louisiana Soybean & Grain Research & Promotion Board Report

LSU AgCenter
Research · Extension · Teaching

Prepared by LSU AgCenter Communications, Tobie Blanchard, Director
Mike Salassi, Interim LSU Vice President for Agriculture and Dean, LSU College of Agriculture
Glen Gentry, Interim Director, Louisiana Agricultural Experiment Station and Frankie Gould, Associate Vice President

Editors: Tobie Blanchard, Marla Elsea, V. Todd Miller

Writers: Anthony Bailey, Tobie Blanchard, Craig Gautreaux, Frankie Gould, Randy LaBauve, Olivia McClure, V. Todd Miller, Kyle Peveto

Designer: Stephen Llorens

MISC-101 3,500 8/25 REV.

For more information on Louisiana soybean and grain production, visit: www.LSUAgCenter.com.

Louisiana Soybean & Grain Research & Promotion Board
LSU AgCenter
128 Knapp Hall
Baton Rouge, LA 70803

NONPROFIT ORG
U.S. POSTAGE
PAID
BATON ROUGE, LA
PERMIT NO. 733

THE LOUISIANA
Soybean & Grain
RESEARCH & PROMOTION BOARD