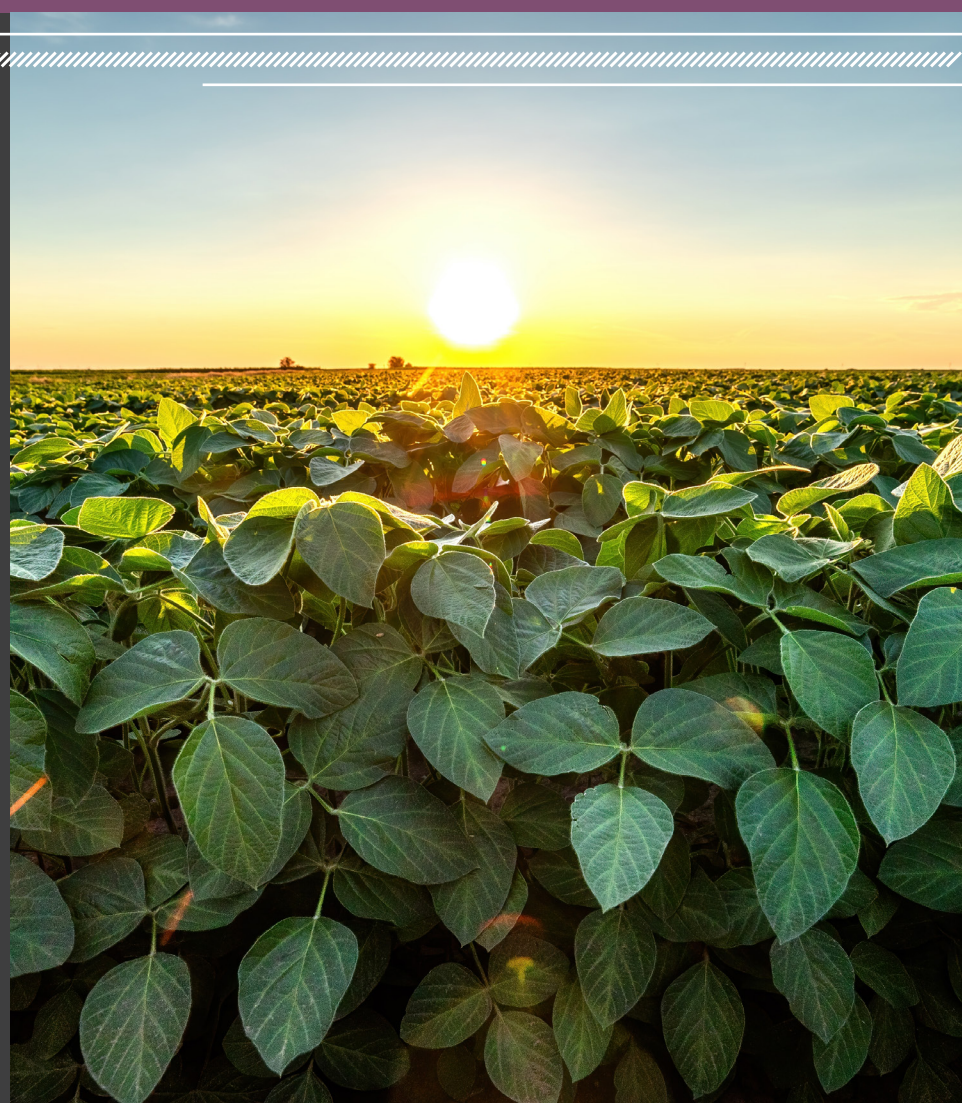
www.LSUAgCenter.com

THE LOUISIANA
Soybean & Grain
RESEARCH & PROMOTION BOARD

2024 REPORT

CONTENTS



New frontier in plant disease management: dsRNA studied to combat fungal infections in soybeans

In Louisiana's hot and humid climate, fungal diseases can thrive. LSU AgCenter scientists are working on novel ways of controlling disease problems on soybeans by looking beyond chemical control and investigating the possibility of interfering with the pathogens' genes when they infect soybean.

The research that AgCenter plant biologist Zhi-Yuan Chen is conducting doesn't involve genetic modification of the plant, which would incur heavy regulation. Instead, he is looking at spraying genetic material — a double-stranded RNA (dsRNA) — on plants to disrupt disease formation, which he called a new frontier in plant disease management.

Chen and his students have identified genes that are important for the pathogen to infect the plant and are seeing effective disease control with dsRNA to suppress the expression of these genes in some instances.

"We have demonstrated that in growth chambers and greenhouses by spraying those double-stranded RNAs targeting those genes that they can reduce the disease symptoms very clearly," Chen said.

But issues arise when the researcher attempts to replicate this in the field. Chen said when the dsRNA gets put into natural field conditions it can break down quickly — rain can wash it away or ultraviolet rays from sunlight can break it apart.

Chen plans to stabilize the spray by binding the dsRNA with iron- and magnesium-based nanoparticles as the carrier. He also is planning to use adjuvants that act as surfactants that help the spray stick to the leaf surface or break down that waxy layer of the leaf to help deliver more of the dsRNA into the plant.

Sunira Marahatta, a graduate student in Zhi-Yuan Chen's lab, examines the differences of frogeye leaf spot disease symptoms among soybean plants four weeks after they were sprayed with dsRNA with or without adjuvants in a field trial at the Doyle Chambers Central Research Station on Sept. 22, 2023. Photo by Zhi-Yuan Chen

Additionally, he is researching ways the dsRNA can be taken up systemically by the plant to help with disease issues that might infect the plant in areas the spray can't reach such as the roots.

This mode of disease management, such as for controlling Cercospera leaf blight in comparison to traditional fungicide approach, has several advantages.

"When we use any fungicide on a pathogen, you will always have some off-targeted effects," Chen said, giving examples of a mosquito spray killing similar insect species in addition to mosquitoes.

Continued on Page 2

From the Louisiana Soybean and Grain Research and Promotion Board

Soybean and grain producers in Louisiana have faced tremendous crop weather challenges over the past few years. From too much rain to not enough rain at the right time to, last year, almost no rain. We can't control the weather, but we can control, to a much greater extent, the planting, fertilization, pest control, irrigation and other production practices we use to produce a crop with the objective of achieving optimal yields. Best management practices utilized by producers in Louisiana are based on recommendations from soybean and grain production research conducted across the state under a variety of growing conditions. Your investment in this research gives us that fighting chance as an industry.

The Louisiana Soybean and Grain Research and Promotion Board serves as Louisiana's facilitator of state wheat and corn checkoffs and facilitates the national checkoffs for soybeans and grain sorghum in Louisiana. As a collective representation of farmers from across the state and across these represented crops, we strive to collectively administer funds for research specific to the needs of Louisiana, while contributing to larger market promotion and advancement of these important crops. Our efforts as Louisiana farmers are to represent our neighbors to the best of our abilities. Thank you to my fellow board members who volunteer their time for the greater good of Louisiana agriculture.

The board reviews many proposed research projects each year which cover a broad range of best management production practices relating to crop variety selection, fertilization, integrated pest management and other practices. Research projects selected for funding are those which the board considers having the greatest potential for benefit to Louisiana producers.

To have good research results, you need good researchers. A major accomplishment for the board in 2024 was to establish an endowed professorship in the LSU AgCenter to support a faculty member conducting research in soybeans. The board gave $480,000 of their funds toward this professorship. Those funds will be matched with another $120,000 from the Louisiana Board of Regents for a total endowment of $600,000. Earnings from this endowment will be available to the professorship holder to support their research program in soybeans. We hope this large investment today will yield results in perpetuity for the Louisiana farmer. We believe it will.

To best represent you and ensure we are stewarding these funds to their best use takes speaking up and showing up. So, get involved, share your thoughts and questions, and let's make this a great year for research and promotion of soybeans, corn, wheat and grain sorghum. We have a board of farmers that are volunteering their time to collectively achieve a better opportunity for Louisiana farmers. With more voices being heard and continued continuity in a greater checkoff system, I believe we can once again produce results that each of you can be proud of. Thank you for your support and thank you for your contributions to our checkoff.

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 and Joey Boudreaux; and back row from left, Kody Beavers, Joey Olivier, Garrett Marsh, Kellon Lee and Wil Miller.*

Charles J. Cannatella
Chairman
Melville

Joey Boudreaux
Vice Chairman
Lebeau

Scott Wiggers Jr.
Secretary-Treasurer
Winnsboro

Kody Beavers
Extension

Kellon Lee
St. Joseph

Garrett Marsh
Tallulah

Wil Miller
Ferriday

Joey Olivier
Arnaudville

Burch Pierce
Jonesville

Luke Sayes
Deville

Darrell VandeVen
St. Joseph

Andy Brown
Executive Director
Baton Rouge

Innovative trials target soybean diseases

LSU AgCenter plant pathologist Sara Thomas-Sharma is studying two diseases that affect soybeans: Cercospora leaf blight and aerial blight.

Cercospora has been a leading foliar disease in soybeans for many years in the U.S. South. Usually appearing while plants are in the reproductive stages of development, the disease can affect seed production and cause yield and quality losses.

Members of LSU AgCenter plant pathologist Sara Thomas-Sharma's lab work in a soybean field where disease management strategies are being studied. Photo provided by Sara Thomas-Sharma

Thomas-Sharma is in the third year of a project examining how the timing of fungicide applications and cultivar resistance affect incidence of Cercospora. She has planted trials in Baton Rouge, Winnsboro and Alexandria with one Cercospora-resistant variety and one variety that is susceptible to the disease. The trials will be sprayed with the Revytek fungicide.

"The focus will be on whether the applications timed close to spore peaks will be more efficacious," Thomas-Sharma said.

Her earlier work on the project has shown that spores of the pathogen that cause Cercospora tend to peak several times before symptoms are observed on plants. She uses spore traps in field trials to monitor their presence.

"Fungicide applications to target spore peaks show promising yield and economic trends," she said. "However, the results are not consistently statistically significant, suggesting that optimization in fungicide application timing is much needed."

She's also studying spore data collected since 2019 to see whether weather variables had any effect on spore peaks. If any trends are identified, that information could help predict spore peaks and determine when to make targeted fungicide applications.

On the issue of aerial blight, Thomas-Sharma recently launched a new project that involves screening new soybean varieties for resistance to the disease. Aerial blight causes small lesions on plants early in the growing season. As the disease progresses, severe damage can occur, with infected leaves, stems and pods often sticking together.

Thomas-Sharma is working on this project in a greenhouse rather than in a field.

"A greenhouse assay is necessary for this pathogen because, as a soilborne pathogen, it is patchy in the field," she said. "Thus, varieties may escape disease rather than truly being resistant if screened only in the field."

The varieties she is testing for aerial blight resistance are in the AgCenter's core block trials this year. They will be available for planting in 2025, and results from her resistance screenings will be provided to help farmers choose varieties. **Olivia McClure**

Continued from Page 1

With Chen's approach, off-target effects wouldn't be an issue because the dsRNA sequence is very specific to one gene in the pathogen. He said the molecule itself is not toxic the way a chemical is.

"It would only act against the pathogen and its very close relatives," Chen said.

Using dsRNA could also help combat issues with herbicide resistance in plants. Chen said the sequence is long — about 500 base pairs long. If the pathogen tries to mutate, the mutation would just be on one or two pairs and wouldn't greatly affect the efficacy of the dsRNA. If mutations occur in more places, he can select a new pathogen sequence to target.

"We are much nimbler in responding to all those changes," Chen said. "We can make a dsRNA to target a different sequence in a couple of weeks. But for regular conventional pesticide or fungicide, it would take five to 10 years to develop chemicals and then have to go through EPA approval."

Chen is working to get this disease defense system to a level that is economical. Chen said his long-term goal with this research is to develop a cost-effective, sustainable and long-lasting alternative to breeding and fungicide application in managing soybean diseases. **Tobie Blanchard**

LSU AgCenter economists equip producers with tools, insights

LSU AgCenter economists offer a wide assortment of information to help agricultural producers navigate market trends, policy changes and other economic forces.

Through spreadsheets, reports, newsletters, workshops and other avenues, economists Michael Deliberto and Naveen Adusumilli are a resource for farmers as they face decisions that affect their bottom lines. Some highlights of their work include:

Interactive enterprise budgets. These budgets are released annually to help with planning for the upcoming crop year. "They allow producers to tailor the anticipated cost and returns to reflect their farming operation," Deliberto said. "In addition to providing detailed estimates on the variable and fixed cost of production, break-even analysis is conducted over a range of price and yields."

Farm financial benchmarking tool. These spreadsheets allow users to compare historical crop prices, yields, production costs, cost per unit and return on investment for the most recent five-year period. 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.

Risk management tools. Several of these tools are released each year. One is a projection tool that can assist farmers in deciding whether to enroll in either Agriculture Risk Coverage or Price Loss Coverage, which are federally backed crop insurance programs. The choice between the two boils down to a producer's risk tolerance, Deliberto said. "The focus of this research is to analyze alternative price and yield combinations that illustrate the mechanics and effectiveness of price and revenue protection available," he said. He holds workshops to provide additional information.

Social media. Adusumilli has found success in using the social platform X, formerly Twitter, to share important policy information with stakeholders. "The Louisiana Ag Policy (@LA_AgPolicy) page runs under my direct supervision and has a very active engagement," he said.

Student projects. Adusumilli has hired students to expand his research scope. Students are undertaking projects evaluating how conservation funding can help reduce inefficiencies in the production of soybeans and other crops. "These projects have led to bigger opportunities for contribution to the upcoming farm bill discussions through report writing for farmer advocacy groups at the national level," he said.

LSU AgCenter economics Michael Deliberto, left, and Naveen Adusumilli look over a graph regarding U.S. corn production. Photo by Olivia McClure

Newsletters. Adusumilli and Deliberto both use newsletters to communicate with clientele. Adusumilli's "Conservation and Commodity Updates" publication has a reader base of more than 500. Deliberto writes a widely read monthly market report that summarizes domestic and international factors affecting commodity prices. He also puts together a quarterly newsletter that informs producers and other stakeholders on policy-related issues such as trade, labor and programs conservation.

Newsletters, decision-making tools and other information from the economists can be accessed at www.LSUAgCenter.com/agecon.

Olivia McClure

Cutting costs and boosting yields: Entomologist targets soybean pests

Entomologists at the LSU AgCenter are waging war on several fronts to protect soybean plants from insect pests.

Dawson Kerns, the newest investigator on the mission, is leading the charge with various projects aimed at controlling stink bugs and protecting vital Louisiana crops.

With soybeans being a critical part of Louisiana infrastructure, Kerns emphasizes the dual benefits of his work and research.

"A lot of it is going to come in terms of economic benefits for growers," Kerns said. "By determining the optimal timing for insecticide applications, we can reduce the amount needed, which not only saves money but also benefits the environment."

Keeping production and growing costs low is critical in this billion-dollar industry. One key project examines the rain-fastness of insecticides. "We're looking at several different insecticides to understand which work better under varying conditions," Kerns said.

This research is crucial to crop retention, as some insecticides tend to lose effectiveness after rain, impacting their ability to control pests like the redbanded stink bug.

He stressed that insecticide use should be limited to when pest populations reach economically damaging levels.

Louisiana, in particular, faces significant challenges from redbanded stink bugs.

"The state as a whole is the most heavily impacted by this pest," Kerns said.

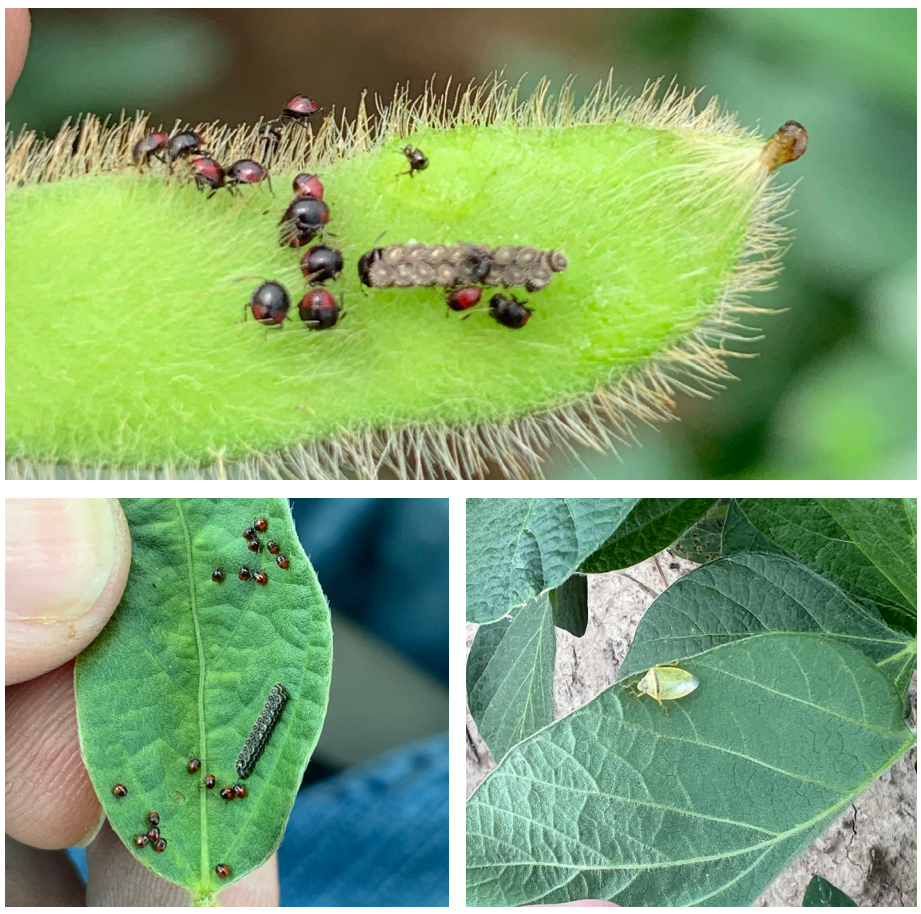
He also discussed their overwintering habits, which influence pest pressure in the growing season and advises farmers to follow recommended economic thresholds and rotate insecticides to prevent resistance. "That's the best way to manage these pests right now," he said.

Kerns is optimistic about the future and this year's pest population.

"So far, we haven't seen a lot of redbanded stink bugs this year, so it might be a light year for them."

The results of his research extend far beyond farmers. By reducing the need for insecticides and improving pest management, the work of LSU AgCenter entomologists helps ensure a stable supply of soybeans, impacting everything from food prices to the availability of soybean products for everyday consumers.

Michael Wilcher



Top: *Redbanded stink bug eggs and juveniles are seen on the underside of a soybean pod in northeast Louisiana. Monitoring egg clusters helps in the timely application of pest control measures.*
Bottom left: *Juvenile redbanded stink bugs and eggs gather on a soybean leaf. Early detection and management are crucial to preventing crop damage.*
Bottom right: *An adult redbanded stink bug rests on a soybean leaf. These insects are a significant threat to soybean crops due to their feeding habits.*

Photos provided by Dawson Kerns

Integrated approach is key to controlling nematodes in soybean production

Soybeans, like all living things, cannot survive without water and nutrients. Two potential roadblocks to accessing both are the southern root-knot nematode (*Meloidogyne incognita*) and the reniform nematode (*Rotylenchulus reniformis*). LSU AgCenter nematologist Tristan Watson is trying to get the word out about the pests while also developing integrated methods to control them.

Watson, who has been conducting the lion's share of his research at the AgCenter's Northeast Research Station in St. Joseph and Macon Ridge Research Station in Winnsboro, said the two feed on the roots of plants, reducing their ability to access the life-giving water and nutrients.

"The symptoms look a lot like nutrient deficiencies and can easily be mistaken for such if not properly diagnosed," Watson said. "This can lead to yield loss, which can get up to 50% in some cases, thus costing producers a significant amount of money."

According to an in-state survey of fields, the root-knot and reniform varieties are two of the most damaging nematodes in Louisiana agricultural fields, with the root-knot variety in 20% and the reniform type in more than 60% of the fields examined.

Watson said the loss numbers last year were not insignificant. In Louisiana soybean production, the root-knot nematode was responsible for 2.25% yield loss, resulting in 931,628 bushels lost and $12,390,650. The reniform nematode was responsible for 1.90% yield loss, resulting in 786,708 bushels lost and $10,463,215.

"The root-knot nematode causes galls on the root system," Watson said. "I encourage farmers who think they might be experiencing an infestation to uproot a plant, preferably mid- to late-season, and examine it. But take care not to confuse the pests for nodules associated with beneficial nitrogen fixing bacteria."

Watson said to diagnose the reniform nematode, which is harder to detect, producers should take soil samples and send them to the LSU AgCenter Nematode Advisory Service where experts can extract the pests, quantify the number the sample has and inform the farmer how likely they are to have yield loss at that population level.

So, that's the bad news. The good news is that last year Watson evaluated the chemical nematicide Velum as an in-furrow spray for nematode management on soybeans. The product has been used successfully in cotton and sweet potato production to control the same nematodes and was recently labeled for use on soybeans.

The preliminary trial showed moderate reductions in root-knot nematode populations relative to soybeans that were not treated. For the 2024 crop year, Watson is following up on this work, but from a more integrated approach.

Doctoral student Lucy Kiarie plants a reniform nematode variety screening trial at the LSU AgCenter Macon Ridge Research Station. Photo by Tristan Watson

In addition to nematicide applications, soybean variety breeding for resistance to the pests is an important route Watson has been researching in trials. Varieties found in Missouri seemed resistant to nematode reproduction in the 2022 growing season, as well as outyielding some of the commercial lines that are currently grown in state.

"During the 2023 growing season, we observed the exact same trend," he said. "The reniform nematode resistant soybean varieties resulted in marked reductions in nematode population densities in soil and often outyielded the currently grown commercial varieties in Louisiana."

Based on Watson's previous work on the utility of soybean host resistance and nematicides for nematode suppression, he says it is becoming clear that there is the need to use a fully integrated management approach on soybeans. The use of just one management tactic alone often does not provide adequate protection from nematodes.

Watson's team also is evaluating the best integrated nematode management tactics for Louisiana soybean growers. He hopes to figure out which combination of management strategies can provide adequate suppression of nematodes, high yields and minimize input costs.

"Our current trial is looking at combining three different nematode management tactics: deployment of host resistance, in-furrow application of nematicides and winter cover crop mixes," Watson said. **V. Todd Miller**

Entomologists are thinking outside the box for integrated pest management strategies

The hum of drones is becoming a familiar sound above James Villegas' soybean test plots. Entomologists like Villegas work with a variety of tools to control pests. A potential new tool is sprayer drones. Villegas is looking at ways to incorporate sprayer drones into a pest management strategy.

The researcher has gathered preliminary data comparing sprayer drones to tractor spray on a major pest of soybeans — the redbanded stink bug.

"Although our redbanded stink bugs were pretty low last year, we were able to see that using sprayer drones and tractor spray yielded similar results," Villegas said.

This year he is working to optimize the use of spray drones, flying at different heights and at different speeds and using different nozzle types. He also is trying to determine how much wind speed the drones could tolerate and looking at the potential of pesticide drift at different wind speeds.

The drones he is using for these initial studies are small and cover a width of about 18 feet. He said to put this practice into production fields would require bigger drones with more range.

"We have already a lot of people trying to use sprayer drones, and I know that there are already several consultants using sprayer drones as part of herbicide or insecticide applications," he said.

While one new tool is being tested, entomologists are looking at the potential of another being removed from their toolbox — acephate. AgCenter entomologist Jeff Davis always has an eye out for new products on the market and is seeing what could replace acephate if it is banned.

"Unfortunately, there's not a lot new on the market," Davis said. "So, we are thinking outside of the box, can we make an insecticide that is almost like a repellent. I know that sounds funny. Not that you put on yourself, but you put on your crop to try to keep them away from the beans."

Davis said this could be a change in the paradigm. He said they shouldn't just consider ways to kill insects, but the main goal is to keep them from damaging the plant in whatever ways possible. He said he has tested some products in the lab that seem to repel insects, but the next step would be field tests.

Another tool Villegas is investigating is silicon soil amendment. He wants to see how silicon could help soybeans tolerate insect pests, particularly the redbanded stink bug.

Davis said he didn't see a lot of stink bugs early in the season. Some farmers were slow to plant because of rain and wet conditions, but Davis recommends early planting if possible. He also recommends planting maturity group 5 soybeans if it fits the farm.

"The pods don't seem to form as fast. They form faster in the group 4s and that attracts the stink bugs," he said. "So, if you can plant a soybean that pods later, it's better."

Another project involves seeing how insects move from conservation areas on farms into crop fields. Using egg whites sprayed on conservation areas, he can test insects found in fields for the egg albumin to see if they moved from one area to another.

"We are seeing some pests move. About a third of the insects that move into the crop are pests, but two-thirds are predators, and that's more exciting. So, these areas are providing a benefit," Davis said.

He is also monitoring the presence of the brown marmorated stink bug. It has been found in Iberville Parish but hasn't moved from that area.

Villegas is also working on insects in corn and grain sorghum. In corn, he is looking at seed treatments and the return on investment.

"So far what we've seen is that there are some instances where seed treatments would really give a good return on your investment," Villegas said. "But for the most instances, we're not seeing the advantage of it, especially if you do a lot of rotation in your field."

For grain sorghum, Villegas is doing detection for sugarcane aphids. With only two products approved for aphid control, Transform and Sivanto, he wants to make sure they are still working against the insects. **Tobie Blanchard**

Ignoring soil fertility issues leads to lower yields

Farmers are noted for being good stewards of the land. After all, the soil is where they plant and grow their crops for the purpose of earning a living. Many have the intention of passing it to the next generation, so taking care of the soil is of upmost importance.

Nitrogen used for fertilization purposes is one of the largest input costs for row crop producers. Because of the expense involved, using nitrogen efficiently is beneficial to the crop and the farmer's pocketbook.

Sulfur is a plant-essential nutrient that helps increase nitrogen efficiency. Therefore, producers should test their soils for sulfur content.

Brenda Tubaña, a soil fertility specialist in the LSU AgCenter School of Plant, Environmental and Soil Sciences, has been studying sulfur to determine fertilization guidelines for grain production in Louisiana.

Tubaña's research indicates the sulfur content in soil should be at least 10 ppm. For levels below this, she recommends producers add at least 20 pounds of sulfur per acre to avoid deficiencies. Generally, there is little residual sulfur left from the previous year's application.

"We found that there is a minimal buildup of sulfur, even for those fertilized at high rates," Tubaña said. "Sulfur is mobile in the soil, and it is not uncommon to lose it through leaching."

The timing of the sulfur application is also a determinant, according to Tubaña.

"Our latest results showed a 19 bushel per acre increase in corn yield from side-dressing 70 units of nitrogen with 20 units of sulfur at the V6 stage," she said.

Another area of fertility being studied by AgCenter scientists focuses on the role of micronutrients. These nutrients are needed in small amounts but are required for the production of energy and in combatting stress factors brought on by issues such as diseases.

Soil pH plays a major role in micronutrient deficiency. Soils with a pH between 6 and 6.8 are less likely to suffer from micronutrient deficiency, making managing soil pH vital.

AgCenter soil fertility scientist Rasel Parvej, stationed at the Macon Ridge Research Station near Winnsboro, performed a zinc fertilization trial in corn. He described it as the first time zinc has been studied in this manner.

"Zinc is a micronutrient, so if the pH goes higher, the availability of micronutrients becomes less and less except molybendum," Parvej said. "If the pH level is 7 or above, the phosphorus binds with zinc creating phosphorus-induced zinc deficiency. Soil testing is very important to determine if you need to add zinc or not."

Parvej is also reevaluating soil-test-based phosphorus (P) and potassium (K) fertilizer recommendations for corn across 15 sites at five different research stations. From last year's results, he found that P and K recommendations do not vary with soil types. Corn requires more P and K than the current recommendations in very low-testing soils, while no P and K fertilizer is needed in soils with more than 35 ppm Mehlich-3 P (70 lb P/acre) and 130 ppm Mehlich-3 K (260 lb K/acre) at a 0- to 6-inch soil depth.

Tubaña found in her research that a foliar application of multiple micronutrients as a tank mix (solution) was more yield positive than a suspension form. She did caution that an unnecessary application of some micronutrients may counteract the benefits of other micronutrients.

So, what does this mean? Tubaña said that soil or plant tissue testing could be used to select the appropriate micronutrient mixes.

Because of the complexity of soil fertility, there are many avenues of new research to pursue.

One area involves the use of biostimulants. They are designed to improve nutrient efficiency, increase tolerance to stress and strengthen quality traits. She will evaluate the performance of different biostimulants on the market.

Cover crops have been used to help increase soil organic matter. Tubaña and Parvej plan to look at long-term effects of cover cropping and biochar application on nutrient cycling and nutrient requirements for corn and soybean rotations.

Slow-release technology with regards to fertilization is being used more frequently. Both scientists plan to evaluate the source, timing and use of this technology in both soybean and corn.

Research in these areas is expected to be performed for four years before recommendations are made. **Craig Gautreaux**

Soil fertility expert Rasel Parvej addresses corn response to zinc fertilization at the 2024 Wheat and Oat Field Day, which was held at the at the LSU AgCenter Macon Ridge Research Station in Winnsboro.
Photo by V. Todd Miller

2024 Soybean and Grain Research and Promotion Board-funded projects

Agricultural Economics and Agribusiness.....$38,000

Outreach and Education on Water and Soil Policy Reforms for Profitable On-Farm Soil and Water Management, *Naveen Adusumilli*

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

Biological and Agricultural Engineering.....$56,667

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

Improving Automatic Soybean Quality Analysis, *Kevin Hoffseth*

Communications.....$7,500

Louisiana Soybean and Grain Research and Promotion Board Report and Web Portal, *Frankie Gould*

Dean Lee Research Station.....$312,607

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*

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

Investigation of Weed Management Programs in Louisiana Feed Grains, *Daniel Stephenson*

Soybean On-Farm Demonstration Program, *David Moseley*

Louisiana Soybean Production Agronomic Best Management Practices: Decrease Risk and Profits in Louisiana, *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*

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

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

Entomology.....$105,600

Sustainable IPM Solutions for Louisiana Soybean, *Jeff Davis*

Investigation of Susceptibility/Resistance of Field Populations of Corn Earworm and Fall Armyworm in Louisiana to Common Insecticides, *Fangneng Huang*

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.....$410,862

Corn On-Farm Demonstration Program – 2024, *Trey Price*

Evaluation of Phosphorus and Potassium Applications to Commercial Corn Fields in Northeast Louisiana, *Trey Price*

Improving Soil Fertility and Nutrient Management Recommendations for Corn and Soybean and Reevaluation of Sulfur Recommendations for Soybean in Louisiana, *Rasel Parvej*

Enhancing Soybean Insect Pest Management Strategies for Northeast Louisiana, *Trey Price*

Identifying and Refining Varietal, Cultural, and Chemical Management Strategies for Important Biotic and Abiotic Soybean Diseases, *Trey Price*

Determining Early and Late Season Impacts of Stink Bugs in Soybean, *Tyler Towles*

Reevaluation of Sampling Methodology and Host Shift Patterns for the Redbanded Stink Bug in Louisiana Soybean, *Tyler Towles*

Integrated Corn Disease Management, *Trey Price*

Integrated Wheat Disease Management, *Trey Price*

Integrated Soybean Disease Management, *Trey Price*

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

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

Plant Pathology and Crop Physiology.....$253,620

Tools for the Management of Taproot Decline, *Vinson Doyle*

Development of Seed-Priming Agents that Augment Soybean Growth and Broad Spectrum Disease Resistance, *Jong Ham*

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

Evaluation of Fungicide Application Timing and Cultivar Resistance for Management of Cercospora Leaf Blight on Soybean, *Sara Thomas-Sharma*

Cercospora Leaf Blight Disease of Soybean — Explore New Approaches for Management, *Zhi-Yuan Chen*

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

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

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

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

School of Plant, Environmental and Soil Sciences.....$202,350

Characterizing Soil Health and Yield Under Conservation Practices in Soybean and Grain Production Systems, *Brenda Tubaña*

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

Harnessing UAV and Machine Learning Technologies to Promote Resilient Soybean and Corn Production, *Tri Setiyono*

Improving Nutrient Availability in 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*

Total Funding for 2024: $1,487,206

Fall herbicide application and cover crops used for ryegrass control

Uncontrolled ryegrass is notorious for competing with crops, which can reduce yields for producers. LSU AgCenter weed specialists Donnie Miller and Daniel O. Stephenson are focused on curtailing the spread of ryegrass in crops and, as with most things in life, timing is everything.

Miller, who works out of the Northeast Research Station in St. Joseph, said that ryegrass continues to be a troublesome winter species to all crops.

Miller said 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. The weed may also host insect populations, which is doubly problematic. Often attention is not focused on later-emerging spring populations or earlier misses in control until it's too late, Miller said. And the size of the ryegrass limits effective control in populations that aren't resistant to over-the-top herbicides.

For his part, Stephenson agreed that glyphosate-resistant ryegrass has become a major problem. He and Miller are in the third year of a project looking at different techniques to control ryegrass.

Initiated in fall of 2022, their research in ryegrass management expanded in fall of 2023. Thus far, findings show that the use of cover crops and/or herbicides applied in the fall after harvest can be effective tools in combatting spread.

"Initial indications are that cereal rye can effectively compete with emerging ryegrass and limit tiller and seedhead production," Miller said. "The ryegrass tiller number in spring of 2024 was reduced 43% with only cereal rye planted in fall at an 80 pounds per acre seeding rate and reduced 50% with only s-metolachlor applied in the fall at 1.33 pints. The combination of the two, however, resulted in a 95% reduction by spring of 2024."

Seedhead production, however, was only significantly reduced by the combination (93%), according to Miller.

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 has shown that some residual herbicides, such as s-metolachlor or pyroxasulfone, can be applied at the spiking stage (80% emerged cereal rye or black oats), while others such as metribuzin and clomazone are much better tolerated when applied two weeks after emergence to one- to two-leaf plants.

"When coupled with Dual Magnum, a soil residual herbicide applied two weeks after cover crop emergence in fall, producers have 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."

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 due to prolific biomass production in spring.

V. Todd Miller

Left: *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.* ***Right:*** *Ryegrass population four weeks before soybean planting with no treatment or cover crop used in the fall. Photos provided by Donnie Miller*

Variety tests, fertility experiments, planting dates part of latest soybean research

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 2023-24, official variety trials at seven AgCenter research stations included small plot tests for nearly 100 varieties, while 20 core-block varieties were grown at 27 on-farm demonstrations in 14 parishes.

"There was a three-bushel-per-acre difference from the top-yielding to the middle variety, and a seven-bushel-per-acre difference from the top to the bottom variety," said LSU AgCenter soybean specialist David Moseley.

The average yield and top yielding varieties could produce an additional profit of $33-$77 per acre compared with the lowest yielding variety, and this could help the soybean industry collect an additional $77 million, according to Moseley.

The on-farm demonstrations were divided into three maturity group sections. Data from these trials was published in the LSU AgCenter 2024 Soybean Variety Yields and Production Practices publication.

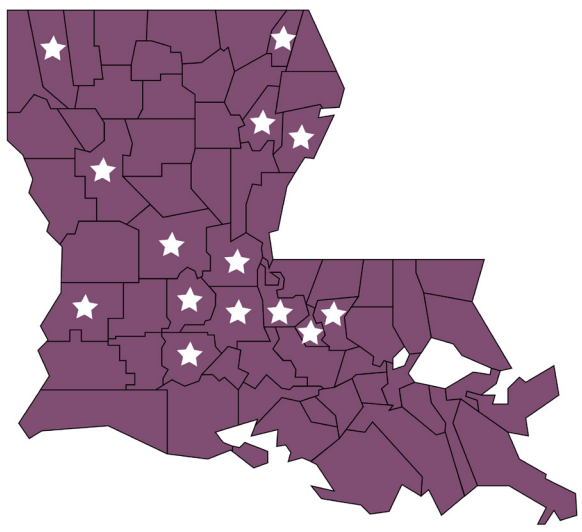
AgCenter researchers also did nematode resistance screening trials and conventional soybean variety demonstrations.

Other testing focused on management practices to correct low potassium, phosphorus, sulfur, manganese and zinc levels. Currently, research at two on-farm trials is comparing different fertilizer formulations and treatments — specifically examining fertilizer rates and application timings to establish the most economical fertilizer plan.

"One trial showed a potential economic benefit of applying less potassium oxide per acre than the recommended amount," said Moseley.

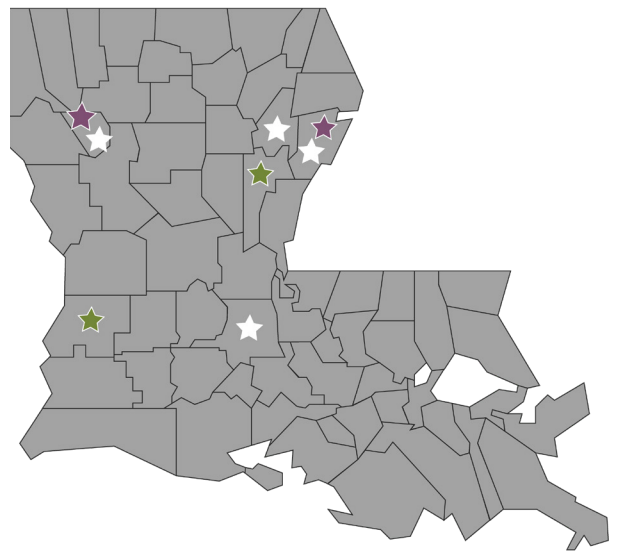
Phosphorous application timing trials on alkaline, low-phosphorous soils showed a significant increase in yields when applying recommended amounts at planting dates and at reproductive stages, as compared to no applications. However, the most significant yield bump came when phosphorous was applied at planting.

Tests done on biological seed treatments, for the most part, had small and inconsistent effects on yield. Bradyrhizobium, a nitrogen-fixing bacteria, outperformed the other treatments, achieving a small but consistent increase in yield.



Soybean core block locations

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



Soybean nematode resistance
Franklin, Red River, St. Landry, Tensas

Conventional soybean trial
Tensas, Red River

On-farm potassium trial
Catahoula, Beauregard

Planting date trials were another important aspect of soybean research. Findings indicated optimum planting dates were April 8 for the northern region, April 21 for the central region and May 17 for the southern region.

Data also indicated farmers can increase mature seed protein and oil content through variety selection and proper planting dates. Some initial data shows an increase of soybean oil content when planting in May or later, and an increase in protein when planting in March.

The AgCenter has recently published a paper showing data on planting date findings in the three regions to help farmers select the best times for them to plant.

Additional current and upcoming research analyzes:

- Desiccant harvest aids across multiple maturity groups — understanding optimum timing for application, whether soybean plants are developed enough to be desiccated without losing yield because of decreased seed size and potential effectiveness of a new desiccant, Reviton.
- Macro nutrient fertilizer applications — investigating correlations between phosphorous uptake and yield, potential benefits of inputs like humic acid and other biological products and evaluating impacts of foliar nutrients applied at planting and during the growing season.
- Planting date trials — identifying the best maturity groups and seeding rates to maximize yield potential in extremely early and late planting dates, evaluating the effects of fungicide treatments and researching the impact of planting date by populations.
- The economic feasibility of growing two cash groups in one season.
- The potential benefits of deer repellants for soybean fields.

Randy LaBauve

On-farm demonstrations continue to be the standard-bearer of ag research

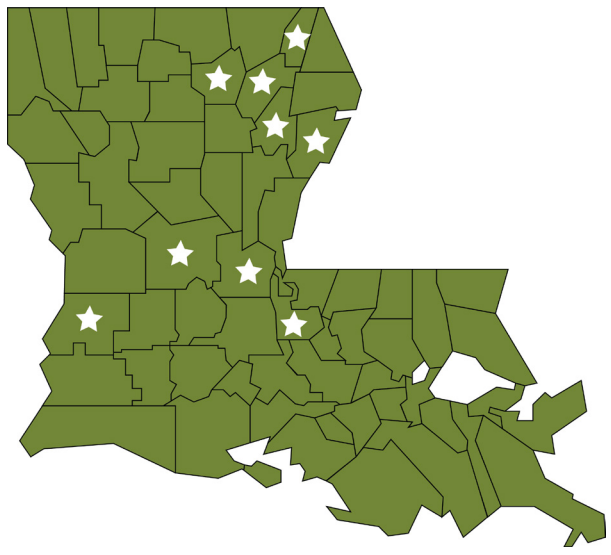
Demonstration plots have been a foundational research tool in agriculture since Seaman A. Knapp began using them in the early 1900s. Today, they are just as relevant and are utilized to highlight the newest varieties and hybrids to farmers currently engaged in production agriculture.

Shelly Pate Kerns, a Tennessee native, was recently hired as the LSU AgCenter corn, grain sorghum and cotton specialist. One of her duties will include managing corn and grain sorghum demonstration plots and helping with the selection sites. Kerns is a trained pathologist in both cotton and soybean.

"On-farm demonstration plots are instrumental in gauging the performance of varieties and hybrids in commercial settings," Kerns said.

In Louisiana, corn hybrid plots are planted across the state to provide the agriculture sector with nonbiased scientific information that is anchored in the fields of growers. These demonstrations will allow farmers to make informed decisions regarding how well corn hybrids perform in a real-world environment.

Last year, 12 corn hybrids were tested in the on-farm demonstration plots. Yields ranged from 170 to 259 bushels per acre.



Corn core block locations

Avoyelles, Beauregard, Franklin, Ouachita, Pointe Coupee, Rapides, Richland, Tensas, West Carroll.

While AgCenter Experiment Station scientists conduct hybrid trials at several research stations across Louisiana, one pertinent question remains: Are these hybrids suitable for different growing regions in the state? These on-farm demonstrations are geared toward answering this question.

The demos may also answer other important questions such as soil-type performance and what yields are in irrigated and nonirrigated settings.

These plots are in commercial fields, and the plots will undergo the same management strategies that the producers use in their fields. Data will be recorded concerning planting and harvest dates, soil type and irrigation events.

"Growers that plant farm demos are helping to provide data that is used for hybrid selection by growers throughout the state," Kerns said.

Another important research component involves stand counts. Approximately 30 days after planting, a stand count will be undertaken to ensure that plant populations are consistent and do not skew any data.

At harvest, data will be recorded including yield, percent moisture and test weights.

In a typical year, there will be anywhere from 10-20 hybrids involved in the demo plots. The results of the demonstration are published annually on the AgCenter website. A publication entitled Corn Hybrids for Grain is published annually and can be found on the website. **Craig Gautreaux**

Soybean resilience: Seed-priming agents shown to have protective results

An ongoing study of seed-priming agents is homing in on how bacteria applied to soybean seeds can improve the plants' response to disease and drought stress.

LSU AgCenter plant pathologist Jong Ham and his research team have been investigating how different biostimulants or bacterial agents used as seed treatments can help plants fight off stress.

LSU AgCenter plant pathologist Jong Ham examines soybean plants in a greenhouse at the Doyle Chambers Central Reseach Station in Baton Rouge. The plants are grown from seeds treated with bacteria that can improve the plants' response to disease and drought stress. Photo by Tobie Blanchard

"We observed that plants grown from the treated seeds actually respond faster and in a more robust way to a pathogen attack," Ham said, explaining that the treatment acts as a kind of immunization, preparing the plant to induce a defense.

The researcher is working to understand the mechanics behind how the bacteria is offering these protections. Ham said it could be epigenetics — how the plant memorizes the stress put on the seed from the bacteria, and upon the real challenge in the field, it can respond more efficiently.

He also suggested that the bacteria may colonize the plant and protect the plant's roots from drought stress for example. He said an extracellular polysaccharide may act as a coating on the roots.

His research is also looking at characterizing the microbial community in the soil and the seed treatment's influence on it.

"In the soil, there's millions of different species or microorganisms living in there, and there are dynamics within the soil," he said.

Last year, he and his team collected samples from drought-damaged plants in the field and characterized the bacterial composition there.

"We wanted to find some major differences between the surviving plants and the dead or damaged plants," he said. "We saw some difference in the microbial community in that field, and we isolated some candidate bacterial agents that have some drought tolerance."

His studies last year were conducted at the Doyle Chambers Central Research Station in Baton Rouge and the Red River Research Station in Bossier City. This year his work continues in Baton Rouge, and he is also working at the Dean Lee Research and Extension Center in Alexandria.

Ham also is working on potential ways to keep the bacteria on the seed stable. He said currently treated soybean seeds should be planted within a week of being treated.

This type of treatment could reduce the need to spray fungicide on the fields.

Ham said the next steps in the project include expanding its scope. He wants to apply the same techniques and technologies to see if the seed-priming agents can affect the plants' tolerance to nematode damage.

He also plans to analyze the plant's metabolic changes that result from seed-priming using cutting-edge analytical tools, such as mass spectrometry. Ham said this will help his research team understand the biochemical mechanism underlying the effects of seed-priming. **Tobie Blanchard**

Four new hires to work in soybean and grains for the LSU AgCenter

Peters Egbedi is an assistant professor and a sustainable cropping systems and field management specialist at the Red River Research Station. He was born in Oleh, Delta State, Nigeria, and grew up on a family farm. At an early age, his quest to address crop yield declines on the farm led him to obtain a bachelor's degree in agriculture at the University of Ibadan. He also earned a master's degree in environment, health and safety from the University of Sunderland and a doctorate in agronomy from LSU. He conducted his postdoctoral research at the Northeast and Red River research stations. Passionate about extending the frontiers of knowledge in agriculture and the noble aim of achieving food security, his research focus is not only on developing sustainable cropping systems and other best management practices that can improve soil health and crop yield, but also on building resilience of the farming systems to climate change as well as ensuring long-term sustainability.

Dawson Kerns is an assistant professor in field crop entomology in the LSU AgCenter northeast region. Kerns earned a Bachelor of Science in entomology from Texas A&M University and a Master of Science and a Ph.D. from the University of Tennessee. He investigated the molecular mechanisms involved in resistance to Bt crops in bollworm populations and used bioinformatic tools to identify potential resistance genes in bollworm. His work at the AgCenter will involve the improvement and implementation of integrated pest management (IPM) practices for insect pests of corn, cotton, soybean and sorghum, and the evaluation of IPM strategies and insecticide efficacy, as well as monitoring insecticide resistance in field populations of crops pests. His program goal is to provide solutions to the problems facing producers and agricultural professionals in Louisiana. Originally from west Texas, Kerns said he always had an interest in insects, and cotton was a huge part of his community. His time in FFA sparked his desire to contribute to the advancement of agriculture in my community.

Shelly Pate Kerns joins the LSU AgCenter as an assistant professor and the corn, cotton and grain sorghum specialist. Kerns is originally from west Tennessee and earned a Bachelor of Science in crop and soil management from the University of Tennessee at Martin. She said her passion for agriculture developed after becoming involved with her local high school FFA chapter (Obion County Central FFA) and through 4-H activities. Kerns earned both a Master of Science and Ph.D. in plant pathology from the University of Tennessee. During her time as a graduate student, Kerns' research was focused on fungal and nematode pathogens of field crops, specifically cotton and soybean. She is now in charge of coordinating the statewide cotton, corn and grain sorghum official variety and hybrid trials. She also works closely with extension agents to plant on-farm variety and hybrid demonstrations with growers throughout the state. Kerns hopes to expand her program to include the creation of extension education initiatives, centered around research that is directly impactful to Louisiana farmers. Additionally, being based in Scott in the northeast region of Louisiana, Kerns hopes to build a great working relationship with the local community to educate the youth and citizens within the region about the importance of agriculture.

Continued on Page 9

Researchers using high-tech cameras, machine learning to answer questions

Oftentimes, farmers provide ideas for research that can improve quality and yield of their crops. Three LSU AgCenter scientists who work continuously with emerging technologies — Tri Setiyono, Randy Price and Kevin Hoffseth — are each currently studying crop production and post-production projects that directly respond to requests from farmers:

- Tri Setiyono, an assistant professor, has been studying how extreme weather events like heavy rain and flooding effect nitrogen fertilizer effectiveness in corn and establishment of stands in soybean. Producers wanted help determining mitigation options — whether they should, in these conditions, supplement nitrogen fertilizer in corn and replant soybean.
- Randy Price, an engineer, is researching different drone nozzle types and their impact on crop infiltration, as well as researching crop coverage at different spraying heights. These trials are in response to requests from farmers that spray with drones.
- Kevin Hoffseth, an assistant professor, is developing an automated system to more efficiently determine the quality of harvested soybeans. Farmers had approached the AgCenter for ways to help ensure they weren't missing out on potential value for their grain loads.

Hoffseth submitted a full patent application for a high-tech system of digital image acquisition and data analysis of soybeans. He and his graduate students designed this configuration to run numerical calculations that consistently and quickly analyze the quality of soybeans based upon color, shape and texture.

"This technology is designed to help the farmer quickly know what sort of damage there might be and help him decide whether to sell the beans or not," said Hoffseth. "We're developing ways to improve and speed up the processing of large amounts of complex data."

Hoffseth and his students recently purchased a highly specialized camera which can compare images taken in the visible spectrum to images in the shortwave infrared spectrum.

"That camera should give us valuable data on the oil and protein content in the soybean," said Hoffseth.

These developing technologies could provide a more accurate and consistent way of understanding the quality of grain in the field or in the warehouse.

"It can benefit both the buyer and the seller, saving them time and improving accuracy," said Hoffseth.

Tri Setiyono looked at simulated flood conditions for soybean and corn on different soil types.

"The concern after flooding is, if it causes leaching in N fertilizer, how much fertilizer should be put back to avoid significant yield loss," said Setiyono.

The two-year studies included flooding of fields soon after applying fertilizer. Researchers used a specialized unmanned aerial vehicle and camera with multispectral sensors to detect corn growth anomaly during the growing season that can lead to yield loss.

Flooded corn field, Doyle Chambers Central Research Station, Baton Rouge. Photo by Tri Setiyono

Monitoring nitrogen status in corn using normalized difference red edge (NDRE) index under excessive rainfall. Photo by Tri Setiyono

Continued on Page 10

Egbedi

D. Kerns

S. Kerns

Jha

Continued from Page 8

Prashant Jha joins the LSU AgCenter School of Plant, Environmental and Soil Sciences as a professor of weed science. Jha earned his Ph.D. in weed science from Clemson University. He was previously at Montana State University working in dryland small grain and irrigated sugar beet-based cropping systems and at Iowa State University as a statewide extension weed specialist. He led the statewide weed extension and herbicide evaluation program in Iowa corn and soybean before joining the LSU AgCenter. His research at the AgCenter is focused on developing precision integrated weed management strategies. His program is screening newly evolved herbicide-resistant weeds in Louisiana soybean, cotton, rice and other crops. As part of his program in precision agriculture, he works on automated weed and crop detection, identification and mapping of herbicide-resistant weeds using ground-based and UAV platforms, with the goal to facilitate machine-learning/AI applications for precision weed control.

Improving soybean variety resistance through the study of genetic pathways

"A management tool that can potentially target multiple soybean diseases," is the primary goal for LSU AgCenter plant pathologist Jonathan Richards and his team. They have been analyzing differences in gene expression between resistant and susceptible soybean varieties.

Specifically, Richards and his team are interested in understanding the role of phytohormone signaling pathways in the resistance response during frogeye leaf spot disease development. By characterizing which pathways are activated in resistant soybeans and at what stage of infection, Richards aims to design a control method to induce resistance.

"Resistant soybean varieties activate specific genetic pathways, which susceptible varieties do not have, or are unable to turn on," he said. "By understanding which genes or pathways are important for resistance, we can be better informed on how to improve soybean varieties and use host resistance."

Richards said resistance pathways can be induced in plants through various chemical applications, but these treatments can have varying effects depending on the specific pathogen."

"This is why we want to first get a firm understanding of which pathways are important for frogeye leaf spot resistance," he said.

In addition to examining soybean gene expression, Richards and his team have been focusing on expression of genes in the fungal pathogen.

"Fungi that cause plant diseases have genes, called effectors, that help them infect the plant and suppress the plant immune system," he said. "Our research has identified a set of effectors that are highly expressed during infection, indicating that they might play an important role in causing disease."

Richards mentioned that other fungal pathogens of soybeans, such as those that cause Cercospora leaf blight, possess related genes that may function similarly. Richards says that by identifying these common genes, targeted interventions can be developed to suppress their expression and inhibit infection by multiple fungal pathogens.

Complementing his work on host and pathogen gene expression, a primary focus of his research of the last five years has been towards the identification of host resistance genes. According to Richards, novel races may arise that overcome currently deployed resistance genes, which highlights the need to continue doing the work to identify new sources of resistance. His team continues to screen soybean germplasm with the goal of identifying and mapping novel resistance genes that can be used to increase the durability of frogeye leaf spot resistance.

On a research plot, Brenda Tubaña's soil health team is testing several biostimulant products. Photo provided by Brenda Tubaña

Host genetic resistance is important because if his team can use a soybean variety that's resistant to different fungal diseases, that reduces the reliance on other management practices, such as fungicide applications, which can save producers time and money.

"Especially for some of these pathogens like the one that causes frogeye leaf spot," he said. "Some of these chemicals aren't effective anymore, so we need to use other strategies, like genetic resistance to help control the disease." **V. Todd Miller**

Continued from Page 9

The flooded fields caused no loss of yield for corn at the Doyle Chambers Central Research Station in Baton Rouge, while diminishing corn yield at Red River Research Station in Alexandria. However, the results were exactly opposite for flooded soybean fields at each location.

Combined Red Edge and near-infrared spectroscopy technologies were used to scan the field and detect any deficiencies early enough where additional fertilizer could be added to correct potential loss.

"We scan the plants, take the images and apply machine learning algorithms to determine seed counts and whether you have a good or bad stand," said Setiyono. "We can use this kind of technology to anticipate whether there could be a problem down the road."

Normalized difference red edge (NDRE) index maps helped the researchers rapidly detect N levels in the fields. Further research needs to determine if rescue nitrogen applications, following the flooding of fields, has yield benefits during variable climate conditions.

One of Price's projects compared drone nozzle types and how well they infiltrate droplets into soybean canopies. Tests were between regular hydraulic orifice nozzles (similar to boom-type sprayers) compared to newer, more widely used centrifugal rotary spinning nozzles.

"We've been finding the spinner nozzles are quite a bit more efficient," said Price. "They'll actually get droplets all the way down to the bottom, so we've been really impressed."

Future nozzle tests will compare insecticide coverage and effectiveness on crops.

Another set of spraying tests compared the effectiveness of various spraying heights. Operators typically spray 4 feet or 10-12 feet above the crops.

"We're seeing as you get the drones higher, you actually get better infiltration with the droplets versus low flying," said Price.

Another aspect of Price's drone research has been to detect early disease and insect damage to corn and soybean using RGB and thermal cameras.

"We're just collecting data now, but we would like to get to where we can use the drone to actually predict the disease severity rating for these plants," said Price. **Randy LaBauve**

Entomologist studies insecticide on corn earworm, fall armyworm

Fangneng Huang, an LSU AgCenter entomologist, has spent years documenting the resistance of the corn earworm and fall armyworm to Bt corn and cotton, crops that have been developed to protect against certain insect pests.

Bt crops have been enhanced through biotechnological methods to include protection from a naturally occurring microorganism, *Bacillus thuringiensis*, that targets caterpillars in the order of Lepidoptera, according to the U.S. Department of Agriculture Agricultural Research Service.

However, in recent years the fall armyworm and corn earworm have developed resistance to Cry proteins vital to this protection. These include Cry1A, Cry2A and Cry1F. Because of the resistance, Huang is searching for other means to control these Bt-resistant pest populations.

"Those two insects have developed resistance to Bt corn and Bt cotton, particularly for some of the Cry genes — especially for the corn earworm populations in Louisiana and other southern states in the United States," Huang said. "The corn earworm has developed a high level of resistance to Cry Bt cotton. This is very much a problem. We want good insecticides for application to control the Cry-resistant pest populations."

Huang's research supported by the Louisiana Soybean and Grain Research and Promotion Board focuses on how susceptible or resistant the corn earworm and fall armyworm are to common insecticides. The studies focus on corn and grain sorghum.

"We do not have other technology available at this point," he said. "That is why we are working on the chemical insecticides."

Research on insecticide susceptibility for these pests in Louisiana is more than 15 years old, Huang said, and some new insecticides have become available since the last studies in Louisiana.

"So far, our results have shown that resistance of the armyworm in our state and in neighboring states is very common to some of the insecticides we have evaluated, and also there are some good insecticides that are effective," he said. "On the other hand, most insecticides we have tested are very effective against the corn earworm populations in this state."

There is a wide variety of susceptibility and resistance depending on local populations of the insects, Huang said. Huang is studying the resistance to insecticides in Louisiana and in neighboring states.

"There are a few populations that really show a relatively high level of resistance to some of the chemicals, particularly for the fall armyworm," he said. "For the corn earworm, basically, the insecticides are pretty good."

Corn earworm larva. Photo by Robert J. Bauernfeind, Kansas State University, Bugwood.org

Huang expects to have results available in the next year.

Huang continues to study insects' resistance to the common Bt toxins, the Cry proteins. He is completing research on an exciting development now. A decade ago, his lab found that fall armyworm populations from Florida were highly resistant to Cry1F corn, a common Bt corn trait expressing the Cry1F protein, but the lab's current tests show that the populations from the same locations are now susceptible to the common Bt proteins expressed in corn and cotton that target caterpillars, including the fall armyworm.

"The reversed Cry1F susceptibility in the fall armyworm identified in this study represents the first case of documented resistance reverting to susceptible status in Bt crop-insect systems, and thus has important implications for Bt crop resistance management." Huang said.

"That is very good news," he added. "The resistance is just cured. We are working on the manuscript now, and it is going to be published soon." **Kyle Peveto**

Fall armyworm. Photo by U.S. Department of Agriculture Agricultural Research Service Photo Unit, Bugwood.org

A pack of feral hogs in a field at the LSU AgCenter Bob R. Jones-Idlewild Research Station. Photo by Olivia McClure

Patented sodium nitrate bait targets rampant feral hog problem

The past year saw a major milestone in the battle against feral swine when scientists with the LSU AgCenter and LSU Department of Chemistry received a patent for their sodium nitrite bait that is lethal to hogs.

The patent — the result of years of work aimed at finding an effective way of controlling skyrocketing feral hog populations — was awarded in August 2023.

Since then, research has continued, with the focus now being placed on environmental testing, shelf-life studies and bait delivery methods. These steps are required before the bait can be approved by the U.S. Environmental Protection Agency and released to the public.

"We want to make sure that the bait holds up under the Louisiana environment and delivers as promised," said Glen Gentry, an animal scientist and director of the AgCenter Bob R. Jones-Idlewild Research Station near Clinton, where much of the feral hog research has taken place.

The bait that Gentry and his team developed has a texture similar to gummy bears and a fishy taste that is appealing to hogs. It uses sodium nitrite as a toxicant. Hogs become sleepy and die within three hours of consuming the bait, which is shaped into golf ball-sized spheres.

If any bait is left behind, the sodium nitrite eventually breaks down into compounds that do not harm other species or present environmental concerns.

Feral hogs have been a growing concern across rural America in recent years. In Louisiana, their population has exploded in the past decade. Experts believe there are about 1 million of the animals in the state, where they cause an estimated $91 million in damage annually.

The hogs travel in packs, rooting up crop fields in search of food. They reproduce rapidly, making it difficult to bring their numbers under control. While hunting and trapping can help, a better solution has long been needed. Gentry said the bait will give agricultural producers and landowners an effective option.

LSU AgCenter and LSU Department of Chemistry scientists received a patent for their sodium nitrite bait, which is lethal to feral hogs, in August 2023. Photo by Olivia McClure

"This bait, once approved, will give stakeholders another tool in the toolbox to combat the damage inflected on agricultural crops by feral swine," Gentry said. "This should allow the reduction of their population to more manageable numbers."

Olivia McClure

Wheat, small grain breeders work constantly to create improved varieties

Global wheat prices have softened since hitting a record high in 2022, and Louisiana producers followed suit by planting fewer acres this past season.

LSU AgCenter wheat breeders constantly work to develop new varieties so farmers can grow a profitable crop when market conditions are right, said Noah DeWitt, who joined the AgCenter breeding program last year.

"Wheat acres in Louisiana bounce up and down," DeWitt said. "If there's a thing we need to make sure is there for when there is a higher wheat price — and it's really going to be economical for growers to plant wheat like it was last year — we want to make sure that we have varieties that are ready and be responsible in that respect."

DeWitt and veteran wheat breeder Stephen A. Harrison have breeding program yield trials at the AgCenter Doyle Chambers Research Station in Baton Rouge and six other research stations around the state, mostly in Alexandria and Winnsboro. This year they planted additional breeding trials in Mississippi and Arkansas with a focus on developing varieties for northern Louisiana and the surrounding region.

This year research plots were hit with stripe rust, even in Baton Rouge, which typically sees less of the cool weather fungal disease, Harrison said. This allowed the breeders to toss out the breeding lines that were susceptible.

A resistance gene, Yr17, was used to prevent stripe rust for years, but it is no longer effective, Harrison said.

"We're using molecular markers and field resistance to select for additional genes that are effective now," Harrison said. "That's important because anytime you can save a grower a $25 an acre herbicide or fungicide application, that affects his bottom line."

Last year the Hessian fly was a "huge issue," Harrison said, but not this year. Harrison and DeWitt realized that varieties may appear to have resistance to the insect in the greenhouse but not in the field, while others are susceptible in the greenhouse but show good field resistance.

"What we're trying to make an effort to do is more field-based screenings for Hessian fly to try to get a better sense of what's actually going to stand up," Harrison said.

The wheat and small grain breeding program is supported by the Louisiana Soybean and Feed Grain Research and Promotion Board and through royalties from SunGrains, a consortium of six university-based small grain breeding programs across the southeast.

Harrison and DeWitt make hundreds of new crosses each year, and it takes years to bring a new variety to market. This year they had two wheat breeding lines increased for release at the University of Georgia foundation seed facility in Plains, Georgia, as part of the SunGrains collaborative program. These potential releases, LA17-42, which has yielded well in the Gulf Coast regions of the South, and LA18-119, a highly scab-resistant line that shows resistance to Fusarium head blight and Hessian fly, should be available to growers in a few years.

LA16022, a release from 2021 marketed as AgSouth Genetics 3022, "has done very, very well in growers' fields," Harrison said.

The breeding team is also working on oat varieties, which are often used for deer food plots but have potential for cover crop use, and triticale, a common cover crop that has much of the utility of rye but with higher grain yield.

"It's a constant series of experiments in the breeding program," Harrison said. "As breeding lines progress in the program, selection criteria become more stringent, you have fewer and fewer lines that are better suited as varieties."

Another research project that DeWitt and Harrison have begun with graduate students focuses on developing wheat maturities that work well for double cropping with soybeans. They use drones to collect data to determine when different lines are flowering and drying down, DeWitt said.

"The hope is to try to develop earlier maturing lines that don't head too early," DeWitt said. "A short grain fill duration is going to help avoid early freezes that we often get in Louisiana and allow growers to get out of the field in time to plant a profitable soybean crop."

Harrison and DeWitt also have begun focusing on wheat genes that respond to day length rather than cold accumulation because wheat varieties that have an early, short fertilization period can be devastated by a warm winter.

"Day length is the same every year no matter what climate change does," Harrison said. "That gives you a predictable heading date, which would be very important." **Kyle Peveto**

LSU AgCenter Extension agent Justin Dufour inspects a wheat crop in a central Louisiana field. Photo by Kyle Peveto

Hessian flies are a major insect pest for wheat. Photo by Noah DeWitt

Biostimulant materials studied for effects on soybean, corn and wheat

In the past decade, a group of additives and other treatments called biostimulants, which claim to enhance the use of nutrients in crops, has seen a boom in the marketplace.

Agricultural producers have embraced this new class of materials, but they question which products they should use for different crops, said Brenda Tubaña, a soil fertility researcher with the LSU AgCenter.

Last year, Tubaña and her research team are studying these types of treatments. They are assembling the biostimulant products most commonly used by Louisiana producers and testing them, Tubaña said.

"This project came about because we want to document their performance based on soil and plant parameters including yield, so that when growers ask me if this product is working, we can pull out information to help them make a decision," Tubaña said.

Biostimulants include a wide range of products. They may be made from bacterial and microbial inoculants, biochemicals, humic and fulvic acid, or seaweed extracts, according to manufacturers that produce them.

"In agricultural production, there's a wide landscape of biologicals, and that includes biostimulants," Tubaña said. "By definition itself, and it's still changing right now, these are materials that are either fortified with microorganisms or some organic materials that enhances the efficacy of applied fertilizer."

The 2018 farm bill stated that a biostimulant was "a substance or microorganism that, when applied to seeds, plants or the rhizosphere, stimulates natural processes to enhance or benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, or crop quality and yield."

Some biostimulants "claim they can fix atmospheric nitrogen, adding nitrogen supply to crops like wheat or corn. This may not be as beneficial to soybean," Tubaña said. Other biostimulants contain microorganisms that help make precipitated nutrients in the soil soluble and available for the plant.

For the biostimulant study, Tubaña and her team bought popular products or asked companies to send them samples. In some cases, they asked producers for leftover products to test.

Biostimulants could become more important in the future in view of depleting mineral deposits, Tubaña said. Phosphorus fertilizer, for example, is produced from rock phosphate, she said, and feldspar is mined for potassium fertilizer.

"These minerals have finite sources," she said. "While the phosphate rock deposit is plentiful, only a small amount of phosphorus can be economically extracted. If you keep mining the easily extractable minerals, perhaps 50 years from now, we may not have these resources."

Tubaña and her team are studying additional soil fertility avenues as well. One long-term project documents the effects of cover cropping, slow-release fertilizers and biochar on fields.

Cover crops collect nutrients while they grow, and after the crop is terminated and incorporated into the soil, the nutrients are released back to the soil to be used for the main crop corn or soybeans.

"There's a long list of benefits of cover crops — soil surface protection, increases soil organic matter content, nutrient recycling," Tubaña said.

The cover cropping study began in 2018. Now, Tubaña is seeing an increase in yield of 2 to 3 bushels per acre and soil sulfur and phosphorus content.

"This may not be a big return in terms of yields," she said. "But the long-term practice of cover cropping helps out in raising the level of plant essential nutrients in the soil and overall soil fertility."

Applying biochar to fields has similar effects, Tubaña said. Biochar, which is the partially combusted residue of various materials, has been used as a soil amendment for years, according to the U.S. Department of Agriculture.

In Louisiana, biochar from sugarcane bagasse is common, and Tubaña has applied this form of biochar on fields with microorganisms added. She is working to determine the optimal application rate, and her research so far showed 1/2 to 2 tons per acre.

"These are practices that do not bring benefits overnight," she said. "It takes years of practice before you start seeing the benefits, especially when you're looking at nutrient cycling and buildup of organic matter in the soil." **Kyle Peveto**

Representatives of companies that produce biostimulants observe the trials begun by Brenda Tubaña's research team. Photo provided by Brenda Tubaña

Biostimulants are sprayed at a field trial undertaken by Brenda Tubaña's soil health research team. Photo provided by Brenda Tubaña

On a research plot, Brenda Tubaña's soil health team is testing several biostimulant products. Photo provided by Brenda Tubaña

First column: *Soybean seedlings.* ***Second column:*** *Soybean seedlings inoculated with Xylaria necrophora at the time of planting.* ***Third column:*** *Cotton seedlings.* ***Fourth column:*** *Cotton seedlings inoculated with Xylaria necrophora. Photos provided by Vinson Doyle*

Taproot decline: LSU researchers make strides in understanding soybean threat

Scientists today know much more about taproot decline, a disease primarily seen in soybeans in Louisiana, than they did just a few years ago. Once called a "mystery disease," it interferes with root development, often killing crops before they emerge and sharply limiting yields of infected plants that survive.

Researchers have learned a lot about *Xylaria necrophora*, the pathogen that causes the disease — but many questions remain. LSU AgCenter plant pathologist Vinson Doyle is focusing on refining inoculation methods so he can better understand the disease.

"One of the big challenges that we've had is reproducing the disease consistently in greenhouse studies and growth chamber studies," Doyle said. "The pathogen doesn't always cause disease, so when you add the pathogen to the soil, sometimes you see plants that show no evidence of symptoms. Other times, the seedlings don't even emerge. You get the two ends of the spectrum. We want plants that are still alive but exhibiting symptoms."

Being able to produce symptomatic plants more consistently will aid cultivar screening and other research.

Doyle also is studying the mRNA of soybeans, cotton and peanuts with taproot decline to understand how each plant responds to — and in some cases, resists — the disease. Peanuts don't seem to be affected by taproot decline, and cotton is being evaluated because the disease has begun showing up in that crop.

Interestingly, though, taproot decline probably is not a truly new problem in cotton. The disease has been around for a long time and likely was misdiagnosed as other diseases or abiotic stresses in years past.

"Some pathologists have speculated that maybe cotton was the first host — that this pathogen made its way into agricultural populations on cotton and then jumped over on the soybean — because cotton's been grown in this area a lot longer," Doyle said.

He hopes researching how taproot decline shifted from one crop to the next will offer clues about how the disease functions and possibly can be controlled. He has turned to historical collections of samples from Louisiana and Florida in the 1930s and '40s for insight. Back then, a similar pathogen existed mostly in wooded areas and on woody debris.

"Now we're trying to find this pathogen in forested populations so we can find isolates that may not be particularly well adapted to soybean or might show characteristics that give us an insight into how this pathogen shifted over onto soybean," Doyle said.

While there is still much work to do, Doyle is pleased with the progress that's been made.

"I think we've made a lot of progress on understanding this pathogen, and we've also developed some insight into how you can actually manage the disease," Doyle said. "We know that debris is probably the primary source of the disease, if not the only source."

Managing plant debris in fields can help prevent taproot decline.

Doyle has been studying taproot decline since 2017, when very little was known about it. He has enjoyed the process of scientific discovery.

"It's an incredible opportunity," Doyle said. "When you work with an emerging disease, it's exciting from a scientific perspective but also critically important to all of the stakeholders that are involved. When you get to work on something like this, it's rewarding." **Olivia McClure**

If high yield is your goal, don't let diseases take their toll

It's the goal every farmer strives for — attaining the highest yield possible while maximizing profits. Sounds easy, but it is much easier to do it with a pencil than it is to do in the field.

What keeps most farmers from achieving utopia? Too many to be mentioned in this article, and some (like the weather) are totally out of control of the farmer. Nature can be the mother of all monkey wrenches.

So, let's focus on one area producers can control. Managing diseases is paramount to reaching that high yield threshold. The LSU AgCenter has an entire Department of Plant Pathology geared toward fighting diseases that reduce yields.

Two pathologists tasked with developing strategies for disease management in corn, grain sorghum and soybean are Boyd Padgett and Trey Price. These two scientists have more than 50 years of combined experience combatting diseases of these row crops.

Price is housed at the Macon Ridge Research Station near Winnsboro, where he studies corn diseases like rust, northern corn leaf blight and Curvularia leaf spot (CLS), which is becoming an annual issue in Louisiana.

Continued on Page 16

Left: *A close-up of frogeye leaf spot on a soybean plant. It is a common disease in soybeans, and severe infestations can result in yield reductions of approximately 20%.* ***Right:*** *Trey Price, plant pathologist at the Macon Ridge Research Station, operates a spray rig used for fungicide experiments in an on-farm test on soybeans. These trials are used to help determine the efficacy of various fungicides on common diseases found in soybean fields. Photos provided by Boyd Padgett*

Continued from Page 15

The first step a producer should take in managing diseases such as CLS is to select resistant hybrids, not only sound advice for corn but any commodity.

"There are already hybrids with resistance," Price said. "We have rated official hybrid trials for the past two years and identified susceptible and resistant hybrids that are commercially available."

Another problem related to CLS is that neither yield loss potential nor effective fungicides have yet to be well-defined regarding the disease. For the 2023 growing season, Price and colleagues were able to obtain ratings for CLS, which should help lead to finding effective fungicides and determine potential yield loss.

Price is excited that the Macon Ridge Research Station has a new research plot sprayer that will allow for ground applications in corn. This equipment will facilitate research regarding water volume.

"Fungicide efficacy will likely increase with water volume," Price said. "Farmers may be reluctant to do it because they are irrigating at the same time fungicides would need to be applied."

Padgett works primarily out of the Dean Lee Research Station on the LSU-Alexandria campus. One area of research he is working on is fungicide efficacy, an area that needs to be constantly monitored.

Cercospora and aerial blight in soybean have documented resistance to some fungicides, but according to Padgett, some new fungicides have activity on the two diseases.

"To extend the usefulness of these new fungicides, producers should only apply these products when needed," Padgett said. "We will continue to do work as to when the applications are justified."

Because of the chemistry complexity of fungicides, Padgett is staying watchful for any pathogen resistance.

"If we suspect any resistance, we are going to take samples and evaluate for sensitivity," he said. "It is imperative that farmers and chemical companies know as soon as possible if resistance occurs."

Looking for another step producers can take that may lead to less disease pressure and increase yield?

Very simply, get your crop planted in the optimal window.

According to Padgett, preliminary research findings indicate disease severity is influenced by planting date. He cautions that more research is needed, and he plans to continue research in this area.

"Some diseases, such as Cercospora leaf blight, frogeye leaf spot and aerial blight, are not big problems every year," Padgett said. "If we can fully document that planting dates reduce the risk, then this will increase profits at no additional cost."

Both Padgett and Price believe that the 2023 growing season was one of the most difficult in memory. One of the very few benefits from the excessive heat and drought is that it minimized disease development. While that was good for producers, it did affect researchers studying diseases.

The two researchers plan to continue research studying issues such as fungicide efficacy and disease resistance on corn hybrids, soybean, grain sorghum and wheat.

Craig Gautreaux

Louisiana Soybean & Grain Research & Promotion Board Report

LSU AgCenter
Research · Extension · Teaching

Prepared by LSU AgCenter Communications, Tobie Blanchard, Director
Michael Salassi, Executive Associate Vice President and Director, Louisiana Agricultural Experiment Station
and Frankie Gould, Associate Vice President

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

Writers: Tobie Blanchard, Craig Gautreaux, Randy LaBauve, Olivia McClure, V. Todd Miller, Kyle Peveto, Michael Wilcher

Designer: Hernan (Andy) Gonzalez

MISC-101 3,500 8/24 REV.

The LSU AgCenter and LSU provide equal opportunities in programs and employment.

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

PRINTED WITH SOY INK

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