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THE LOUISIANA
Soybean & Grain
RESEARCH & PROMOTION BOARD

2022 REPORT

CONTENTS

Soybean research targets old and new pests, evaluates host plant resistance

Soybean farmers are familiar with the damage redbanded stink bugs can cause to their crops. In the first year of a three-year project, the LSU AgCenter has focused on this insect and others, to develop integrated pest management strategies that can help soybean plants resist an onslaught of pests.

The studies are being conducted at five AgCenter research stations: Doyle Chambers Central Research Station in Baton Rouge, H. Rouse Caffey Rice Research Station (South Farm) in Crowley, Dean Lee Research and Extension Center in Alexandria, LSU AgCenter Botanic Gardens in Baton Rouge and the Northeast Research Station in St. Joseph.

One objective is to evaluate 14 commercial varieties to home in on host-plant resistance to insect pests — particularly redbanded stink bugs.

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Top: *LSU AgCenter entomologist Jeff Davis sweeps for insects in a soybean field at the Doyle Chambers Central Research Station.* ***Middle:*** *The redbanded stink bug causes more damage to soybeans than any other insect pest.* ***Bottom:*** *Grassy border area between soybean fields at the Doyle Chambers Central Research Station in Baton Rouge. Photos by Randy LaBauve*

From the Louisiana Soybean and Grain Research and Promotion Board

No two years are the same. If you've been farming for long, you've heard that said and likely have seen it proven true. After multiple years of wet weather challenges, 2021's harvest was dry (thankfully) and now 2022 is the hottest and driest (not as thankful) we've seen in some years. That is why continuous research and promotion is so important.

As your checkoff board, the Louisiana Soybean and Grain Research and Promotion Board serves as Louisiana's wheat and corn checkoff and facilitates the national checkoffs for soybeans and grain sorghum in Louisiana. This important responsibility allows farmers to collectively administer funds for research specific to the needs of Louisiana while contributing to the national and worldwide market promotion of these staple crops.

Often when the board is reviewing projects in November and January, we may question projects that we have not seen the cause for in a few years. To have research on drought tolerance and flood tolerance going on at the same time may seem silly to some. 2021 and 2022 say otherwise.

That is why many years ago farmers began to see the need for a greater research and promotional effort through a checkoff. It is necessary that we have research and promotional relationships in place for the betterment of all. When the markets, weather, disease, pests or other uncertainties occur, we have research and promotion continuing to carry us through. That is accomplished with your contribution every time your crop is delivered to the market. Thank you!

This continuous research is also paying off in combating the exponential spike in input prices. Research helps us find efficiencies the average farmer's pocketbook might not be able to carry. We see this in our best management practices and variety selection trials. We see it at field days showcasing innovative new rotations from row-rice to soybeans. We also see it in the numerous input trails that select for different herbicide/pesticide/fungicide programs, fertility programs, or irrigation strategies that we fund annually. With inputs where they are in 2022, we can see how valuable one saved application or one saved watering can be on a fuel bill.

We hope in 2022-2023 to be more proactive on challenges before they arrive. The only way we can do that is to hear from you. The LSGRPB invites all checkoff participants to make their voice heard. Our nominations for the board come through organizations such as Louisiana Farm Bureau Federation and the Louisiana Cotton and Grain Association. Get involved now to let us know what we can do better to meet your needs. No matter the size, crop mix, location or demographic of your farm — if you farm soybeans, corn, wheat or milo — you have a place at this table.

As your chairman, I hope you find some area of your farm that is improved from scientific, credible, data-driven research, and you see how promoting these Louisiana crops worldwide benefits us all. Please attend the next board meeting Nov. 17-18 in Baton Rouge at the LSU AgCenter. You can hear reports on funded projects, review new proposals and provide feedback on the needs of your farm and how research and promotion could address them. I hope you have a blessed year and many more to come.

Sincerely,

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

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

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Researchers explore sulfur, micronutrient fertilizer applications

The chemical elements nitrogen, phosphorus and potassium may be well understood among producers as important parts of their fertilizer regimens. The LSU AgCenter is studying some lesser-known elements that may play a vital role in producing viable, profitable soybean and grain crops.

Brenda Tubaña, professor at LSU's School of Plant, Environmental and Soil Sciences, has been working to determine how the application of sulfur and micronutrients affect plant health, and ultimately crop yields.

"We need to make sure our fertilization guidelines for sulfur are up to date. With the cases of sulfur deficiency in crops increasing, it (sulfur) is now commonly included in crop fertilization programs," said Tubaña.

Tubaña said sulfur is a vital nutrient for plants because it facilitates the production of amino acids — the building blocks of proteins that are found abundantly in soybeans. Sulfur also aids plants in developing a compound that helps the plant use nitrogen. Sulfur deficiency has not always been an issue for crop production. Tubaña explained how a trade-off of cleaner air has contributed to deficiencies of atmospheric-derived sulfates.

"In the past, sulfur wasn't really a major issue in crop production in terms of supply," Tubaña said. "There is less sulfur dioxide in the atmosphere due to the Clean Air Act enacted way back in the 1980s, thus we don't see a high concentration of sulfate in precipitation."

The LSU AgCenter's efforts in studying sulfur application rates are focused on making sure the sulfur fertilizer rates producers are applying to their crops are adequate considering the decrease in sulfates provided by precipitation.

In field trials, Tubaña and her colleagues tested soil treated with sulfur, in various forms, at rates of 20, 40 and 60 pounds per acre. What they found is that due to the nutrient's mobility, no accumulation of sulfur in the soil was observed, regardless of the rate applied. Like nitrogen, sulfur is a mobile nutrient in the soil; sulfur losses often occur following precipitation events. Proper application techniques are being studied to determine how to decrease nutrient losses caused by leaching or runoff.

Tubaña said one of the sources being studied is pelletized elemental sulfur. In this form, sulfur must be first converted into sulfate, which is the form that plants uptake of this vital nutrient. The benefit to using pelletized elemental sulfur is that it provides a delayed-release characteristic that can slow down sulfur losses from runoff and leaching. The downside to applying this compound in pelletized form is that it takes longer for the crop to be able to uptake sulfur in sulfate form.

Tubaña and her colleagues are testing blends of compounds that can assist producers with application timing and nutrient uptake.

"The pelletized elemental sulfur is considered a slow-release fertilizer, so we are mixing it with the sulfate form, so a fraction of the blend has an immediate source of plant-available sulfur," Tubaña said. "With the sulfate being mobile, the soil might start losing it, but the presence of elemental sulfur in the blend will later supply the plants to avoid deficiency."

Other water-soluble compounds being tested for sulfur applications include calcium sulfate and ammonium thiosulfate.

Tubaña said research has shown that grain crops experiencing deficiencies of micronutrients can lead to yield losses similar to crops with deficiencies of nitrogen, phosphorus and potassium. The AgCenter is exploring applying solution and suspension forms of different micronutrient blends of zinc, manganese, copper and molybdate. The micronutrient causing the deficiency is sometimes hard to determine during a crop's growth stage because of the similarity of micronutrients' symptomology.

"While you may not see abnormalities, or discoloration, of the crops, the deficiency can be in a state called 'hidden hunger,'" Tubaña said. "In such a state, a plant is already experiencing deficiencies and starts reducing its yield potential before the visible symptoms occur."

The functions of the micronutrients being tested are to aid crops in activating enzyme reactions and to prevent lipid peroxidation that may occur naturally during the photosynthesis process. Tubaña said oxidation can lead to damage in plant cells and tissues resulting in impaired growth and yield losses. Micronutrients also play a role in establishing adequate lignin production which gives plant cell walls their rigidity.

"The reinforced mechanical structure of the plant is quite important to reduce lodging and to help control diseases," Tubaña said. "With stronger structure, pathogens and insects will find it harder to have entry into a plant cell."

Because micronutrients are needed in such small amounts, as their moniker suggests, a single application of a solution or suspension containing no more than 3%, at most, of a certain element by volume should be sufficient in preventing yield losses caused by micronutrient deficiency. **Derek Albert**

Helping producers with savvy marketing is the goal of LSU AgCenter economists

Keeping producers on the cutting edge of marketing is the goal of LSU AgCenter economists Naveen Adusumilli and Michael Deliberto. The work Deliberto does helps producers market their products for the best possible price.

Some of the his work focuses on farm commodity programs and cost of production estimates for corn, soybeans, grain sorghum and wheat, he said.

"With the funds that we are provided, we develop projected cost of returns so that we can provide producers with planning information for the upcoming crop year," he said. "We make this information available to the producers in the form of decision aids that allow them to input their own numbers."

Normally, the producers would be looking at how their returns are sensitive to market prices, but this year the focus has been on input prices, he said.

"So, this allows growers to estimate how a 10% increase in the price of fertilizer will affect the profitability of a corn crop, for instance," he said.

The information is available each year in January, so growers have a bit of a window to do their estimations before planting time.

Deliberto also works with crop insurance estimates and the potential payments growers can receive from U.S. Department of Agriculture programs.

Growers have been concerned with the cost of inputs, mainly because of supply chain issues. The price of fertilizer, however, has not been affected by the war in Ukraine as much as was expected, he said.

"We produce a lot of the nitrogen and phosphorus for our fertilizers, but we import a large amount of potash, with the bulk coming from Canada," he said.

The increasing costs of the raw materials, such as natural gas, used in producing the fertilizer are a major factor in the final cost.

Deliberto said the increase in commodity prices will help to offset the increased cost of production, but their profit margins will remain relatively flat, he said.

AgCenter economist Naveen Adusumilli also looks at ways to help farmers by evaluating production decisions that are economically and environmentally sustainable.

"Some of the projects that I have been working on include the Climate Action Plan, Louisiana Department of Agriculture and Forestry and the Environmental Protection Agency's interest in hypoxia," he said. "We look at how all of their conservation programs affect the soybean farmers' decisions as it relates to conservation practices."

A goal of Adusumilli's work is to reduce the amount of nutrients in water bodies, which in turn reduces hypoxia (low oxygen levels) in water.

"Most of our farmers are pretty progressive, so what I try to do is look at the different conservation programs to help the growers make a more informed decision," he said.

Each year, Adusumilli and his graduate students add one or two objectives that fit into the national priorities.

"So, the project goes year to year, but the development of information for growers is ongoing," he said. **Johnny Morgan**

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"We're looking at different varieties in a randomized, complete block design," said Jeff Davis, AgCenter entomologist and project leader. "How are they going to yield in response to insecticides and how are they responding to the different stink bugs?"

The study is also tracking stink bugs — which taste with their feet (tarsi) and ears (antennae) — to see whether they use pods or leaves to feed and lay eggs. Some farmers believe when the pods are brownish in color, stink bugs like them less, so Davis is trying to understand, from a scientific standpoint, if they have a different sense or taste that guides them to an optimal pod.

The research project is also monitoring the brown marmorated stink bug which first arrived last year in Iberville Parish after making its way from Pennsylvania, having originally arrived there from Asia in 2000. The pest is not only a potential threat to soybean and corn, but also likes to overwinter in houses.

Seed decay can occur when a weather event coincides with the application of harvest aids like desiccants used to dry the beans for harvest. AgCenter pathologists and entomologists are studying fungicides and looking for the best-timed applications to protect the beans.

They also want to find out if stink bugs are increasing the spread of Phomopsis, a type of fungi.

"We're trying to figure out if stink bugs are transmitting Phomopsis by moving their mouths like a dirty needle," said Davis. "Can they pick up some of the fungi and transmit it into the seeds directly, which can cause rot?"

Some soybean producers allow grasses and pollinator plants to grow along ditch banks and tree lines as part of a conservation stewardship program. One particular study was initiated because growers wanted to know more about soybean pests and beneficials living in the grassy growth.

"We spray egg whites on those grass sections where we know insects are," said Davis. "A couple days later, we come into our soybeans, sweep our areas, collect those insects and then we can detect foreign proteins with antibodies in the lab."

Tests have shown both beneficials and pests have overwintered in the buffer grasses and moved into the soybean plants. Research is ongoing, but measurements indicate the insects have migrated at least 50 meters into the fields.

Monitoring will continue, and if higher populations are detected in certain areas nearer to grass buffer areas, there may be an opportunity to apply site-specific applications using sprayer drones.

An important additional project is an AgCenter entomological collaboration with a University of Missouri plant breeder. Research, funded by the Mid-South Soybean Board, is analyzing new soybean varieties, with potential for greater insect resistance and higher yield potential.

AgCenter entomologists continue to work with agronomists, pathologists and weed scientists testing new and existing soybean insecticides for overall effectiveness against insects and disease. Overall, integrated pest management strategies can reduce insecticide applications and grower costs, while maintaining plant health.

"Soybean is the rotational crop for everybody, and we're trying to protect it," said Davis. **Randy LaBauve**

Insect pests' impact on soybean plants, other crops studied

Mild winters are nice and welcomed, but the insects they bring are not. Stink bugs, especially the redbanded stink bug, do well when the temperatures stay in the mild range through the winter months.

LSU AgCenter entomologist Jeff Davis said he found stink bugs in agricultural fields earlier this year than expected.

In a normal year, the redbanded stinkbug is found in clover until early summer, and then they move into soybean fields.

Davis is also monitoring insect pests for insecticide resistance because some populations of stink bugs have been showing resistance to certain insecticides.

Pyrethroid insecticides are one of the best ways to control redbanded stink bugs. Loopers, though, are resistant to the chemical, which, in addition to controlling the redbanded stink bugs, also kills beneficial insects that prey on loopers. Acephate also is effective against stink bugs, but it also has the downside of increasing loopers.

"The goal is to develop methods of controlling redbanded stink bugs without increasing soybean looper populations," he said. "When you remove all beneficial predators, the looper population grows exponentially."

Loopers don't overwinter in the U.S. The moths migrate on winds sweeping out of the Caribbean islands and Mexico where high doses of pyrethroids have resulted in resistant populations.

Davis said some populations are resistant to most products available for control.

There are three different chemical options that he will give to growers for stink bug control: neonicotinoids, pyrethroids and organophosphates.

If left unchecked, the redbanded stink bug can cause damage so extensive that farmers may lose an entire field of beans, Davis said.

When asked what the worst insect pest for Louisiana growers is, without hesitation, Davis said the redbanded stink bug is the No. 1 pest of Louisiana soybeans.

"It is the hardest to kill, most destructive, has high populations and is most resistant to the pesticides that we have," he said.

Three other AgCenter entomologists are also working on a variety of insect issues in corn, grain sorghum and cotton.

Tyler Towles is mainly working with insect pests in cotton, while Fangneng Huang screens different populations of fall armyworms, corn earworm and sugarcane borer to different Bacillus thuringiensis proteins.

AgCenter entomologist James Villegas is continuing ongoing experiments and initiating new investigative aspects to existing soybean insect pest problems and improving chemical control strategies.

"The work that I'm doing involves pest management in corn, soybeans, sorghum and cotton," he said. "We are looking at ways to manage our insect pests sustainably and try to extend that to our producers." **Johnny Morgan**

Three scientists join AgCenter to aid, research soybean production

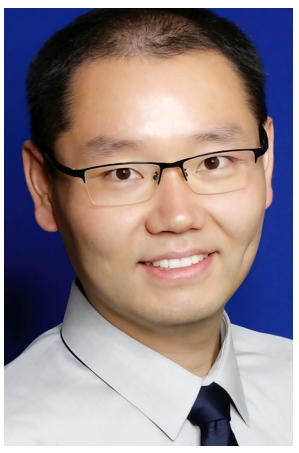
Xi Zhang is an assistant professor and soil scientist. He has joint appointments between the Red River Research Station and the School of Plant, Environmental and Soil Sciences. Zhang has expertise in soil physics and conducts research on soil physical and hydrologic processes as influenced by agricultural management practices under different cropping systems with the goal of improving crop production in Louisiana. He also works collaboratively with extension agents and specialists to help farmers improve soil health and water quality. Prior to joining the AgCenter, he received a doctorate in soil science from the University of Kentucky and worked at Oregon State University.

James Villegas is an assistant professor and field crops entomologist with extension and research appointments at the LSU AgCenter Dean Lee Research and Extension Center. His general research interests involve both applied and fundamental aspects of plant-insect interactions in crop agroecosystems. Villegas said he takes a holistic approach to insect pest management by integrating various control tactics that can help maximize grower profitability and promote sustainable approaches. He received his doctorate in entomology from LSU in 2021, where he investigated the role of plant tolerance and cultural tactics for the management of rice water weevil and the invasive stem-boring species, the Mexican rice borer. Prior to pursuing his graduate degrees, Villegas was a researcher at the International Rice Research Institute in his native Philippines.

Tri Setiyono is an assistant professor in the School of Plant, Environmental and Soil Sciences conducting research on digital agriculture applications to enhance resiliency of agronomic crop production in Louisiana. Setiyono's work will support education and extension activities for the AgCenter's digital agriculture program. He received a doctorate in agronomy from the University of Nebraska-Lincoln. Prior to joining the AgCenter, Setiyono worked for the International Rice Research Institute in the Philippines managing a team applying geospatial science and modeling in rice agri-food systems.

Setiyono

Villegas



Zhang

Scientists study ways to help farmers improve soil health

LSU AgCenter scientists are working to help farmers protect, improve and better understand the soil.

From planting rotational and cover crops to implementing conservation or no-till systems, there are many practices that offer potential benefits to soil health. AgCenter soil scientist Lisa Fultz has begun a new project examining these methods and quantifying their impact.

Fultz is gathering data from several existing research plots in northeast Louisiana. Using study sites that have been in place for years has its advantages.

"When we implement these conservation practices, we don't always see the benefits right away. Sometimes it takes three to five years," she said. "We have this opportunity now to go in and look at fields where these practices have been in place for multiple years and quantify these changes. On a lot of these fields, we also have yield data, so we can also see how yield has fluctuated over that time."

In another project, Fultz is studying the feasibility of planting cover crops using lower seeding rates.

"The current rates that are recommended are not necessarily based on best practices for cover crops. They're geared toward grain production, especially for grasses," she said. "What we've found for grasses like cereal rye is that we can plant at lower seeding rates and get as much biomass and ground coverage as the recommended rates while saving money."

Fultz also is studying timing and methods for terminating cover crops. Farmers need to get rid of cover crops before the growing season for their cash crops — but deciding when to terminate can be tricky.

Fultz is hoping to find a balance between maximizing the benefits of cover crops and terminating them early enough to avoid them turning into weeds that persist once other crops are planted.

Xi Zhang, who is based at the AgCenter Red River Research Station near Bossier City, is working to learn more about managing inputs based on local soil conditions. As a soil physicist, Zhang is studying spatial variability of soil properties. His goal is to learn more about the distribution of different soils in farmland and how those varying textures can affect the movement of water and nutrients.

"In Louisiana, substantial spatial variability of soil properties and thus crop yield has long been recognized by soil scientists as well as farmers," Zhang said. "For example, the soil type can vary between sandy and silty or heavy clays within the same field."

To meet yield goals, he said, farming practices should be adjusted to accommodate soil variability. That could mean dividing a field into several smaller management zones where inputs such as fertilizer and water are applied according to soil conditions in a specific area. But there is a limited amount of data to help farmers make decisions about this type of site-specific water and nutrient management.

A mixture of cereal rye and hairy vetch planted as cover crops is seen at the AgCenter Northeast Research Station on March 2, 2022. Photo by Olivia McClure

"This research will help farmers in Louisiana manage agricultural resources more efficiently and enhance grain yields," he said.

Fultz said all of these projects are important for a variety of reasons.

"From an economic standpoint, all of the resources that producers are putting into their field — fertilizers, herbicides, pesticides — are in some way interacting with the soil. Every time you lose soil off your field, you also lose inputs that plants rely on," she said. "And from an environmental standpoint, we don't want to see those inputs being lost from the field because they have the potential to end up in local waterways, and that creates problems with excess nutrients and cloudy water, which influences wildlife and other vegetation." **Olivia McClure**

Above: *Tristan Watson, a nematologist with the LSU AgCenter, collects a soil sample from a soybean field at the AgCenter Northeast Research Station near St. Joseph. Watson uses soil samples to determine the type and number of nematodes present in a production field.* ***Below:*** *Watson, right, and graduate student Caleb Hamm are involved in research designed to combat nematodes, which feed on the roots of plants and can reduce yields significantly if their populations reach a high density. Photos by Craig Gautreaux*

Nematodes small in stature but create big problems

Many people may not know that nematodes are the most numerous multicellular animals on earth, but you can be sure farmers are well aware of the damage these animals can cause on their crops.

Tristan Watson is a nematologist for the LSU AgCenter who is charged with helping farmers manage their nematode problems. His tasks include surveying fields across the state, identifying the types of nematodes found and watching for any new nematode species that might be encountered.

In Louisiana, the two most common nematodes are the reniform and Southern root-knot. Also known as roundworms, these parasites are found in the soil and can make waste of a crop in short time if they exist in high concentrations.

"The vast majority of nematodes damage crops by feeding on the root system, and this prevents plants from accessing water and nutrients," Watson said. "So a lot of times, the symptoms of nematode damage look identical to nutrient deficiencies and water stress."

Watson is currently doing research at the Macon Ridge Research Station near Winnsboro and the Northeast Research Station near St. Joseph on different soybean varieties. He is looking at the 20 most widely planted varieties grown in Louisiana and seeing if any provide resistance to nematodes.

"With every variety, we saw reniform nematode reproduction on every single one," Watson said. "But there were some differences in the extent of nematode reproduction."

Watson said five varieties seem to be the least susceptible to damage, but two varieties seemed to show high susceptibility.

Watson is also examining five new varieties that have confirmed resistance in Missouri and is working under the premise that this resistance would extend to Louisiana populations of reniform nematode.

Some populations of root-knot nematodes were able to overcome resistance in soybean varieties and build up to significant population densities. This discovery was concerning to Watson because there are very few nematicides to combat nematodes in soybeans.

One defense for reniform nematodes is to use a corn rotation, a commonly grown nonhost crop. This strategy seemed to reduce the population density in the field, which would mean lower numbers for the subsequent crops.

"Each crop in Louisiana has its own management strategy that can be utilized," Watson said. "For instance, soybean and corn, we don't have a lot of nematicides that are registered for use. But on soybeans we have some resistant varieties to the Southern root-knot nematode that can be utilized."

The simplest way to determine how many nematodes are present and what species they are is to collect a soil sample.

"You need to go out and sample soil in your field and send it in to a diagnostic lab," Watson said. "What you are going to get back is a list of nematode species you have and at what density."

One trend Watson has been seeing in his research is the displacement of root-knot nematodes by reniform nematodes across the state. He has not been able to explain the phenomenon, but the reniform nematode does not seem to be as damaging to some crops as the root-knot. This may be a form of good news for farmers.

A third species of nematode Watson is on the lookout for is the guava root-knot nematode. It has been found twice in Louisiana. If this nematode becomes established, it could cause serious issues.

"We don't have a lot of management tactics like we have for some of these other nematodes," he said. "We don't have any resistant varieties yet. We don't really know if any of the nematicides that we have available will work for this nematode."

Because nematodes feed on the roots of plants, it can turn sweet potatoes into an unmarketable product.

"The root-knot nematode, it causes deformation of your roots, and that's what you're trying to sell as a sweet potato grower," Watson said.

If his research is successful, growers should have a good selection of varieties that can stand up to the attacks from these parasites to choose from. **Craig Gautreaux**

2022 Soybean and Grain Research and Promotion Board-funded projects

Agricultural Economics and Agribusiness.....$28,500

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.....$53,000

Fungicide Seed Treatment with Lignin Nanoparticles, *Cristina Sabliov*

Analyzing Soybean Quality with Automated Image Processing, *Kevin Hoffseth*

Communications.....$6,500

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

Dean Lee Research Station.....$287,494

Soybean On-Farm Demonstration Program, *David Moseley*

Assessing Soybean Cultivars and Planting Date for Disease Management in Central and Southern Louisiana, *Boyd Padgett*

Disease Resistance and Fungicides for Disease Management in Central and South Louisiana, *Boyd Padgett*

Development of UAV Technologies for Soybean, Corn and Small Grain Crops, *Randy Price*

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

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

Evaluation of Mature Seed Damage Resistance, Fertilizer Inputs and Planting Practices to Increase Soybean Yield and Profits in Louisiana, *David Moseley*

Enhancing Field Corn Insect Pest Management Strategies for Central Louisiana, *Tara Smith*

Enhancing Grain Sorghum Insect Pest Management Strategies for Central Louisiana, *Tara Smith*

Enhancing Soybean Insect Pest Management Strategies for Central and South Louisiana, *Tara Smith*

Evaluating Agronomic Strategies to Improve Soybean Growth and Yield, *Tara Smith and Andre Reis*

Entomology.....$107,500

Sustainable IPM Solutions for Louisiana Soybeans, *Jeff Davis*

Baseline Susceptibility and Resistance Monitoring of Louisiana Corn Earworm Populations to VIP3A, A Novel Insecticidal Protein in Bt Crops, *Fangneng Huang*

Documenting Field Resistance to Transgenic Corn Hybrids Expressing the Novel VIP3A Protein in Louisiana Corn Earworm Populations, *Fangneng Huang*

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

Development of Control Options for Feral Swine in Soybean Fields, *Glen Gentry*

Macon Ridge Research Station.....$395,017

Corn On-Farm Demonstration Program, *Matt Foster*

Evaluation of Phosphorus and Potassium Applications to Commercial Corn Fields in Northeast Louisiana, *Matt Foster*

Effect of Crop Inputs on Corn and Soybean Yields in Louisiana, *Rasel Parvej*

Evaluation of Commercial Foliar Fertilization for Corn and Soybean Production in Louisiana, *Rasel Parvej*

Reevaluation of Phosphorus and Potassium Fertility at Different Soil Depths for Soybean Production in Louisiana, *Rasel Parvej*

Cultivar Evaluation, Fungicide Efficacy, Emerging Diseases and Novel Fungicide Application Methods in Corn and Wheat, *Trey Price*

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

Reaction of Selected Grain Sorghum Hybrids to Fungicide Application, *Trey Price*

Enhancing Soybean Insect Pest Management Strategies for Northeast Louisiana, *Tyler Towles*

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

Spatial and Temporal Variation of Soil Sampling Affect Phosphorus and Potassium Recommendations for Corn and Soybean, *Rasel Parvej*

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

Evaluation of Labeled Insecticides in Stored Field Corn and Grain Sorghum, *Tyler Towles*

Northeast Research Station.....$92,515

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

Evaluation of 30-inch Production Systems on 60-inch Beds in Corn and Soybean Production Systems, *Dennis Burns*

Plant Pathology and Crop Physiology.....$286,743

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

Direct Double Stranded RNA Application for Managing Cercospora Leaf Blight and Rust, *Zhi-Yuan Chen*

Characterizing the Production and Spread of Inoculum and Infection Strategies for Cercospora Leaf Blight and Purple Seed Strain Pathogens, *Vinson Doyle*

Evaluation of Soybean Germplasm for Novel Sources of Resistance to Frogeye Leaf Spot and Assessment of Pathogen Race Structure in Louisiana, *Jonathan Richards*

Redesigning Fungicide Control Strategies for Cercospora Leaf Blight of Soybean, *Sara Thomas-Sharma*

Evaluation of Reniform Nematode Resistance in Soybean Cultivars Planted in Louisiana, *Tristan Watson*

Host Status of Resistant Soybean Varieties to Geographically Diverse Root-Knot Nematode Populations in Louisiana, *Tristan Watson*

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

Evaluation of Biostimulants and Seed Priming Agents for Soybean Growth and Broad-spectrum Disease Resistance, *Jong Ham*

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

Red River Research Station.....$130,370

Soybean Breeding and Variety Development, *Blair Buckley*

Effect of Tillage System on Crop Irrigation and Evaluation of New Methods to Determine Irrigation Initiation Timing, *Syam Dodla*

Evaluation of Micronutrient Fertility to Increase Corn Yields in Louisiana, *Syam Dodla*

Fertility Loss via Soil Erosion and Runoff Water Quality from Rainfed and Irrigated Croplands, *Changyoon Jeong*

Spatial Variability of Soil Properties in Agricultural Fields, *Xi Zhang*

H. Rouse Caffey Rice Research Station.....$64,900

Evaluation of Soybean Cultural and Fertility Practices in Southwest Louisiana, *Manoch Kongchum and Dustin Harrell*

School of Plant, Environmental and Soil Sciences $395,500

Molecular Mapping and Expression Profiling for Development of DNA-Based Markers to Complement Wheat Breeding, *Niranjan Baisakh*

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

Herbicide Resistance Screening in Louisiana Cropping Systems, *Lauren Lazaro*

On-Farm Precision Agriculture Research to Support Variety Trials, *Luciano Shiratsuchi*

Soybean Improvement through Identification and Introgression of Salt Tolerance Genes, *Prasanta Subudhi*

Foliar Treatment of Micronutrient Deficiency: Addressing Yield Gap and Disease Pressure in Field Crops Production in Louisiana, *Brenda Tubaña*

Sulfur Fertilization Updates: Application Rate, Sources and Potential of Biostimulant, *Brenda Tubaña*

Improving Grain Crop Production through Fertilization Integrated Pyroligneous Acid, *Jim Wang*

Improving Micronutrient Fertilization for Soybean Production, *Jim Wang*

Characterizing Soil Health and Yield Under Conservation Practices in Soybean and Grain Production Systems, *Lisa Fultz*

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

Total Funding for 2022: $1,888,039

The soybean research field at Doyle Chambers Central Research Station in Baton Rouge is used to explore integrated pest management strategies. Photo by Randy LaBauve

Soybean agronomic trials support best management practice decisions

On-farm crop demonstrations are a long-standing tradition in agriculture. It is a tradition that Seaman A. Knapp instilled in the extension service. These demonstrations remain as a vital cog of research conducted by LSU AgCenter specialists.

David Moseley, AgCenter soybean specialist, collaborates with AgCenter agents, farmers and other specialists to conduct the state's soybean on-farm demonstrations.

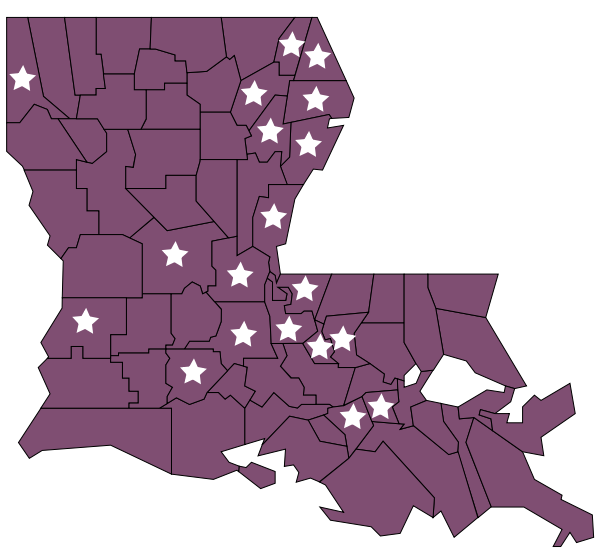
This year, Moseley has five areas of emphasis for the on-farm soybean demonstrations. They are the traditional on-farm variety performance strip trials (core block), a variety nematode resistance demonstration, conventional soybean variety evaluations, a planting date by maturity group demonstration and a potassium fertility trial.

"This year we are evaluating 36 different varieties across 19 parishes for the core block," Moseley said. "Yields are a priority for these demonstrations, but we are also placing an emphasis on nematode resistance and planting dates with some of our on-farm research."

Half of the core-block demonstrations are maturity group IV soybeans, but he is also looking at maturity groups III and V.

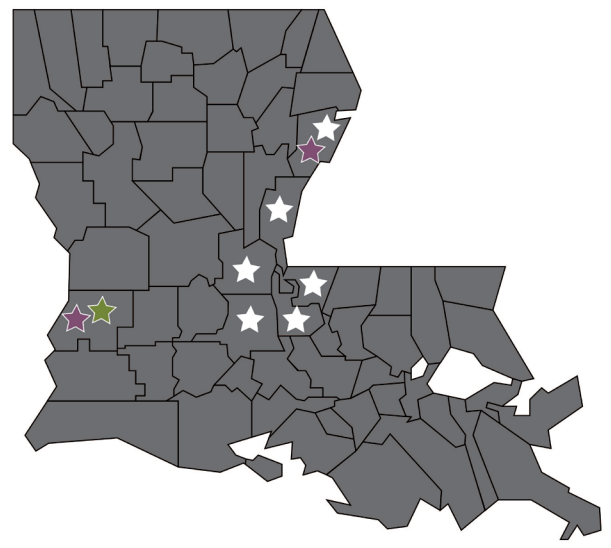
For the past three years, a planting date trial was conducted at the Dean Lee, Rice Research and Macon Ridge Research stations, which examined how planting dates affect yields, specifically for maturity groups III, IV and V. The six dates of planting ranged from the earliest on March 22 to the latest on July 1.

The optimal planting dates for these trials have been in April with a small drop-off in yield for late-March to mid-May planting dates.



Soybean core block locations

Acadia, Assumption, Avoyelles, Beauregard, Caddo, Concordia, East Baton Rouge, East Carroll, Madison, Pointe Coupee, Rapides, Richland, St. James, St. Landry, Tensas, West Baton Rouge, West Carroll, West Feliciana



Soybean nematode resistance
Avoyelles, Concordia, Pointe Coupee, St. Landry, Tensas, West Feliciana

Conventional soybean trial
Beauregard, Tensas

On-farm potassium trial
Beauregard

Moseley also did a phosphorus study in a field with low soil phosphorus levels last year and made an interesting finding.

"Applying phosphorus at the recommended rate at planting date is a recommended practice and did not result in the highest yield," Moseley said, "but in 2021 an in-season phosphorus application in a soil with low phosphorus content and high pH did result in yield increase."

Because many soybean varieties mature in August and September, they are often exposed to persistent afternoon showers or heavy downpours associated with tropical systems, which can affect quality.

"In 2020, we found there was evidence some varieties can have better weathering resistance," Moseley said. "We need to collect more data, but it may be possible to screen varieties to resist persistent rainfall during harvest season." **Craig Gautreaux**

Foster finds his niche as corn specialist, continues to examine potassium, phosphorus

Matt Foster is finishing his second corn crop as the LSU AgCenter corn specialist, and he will tell you with each day, he is becoming more comfortable in the role.

One of his duties is to continue to perform on-farm demonstration trials across Louisiana. These research projects allow Foster and the farmers a first-hand look at how various corn hybrids perform in a real-world setting.

"This year we have 17 on-farm demonstrations in 15 parishes across the state," Foster said. "We are looking at eight different hybrids at each location."

He also is conducting research on the role of potassium and phosphorus as it pertains to corn yields.

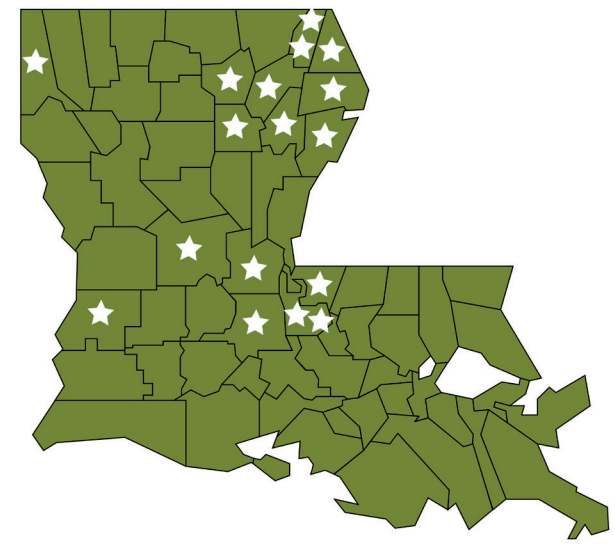
"In 2021, two fields were used for the studies," he said. "One was in Tensas Parish, and the other was in West Carroll Parish. Both fields were low in phosphorus and sufficient in potassium."

Foster said the Tensas field was a silt-loam soil type with a phosphorus content of 13.1 parts per million. The West Carroll location was a clay-soil type and had a phosphorus level of 19.6 ppm level.

After applying additional amounts of both phosphorus and potassium at both locations, only the Tensas location saw a significant yield response.

"Our control group had a yield of 185 bushels per acre," Foster said. "Adding 80 pounds per acre of each nutrient, the yield at the Tensas location went to 245 bushels per acre. Adding 120 pounds per acre of each nutrient got the yield to 269 bushels."

Foster noted that applications for each group were done around the V3 growth stage.



Corn core block locations

Avoyelles, Beauregard, Caddo, Caldwell, East Carroll, Franklin, Madison, Ouachita, Pointe Coupee (2), Rapides, Richland, St. Landry, Tensas, West Carroll (2), West Feliciana

According to Foster, these minerals are available for uptake immediately after a rain event. He also indicated that soil tests can be a very useful tool and can oftentimes indicate whether you can expect a response by adding fertilizer.

"It could be that actual ppm levels are more important than if a field is determined to be low or adequate with these nutrients," Foster said.

This year, Foster is continuing this project in Tensas and West Carroll parishes.

Another project that Foster is involved with is examining the importance of crop residue.

Foster said that corn stover has value as a nutrient source. Generally, for every bushel of grain yield, the corn stover contains 0.45 pounds of nitrogen, 0.10 pounds of phosphorus, 0.60 pounds of potassium and 0.06 pounds of sulfur. Therefore, the stover of a 200-bushel per acre corn crop would contain 90 pounds of nitrogen, 20 pounds of potassium and 12 pounds of sulfur per acre.

When crop residue is burned, approximately 100% of nitrogen and 80% of sulfur will be lost upon combustion. In theory, phosphorus and potassium are not lost during combustion, but substantial loss can occur from the smoke and ash.

The loss usually occurs when ash floats away during the burn event or is moved away from the field by wind or rain after the burn. If the remaining ash is not immediately incorporated into the soil, up to 80% of the phosphorus and potassium could be lost.

Excessive removal of crop residues can eventually result in soil nutrient and organic matter depletion and require more fertilizer inputs. While the lost nutrients can be replaced, the loss of soil organic matter is not easy to improve. Foster encourages producers to let corn residue naturally decompose during the winter months instead of burning it.

The results of these projects may find their way into recommendations made by the AgCenter regarding corn production. Foster said this information is being shared with AgCenter soil fertility specialist Rasel Parvej and will be included with some of the findings of Parvej's research. **Craig Gautreaux**

Research suggests lower recommended fertilization rates for soybean and corn

Costs of crop fertilizers are continuing to remain at all-time highs. Fortunately, 2021-2022 LSU AgCenter research indicates there could soon be lower recommended rates of phosphorous and potassium fertilizer in medium- to-high-tested soils for both Louisiana soybeans and corn, which would save producers money.

Researchers have been looking at current soybean recommendations that were originally made more than 20 years ago, according to Rasel Parvej, an AgCenter soil fertility specialist. Higher-yielding genetic plants with improvements have been developed since that time.

Parvej has continued to develop a critical soil test level that indicates crop yield response to fertilization. This is the exact amount of fertilizer — not too little, nor too much — needed to reach maximum yield for current soybean varieties.

The trials were conducted at 32 locations in 2020-2021 and are ongoing at another 20 different sites for 2022. Tests were performed on all different soil types that range from sandy loam to clay.

"I've found with the two years of data so far, we need to revise our current phosphorus and potassium recommendations," said Parvej.

He said when the soil phosphorus level was below 20 parts per million (ppm), or 40 pounds per acre of phosphorus, and fertilizer was applied, there was a yield response. However, the probability of yield response to fertilization was much higher when the soil test was 15 ppm (30 lbs./acre) or less of phosphorus.

When the phosphorus level was more than 20 ppm, there was no increase in yield with added fertilizer.

"The current soil-test-based phosphorus fertilizer recommendations are fairly accurate, but we may need to fine-tune our critical level and fertilizer rate above critical level," said Parvej.

Evaluation of ear development in a potassium and phosphorus trial for corn in Tensas Parish. Photo by Olivia Hendrix

The existing potassium recommendations for Louisiana soybean vary with soil types and geographical position. For example, if a soil is tested at 150 ppm (300 lbs./acre) of potassium, the current recommendations call for potassium fertilizer application for clay soil, but not for sandy or silty soil.

Parvej's research has shown that the current potassium recommendations are too complicated, and there is no added benefit of potassium to yield if a soil tests over 110 ppm (220 lbs./acre). Another important finding showed there were similar yield responses on all the soils that were covered, meaning producers could use one recommendation for every field.

Parvej has also compared the current recommended depths (0 to 6 inches) for soil testing against other depths (0 to 8 and 0 to 12 inches), because deeper soil might have more nutrients, such as potassium, available to the plant. His research, to this point, has found the recommended 0 to 6 inches of soil still works well for determining the plant's nutrient needs.

"But what we will change is our critical level," he said. "That will change for both phosphorus and potassium."

Matt Foster, AgCenter corn, cotton and grain sorghum specialist, has conducted a research project about fertilizer applications for commercial corn for the last two years. The 2021 test sites were on sandy, silty soil in Tensas Parish and on heavy, Sharkey clay soil in West Carroll Parish.

There was no yield response for potassium or phosphorous fertilizer applications in the clay soil, but there were yield improvements on the silty soil.

"Similar to Parvej's phosphorus findings for soybean, based on 32 site trials, anything below 15 ppm of phosphorus, we're seeing improved yield for corn. But anything above it, we see no improvement in yield," said Foster.

Also similar to Parvej's soybean findings, Foster's corn results showed potassium applications above 110 ppm (220 lbs./acre) had no statistical impact on yield compared to non-treated corn — on both soil types.

Based on the data from these few corn trials, Parvej will propose research on at least 30 to 40 additional sites to replicate these findings and to revise current phosphorus and potassium recommendations.

"This tells you updating our current soil-test-based recommendations is very important, so you can predict whether you'd see a response from fertilizer," said Parvej. **Randy LaBauve**

Johnson, ryegrass provide challenges this year

Louisiana soybean producers always have a full plate during growing season with factors such as weather, insects and weeds coming into play. This year one of the biggest issues they face is glyphosate-resistant johnsongrass and ryegrass.

LSU AgCenter weed expert Daniel O. Stephenson said he's been getting a lot of calls from producers about johnsongrass that seems to have built a resistance to glyphosate.

"We had an unusually warm December this year," Stephenson said. "I remember seeing johnsongrass back then, and it never really got cold enough to knock it back, so it's been a monster year for it."

Stephenson went on to say the LSU AgCenter confirmed glyphosate resistance in johnsongrass in 2010 in Rapides and West Baton Rouge parishes. In the years since, glyphosate-resistant johnsongrass has spread throughout the central and southern areas of Louisiana.

Stephenson said that he has received complaints from producers in the Macon Ridge and Mississippi River parishes over the past two years about glyphosate's ineffectiveness on johnsongrass.

"Glyphosate resistance is similar to antibiotic resistance in bacteria," he said. "Multiple sub-lethal doses of glyphosate year after year is the cause. This is the same scenario as many other weedy species that are currently resistant to a herbicide. A weed management plan that has a holistic approach must be adopted to manage the problem or potentially avoid it."

In addition to johnsongrass, Stephenson said that glyphosate-resistant ryegrass has also "exploded." He and his AgCenter colleague weed scientist Donnie Miller have a project starting in the fall looking at different techniques to control ryegrass.

Miller, who works out of the Northeast Research Station in St. Joseph, said that ryegrass is quickly becoming the most common and troublesome weed to all crops — not just soybeans — due to increases in population and development of resistance to most over-the-top herbicide options, including paraquat, which was confirmed this year.

"In 2020, we saw probably the biggest population of ryegrass I've ever seen in northeast Louisiana," Miller said. "In fields, on borders of fields, in roadside medians, it was just everywhere."

Miller said if growers can't control the grass, it becomes a tremendous competitor with crops, especially those that are planted early like corn, which reduces yield for producers. The weed may also host insect populations, which is doubly problematic.

Italian ryegrass shown after a fall, residual herbicide application (Clomazone). Photo by Donnie Miller

"It's just one of those weeds that can slowly take over. It sits on the edge of the field for a couple of years then, all of a sudden, it's 10 feet into the field edge, then next year 30 feet in. And when the farmers conduct tillage operations, they can drag seed from plants on the outer field edges into their production fields," he said. "I like to say it's like being stalked by a turtle — it closes in little by little until it's got you."

Much of the work Miller and his researchers are focused on began last year and will ramp up this year regarding ryegrass management, either through cover crops and/or herbicides applied in the fall after harvest.

"If we apply the herbicides at earlier stages of growth of a cereal rye cover crop in the fall, it can still do a decent job of knocking it back," Miller said. "So, we're going to look at some combinations of that with different cover crops, which would be another tool in our toolbox to help producers." **V. Todd Miller**

Early summer heat curtails the impact of grain disease, but research moves forward

The unusual late spring, early summer heat wave combined with dry conditions have lessened the severity of soybean and grain disease this year — a far cry from last year's rain-drenched season. Yet, according to LSU AgCenter pathologists Boyd Padgett and Trey Price, the weather hasn't slowed down the research that both are currently conducting on behalf of growers.

"A lot of these fungal organisms need moisture for the spores to germinate, and in fact we haven't had that this year," Padgett said in June. "I mean, it was 100 degrees just the other day."

Padgett says that there have been a few occurrences of aerial blight, but it is nothing compared to the growing season of 2021. To keep the research robust, his team has been planting susceptible varieties to test the efficacy of commercial and experimental fungicides.

"We also evaluate the impact fungicides have on different varieties," he said. "We have evaluated as much as 125 different varieties in five different maturity groupings in the official variety trials."

Padgett went on to say that his team planted two official variety trials at two locations: Alexandria and Baton Rouge. One trial was treated with a fungicide and the other trial was not treated, which provides stakeholders with variety performance with or without a fungicide.

"The applications are triggered by the growth stages of the plants, so when the different maturity groups start developing tiny pods, we'll put the fungicide application out," he said.

Padgett's colleague Trey Price currently has three projects that the AgCenter is conducting. In addition to soybeans, he is also researching 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.

"Producers can use our information to make decisions on which varieties they want to plant the following year," he said. "From an agronomic standpoint, that continuous corn information may be helpful to a lot of growers that plant continuous corn."

Like Padgett, Price says the hotter, dryer June weather has adversely affected the foliar diseases in his plots, calling them "practically nonexistent."

"It's been a very clean corn crop this year, and that's mainly due to the dry weather," he said. "Most of these foliar diseases in corn are driven by frequent rainfall."

As far as soybeans go, Price is continuing to work on salt-tolerant varieties, which is important to producers in and around northeast parishes where the Macon Ridge Research Station is located. There, groundwater salinity is high.

Price said his researchers rate soybean varieties on a zero to nine scale, where zero means the varieties are invincible to salt and nine means they will surely die. He says many fall in the middle. Those with higher tolerance are called excluders.

"It may not be a zero, but a four, five or six," he said. "When planting soybeans marketed as excluders, growers need to know to what extent they are effective, which is the main purpose of our trial."

In addition, one disease Price and his team are currently looking at is taproot decline (TRD) with a specialized variety screening at Macon Ridge, where there appear to be TRD-resistant commercial varieties farmers can use. He says there are a few promising seed treatments for managing the disease, but the researchers don't have solid recommendations yet.

"Growers would rather be able to use a seed treatment, which is much more convenient for them instead of in-furrow fungicide applications, so we are continuing to look at that," he said. **V. Todd Miller**

Work to combat Cercospora continues

LSU AgCenter plant pathologist Sara Thomas-Sharma is looking for new ways to control an old problem in Louisiana soybeans: Cercospora leaf blight.

Cercospora has long been the prime foliar disease in soybeans throughout the South. The disease usually sets in as plants enter reproductive stages of development, meaning it can affect seed production and lead to yield and quality losses.

These symptoms are caused by a toxin called cercosporin, which is produced by the Cercospora fungus.

"It's toxic universally, so all kinds of cells die with it, but the fungus does not die in the process of producing the toxin," Thomas-Sharma said. "So we are trying to understand how the fungus is able to resist the toxin. How is it not killing itself when it is killing the plant?"

Research has shown that the cells of other kinds of fungi contain lipid droplets that sequester toxins and prevent damage. Thomas-Sharma wants to find out if Cercospora cells function similarly.

"My interest is seeing if there are chemicals that can inhibit lipid droplet formation, which would then make the fungus perhaps kill itself or not produce enough cercosporin to damage plant cells," she said.

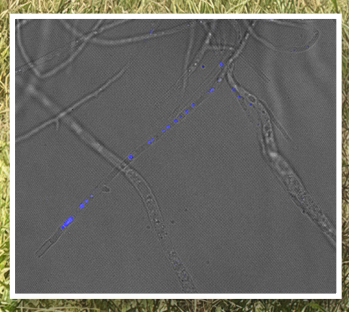
Thomas-Sharma also is following up on the findings of a previous project conducted by fellow AgCenter plant pathologist Vinson Doyle. This work aims to determine if spore traps can be used to detect peak times for spore transmission and help target fungicide applications and whether those applications are economical.

Though it previously was thought that seeds brought the Cercospora fungus into fields, Doyle's work has suggested that weeds can serve as hosts to Cercospora, which can then spread via airborne spores to neighboring soybeans.

Thomas-Sharma also recently completed a project looking at whether foliar iron applications can help control Cercospora. The applications didn't seem to work, but the project sparked an idea for future research.

In examining soybean plants, Thomas-Sharma found that iron content is the highest in the lower leaves, while Cercospora tends to be most prevalent in leaves that are higher on the plant. Also, the disease comes in during reproduction, when nutrient balances are changing.

"We still think nutrients are playing a role in how this disease is seen in the field," she said. **Olivia McClure**



Nelomie Galagedara, a graduate student, checks a spore trap being used in work on Cercospora leaf blight. Inset: This microscope photo shows blue coloration of the cercosporin toxin in lipid droplets of the fungal strand (hyphae). Photos by Sara Thomas-Sharma

Engineer designing software, hardware to analyze soybean quality

A technological solution could soon aid soybean producers and crop inspectors in determining the quality of soybeans bound for sale.

Kevin Hoffseth, an engineer who specializes in the analysis of the mechanics and deformation of biological materials, is developing ways to use cameras and computer algorithms to better analyze soybeans.

New technologies will never replace human crop inspectors, Hoffseth said, but they can help them become more consistent.

"It makes everyone's job easier by removing some subjectivity and improving accuracy and precision in the evaluation of visual indicators of soybean quality," he said. "You can't replace the inspection process. It's worked great for a long time, but there's nothing to say you can't help the process."

In conversations with soybean producers, Hoffseth found some felt frustrated with unexpected variations in grades their crops received in the past. The tools Hoffseth is developing could help producers know what to expect when they transport their crops to the warehouse for sale.

"I think it removes a lot of the stress and uncertainty," Hoffseth said.

Hoffseth first received grant funding for the soybean imaging project in 2020, and over the past two years his team has worked to build a soybean-specific imaging system from scratch. The system comprises two parts: custom software that can analyze the color, shape and texture of soybeans and machinery that photographs the beans.

Creating a software that can view texture as well as the human eye is challenging, Hoffseth said.

"When you see a pattern on a cushion or the roughness of a sawn piece of wood or even spackle on your wall, it comes back to what people can intuitively figure out," he said. "With your eyes you can see that the surface is not perfectly flat. You can see the undulations."

Hoffseth has harnessed the same image processing techniques used in applications ranging from medical imaging to satellite imagery to decipher texture.

"Once you have the image in digital form, you can perform all these mathematical operations on it," he said. "You can calculate a lot of stuff, and essentially what you're doing is you're finding the patterns in the data."

Using color, shape and texture to analyze the quality of soybeans has shown promise in connecting to existing standards for crop inspection.

"Part of what we're trying to do is link up to the visual measures that they use as part of that process, which is indirectly linked to the transaction that the producers have with the buyers," he said. "How can we level that playing field? How can we give a repeatable, accurate sort of measure of a lot of these visual indicators?"

While developing this imaging software, Hoffseth and his team have tested several ways of creating high-quality images of soybeans. Because no sufficient imaging solutions exist, they are building new machines that might be patentable.

"Maybe you can do an assembly line — one by one that is really fast — or maybe you could take one big photo of the top of a truck bed?" Hoffseth said. "There are all these different ways to possibly do it, so we're looking at ways that have some potential in really speeding up the process."

Throughout the research process, Hoffseth has spoken with soybean producers to understand their needs, and underlying challenges of the work.

Kevin Hoffseth, an engineer in the LSU AgCenter Department of Biological and Agricultural Engineering, is developing ways to use cameras and computer algorithms to determine the quality of soybeans bound for sale. Photo provided by U.S. Department of Agriculture

"I want to really address their needs and the questions they have had," he said. "They have helped me figure out what their needs are, and that helps me think about the possibilities." **Kyle Peveto**

Drone field images help assess plant health

Farmers are moving into the high-tech arena when it comes to scouting soybean and corn fields in the state.

For nearly 10 years, AgCenter agents Dennis Burns in Tensas Parish and R.L. Frazier in Madison Parish have used unmanned aerial vehicles, commonly known as drones, to take whole-field images to assess the health of plants.

The LSU AgCenter's precision and digital agriculture program continues to expand, allowing researchers to cover more ground.

Luciano Shiratsuchi, precision agriculture specialist and coordinator of program, plans to use data to generate management parameters for farmers who are equipped for variable rate applications.

Shiratsuchi said the majority of farmers in Louisiana are still applying uniform rates of seeds, fertilizers and herbicides to their fields because of a lack of public information or service providers with a cost-benefit option that is affordable to them.

"Most crop management decisions are made using uniform rates over large areas, disregarding the soil spatial variability that is very high in our state," he said. "A public and unbiased on-farm precision agriculture research program is needed to support the farmer to select the right variety and plant population to their management zones in the field."

In general, new farm equipment has the ability to vary the rate of any input in their fields, but without many official unbiased recommendations, farmers may not use this technology.

Planters are available in the market that can vary not only plant population according to maps, but also up to three hybrid varieties based on management

The LSU AgCenter's precision and digital agriculture program continues to expand. Stock image

zones. But the performance of these varieties in different management zones still needs on-farm experimentation.

"What is being done by some companies is the use of official recommendations originated from experiments conducted in small plots inside research stations," he said. "But soil spatial variations in the same experimental condition were not considered in the analysis due to the size of experiment."

Shiratsuchi said there is a huge advantage to conducting on-farm experimentation because you will have larger plots, low human errors, better

Continued on Page 11

Wheat and oat breeder Stephen Harrison discusses new varieties at the 2022 LSU AgCenter wheat, oat and cover crop field day at the Tom H. Scott Research, Extension and Education Center in Winnsboro on April 20. Photo by Johnny Morgan

Interest in wheat grows as prices rise because of war, drought

High wheat prices have spurred many Louisiana producers to take an interest in planting the grain crop in 2022.

Producers planted 14,000 acres of wheat in Louisiana in 2019, according to AgCenter statistics, and LSU AgCenter wheat breeder Stephen Harrison expects that number to rise substantially this year as wheat prices rose from $6 per bushel last year to more than $10 for much of 2022.

Harrison has taken numerous calls from farmers and consultants inquiring about the best varieties for their acreages in 2022.

"There's a tremendous amount of interest in wheat varieties right now because wheat prices are at an all-time high due to the Ukraine situation and drought in the (American) West and a number of issues," he said.

Harrison has spent 37 harvest seasons at the AgCenter working to improve wheat varieties. He has collaborated with breeders and research programs in other Southern states through SunGrains, a seven-university wheat breeding cooperative that shares resources and royalties from seed sales.

Last year AgSouth Genetics released AGS 3022, a new wheat variety developed by Harrison's team using methods that can bring new wheat varieties to market more quickly.

"It is a very good variety for all of Louisiana," Harrison said. "It is a little bit on the early side, but not nearly as early as some we have released. It did very well in north and south Louisiana this year and was also the highest-yielding variety in the soft wheat trials in Texas."

The variety has excellent test weight and very high yields, he said. It also has a strong resistance to stripe rust and to fusarium head blight, or scab.

"Scab is our biggest nemesis and what we spend a large proportion of our resources on," Harrison said.

In most cases, new wheat varieties take 10 years to develop from the time breeders first make a cross between existing lines to the day the seed becomes available for farmers.

"That's because it takes five or six generations of self-pollination to purify the line from the time you make the cross," Harrison said. "Then it takes another three to four years of yield trials across the region to know that it's worth releasing. After that it is increasing the seed and getting it to commercial quantities."

However, AGS 3022 was released in six years. Harrison and his team used a time-saving procedure, the double haploid methodology, which is a breeding shortcut used in some cases to speed up the process.

"We can't do that with our entire breeding program because it's a very expensive process," Harrison said. "It would take an additional half a million dollars to do that on every cross we make, but we do choose a few high-priority crosses each year."

Another new variety developed through traditional breeding methods may see a release date later this year. Currently named LA 13154, the cross was made in 2013.

"It's been very, very high yielding," Harrison said. "It did exceptionally well in the USDA (U.S. Department of Agriculture) uniform regional trial across 14 or 15 states last summer."

The variety is being prepared for release with a large seed increase at Georgia Foundation Seed in Plains, Georgia, Harrison said.

In the next year, changes are coming to the SunGrains cooperative, Harrison said. Paul Murphy, a breeder with North Carolina State University and a major contributor to SunGrains, is retiring in 2023. A breeder at Clemson University in South Carolina will take over much of his research and the genetic material Murphy has developed, Harrison said. **Kyle Peveto**

Continued from Page 10

extrapolation of the results for a determined cropping system, better equipment being used to conduct all operations (seeding, fertilization, spraying, harvesting, etc.) and a direct application to the farmer who is conducting the experiment.

"The big paradigm and challenge of this project is to bring experimentation to the farmers' fields using a different approach where their equipment will do all treatments automatically and the data will be transmitted wirelessly to cloud based systems," he said.

AgCenter agricultural engineer Randy Price is also using drone technology to determine the proper amount of nitrogen to apply in corn fields.

Price said his research separated the field into strips and nitrogen was applied at various rates to check how the plants responded.

The aerial images captured across the fields could be helpful to farmers who want to know the variance of what nutrients may be lacking in or being overused in his fields.

"We tell the growers to start out with a low-cost drone to get comfortable, so they map a field, monitor equipment or even check on wild hog damage," said Price.

Price said most of his work is with soybeans, cotton, wheat, oats and sugarcane, where he is looking at variances across fields.

Shiratsuchi said the greatest finding of the study was that you cannot pick a variety by yield.

"It's not the first in the ranking that is best for your field," he said. "There are varieties that perform better in light-textured soils, while other varieties perform better in heavier soils. Choosing a high ranking variety doesn't tell the whole story."

Others working on the project include AgCenter researcher Tri Setiyono, who is studying the integration of crop models and remote sensing. **Johnny Morgan**

Biostimulants, seed priming can protect soybeans from pathogens

Plant pathologists are often focused on bad bacteria — the ones causing disease in plants. Jong Hyun Ham, however, is looking at good bacteria to help grow better soybean plants.

Ham is conducting research on biological materials that can encourage disease resistance and enhance soybean growth and yields.

He said these biostimulants can cause a good reaction in the plants, boosting immunity to challenges they might face in the field similar to how a vaccine can prevent illness.

"It could be put directly on the plant or used as a seed treatment. I am interested in seed treatments," Ham said. "It is more efficient and potentially safer."

With seed treatments, a farmer wouldn't have to spray the chemical or biological agent in the field, which would reduce runoff and keep it from reaching non-targeted plants.

Ham starts the process by screening bacteria from the soybean fields and isolating strains. He also screens the individual bacteria cells and selects strains based on their possible beneficial activity to the plant's growth.

"Some bacteria produce plant growth hormones, so we identified those bacteria and tested the bacteria on the plant growth," he said.

Ham has been investigating the use of biostimulants on soybean plants and rice for about five years. This year his research will expand to priming the seed — treating the seed with the chemical or biological agent as opposed to spraying the plant. He said priming makes the plants ready to respond to challenges in the field such as pathogens.

"We are testing different chemical material known to induce plant defense," he said. "The difference with some previous research is to test if priming protection can be obtained by the seed treatment."

Plants growing from primed seeds won't appear much different from non-primed plants. The growth and yield will be similar, but Ham said if a pathogen infects the field, the plants grown from primed seeds will be more likely to exhibit elevated resistance or less disease symptoms.

Ham said in his research he has seen that treating soybean seeds with salicylic acid or methyl jasmonic acid enhanced resistance of soybean seedlings to the fungal pathogen *Rhizoctonia solani*, which can cause root and stem rot.

"The plant shows resistance to rhizoctonia, and they might be resistant to other pathogens," he said.

Ham is developing additional research with AgCenter plant pathologist Vinson Doyle to look at how the seed priming may work against Cercospora.

Ham said he conducted similar studies in rice using chitosan, a component of shellfish, and said the compound induced plant protection.

One challenge Ham is facing is the shelf life of the formulations he is developing.

"The bacteria are a living organism, so it is challenging to preserve it."

He is freeze drying the bacteria cultures and testing the stored formulas at different time periods to see how they perform.

Ham expects to continue the study for a few years to test different combinations and formulations of the biostimulants and compare his products with commercially available ones. Ham said because he is using common material, his formulas would be less expensive than what's currently on the market.

"Hopefully we get a cheaper option to enhance soybean resistance to diseases," he said. **Tobie Blanchard**

Jong Ham, LSU AgCenter plant pathologist, inspects soybean plants at the LSU AgCenter Plant Material Center. The plants are grown from seeds treated with biostimulants and inoculated with pathogens to see how the biostimulants protect the plants from diseases. Photo by Tobie Blanchard

Louisiana Soybean & Grain Research & Promotion Board Report

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