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LOUISIANA Agriculture

VOL. 69, NO. 3, SUMMER 2026
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ENSURING OUR FUTURE THROUGH SCIENTIFIC RESEARCH AND EDUCATION



HOW TECHNOLOGY is TRANSFORMING AGRICULTURE

LSU AgCenter
Research · Extension · Teaching

AGCENTER HARNESSES MODERN TECHNOLOGIES

TO HELP LOUISIANA PRODUCERS

KYLE PEVETO

IN THE PAST THREE DECADES, modern innovations like GPS have changed the way we travel, and interconnected sensors have improved home security and efficiency. Now, self-driving cars are appearing on city streets, and drones are delivering packages to homes.

Through a movement called digital agriculture, similar innovations are transforming farming with technologies that allow producers to automate tasks and digitize data to make better decisions. LSU AgCenter researchers are working to better understand these emerging technologies while also developing the next generation of tools to help producers.

Employing modern digital information tools such as internet-connected sensors, satellite imagery, yield monitor and unmanned aerial and ground equipment to collect and share data and make farming more efficient is an important part of the digital agriculture field.

Within digital agriculture lies precision agriculture, a field that focuses on better management of crops and animals and has potential to save money and conserve resources. Through precision agriculture, producers aim to observe crops, discover the appropriate amount of an input — fertilizer or pesticides, for example — and apply only the amount needed.

"We need to know the specific needs of each plant and then we need to make the precise application or the minimum needed for that plant," said Congliang Zhou, the AgCenter precision agriculture Extension specialist. "Right time, right location, using the right method. That's the key concept of precision agriculture."

Digital and precision agriculture technologies began developing as early as the 1970s, according to a U.S. Department of Agriculture Economic Research Service summary of this facet of agriculture. Early precision agriculture tools included tractor guidance systems, advanced soil sampling and yield monitors that measured crop attributes. Many of these once-cutting-edge technologies are conventional now. Additional tools like variable rate technologies, which allow producers to use tractor implements to apply different specific amounts of nutrients, seeds or other inputs to different areas, have become common since their introduction in the 1990s.

Zhou expects Louisiana growers to adopt drones to both scout fields and spray needed applications as these technologies become more advanced. Applying variable rate technologies to sprayer drones is expected in coming years. Developing artificial intelligence models to help identify weeds, diseases and insect pests could also help producers use fewer chemicals and become more efficient.

In this issue of Louisiana Agriculture, LSU AgCenter researchers and Extension personnel detail the rapidly progressing fields of digital and precision agriculture and explain how they are educating Louisianans on the benefits of these tools.

The AgCenter precision agriculture team is working on numerous projects and identifying ways to collaborate and connect digital agriculture tools.

"There is a lot of work to be done," Zhou said. "How can we combine these technologies? That will be the key to making it successful."

Kyle Peveto is the editor of Louisiana Agriculture.



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ON THE COVER: A sprayer drone flies above sugarcane during an evaluation near Alexandria. Photo by Kyle Peveto

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Kyle Peveto

CONTRIBUTING EDITOR:
Olivia McClure

ASSOCIATE EDITOR:
Marla Elsea

ASSISTANT EDITOR:
V. Todd Miller

DESIGNER:
Ana Iverson

CONTRIBUTORS:
Tobie Blanchard, Annabelle Lang and Elma Sue McCallum

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Kyle Peveto, Editor
Louisiana Agriculture
115 Knapp Hall
Baton Rouge, LA 70803
225-578-2939
kpeveto@agcenter.lsu.edu

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SYMBIOSIS MARKS INNOVATIVE FRONT IN BATTLE TO CONTROL NEW WORLD SCREWWORM

Two LSU AgCenter scientists are studying how to use symbiosis to potentially control a dangerous pest that is anything but harmless — the New World screwworm.

AgCenter entomologists Honglin Feng and Kristen Healy recently were awarded a U.S. Department of Agriculture Animal and Plant Health Inspection Service grant totaling $691,000 to conduct research focusing on engineered microbial symbionts that express lethal double-stranded RNA to control the New World screwworm (*Cochliomyia hominivorax*). The hope is to strengthen protection of livestock and wildlife and enhance U.S. preparedness against the pest's recent reemergence.



LSU AgCenter entomologists Honglin Feng and Kristen Healy recently received a $691,000 U.S. Department of Agriculture Animal and Plant Health Inspection Service grant to conduct research on symbionts in an effort to combat the New World screwworm, seen here, which has recently reemerged in the United States. Stock photo

The idea is to piggyback on the sterile insect technique, which entails releasing genetically modified sterile male insects into targeted areas to mate with females. Because females typically mate only once per life cycle, the technique results in a mass die-off. This was the method first used to eradicate the New World screwworm in the U.S. in the 1960s, then again in the 1980s.

The Feng/Healy research focuses on culturing, engineering and testing defined, tractable symbionts — organisms that rely on hosts to live — using a secondary screwworm, thus establishing a symbiont-based RNA interference (RNAi) control platform that complements existing sterile insect technique programs. The secondary screwworm (*Cochliomyia macellaria*) larvae feed on dead or decaying flesh, so are not a danger to livestock.

In layman's terms, Feng explained that the technology he is developing can be applied on top of the sterile insect technique by engineering symbionts that will attach to sterile male secondary screwworm hosts. This will eliminate the need to inoculate millions of insects repeatedly before releasing them into the wild. ■ **V. TODD MILLER**

AGCENTER DEBUTS TWO PROMISING NEW RICE VARIETIES

Next year, rice farmers will be able to plant two fresh releases from the LSU AgCenter that address key disease and grain quality issues.

The varieties — Suivant and LA22-1082 — were unveiled June 24 at the 117th annual field day at the AgCenter H. Rouse Caffey Rice Research Station near Crowley.

Suivant, a conventional long-grain variety, bears strong resemblance to a popular release called Avant, said Adam Famoso, station director and rice breeder. Both have good milling quality, reach heading and maturity early and have good ratoon, or second, crop potential.

"We see slight improvements on the first crop potential with Suivant, but one of the biggest benefits of this variety over Avant is the blast resistance," Famoso said.

The other new release, LA22-1082, is a Clearfield long-grain variety.

"It has excellent grain appearance, very low chalk, very long grain," Famoso said. "It's shown excellent milling and, most importantly, exceptional yields. In four years of our testing across the state, it's been our top-yielding line."

The variety ratoons well and is taller, which boosts its tolerance of sheath blight disease. It also generates more biomass, a positive for rice farmers who rotate fields to crawfish production. ■ **OLIVIA MCCLURE**



People ride trailers as they tour the LSU AgCenter H. Rouse Caffey Rice Research Station during the facility's 117th annual field day held June 24. Photo by Olivia McClure

From Our SOCIAL MEDIA

Join the LSU AgCenter on social media. AgCenter researchers and Extension agents reach out via the web with videos, articles and helpful hints on Facebook, YouTube, Instagram, LinkedIn and X.

Join the conversation by following the LSU AgCenter.

FACEBOOK | FOLLOW THE AGCENTER AT FACEBOOK.COM/LSUAGCENTER

Limelight hydrangeas are starting to show off their large blooms. These flowering shrubs are Louisiana Super Plants and thrive in full sun but can also tolerate partial shade.

You can read more about caring for them here: tinyurl.com/3rcwsnnn



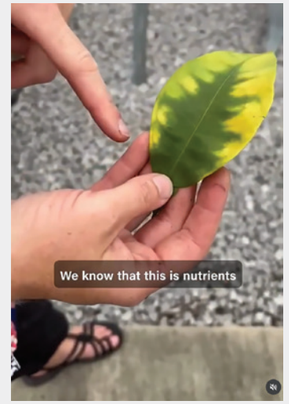
YOUTUBE | FOLLOW THE AGCENTER AT YOUTUBE.COM/LSUAGCENTER

Get an aerial view of the Hammond Research Station. The Hammond Research Station is one of 14 LSU AgCenter research stations located throughout the state. For more than 100 years, researchers at these stations have produced improved crop varieties, as well as better cultural practices and improved pest, disease and weed control for crops, ornamental plants and livestock.



INSTAGRAM | FOLLOW THE AGCENTER AT INSTAGRAM.COM/LSUAGCENTER

If your citrus tree leaves have strange patterns or stippling, it may be a sign that you have pests or a nutrient deficiency. LSU AgCenter horticulture agent Anna Timmerman explains common leaf problems and what they may indicate for your tree.



LINKEDIN | FOLLOW THE AGCENTER AT LINKEDIN.COM/COMPANY/LSU-AGCENTER

The LSU AgCenter Communications team earned national recognition at this year's Association for Communication Excellence Awards, bringing home multiple gold and silver awards.

- **GOLD AWARD** | Internal Marketing and Communications
  Louisiana Solutions, Global Impact Campaign
- **GOLD AWARD** | Promotional Publications
  Louisiana Solutions Global Impact Strategic Plan Booklet
- **GOLD AWARD** | Writing for Magazines
  Century-Old LSU AgCenter Dairy Store Modernizes
- **SILVER AWARD** | Cover
  2025 Louisiana 4-H Annual Report Cover
- **SILVER AWARD** | Single Item
  A Cypress Tree Mystery





Congliang Zhou
is using his digital agriculture expertise to create new technologies, including a robot that can roll through sugarcane fields and accurately count sugarcane stalks to aid crop breeders in analyzing new varieties.
Photo by Kyle Peveto

Congliang Zhou works on a robotic system he has helped design.
Photo by Kyle Peveto

CONGLIANG ZHOU

AIMS TO CONNECT LOUISIANA PRODUCERS WITH ARTIFICIAL INTELLIGENCE, NEW TECHNOLOGIES

■ KYLE PEVETO

A FUTURE WHERE ROBOTS crawl through fields to care for crops and where drones can spot and treat pests from the sky isn't far off in the mind of Congliang Zhou.

Zhou joined the LSU AgCenter School of Plant, Environmental and Soil Sciences in 2024 to focus on precision agriculture, a strategy that uses data collected with new technologies, such as drones or robotic systems, to make agricultural operations more efficient.

Precision agriculture has increased the efficiency of farms worldwide over the past three decades, and Zhou sees a greater need for labor-saving technologies in the future.

"The labor shortage is a major issue for the modern farming system," he said. "We cannot find enough people, especially in the United States."

Born in a small village in Jiangxi, a province in southern China, his parents grew rice on a small farm. When he was a child, they relocated to Zhejiang Province because of employment opportunities. There, Zhou excelled in school and found an interest in science and technology, training for academic science competitions.

When it came time for Zhou to decide where to attend college, he chose Shandong Agricultural University. While engineering and computer science were popular choices for his generation, he often thought of his family's small farm and felt drawn to agriculture.

"My family and the living environment had some impact on my decision," he said.

By his second year at the university, Zhou had discovered precision agriculture. His undergraduate thesis focused on precision nutrient management that uses remote-sensing technology to estimate the nutrient content of soils. He loved seeing how quickly new methods developed through precision agriculture could make a difference to farmers.

"For this technology, you can see the immediate influence for some people," Zhou said.

During his undergraduate studies, Zhou became passionate about precision agriculture technologies, especially geospatial analysis and remote sensing, which involves gathering data from satellites or drones or other means. Zhou then decided to come to the United States to study. A graduate assistantship at Texas Tech University enabled him to earn a master's degree in geography. There, he deepened his study of precision agriculture by focusing on remote sensing data from satellites. For his thesis, Zhou developed an artificial intelligence model for satellite remote sensing analysis.

In 2019, Zhou began his doctoral work at the University of Florida Department of Agricultural and Biological Engineering. Working in the department's precision agriculture laboratory, he used his experience in spatial analysis, computer vision and artificial intelligence to develop a smartphone app to help strawberry farmers battle two-spotted spider mites. The tiny bugs attack plants, causing leaf cells to collapse and die. They grow less than a millimeter in length. Accurately counting the pests can help farmers decide the optimal method for controlling them.

"Most people — at least me — can't see them without a magnifying lens," he said.

Zhou sees new frontiers for technology in agriculture. He has developed a robot that creeps through fields and helps sugarcane breeders more accurately count cane stalks to help in research, and he is working on developing artificial intelligence-enabled weed control systems.

He aims to increase awareness and adoption of precision agriculture tools in Louisiana. The key to adoption is education, Zhou said.

"Helping farmers adopt precision agriculture technologies takes time," he said. "These are new tools, and they need more time to learn these kinds of things. That's why Extension programs are so important."

To educate Louisianans, Zhou trains Extension agents and hosts monthly Artificial Intelligence in Agriculture seminars featuring guest speakers from the AgCenter and other universities. He hosts an annual summit for producers, the agricultural industry, Extension agents, students and researchers to learn from AgCenter faculty. He also works closely with other Extension specialists, Extension agents and farmers to evaluate various precision agriculture technologies. Most importantly, Zhou often meets agricultural producers and learns what needs they may have and then evaluates or develops tools to make their operations more efficient.

"I like to listen to people, talk to people," he said, "and then bring the precision agriculture technology to the people."

Kyle Peveto is the editor of Louisiana Agriculture.



Figure 1. Internet of Things (IoT) applications in agriculture.

Illustration by Matt Faust

VISION4AG:

COMPUTER VISION AND AUTOMATION IN LOUISIANA AGRICULTURE

■ IVAN GRIJALVA, SAURAV UPADHYAYA, MICHAEL J. STOUT AND PRASHANT JHA

LOUISIANA AGRICULTURE contributes approximately $12.96 billion to the U.S. economy each year and is essential for supplying food and fiber nationwide. As agricultural systems face increasing pressure to produce more with fewer resources, pests, weeds and plant diseases continue to threaten productivity, farm profitability and surrounding ecosystems. In response, LSU AgCenter scientists are working to advance precision agriculture technologies to better address emerging pest challenges.

A major component of this effort is improving how pests are detected and monitored in real time across agricultural fields, moving beyond traditional approaches that rely heavily on manual scouting. In these practices, producers and consultants inspect crops and weeds, count pests and estimate damage across only small portions of a field. While these approaches remain important, they are labor-intensive, time-consuming and often subjective, making it difficult to capture the full extent of pest infestations as farms become larger and more spatially variable.

Recent technological advances are helping overcome these limitations, particularly through the adoption of Internet of Things (IoT) applications in agriculture, which integrate interconnected sensors, devices and communication networks to continuously collect, transmit and analyze agricultural data in real time (Figure 1). Sensor systems now enable more consistent monitoring across larger spatial (relating to space and distance) and temporal (relating to time) scales. Ground-based sensors, imaging platforms and environmental monitors collect continuous data while drones capture high-resolution imagery across entire fields within minutes.

Satellite imagery provides repeated observations over time, revealing trends that are difficult to detect from the ground. Smartphones and modern farm equipment also contribute real-time data streams. Together, these technologies generate numerical and spatial datasets that provide a complete and more objective picture of crop health and pest pressure. However, collecting large volumes of data alone is not sufficient. The real value emerges when data are transformed into usable and actionable information. This is where artificial intelligence (AI), particularly machine learning and computer vision, becomes essential.

Computer vision algorithms identify patterns within large datasets, linking visual, spectral (relating to a spectrum of colors) or environmental signals to test pest presence or crop stress. Machine learning enables automated image analysis, improving consistency and reducing reliance on subjective visual interpretation. Together, these tools enable rapid processing of large datasets and provide timely decision support for crop and pest management, phenotyping (observing traits) and other agronomic practices.

These analytical approaches are already supporting practical applications developed by LSU AgCenter scientists. Weed detection models identify infested patches within fields, enabling spot treatment rather than whole-field applications, with estimated herbicide reductions of 90% or more (Figure 2). Furthermore, herbicide-resistant weeds in corn, soybean and cotton continue to pose a major challenge, costing farmers millions of dollars in losses annually.

Insect detection models help prioritize where scouting should be focused, increasing efficiency without adding labor demands with close to 85% accuracy using drones and mobile devices, according to a 2025 study by LSU and Kansas State researchers (Reference article: https://doi.org/10.1016/j.mlwa.2025.100711).

Computer vision systems are also used in seed grading to detect and quantify insect- and disease-related damage, protecting market value and accelerating breeding programs with 80% or more accuracy using camera sensors (Figure 3). Across these applications, the goal is to focus management efforts where they are needed most and automate tasks that traditionally rely on visual assessment.

Together, these capabilities enable precision pest management — applying the right control tactic in the right

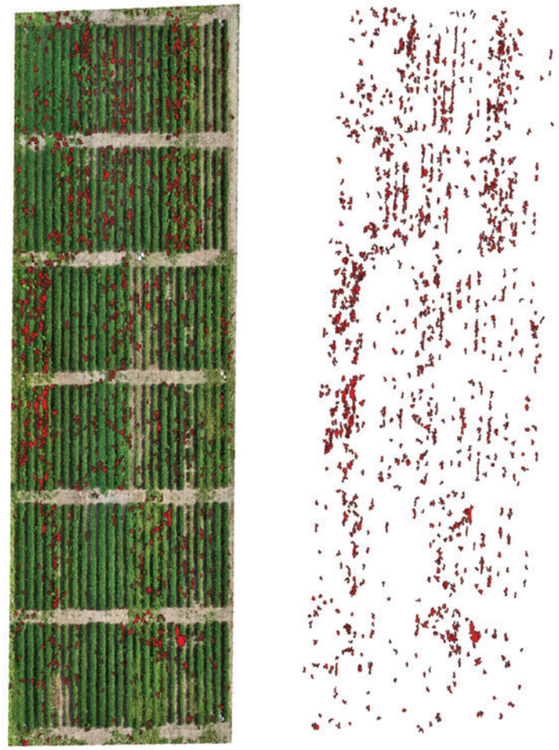


Figure 2. A Palmer amaranth (Amaranthus palmeri) prescription map generated from high-resolution drone imagery. Illustration by Usman Mohammed

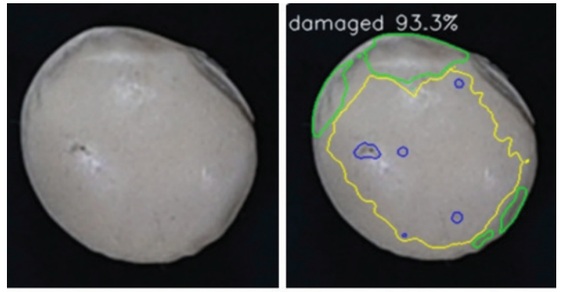


Figure 3. A computer vision model designed to detect and assess damages in soybean seeds. Illustration by Peyton A. Falterman and Kevin Hoffseth

Continued on next page.

place at the right time. Rather than uniform treatments across entire fields, interventions can be tailored to specific zones identified through sensor data and analytics. Site-specific spraying illustrates this approach, where prescription maps guide targeted applications. This strategy reduces chemical use, lowers input costs and minimizes unintended environmental impacts while maintaining effective and profitable pest control.

Drones and robotic platforms further strengthen these systems by linking monitoring, analysis and action into coordinated workflows. Drones are widely used for data collection and are increasingly capable of carrying out targeted pesticide applications. Emerging robotic and autonomous systems integrate sensors, detection algorithms and treatment mechanisms into unified platforms. Examples include drone-based spot spraying guided by machine-generated maps and robotic units designed to detect and treat localized infestations compared to broadcast applications in the field (Figure 4).

Importantly, these technologies are designed to support — not replace — human decision-making. Outputs from machine learning and computer vision serve as decision support tools, helping producers, consultants and managers allocate time and resources more effectively.

By increasing sampling coverage and reducing subjectivity, these approaches provide faster and more consistent feedback. When problems like pests or weeds that no longer respond to herbicides are found earlier, they can be dealt with before they spread, which lowers risk and helps keep farms profitable.

Overall, integrating pest monitoring, field sampling, sensors, computer vision and machine learning offers a practical path forward for integrated crop and pest management. As agriculture faces more pressure to produce food efficiently and in environmentally friendly ways, decision support tools that improve timing, precision and confidence will be essential for meeting the needs of both producers and the environment.

Ivan Grijalva is an assistant professor of precision pest management and data analytics in the LSU AgCenter Department of Entomology. Saurav Upadhyaya is a graduate student in the Department of Entomology. Michael J. Stout is a professor of rice pest management and executive associate dean of the LSU College of Agriculture. Prashant Jha is a professor of weed management in the AgCenter School of Plant, Environmental and Soil Sciences.

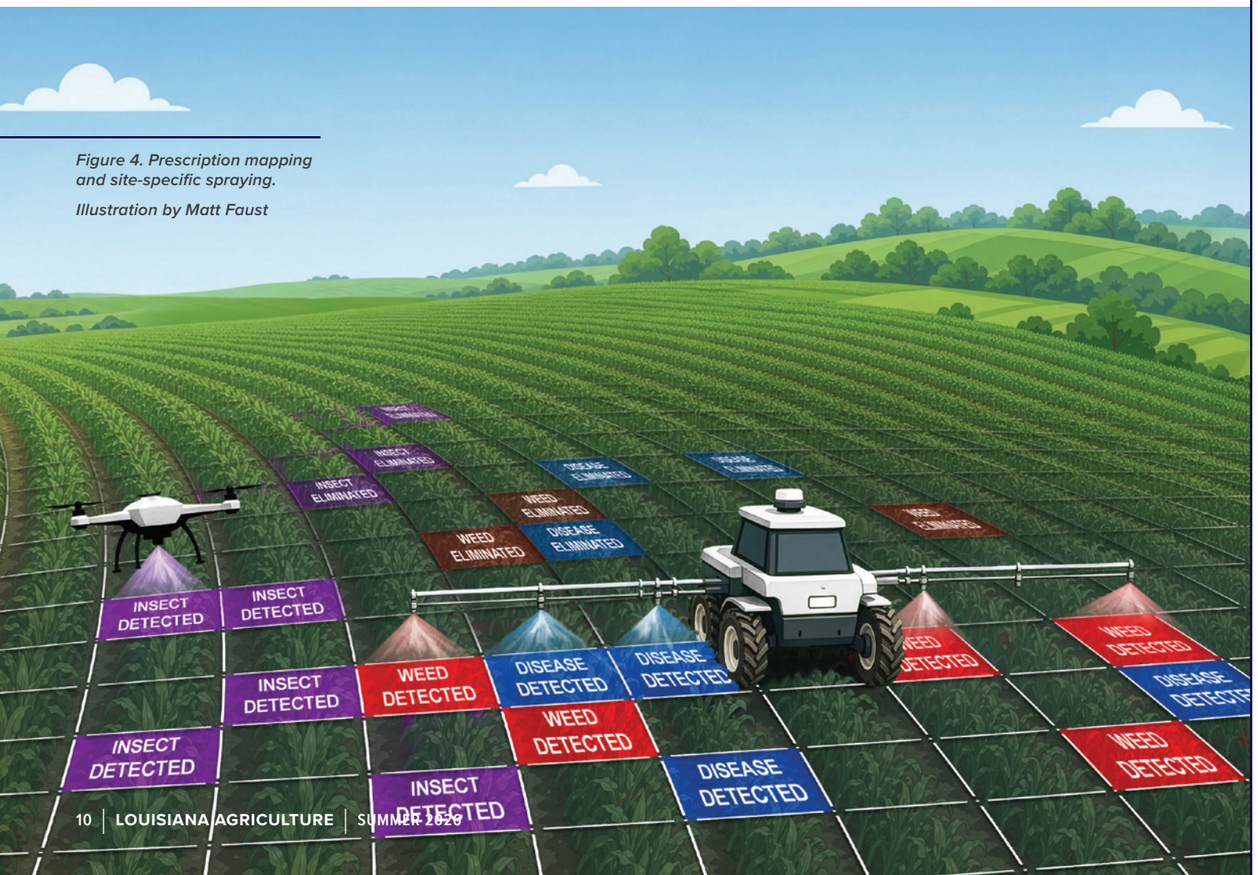


Figure 4. Prescription mapping and site-specific spraying.

Illustration by Matt Faust



Agricultural engineer Randy R. Price controls a sprayer drone during a test near Alexandria. Photo by Kyle Peveto

SPRAYER DRONE OPERATIONS

IN LOUISIANA AND FUTURE PRECISION FARMING ASPECTS

■ RANDY R. PRICE

SPRAYER DRONES are relatively new tools available to farmers, consultants and aerial applicators to spray inputs, such as pesticides or ripening agents, on crops. LSU AgCenter researchers and Extension personnel are studying the flight characteristics, operational procedures and application patterns to make recommendations to a variety of agricultural producers.

As these tools improve, Louisiana is seeing a continued increase of sprayer drones. Operators are still not spraying as many acres as manned aircraft, which are commonly called crop dusters, but numbers are growing each year. However, experts expect producers to adopt the technologies in coming years. One manufacturer stated that Louisiana will be a prime state for sprayer drone sales because farming occurs nearly 10 months out of the year.

COST

Currently, sprayer drones are inexpensive when compared with other agricultural equipment purchases, costing between $10,000 and $50,000, and typically coming as a kit with all the items needed to operate. These include a sprayer drone, controller, three batteries and a high-speed charger. Users will also need a service truck or trailer with tanks, mixing equipment, high-capacity pumps capable of pumping more than 10 gallons per minute and a large size generator (13,000 to 27,000 watts). All these items, depending upon setup, can cost more than the drone itself.

DRONE AVAILABILITY

Much has changed in the last year. China was the leading manufacturer of drones and all but dominated foreign and U.S. markets. Then, in December 2025, a new law came into effect that mandated that any drone sold in the U.S. had to be manufactured by a company at least partly based in the U.S. This greatly changed the landscape of drones in the U.S., giving U.S. companies a chance for market success and survival against low-cost Asian brands.

CURRENT RULES

To operate a sprayer drone in Louisiana, users will need multiple licenses from both the federal and state government including:

- A Part 107 license, which is required by the Federal Aviation Administration to fly drones commercially
- A Part 137 business license for the application of hazardous chemicals
- An exemption to Title 49 of U.S. Code Section 44807, which allows for operating heavy drones over 55 pounds
- Registration in the federal database

For the state of Louisiana, users will need to pass several different commercial applicator knowledge tests and register the drone every three years with the Louisiana Department of Agriculture and Forestry (LDAF). Many drone companies will help drone purchasers obtain and file this paperwork.

CALIBRATION

An important aspect of using a sprayer drone is getting to know its flight properties and spray characteristics. Each drone has a particular travel speed, application height, nozzle setting and flow rate, and these need to be set to create the best and most efficient application pattern and swath width. Determination of these aspects can be quite hard with visual cues alone, and pattern testing is needed. The LSU AgCenter has pattern-testing equipment that can help you determine these aspects.



A sprayer drone flown by agricultural engineer Randy Price hovers over sugarcane near Alexandria during a spraying trial.

Photo by Kyle Peveto

FUTURE PRECISION FARMING ASPECTS

The future of precision farming with sprayer drones is quite good. Their small sizes (less than 20 gallons), swath widths and automated flight capabilities lend them well to performing site-specific farming applications. Still, they are rarely used for this purpose because economically viable variable rate solutions, which allow drones to spray only the needed amount of an input on a predetermined segment of a crop, do not exist yet. If they did, AgCenter researchers suspect, more producers would be using them. Still, sprayer drones are well suited for this type of application because they are able to easily treat small areas with different tank loads.

Randy Price is an agricultural engineer at the AgCenter Dean Lee Research and Extension Center in Alexandria.



Agricultural engineer Randy Price shows off a sprayer drone controller while testing drones near Alexandria.

Photo by Kyle Peveto

LSU AGCENTER EXTENSION SPRAYER DRONE EXPERT ADVICE

- AgCenter Extension agents and agricultural engineer Randy Price hold occasional calibration assistance seminars at AgCenter research stations. The next is tentatively scheduled for the Iberia Research Station in March 2027. Visit LSUAgCenter.com for more information.
- The LSU AgCenter has pattern testing equipment that can help drone users determine flight properties and spray characteristics.
- The annual Precision Agriculture Summit is held each winter in Alexandria.

If you have any questions or comments, or if you need a drone tested, you can contact him at rprice@agcenter.lsu.edu or call: 225-936-7593.

SCAN QR CODE

To learn more about the state of agricultural drones and find advice for purchasing and setting up a sprayer drone.

HELPING STUDENTS *EXPLORE TECH-FOCUSED CAREERS IN AGRICULTURE*

■ BRIAN GAUTREAU AND KYLE PEVETO

TO HELP PREPARE young people for careers in modern agriculture, the LSU AgCenter has developed an educational program focused on drone and geographic information system mapping to teach classroom teachers, 4-H agents and students the skills needed to succeed. The Agricultural Career Exploration with Drones (ACED) program uses high-tech tools to spark interest in agriculture, science and engineering through multiple educational streams.

ACED was developed through the support of a $749,000 grant from the U.S. Department of Agriculture's National Institute of Food and Agriculture (USDA NIFA). The program creates multiple pathways for students to explore digital and precision agriculture. One component is a classroom curriculum designed to prepare students for the Federal Aviation Administration (FAA) Part 107 Remote Pilot Certification, which is required to fly a drone for commercial purposes. Grant funding also allowed ACED to provide drones to participating schools, helping students gain hands-on flight experience while preparing for certification. This approach distinguishes ACED from other certification programs that rely primarily on textbook instruction. In addition, ACED provides professional development for 4-H Youth Development and other Extension agents, equipping them to deliver agricultural drone education and youth camps in their communities.

An FAA Part 107 certification opens many pathways for a wide range of careers. Agricultural drone operations include crop scouting and spraying of important inputs such as pesticides and insecticides. A certified drone operator may provide aerial photography services, conduct infrastructure and facility inspections, perform building maintenance tasks and pursue opportunities in industries that continue to emerge as drone technology advances.

In the future, the ACED team plans to offer an on-farm education component for students who have earned the FAA certification. Envisioned as four hands-on workshops, the sessions will provide students with direct exposure to agricultural drone applications. Working alongside LSU AgCenter faculty and staff, participants will gain practical skills and a deeper understanding of precision agriculture technologies.

Brian Gautreau is the Louisiana 4-H STEM education specialist, and Kyle Peveto is the editor of Louisiana Agriculture.



4-H graduate assistant Benita Komunjeru teaches children to use drones at a day camp in Plaquemine.

Photo by Kyle Peveto

EYES IN THE SKY, MINDS ON THE GROUND: *BRINGING DRONES TO CLASSROOMS AND CAMPS*

■ BENITA KOMUNJERU

AT THE AGRICULTURAL CAREER EXPLORATION WITH DRONES program training for educators, the classroom in Alexandria was buzzing not just with propellers, but with ideas. By the third day of training, teachers from across Louisiana talked of how they would take this technology to their students.

"Some of our kids go home and play video games," one teacher said. "Now we're bringing something from their world into ours."

Held over five days in Alexandria, the workshop offered a two-part curriculum teaching FAA certification and drone applications in agriculture. Teachers from St.

Continued on next page.



Drones used for teaching children the basics of flying are prepared for class.

Photos by Kyle Peveto

Tammany, Vernon, St. John and Iberville parishes took part, with some having previous experience and others handling drones for the first time.

Teachers learned to instruct the basics needed for agricultural drone use. An important skill in drone programming includes creating commands and looping statements to direct a drone to fly up one crop row, turn around and fly down another row. In training, students may learn in a gymnasium or on a practice field outside. Another activity ACED instructors implement is to teach students to program the drone to land only on certain colors of blocks, which mimics a drone scouting a field for yellowed leaves showing signs of disease or healthy green plants.

Instructors guided participants through airspace regulations, emergency procedures and communication protocols before shifting focus to classroom-based instruction on crop scouting, livestock monitoring and other agricultural applications. By the week's end, participants weren't just better pilots; they were future ag-tech instructors.

One educator from Vernon Parish said, "The hardest part is going to be containing the excitement. They'll want to stay out there flying all day."

Others saw the program as a path to evolve with their students. "I had a teacher who used to say, 'Adapt, move on or die,'" one instructor shared. "This drone program is helping me evolve every year."

A 4-H agent helps a child learn to fly a drone at a camp in Plaquemine. Photo by Kyle Peveto





A 4-H agent gets a drone off the ground while students watch during a camp in Plaquemine.

Photos by Kyle Peveto

DRONES THROUGH A CHILD'S EYES

ACED also works to educate younger students on the growing field of agricultural drone use. At a camp designed to introduce drone flight to young people, third through sixth grade students learned the basics of drone operation and reflected on their experience.

They were asked two questions: "What was the most fun part of flying?" and "Was it easier or harder than you thought?" After their flights, students left behind a flurry of comments that captured their excitement and surprise.

"Doing a flip," one note read. Another said, "Learning to do the back flip." Speed thrilled some campers. "Flying fast!" one wrote. Another enjoyed full control: "Spinning around and coming back."

When it came to difficulty, the majority of students were surprised by how manageable it felt. Most said flying was easier than expected. A few mentioned how familiar the joystick felt, perhaps thanks to experience with game controllers at home.

Whether flipping, spinning or sticking the landing, these young flyers showed how early exposure to drone technology can build confidence, excitement and curiosity. For many, it was their first flight — but likely not their last. With the guidance of teachers and 4-H Extension agents, it might just be the start of something even bigger.

Benita Komunjeru was a doctoral student in the LSU Department of Agricultural and Extension Education and Evaluation and a graduate assistant in LSU AgCenter 4-H Youth Development.

DEVELOPING ARTIFICIAL INTELLIGENCE AND ROBOTICS TECHNOLOGIES

TO ADVANCE SUGARCANE BREEDING AND RESEARCH IN LOUISIANA

■ **CONGLIANG ZHOU, ZELIN QIAN, BRAYDEN BLANCHARD, NIRANJAN BAISAKH, JIM WANG AND ANDRE GAMA**

SUGARCANE IS ONE OF Louisiana's most valuable commodities. According to the 2025 Louisiana Summary, it was grown on more than 543,000 acres with a total value of $1.51 billion. LSU AgCenter researchers are developing artificial intelligence (AI) and robotics technologies to improve the efficiency and accuracy of sugarcane breeding and research by automating one of the crop's most labor-intensive field measurements: stalk counting.

Sugarcane breeding is the foundation for developing varieties with higher yield and greater resistance to disease. In Louisiana, every new variety is tested across many locations and years, and selection decisions depend on accurate field measurements collected from hundreds or thousands of plots. Stalk number is one of the most important traits contributing to final sugar yield. In addition, accurate stalk counts are essential for fungicide trials, fertilizer trials, soil health studies and other field experiments.

Typically, stalk counting is still done by hand. Field crews must walk each plot and manually count stalks, requiring significant labor and time. As trial sizes increase and labor becomes more limited and expensive, collecting consistent, timely stalk population data becomes increasingly difficult.

As shown in Figure 1, counts of the same plots varied considerably among different people. For the 30 plots, each 16 feet long, it took a sugarcane breeder 22 minutes and 45 seconds to complete the counting, which is time-consuming. With thousands of plots to evaluate in a season, a rapid, accurate and consistent stalk counting method is needed.

Recent advances in AI, computer vision and robotics offer a practical solution. AI models can analyze field images and automatically detect and count sugarcane stalks, providing consistent measurements across large numbers of plots. This approach has the potential to reduce labor requirements while improving data accuracy and repeatability.

In July 2025, researchers collected smartphone images of sugarcane stalks from two different breeding trials at the LSU AgCenter Sugar Research Station in St. Gabriel and from a fertilizer trial in St. James Parish. As shown in Figure 2, the different trials represented a range of field conditions, including variation in sugarcane stand density, leaf cover, lodging and background interference.

An iPhone 12 was used to collect video data while walking along sugarcane rows. During recording, the camera was positioned close to the row so individual stalks near the plant base could be clearly observed. For the fertilizer trial data, each video covered a 50-foot counting section. For the breeding trial data, each video covered one 6-foot (first line) and 16-foot (second line) long plot. In total, 127 videos were collected. Importantly, these data were collected around the same time manual stalk counts are typically conducted by researchers. Manual stalk counts in the field and video-based stalk counts in the laboratory served as reference data to evaluate the AI counting results.



Figure 4. Researchers demonstrate a robotic system at the LSU AgCenter sugarcane field day at the AgCenter Sugar Research Station in 2025. Photo provided by Zelin Qian

Researchers designed and trained different AI models for sugarcane stalk counting. Preliminary smartphone-based results show AI can recognize and count sugarcane stalks with good accuracy and stability. As shown in Figure 3, under different trial conditions, most sugarcane stalks were correctly detected by the AI algorithm. The AI algorithm also maintained good counting performance under challenging conditions, including dense stands, occlusion and complex backgrounds. Across all video datasets, the best AI-based counting method achieved approximately 84% counting accuracy. These preliminary results provide a solid foundation for the further development of an automated robotic system that uses cameras and AI to rapidly count stalks for sugarcane research.

As shown in Figure 4, researchers designed and assembled a remotely controlled robotic system capable of navigating sugarcane research trials. The robotic system has a track width of 72 inches and a height of 135 inches, allowing it to cover a single row within a sugarcane plot at the optimal window of the season where the cane is standing and not lodged. Currently, it can operate in the field for up to two hours of continuous data collection.

Future work will integrate the AI-based stalk counting system into the field robotic platform for practical testing. By improving the speed, consistency and scalability of stalk population measurements, this work will directly support sugarcane variety development for Louisiana by helping breeders make better, data-driven decisions. The robotic platform also has the potential to support a wide range of sugarcane research efforts in Louisiana.

Congliang Zhou is an assistant professor in the LSU AgCenter School of Plant, Environmental and Soil Sciences. Zelin Qian is a Ph.D. student in his lab. Brayden Blanchard is an assistant professor based at the AgCenter Sugar Research Station in St. Gabriel. Niranjan Baisakh is an associate professor, and Jim Wang is a professor, both in the School of Plant, Environmental and Soil Sciences. Andre Gama is an assistant professor in the AgCenter Department of Plant Pathology and Crop Physiology.

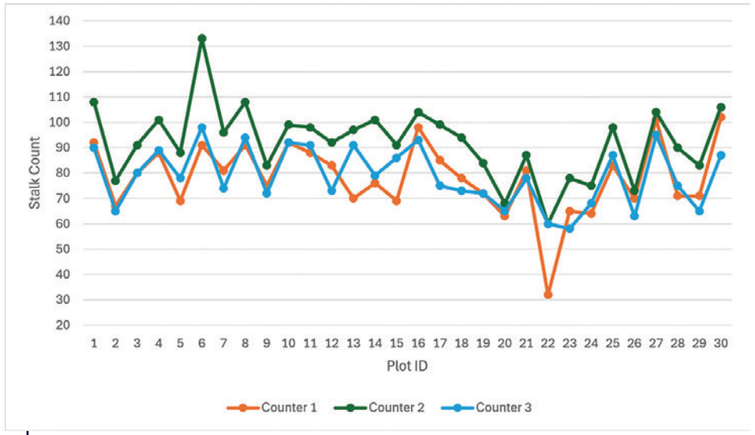


Figure 1. Stalk counts measured by three counters across experimental plots. Data provided by Brayden Blanchard



Figure 2. Example images of breeding and fertilizer trials. From left, first line breeding trial, second line breeding trial and fertilizer trial. Photos provided by Zelin Qian

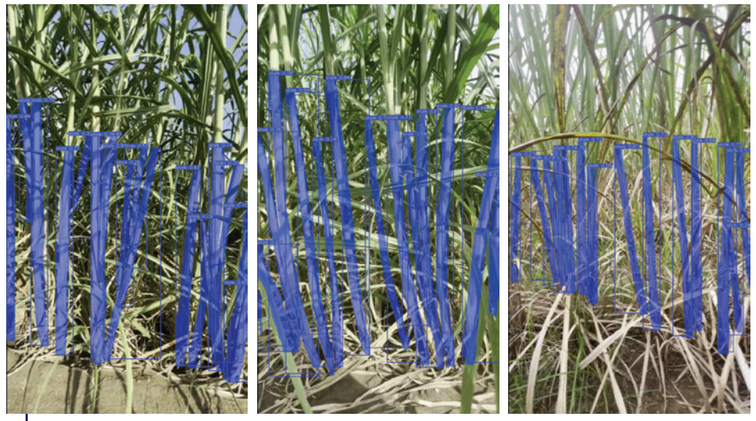


Figure 3. Example images of sugarcane stalk detection result using AI. From left, first line breeding trial, second line breeding trial and fertilizer trial. Photos provided by Zelin Qian

TECHNOLOGY HAS REVOLUTIONIZED AGRICULTURE.

The ability to collect large amounts of data through sensors has helped researchers and agricultural producers better understand the needs of crops and the land.

PRECISION AGRICULTURE is a farm management concept that prioritizes finding and measuring the variations in fields and crops and treating the field or crop according to those differences. Certain areas of a field may need less fertilizer, water, seeds, pesticides or other inputs than another area. By studying the field and understanding these differences, a producer can apply the proper amount of inputs to that field rather than placing the same amount everywhere. This form of management can save money and time. In the case of fertilizer, it can prevent excess nutrients from running off into waterways or leaching into groundwater.

Tools used for precision agriculture, such as GPS-guided tractors or unmanned aerial vehicles, or autonomous robots, can scout fields with sensors, apply pesticides and make other applications. Precision agriculture is a subset of digital agriculture. Digital agriculture includes data analytics, artificial intelligence and other high-tech tools that help agricultural producers better understand the needs of their crops and their land.

UNMANNED AERIAL VEHICLES (DRONES)

Drones can fly over fields to collect data using cameras or sensors. Specialized agricultural sprayer drones can also apply inputs, such as pesticides or ripeners, which help farmers harvest their crops.

TRACTOR GUIDANCE AND VARIABLE RATE TECHNOLOGY

Farm equipment guided by GPS or other satellite systems can vary the rates of fertilizer, seeds, pesticides and other inputs applied to a field. A computerized tractor implement, such as a fertilizer spreader or planter, can apply specific rates of fertilizer or seeds to an area according to a pre-loaded map or via sensors that analyze the field.

ROBOTS

AgCenter researchers are developing robots that can aid in sugarcane breeding by rolling through a field and analyzing varieties' important attributes like stalk count.

INTERNET OF THINGS SENSORS

Sensors can be placed in crops and in the soil to help remotely monitor moisture levels, temperature, plant stress and many other factors.

VIRTUAL FENCING AND ANIMAL SENSORS

Some cattle producers and others involved in animal agriculture use virtual fencing systems, which use GPS-enabled collars to move animals from one pasture to another. The collars emit a sound that moves the animals and can buzz or lightly shock them if they refuse to move. These collars can collect other health information, and additional sensors can monitor animal health through rumination, heart rates and other biometrics.



Brenda Tubaña is one of the LSU AgCenter's top researchers in the field of variable rate technology, and she helps teach producers and AgCenter Extension agents about the technology.
Photo by Anthony Bailey

DEVELOPMENT OF VRT

CAN ALLOW FARMERS TO CUT DOWN ON COSTS, POTENTIALLY IMPROVE YIELD

■ ANTHONY BAILEY

A NEW TECHNOLOGY could help Louisiana producers save money by regulating the amount of seeds, fertilizer and other inputs they apply to their crops.

In recent years, variable rate technology, or VRT, has been developed and improved by LSU AgCenter researchers. Its primary purpose has been dispersing nitrogen fertilizer in sugarcane and rice fields, but researchers envision many more uses in the future.

Brenda Tubaña, department chair of the AgCenter School of Plant, Environmental and Soil Sciences, said the technology can provide farmers with a chance to be more cost-efficient with their nitrogen fertilizer applications.

"If we can demonstrate that we can apply less nitrogen fertilizer without reducing yield using this technology on a farmer's own field, I think this becomes more convincing to them," Tubaña said. "The idea is we can cut expenses for nitrogen fertilizer that will not make any yield benefits anyways, right? You only need to change fertilizer application method."

Tubaña's team built a mobile VRT applicator and sensor system in 2025. It is a complete system consisting of sensors, flow rate controller, applicator rig, GPS antenna and computer that can be easily attached to a farmer's tractor. The sensor reads plant health and the formula in the computer system converts the reading to the amount of nitrogen needed, and the flow rate controller changes the application rate while the VRT rig is running.

This technology can also be applied to other agricultural inputs, like herbicides or lime, but nitrogen fertilizer is among the most used inputs applied via VRT because of its large impact on crop yield and expense. As the most expensive nutrient input, managing it efficiently is important to a farm's success.





Brenda Tubaña's team built a mobile variable rate technology applicator and sensor system that consists of sensors, a flow rate controller, applicator rig, GPS antenna and computer that can be easily attached to a farmer's tractor. The sensor reads plant health and the formula in the computer system converts the reading to the amount of nitrogen needed, and the flow rate controller changes the application rate while the VRT rig is running. Photos by Anthony Bailey

While there are potential financial benefits for farmers to use and have this technology on their farms, VRT is yet to be widely adopted commercially. Farmers may be hesitant to use a tool that they aren't familiar with and, on top of that, putting together a system of their own won't be cheap, Tubaña said.

To combat this hesitance, Tubaña and her team have brought the technology to farmers for a test drive on their own land to provide them with information on how much fertilizer they could save by not just applying the amount suggested on the fertilizer's label. Tubaña says the tests have helped provide the researchers with more information for their sensors, and it also provides the farmers a chance to see for themselves how much they can save as well as the relative ease of attaching it to their tractor.

"We have had eight or nine growers join us inside the tractor with my students, which is a good thing," Tubaña said. "When you have growers in the tractor seeing how the system works and with the digital display, showing real time application of variable rates of nitrogen, such experience is more engaging and perhaps an effective hands-on training for the farmers, I would say."

Farmers have an option to use sensor-based nitrogen recommendations without using a VRT applicator from these test drives. Here, the sensor readings are averaged and converted to a uniform rate of nitrogen, thus the recommendation still is based on the need of the crops. This provides farmers with a chance to lower their rates of application using their own fertilizer applicator so that they don't need the technology on their property all the time.

So far, Tubaña and her team have gone to 12 sugarcane farms and three rice farms this year. On the cane farms, VRT has shown that farmers could save on their fertilizer on all but one property. For Tubaña, this shows the potential significance VRT may have on Louisiana farms.

"Knowing that we have a technology capable of applying nitrogen on a need basis, it has become like a mantra to me: You don't have to spend that much on nitrogen inputs, just implement a technology that can apply the right rate of nitrogen where it is needed in the field without hurting the yield," Tubaña said. "It could be yield neutral, and in many cases yield positive, overall producing more with less nitrogen inputs mean greater returns."

Anthony Bailey is a writer in AgCenter Communications.

ARTIFICIAL INTELLIGENCE APPLICATIONS

IN PRECISION WEED MANAGEMENT FOR SUGARCANE AND RICE IN LOUISIANA

■ CONGLIANG ZHOU, ZELIN QIAN, MATTHEW FOSTER, CONNOR WEBSTER, JEREMY HEBERT AND RANDY PRICE

WEED MANAGEMENT remains a persistent challenge across multiple crops in Louisiana. If left uncontrolled, weeds can spread rapidly and compete with crops for nutrients, water and sunlight, leading to yield losses. Herbicides remain the most widely used weed control method in Louisiana sugarcane and rice production. While residue herbicides require uniform application across the entire field, broadcast spraying is also widely used for postemergence weed control, including in areas without weeds, which increases herbicide use and production costs. LSU AgCenter researchers are evaluating how artificial intelligence (AI), drones and sensing technologies can improve weed detection and enable more precise herbicide applications, helping producers reduce costs while maintaining effective weed control.

Recent advances in precision agriculture powered by AI and sensing technologies have created new opportunities for precision weed management. AI can extract useful information from sensor data. For example, AI can detect and identify different weeds from RGB images, which are the standard images made up of red, green and blue light that are captured by digital cameras. To train AI models for weed detection, hundreds or thousands of images must first be collected and labeled. The dataset is then divided into training, validation and testing sets. The training and validation datasets are used to develop and optimize the AI model, while the testing dataset is used to estimate how well it will perform under field conditions. Precision weed detection and mapping can identify the exact locations of weeds, allowing targeted herbicide applications.

The LSU AgCenter Precision Agriculture Program worked closely with sugarcane and rice farmers to evaluate drones and AI for precision weed mapping and to help farmers better understand these technologies through on-farm trials. In spring 2025, researchers used RGB cameras to collect 656 images of bermudagrass (*Cynodon dactylon*) at the LSU AgCenter Sugar Research Station in St. Gabriel and several commercial sugarcane farms. Using those images, an AI model was trained and evaluated for bermudagrass detection and 97% accuracy was achieved. Only a small number of samples were misclassified because they looked similar to other weeds or sugarcane plants. These results demonstrate the potential to integrate sensors with sprayer systems for real-time weed detection and targeted herbicide applications, reducing herbicide use and lowering weed management costs.

In spring 2026, researchers visited additional sugarcane farms and collected images of problematic weed species, including 698 additional bermudagrass images and 470 divine nightshade (*Solanum nigrescens*) images. Previous research has shown that these weeds can reduce sugar yield by as much as 32% and 33%, respectively. Future work will continue expanding the image database and improving the AI model for sugarcane weed detection. Researchers also plan to integrate AI and sensors with conventional sprayer systems to enable real-time weed detection and targeted herbicide application in sugarcane production.

Many weeds also cause serious problems for rice producers. One of the most economically important weeds in rice is red rice, which belongs to the same genus and species as cultivated rice, making it difficult to distinguish and manage in the crop. Season-long red rice infestations have been shown to reduce rice yield from 52% to 86% across multiple rice varieties. An area of interest for rice farmers is whether drones can map red rice infestations and apply herbicides only where weeds are detected.

Researchers flew a drone equipped with an RGB camera over a rice field after the red rice emerged above the crop canopy and evaluated an AI model for red rice detection using the drone images. Based on preliminary results, 87% of red rice plants were correctly detected by the AI model. For example, in a 53.9-acre rice field with a 20% red rice infestation, assuming a Provisia herbicide cost of $15 per acre, a single targeted herbicide application could save approximately $647 in this one field alone by spraying only the infested areas. Because herbicides are typically applied more than once during the growing season, the potential savings could be even greater while reducing overall herbicide use.

The next phase of the rice research will include collecting more drone images during the early rice growth stages, expanding the dataset to include additional weed species and further improving the AI model for weed detection. Researchers also will begin testing sprayer drones and different nozzle types to determine how these factors affect the accuracy of targeted herbicide applications.

Results from both the sugarcane and rice studies show that AI and sensing technologies can accurately detect weeds, demonstrating their potential to improve precise weed management. These findings have been shared with stakeholders at the Louisiana Row Crop Agriculture Agent Advisory Meeting, the Louisiana Precision Agriculture Summit and the American Sugar Cane League Farm Machinery Committee Meeting in 2025.

Congliang Zhou is an assistant professor in the LSU AgCenter School of Plant, Environmental and Soil Sciences. Zelin Qian is a doctoral student in his lab. Matthew Foster is a sugarcane weed scientist at the AgCenter Sugar Research Station in St. Gabriel. Connor Webster is an assistant professor in the School of Plant, Environmental and Soil Sciences and is the AgCenter rice weed specialist. Jeremy Hebert is the coordinator for AgCenter Southwest Region agriculture and natural resources Extension. Randy Price is a professor at the AgCenter Dean Lee Research and Extension Center.



Bermudagrass commonly presents weed management issues for sugarcane farmers.

Photos by Fengting Shi

FOR ASSISTANCE WITH THESE NEW TECHNOLOGIES

or for help implementing precision weed management on your farm, please contact Congliang Zhou at CONGLIANGZHOU@AGCENTER.LSU.EDU or 225-578-5783.

FROM LEAF TO LANDSCAPE:

MEASURING PHOTOSYNTHESIS TO UNDERSTAND CROP PRODUCTIVITY AND WATER DYNAMICS IN AGROECOSYSTEMS

■ PENG FU

PHOTOSYNTHESIS — the process by which plants convert sunlight, water and carbon dioxide into energy for growth — powers crop growth, productivity and resilience, yet much of this critical process remains invisible to the human eye. Today, advances in sensing technologies are allowing LSU AgCenter researchers to measure photosynthesis in new ways that were not previously possible, from individual leaves in the field to entire agricultural regions observed by satellites. These observations provide new opportunities to improve crop breeding, monitor crop growth and better understand agricultural productivity and water dynamics in Louisiana.

Because photosynthesis drives plant development and regulates water use, measurements associated with photosynthesis can help researchers better understand crop productivity and water consumption. Studies suggest that continued increases in crop productivity may require a better understanding and optimization of photosynthesis, such as improving photosynthetic efficiency through optimized canopy structure, especially as agricultural systems face increasing environmental challenges, including land shortages and degradation.

Direct measurements of photosynthesis collected at the leaf level remain an important foundation for plant science research. Using portable field instruments (Figure 1), researchers can measure how plants respond to environmental conditions such as heat, drought, disease and salinity stress. These measurements provide detailed information about plant function and photosynthetic performance. However, collecting measurements one leaf at a time is time-consuming, requiring more than 30 minutes for a single leaf, and is difficult to scale across large agricultural systems. New sensing technologies are helping researchers extend these observations from individual plants to entire fields and landscapes.

This research pairs leaf-level photosynthesis measurements with hyperspectral observations, which capture how leaves and crop canopies reflect light across hundreds of narrow wavelengths. Healthy plants absorb and reflect light differently depending on chlorophyll content, water status and photosynthetic activity. This work also contributes to the Global Spectra-Trait Initiative, an international effort to compile plant spectral (related to a spectrum of colors or light) and trait measurements from around the world. The database currently contains more than 7,500 paired measurements that help researchers understand how plant traits are expressed in spectral signals. Combined with machine learning and statistical approaches, these observations allow researchers to estimate plant function and photosynthetic performance without physically sampling every plant.

While leaf-level measurements provide detailed physiological information, drones and satellites allow researchers to scale these observations across fields and regions. Drones equipped with thermal, hyperspectral and multispectral cameras can rapidly monitor crop canopies and identify differences in canopy temperature and plant vigor associated with crop performance. Satellites, including NASA's Landsat and NISAR missions, repeatedly observe Louisiana's agricultural landscapes throughout the growing season, providing continuous information on crop development and field conditions, such as soil moisture, over time.



Figure 1. LSU AgCenter digital agriculture professor Peng Fu works in the fields measuring photosynthesis using a portable photosynthesis system.

Photo by Wei Nie

One important application of this research is selecting crop cultivars with improved photosynthetic performance. Feeding a growing population will require continued increases in agricultural productivity, and improving photosynthesis is considered one promising pathway to achieving higher crop yields. At the LSU AgCenter, sensing technologies help researchers and breeders evaluate crop performance more efficiently across large breeding programs.

Traditionally, plant breeders relied heavily on manual observations collected throughout the growing season. Today, drones and spectral sensing technologies allow researchers to rapidly measure plant traits related to photosynthesis, canopy development and water use across thousands of breeding plots. These tools help accelerate the identification of promising cultivars with improved productivity and stress tolerance under Louisiana's environmental conditions.

Another important application involves monitoring crop growth and estimating productivity at the field level. Because photosynthesis is directly linked to plant growth and water use, repeated observations of crop function can help researchers track crop development throughout the growing season and estimate yield before harvest. At the LSU AgCenter, researchers combine drone and satellite observations with crop and ecosystem models to better understand how plant biomass changes throughout the growing season (Figure 2).

Photosynthesis plays a central role in regulating both crop growth and water use, making it an important process to represent accurately in computational crop models. With improved photosynthesis parameterization, these models can act as digital or virtual representations of crop systems (e.g., biomass accumulation over time shown in Figure 2), helping researchers evaluate how crops may perform under different environmental and management scenarios. When updated continuously with real-time observations, such as those from sensor networks or NASA satellites, these systems may eventually function as "digital twins" of agricultural fields — virtual representations that continuously mirror real-world crop conditions. Such virtual representations could help growers monitor crop conditions, estimate yield and evaluate management strategies for better decisions.

The ability to measure photosynthesis from individual leaves to entire agricultural landscapes represents a major advancement for agricultural science. What was once hidden inside plant leaves can now be monitored across fields and regions using modern sensing technologies. For breeders, these tools provide faster ways to identify promising cultivars. For producers, they offer opportunities for improved crop monitoring and management decisions. For researchers, they create new opportunities to better understand how crops grow and respond to changing environmental conditions.

As sensing technologies continue to advance, digital and precision agriculture will play an increasingly important role in Louisiana farming systems. By combining field research, remote sensing and computational modeling, LSU AgCenter researchers are developing tools and knowledge to support productive, resilient and sustainable agriculture in Louisiana. This research is supported by the U.S. National Science Foundation, NASA and the Louisiana Board of Regents.

Peng Fu is an assistant professor of digital agriculture in the LSU AgCenter School of Plant, Environmental and Soil Sciences.

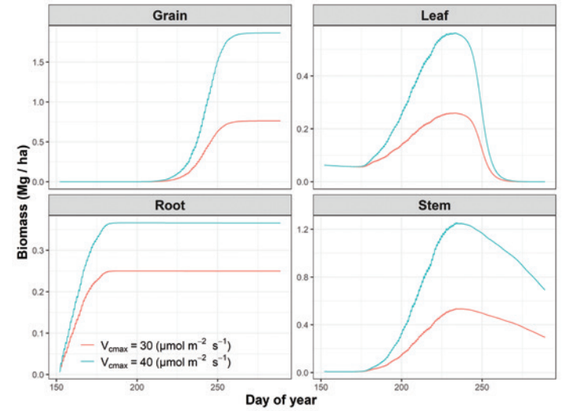


Figure 2. Simulated plant growth under two levels of photosynthetic capacity. Plants with higher photosynthetic capacity (represented by Vcmax, the maximum rate of carbon fixation during photosynthesis) accumulate more biomass in leaves, stems, roots and grain over time, illustrating how improvements in photosynthesis can contribute to increased crop productivity.

The Global Spectra-Trait Initiative *is an international effort to compile plant spectral and trait measurements from around the world.*

SCAN QR CODE

VIRTUAL FENCING TECHNOLOGY

HAS POTENTIAL TO REMOVE SWEAT AND LABOR FROM MOVING CATTLE

■ KYLE PEVETO



Cattle producer Stacy Taylor is using virtual fencing collars to move his animals within pastures.

Photo by Kyle Peveto

THE CATTLE GRAZING on Stacy Taylor's ranches in Caddo and Red River parishes are herded two times a day — but not by a worker on horseback or a four-wheeler. Instead, they're gently guided by the orange-and-black collars that emit audio cues to keep moving to greener and thicker pastures.

Virtual fencing collars like those used by Taylor aid cattle producers who follow regenerative agriculture techniques designed to maintain healthy pastures by rotating livestock regularly and allowing their grass to recover.

"We've been able to stockpile a lot of extra grass and get more out of the ground and grass during the drought that we've been in," Taylor said in late May. "We have more grass than we probably have ever had because we're able to move our cattle twice a day."

While Taylor and others experiment with virtual fencing technology, LSU AgCenter researchers and Extension personnel are learning from them, evaluating the various systems to pass along advice to other interested Louisiana producers. These systems show promise for small-to-medium-sized operations, especially those interested in regenerative ranching, said Ashley Edwards, the AgCenter state livestock beef specialist.

"It's reducing the need for interior fencing," Edwards said. "We still need the exterior fence to keep cattle from getting out onto roads, but it allows producers to rotationally graze within a pasture, which is better for both forage and soil productivity."

Virtual fencing collars allow cattle producers to create a grazing area by setting a boundary using GPS coordinates. As an animal wearing the collar approaches the boundary, the collar will emit a tone that encourages it to move away. If the animal ignores the audio cue, the collar will buzz and can eventually give a small shock if needed.

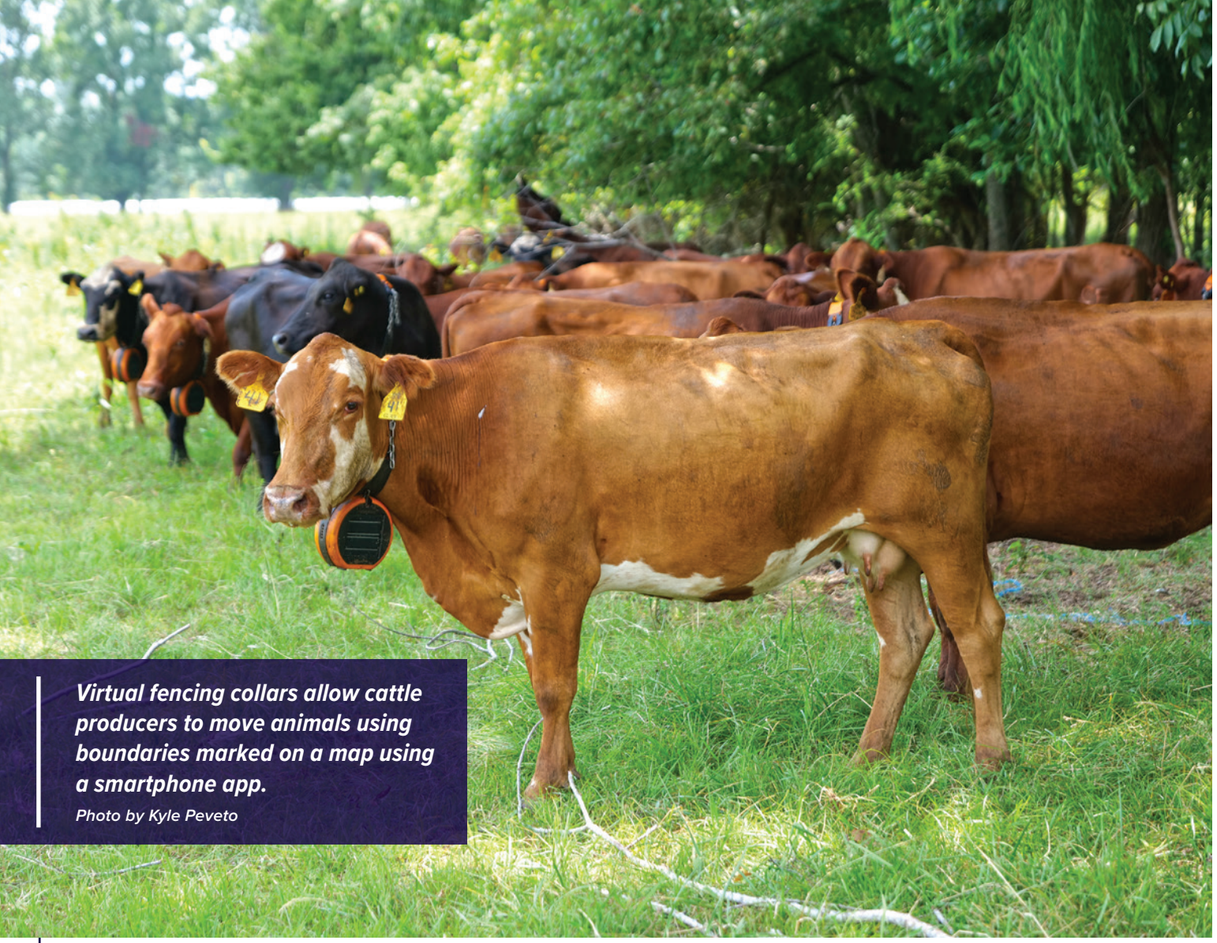
Taylor first experimented with virtual collars last year and bought 100 collars. He was skeptical that it would work for his Brahman-mix cattle, a spirited breed with a reputation for overreacting to loud noises. His first trial worked well, and he increased his order of collars to 500. He plans to eventually collar all 800 of the cows in his cow-calf program.



Virtual fencing collars hang from a fence at Stacy Taylor's cattle pen near Shreveport.

Photo by Kyle Peveto

Continued on next page.



Virtual fencing collars allow cattle producers to move animals using boundaries marked on a map using a smartphone app.

Photo by Kyle Peveto

When it was time to sort females into paddocks with bulls for breeding, Taylor consulted his list of cattle genetics and paired bulls and heifers with desirable traits in virtually fenced pens. From his smartphone, he sorted 150 females in multiple paddocks to breed with separate bulls.

"What would normally have taken three cowboys to come in and do, I did in three hours sitting in my recliner," he said.

In Franklin Parish, dairy producer Ted Miller has also found success with virtual fencing. Miller and his wife started their dairy operation in their native Pennsylvania in 2003 and moved to Louisiana in 2009. Attracted by more affordable land prices, warmer weather and the abundant irrigation water of the Mississippi River Delta, they took the opportunity to relocate and expand. They follow a New Zealand-style dairy model with seasonal milk production that relies on leaving cattle in pastures year-round to graze primarily on grass.

On 1,200 acres, the Millers milk 500 to 600 cows while raising about 600 replacement heifers and keeping 100 or so bulls for breeding. They have always practiced rotational grazing, and in Louisiana, they divided their land into 60 paddocks and regularly moved them. Their cattle caught on to virtual fencing quickly.

"It surprised me how fast they really took to it. Two to five days is how long it takes a group to learn the virtual system," Miller said. "It's really remarkable how quickly they pick up on that."

Earlier this year, Miller hosted a field day at his dairy farm for LSU AgCenter Extension agents and other producers to learn more about virtual fencing. AgCenter forage agronomist Jose Pereira Neto said he was impressed by the technology and is discussing a research project to help Miller precisely estimate how much forage is available in each paddock using drones or sensors.

"Taking pictures can introduce errors and may not be very precise," Neto said. "That's why I would like to do a trial and see if we can improve it."

One drawback of virtual fencing systems is the lack of cellular system signals on most cattle operations, Edwards said. Producers must invest in more costly towers to connect the collars to the cloud.

While Miller's virtual fence system costs $70 per animal each year to lease, he has seen a reduction in labor and material costs. The collars cost a few hundred dollars to purchase, which is the route Taylor has chosen. Both producers have seen the value in the system and say it can likely pay for itself over a few years. Miller hires fewer hands to build and move temporary polywire fences and has watched his pastures grow healthier as cattle put less pressure on the land.

"We couldn't produce that effect, even if we wanted to, even with an unlimited supply of labor with polywire," Miller said. "So, we're able to rotationally graze on a different level than we ever could have before."

The electronic collars provide additional benefits to producers. Miller's collars can monitor rumination, heat activity, rest times and grazing times.

"You have a lot of data coming at you that the collars are collecting all the time in real time," he said.

Collars also can monitor whether cattle are mobile and send alerts when they have not moved in a few hours. This feature has saved two pregnant heifers as well as their calves, Taylor said.

"I know exactly where the heifer is. When I get to the property, I drive straight to where she's at," Taylor said. "I pulled two calves out of heifers that were in distress and assisted them at birth because I had the alert. I wouldn't have had that, and it may have been several more hours before I realized I had a problem."

Taylor, a sixth-generation cattle producer, has heard stories of his family moving cattle by horseback and then adopting motorized ways of herding animals. Virtual fencing is the next step, he said.

"You know, times have changed," he said. "I think you have got to change with them."

Kyle Peveto is the editor of Louisiana Agriculture.

AGCENTER RESEARCHER USING ANIMAL SENSOR DATA TO UNDERSTAND GENETICS, HEALTH ISSUES



Shavahn Loux

Today, ranchers, dairy farmers and other livestock producers can track nearly every aspect of an animal's life with sensors that can track vital signs as well as rumination and activity levels. These sensors can also be used to track milk production, feed intake and other biometrics that play a large role in the productivity and profitability of each farmers' herd.

In the fast-growing field of precision agriculture, researchers can take advantage of these biometrics to help producers improve productivity. LSU AgCenter assistant professor Shavahn Loux specializes in bioinformatics, a field where computer programming meets animal science.

Loux has recently collected both genetic data and biometrics from large goat dairies where animals wear radio frequency identification tags to help keep track of each animal as they move through their day. Milk production is tracked as the goats are milked by rotary milking machines that can milk animals on a rotating platform. These tools help dairy producers understand how much feed individual animals eat and how much milk they produce.

"By being able to collect all this quantitative data, we can get really good insight into which genes are likely affecting milk production in dairy goats," Loux said. "With that, we can start being able to identify some of these markers of interest for the dairy goat producers so they can better refine their breeding practices."

Using information gleaned from the bioinformatic tools, producers can save money and time, Loux said.

"In a traditional system, it can take three to four years before producers have all the information they need to decide whether or not they want to keep any individual goat around and keep her genetics," she said. "If we can figure out which of these goats is most valuable genetically at birth, then producers can save a lot of time and money by only raising the does with the best genetic potential."

Loux uses these bioinformatic tools to help better understand health and reproductive issues with cattle, goats and sheep. Breakthroughs in animal health can often lead to new treatments for people, too.

"My overall goal is to use these bioinformatic technologies to learn more about clinical problems that people and animals are having," she said. "The purpose of these technologies is to generate knowledge and therapies that help improve the health and productivity of the animals we study." ■ **KYLE PEVETO**

LOUISIANA CLIMATE AND DIGITAL AG NETWORK: *BUILDING STATEWIDE, AG-FOCUSED ENVIRONMENTAL SENSING NETWORK*

NUSRAT JAHAN, MICHAEL NII ATTOH AGYIRI, FRANK ANYOKA ADEKILAE, PARVIN MOMENIAN, PRASHANT JHA, STACIA CONGER AND VINIT SEHGAL

THE LOUISIANA CLIMATE AND DIGITAL AGRICULTURE NETWORK, known as LaCADIAN, is LSU AgCenter's recently established statewide monitoring network designed to help farmers, Extension agents and researchers better understand the weather, soil and crop conditions affecting Louisiana agriculture. LaCADIAN is operated as a network of 24 automated stations that continuously monitor environmental conditions across key strategic locations within the state.

Louisiana weather conditions are dynamic and highly variable, which can change a farmer's plans with a moment's notice during the crop season. Localized rainfall can flood certain fields while others nearby still require irrigation. During seasonal transitions, air temperatures can swing by more than 40 degrees in a single day, and torrential downpours can stunt seedlings or limit harvest of a mature crop. Chemical drift can also happen with shifts in wind speed or direction, affecting application efficiency, economics and even neighborly relations when chemicals move beyond the intended field. Weather information is critically important to producers making decisions about planting, irrigation, drainage, chemical applications and harvest.

LaCADIAN stations are placed across important farming and ecological landscapes, including AgCenter research stations and the Mississippi River Alluvial Plain. Many are concentrated in northeast and central Louisiana, where row-crop agriculture, alluvial soils, water management and flooding risk are closely linked. Others extend into northwest, southwest and southeast Louisiana to capture differences among inland, upland and river-influenced areas. This placement is intentional: Louisiana agriculture is not one uniform system, and neither is its climate.

The project is led by Vinit Sehgal at the AgCenter and is supported by funding from the U.S. Department of Agriculture's Natural Resources Conservation Service (USDA NRCS). AgCenter faculty Stacia Conger directs irrigation management, Extension and outreach activities, while Prashant Jha manages the precision weed management aspects of the project.



A LaCADIAN field station is shown during a project team visit at the LSU AgCenter Macon Ridge Research Station in Winnsboro.

Photo by Vinit Sehgal



A drone sprays herbicide on Palmer amaranth infesting soybeans in an integrated weed management program using unmanned aerial vehicle-based multispectral imaging. Photo by Prashant Jha

Each station collects measurements every 15 minutes, which are processed and made available through an open-access public dashboard in hourly and daily summary formats. The aboveground sensors measure rainfall, air temperature, relative humidity, wind, sunlight and barometric pressure, among several other variables. Specialized sensors also provide crop greenness and surface temperature to help detect growth and early stress. The underground sensors measure soil moisture, matric potential (indicating how tightly water is held in the soil and its availability for plant uptake), temperature and salinity at multiple depths.

WHY DOES LOUISIANA NEED THIS NETWORK?

Louisiana agriculture faces weather challenges that are both intense and uneven. Flash flooding, drought, extreme heat and hard freezes can all affect production, but not every parish, farm or soil type experiences them in the same way. A forecast may describe the region, but farm decisions often depend on what happens at a specific field. These decisions include whether rainfall or irrigation entered the soil, whether the root zone is drying, whether a freeze stayed near the surface or moved deeper or whether a crop canopy is beginning to show stress.

That kind of local information has been difficult to gather consistently across the state. Many weather stations measure conditions above ground, but fewer systems colocate soil and crop measurements in Louisiana. Louisiana also has not had a coordinated agricultural soil moisture monitoring network, a gap that matters beyond crop production. Soil moisture information can help assess drought stress, wildfire risk, prescribed burning conditions and smoke-related hazards when dry vegetation, fog and shifting winds create public safety concerns.

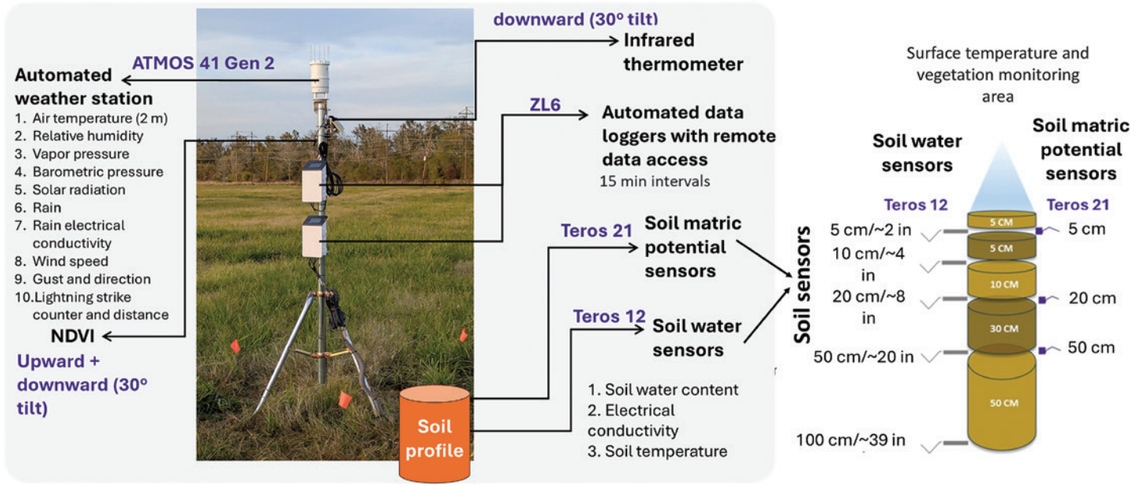
Reliable field data also require reliable care. Weather stations and sensors operate in harsh outdoor environments, where equipment can become nonoperational because of debris, excessive vegetative growth, insect activity or storm damage.

LaCADIAN was designed to be a well-maintained and validated monitoring system, not simply a set of instruments placed in fields. Regular site visits, sensor cleaning, vegetation management, equipment checks and data review help make the information dependable for research, Extension and on-farm decision-making.

WHAT CAN THE DATA SHOW AND WHO CAN USE IT?

As LaCADIAN data becomes available, they are beginning to show how Louisiana's farm environment responds to weather extremes. During recent winter events, stations captured sharp changes in air and surface temperatures, differences between shallow and deeper soil responses and regional patterns in cold exposure. These observations illustrate why local measurements matter: One weather event can create very different agricultural conditions across Louisiana, and the aboveground effect may not be the same as the effect belowground.

The data are freely available through a user-friendly interactive dashboard where users can view station locations, explore the latest environmental trends through interactive data plotter, and download hourly and daily summaries for



The LaCADIAN weather station consists of an ATMOS 41 automated weather station with a normalized difference vegetation index (NDVI) sensor, an infrared thermometer and ZL6 data loggers. Below ground, along the soil profile, TEROS 12 sensors measure soil water content, temperature and electrical conductivity, while TEROS 21 sensors measure soil matric potential, indicating how tightly water is held in the soil and its availability for plant uptake. Graphic by Vinit Sehgal.

Continued on next page.

the variables on demand. Users can use the dashboard to check rainfall, soil moisture or soil temperature near a production area. Researchers can use the same data to study drought, flooding, cold events, irrigation response, crop stress and long-term environmental change.

Because measurements are collected frequently, LaCADIAN can capture short-term changes that daily summaries may miss. That information can support irrigation scheduling, drainage decisions, frost and freeze risk, pest and disease models, nutrient management and conservation practices such as cover cropping, reduced tillage and precision irrigation. As the network collects long-term data, it will support new digital agriculture tools, including estimates of evapotranspiration and plant-available water for each site.

New statewide, high-resolution hydrology and crop support models are currently in development — relying on LaCADIAN for training and validation — to give stakeholders a comprehensive and high-resolution outlook of soil and water conditions in the state. Automated quality assurance and control procedures are currently under development to be deployed alongside the data so users can reliably use the data.

Farmers have always watched the land and sky closely. LaCADIAN extends that tradition with modern tools, helping Louisiana agriculture make better decisions in a future where local, reliable information is becoming more important than ever.

Nusrat Jahan, Michael Nii Attoh Agyiri, Frank Anyoka Adekilae and Parvin Momenian are graduate students in the LSU AgCenter School of Plant, Environmental and Soil Sciences. Prashant Jha is a professor in the AgCenter School of Plant, Environmental and Soil Sciences. Stacia Conger is an associate professor at the AgCenter Red River Research Station.

SUPPORTING SOYBEAN AND CORN RESILIENCY *AGAINST WEATHER EXTREMES IN LOUISIANA WITH PRECISION AGRICULTURE TECHNOLOGY*

■ TRI SETIYONO, AAKRITI POUDEL, CAROL PINNELL-ALISON AND DAVID MOSELEY

SOYBEAN AND CORN GROWERS in northeast Louisiana are concerned about adverse weather events, such as prolonged periods of rainfall, that can reduce the quality and yields of crops. LSU AgCenter researchers are studying ways to prevent these crop problems while also using precision agriculture tools to improve their assessments of the impacts from these weather events. These tools include sophisticated crop modeling software, satellite-based sensors and drone-based sensing technology. Two AgCenter studies serve as prime examples of this work.

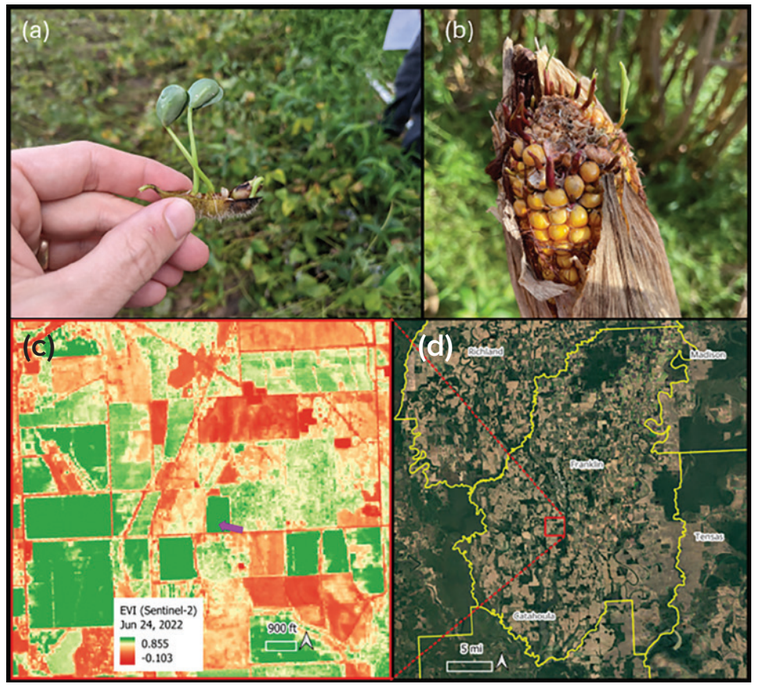


Figure 1. (a) Soybean seeds sprout in the pod. Photo by David Moseley. (b) Corn seeds sprout while still on the cob. Photo by Carol Pinnell-Alison.

(c) The location of the soybean field is shown by the purple arrow in the accompanying map. The Enhanced Vegetation Index color gradient toward green indicates a high vegetatively active crop canopy coverage, whereas yellow to red indicates either more exposed bare soil or non-vegetatively active crop cover such as mature crops. (d) The overview of the location of the left map.

EFFECTS OF HEAVY RAINS ON SOYBEANS

The year 2022 was particularly devastating for growers in Franklin Parish as continuous rain in August caused widespread damage to soybeans and corn. Soybean seeds sprouted out of the pod, and likewise, late-planted corn seeds sprouted on the cobs (Figure 1). The weather event affected soybeans the most because the wet spell occurred while most soybean acres were in the beginning stages of maturity, which is a stage called R7, and were beginning to dry down to full maturity before they could be harvested, which is a stage called R8. At these growth stages, continuous rain events can cause soybean seeds to rot or germinate in the pod. Approximately 18 inches of rain — a record rainfall for August — were registered through the weather station at the AgCenter Sweet Potato Research Station near Winnsboro (Figure 2). Geographic data suggested that August 2022 was unusually wet for most of northeast Louisiana (Figure 3). It was also unfortunate that in 2022, soybean acreage surged as growers switched to soybeans instead of corn because of the high price of fertilizer.

COMPUTER MODELING CROP GROWTH AND SATELLITE OBSERVATIONS

To further investigate how this weather event affected soybeans planted in northeast Louisiana, AgCenter researchers used a computer program that predicts how crops grow — the CROPGRO model in the Decision Support System for Agrotechnology Transfer (DSSAT) software. With remote sensing data from the European Space Agency's Sentinel-2 satellite, an analysis explained the difference between soybeans planted in the early part of the 2022 season versus those planted in late April. Plenty of rainfall occurred while early planted soybeans progressed from the R7 stage of physiological maturity to the R8 stage of full maturity where

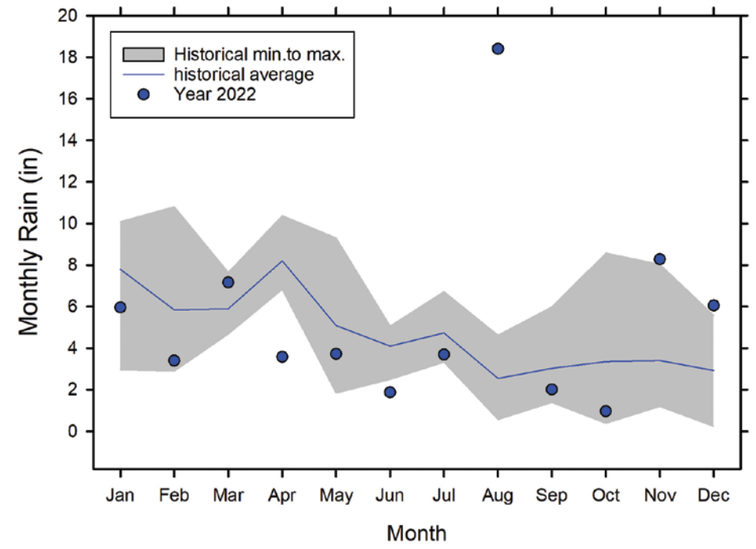


Figure 2. Monthly rain in 2022 reported by the LSU AgCenter Weather Station at the Sweet Potato Research Station near Winnsboro. Figure by Tri Setiyono

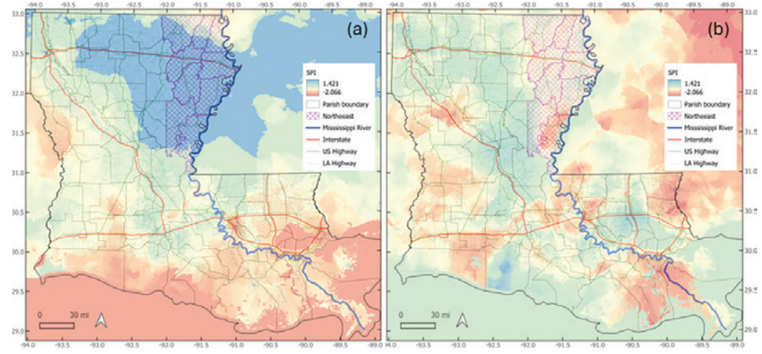


Figure 3. Map of Standard Precipitation Index (SPI) for Louisiana for August 2022 (a) and 2024 (b). Notice the excessive moisture extended across northeast Louisiana in 2022. The SPI for August 2024 represents normal conditions. The color gradient toward blue indicates high SPI or wet conditions, whereas yellow toward red indicates normal to dry conditions. SPI is a simple numerical score that shows how much rain a specific place has received compared to its normal historical average. Figure by Tri Setiyono

the beans dry down before harvest. However, the wet spell was very much over by the time the soybeans planted in late April reached the R7 stage of physiological maturity.

Another tool, the Enhanced Vegetation Index (EVI), uses satellite images to measure how green a crop canopy is to understand plant health. The EVI data from this period confirmed the differences between early-planted soybeans and late-planted soybeans. The drop in the index for the early planted soybeans, which indicated maturing soybeans, coincided with the frequent rain events. Such a drop for the late-planted soybeans occurred past these wet spell events.

At this time, the EVI was substantially higher for the early planted soybeans, while another tool, the Bare Soil Index (BSI), showed the reverse. The BSI uses

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Figure 4. Flooded corn field at LSU AgCenter Macon Ridge Research Station.

Photo by Tri Setiyono

satellite images to find bare soil and delineates soil background against surface vegetation, with a higher value indicating more soil surface exposed in the image. The early planted soybeans exhibited a lower value when compared with the late-planted fields. This example showed the early and late-planted fields compared to one another despite being located in Franklin and Catahoula parishes.

A comprehensive analysis of satellite-derived remote sensing data of major soybean landscapes in Catahoula, Franklin, Tensas and Madison parishes suggested that as much as 68%, 71%, 82% and 85% of the parishes' soybean acreage, respectively, were affected by the widespread damage from the 2022 August wet spell. These spatial data match the 2022 Louisiana Ag Summary released by the AgCenter, which found that only 20% of the soybean crop was rated as good to excellent.

LSU AgCenter scientists have been conducting research trials on soybean desiccants, which are herbicides or other drying agents that improve harvest efficiency. Important studies include those that examine the impact of desiccant application timing on soybean yield and quality. However, interventions that may come out of soybean desiccant studies as potential preventive measures against adverse weather conditions like the August 2022 rains will need to be supplemented by breakthroughs in weather information, especially long-range forecasts or seasonal outlooks. This study, and the following study on corn, will help researchers better understand the effects of erratic rainfall.

EFFECTS OF ERRATIC RAINFALL ON CORN

Erratic rainfall can also result in uncertainty in the management of nutrients applied as fertilizer in corn crops. Excessive rain can cause nitrogen fertilizer to leach, or move down through the soil away from plants. During the writing of this article, flooding occurred in corn fields at the LSU AgCenter Macon Ridge Research Station (Figure 5). Research trials implementing precision agriculture technology were conducted at AgCenter research stations from 2022 to 2024 to address flooding in soybeans and corn and were funded by the Louisiana Soybean and Grain Research and Promotion Board. The study investigated the impact of flooding on stand counts in soybeans and evaluated the vulnerability of nitrogen management in corn in excessive moisture conditions.

The corn flooding study found that corn yield was significantly reduced when excessive moisture followed the application of nitrogen fertilizer at the Red River Research Station site in Bossier City. That was not the case at the Doyle Chamber Central Research Station in Baton Rouge. A detailed analysis at the Baton Rouge site suggested that excessive moisture made the corn crop less economically viable. The excessive moisture reduced the Economically Optimum Nitrogen Rate (EONR), which is the fertilizer application rate that will allow the highest amount of profit for the crop. A higher amount of nitrogen was needed to achieve an attainable yield, which resulted in a lower maximum net return to nitrogen, a measurement that marks the point where the last pound of nitrogen applied to a crop is paid for by the last bushel of the crop that is produced.

NEXT STEPS

Weather anomalies are recurring risks that threaten the profitability of soybean and corn growers in Louisiana. This underscores the need for improved insurance protection, optimized planting time, better seasonal forecasting and enhanced predictive modeling and assessments to strengthen readiness and reduce future losses. These studies are among the first steps in understanding these weather anomalies.

Tri Setiyono is an assistant professor in the LSU AgCenter School of Plant, Environmental and Soil Sciences. Aakriti Poudel is a research associate in the School of Plant, Environmental and Soil Sciences. Carol Pinnell-Alison is an LSU AgCenter Franklin Parish Extension agent. David Moseley is an associate professor at the AgCenter Dean Lee Research and Extension Center in Alexandria.

CHARACTERIZING SOYBEAN DISEASE RISK

USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

STEPHANIE RAMOS, SAMUEL HUAYAMABE, SARA THOMAS-SHARMA, BRENDA TUBAÑA, DAVID MOSELEY AND TRI SETIYONO

LSU AGCENTER RESEARCHERS are using satellite imagery to map planting timing across Louisiana soybean fields to help identify areas where crops may be at greater risk for disease. For soybean farmers in Louisiana, the timing of planting can mean the difference between a healthy crop and one devastated by disease.

In Louisiana and across the Midsouth, soybean production is frequently affected by diseases such as Cercospora leaf blight (Figure 1), frogeye leaf spot and aerial blight. Among the factors influencing disease development, planting timing plays an important role, as delayed crop development exposes soybeans to warmer and more humid conditions later in the growing season. Understanding how planting timing varies



Figure 1. Soybean leaves showing symptoms of Cercospora leaf blight (CLB) in Louisiana. Characteristic purple discoloration and leaf blighting are visible on infected leaves. Photo by Sara Thomas-Sharma

Figure 2. Spatial distribution of soybean crop development timing in Minor Civil Division 95062, Tensas Parish, Louisiana, during the 2024 growing season. Fields were classified based on Enhanced Vegetation Index (EVI), a measure of canopy greenness into extremely early (March to early April), early (mid-April to mid-May), and late (late May onward). Figure created by authors



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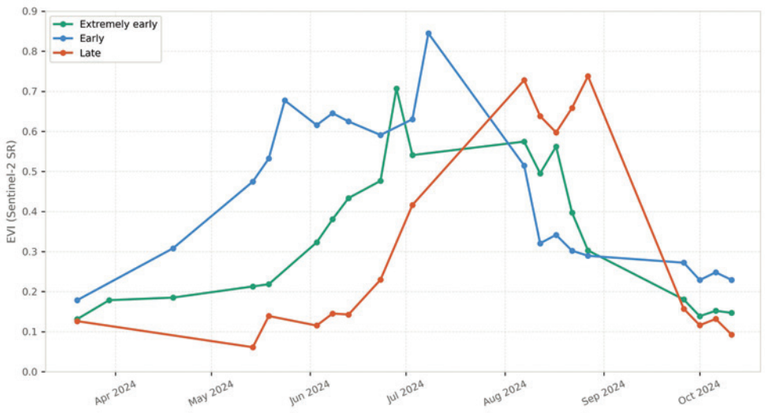


Figure 3. Enhanced Vegetation Index (EVI) time series (Sentinel-2 SR, a European Earth observation satellite) for three soybean fields by crop development timing in Minor Civil Division 95062, Tensas Parish, Louisiana, 2024 growing season. Figure created by authors

across agricultural landscapes is important to better assess disease risk and support management decisions. However, traditional assessments of planting dates rely on field surveys, farmer-reported data or parish-level summaries, which often do not capture differences in planting timing from one field to another. This makes it difficult for producers and consultants to identify where crops may be more exposed to favorable conditions for disease development.

Satellite remote sensing provides an alternative approach to monitoring crop development across large areas by collecting repeated images of the same fields throughout the growing season. In this study, satellite imagery was used to track soybean development during the 2024 growing season in the southwestern area of Tensas Parish. Changes in crop greenness over time were analyzed to estimate the onset of vegetation development for individual fields. This metric reflects the beginning of active crop growth and can be used as a proxy for planting timing. Because these data are collected repeatedly throughout the season, they allow for a consistent and scalable way to monitor crop development across multiple fields without the need for intensive field observations. A total of 112 soybean fields were evaluated in the study area. Based on the estimated timing of vegetation development, fields were classified into three categories: extremely early development (March to early April), early development (mid-April to mid-May), and late development (late May onward). This classification showed how the timing of crop development varied from one field to another across the study area.

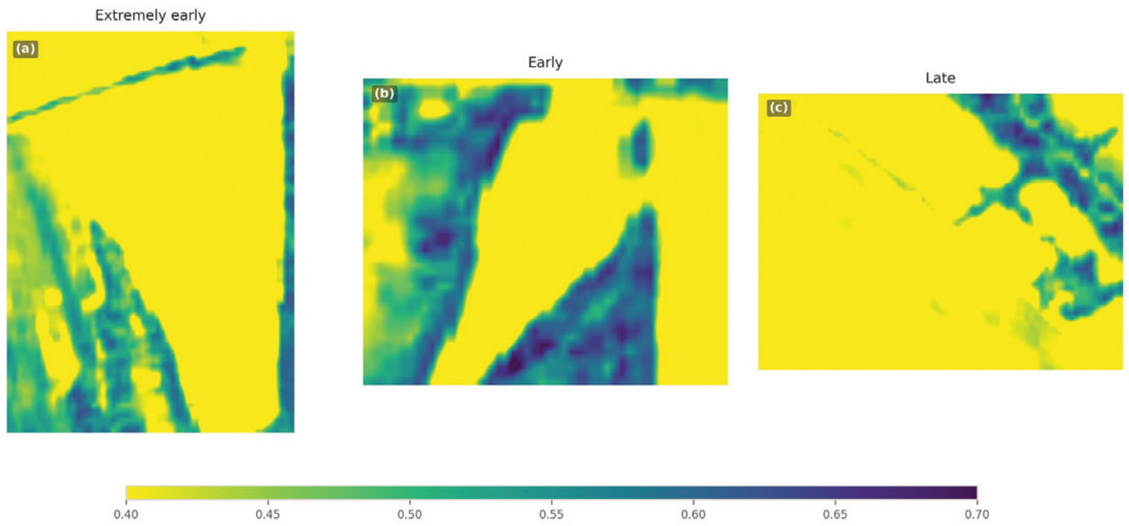


Figure 4. Seasonal mean EVI (March 15–Oct. 15, 2024) derived from Sentinel-2 SR imagery for representative soybean fields by planting group in Minor Civil Division 95062, Tensas Parish, Louisiana. Panels show representative fields with (a) extremely early, (b) early, and (c) late planting. Color ramp represents EVI magnitude (low = yellow, high = purple).

The analysis revealed clear variability in crop development timing across the study area during the 2024 growing season. Most soybean fields were classified as late development, representing 74% of fields. Early development accounted for 23% of the fields, while only 3% were classified as extremely early. This distribution indicates that most soybean fields entered key growth stages later in the season. The spatial distribution (how the crops are spread out) of these categories showed that late-development fields were widespread throughout the study area, while early and extremely early fields were more limited and occurred in scattered locations. This pattern suggests that a large proportion of soybean fields may be exposed to similar environmental conditions during critical growth stages (Figure 2).

Late-planted soybeans are more likely to reach reproductive stages such as flowering and pod filling under the high temperatures and frequent precipitation that are typical of Louisiana from July through September. These conditions favor the development and spread of several soybean pathogens. As a result, fields with later crop development may experience increased disease pressure compared to earlier planted fields. This information is particularly important for improving the timing of scouting and fungicide applications, as fields with later development may require closer monitoring during periods of high disease risk. In addition to differences in timing, the seasonal patterns of crop development also varied among fields. Satellite images showed how soybean growth changed throughout the growing season (Figure 3). Fields classified as extremely early showed earlier canopy development and reached peak growth sooner while later fields exhibited delayed but rapid canopy expansion. These differences in growth trajectories can influence canopy closure, humidity within the crop canopy, and the duration of conditions favorable for disease development.

Satellite images also revealed differences in crop growth within individual fields during peak season (Figure 4). The extremely early developed field showed consistently higher enhanced vegetation index (EVI) values across much of the field, indicating more uniform canopy development. The early developed field displayed moderate to high values across most areas, while the late developed field exhibited greater variability. The late developed field showed more variation in crop growth across the field. This variation may reflect differences in emergence, soil conditions or crop vigor, all of which can contribute to uneven disease development within fields.

The use of satellite-derived vegetation indices allowed the identification of crop development timing across the landscape and provided a detailed view of variability among soybean fields. When combined with Geographic Information System (GIS) tools, these data can be used to visualize patterns and support the assessment of disease risk at the field and regional scale. This type of information can be used to prioritize fields for scouting, identify areas of higher risk within farms and support more targeted management decisions.

However, there are some limitations to this approach. Satellite data can be affected by cloud cover, which may reduce the availability of observations during certain periods. In addition, the timing of vegetation development represents early crop growth rather than the exact planting date. Despite these limitations, this approach provides a practical and scalable way to estimate crop development timing and evaluate its relationship with disease risk.

Overall, these findings highlight the potential of combining remote sensing and GIS technologies to improve the understanding of how planting timing varies across agricultural landscapes and how it may influence soybean disease risk. By translating satellite data into actionable information, this approach can help producers and crop consultants better anticipate disease pressure, optimize management practices and improve decision-making in Louisiana for soybean production systems.

Stephanie Ramos is a graduate assistant in the LSU AgCenter Department of Plant Pathology and Crop Physiology. Samuel Huayamabe is a graduate student in the School of Plant, Environmental, and Soil Sciences. Sara Thomas-Sharma is an associate professor in the Department of Plant Pathology and Crop Physiology. Brenda Tubaña is the chair of the School of Plant, Environmental and Soil Sciences. David Moseley is an associate professor at the AgCenter Dean Lee Research and Extension Center in Alexandria. Tri Setiyono is an assistant professor at the School of Plant, Environmental, and Soil Sciences.

SEE INSIDE

Satellites and sensors connected through the Internet of Things can help computer systems learn to see insects, weeds and crop damage. AgCenter scientists are using computer vision to manage crops and pests.

SEE PAGE 8.

The Agricultural Career Exploration with Drones program aims to teach children and young adults to use drones in ways that can help them earn a living. This program trains educators and Extension agents to help students earn certifications and practical skills to begin a new career in digital agriculture.

SEE PAGE 14.

In recent years, variable rate technology has been developed and improved by LSU AgCenter researchers. Its primary purpose has been dispersing nitrogen fertilizer in sugarcane and rice fields, but researchers envision many more uses in the future.

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