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LOUISIANA Agriculture

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Drones Aid Agriculture

Two New Louisiana Rice Varieties for 2014

Steve Linscombe

The LSU AgCenter Rice Research Station has as one of its goals to continuously develop and release new varieties that will benefit the Louisiana rice industry. The program works with many different types of rice, including conventional and Clearfield long-grain, medium-grain and specialty types. Four years ago the project also initiated research into the development of rice hybrids. Typically, it takes seven to eight years from when a cross is made until foundation seed of a new variety is delivered. However, two new varieties will be released in 2014, which made it to foundation seed in four years. They are CL271 and CL-Jazzman.

CL271, which was tested as LA1202065, is an early-maturing, short-stature Clearfield medium-grain variety, which has consistently outyielded CL261, which is the only Clearfield medium-grain variety now available in the southern United States. In 18 head-to-head yield tests in 2012 and 2013, CL271 had an average per acre yield of 8,995 pounds compared to 7,687 pounds for CL261. CL271 has also shown similar or slightly better yields than Jupiter and Caffey, the predominant conventional (not Clearfield) medium grains.

CL271 is similar to CL261 in having excellent whole-grain milling yields and excellent grain appearance characteristics. One of the significant advantages of CL271 is the very high level of resistance to blast disease. CL261 is very susceptible to this disease, which was especially evident during the blast epidemic of 2012 in southwest Louisiana. The new variety also has shown high levels of resistance to Cercospora. It is moderately susceptible to sheath blight and susceptible to bacterial panicle blight and straighthead.

Seed of LA1202065 was increased as headrows at the winter nursery in Puerto Rico during the winter of 2012-2013, and the seed harvested from this increase was used at the Rice Station during the summer of 2013. To maximize seed production, a 32-acre field was planted at a seeding rate of 10.2 pounds of seed per acre. In spite of the low seeding rate, stands were excellent, and the field yielded 8,500 pounds (52.5 barrels or 188 bushels) per acre on a dry weight basis. This production will be used primarily for seed production in 2014, but a limited amount of certified seed should also be available.

Another new variety will be marketed as CL-Jazzman. This is an aromatic, soft-cooking Clearfield long-grain line. The line has cooking, appearance and aroma characteristics similar to Jazzman-2. It has very nice aroma and excellent grain appearance, as well as very long and uniform milled grains. This line was developed primarily through the work of Xueyan Sha, a breeder formerly at the Rice Station. Jazzman and Jazzman-2 were grown on approximately 33,000 acres in Louisiana in 2013. The new variety will allow for the production of a Jazzman-type variety to be grown using the Clearfield production system. CL-Jazzman has excellent grain yield and has consistently outyielded both Jazzman and Jazzman-2. The new variety is similar in height to Jazzman, making it 4-5 inches taller than Jazzman-2. Therefore, CL-Jazzman will be somewhat more susceptible to lodging than Jazzman-2 and will require slightly lower levels of applied nitrogen. The new variety is similar in maturity to Jazzman-2 and about three days earlier than Jazzman. The new variety is highly resistant to blast disease and Cercospora, moderately susceptible to sheath blight, and susceptible to both bacterial panicle blight and straighthead disorder.

The development of these two new varieties was possible only through the repeated use of the winter nursery facility in Puerto Rico. This nursery facility is crucial to the Rice Station's variety development activities.

Steve Linscombe is a rice breeder, director of the Rice Research Station and director of the LSU AgCenter Southwest Region.

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Linda Foster Benedict, Editor
Louisiana Agriculture
115 Knapp Hall
110 LSU Union Square
Baton Rouge, LA 70803
(225) 578-2263
lbenedict@agcenter.lsu.edu

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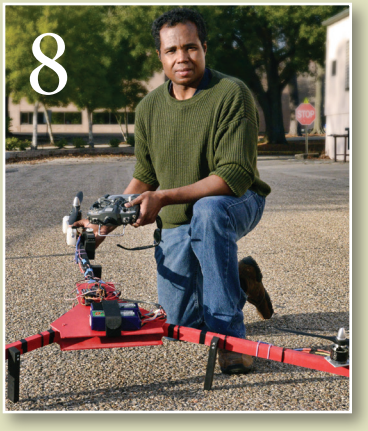

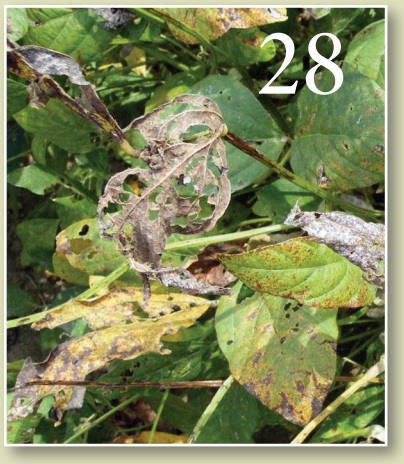

LOUISIANA Agriculture

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FEATURES

SCIENCE NOTES

DEPARTMENTS

On the cover: This photo illustration of a camera-equipped drone taking a photograph was created by Charles Malveaux, research associate in the Department of Biological and Agricultural Engineering; John Wozniak, assistant director in Communications; and Matt Faust, an illustrator for Communications and Information Technology. Malveaux took the photo of the Mississippi River scene at Baton Rouge with a drone camera; Wozniak took the photo of the drone (see page 8); and Faust made the propellers of the drone appear to be moving. This drone is about 4 feet in diameter with three battery-powered motors. The camera is gyroscopically stabilized on a gimbal mount. Read the story of Malveaux's research with drones on page 8.

Families learn to eat healthy, exercise at weekend 4-H camp

Families learned about healthy eating and the importance of exercise at the Louisiana 4-H Food and Fitness Camp at 4-H Camp Grant Walker Feb. 22-23.

"The camp has been refocused on family nutrition this year," said Lanette Hebert, LSU AgCenter 4-H coordinator for the Southwest Region.

The camp was the result of Youth Voice-Youth Choice grant from the National 4-H Council and the Walmart Foundation.

An important part of the camp was the teaching of MyPlate, which emphasizes eating healthy portions and more fruits and vegetables, along with more physical activity, Hebert said.

During the camp, youngsters and their parents met together and separately for the nutrition and exercise sessions. They also learned how to plan menus and prepare food.

Eating together as a family without distractions of television or cellphones also was stressed, Hebert said.

Assisting in many of the nutrition classes were four dietitian interns from Louisiana Tech University. One of the interns, Christie Clark, said the camp helped them gain valuable experience.

"We teach them to apply what we've learned," Clark said.

In one class, parents learned about smartphone apps such as MyFitnessPal, which tracks calorie consumption and physical activity. In a class on food shopping, they learned about apps to save money on groceries such as ibotta, Money Saving Mom, Hip2Save and Scantopia.

Participants at the Food and Fitness Camp practice stretching as one of the exercises taught during the event. Photo by Bruce Schultz

Denise Holston-West, LSU AgCenter nutritionist, taught a class on reading food labels and watching out for fat and sodium.

"Studies have shown that gradual weight loss is more healthful," said another of the interns, Michelle Falin.

The kids also learned how to prepare healthy foods and snacks, such as hummus with carrots and cucumbers.

The camp was planned and implemented by the Louisiana 4-H Food & Fitness board composed of teens from across the state. Four of the 4-H students who taught classes had attended a workshop in Chevy Chase, Md., to learn about how to teach healthy living habits. That trip was funded by the Eat4-Health grant funded by the National 4-H Council and United Healthcare.

Also, 4-H students taught the kids about different exercises, and they took pulse rates before and after activity to learn about getting their hearts working harder to develop fitness.

Parent participant Nicole Coreil, of Rapides Parish, said she used the camp to get a jump start on eating better and getting more exercise. "I'm trying to change some of my lifestyle habits. If they see us set good examples as parents, they'll learn those healthy habits."

Her daughter, Rebecca, also came to the camp even though she was hobbling on crutches from a foot injury. **Bruce Schultz**

Jumping rope was one of the exercises at the Food and Fitness Camp used to show kids how fun exercises can be part of a healthy lifestyle. The two-day event was held at the LSU AgCenter 4-H Camp Grant Walker near Pollock. Photo by Bruce Schultz

Youngster with Down syndrome finds pride showing livestock

John Sonnier, 4-H'er from St. Mary Parish, shows off the ribbons he won at the LSU AgCenter Livestock Show. Sonnier has Down syndrome, and his sister says showing livestock has improved his demeanor. Photo by Tobie Blanchard

Affectionately known as "John John" by his family, friends and fans, John Sonnier, a 4-H'er from St. Mary Parish, was prepping to show his pigs at the LSU AgCenter's state livestock show. He stopped occasionally to visit with people passing by and to show off his dance moves.

Sonnier has Down syndrome, and his sister, Brittany Durham, says showing livestock has given him a real purpose.

"It gives him something to be proud of and to accomplish because he doesn't get to do a lot of other things like kids his age," Durham said. "So this shows him a sense of pride and something he can be successful at."

Sonnier started showing livestock four years ago when a family friend let him show their pigs.

Sonnier communicates in short sounds and signs. He gave a quick demonstration of what is required when showing. "You hit the pig with a stick," his sister said, speaking for him.

He has showed chickens, ducks and rabbits in the past, but preferred pigs.

His 4-H agent, Jennifer Ducote, said Sonnier is just another kid at the shows and with his 4-H Club.

"John, he is a kid with special needs that does not require many needs. He encourages a lot of others. He is pretty normal, and I think he can show others that even with a disability, they can show and do the same things," Ducote said.

A goal of the 4-H livestock program is to instill in youngsters a sense of responsibility that comes with caring for animals. Sonnier has daily chores with his pigs.

Sonnier described his chores through his sister, "We bathe them and give them water."

Durham says once Sonnier started caring for his animals, his demeanor became calmer.

"Kids with Down's, the more of a routine, the better they are each day," she said.

His family lovingly calls him a clown, but that night in the show ring, Sonnier was a winner – placing third in both of his categories and walking away with more ribbons to add to his growing collection. **Tobie Blanchard**

Sugar mills improve efficiency with AgCenter technology

Louisiana sugarcane mills have begun installing new equipment that has the potential of reducing processing time and increasing capacity for processing raw sugar.

The Crompion LLT Clarifier incorporates two new technologies developed by the LSU AgCenter and licensed to Crompion International, said company president George Schaffer.

The new product, a short-retention clarifier, reduces the time in one step in the process from two or three hours to about 45 minutes, Schaffer said. A flash trough incorporated in the device reduces the amount of air in the process and improves the results.

The sugarcane milling process involves pressing juice from the cane. The resulting raw juice contains suspended solids called mud, which includes soil and plant residue, and must be removed in the clarification process.

"We want the mud to settle and the juice to rise," Schaffer said.

The Louisiana Low Turbulence Clarifier was developed by Vadim Kochergin, formerly with the AgCenter, and Cy Gaudet, one of Kochergin's graduate students. The flash tank was developed by Kochergin and another of his graduate students, Santiago Grimaldi. Both technologies are licensed by the LSU AgCenter to Crompion.

The clarifier incorporates a patent-pending turbulence-reduction device that helps solids settle out of the sugarcane juice more efficiently, resulting in less sucrose loss and cost and energy savings, according to LSU AgCenter officials.

"You want sucrose," said Ben Legendre, director of the LSU AgCenter Audubon Sugar Institute. "As the juice sits in the clarifier, sucrose degrades to glucose and fructose. So the quicker you get the juice out of the clarifier, the less sucrose you lose." **Rick Bogren**

Two AgCenter rice scientists honored at national meeting

Mike Stout, LSU AgCenter entomologist, second from the left, was among the entomology team to receive the Distinguished Rice Research and Education Team Award given at the 2014 RTWG meeting. Others pictured are, left to right, Mo Way, Texas A&M; Jeffrey Gore, Mississippi State University; and Luis Espino, University of California. Not pictured are G.M. Lorenz and John Bernhardt of the University of Arkansas; and Larry Godfrey, University of California. The team award was made to the entomologists for their work on seed treatments for controlling the rice water weevil and other insects. Photo by Bruce Schultz

Johnny Saichuk, left, LSU AgCenter rice specialist, receives the Distinguished Rice Research and Education Award at the 2014 meeting of Rice Technical Working Group in New Orleans Feb. 18-21. Presenting the award is Chuck Wilson of the University of Arkansas, RTWG chairman. Saichuk works with rice farmers across the state, and he oversees the LSU AgCenter's rice verification program. Photo by Bruce Schultz

College mounts major recruitment effort

With a renewed focus on student recruitment, the LSU College of Agriculture is on a mission to show young people that an education and career in agriculture is not just about plows, sows and cows.

Because agriculture's success depends on research, the field is always evolving to meet the world's changing, growing needs. There is no shortage of opportunities, but many students are simply unaware of them, according to Mary Claire Gilder, College of Agriculture coordinator of recruitment and public relations.

The college is expanding its recruiting efforts beyond on-campus events and hitting the road to promote to high schoolers, especially those in 4-H and FFA. Taking time to talk one-on-one to students is worth a lot, Gilder said. By learning about their interests, recruiters can plug them into relevant opportunities in agriculture.

Reflecting the diversity of today's agriculture industry, the College of Agriculture offers eight majors: agricultural business; agricultural education; animal, dairy and poultry science; environmental management systems; natural resource ecology and management; nutrition and food sciences; plant and soil systems; and textiles, apparel and merchandising. Students can even live on campus in the Agriculture Residential College – a community of people with similar interests.

Gilder said agriculture is too often stereotyped as antiquated and insignificant. Recruiting can help remove that stigma, she believes, because it is a process that seeks to educate as many people as possible. Parents need to know that agriculture – and their college-bound children's possible contributions to it – matters, Gilder said.

"As long as there are people on this planet, we're going to have agriculture, especially with the increase in population and how we're going to feed them and solve those problems," Gilder said.

By making sure the College of Agriculture has a presence across Louisiana, the potential of the state's best students can be harnessed for the good of agriculture. That is important, Gilder said, because every aspect of life depends on agriculture, from what people eat for breakfast to the clothes they wear. Expanded recruiting also demonstrates the College of Agriculture cares about its students and believes they can be successful at LSU and beyond.

Olivia McClure

Burnett named new college administrator

Photo by Olivia McClure

Mike Burnett has been named executive associate dean of the LSU College of Agriculture. In this new role, Burnett hopes to help the college's 10 departments and schools meet needs that will allow improved funding and recruitment, particularly in graduate programs.

"This is a new position we have created to strengthen the administration of the college," said Bill Richardson, LSU vice president for agriculture, who also serves as dean. "One of our primary goals is to expand our enrollment – especially in our graduate programs. Dr. Burnett brings the experience and leadership skills we need to grow our college."

Burnett arrived at LSU in 1980 as a newly-minted Ph.D. in agricultural education from Ohio State University. His master's and bachelor's degrees, also in agricultural education, are both from Clemson University.

After 15 years as a professor at LSU, he became director of the School of Vocational Education – now called the School of Human Resource Education and Workforce Development (SHREWD) – and held that position until becoming executive associate dean.

He has served as committee chair for more than 160 master's and doctoral students and graduated more than 80 doctoral students.

As its director, Burnett led SHREWD in broadening its mission to prepare students for a variety of careers. For example, the ag education program that originally trained students to be teachers was updated to reflect that degree's value in other disciplines. Burnett also helped expand the school's undergraduate curriculum to include more practical experience, such as internships in LSU AgCenter extension offices.

Students should always come first, Burnett believes, and he wants to help the College of Agriculture honor that commitment by adequate funding. Burnett said the college's graduates are successful and in demand because they are both technically competent and have leadership skills. However, faculty must have sufficient resources to provide that kind of well-rounded education and stay on the cutting edge, he said.

Burnett will also concentrate on improving recruitment to graduate programs, which is a familiar task – the number of SHREWD graduate students doubled in the past 10 years. "Students make the programs good," Burnett said.

"LSU is my home," Burnett said – and it's not just because he's been here for 33 years.

"The thing that's special about LSU is the people," Burnett said. "They have dedication to the program and dedication to the students that is unmatched anywhere."

Olivia McClure

Students take fashion designs to the runway

Photo by Yao Zeng

Current students and recent graduates of the LSU College of Agriculture's Department of Textiles, Apparel Design and Merchandising participated in Oneofakind Baton Rouge Fashion Show on Feb. 15 at the Capital Park Museum, where students showed off designs they completed as part of their coursework. Ella Rose, a 2013 graduate of the college, made this painted alligator dress. Rose is working as a designer in New Orleans.

International scientists get training as Borlaug Fellows

For the past three years, the LSU AgCenter International Programs office has been hosting scientists from around the world through the Norman E. Borlaug International Agricultural Science and Technology Fellowship Program to assist them with research in their countries.

Susan Karimiha, AgCenter coordinator of the Borlaug fellowship program, said the fellowship, which is funded through the U.S. Department of Agriculture, pays the expenses for the scientist to come here for training.

Karimiha said in addition to land-grant universities, USDA also works with government agencies and international research centers to implement the program.

The fellowship provides for mentors to work with the visitors during a 12-week stay. "Following the training period, the mentor spends up to 10 days with the scientists when they return home," she said.

Since 2011, 14 scientists from 11 countries have come to the AgCenter to work on various projects. "Normally they are interested in doing research on an agricultural challenge in their home country," she said.

The first grant in 2011 was to host an Indonesian scientist. "We did really well with that project. So well, that we've been hosting international scientists every year since through this program," Karimiha said.

"Each participant applies for the program through the USDA Foreign Agriculture Service. Fellows from developing and middle-income countries are eligible to participate in the fellowship program," she said.

"The scientists typically have a work plan for a project that they want to work on in their country but want collaborators or additional training," Karimiha said.

Projects have included solar drying to minimize post-harvest losses of agricultural products, minimizing the effects of agriculture on climate change and ways to help combat major plant diseases.

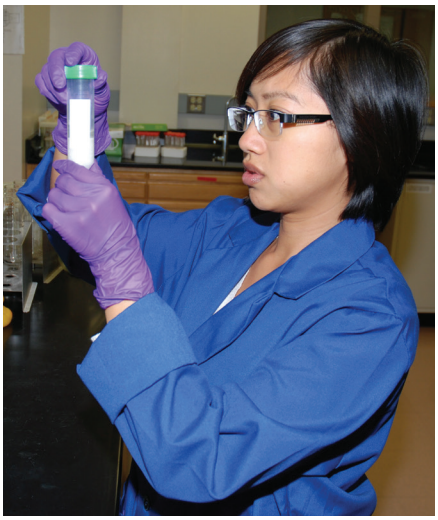
Karimiha believes improving people's access to food is an immediate benefit of the research and in the long term helps improve food security.

Currently, a Borlaug Fellow, Usman Ahmad from Bogor Agricultural University in Indonesia, is working on postharvest grain technology with Subramaniam Sathivel, an AgCenter food engineer.

The two most recent participants in the program were Dorsaf Yahiaoui, an engineer in plant protection of fruit trees at the Technical Center of Citriculture in Tunisia, and Yen Pham, a researcher and lecturer at the Key Laboratory of Enzyme and Protein Technology, Hanoi University of Science, Vietnam National University.

"The Indonesian scientist who came in 2011 to study sweet potatoes is back at the expense of her country for additional training," Karimiha said. "There also are two scientists from Kosovo who are returning." **Johnny Morgan**

Dorsaf Yahiaoui, a Borlaug Fellow, studied with AgCenter plant scientist Jong Ham. Her research focused on the development of new methods for diagnosis and biological control of fire blight, one of the most destructive diseases of apple and pear trees. Photo by Johnny Morgan



Borlaug Fellow Yen Pham's interests are in how pesticides and other chemicals used in agriculture can be monitored for safety. She conducted her research in the Department of Agricultural Chemistry with her mentors Mark LeBlanc and Amy Hernandez. Photo by Johnny Morgan

Richardson helps Honduran ag school make U.S. connections

Bill Richardson, LSU vice president for agriculture and dean of the LSU College of Agriculture, has an additional title as a member of the board of trustees for a Honduran agricultural university.

Richardson said he first learned of the Zamorano Pan American Agricultural School in the late 1980s, when he taught vocational education at Purdue University. At that time, Zamorano was only offering a three-year degree.

Zamorano was founded in 1941 by Samuel Zemurray, a Russian immigrant who made his fortune with a banana importation business that became the United Fruit Co. in New Orleans.

Richardson said LSU offered Zamorano students, who completed their three-year education in Honduras, a chance to come to LSU and enroll in a year of studies that enabled them to get a bachelor's degree.

After Zamorano began a four-year bachelor's degree program, LSU provided students with the opportunity to obtain advanced degrees.

A student who completed a master's degree and went on to obtain a doctorate at LSU graduated in August 2013, Richardson said, and two more graduated with Ph.D. degrees in December 2013.

"The quality of the students is what I'm impressed with most," Richardson said. "The faculty here at LSU appreciate these students. They work hard from daylight to dusk."

He said he has been present when students learn they have been selected to attend LSU, and the experience is profound. "They get rather emotional. There are some kids who come out of extraordinarily poor conditions."

About a third of the students are Hondurans with the rest from Ecuador, the Dominican Republic, Nicaragua, Guatemala and Panama.

Richardson said he was appointed to the university's Board of Trustees in November 2013 after Zamorano students petitioned the administration for his selection. "I was quite honored that my appointment came from the efforts of the students."

Richardson has been on the Zamorano campus several times. He said students grow the university's food, and it is processed in a state-of-the-art canning facility. **Bruce Schultz**

Photo by John Wozniak

Investigating the Potential for Drone Use in Agriculture

Charles Malveaux

The aerial drone is a unique remote sensing platform that allows real-time collection of remote sensing data. LSU AgCenter researchers are exploring uses of these unmanned aerial vehicles in agriculture. One of the first projects involves flying a drone equipped with a sensor device to measure the vegetative index of a crop. The device measures the green growth of a plant, giving a possible indication if additional fertilizer is needed on specific areas of a field. Research into accurate application of agricultural chemicals and fertilizers can save costs and reduce farm runoff, which will help preserve and protect the environment. The drone is capable of carrying a modified Trimble GreenSeeker NDVI sensor as well as a modified Canon camera configured to take wide-angle near-infrared photographs. For this research project, sensors were carried by drone aircraft and employed to remotely analyze the effects of aerial applications of farm chemicals on farm fields over multi-acre plots.

NDVI is the acronym for Normalized Difference Vegetative Index. The Trimble GreenSeeker is a sensor that uses a laser scanning system and analyzer to generate NDVI reflectance values for crops passing underneath. NDVI data can also be generated through near-infrared photography, such as that provided by the drone's modified Canon camera. By using software called Image J, the data generated can be converted into numerical values that can then be plotted as a calculated NDVI value.

Using this technique, calculated NDVI data derived from infrared imagery using the drone's modified Canon near-infrared camera was compared to computed NDVI numbers created by a Trimble GreenSeeker. In addition, Landsat 8 satellite data were also compared to the high resolution imagery of the drone's near-infrared camera to gauge the sufficiency of its resolution for this application.

The automated stability controls and guidance systems these drones carry can result in increased efficiency when compared to manned systems, while also providing enhanced safety factors to operators as well as reduction of human error. The drones constructed are robust aerial platforms that have the ability to be rapidly configured in the field and put to work on multiple remote sensing missions.

Safety was a factor in the design of the drone used in this research project. The drone was designed to absorb force and strategically break apart rather than injure bystanders or property while also being able to carry a working payload in excess of 6.5 pounds at a speed in excess of 40 miles per hour.

Methodology

Geo-referenced shape files of fields were created by a hand-held GPS survey of the area to be studied by the drone. These shape files were then integrated into ArcGIS software to geo-reference the imagery taken for this project. Field area coordinates were used to program the drone flight routes. The drones flew a programmed pattern over the selected fields, and more than 150 high definition images were taken at various altitudes over two areas in Donaldsonville and St. Gabriel containing mature as well as juvenile sugarcane crops. Observations were made to determine if the effects of different treatments could be discerned through remote sensing image analysis.

The mature sugarcane crop areas flown over had received chemical applications intended to rapidly ripen them, causing them to store the maximum amount of sucrose in their

The drone gathered data used to gauge the effectiveness of the various herbicides and chemicals used to ripen these crops. In the near future these data can give farmers a better understanding of the amount of chemicals needed to treat crops.

stalks. The drone gathered data used to gauge the effectiveness of the various herbicides and chemicals used to ripen these crops. In the near future these data can give farmers a better understanding of the amount of chemicals needed to treat crops.

Results and Discussion

Near-infrared cameras and Trimble GreenSeekers are different sensor systems, but in comparison they still produced parallel reflectance curves while showing substantial positive covariance. In comparison with the GreenSeeker, this study shows that an inexpensive near-infrared camera carried by drone aircraft on autonomous missions can effectively be used for crop analysis. The comparable data that the camera generated combined with the camera's greater scan area at higher altitudes in excess of 300 feet versus the GreenSeeker's limited scan area at less than 5 feet above crops make the near infrared camera system more suitable for rapid field surveys. Based upon analysis results between the two sensor systems, it was determined that the Canon near-infrared camera was more suitable for this project and as a stand-alone imaging method for future research.

Data analysis showed visible differences in crops along with the overlap between treatments. The satellite images in Figures 1 and 2 show the Donaldsonville farm area being studied. Discoloration in the near infrared-image of Figure 3 shows areas where the crop has been affected by chemical treatments. In addition, overlap areas between different treatments can be observed in this image. In Figure 5 the field was treated uniformly with a single chemical application, and this is apparent when the image was analyzed using Image J software.

Figure 1. This is a satellite map showing the Donaldsonville farm research study area, which is outlined in black.

Figure 2. This is a close-up of the same area, Donaldsonville farm research study area.

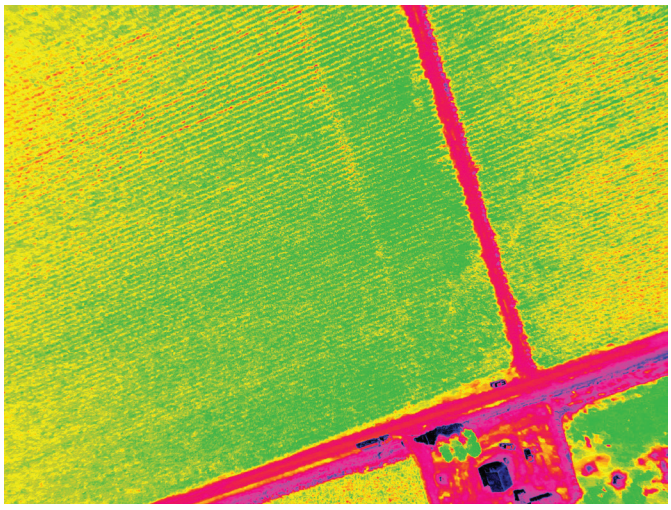


Figure 3. This is a rendered NDVI image using Image J software of the Donaldsonville farm research study area.

Figure 4. This is a near-infrared image taken with the drone carrying the modified Canon camera of the Donaldsonville farm research study area.

Charles Malveaux, LSU AgCenter graduate assistant in Biologic and Agricultural Engineering, conducts research using radio-controlled drones to collect data in agricultural settings. Photo by John Wozniak

Conclusion

The drone's ability to safely and quickly survey farmland and assist in precision control over chemical and fertilizer application rates can greatly increase farm industry profitability. Farmers, environmentalists and regulatory agencies can use drones for real-time analysis of farm areas, coastal areas and various other land areas to study a wide range of data points from tracking crop treatments to cataloging regional and coastal topography as part of preservation efforts. Agricultural survey drones can monitor land use and take air samples to help researchers gather valuable data, which can be used for various precision agriculture applications.

For this project the results exceeded the expectations for the GreenSeeker in that its laser light emitter is somewhat underpowered and its range is limited to a maximum of less than 5 feet above the crops being analyzed compared with the near-infrared camera's ability to scan large areas at a height in excess of 300 feet above crops. The near-infrared camera was able to take data from a much higher vantage point, which means it could analyze an entire field with a single high-resolution, near-infrared photo. Sensors similar to the GreenSeeker with extended range exist for use with manned aircraft; however, these large NDVI sensors are too heavy for use on the small drones.

The resolution of Land Sat 8 satellite data more than 30 yards is not comparable to the resolution of the drone imagery. Lightweight drones like the ones employed in this research can be conveniently launched and can easily provide high resolution regardless of cloud cover or time schedule, unlike satellites. Satellite data still has its place in that satellites can gather cohesive data from entire agricultural regions; however, this research shows that drones can greatly augment environmental and agricultural remote sensing capabilities. The National Agricultural Imaging Program (NAIP) has yearly aerial imagery data available at a resolu-

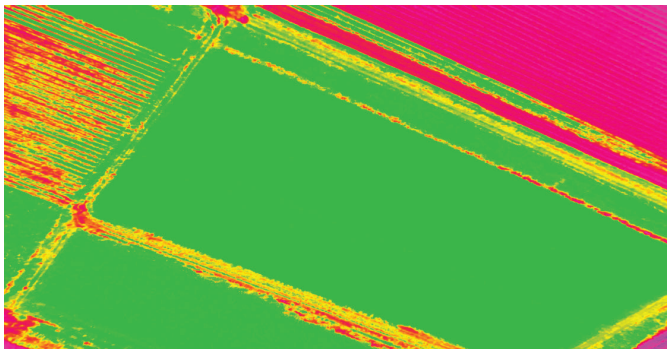


Figure 5. This is a rendered NDVI image using Image J software of the Sugar Research Station in St. Gabriel.

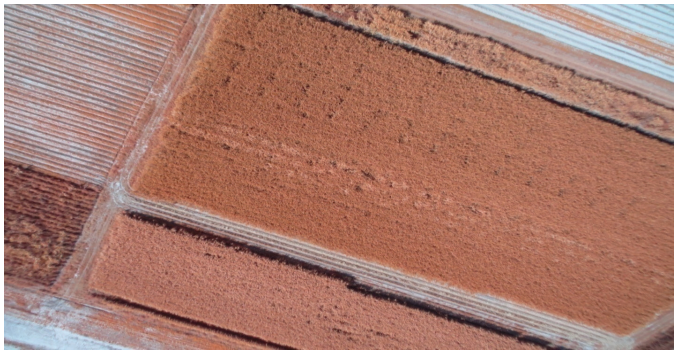


Figure 6. This near-infrared image was taken with the drone carrying the modified Canon camera. The fields are at the Sugar Research Station in St. Gabriel.

tion of about 1 yard. But while its resolution is sufficient, its once-a-year availability is not adequate for the weekly surveys of land areas for agricultural and coastal land management purposes. This research shows that lightweight aerial drones can regularly monitor agricultural regions as part of a systematic farmland management and control system.

Unlike manned aircraft, lightweight drones require less fuel, and maintenance costs are much lower. Lightweight drone aircraft are highly mobile and capable of being carried close to study areas on foot or by using land vehicles. Survey drones can easily be transported into areas whenever the need arises. In addition, the added safety of not putting manned aircraft at risk while also offering no risk to those on the ground in comparison to manned aircraft, make lightweight drone aircraft a favorable choice for agricultural land management efforts.

Aerial drone systems have a many uses. Robotic drone aircraft can be the foundation of an advanced remote-sensing-based agricultural control system, which can revolutionize the industry. In addition, these autonomous systems can also be used as part of environmental and coastal preservation efforts.

Farmers, environmentalists and regulatory agencies can use drones for real-time analysis of farm areas, coastal areas and various other land areas to study a wide range of data points from tracking crop treatments to cataloging regional and coastal topography as part of preservation efforts.

Charles Malveaux is a research associate in the Department of Biological and Agricultural Engineering.

The Mississippi River in Baton Rouge at sunset. The photo was taken with a camera-equipped drone. Photo by Charles Malveaux

Energycane, sweet sorghum show promise as crop options for Louisiana and Mississippi farmers

A. Denise Attaway

The LSU AgCenter is in its third year of a federal grant project to study alternative biofuels.

Researchers with the LSU AgCenter, Mississippi State University Cooperative Extension Service and the U.S. Department of Agriculture are working together to bring the high biomass version of sugarcane, known as energycane, and sweet sorghum way north of Interstate 10, which runs east and west across south Louisiana.

"We're looking at these as crops producers can grow in addition to crops they're already growing," said Donal Day, project manager for the LSU AgCenter's Sustainable Bioproducts Initiative. "We're looking at how producers in the northern areas of Louisiana and Mississippi can grow these crops to help supplement their incomes."

Both crops can be used to provide feedstock for biorefineries to use in producing biofuels.

Brian Baldwin, a professor of plant and soil science at Mississippi State, said energycane is a hybrid of sugarcane and wild cane bred for high fiber – or high biomass.

The researchers are testing five types of energycane at locations in Tifton, Ga., Athens, Ga., Starkville, Miss., Raymond, Miss., St. Gabriel, La., College Station, Texas, Beaumont, Texas, and Waimanalo, Hawaii.

"Yes, we're testing energycane in Hawaii," Baldwin said. "The coastal areas are rapidly being converted to housing. The only place for agriculture to grow is farther up the mountains, and those areas can get cold."

Researchers at the USDA-Agricultural Research Service Sugarcane Research Unit in Houma, La., are crossbreeding sugarcane with miscanthus, commonly known as elephant grass, and two ancestral species of sugarcane to produce a number of different energycane varieties that can be grown in colder temperatures.

"Creating an energycane variety that is cold-tolerant will extend the range of cultivation and allow for producers outside the traditional cane growing areas to produce energycane crops," said Collins Kimbeng, a plant breeder with the LSU AgCenter. "Creating cold-tolerant varieties also will allow for energycane to be grown later in the winter months, prolonging the growing season and enabling producers to produce crops for longer periods of time."

In addition to creating a new breed of cane, researchers also are studying management practices for growing energycane in colder temperatures. LSU AgCenter sugarcane specialist Kenneth Gravois said these practices include fertility management and planting depths and, farther north, row spacing.

"Our goal is to produce an energycane crop with minimal inputs, such as reduced nitrogen rates and reduced cultivation," Gravois said.

Researchers also are studying sweet sorghum as another feedstock. According to Sonny Viator, an LSU AgCenter professor and resident coordinator of the Iberia Research Station, sweet sorghum has been identified as a high-producing sugar crop that creates juice that can be used to make biofuels and biochemicals.

Just as the fiber in energycane is used to produce biofuels, the juice in sweet sorghum is used to make butanol, ethanol and other products.

Sweet sorghum "is a low-input crop, one that can be grown on marginal soil, and a crop suitable for sustainable production," Viator said. "And we've identified it as one of the sugar crops that can be used to produce biofuels."

The researchers are trying to determine the potential for producing sweet sorghum from midsummer to the first frost by varying the timing of planting and using plants of different maturity levels. That combination of planting dates and differing maturities allows the sorghum to be available for harvest over a sustained period of about three months.

Traditionally, the best planting period for sweet sorghum in Louisiana has been from mid-April to mid-May, with harvest in August. This study is looking at a production model of

Researchers are crossbreeding sugarcane with miscanthus, commonly known as elephant grass, and two ancestral species of sugarcane to produce a number of different energycane varieties that can be grown in colder temperatures. Photo by A. Denise Attaway

LSU AgCenter researchers are investigating sweet sorghum sustainable production practices at AgCenter research stations across Louisiana to identify production practices that help producers optimize yields. Photo by A. Denise Attaway

harvesting sweet sorghum beginning in July and extending until early November. Following that, energycane would be harvested until spring, when, perhaps, a third crop would be available.

"The ultimate goal is to supply feedstock to a biorefinery for most of the year," Viator said.

A trio of LSU AgCenter researchers is investigating sweet sorghum sustainable production practices at AgCenter research stations across the state. Wink Alison at the AgCenter Scott Research and Extension Center in Winnsboro, La., Kun-Jun Han in the School of Plant, Environmental and Soil Sciences in Baton Rouge, and Dustin Harrell at the AgCenter Rice Research Station in Crowley, La., are identifying production practices that can help producers optimize yields.

When the project is completed, producers should know how much fertilizer to apply and how much tillage is required and understand the benefits of using legumes in rotation with sweet sorghum.

LSU AgCenter forestry specialist Michael Blazier at the Hill Farm Research Station in Homer, La., is conducting a carbon sequestration study in tandem with the research on fertilizing sweet sorghum and growing energycane north of its typical growing area.

Blazier's study measures the carbon content of soils to a 3-foot depth and the organic matter residues left after harvest. In addition, the study involves measuring soil microbial biomass activity and functional diversity.

"We're measuring the soil microbial parameters because soil microbes are essential for converting organic matter into nutrients needed for crop growth," Blazier said. "With the microbial information, we'll understand how well organic residues are recycled as nutrients, which can be helpful for Louisiana producers in making decisions about fertilizer sources for sweet sorghum and residue retention for sugarcane."

Creating cold-tolerant varieties also will allow for energycane to be grown later in the winter months, prolonging the growing season and enabling producers to produce crops for longer periods of time.

The soil and organic matter carbon information the researchers are collecting will be used to determine the extent to which producing biofuels from sweet sorghum and sugarcane takes carbon dioxide from the atmosphere and stores it long-term in the soil.

"This is an important component of being able to enter the biofuels market because those markets are heavily influenced by domestic and international government programs and mandates to offset conventional fuel use with biofuels that take up more carbon dioxide from the atmosphere than emitted in their production and use," Blazier said.

After the energycane and sweet sorghum have been harvested, the crops can be brought to a processing plant to produce juice, syrup and bagasse for use in the biofuels industry. As part of the Sustainable Bioproducts Initiative, the LSU AgCenter has constructed a pilot plant at the Audubon Sugar Institute in St. Gabriel, La.

Energycane and sweet sorghum are converted into biofuels using several different processes, such as the Optinol Process. This process comes from an industry partner on the project, Optinol, and uses a patented bacterium that naturally favors the production of butanol while producing virtually no acetone or ethanol.

Another process developed by industry partner Virent converts fermentable sugars into jet fuel.

According to Day, plants similar to the AgCenter's pilot plant can be strategically placed so that they are located near energycane and sweet sorghum production for use as biofuel feedstock.

"Producers would greatly benefit from having a plant such as this nearby," Day said. "We would be happy to meet with anyone interested in growing these crops or building one of these plants. This would be a great venture for producers living in the Delta."

A. Denise Attaway is an assistant communications specialist with the LSU AgCenter Sustainable Bioproducts Initiative.

Effectiveness of a Saltwater Bath in Purging Crawfish

W. Ray McClain, John J. Sonnier and Anna McClain

Crawfish have been consumed in the southern United States for centuries, first by Native Americans, who later introduced the European settlers to this bountiful food resource. Immigrants who settled near the waterways and swamps of Louisiana found a ready supply, and soon crawfish became an object of commerce, dating back to at least the late 1800s. As demand increased, particularly in the larger cities, and because the wild supply varied considerably from year to year, farmers began experimenting with methods to ensure a more consistent supply. Rice farmers of the early 1900s noticed that populations of crawfish naturally inhabited their fields during the flooded stage of production. Therefore, they began to experiment with harvesting techniques and water management practices to capitalize on the increased demand for crawfish. By the late 1960s and early 1970s, crawfish aquaculture as we know it today was well underway. Today, Louisiana farmers produce almost 100 million pounds annually, worth approximately $150 million. Another $5 to $20 million is generated from the wild crawfish fishery.

Most of the crawfish are sold live for consumption with less than 20 percent processed and packaged. As in other parts of the world where crawfish (or crayfish) have been enjoyed for centuries, crawfish consumption is generally associated with social occasions. In the southern United States, crawfish are typically boiled with spicy seasonings and served hot, usually with a mixture of accompanying vegetables. In the spring, coinciding with peak production months, home consumption of crawfish often occurs in outdoor venues. Dedicated cooking rigs are used, often large enough to accommodate a 30- to 40-pound sack of crawfish – the typical means of transport. Cooks will often empty the entire sack of crawfish into the pot, perhaps after a cursory wash. Others will first empty the sack of live crawfish into a tub of water for a more thorough wash. Many households will routinely add one to two pounds of salt in the wash water with the intent of "purging" the digestive tract before cooking. This practice is based largely on hearsay or tradition, often passed down from generations.

Though seldom employed, commercial depuration, or purging, confines freshly harvested crawfish in water for one or two days without food prior to further sales. This process is effective at reducing the volume of material in the hindgut – that portion of the gastrointestinal tract exposed upon removing the exoskeleton from the abdomen (Figure 1). Yet, the practice of commercial depuration is not widely used in the high volume crawfish industry in Louisiana because of time and cost.

Figure 1. Notice the location of the hindgut in cooked crawfish after removal of part of the exoskeleton with the purged specimen on the left and the full "vein" of a nonpurged specimen on the right. Photo by W. Ray McClain

The efficacy of a short-term saltwater bath in reducing the contents of the gastrointestinal tract has not been thoroughly tested. Still, people continue to employ it, and advocates continue to recommend it. The internet is replete with instructions for using a saltwater bath to purge crawfish, often with reference to increased mortality when soaking crawfish too long in the hypersaline solution.

Therefore, this study was designed to obtain more definitive data regarding the effectiveness of the common saltwater bath in cleansing the hindgut of digesta. Freshly harvested red swamp crawfish were subjected to four treatments that simulated different preparation methods for cooking: (1) no washing (controls), (2) crawfish washed in a saltwater bath, (3) crawfish washed in fresh water without the addition of salt, and (4) crawfish subjected to a commercial purging process for 24 hours.

On each of three occasions during the spring of 2013, about 30 pounds of crawfish harvested that day were placed in a tub containing 10 gallons of fresh water and allowed to soak for 10 minutes. A similar portion of crawfish was placed in a second tub containing 10 gallons of water and 1.6 pounds of noniodized table salt and allowed to soak for 10 minutes (Figure 2). A third portion of the day's harvest consisted of nonwashed individuals. The fourth group consisted of crawfish harvested the previous day and purged for 24 hours in an aerated vat without access to feed. A subset of crawfish from each treatment on each test date was randomly collected for determination of hindgut content weight. The remaining crawfish from each wash treatment were sacked and immediately placed in humid refrigerated storage at 42-46

degrees Fahrenheit for assessment of mortality after 72 hours, a second objective of the study.

Hindgut content was collected by dissecting the crawfish and flushing the intestine with distilled water over a pre-weighed aluminum pan (Figure 3). Abdominal muscle (tail meat) was then extracted. Gut contents and abdominal muscle were pooled by sex and maturity, and dry weight was recorded after drying overnight at 167 degrees Fahrenheit. Because individual crawfish size varied, dry hindgut content weight was computed as a percent of whole wet crawfish weight and dry abdominal muscle weight.

Results

Immersing farm-raised crawfish in a water bath prior to cooking, even for as little as 10 minutes, aids in removing mud and debris from the exterior of the animal as evident from the immediate increase in turbidity of the wash water. As crawfish rub against each other in a crowded water bath, it loosens material from the exoskeleton. The results of this study also suggest that a water bath may aid in lessening the amount of content contained in the hindgut by a small percentage.

Figure 2. Water bath, with salt, for cleaning crawfish. Photo by W. Ray McClain

Figure 3. Flushing of hindgut to extract contents. Photo by W. Ray McClain

The amount of hindgut content in crawfish was greatest among the nonwashed specimens. Regardless of whether gut contents were expressed as a percentage of whole wet crawfish weight (0.07 percent) or as dry abdominal weight (1.9 percent), the relative hindgut content weight of fully purged crawfish was significantly lower, approximately 60 percent less than that of crawfish not washed (Figure 4). The 10-minute water baths, with or without salt, resulted in from 17 percent to 26 percent less gut content weight than nonwashed specimens. Salt provided no significant advantage in this study despite the numerous claims that continue to be made to the contrary.

To address the question posed by some regarding the effect of salt in a water bath on crawfish mortality, death was assessed immediately after the bath and then again after 72 hours under refrigerated storage. Less than 1 percent of dead crawfish were observed immediately after the water bath, and these may have been simply due to handling. While mortality was typically low after 72 hours of refrigerated storage, more deaths were observed in association with the saltwater bath (6.2 percent) than the freshwater bath (1.9 percent). This effect may be a moot point because in nearly all cases, crawfish are cleaned shortly before cooking only. The home consumer will likely not store live crawfish after cleaning, and the retail or restaurant trade, which typically receives live crawfish chilled, will likely keep the animals in a chilled condition until cleaning immediately prior to cooking.

In conclusion, preparing crawfish for cooking by immersion in a water bath, with or without salt, for a short time will often provide some degree of cleansing, although this is mainly associated with exterior surfaces and the gill cavity where debris can accumulate. The amount of digesta in cooked crawfish subjected to an adequate wash may not be discernible from nonwashed crawfish; however, washing will lessen the amount of debris shed during the cooking process. There is no evidence from this study that suggests the use of salt in cleansing crawfish was beneficial, but results do indicate that a saltwater bath may contribute to increased mortality, if washed crawfish are subjected to refrigerated storage for several days prior to cooking. Conventional commercial-style purging for 12 hours or longer is the only known way to significantly reduce the size of the hindgut in cooked crawfish, and that method is usually not practical for consumers.

W. Ray McClain is a professor at the Rice Research Station in Crowley, La. John J. Sonnier is a research farm specialist, and Anna McClain is a retired research farm specialist, also at the Rice Station.

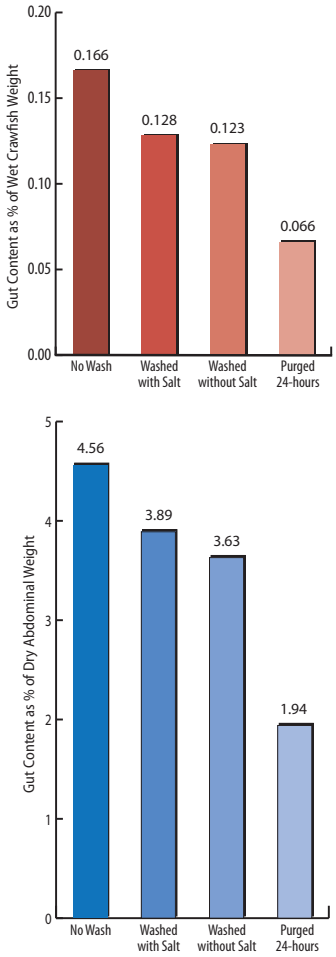


Figure 4. Dry hindgut content of crawfish from each of the four treatments expressed as a percentage of whole wet crawfish weight and dry abdominal weight.

Federal program restores profitability – and dignity – to Louisiana shrimp industry

Olivia McClure

Louisiana shrimpers have received more than $18 million in the past three years from the federal Trade Assistance Adjustment for Farmers program (TAA). To receive these funds, shrimpers were required to complete several hours of training conducted by the LSU AgCenter and Louisiana Sea Grant.

TAA, which is administered by the U.S. Department of Agriculture's Foreign Agricultural Service, seeks to financially assist producers negatively affected by imports, while providing them with valuable technical training. The financial assistance is coordinated by the USDA Farm Service Agency.

About 2,300 Louisiana shrimpers took part in more than 100 workshops between November 2010 and December 2011, according to LSU AgCenter economist Kurt Guidry, who led the state's TAA effort.

The first TAA for Farmers program was available 2004-2006 and was not reauthorized again until 2010. Guidry said the second round of TAA was a significant upgrade from the initial version, in which producers completed a three-hour workshop and received payment based on how much shrimp they sold in the past five years.

This time, producers had to complete a two-hour orientation, a short-term business plan and 12 hours of training taught by AgCenter and Louisiana Sea Grant personnel. The shrimpers then received up to $4,000 in direct financial assistance. If they wrote a long-term business plan and it was approved by TAA, they were eligible for up to $8,000 in additional assistance.

Mark Shirley, LSU AgCenter and Sea Grant fishery agent, shows shrimpers in Delcambre how to use an Emergency Position Indicator Radio Beacon to alert the U.S. Coast Guard with a distress signal as part of one of the workshops fashioned after the federal Trade Assistance Adjustment for Farmers program. Photo by Bruce Schultz

"These funds were an important boost to Louisiana's struggling shrimp industry," Guidry said, adding that operating costs have risen and cheap imported shrimp is probably not going away.

However, the biggest benefit of the TAA program was not the money, Guidry said. The training component has had a lasting effect that will make Louisiana shrimpers more efficient and competitive. It also laid a foundation for AgCenter and Sea Grant agents to do more outreach work with shrimpers in the future.

Participants took classes on technology, ways to reduce costs, how to diversify operations, best handling practices, marketing and federal regulations. They also learned about how to use this information to write a long-term business plan, which Guidry said few shrimpers in the program had ever done.

"That process of collecting information and developing a business plan in and of itself is very useful," he said. "It's forcing these fishermen to really take a detailed look at their operation and see how they're doing things and look for ways to improve."

Many shrimpers in Louisiana do not speak English. Thu Bui, AgCenter and Sea Grant marine agent for St. Mary, Iberia and Vermilion parishes, translated educational materials and conducted 26 training sessions in Vietnamese.

Albert "Rusty" Gaudé, AgCenter and Sea Grant fishery agent for Jefferson, Orleans, St. Charles and St. John parishes, said Louisiana had the biggest TAA program in the nation. Shrimpers in Jefferson Parish, which had the most participants of all Louisiana parishes, received more than $5 million from TAA.

"These fishers were at a financial disadvantage to compete in the global shrimp industry," Gaudé said. "It was difficult to live a dignified normal life with their income. This program was an attempt to provide balance."

While most shrimpers have received their money from TAA, the momentum that the program established has continued, Gaudé said. People involved in delivering the TAA training have developed outreach techniques and a message that is still being infused into the fishery industry through programs such as the Louisiana Fisheries Summit, an annual event that launched in 2013.

"The impact was the restoration of financial stability for the shrimpers and their morale for the leaders of this state to acknowledge that they had a problem with this imbalanced industry," Gaudé said. "The combination of the cash in pocket, the opportunities that were given to them – to improve the way they shrimp physically, record-keeping, taxes – it was the whole nine yards. All of these things gave them tools they did not have before TAA."

Olivia McClure is a student worker with LSU AgCenter Communications.

Seafood Processors' Preferences for Hiring Nonimmigrant Labor

Ashok K. Mishra, Hyunjeong Joo and Jeffrey M. Gillespie

The seafood industry has faced significant economic challenges over the past two decades, causing seafood businesses to search for cost reduction strategies, including those associated with labor. It has become difficult for seafood processors to recruit local workers, perhaps because of relatively low wages. Most workers have found better-paying jobs in the construction and oil industries. Local seafood businesses have tried creative recruiting measures, such as plant shifts during school hours for working mothers. Employee retention continues to be a problem despite such efforts, with high turnover rates and poor retention.

To fill the shortage of local workers in the seafood processing industry, Louisiana seafood businesses increasingly rely on H-2B workers (so-called nonimmigrant labor) despite substantial upfront costs to participate in the program. Since 2005, the Louisiana seafood processing and packaging industry has employed a considerable number of H-2B visa workers (more than 2,500 per year). They are temporary workers hired for seasonal industries from other countries, mainly Mexico and Central America.

This article provides insights into the hiring preferences by Louisiana's seafood processing industry. This analysis may aid elected officials in supporting policies that can help smooth labor gaps; extension agents in targeting gaps in their parishes that can be addressed; and seafood processors in assessing which attributes are important in hiring and retaining productive nonimmigrant workers.

Data were collected from Louisiana seafood processors to determine wages and worker numbers and to shed light on the demand and supply of workers, both domestic and foreign (H-2B), and preferences for nonimmigrant workers by Louisiana seafood processors. A survey included questions dealing with the firm's labor requirements, use of migrant workers and effects of federal regulations concerning labor and hiring preferences. All questions concerning labor use and firm productivity referred to 2011.

Respondents were asked to first consider a most preferred and a least preferred worker profile on the basis of three attributes – immigrant status, references and wages. They were to rate worker profiles on a scale of zero to 10, with 10 being most preferred and zero, least preferred. Consultation with the Louisiana Department of Wildlife Fisheries confirmed that 70 seafood processing companies were operating in Louisiana. With 37 completed surveys, this constituted a 53 percent response rate.

Results of the study indicate that domestic employees were preferred to immigrant employees who were non-H-2B visa holders. A potential employee with excellent references was preferred to one with mediocre or poor references. As expected, paying lower wages was preferred to paying higher wages. Results in Table 1 indicate that, given the range of wages for consideration ($8 - $15), seafood processors were most concerned about wages, which accounted for 42.4 percent of the preference. The second most important attribute, at 30.2 percent importance, was references, followed by immigrant status, at 27.5 percent. Findings suggest seafood processors are most sensitive to labor costs. Therefore, new policies forcing increased wages for H-2B visa workers would have a significant negative effect on a processor's well-being.

Table 1: Relative importance of associated attributes

Attribute	Score	% Importance
Immigration Status	5.206	27.5
References	5.712	30.2
Wage	8.024	42.4
Total	18.942	100.0

It is also striking, however, that both references, which are a proxy for perceived worker productivity, at 27.5 percent and immigration status at 30.2 percent are also quite important and are of roughly equal importance. While the wage to be paid is the most important, hiring non-H-2B immigrants and applicants with poor or mediocre references would reduce processor well-being significantly. Thus, when hiring migrant labor, H-2B status is highly important, as is perceived worker productivity – two results consistent in discussions with seafood processors.

Finally, processors were clustered into two groups based upon the similarity of their preferences. Findings in Table 2 from that analysis reveal that larger-scale processing firms in Group 2 placed greater emphasis on references while the smaller-scale firms of Group 1 placed greater emphasis on wages. Assuming significant economies of size associated with seafood processing, the greater emphasis smaller firms place on wages would be expected.

Table 2: Preferred attributes by processor group

Attribute	Group 1		Group 2	
	Score	% importance	Score	% importance
Immigration Status	3.64	19.41	5.43	31.90
References	2.70	14.40	7.08	41.56
Wage	12.40	66.19	4.52	26.54
Total	18.73	100	17.03	100

If the new wage of H-2B visa workers was higher than the current wage for a U.S. citizen and non-H-2B visa workers, then the new policy would lower the well-being of processors and reduce their use of H-2B labor relative to domestic and non-H-2B labor. Indirectly, one can surmise that if the U.S. Department of Labor forced seafood processors to pay higher wages to H-2B workers, then the increased wages would result in a burden for employers and in lower firm profit. This is of particular concern if wages for H-2B workers are lower than those for non-H-2B workers, as these data suggest.

Acknowledgment: Louisiana Sea Grant for funding this study.

Ashok K. Mishra is Donald Welge Endowed Professor, Hyunjeong Joo is a graduate research assistant and Jeffrey M. Gillespie is Martin D. Woodin Endowed Professor in the Department of Agricultural Economics and Agribusiness.

Do cattle know what to eat and when to eat it?

Guillermo Scaglia

Humans have different tastes in salad. Some people prefer just lettuce and a little oil as ingredients; others prefer to add cucumber, tomato, spinach, onion, avocado and black olive, and then add olive oil or a salad dressing. Some prefer all these ingredients but placed separately on the plate. Cattle approach their feed in a similar way. They don't like single ingredients; they would rather have a mixed or complex diet.

If ruminants have access to different forage species, they always choose a mixed diet, although they will show partial preference for certain forages. The question is, If they require only one of those forages to meet their nutrient requirements, why do they pick a "mixed salad"? Some of these cattle behaviors when grazing different forages have been studied by scientists with the aim of understanding the underlying mechanisms of animal-plant relationships and with the objective of increasing the efficiency and profitability of animal farming.

The ability of the animal to select or exercise free choice is sensible and provides an evolutionary advantage. Preference has been defined as the ability of the animal to choose without physical restriction of access any of the diet components offered. It is best demonstrated by animals eating a certain proportion of grass and clover from monoculture pastures that are separated so the animal can exhibit free choice for either forage.

Preference is not the same as selection. Selection can be defined as the preference of the animal modified by physical constraints to access at least some of the components offered. A pasture where a grass and a legume are planted together causes the animal to search for the preferred ingredient of the diet, in this case, the legume. The barrier is the grass, so cattle express selection for what they want. Selection is demonstrated by a ruminant grazing a pasture composed of a mix of, for example, white clover (a legume) and ryegrass (a grass). In normal conditions, either of the two plants would meet the dietary requirement of the animal; however, in this type of pasture, the white clover commonly comprises 10 to 20 percent of the total available dry matter of the forage. It has been proven that cattle have partial preference for legumes. They would search for the white clover from within the ryegrass to obtain the "balanced" diet they prefer. Consequently, a typical diet is composed of 50 percent or more clover (or other legume) of the total forage dry matter consumed.

The next question is, Will this response change if we add a mix of legumes? To answer it, crossbred beef heifer calves with an average body weight at the beginning of the grazing period of 525 pounds were offered different grazing options: annual ryegrass only; a clover mix only of white, red and berseem clovers; a mixed pasture of annual ryegrass and the same clover mix; and adjacent areas of equal size of annual ryegrass or the clover mix. To study calves' grazing behavior, one heifer per group was fitted with a cattle pedometer. Video cameras were used to study the cattle during the day.

Heifers placed on pastures with mixed annual ryegrass and clovers or in pastures with separated ryegrass and clover areas gained 2.77 pounds per day and produced 245 pounds per acre. Calves grazing only annual ryegrass or only clovers alone gained 2.57 pounds per day and produced 228 pounds per acre. Calves in separate but adjacent pastures spent less time grazing because the two major diet components, mixed clovers and annual ryegrass, were in distinguishable portions of the paddock (Table 1), thus eliminating the need for excessive searching for different species. The proportion of time they spent grazing each pasture type is shown in Figures 1 and 2.

The calves grazing the annual ryegrass and clovers mix walked more, searching for the appropriate balance between annual ryegrass and clover (Table 1). As averaged throughout the grazing season, calves grazed longer on the clover mix (thus ate more) than on annual ryegrass (Figure 1), and they spent more time grazing the clover mix in the morning hours (75 percent) than in the afternoon (60 percent). This means that preference for annual ryegrass increased in the afternoon (25 percent in the morning versus 40 percent in the afternoon). One theory to explain this result is that eating fiber-rich forages (annual ryegrass in this case) in the afternoon requires more time to digest in the rumen, helping cattle to maintain gut fill and decreas-

Adjacent pastures of annual ryegrass (left) and clover mix (right) after the end of the grazing season in June 2011. Calves had the chance to walk from one side to the other and grazed with no restrictions. Note the clovers were still green while annual ryegrass was already gone. Photo by Guillermo Scaglia

es the need for them to graze at night, avoiding possible predators. In the present experiment, however, there were no differences in fiber content (expressed as neutral and acid detergent fiber) between pasture types (Table 2).

Daytime patterns of preference in ruminants have also been attributed to changes in forage carbohydrate (sugar) concentrations as day progresses from dawn to dusk. Tests showed differences in water-soluble carbohydrate concentrations between pasture types (Table 2) and also between forage samples taken in the morning and afternoon hours. Annual ryegrass had a greater concentration of water-soluble carbohydrates in the afternoon (22.1 percent of the dry matter) than in the morning hours (12.9 percent of the dry matter). It was greater than the concentration in the clover mix – 9.9 percent of dry matter in the morning and 6.1 percent of dry matter in the afternoon. These data may explain the increase in time spent on annual ryegrass in the afternoon because it was "sweeter" (more sugar) than in the morning hours, although heifers still showed a partial preference for clover mix (75 and 60 percent of the time, Figure 1). Throughout the day, there was a clear trend to decrease the time spent grazing on the clover mix (Figure 2).

There was also a clear disparity between the average time on clover mix throughout the grazing period and that for the last 30 days (Figure 2). In the latter, the time spent grazing on clover

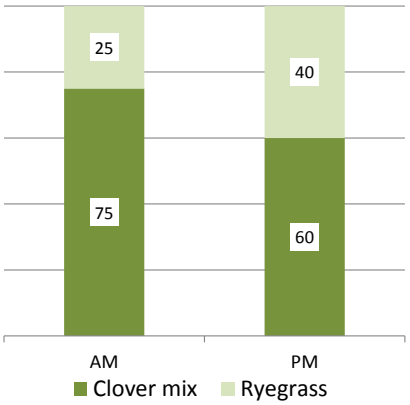


Figure 1. Average percent of the time throughout the grazing season that heifers spent grazing annual ryegrass or clover mix in adjacent pastures during the morning and afternoon hours.

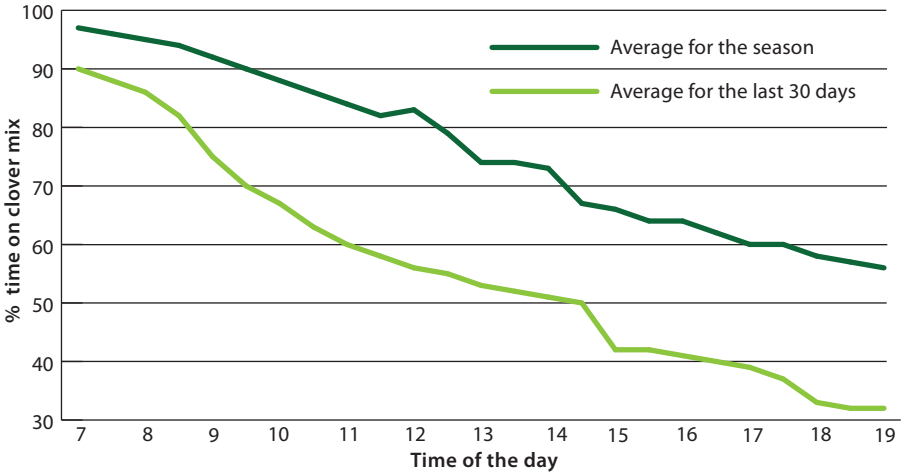


Figure 2. Percent of the time throughout the day as an average for the season (—) and for the last 30 days of the grazing season (—) that heifers spent grazing on the clover mix in adjacent pastures.

Table 1. Effect of pasture type on daily number of steps taken, walking time (minutes), lying time (minutes) and grazing time (minutes) by beef heifers grazing annual ryegrass alone, a combination of annual ryegrass and clovers (berseem, white clover and red clover), mixed clovers alone, and adjacent pastures of ryegrass and mixed clovers.

Item	Pasture type			
	Ryegrass	Ryegrass and mixed clovers	Clovers only	Adjacent pastures of ryegrass and clovers
Number of steps	3,710	3,202	2,689	2,779
Walking, minutes	28	26	17	12
Lying, minutes	688	728	711	729
Grazing, minutes	430	390	325	341

Table 2. Effect of pasture type on forage mass, height and nutritive values of annual ryegrass alone, a combination of annual ryegrass and clovers (berseem, white clover and red clover), mixed clovers alone, and adjacent pastures of ryegrass and mixed clovers.

Item	Pasture type			
	Ryegrass	Ryegrass and mixed clovers	Clover only	Adjacent pastures of ryegrass and clovers
Herbage mass, pounds per acre	2,241	2,000	1,409	1,612
Herbage height, inches	10.5	12.2	8.7	9.5
Nutritive value, percent of dry matter				
Crude protein	17.9	18.1	22.1	20.2
Neutral detergent fiber	47.9	50.0	52.9	49.8
Acid detergent fiber	29.5	29.8	33.1	31.2
Total digestible nutrients	68.9	69.1	62.7	63.9
In vitro true digestibility	71.8	72.9	77.6	74.6
Water soluble carbohydrates	13.1	10.9	6.9	10.8

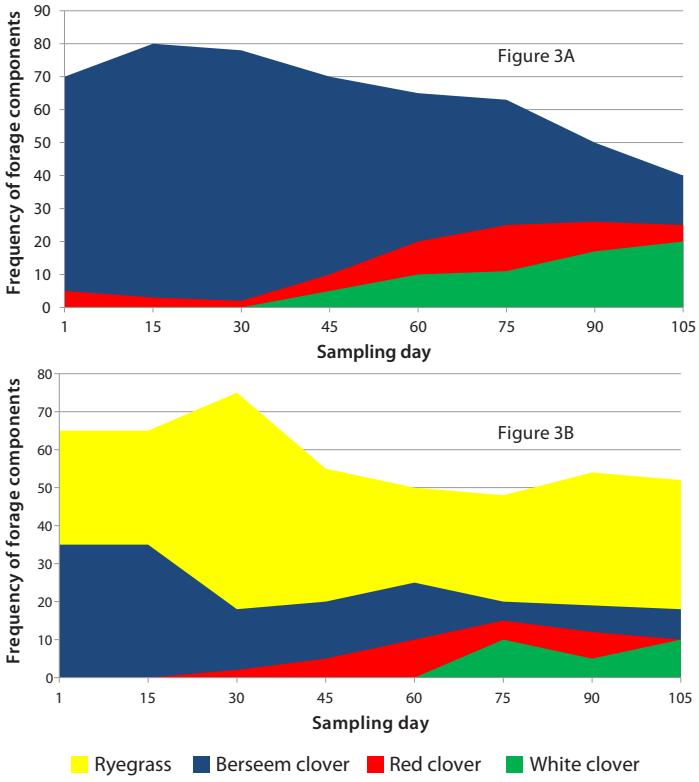


Figure 3. Average (3 years) botanical composition of clover (A) and mixed ryegrass and clover (B) pastures throughout the grazing season.

mix was less than 50 percent during the major afternoon grazing period (after 3 o'clock in the afternoon), probably associated with the lower water-soluble carbohydrate concentrations of the clover mix, but also because of the changes in botanical composition (Figures 3A and 3B). From day 75 of grazing until the end of the grazing period, the proportion of berseem clover decreased significantly, drastically reducing the amount of forage available. Red and white clover started to increase their contribution to the dry matter produced (Figure 3A) at that point, but it was not abundant.

Calves grazing different pasture configurations (mixed or adjacent) gained the same amount of body weight, but their grazing behavior was affected. Animals grazing adjacent pastures were offered the opportunity to select their diet at the time of the day they wanted, which gave them the chance to walk less than those grazing other pasture types where calves needed to spend time searching for the missing component of their diet (grass or legume). Differences in the concentration of water-soluble carbohydrates between grass and legumes may explain the different proportion of time that calves spent grazing on adjacent pastures of annual ryegrass or clover mix; however, during the last 30 days of the grazing season, the reduction in the proportion of berseem clover also influenced the proportion of time that calves grazed on annual ryegrass or clover mix.

Guillermo Scaglia is an associate professor at the Iberia Research Station, Jeanerette, La.

Factors influencing adoption of VSH queens in the honey bee breeding industry

Julie S. Leiby and John V. Westra

Varroa destructor, a mite that parasitizes honey bees, was accidentally introduced into the United States about 25 years ago. As it spread across the country, it killed honey bees, destroyed their colonies and created management challenges for beekeepers. Nearly the size of a pinhead, a female mite attaches herself to a honey bee and eventually enters the hive, where she finds a brood cell and lays multiple eggs on the pupae. The pupae soon develop with mites attached. The mites feed off of the bee's hemolymph (similar to blood) until the pupae are weakened or dead. As more pupae and honey bees become infected, the colony is severely weakened and often dies. Evidence suggests this may be a contributing factor to colony collapse disorder. According to data from the U.S. Department of Agriculture's National Agricultural Statistics Service, the number of honey bee colonies in the United States has declined substantially since 1986 – approximately the time *Varroa destructor* was discovered in the country.

Honey bees, which are not native to North America, were introduced by European colonists about 400 years ago. Today, honey bees produce about 147 million pounds of honey, with a production value of approximately $287 million annually. However, honey bees' greater economic value to agriculture is in the pollination services they provide each year to a variety of crops. In addition to apples, melons, alfalfa seed, plums, avocados and blueberries, pollination by honey bees is an essential component of almond production. California almond growers are entirely dependent on honey bees pollinating almond blossoms each year to make an almond crop. If honey bees aren't available at a critical, short period in the growing season, almond orchards cannot successfully produce.

Beekeepers have tried a variety of measures to prevent losses associated with the varroa mite. Some include nonchemical treatments, such as removing infected pupae, using screened floors and placing sticky traps on the bottom board of the hive to exclude or trap mites. Chemical treatments for killing mites, including fluvalinate and coumaphos, have limited future effectiveness, in large part because varroa mites appear to be developing resistance to these chemicals in certain areas of the country. Additionally, researchers have found that when colonies are treated with these chemicals, some honey bee queens suffer a high mortality rate or develop physical abnormalities and atypical behaviors. This is critical because each colony must have one queen to lay eggs that develop into bees. These bees carry half of the genetic traits of the queen and half of the genetic traits of the drone that fertilized the eggs.

Recent advances in bee breeding and methods for controlling varroa mites have contributed to a measured recovery of the beekeeping industry. One example of this work has been queens from a line of Varroa Sensitive Hygiene honey bees selected for hygienic behavior traits. Honey bees from queens with such traits, selected by researchers at the U.S. Department of Agriculture-Agricultural Research Service Honey Bee Breeding, Genetic and Physiology Laboratory in Baton Rouge, clean the hives, removing infected pupae and associated varroa mites. These VSH queens began to be released to commercial breeders and producers in 2001. VSH honey bees retain the commercial characteristics that beekeepers desire while also needing no chemicals for treating varroa mites.

For those beekeepers who have adopted this technology, varroa mite levels have decreased dramatically in their colonies. Since the release of VSH honey bees for beekeepers, however, the widespread adoption of this VSH technology has not occurred. This raises a question for researchers, Why haven't more beekeepers adopted this technology? Part of the answer might be studying the reasons why some beekeepers have adopted this technology. If we know which characteristics or factors influence the decision to use this technology, we might be better able to develop outreach efforts tailored to increase adoption of this technology effective for managing varroa mites.

A survey was sent to commercial queen breeders across the country. These commercial queen breeders are firms that breed queens for honey bee production, which are then sold either directly to beekeepers (usually larger-scale commercial operations) or to other firms that breed queens for resale to smaller, hobby beekeepers. Data from 108 respondents to the survey out of a sample of 228 queen breeders were gathered and analyzed. Of the 108 respondents, 50 reported using VSH technology.

A probit or limited dependent variable model was used to help identify factors that had a statistically significant influence on the adoption of the VSH queen technology. Among the many potential factors that might influence the adoption of VSH queens are risk preference, education level and household income. Results indicated that queen breeders who were risk averse or had a bachelor's degree or higher were more likely to adopt VSH technology; these factors positively influenced the adoption decision. On the other hand, household income appeared to have a negative significant influence on the adoption decision, so that as income rose, commercial queen breeders were less likely to use VSH technology.

Specifically, with respect to the attitude of a queen breeder toward investment risk (risk averse), the odds of VSH adoption are 3.5 times higher for queen breeders who characterize themselves as risk averse regarding their investment decisions compared with queen breeders who are risk neutral or risk taking in their investment decisions.

Education was positively associated with VSH technology adoption. The findings indicated that for queen breeders with a bachelor's degree or higher, the likelihood of VSH adoption is 3.6 times higher than for those queen breeders with only some college, technical school, high school or lower.

Counterintuitively, household income was negatively associated with VSH adoption by queen breeders. Substantial research in technology adoption tends to indicate that as income increases, the likelihood of an individual adopting an innovation increases. However, these research findings indicate that as household income increased, commercial breeders were slightly less likely to adopt VSH queens. Specifically, for an incremental increase of $30,000 in household income above the mean income level, the probability of adoption decreased by 26 percent.

These discoveries of the positive and negative factors associated with technology adoption will benefit the beekeeping industry because industry leaders can help better inform queen breeders and beekeepers about the benefits of VSH technology. Extension and outreach efforts can explain the potential effect of VSH on reducing the risk of colony collapse disorder and economic damages associated with varroa mites.

Julie S. Leiby is a graduate research assistant and John V. Westra is an associate professor in the Department of Agricultural Economics and Agribusiness.

Photo by John Wozniak

Productivity, Labor and Economic Factors Affected by Cow-Calf Grazing Methods in Southern Louisiana

Wayne E. Wyatt, Jeffrey M. Gillespie, David C. Blouin and Bradley C. Venuto

Most beef operations in Louisiana are based on a cow-calf production system. Efficient use of available pasture is critical to the sustainability and economic viability of these operations. Stocking rate and method are managerial factors affecting frequency and height of defoliation of pasture forages. A stocking system that increases production and economic efficiencies without making unreasonable time, labor and resource demands and that is sustainable year-round is desirable. Research was undertaken at the LSU AgCenter's Iberia Research Station to address the issues of productivity and economics of stocking rate and rotational versus continuous stocking methods for cow-calf production.

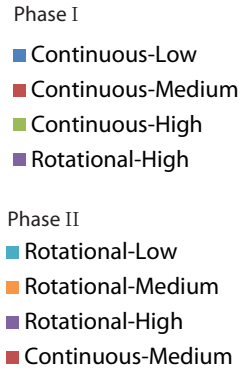
Over a five-year period (Phase I 1999-2002; Phase II 2004-2005), mature Brangus cows with calves-at-side were allocated to six different stocking treatments (four stocking treatments per phase). During Phase I, the continuous stocking method was compared at low, medium and high stocking rates. Low was 0.5 cows per acre (2 acres per cow); medium was 0.8 cows per acre (1.3 acres per cow); and high was 1.1 cows per acre (0.9 acres per cow). A fourth rotational stocking treatment with eight paddocks using the high stocking rate was also included. Consequently, the comparison of continuous and rotational stocking methods was done at a high stocking rate in Phase I. During Phase II, the rotational stocking (eight-paddock) method was compared at low, medium and high stocking rates and a continuous-medium stocking treatment was also included. The comparison of continuous and rotational stocking methods was done at a medium stocking rate in Phase II. Both phases included the continuous-medium and the rotational-high stocking treatments.

Pastures in both phases contained warm-season grasses (common bermudagrass and dallisgrass) as a perennial sod. In the fall of each year, pastures were seeded with annual ryegrass. Pastures annually received 155 pounds per acre of nitrogen in three split applications. Cows were maintained on pasture on a year-round basis.

Cow body weights were recorded in January (pre-calving), April (pre-breeding), July (post-breeding), October (weaning) and again in January of the subsequent year. Calves were weighed at weaning of each year. An adjusted 205-day weight (adjusted for cow age, calf gender and weaning age) was calculated. Also, pasture weaning weight – pounds of calf per acre – was calculated.

In Phase I, increases in stocking rate resulted in numeric decreases in average cow weight, although there was no statistical difference between continuous-low and continuous-medium stocking rates (Figure 1). Nor was there a difference between continuous and rotational stocking when both were stocked at the high stocking rate. In Phase II, the rotational-low stocking treatment resulted in a greater average cow weight than the remaining stocking treatments. Average cow body weight was similar for the rotational-medium and rotational-high stocking treatments. Also, average cow body weight was similar between the rotational and continuous stocking treatments when compared at the medium stocking rate. Apparent cow weight differences in the Phase I and Phase II continuous-medium and rotational-high stocking treatments were likely because of greater rainfall accumulation in the spring and summer months of Phase II compared to Phase I. Also, greater amounts of supplemental feed were fed to cows during the winters of Phase II.

The effect of stocking rate within the continuous stocking treatments in Phase I on calf adjusted 205-day weights (adjusted for cow age, calf gender and calf age at weaning) was very pronounced (Figure 2). Calf adjusted 205-day weight was greater for low compared to medium stocking rates and for medium compared to high stocking rates. Such was not the case for the rotational stocking treatments in Phase II. In Phase II, calf adjusted 205-day weights were simi-



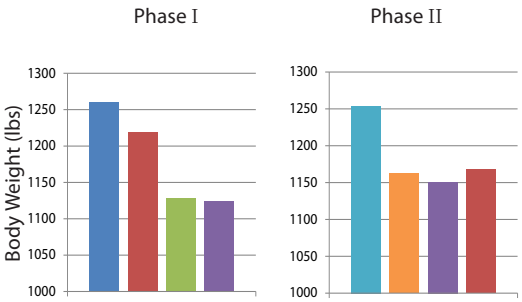


Figure 1. Cow average body weight (lb). Red and purple bars refer to the stocking treatments common to both phases.

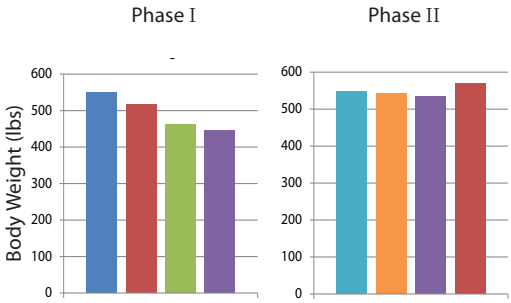


Figure 2. Calf adjusted 205-day weight (lb). Red and purple bars refer to the stocking treatments common to both phases.

lar between the stocking treatments. The comparison of continuous versus rotational stocking was similar for calf adjusted 205-day weight for both the high (Phase I) and the medium (Phase II) stocking rates.

In both phases, there was a pronounced impact of stocking rate upon pasture weaning weight (Figure 3). Under continuous (Phase I) and rotational stocking (Phase II), increases in stocking rate significantly inflated the pounds of calf weaned per acre. However, whether continuous versus rotational comparisons were made at the high (Phase I) or medium (Phase II) stocking rates, pounds of calf weaned per acre were the same.

Detailed production data collected in the study allowed for the estimation of costs and returns associated with each of the stocking strategies. Input prices assumed in the study were those published in annual LSU AgCenter cost of production estimates. Calf prices were adjusted according to their weaning weights. In Phase I, the stocking strategies yielding the greatest net returns over total expenses per acre, excluding labor, were the continuous-medium and continuous-high strategies, with means of $109.07 and $111.95, respectively (Figure 4). These were greater than the net returns over total expenses for the continuous-low and rotational-high strategies, at $39.76 and $57.32, respectively. While the continuous-high and rotational-high strategies yielded the greatest returns since more beef was produced per acre, they also resulted in greater expense, particularly in the case of the rotational-high, where there was increased machinery expense associated with moving animals and pasture maintenance, and increased expenses associated with cross-fencing. In Phase II, the rotational-high strategy resulted in the greatest net return per acre, at $247.30, followed by the rotational-medium and continuous-medium, and finally the rotational-low. In this phase, the greater net returns of the high stocking rates resulted from more beef being produced per acre.

In Phase I, 10.6 hours of labor were required per acre in the rotational-high compared to 6.3 hours per acre used in the other strategies (Figure 5). In Phase II, the rotational stocking strategies similarly required much greater labor. In both cases, the increased labor was associated primarily with moving animals and shades, repairs and maintenance on fencing,

Wayne E. Wyatt at the Iberia Research Station. Photo by Bruce Schultz

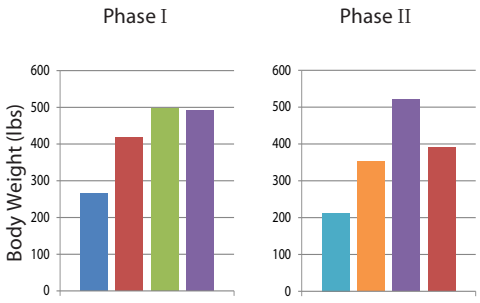


Figure 3. Pasture weaning weight (lb/acre). Red and purple bars refer to the stocking treatments common to both phases.

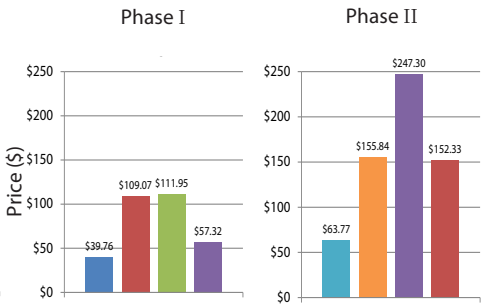


Figure 4. Returns over total expenses, labor excluded (per acre basis). Red and purple bars refer to the stocking treatments common to both phases.

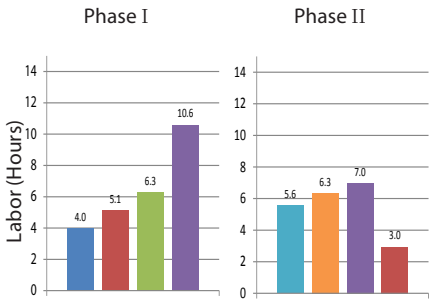


Figure 5. Total labor expended (per acre basis). Red and purple bars refer to the stocking treatments common to both phases.

and increased machinery time associated with forage management.

In terms of animal and pasture performances, stocking rate appears to affect both more so than does stocking method. Producers will find a larger effect on production by manipulating the stocking rate to their particular environment and then consider stocking methods. In terms of returns over total expenses (labor excluded) on a per acre basis, greater returns were realized for Phase II than in Phase I. The reversal of the comparison of continuous-medium to rotational-high between the two phases was surprising and can possibly be attributed to a more favorable weather environment of the latter phase. Also, hay was harvested from rotational treatments in the latter phase and contributed to income for those treatments. It is worth noting that at comparable stocking rates, there was either greater (Phase I) or equal (Phase II) returns for the continuous compared to their rotational counterpart. Returns over total expenses would suggest that producers again focus more attention on stocking rate than on stocking method. As anticipated, labor expended increased in response to increases in stocking rate and in response to rotational grazing.

Wayne E. Wyatt is a professor at the Iberia Research Station, Jeanerette,La. Jeffrey M. Gillespie is a professor in the Department of Agricultural Economics and Agribusiness. David C. Blouin is a professor in the Department of Experimental Statistics. Bradley C. Venuto, formerly with the LSU AgCenter, is deceased.

Photo by John Wozniak

SCIENCE NOTE

Temperament affects growth of replacement heifers

Wayne E. Wyatt, David C. Blouin, Sidney M. DeRouen and Donald E. Franke

The effect of ill temperament on heifer growth and development would be important to assess as early in the animal's life as possible for making decisions regarding female herd replacements. It is unknown whether assessing temperament as a newly weaned heifer at approximately 7 months of age (weanling) or at approximately 14 months of age (yearling) is best in terms of postweaning growth and conception as yearlings. The chute temperament score test and the exit velocity are easy methods for classifying animal temperament in on-farm situations. The objective of this study was to determine the effect of temperament measure types (chute score or exit velocity) and times of assessment (weaning or yearling) on heifer weaning body weight, postweaning growth, postbreeding body weight and pregnancy status.

Spring-born heifers (n = 432) reared at the Central, Hill Farm and Iberia research stations were weaned in the fall of their respective birth year (2003-2007) and retained as replacement females. On data collection days, the weanling and yearling heifers were allowed to enter the squeeze chute and were constrained, but not squeezed. Heifers were immediately scored for chute temperament behavior using a 5-point subjective scoring system: 1 = calm, stands still, no movement; 2 = slightly restless; 3 = restless, shaking the chute; 4 = vigorously shaking the chute or resolutely lying in the bottom of the chute; and 5 = extremely frenetic and severely shaking the chute.

Based on the chute score, cattle scoring 1 and 2 were classified as calm; cattle scoring 3 were classified as intermediate; and cattle scoring 4 and 5 were classified as ill-tempered. The front gate was subsequently opened, allowing the heifer to exit. Heifers exited straight ahead into a fenced lane, which led to a loafing pen. Infrared sensors were used to remotely trigger the start and stop of a timing apparatus, and an exit velocity was calculated. Based on exit velocity taken as weanlings and yearlings, heifers were classified as slow (average velocities of 5.5 and 5.0 feet per second), moderate (average velocities of 8.6 and 8.7 feet per second) or fast (average velocities of 12.3 and 16.1 feet per second).

Heifer body weight was similar across chute score for both the weanling and yearling assessments (Figure 1). Heifer body weight at weaning was significantly affected by both the weanling and yearling assessment of exit velocity. In the weanling assessment, weaning weights were similar for "slow" and "moderate" heifers but were less for the "fast" heifers than for the "moderate" heifers. In the yearling assessment, "slow" heifers were heavier at weaning than "moderate" heifers, but weaning weights were similar between "moderate" and "fast" heifers.

While the weanling assessment of chute score resulted in similar postweaning weight gains across chute score classes, "calm" heifers gained at a faster rate than did "intermediate" heifers in the yearling assessment (Figure 2). Exit velocity taken as weanlings significantly affected heifer postweaning growth. Although "slow" and "moderate" heifers had similar growth rates, there was a tendency for "moderate" heifers to gain at a faster rate than "fast" heifers. There was a tendency for exit velocity, assessed as yearlings, to affect heifer

postweaning growth rate, with "slow" heifers tending to gain at a faster rate than "moderate" heifers, whereas "moderate" and "fast" heifers had similar postweaning growth rates.

Postbreeding (approximately 16-18 months of age) body weights of heifers were similar among the "calm," "intermediate" and "ill-tempered" chute scores assessed as weanlings, but "calm" heifers were heavier than "intermediate" heifers assessed as yearlings (Figure 3). Exit velocity significantly affected heifer postbreeding body weight in both the weanling and yearling assessments; "slow" heifers were heavier than "moderate" heifers, and "moderate" heifers were heavier than "fast" heifers.

Pregnancy rates were similar across chute score and exit velocity classes assessed as either weanlings or yearlings (Figure 4). The only factor affecting differences in pregnancy rate was associated with a tendency for "intermediate plus ill-tempered" heifers to have greater pregnancy rates than their "calm" counterparts, which was unexpected and inexplicable.

The importance of enhanced pre- and postbreeding body weights and postweaning growth rates on heifer development and subsequent pregnancy rates is well-documented. In this study, it was apparent that the exit velocity measures taken at calf weaning were sufficient in eliciting differences in weaning and postbreeding heifer body weights and in postweaning growth rates. This means that producers can evaluate heifers at weaning time and cull "fast" heifers as herd replacements based upon exit velocity. The equipment necessary for measuring exit velocity is relatively inexpensive and easily assessed by producers interested in retaining heifers from their own herd as replacement females.

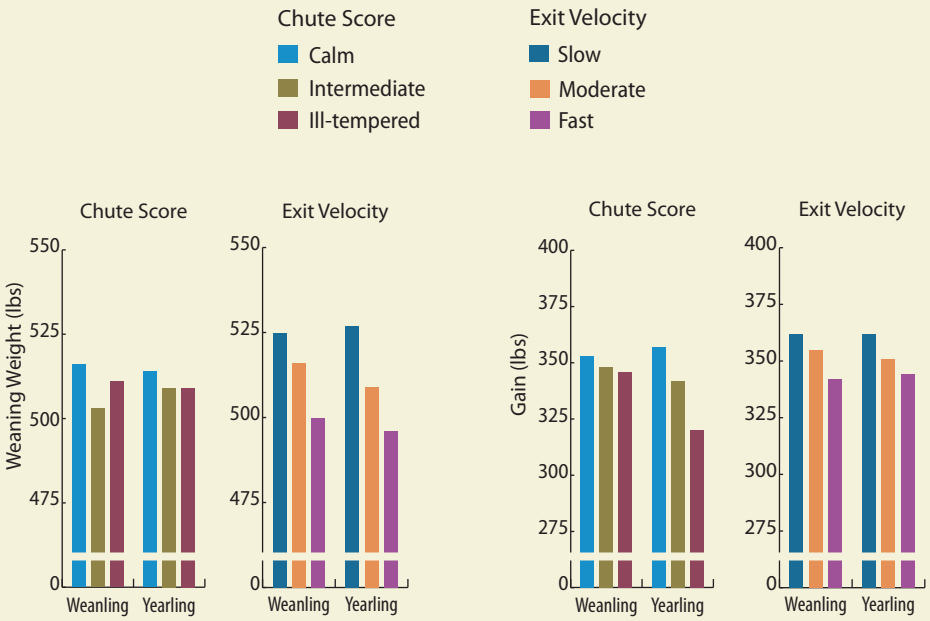


Figure 1. Effects of chute score and exit velocity at weaning weight.

Figure 2. Effects of chute score and exit velocity on heifer postweaning gain.

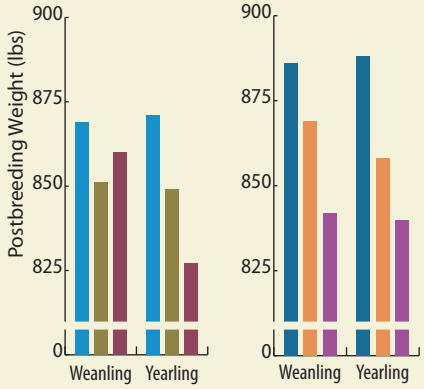


Figure 3. Effects of chute score and exit velocity on heifer postbreeding weight (approximately 16-18 months of age).

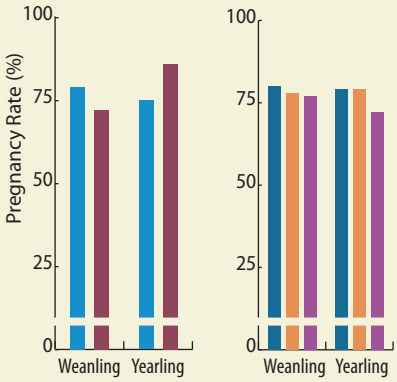


Figure 4. Effects of chute score and exit velocity on pregnancy rate. Intermediate and ill-tempered chute scores were combined.

Wayne E. Wyatt is a professor at the Iberia Research Station, Jeanerette, La. David C. Blouin is a professor in Department of Experimental Statistics. Sidney M. DeRouen is a professor, now retired, at the Dean Lee Research and Extension Center, Alexandria, La. Donald E. Franke is a professor emeritus in the School of Animal Sciences.

Influence of Supplemental Nitrogen Applications at Tassel Emergence on Corn Yield on a Mississippi River Alluvial Soil

Rick Mascagni, Brenda Tubaña, Michael Salassi and Michael Deliberto

Nitrogen fertilization is a critical management practice required for producing maximum corn yield. Many factors, including soil type and crop management systems, determine optimum rates. Nitrogen is typically applied soon after crop has emerged and an adequate stand has been established. After fertilization, uncontrollable factors, such as too much or too little rainfall, may produce soil conditions conducive to nitrogen fertilizer loss through leaching, denitrification or inefficient plant uptake. Sometimes nitrogen applications are delayed or omitted due to inclement weather. At other times, growers apply the recommended nitrogen rate for an expected yield potential; however, as the crop develops, yield potential may be higher than expected and additional nitrogen may be required. In each of these situations, the question arises: How late can nitrogen fertilizer be applied and still be effective? The objective of this study was to determine the effectiveness of supplemental nitrogen applied at tassel emergence on a Mississippi River alluvial soil.

Eight field experiments were conducted from 2006 to 2012 on Sharkey clay at the Northeast Research Station near St. Joseph to determine the efficacy of late nitrogen applications (Table 1). Early-season rates ranging from 150 to 270 pounds of nitrogen per acre were injected using urea ammonium nitrate solution at the two- to three-leaf seedling stage, which is when most growers apply their nitrogen fertilizer. Additionally, one treatment consisted of a split application nitrogen of 180 pounds per acre applied early-season plus a supplemental rate of 60 pounds per acre applied at tassel emergence, giving a total of 240 pounds of nitrogen per acre. The second fertilizer application was activated soon after application with furrow irrigation to enhance plant uptake efficiency and minimize any nitrogen loss through volatization. Grain yield is reported at 15.5 percent moisture. Grower net returns for nitrogen applications above variable costs were determined using corn prices of $4.40, $5 and $6 per bushel and nitrogen fertilizer prices of 59 cents per pound of nitrogen. A 20 percent crop share was also taken out of added returns for rent. The trials were furrow irrigated, and the previous crop was cotton. All LSU AgCenter management recommendations were followed.

Rainfall was at or below normal each year except in 2007, when 16 inches of rain occurred in July. Average yields ranged from 143 bushels per acre in 2010 to 203 bushels per acre in 2012. Yield responses to nitrogen treatments averaged across years are presented in Figure 1. Although 180 pounds of nitrogen per acre was not adequate for maximum yield on this Sharkey clay soil, a supplemental application of 60 pounds of nitrogen per acre at tassel emergence increased yield in seven of eight trials. Yields were not sacrificed in most trials when supplemental nitrogen was applied at tassel because yield showed little difference between equivalent nitrogen rates when applied early-season (240 pounds of nitrogen per acre) versus early-season plus supplemental nitrogen at tassel emergence (180 pounds plus 60 pounds of nitrogen per acre) or the highest early-season rate of 270 pounds of nitrogen per acre. In a few trials, yield for

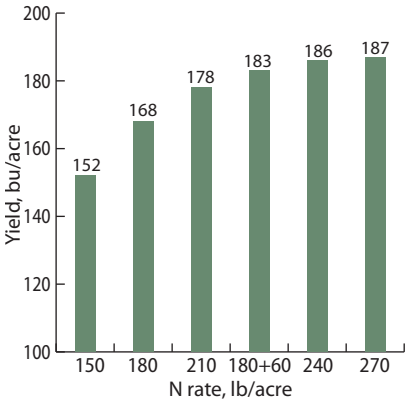


Figure 1. Influence of early-season nitrogen rate and early-season plus late nitrogen application (180+60) on average corn yield on Sharkey clay at the Northeast Research Station, 2006 – 2012.

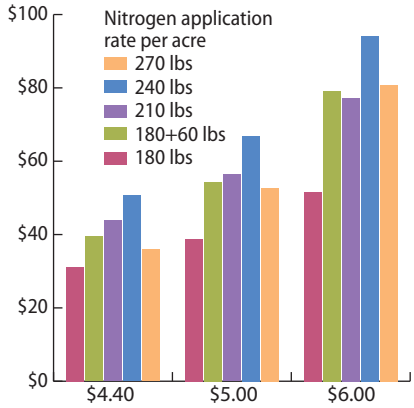


Figure 2. Influence of early-season nitrogen rate and early-season plus late nitrogen application (180+60) on change in grower net returns for nitrogen applications on Sharkey clay at the Northeast Research Station, 2006-2012.

Table 1. Field experiments conducted at the Northeast Research Station in St. Joseph, 2006-2012

Trial number	Year	Nitrogen rate[1] lb./acre	Supplemental nitrogen rate[2] lb./acre
1	2006	150, 180, 210, 240, 270	180 - 60
2	2007	150, 180, 210, 240, 270	180 - 60
3	2008	180, 210, 240, 270	180 - 60
4	2009	180, 210, 240, 270	180 - 60
5	2010	180, 210, 240, 270	180 - 60
6	2011	180, 210, 240	180 - 60
7	2012	180, 210, 240	180 - 60
8	2012	180, 210, 240, 270	180 - 60

[1]Rates applied at the 2- to 3-leaf growth stage
[2]180 pounds of nitrogen per acre applied at 2- to 3-leaf stage and 60 pounds of nitrogen per acre applied at tassel emergence.

the split application was less than the equivalent rate applied early season. In these cases, an earlier supplemental timing or a higher rate may have been more effective.

As expected, the highest net return for nitrogen fertilizer applications occurred when corn market price was $6 per bushel, with the highest net return occurring for the single, early-season application of 240 pounds of nitrogen per acre (Figure 2). Even though yields were similar when 240 pounds of nitrogen per acre were applied regardless of timing, net return to the grower for the single application compared to the dual application was increased by $14.95 per acre.

The present AgCenter nitrogen recommendation is 180-240 pounds of nitrogen per acre on irrigated alluvial soils, with the higher rates suggested for the heavier clay soils. Findings from this study confirm the present nitrogen recommendation of about 240 pounds of nitrogen per acre for irrigated alluvial clay soils. Although 180 pounds of nitrogen per acre applied early season was not adequate in these trials, supplemental nitrogen applied as late as tassel emergence was effective in most years, not sacrificing yield. Oftentimes visual nitrogen-deficiency symptoms late in the season can alert the grower that additional nitrogen is needed. Also, recent advances in diagnostic tools such as remote sensing are being refined to aid in identifying late-season nitrogen problems. Determining optimal nitrogen needs is challenging because of the complex interaction between climatic factors affecting the availability of soil nitrogen and plant demand. An in-season nitrogen fertilizer management system permits the grower to make decisions based on the plant's needs for the current season, maximizing return and minimizing environmental concerns.

Rick Mascagni is a professor at the Northeast Research Station, St. Joseph, La.; Brenda Tubaña is an associate professor in the School of Plant, Environmental and Soil Sciences; Michael Salassi is the Fairbanks Endowed Professor and Michael Deliberto is a research associate in the Department of Agricultural Economics and Agribusiness.

Shake Off Your Weight

Fatemeh Malekian, Sebhatu Gebrelul, Kasundra Cyrus, De'Shoin Friendship, Janana Snowden, Betty Kennedy and Jack Losso

Obesity is widely recognized as one of the most critical health threats to families and children across the country. The direct medical costs and losses of worker productivity for obesity and obesity-associated chronic diseases in Louisiana and the rest of the country are staggering. Reducing obesity can be accomplished by diet and exercise and altering hunger or satiety signals.

Resistant starch is a substance in some foods that contributes to an increase in dietary fiber, supports a healthy weight, helps maintain healthy blood sugar levels and promotes digestive health. Resistant starch is found in beans, peas, lentils, foods cooked and then cooled (potatoes, pasta), whole-grain breads and cereals, and bananas.

Whey protein is produced during the cheese development process and aids in maintaining a healthy weight, reducing appetite, building and repairing lean muscle and reducing muscle loss.

Researchers from the Southern University Agricultural Research and Extension Center in Baton Rouge, in collaboration with scientists from the LSU AgCenter and Pennington Biomedical Research Center, conducted a study to show the effect of whey protein and resistant starch in combination in the form of shakes and smoothies on satiety and energy expenditure and reduction of body weight. The primary goal of this project was to develop innovative food products effective in reducing body fat.

The 26 study participants were 18-40 years old, African-American males and females with BMIs (body mass index) greater than 30. The participants were divided into two groups. The treatment group consumed shakes and smoothies made with whey protein and resistant starch, and the control group consumed the same shakes and smoothies made with starch powder. The shakes were consumed by the participants every morning for 24 weeks. Dietary intake was assessed at the beginning of the study, and every participant kept a food diary. The participants came to Southern University weekly for body weight measurements, to obtain their shake mixes, submit their daily diaries, attend nutrition education classes and complete questionnaires and evaluation forms. Nutrition education was conducted once a week for 12 weeks and once a month for the remaining 12 weeks. To monitor body fat distribution, a Dual X-Ray Absorptiometer (DXA) was used at the beginning and at the end of study.

Participants in both groups lost weight, including one who lost 62 pounds. The treatment group, especially those who particpated in nutrition education classes and applied what they learned to their diets and lifestyles, lost significantly more weight than the control group. These variations in weight loss, along with findings from many other weight loss and weight management studies, suggest that future weight loss programs must be more individualized and include nutrition education.

The participants were encouraged to drink their shakes and smoothies for breakfast. Not skipping breakfast is recommended in a weight loss program because people who eat breakfast tend to lose more weight at higher rates than those who do not eat breakfast. The participants in this study who lost the most weight were the ones who consumed the shake early in the morning, compared to participants consuming the shakes after exercising and later during the day. Additionally, diaries reflected that changes in daily food selection and eating schedule can be determining factors for consistent weight loss.

The results of this study are promising. Whey protein and resistant starch incorporated into food, in conjuction with nutrition education intervention, can be used in developing noninvasive, practical, consumer-friendly and cost-effective approaches to combat the national obesity epidemic.

Fatemeh Malekian and Sebhatu Gebrelul, professors; Kasundra Cyrus, specialist; De'Shoin Friendship, associate specialist; and Janana Snowden, post-doctoral fellow, all from the Southern University Agricultural Research and Extension Center; Betty Kennedy, community outreach specialist, Pennington Biomedical Research Center; and Jack Losso, professor, LSU AgCenter School of Nutrition and Food Science.

Photo 1. Early symptoms of Cercospora leaf blight.

Photo 2. Early foliar symptoms of Cercospora leaf blight.

Photo 3. Severe symptoms of Cercospora leaf blight.

Cercospora Leaf Blight Pathogen Resistant to Fungicides

Paul P. Price III, Myra A. Purvis, Clark L. Robertson, Raymond W. Schneider and G. Boyd Padgett

Cercospora leaf blight is a fungal disease caused by *Cercospora kikuchii* and is the predominant foliar soybean disease in Louisiana. Early symptoms usually appear during pod fill in the upper portion of plants. Purplish lesions begin to appear on petioles (Photo 1), causing leaves to exhibit a bronzing or leathery appearance. As the disease progresses, stem lesions increase in size and occurrence, and leaves exhibit reddish purple, angular and irregular lesions (Photo 2). The pathogen has been noted to produce spores profusely within lesions, creating an ashy appearance (Photo 3). Lesions may grow together, resulting in premature defoliation, which reduces yields (Photo 4).

Since 1991, fungicide use has increased in Louisiana soybeans with estimates by LSU AgCenter scientists ranging from 40 percent to 75 percent of planted acres. This increase may be attributed to increased yield potential, increased soybean prices, application conveniences, industry encouragement and increased disease awareness brought on by the discovery of soybean rust in 2004. Strobilurin fungicides such as Quadris (azoxystrobin) and Headline (pyraclostrobin) or benzimidazole fungicides such as Topsin M (thiophanate-methyl) were historically recommended for management of Cercospora leaf blight and are currently in use. Recently, triazole fungicides such as Topguard (flutriafol) and Domark (tetraconazole) have been recommended for disease management. According to plant disease management reports and results from research station trials conducted over the past 15 years, strobilurin and benzimidazole fungicide efficacy on Cercospora leaf blight has decreased in Louisiana and across the Southeast.

Since a decrease in fungicide efficacy was observed and fungicide resistance has been documented in other Cercospora species affecting other crops, fungicide resistance was suspected in *C. kikuchii*. Fortunately, a collection of 176 isolates of the pathogen, collected in 2000 prior to heavy fungicide use, has been maintained in the LSU AgCenter Department of Plant Pathology and Crop Physiology. To determine if resistance had occurred, isolates were collected from research stations and producer fields in 27 soybean-producing parishes across Louisiana in 2011 (160 total) and 2012 (80 total) and compared to the baseline population from 2000.

In the laboratory, isolate sensitivity was assessed by conducting growth tests on fungicide-amended media. Selected fungicides used in the experiments were technical formulations of azoxystrobin (Quadris), pyraclostrobin (Headline), trifloxystrobin (Gem), flutriafol (Topguard), propiconazole (Tilt), tetraconazole (Domark) and thiophanate-methyl (Topsin-M). The effective concentration to inhibit 50 percent growth (called the EC_{50} value) for each isolate was calculated and used as a measure of sensitivity (low values = sensitive; high values = resistant). In the case of thiophanate-methyl, discriminatory doses (growth/no growth) were used to test for resistance.

Median baseline EC_{50} values (calculated for the 2000 collection) for azoxystrobin, pyraclostrobin and trifloxystrobin were low, indicating that isolates from that time period were sensitive to strobilurin fungicides (Figure 1). In 2011 and 2012, median EC_{50} values for azoxystrobin, pyraclostrobin and trifloxystrobin were much higher, indicating resistance to strobilurin fungicides (Figure 1). Resistance to strobilurin fungicides appears to be widespread in Louisiana, with 21 of 27 parishes testing positive in this study (see map). Results also indicated the majority (85 percent) of the pathogen population appear to be composed of strobilurin-resistant individuals (Figure 2). Cross-resistance (resistance to the same chemistry type) to all three fungicides was observed in the 2011 and 2012 populations, indicating that replacing one strobilurin with another would be ineffective.

When comparing baseline triazole sensitivity to values for the 2011 and 2012 samples, significant shifts toward less sensitivity were detected in isolates exposed to flutriafol and propiconazole (Figure 3). Conversely, isolates from 2011 and 2012 were more sensitive to tetraconazole than the baseline population (Figure 3). Outliers toward less triazole sensitivity were detected in 2012

Photo 4. Defoliation caused by Cercospora leaf blight.

for all three triazole fungicides, which indicates a possible shift towards less sensitivity. Populations require further monitoring to confirm this shift. Cross-sensitivity was observed among isolates exposed to all three triazole fungicides, indicating a need for alternating chemistry types.

Benzimidazole resistance was detected at 23 percent in 2000, 45 percent in 2011 and 36 percent in 2012 populations, indicating that this type of resistance occurred long ago and has remained stable in the pathogen population (Figure 2). Benzimidazole resistance also is widespread, with resistant isolates identified in 19 of 27 parishes (see map). Isolates exhibiting multiple resistance (resistance to two or more chemistry types) to strobilurin and benzimidazole fungicides also were detected in 15 of 27 parishes. Ninety-eight percent of benzimidazole-resistant isolates also were resistant to strobilurin fungicides, which was unexpected because of differences in the modes of action of the fungicides. Further investigation is required to determine the correlation between the two resistance mechanisms.

Results from this research confirm strobilurin and benzimidazole resistance in the Cercospora leaf blight pathogen. Because of the highly specific modes of action and selection pressure induced by strobilurins and benzimidazoles, resistance is not uncommon in areas where these fungicide classes are used regularly. Once this resistance occurs, it is persistent in pathogen populations; therefore, producers should not apply these fungicides for management of Cercospora leaf blight in areas where resistance has been documented. These fungicide classes, however, may still be effective on other soybean diseases. Furthermore, proper management practices should be followed to extend the effectiveness of available products. These include avoiding fungicide applications if they are not necessary, using the proper nozzles and spray volumes to ensure adequate coverage, not applying the same fungicide classes in succession, alternating chemistries in subsequent applications, and using tank mixes or pre-mixes with multiple modes of action.

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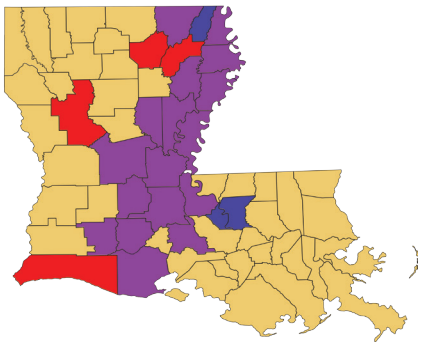
Paul P. Price III is an assistant professor and Myra A. Purvis is a research associate at the Macon Ridge Research Station in Winnsboro, La. Clark L. Robertson is a research associate and Raymond W. Schneider is a professor in the Department of Plant Pathology and Crop Physiology. G. Boyd Padgett is a professor at the Dean Lee Research and Extension Center, Alexandria, La.

Photos by Paul P. Price III



Parishes with strobilurin (red), benzimidazole (blue) and multiple (purple) fungicide resistance in Louisiana as determined from isolates of *Cercospora kikuchii* in 2000, 2011 and 2012.

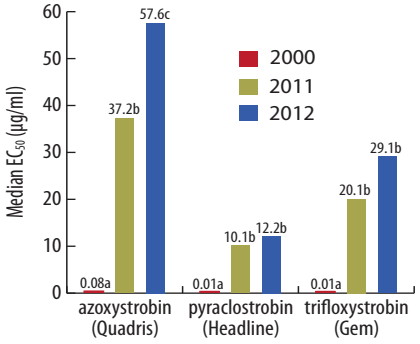


Figure 1. Overall sensitivity (median EC_{50} values) of isolates of *Cercospora kikuchii* to strobilurin fungicides in 2000, 2011 and 2012. Medians followed by the same letters are not significantly different.

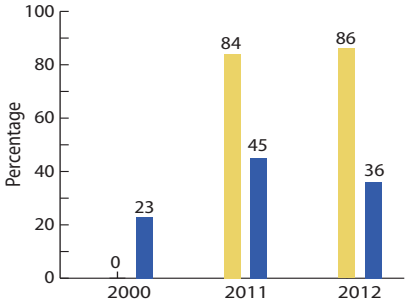


Figure 2. Percentage of strobilurin–resistant (yellow) and benzimidazole–resistant (blue) isolates of *Cercospora kikuchii* from 2000, 2011and 2012.

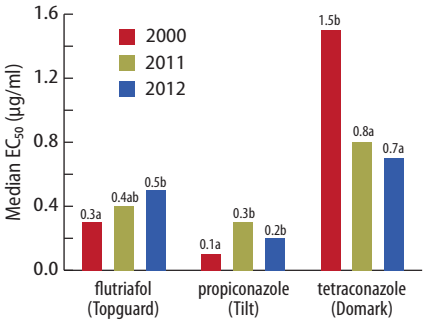


Figure 3. Overall sensitivity (median EC_{50} values) of isolates of *Cercospora kikuchii* to triazole fungicides in 2000, 2011 and 2012. Medians followed by the same letters are not significantly different.

Citrus Canker and Its Impact on Louisiana's Citrus Industry

Raghuwinder "Raj" Singh

Citrus canker is a devastating disease of citrus caused by the bacterium *Xanthomonas citri* subsp. *citri*. It causes defoliation, premature fruit drop, blemished fruit and tree decline. It was first detected in Florida in 1910. By 1914, it spread to seven Gulf and Atlantic coastal states including Alabama, Georgia, Louisiana, Mississippi, South Carolina and Texas. In Florida, citrus canker was declared eradicated in 1933, but it reappeared in 1986 and then in 1995. It is now present in all citrus-growing counties in Florida. Until recently, the disease had not been seen in Louisiana since 1940; however, it was re-confirmed in the state on June 21, 2013.

Citrus is grown primarily in southeast Louisiana and includes grapefruit, kumquats, lemons, limes, oranges and satsumas. Commercial citrus production is centered in Lafourche, Plaquemines, St. Bernard and Terrebonne parishes. Citrus canker has been positively identified in Plaquemines Parish, where the majority of commercial citrus industry is located, along with Jefferson, Orleans and St. Charles parishes. More than 400 trees have been confirmed positive, and all of Orleans and portions of Jefferson, Plaquemines and St. Charles parishes are under quarantine. Consequently, the movement of citrus plants, plants parts, clippings or fruits is restricted. At present, the total value of citrus fruit and nursery stock industry in the state is around $10 million. Without effective management options, citrus canker has the potential to destroy Louisiana's citrus industry.

Citrus canker is highly contagious, and all citrus varieties are susceptible – although some varieties are less susceptible than others. Varieties ranked from highly susceptible to less susceptible are grapefruit, trifoliate orange, Mexican/Key lime, navel orange, sour orange, sweet orange, lemon, satsuma, tangerine, Mandarin orange, king orange and kumquat. The bacterium causes symptoms on all above-ground plant parts, including leaves, fruit and twigs. Young expanding tissue is highly prone to infection, and as the tissue becomes mature and hardens off, it becomes less susceptible. Natural infection requires free water on the leaf surface to permit bacterial access through stomates or wounds. The pathogen prefers a temperature range from 68 to 86 degrees but is active over a wide temperature range. Lesions appear at about 10 days to two weeks after infection.

Symptoms on leaves and fruits start as tiny raised blisters that expand and become tan to brown as the disease develops. Lesions are visible on both sides of the leaves with water-soaked margins surrounded by yellow halo (Figures 1 and 2). As the lesion ages, the center becomes raised and corky and can fall out, giving the leaf a shothole appearance. The pathogen forms raised, corky, craterlike lesions on the fruits (Figures 3 and 4). Those fruit lesions often also have water-soaked margins surrounded by a yellow halo. Similar lesions are present on the twigs and leaf petioles, except the water-soaked margins may be reduced and the yellow halos are absent (Figures 5 and 6). As the disease intensifies, defoliation and twig dieback occur, and severely blemished fruit drop prematurely.

The bacterium enters the host tissue via natural openings and wounds. It is not vectored by insects or other

Figure 1. Canker lesions on the top of leaves, with water-soaked margins surrounded by yellow halos.

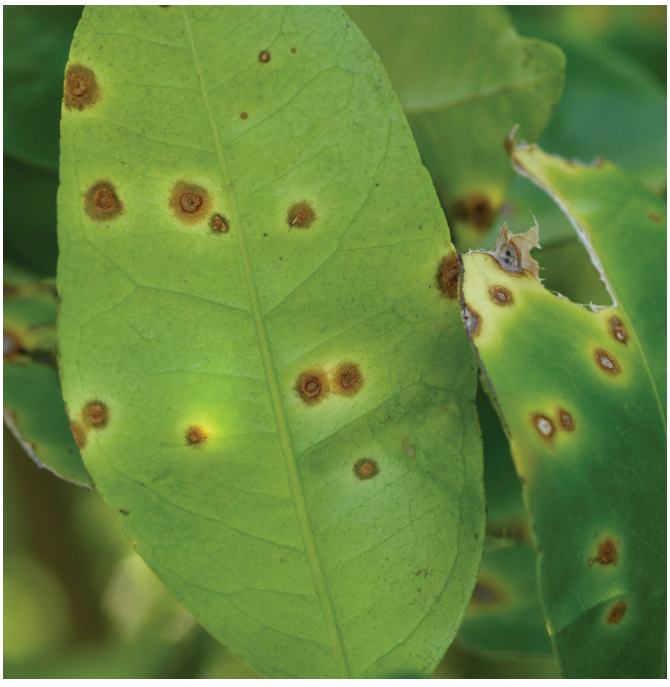


Figure 2. Canker lesions on the underside of a leaf. Notice the young lesion with yellow halo and the older lesions with tan or brown margins.

Figure 3. Raised, corky lesions on a sweet orange.

organisms, but the wounds caused by citrus leafminer may serve as infection sites. Bacteria survive in old cankers and under wet and warm environmental conditions. They can disperse short distances via wind-borne rain, lawnmowers, other landscaping equipment and people carrying the infection on their hands, clothing or equipment. Long-distance dispersal of citrus canker generally is attributed to human movement of infected or exposed citrus material and storms like hurricanes and tornadoes.

Louisiana residents are urged not to move any infected citrus plant material within or out of the state. Homeowners must buy citrus trees from certified nurseries only. Individuals who believe their citrus trees have symptoms should not take any samples but contact the U. S. Department of Agriculture at 225-298-5410 or the Horticulture and Quarantine Division of the Louisiana Department of Agriculture and Forestry at 225-952-8100. More information about citrus canker can be obtained by contacting Raj Singh with the LSU AgCenter at 225-578-4562 or rsingh@agcenter.lsu.edu.

Raghuwinder "Raj" Singh is an assistant professor in the Department of Plant Pathology and Crop Physiology.

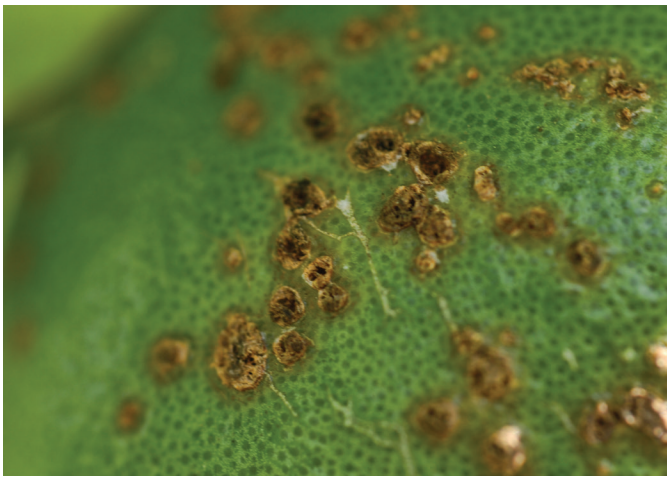


Figure 4. Craterlike lesions on a sweet orange.

Figure 5. Canker lesions on young twig of a sweet orange tree.

Figure 6. Canker on leaf petiole of a sweet orange.

Photos by Raghuwinder "Raj" Singh

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