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LOUISIANA Agriculture

Assuring Our Future Through Scientific Research and Education

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Agriculture and Medicine

Hampton Grunewald

While Louisiana has had legislation since the late 1970s regarding medical marijuana, the lack of enabling rules and regulations prevented patient access until the passage of Senate Bill 143 in 2015. Sen. Fred Mills, of Breaux Bridge, authored the legislation, paving the way for the production, recommendation and use of medical marijuana. The act (La R.S. 40:1046) became known as the Alison Neustrom Act, in honor of Dr. Alison Neustrom, of Lafayette, who was an advocate for medical marijuana. At 42, Dr. Neustrom passed away from aggressive pancreatic cancer.

In June 2016, the LSU Board of Supervisors approved a resolution allowing the LSU AgCenter to proceed with obtaining a license from the Louisiana Department of Agriculture and Forestry (LDAF) for the production of medical marijuana. The AgCenter is currently working to select a supplier to operate in partnership with to produce medical marijuana. This competitive process will allow the AgCenter to select the most qualified partner for the new project. Preliminary estimates show this project will likely cost \$10 million to \$15 million for the first five years of operation; no state dollars will be used. All costs will be the responsibility of the selected supplier. As the licensee, the AgCenter will receive a percentage of gross sales and an annual allocation for research from the selected supplier.

As outlined in the law, the growth, production and distribution of medical marijuana will be done according to stringent rules established by LDAF, the Louisiana Board of Pharmacy (LBOP) and the Louisiana State Board of Medical Examiners (LSBME). LDAF will establish rules for the cultivation, extraction and formulation of medical marijuana. LBOP will establish rules for pharmacies to distribute medical marijuana. LSBME will establish rules for the recommendation of medical marijuana by physicians. To ensure product safety and security, the AgCenter is working with both state and local law enforcement agencies.

As currently written, Louisiana law allows for patients with specific disease states to use medical marijuana, including cancer, positive status for human immunodeficiency virus, acquired immune deficiency syndrome, cachexia or wasting syndrome, seizure disorders, epilepsy, spasticity, Crohn's disease, muscular dystrophy and multiple sclerosis. The law does not allow for raw or inhaled (smoked) use and requires refined methods of delivery, including oils, tinctures, sprays, pills, capsules and suppositories.

The law allows the AgCenter, as the licensee, to conduct research on medical marijuana. Research will result in the creation of intellectual property related to the development of plant varieties, extraction methodology, compound identification, and use for treatment of specific disease symptoms. New opportunities through the Food and Drug Administration (FDA) and National Institutes of Health (NIH) will allow for clinical trials and human testing through collaboration with the Pennington Biomedical Research Center and the LSU Health Science Centers.

Additional information on this project can be found at LSUAgCenter.com/ AgMedical.

Hampton Grunewald is the associate vice president for governmental relations.

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ON THE COVER: The LSU AgCenter Botanic Gardens at Burden in Baton Rouge offers urban education through display and demonstration gardens, year-round activities and events, and research that supports sustainable agriculture. Learn more on page 8. Photo by John Wozniak

Tree planting featured at Arbor Day



Elder Johnston, of the Church of Jesus Christ of Latter Day Saints, helps 3-year-old Kate Ellet Prejean plant a tree during Arbor Day festivities at the LSU AgCenter Botanic Gardens at Burden on Jan. 21. They were among more than 150 visitors who braved muddy grounds to participate in the annual event. The tree planting is part of a reforestation effort to replace damage from Hurricane Gustav in 2008. Each person who planted a tree was given the GPS coordinates to be able to return to the tree over the coming years to mark its growth. Despite the soggy ground, Arbor Day participants planted approximately 110 native trees, said Botanic Gardens director Jeff Kuehny.

"Participants learned about the importance of trees to our environment and watched LSU forestry students do a tree saw demonstration," Kuehny said. **Rick Bogren**

Resistant starch receives health claim

Michael Keenan, a professor in the LSU AgCenter School of Nutrition and Food Sciences, conducts research on resistant starch. A new health claim approved by the Food and Drug Administration says the resistant starch, high-amylose maize starch, could be effective in the fight against Type 2 diabetes.

"The qualified claim means this is emerging science, and there is more research needed," Keenan said.



Keenan and other researchers have been working with resistant starch for nearly 15 years. High-amylose maize starch contains a high percentage of amylose, one of two components of starch, he said. Amylose is a slow-digesting starch that acts like fiber. The other component, amylopectin, is quick to break down and digests rapidly. In his research, Keenan found that resistant starch can improve blood glucose control. **Tobie Blanchard**

Timing key to successful irrigation



Bruce Garner, LSU AgCenter agent in West Carroll Parish, discusses two types of soil moisture sensors during a sustainable irrigation workshop held Jan. 17 at the LSU AgCenter Red River Research Station in Bossier City. Sensors can help farmers to time irrigation events so they are most beneficial.

AgCenter engineer **Stacia Davis** said agricultural irrigation and overall water use have increased in recent years in Louisiana. In 2014, the state used 9.3 billion gallons of water, about half of which was used for power generation, she said. Louisiana's groundwater aquifers — which can take decades and centuries to be replenished — are facing pollution from chemicals, saltwater intrusion and low water levels. That is concerning, Davis said, because groundwater is the most common source of irrigation water.

"We have increased our use but have not changed where we're drawing it from," she

said, adding that the state needs to make better use of its abundant surface water.

AgCenter water quality specialist **Changyoon Jeong** told about his work monitoring nutrient content of water from Red Bayou, a project that pumps water from the Red River to a bayou so farmers can use it instead of groundwater to irrigate.

AgCenter agronomist **Syam Dodla** said most Louisiana farmers irrigate by flooding furrows. That practice is only 40 to 70 percent efficient, he said. Irrigating every other row uses up to 30 percent less water without a yield penalty, Dodla said. The practice works best in heavy soils. **Olivia McClure**

Farmers hear about worker protection rules



New worker protection standards will require more work and record-keeping on farm operations, **Carol Pinnell-Alison**, LSU AgCenter county agent in Franklin Parish, told producers at the Northeast Louisiana

Crops Forum on Feb. 9.

Some of the new regulations went into effect in 2016, with additional changes being phased in this year and full implementation set for Jan. 1, 2018, she said.

Changes with the greatest impact for producers include worker age restrictions, exclusion zones, employee training, record-keeping and posting requirements, she said.

To apply or handle pesticides, or enter fields where pesticides have been applied before the re-entry interval has expired, employees must be 18 years old or older except for immediate family members. Exemptions for family members have been expanded under the new regulations, she said.

Employers are encouraged to become certified trainers because a grace period is no longer allowed for new hires, and new employees on a farm must be trained their first day on the job, she said.

A certified trainer must be either a private or commercial certified applicator who has completed an approved program. The AgCenter no longer administers pesticide certification testing, but trainer programs are available by contacting the AgCenter, she said. **Karol Osborne**

Horticulture group honors Owings



Allen Owings, a commercial ornamental horticulture specialist with the LSU AgCenter, received the Henry Covington Extension Award for Horticulture Professionals from the Southern Region of the

American Society for Horticultural Science at the society's southern region meeting in Mobile, Alabama, on Feb. 5. Owings has been a member of AgCenter horticulture faculty for 25 years and has worked primarily in extension for the past 20 years. He serves as research coordinator for the AgCenter Hammond Research Station. **Tobie Blanchard**

Ag Adventures celebrates 10 years



Baby, a black Dutch bantam chicken, took a break during the LSU AgCenter Ag Adventures in Delhi to briefly perch on the head of Tyrell Jones, a Berg Jones Elementary School second-grader. He was one of 950 students in second and third grades and their teachers who took part in the two-day educational event Feb. 20-21.

For 10 years, Ag Adventures has helped children learn about the agricultural products grown in northeast Louisiana and how they are used in everyday life, said Terri Crawford, AgCenter regional coordinator and co-coordinator of the event.

Students visited interactive learning stations highlighting sweet potato production and processing, gardening, honeybees, handwashing and germs as well as a mini farm, Crawford said.

In the mini farm, six exhibits were set up for hands-on activities and educational talks about different livestock species, including dairy and meat goats, lambs, chickens, rabbits and a donkey, said Union Parish county agent Brandon Reeder. Two activities concentrated on dairy products. Students made

butter and milked Louella, a wooden model of a cow.

Berg Jones Elementary teacher Tara McKeller said many of her second-graders have never been exposed to farm animals, and because children are tactile learners, they will remember these personal experiences.

"I just wanted them to know that agriculture is vital to the economy of north Louisiana, and a lot of them never have a chance to see that," she said. **Karol Osborne**

New rice herbicide topic of meetings

A new herbicide for rice, Provisia, has been approved by federal regulators, according to Eric Webster, an LSU AgCenter weed scientist, speaking on Jan. 17 at a rice producers meeting in Alexandria. The Provisia rice technology is resistant to Provisia herbicide, quizalofop, already used on other crops. The technology will allow farmers to control red rice that has become resistant to Clearfield herbicide, but badly infested fields will require a comprehensive approach that includes soybeans in rotation with Provisia, Webster said.

AgCenter rice breeder Steve Linscombe said he has been working on Provisia rice for four years at the H. Rouse Caffey Rice Research Station near Crowley, and an experimental line has the potential to become the first Provisia variety. "We're hopeful to have a substantial seed increase this year, and it could be commercially available in 2018," Linscombe said. **Bruce Schultz**

Consumers choose more fresh food

As consumers abandon frozen foods for fresh foods, the food distribution chain is changing, said Larry Bell, CEO of Sustainably Fresh Systems in Pacific Grove, California. Speaking at the 2017 Louisiana Food Processors Conference on Feb. 16, Bell explained how packaging from his company uses an ultra-low oxygen and high carbon dioxide atmosphere to extend freshness and marketability of fresh foods, particularly meat and seafood.

The conference was sponsored by the LSU AgCenter School of Nutrition and Food Sciences, Louisiana Sea Grant, the Gulf Coast section of the Institute of Food Technologists and the Louisiana Food Processors Association.

On the other end of the spectrum, experts are working to improve the quality and efficacy of shelf-stable foods. Processors have various choices for selecting antimicrobial packaging, said Claire Sand with Packaging Technology and Research, a packaging design company. Packaging is considered a food

additive, and must meet several health and safety requirements, Sand said.

New packaging concepts include degradation sensors that can measure product quality and be an improved indicator of shelf life. And new water vapor barrier technology helps prevent freezer burn in packaged meals.

The concept of improving shelf-stable products is becoming more important in an age when more consumers are less likely to cook at home, said Louise Wicker, director of the LSU AgCenter School of Nutrition and Food Sciences.

"It's important the food industry meets the needs of consumers in the areas of taste, cost, convenience and health," Wicker said. "Shelf-stable foods are necessary for low-income consumers and anyone who is interested in easier, healthier cooking at home."

Rick Bogren

More than 2,000 youth at 82nd LSU AgCenter Livestock Show



More than 2,000 youth from across Louisiana participated in the 82nd LSU AgCenter Livestock Show held Feb. 11-18 at the Lamar-Dixon Expo Center in Gonzales, showing various breeds of beef and dairy cattle, goats, hogs, poultry and sheep. But the state event, a culmination of competition at the parish and district levels, is much more than about the livestock industry.

"This show is much more about recognizing champion young people than it is about naming champion animals," said Bill Richardson, LSU vice president for agriculture. "Every youngster who participated in this show is a champion."

The 2017 show was presented by Gerry Lane Enterprises and PotashCorp, with additional funding from the Meraux Foundation. Other top-level donors included First South Farm Credit, Sunshine Quality Solutions, Louisiana Cattlemen's Association, Louisiana Land Bank and Mosaic. The Arlene and Joseph Meraux Charitable Foundation endowment supported awards for Supreme Champion animals in all six breeding species: beef cattle, dairy, poultry, sheep, goats and swine. **Rick Bogren**

Escobar receives excellence award



Luis A. Escobar, professor in the Department of Experimental Statistics, received the RAMS Alan O. Plait Excellence Award for best tutorial presented at the 2016 Reliability and Maintainability Symposium. The tutorial was

titled Experiences in Reliability Data Analysis, and the award was presented in Orlando, Florida, in January 2017. **Tobie Blanchard**

Students spend winter break in Greece



Lauren Martin, above, was one of eight students in the LSU College of Agriculture who traveled to Greece during winter break to study the country's food and culture. Martin, a junior, said she is considering a career as a clinical dietitian and the experience will help her work with different populations. She is standing at the Palamidi Fortress in Nafplion, Greece.

Judy Myhand, nutrition instructor and director of this two-week study opportunity, which is in its seventh year, said her goal is to help broaden the minds of these students.

"If they think people are homogeneous, that limits them," Myhand said. "I want them to approach life with the understanding that people have different likes and different experiences."

The students spent time shopping for food and cooking with local residents.

"We spent a profoundly greater amount of time preparing meals, sitting at the table, lingering over food," Martin said.

Martin received an international scholarship from the College of Agriculture to help fund the trip. She had never traveled abroad before visiting Greece. The other students who went were Alexa Bennet, Elizabeth Trujillo, Mandy Gurtner, Sydney Mulroy, Alexis Agard, Lyell Turner and Allison Junca. **Tobie Blanchard**

Tea, Fashion, Fancies celebrates Seersucker Saturday



Laurie Lipsey Aronson, president and CEO of Haspel Clothing Co., tells attendees of Tea, Fashion and Fancies on Feb. 18, about the advent of the seersucker suit, which her family's company is credited with creating. This event is an annual fundraiser for Friends of the LSU Textiles and Costume Museum and Friends of the LSU Rural Life Museum. Baton Rouge Mayor-President Sharon Weston Broome declared Feb. 18 Seersucker Saturday in Baton Rouge for the event. **Tobie Blanchard**

Student overcomes obstacles on path to graduation



When Alexandra Arceneaux crossed the stage with her service dog, Mishka, at the LSU College of Agriculture commencement ceremony on Dec. 16 at the Maddox Fieldhouse, the crowd erupted with applause. To say Arceneaux's journey to graduation had obstacles is to understate her struggle.

Arceneaux, of Bogalusa, came to LSU in 2008, but before she could finish her degree, she developed Neuromyelitis optica, a condition which left her paralyzed from the shoulders down.

"It's sort of like a cousin to multiple sclerosis," Arceneaux said, "But it comes on suddenly."

This was in 2012. Arceneaux spent the next year and half recovering in therapy. She regained use of her arms, but remains in a wheelchair.

"I could have continued in therapy to focus on walking, but I wanted to come to back to school and get my degree," she said.

Arceneaux received her degree in nutrition and food sciences with a focus on food science and technology. She hopes to work in quality assurance in the food industry.

"The program had everything I wanted out of science, and I felt a sense of community in the program." **Tobie Blanchard**

Fashion students participate in Hemline for Hearts



Four students in the Fashion Association@LSU participated in the Hemline for Hearts paper heart dress competition on Jan. 28 in the Mall of Louisiana in Baton Rouge. The students are all studying textiles, apparel and merchandising. The event, sponsored by the American Heart Association, promotes the Go Red for Women campaign.

The students had three hours to complete a garment made entirely of paper hearts, some of which were signed by supporters. The competition took place on the ground floor of Macy's, also a sponsor of the annual event. The dresses were on display in the store until they were moved to the Baton Rouge River Center for the Baton Rouge chapter of the American Heart Association's Go Red for Women luncheon on Feb. 3.

"I feel like we have a good representation of different styles and years in school from our students competing today," said Casey Stannard, assistant professor in the Department of Textiles, Apparel Design and Merchandising.

Senior Lauren Aymond, above, created a knee-length sleeveless dress with alternating red and white layers, which was complemented by a necklace and bracelet made entirely of clear and red plastic spoons. "I'm really happy with how my design came out," Aymond said before judging began. Her design placed first and earned her an invitation to the Baton Rouge chapter of the American Heart Association's Go Red luncheon as well as a Macy's gift card. **Allison Strahan**

New Faculty PROFILE

Xu Finds Fulfillment in Food Safety

Tobie Blanchard

When Wenqing Xu was a child in Chengdu, China, she saw the man who delivered her family's milk putting river water into his milk tanks. It was then she realized how vulnerable our food system can be.

Xu serves as the LSU AgCenter food safety specialist and is an assistant professor in the LSU College of Agriculture. She said that day near the river inspired her to study food microbiology and work to protect consumers against pathogens.

Xu earned bachelor's and master's degrees from Nanjing Agricultural University School of Food Science and Engineering. She came to the U.S. in 2010 to pursue a Ph.D. at the University of Delaware.

"China is 20 years behind the U.S. in terms of food safety research, so I wanted to study in the best country in the world for this type of research," Xu said.

In 2014, Xu finished her Ph.D. and made the move to Louisiana.

"I like the spicy food here. It reminds me of my home," Xu said.

Xu has a three-way appointment at the AgCenter and College of

Agriculture – doing extension work, conducting research and teaching in the classroom. Her first priority when joining the AgCenter was to identify food safety needs in the state and work with agents and educators to create a food safety culture.

Part of her extension work includes training community food handlers such as disaster response teams, festival volunteers and faith-based organizations on safe food handling processes.

"When you cook for groups, it is much different from cooking at home," Xu said.

Xu also is collaborating with Woman's Hospital in Baton Rouge to help prevent the foodborne illness listeriosis in pregnant women.

With an outgoing and friendly attitude, Xu is well-suited for extension work, but she enjoys being in the lab as well. She has several research projects, including one on norovirus, its survival on different surfaces and the decontamination of surfaces. She is also studying the microbial safety of strawberries after a flood.



"I like the idea that I can use what I learn in the lab, implement it and see behavioral changes," she said.

Xu teaches a food safety class in the School of Nutrition and Food Sciences, and she is advising one doctoral and two master's students.

"I keep emphasizing to my students that when they graduate, they must remember to do the right thing. People's lives are at stake. They must make the right decisions to protect consumers," she said.

Xu said she has enjoyed traveling across Louisiana and meeting with diverse groups. Being from a different culture has helped her understand the unique needs groups can have. One of her favorite experiences since coming to Louisiana was working with shrimpers in Terrebonne Parish.

"I added an important piece of knowledge to my professional practice – culture comes first and food safety education follows. Taking time to learn the culture has guided my work with home food preservers in northern Louisiana, small food purveyors in rural communities, as well as food handlers in faith-based organizations who feed the public during natural disasters," she said.

Xu has found a niche at LSU. She enjoys the friendly nature of people, the beauty of campus and the food and culture that make Louisiana unique. One of her favorite spots in Baton Rouge is the top of the state Capitol.

"I like going up there. All of my problems seem very small up there," she said.



Wenqing Xu (third from left) explains the different media for growing bacteria cultures to her graduate students Dorra Djebbi Simmons, Shifa Shiraz and Austin Wong. Photo by Tobie Blanchard

Tobie Blanchard is the assistant director of LSU AgCenter Communications and communication coordinator for the College of Agriculture.

Botanic Gardens at Burden Focuses on Urban Education

Jeff Kuehny

The LSU AgCenter Botanic Gardens at Burden has been undergoing significant changes as it refocuses from a crops research station to a center for urban agriculture education. The process was begun in 2009 with the development of a Cultural Landscape Report and Master Plan. While the Cultural Landscape Report highlighted the elements of the Burden landscape that should be preserved because of their historical significance, the Master Plan outlined three primary destinations and points of activity that reflect the past, present and future of agriculture in Louisiana. The property was renamed Burden Museum & Gardens to create a unified public destination with multiple public and academic venues. The LSU Rural Life Museum and historic Windrush Gardens represent the 18th and 19th century plantation era in Louisiana history. The LSU AgCenter Botanic Gardens represents present day horticulture through display and demonstration gardens, Burden Woods and Barton Arboretum. The AgCenter ornamental and turf and food and fiber plant research facilities support a sustainable agricultural future through research and extension programs.

A nonprofit friends group, the Burden Horticulture Society, was formed in 2007 to support the work of the Botanic Gardens. Using the Master Plan as a guide and with the support of the

Burden Horticulture Society and other plant-related organizations, the Botanic Gardens has been transforming into a unique education and research facility and public destination.

The Rose Garden was updated with formal brick-lined beds and renovated and enhanced in 2014 to include two national trial programs: the American Rose Trials for Sustainability program (ARTS) and the American Rose Garden Selections trial program (ARGS). The ARGS program recognizes roses that are easy to care for, disease resistant and suitable for different regions of the country. The ARTS program conducts regional evaluations under low-input conditions, testing for the most disease- and pest-resistant, hardiest and most garden-worthy rose cultivars. Along with these two programs, the Rose Garden also contains other rose varieties best suited for the Gulf South. A group of volunteers assists with the maintenance of the Rose Garden.

The Vie and Hank Stone Camellia Collection was added to the Botanic Gardens in 2005. A gift from the Stones, who spent their lifetimes collecting camellias from around the world, this camellia collection contains more than 450 named camellias that include japonica, sasanqua, higo and hybrid camellias. This camellia collection serves as a germplasm repository for propagating and breeding camellias and is one of the largest collec-



The LSU AgCenter held a ribbon-cutting ceremony for the Children's Garden at the Botanic Gardens at Burden on Oct. 16, 2012. It was designed for use by children and families to touch, feel, smell and enjoy. Photo by Johnny Morgan



LSU Forestry Club president Mason LeBlanc, left, and member Nicholas Light, right, see how fast they can saw through a piece of wood during Arbor Day festivities at the Botanic Gardens on Jan. 21, 2017. Photo by Olivia McClure

tions in the Gulf South. Added in 2016, the Florence and Charles Crowder Camellia Collection includes the Crowders' collection of more than 200 camellias that were registered in the United States prior to 1900. Many of these camellias had been lost or were no longer available to the public. This collection is planted according to the country of origin and is a significant addition to the germplasm available for propagation and breeding purposes. These collections are maintained through the assistance of the Baton Rouge Camellia Society, which also holds an annual camellia show and sale.

The Tropical Garden is a display garden that contains a collection of tropical and subtropical plants that are trialed for their landscape significance. As the growing season becomes longer and the winters milder, the use of these plants and their maintenance requirements in the Southern landscape has become more important. This garden contains gingers, heliconias, bananas, cycads, palms and seasonal orchids and bromeliads. The Baton Rouge Orchid Society assists with trials of new tropical plants and hosts an annual regional orchid show and sale at Burden.

Established in 2014, the Children's Garden is designed for people of all ages, but especially for children. Visiting children are encouraged to touch, feel, smell and enjoy the garden space. A butterfly garden marks the entry to this garden, which features fruit trees and seasonal vegetables. Depending on the season, various edible plants are ready for harvest. Children are encouraged to snap off a tomato, pick a piece of broccoli or pull a carrot or radish and take a bite.

The Children's Garden is designed for teaching children about gardens and gardening, as well as for teaching school teachers how to implement, maintain and build curricula for school gardens. A set of 20 backpacks includes materials that can be used to complete three hour-long, hands-on garden activities that focus on butterfly life cycles, world geography and math.

StoryTime, supported in part by the Junior League of Baton Rouge, is a creative way of mixing storytelling, reading and imaginative, hands-on craft activities throughout the gardens.

Reflections in the Garden is an adult educational program that includes monthly presentations by prominent, local specialists on a variety of garden-related topics. Other adult educational programs are provided by the Master Gardener Association, Herb Society, Camellia Society, Native Plant Society and Orchid Society.



A boy pets a goat in the petting zoo area of the Corn Maze Festival on Oct. 3, 2015, at the LSU AgCenter Botanic Gardens at Burden. Photo by Olivia McClure

The Herb Garden is sponsored by the Baton Rouge Unit of the Herb Society of America and serves as an educational garden for those who wish to develop a better understanding of herbal plants and how they can enrich our mind, body and spirit. The Herb Garden will comprise four separate gardens, each with special theme reflecting the various influences of the peoples who have lived in our state. The first garden was installed in 2015 and is a Louisiana Kitchen Garden, displaying culinary and medicinal herbs common to our early gardens. Visitors learn the roles these plants played historically and their uses today. Remaining gardens will feature the influences of Native Americans, Africans, Caribbean Islanders, French, Spanish and other Europeans who came to Louisiana, each bringing their own gardening style and plant materials. The last section of the garden will be the Natural Garden, which will include native herbal plants.

Burden Woods covers approximately 150 acres of the Botanic Gardens and is primarily a bottomland hardwood urban forest. Burden Woods is home to Trees and Trails, a trail system that was part of the Steele Burden's vision to provide the community access to an urban forest. Its purpose is to support a variety of pedestrian activities, including hiking and interpretive and educational activities for adventure and discovery. A rain-fed wetland called the Black Swamp with 200-year-old tupelo trees lies at the northern end of the trail. The Mosaic Boardwalk at Black Swamp was installed in 2016 to provide visitors with a better understanding of these types of wetlands. Burden Woods is home to the docent-led Trees and Trails educational program, featuring the Project Learning Tree curriculum, which was developed by school teachers from across the United States and features nature as inspiration for learning and discovery for students in pre-K through eighth grade.

Steele Burden designed the Barton Arboretum in memory of Scott Duchein Barton, a close friend and founding member of the Burden Foundation. The arboretum, which can be accessed by Trees and Trails, is enclosed by spruce pine and has a circular drive through live oaks which memorialize friends and dignitaries who over the years made significant contributions to the AgCenter. Native trees were planted among the pines, and a small pond provides a setting for quiet reflection.

The arboretum includes the James Wandersee Palmetto Walk and the Florence and Charles Crowder Camellia Collection.



A boy glides down a zipline at the Corn/Hay Maze Festival at the Botanic Gardens on Oct. 1, 2016. Other activities at this annual event include a hay mountain climb, hayride and a giant slingshot. The event culminates on the final Saturday with a bonfire. Photo by Olivia McClure

Designed by James H. Wandersee and Renee Clary, the palmetto walk uses best signage practices researched by EarthScholars Research Group and was developed with educational stations detailing historical and botanical facts about the Louisiana native palmetto.

The All-America Trial & Display Garden highlights annual herbaceous ornamentals and vegetables from the current and past All-America Selection trial winners. The Botanic Gardens at Burden is the official Louisiana trial site for this program. Plant selections are rotated each fall and spring and are located at the Food and Fiber Research Facility.

As part of its sustainability plan, the Botanic Gardens offers a variety of facilities surrounded by lush garden settings that have been made available to the public for meetings, education programs, cultural events or other special occasions. The Ione E. Burden Visitor Information and Conference Center was built in memory of Miss Ione Burden and her love for education. The Steele Burden Memorial Orangerie was designed the well-known architect A. Hays Town. It was Town's last design and was a tribute to his longtime friend Steele Burden in recognition of his landscape contributions to LSU and the surrounding region. An orangerie is part conservatory and part interpretive, originally designed to house or protect citrus trees during cold weather, hence the name. Today the Orangerie is the iconic focal point of the Botanic Gardens.

The open-air pavilion, with exposed beams and a handsome fireplace that overlooks the Burden Woods, was built for the Trees and Trails and Project Learning Tree programs. It also serves as an outdoor space for other educational programs and cultural events. The Memory Garden next to the pavilion was completed in 2015 and features the memories of contributors to the Botanic Gardens as well as an intimate space in an outdoor setting.

Windrush Gardens are historic gardens that represent the life's work of Steele Burden, who was naturally artistic and was a self-taught landscape architect. Steele toured the important gardens of Europe and worked in some of the surviving gardens of 19th century Louisiana plantations. Both earlier garden types influenced his approach to garden design and his life's work.

Through both private and public partnerships, the Botanic Gardens continues to provide a variety of educational programs and events that use the specialty gardens, woodlands and facilities. These programs and events help provide funding to continue to expand and enhance the Botanic Gardens, using the Master Plan as its guide. Current fundraising is aimed at establishing a new Welcome Center that will serve as the primary point of contact to enhance the visitors experience, provide expanded facilities for educational programming and house the East Baton Rouge Parish extension offices.

Jeff Kuehny is resident director at the Botanic Gardens at Burden.

Events Bring Visitors and Support Programs

The Botanic Gardens and Burden Horticulture Society have developed several annual events to provide both education and fun as well as raise money for programs.

- The first event developed was Arbor Day at Burden in 2010. Hurricane Gustav inflicted major damage to the Burden Woods with the highest concentration of downed trees in the pedestrian trails. The Arbor Day celebration allows visitors to plant trees to help restore the woodland.
- Brush with Burden, an annual juried exhibition for art of all media, photography and sculpture, was started in 2011 by the Burden Horticulture Society. The inspiration came from Steele Burden, who was a self-taught artist and sculptor. An opening reception, two-week exhibition and educational program are part of this popular and well-respected exhibition.
- Gourmet in the Garden, started in 2012, includes dining and music among the blooms in the gardens. Award-winning local chefs from top restaurants create tastings, and local mixologists create unique cocktails at the Orangerie and the Rose Garden.
- The Garden Fest at Burden was started in 2012 to replace the traditional research station field day. Garden Fest highlights the vegetable and fruit research and trials at the Food and Fiber Research Facility, allowing both the public and local farmers to visit and learn from faculty and staff.
- The popular Corn Maze attracts thousands of families to find their way through the maze, climb the straw mountain, paint a pumpkin, test their skills launching balloons with a giant slingshot, take a hayride and visit the petting farm. Night Maze is the grand finale with costumes, live music and a bonfire.

Managing Crape Myrtle Bark Scale

Yan Chen and Allen Owings

Crape myrtles are considered an essential Southern plant for good reasons. Selected from *Lagerstroemia indica* or its hybrid with *L. fauriei*, these summer-flowering trees offer spectacular flowers, colorful autumn foliage, and handsome sculptural trunks that few other plants can match. A new pest on crape myrtles, the crape myrtle bark scale, was first detected in Texas in 2004 and quickly spread to 130 counties in 11 states by 2016. An article on its distribution, damage, life stage and population trends was published in the spring 2016 issue of Louisiana Agriculture.

Since then, new infestations have been reported from Covington and Mandeville, Louisiana. In addition, the crape myrtle bark scale has been confirmed on beautyberry in an open field and pomegranate, henna, heimia and winged loosestrife in greenhouse tests. This has raised concerns that this pest is capable of infesting native flora of the southeastern U.S.

When it comes to managing this scale, landscape professionals often prefer using neonicotinoids. This chemical class is systemic, which means the active ingredients get transferred into plant tissue and work whenever scales feed on the sap.

They may be more effective or long-lasting than contact insecticides that work only when they have contact with the scale. However, because of concerns on the potential impact of neonicotinoids on beneficial insects and pollinators, they should be used as a last resort. Other control options include insect growth regulators, which mimic insect hormones and disrupt the molting process so the scale cannot move on from one life stage into the next one, or horticulture oil, which works by suffocating crawlers or helping the insect growth regulators work better. There are other systemic insecticides such as cyantraniliprole, which may be low in toxicity to pollinators. All of these options need to be tested on the crape myrtle bark scale.

In a field study, LSU AgCenter researchers tested cyantraniliprole (as Mainspring 200SC) as a stand-alone treatment or in a tank mix with spray adjuvants (materials that help insecticides get into bark tissue) CapSil or Nufilm17. They also tested two insect growth regulators: pyriproxyfen (as Fulcrum) and azadiractin (as Molt-X) as stand-alone treatments or in tank mixes with horticulture oil SuffOil-X. Additional treatments included SuffOil-X as a stand-alone treatment, an untreated control and



A Natchez White that was naturally infested with the crape myrtle bark scale and not treated with any insecticides shows sooty mold and white clusters of bark scale ovisac and gravid adults on its trunks. Photo by Yan Chen

a neonicotinoid treatment (dinotefuran as Zylam 20SG). All treatments were applied as foliar and trunk spray to 80 Natchez White crape myrtles, based on crawler activity monitored weekly from untreated trees using double-sided sticky tapes (Figure 1).

Pyriproxyfen provided the best and most long-lasting control. Control effects were 100 percent from 76 to 210 days after the first application (Figure 2). Stand-alone treatments of Molt-X and SuffOil-X provided only partial suppression.

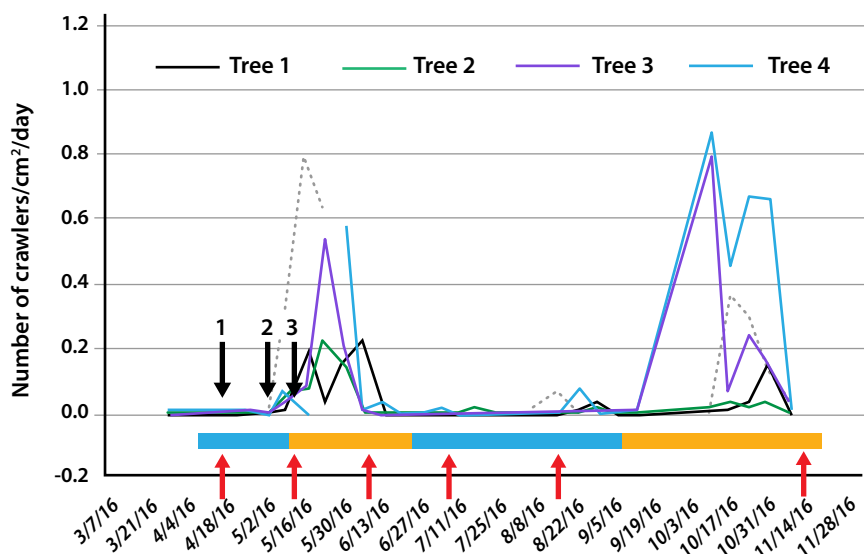


Figure 1. Crape myrtle bark scale crawler population trend in 2016 as monitored on untreated trees at the field trial location. Three applications of treatments (black arrows) were applied at the early stage of crawler emergence on April 14, May 2 and May 12, 2016. Number of nymphs (blue) or adults (orange) were counted on (red arrows from left to right) May 12, May 31, June 30, Aug. 10 and Nov. 9, 2016.

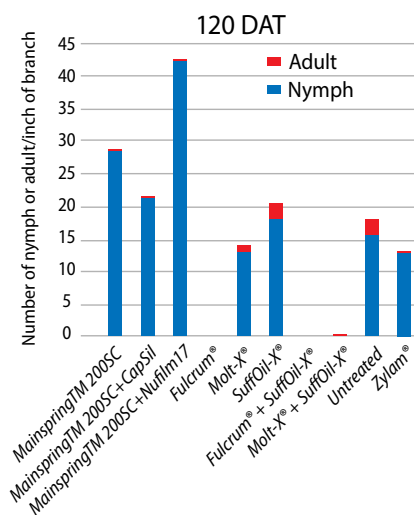


Figure 2. Number of nymphs (blue) or adults (orange) of crape myrtle bark scale counted from selected branches of Natchez White crape myrtles treated with various insecticides at 120 days after the first treatment application (DAT). Trees treated with pyriproxyfen (as Fulcrum), its tank mix with SuffOil-X, and the tank mix of azadiractin (as Molt-X) and SuffOil-X had no crape myrtle bark scale at this sample date.

However, their tank mix provided 100 percent control from 76 to 120 days after the first application. The neonicotinoid (dinotefuran) only provided effective control up to 76 days after the first application. Cyantraniliprole, when mixed with CapSil, suppressed the crape myrtle bark scale population only at 76 days after the first application. This product may need to be applied earlier to have enough time to become available in the bark tissue. Based on these results, insecticides containing insect growth regulators such as pyriproxyfen or a combination of azadiractin and horticulture oil should be incorporated into crape myrtle bark scale integrated pest management program.

Recommendations for controlling crape myrtle bark scale:

- Avoid purchasing crape myrtle plants with sooty mold, even if they are on sale with a discount; they may be pre-

viously infested with crape myrtle bark scale (not just aphid, which also causes sooty mold) and still carry eggs, even if they were treated.

- Treat with insecticides that have a short residual or are less toxic to beneficials/pollinators, such as horticulture oils and insect growth regulators, at the crawler stage.
- There are usually two crawler peaks in Louisiana – late April to mid-May and late September to mid-October.
- Catching the first crawler peak in the spring is critical; its timing is closely related to leaf budding of crape myrtles and will be earlier with early spring weather.
- Foliar spraying of insect growth regulators or their tank mixes with horticulture oils, such as Fulcrum (pyriproxyfen) or Molt-X (azadiractin) with SuffOil-X, were found most

effective against crape myrtle bark scale.

- Foliar spraying of systemic insecticides such as Merit (imidacloprid) or Zylam (dinotefuran) can provide good controls, but they cannot be applied to blooming crape myrtles that may have pollen-seeking pollinators; read label information for protecting pollinators.

Crape myrtle bark scale is found in Alexandria, Baton Rouge, Bossier City, Covington, Hammond, Houma, Mandeville, Minden, New Orleans and Rayville in Louisiana. If you find a new infestation, please contact the LSU AgCenter Hammond Research Station at 985-543-4125 or email Yan Chen at yachen@agcenter.lsu.edu.

Yan Chen is an associate professor, and Allen Owings is a professor, both at the Hammond Research Station in Hammond, Louisiana.

Bt Applied As a Spray Insecticide

Dennis Ring

B*acillus thuringiensis* (*Bt*) is a species of bacterium found in the soil. It was isolated in 1901 and named in 1911. It was used as a commercial biological insecticide for the first time in the U.S. in 1958. *Bt* kills caterpillars, some fly larvae and some beetle larvae but does not kill other organisms. Strains of *Bt* available in products in the U.S. include the following:

- *Bt* var. *kurstaki* is toxic to lepidopteran (butterfly, skipper and moth) larvae.
- *Bt* var. *aizawai* is toxic to wax moth larvae.
- *Bt* var. *israelensis* is toxic to mosquito, midge, fungus gnats and blackfly larvae.
- *Bt* var. *galleriae* is toxic to larvae of May or June beetles (white grubs).
- *Bt* var. *tenebrionis* (or var. San Diego) is toxic to Colorado potato beetle, elm leaf beetle and willow leaf beetle larvae; however, it does not kill all leaf beetles.

Because this insecticide kills larvae of butterflies, moths and skippers (lepidopterans), care should be taken so that nontarget plants are not treated and drift on other plants does not occur. If the product drifts to a nontarget plant with larvae of lepidopterans on them and is eaten by the larvae, then it will kill them.

Monarch butterflies feed only on milkweed plants, so they will not be harmed if the insecticide does not come in contact with milkweed plants.

Bt strains are specific to the insects they kill; therefore, identifying the injurious insect is extremely important. The correct strain must be applied to susceptible insects. Applications of *Bt* to insects not susceptible will not kill them. It does not kill predators, parasites or bees. *Bt* is most effective against young larvae and usually does not kill insects in the adult or other growth stages. Thus, inspections should be made frequently and applications made while larvae are small. Insects must eat *Bt* for it to be effective, and good coverage of the plant is important. Some insects do not eat the outside of the plant part they attack, so applications of *Bt* on the surface of the plant will not kill them. For example, the pecan nut casebearer (a moth) bites the outside of nutlets and spits it out. This insect eats the inside of nutlets and does not eat the *Bt*.

Bt as a biological insecticide applied to plants is not systemic (moving throughout the plant) or translaminar (moving throughout the leaf) and does not kill on contact. It is not toxic to predators, parasites or pollinators and is listed as an organic insecticide. It is placed in a

group of microorganisms that disrupt the midgut membranes of specific insects.

Bt is rapidly deactivated by ultraviolet sunlight. Applications made in the evening and on cloudy or on rainy days last longer. However, heavy rains can wash *Bt* off a plant. Applications become inactivated in one to a few days and may need to be reapplied in three to seven days. Applications for leaf beetles may be effective for only one day. Applications of *Bt* do not result in continuous or long-term insect management. Once a solution of *Bt* is prepared, it should be used immediately – especially if the water used to make the solution has a pH greater than 7 (basic).

The effectiveness of *Bt* may be reduced after two or three years of storage. Dry formulations last longer than liquid formulations. *Bt* products should be stored out of sunlight and in cool, dry conditions.

A crystalline toxin and spore is usually produced by *Bt* cells. Spores may become bacterial cells inside the insect. Once the insect eats the *Bt*, the toxin is activated in the insect's gut by enzymes and alkaline conditions of the gut. The toxin disrupts the cell walls of the gut, and bacterial cells enter the insect's body. Infected insects stop feeding in a few hours and die in a few hours to weeks, usually two to three days.

Dennis Ring is a professor and extension entomologist in the Department of Entomology.

Managing Two Highly Invasive Weed Species in Landscapes

Ron Strahan

Weeds that invade landscapes often can pose serious problems. Some of the toughest weeds to manage are those that spread vegetatively through rhizomes or some other underground storage organ. Regular treatments with herbicides are the surest way to conquer two of these weeds, bushkiller and torpedograss.

***Cayratia japonica* (Bushkiller)**

Bushkiller vine is a highly invasive summer perennial that infests home landscapes across the Gulf Coast. Native to Asia, bushkiller gets its name because the vine rapidly climbs over desirable landscape plants and kills them by blocking out sunlight. The vine has compound leaves with five leaflets that are ovate to

orbicular, 3 or more inches long and 0.5 to 1.5 inches wide. Often bushkiller is confused with another five leaflet vine, Virginia creeper (*Parthenocissus quinquefolia*). However, the middle leaflet on bushkiller has its own stem. Bushkiller has tendrils that grow opposite each leaf and salmon-colored flowers that produce berries that contain two to four seeds. The vine mainly reproduces vegetatively as the seeds do not have high viability.

Bushkiller vine control: Once bushkiller vine invades landscapes, hand removal is difficult. All of the roots must be removed because of the vine's ability to re-sprout from roots and rhizome material left in the soil. Research conducted at the LSU AgCenter has shown that repeated applications of the herbicides triclopyr



Bushkiller leaf. Photo by Ron Strahan



Virginia creeper can often be confused with bushkiller. Photo by Ron Strahan



Bushkiller vine engulfs landscape plants blocking out sunlight. Photo by Ron Strahan

or glyphosate can be effective. However, the vine engulfs flower beds and becomes entangled in desirable vegetation, making spraying difficult. In areas where spraying is not possible, pulling vines away from landscape plants and wiping or brushing the leaves and stems with a 10% solution glyphosate (using 41% glyphosate active ingredient formulation in water) can be effective. Regardless of the method used, removing bushkiller vine from the landscape will likely take years of persistent herbicide treatment.

***Panicum repens* (Torpedograss)**

Torpedograss is a perennial rhizomatous grass that is considered one of the most invasive grasses in the world. The grass is characterized by creeping, pointed, torpedo-shaped rhizomes. Torpedograss has erect leaves that may be up to 10 inches long and 0.3 inches wide. The inner side of the leaf sheath is membranous with short hairs. Although the plant produces seeds, they are not viable. The weedy grass solely reproduces vegetatively by robust rhizomes.

The spread of torpedograss in Louisiana is mainly attributed to the movement of soils infested with weed from the Bonnet Carré Spillway. The spillway is located just west of New Orleans and is the main source of plant material for southeast Louisiana, especially within the New Orleans metro area. The weed will grow in a wide range of soil



Torpedograss outcompetes centipedegrass. Photo by Ron Strahan

types and is salt tolerant.

Torpedograss is often introduced into new areas during construction by using soil contaminated with rhizomes. Once introduced into landscapes, torpedograss quickly becomes the predominant species in flower beds and home lawns. There are currently no effective control options in centipedegrass or St. Augustinegrass

lawns. The herbicide quinclorac reduces torpedograss infestations in bermudagrass and zoysiagrass lawns.

Hand removal is not an effective option for eliminating torpedograss in landscape beds. Selective grass-killing herbicides such as sethoxydim and fluzifop only temporarily suppress the weed's growth, although fluzifop is more effec-

tive than sethoxydim. In landscape beds, carefully wiping or brushing the torpedograss leaves and stems with a 10% solution of glyphosate (using 41% glyphosate active ingredient formulation in water) can be effective with repeated use over several growing seasons.

Ron Strahan is an extension weed scientist.

Community Gardening in Louisiana

Johnny Morgan

The recent popularity of the farm-to-table movement is bringing greater interest to the concept of community gardening, and LSU AgCenter agents are seeing more people with interest in producing their own food or at least obtaining it from local sources.

David Young, a former police chief in Indiana and founder of Capstone, a nonprofit organization in the Lower 9th Ward in New Orleans, began a number of urban gardens in 2010.

"I came to the city to help in the rebuilding effort but discovered that there was a greater need than just a physical house," Young said.

Through the organization, he began acquiring vacant lots and planting small gardens. Since then, he has developed more than 20 plots in the city along with two acres in Plaquemines Parish. His goal is to grow food that can be shared with people in the community.

LSU AgCenter horticulturist Lee Rouse called Young "one of my favorite urban gardeners. David is someone that I've worked very closely with on a number of projects."

The local food movement has been slow to catch on in northeast Louisiana, said LSU AgCenter horticulturist Kerry Heafner, of Monroe.

"Urban gardens are a good idea, but what I've found is that once people realize you have to get out in our summer heat and work, it tends to fall by the wayside," Heafner said.

Shreveport Master Gardener Tina Kendrick is involved in the community gardening effort in her area because it has been a way to help the community. "Farm-to-table appeals to many people in urban areas because people want to get involved," she said. "And the work we're doing helps people across all spectrums of the community."

In northwest Louisiana, the Red River Coalition of Community Gardeners (RRCCG), a nonprofit organization whose members promote education about good nutrition and health, is at the forefront of urban gardening.

Working in cooperation with the AgCenter, the group's mission is to create and maintain community gardens in the Shreveport-Bossier area, said Grace Peterson, AgCenter agent in Bossier Parish.

"Using sustainable practices, we grow healthy food, provide education for healthy lifestyles and empower people to share their unique contributions," Peterson said. RRCCG is part of the We Grow Together! Coalition, a group that works with the AgCenter and the City of Shreveport to develop neighborhood food hubs to address four major barriers to access to nutritious food:

- Lack of physical access creates areas with no grocery stores that become "food deserts."
- Lack of financial access means the cost of nutritious food can be prohibitive.
- Lack of knowledge about how to make healthful food choices.
- Lack of knowledge about how to prepare food in a nutritious way.

The RRCCG, guided by AgCenter faculty, is offering garden-based nutrition education to the residents of the neighborhood and surrounding community.

The food hub also serves as a training site for volunteers from other low-income neighborhoods to learn the skills necessary to offer garden-based nutrition education programs in their communities. RRCCG received grant funds from the City of Shreveport Department of Community Development to pay for the installation of an urban garden on the site.

Johnny Morgan is a communications specialist in LSU AgCenter Communications.



Kale, purple cabbage and other cole crops grow in the Capstone community garden at the corner of Derbigny and Deslonde streets in the Lower 9th Ward of New Orleans on Feb. 24, 2017. David Young, founder of Capstone, maintains gardens on 20 lots, most of them in New Orleans. His focus is on the Lower 9th Ward, which is divided from the Upper 9th Ward by the bridge over the Industrial Canal, seen in the background. Photo by Olivia McClure



Picture 1. Strip grazing also assures good utilization of the stockpiled grass (Dean Lee Research Station). Photo by Jeff Gurie

Extending Grazing Through Fall and Winter

Is stockpiled bermudagrass an option for pregnant beef cows during mid-to-late gestation?

Guillermo Scaglia, Jeffrey Gurie and Glen Gentry

A large portion of cow/calf enterprise production costs are associated with hay feeding that occurs when standing forage nutritive value and/or quantity are low.

Extending grazing through fall and winter reduces the amount of harvested forage needed to maintain cow performance and could reduce production costs associated with winter feeding. Grazing can be extended by different forage management practices, including the use of stockpiled forage. Stockpiling refers to the practice of allowing forage biomass to accumulate in the field until it is needed for grazing. Forages are generally stockpiled for use during the fall and winter, but they can be accumulated for use during any period of expected deficiency. In the southern United States, bermudagrass stands are mainly used for grazing or hay. There is little information on managing stockpiled bermudagrass for the specific purposes of providing fall and winter grazing and thereby reducing the cost of feeding winter hay.

If a medium-quality (8 percent crude protein and 54 percent total digestible nutrients) bermudagrass round bale weighs 1,100 pounds, the average body weight of 20 mature cows is 1,300 pounds and they can consume 2.25 percent of their body weight of that hay per day (29.25 pounds), then one bale is enough for almost two days. Based on these figures, keeping 20 cows on

stockpiled bermudagrass for 60 days can theoretically save 30 bales of hay. If this saving is possible, at \$50 per bale, a producer can save up to \$75 per cow, assuming other costs (fertilizer, labor, fence supplies) are similar. The question, however, is if the nutritive value of stockpiled bermudagrass is enough to provide a pregnant beef cow with enough protein and energy to cover her nutrient requirements?

The attributes of bermudagrass that make it a widely used forage in the South include high biomass production potential, the ability to withstand sustained intense grazing pressure, acceptable palatability, the absence of low-quality components and tolerance to stress agents such as drought, insects and diseases.

Stockpiling forages is an important management practice to reduce wintering cattle on hay, reduce labor and other costs and mitigate damage to the ground when wet. Even though true, stockpiling bermudagrass has its own issues. The landscape in central and south Louisiana is flat; hence, there is always risk of flooding or draining accumulated rainwater from the fields. Also, rainfall can affect nutrient content of stockpiled bermudagrass.

At the Dean Lee Research Station and the Iberia Research Station, pastures of the bermudagrass hybrid Alicia were

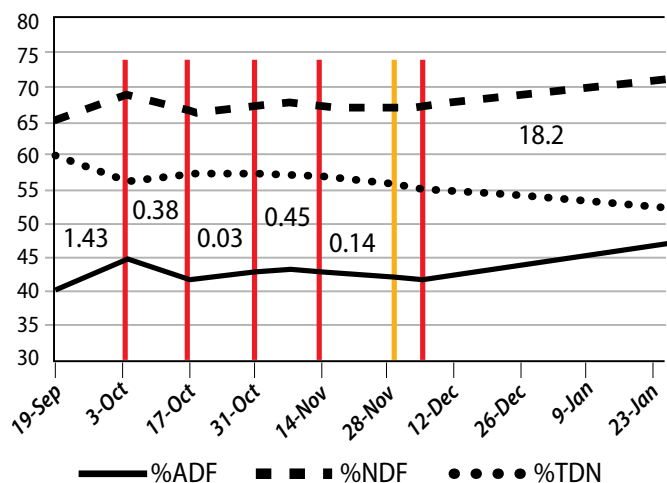


Figure 1. Changes in percent acid detergent fiber (ADF), neutral detergent fiber (NDF) and total digestible nutrients (TDN) through time (September 2012 – January 2013). Number between red vertical lines represent rainfall (inches).

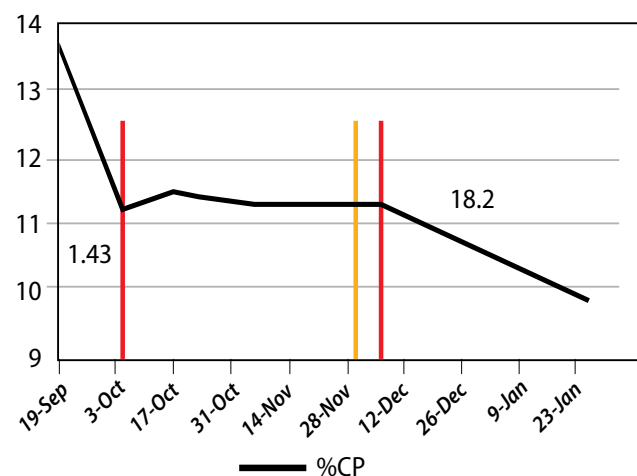


Figure 2. Changes in percent crude protein (CP) through time (September 2012 – January 2013).

stockpiled in three consecutive years. Hay was harvested in late August and the pastures were fertilized with nitrogen and allowed to re-grow. These pastures were not grazed until sufficient forage mass was produced, which occurred in late November. Pastures were stocked using strip grazing, which was moved every day. Each year, two groups of 20 pregnant cows with an average body weight of 1,369 pounds and body condition score of 5.1 (in a scale of 1=emaciated to 9=obese) were used.

Figures 1 and 2 represent the nutritive value of the bermudagrass stockpiled at the Dean Lee Research Station in the 2012-2013 season. The numbers in the graph between vertical lines represent inches of rain during that time. In the two weeks between September 19 and October 4, 1.43 inches of rain produced a decrease in percent of total digestible nutrients and increases in the concentration of neutral detergent fiber, which causes a reduction in matter intake and acid detergent fiber, which decreases digestibility, (Figure 1) as well as a sharp decrease in crude protein (Figure 2). This period was followed by a relative dry period in which 1 inch of rain fell in two months. During this time, the nutritive value of the bermudagrass remained unchanged. After December 4, 18.2 inches of rain affected the nutritive value of the grass. The yellow vertical line in Figures 1 and 2 represents the date of the first frost, which did not affect the nutritive value.

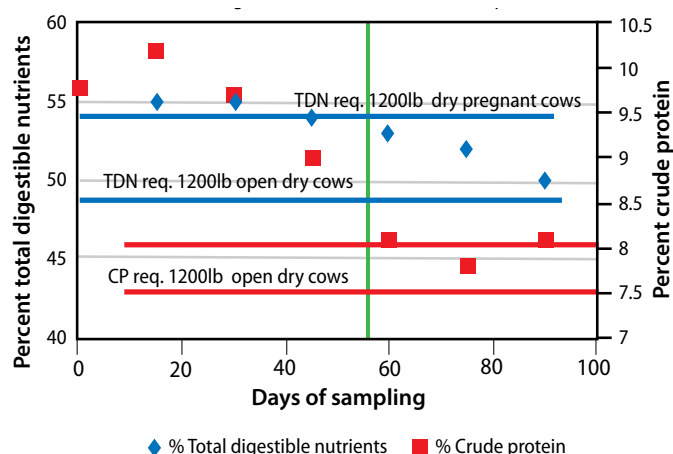


Figure 3. Average percent total digestible nutrients (diamonds) and crude protein (squares) of stockpiled bermudagrass and percent total digestible nutrients (blue horizontal line) and crude protein (red horizontal line) requirements for pregnant or open dry cows.

Table 1 shows the changes in body weight and body condition score of the cows used in both experiments as well as the length of the grazing period. Clearly, cows grazing only stockpiled bermudagrass did not meet their nutritional requirements because they lost weight and condition during the experimental periods, which varied with year and location. All cows were starting their last trimester of gestation. During this time, the fetus

Table 1. Changes in average body weight and average body condition score of pregnant crossbred cows at Dean Lee and Iberia research stations.

Dean Lee Research Station					
Year	Initial Body Weight, pounds	Initial Body Condition Score	Body Weight change, pounds	Body Condition Score change	Length, days
1	1,341	4.9	-180	-1.2	44
2	1,323	5.2	-81	-0.5	31
3	1,312	5.3	-30.5	-0.4	34
Iberia Research Station					
Year	Initial Body Weight, pounds	Initial Body Condition Score	Body Weight change, pounds	Body Condition Score change	Length, days
1	1,369	5.2	-115	-0.8	51
2	1,402	5.5	-66	-0.6	56
3	1,412	5.3	-40.5	-0.4	60

grows exponentially and the cow's requirements also increase substantially.

Figure 3 shows the changes in nutritive value we observed at both locations through the years. The green vertical line represents grazing initiation. The blue (percent total digestible nutrients) and red (percent crude protein) horizontal lines represent the nutritional requirements of cows in two different physiological stages: non-lactating and pregnant (last third of gestation) and non-lactating and not pregnant. While the pregnant female has greater requirements because she is at the last stage of gestation, the non-pregnant female has only maintenance requirements, which are less. Figure 3 shows 1,200-pound open dry cows have requirements for total digestible nutrients (blue line) and crude protein (red line) that were met by the stockpiled bermudagrass; hence, they could be wintered on it without any problems. The nutritional requirements of pregnant cows, however, are greater, and the results indicate that total digestible nutrients were not met by the stockpiled bermudagrass, and crude protein was only marginally met by the forage. Based on these data, pregnant cows would require a feed supplement if grazing stockpiled bermudagrass.

Stockpiled forages have at least a couple of months of accumulation. It is recommended to strip-graze all stockpiled for-

ages to avoid trampling and improve consumption of the forage (Picture 1) and uniform distribution of feces (Picture 2).

Stockpiled bermudagrass may help saving hay. This practice can be used with animals that have low nutrient requirements such as open mature cows. If producers want to use it with pregnant cows, then these should be supplemented. The Iberia Research Station has successfully maintained or improved condition in pregnant cows grazing on stockpiled bermudagrass with daily supplements of 0.7 percent of their body weight in soybean hull pellets (9 pounds per day for a 1,300-pound cow) or 0.4 percent of body weight in ground corn (5 pounds per day for a 1,300-pound cow). Weather, mainly rainfall, influences how quickly the stockpiled material can deteriorate. If soils are flooded, cattle will reduce dry matter intake from standing forages such as stockpiled bermudagrass. And depending on how long those soils remain with standing water, a pregnant cow's condition can quickly deteriorate.

Guillermo Scaglia is a professor at the Iberia Research Station, Jeanerette; Jeffrey Gurie is a research associate at the Dean Lee Research Station, Alexandria; and Glen Gentry is an associate professor and director at the Bob R. Jones Idlewild Research Station, Clinton.



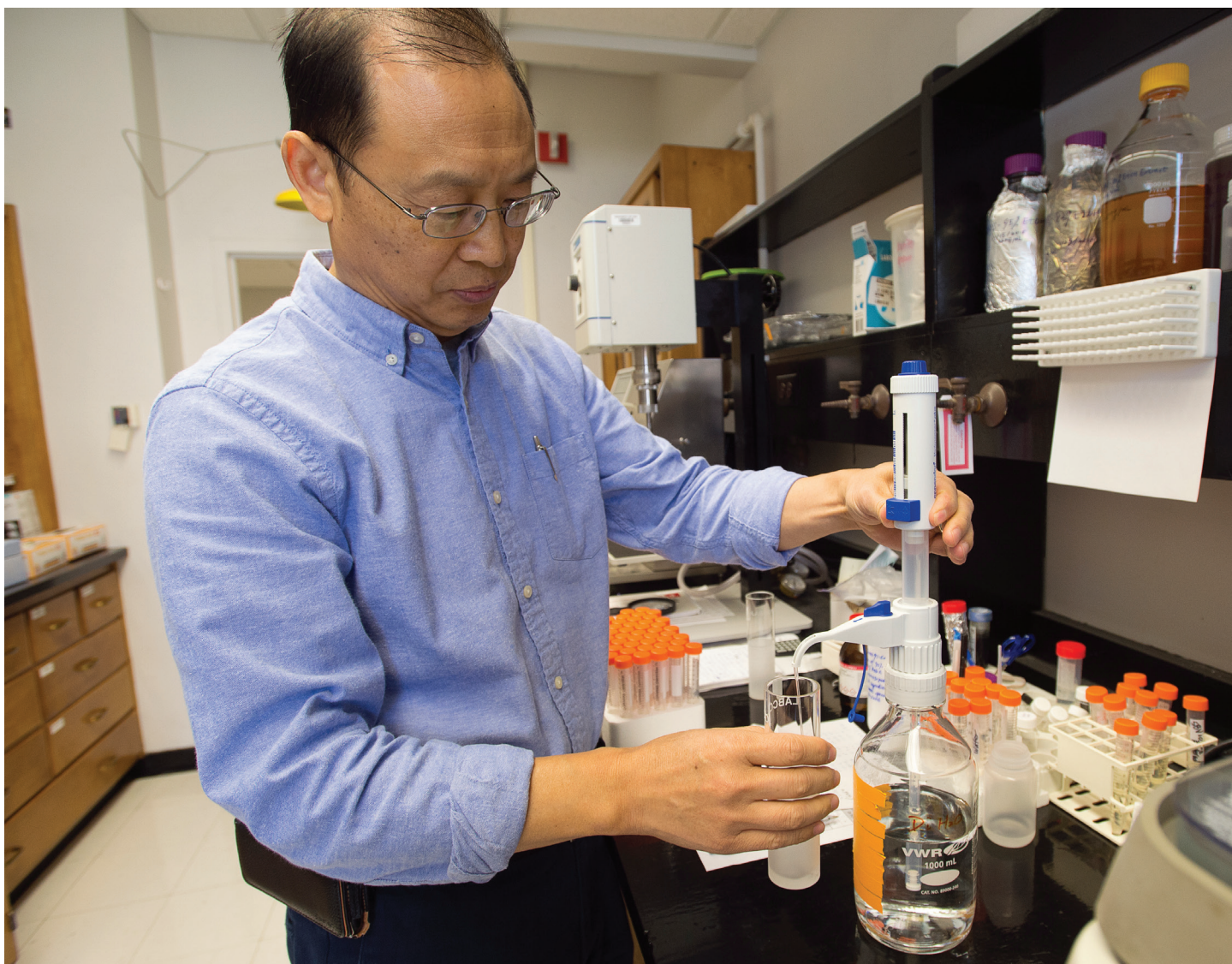
Picture 2. Strip grazing stockpiled bermudagrass can assure appropriate manure distribution (Dean Lee Research Station). Photo by Jeff Gurie



Picture 3. Stockpiled grasses are also called standing hay (Iberia Research Station). Photo by Jeff Gurie



Picture 4. Pregnant Brangus cows on stockpiled bermudagrass (Iberia Research Station). Photo by Guillermo Scaglia



Zhijun Liu in his lab. Photo by Olivia McClure

Antibacterial Botanical Formulations

Zhijun Liu, William E. Owens, Yixuan Dong and Jian Zhang

Plants employ a plethora of molecules as their chemical weapons against bacterial invasion. Bovine mastitis is a bacterial infection of the mammary gland of cows and a major health issue for the dairy industry. Germicidal teat dips commonly containing iodine (Figure 1A) as the active ingredient are often used to disinfect the udder prior to milking to help reduce new infections. However, iodine residues in milk can be problematic. This research is intended to find bioequivalent plant extracts as safer and skin-friendlier alternatives.

Many essential oils, including tea tree oil, are known to be antimicrobial. Essential oils have been widely used since ancient times. The problem is essential oils are not miscible or capable of being mixed with water. This property has made it difficult for water applications such as immersions and sprays. There are many methods for dispersing essential oils in water, but effectiveness and stability, as well as safety issues, have made them less desirable. However, a new method has been identified for

overcoming this problem. A water-soluble plant extract and an insoluble essential oil were used to show proof of concept. In this study, plant extracts of sweet leaf tea and tea tree oil were prepared so they were soluble in water and culture media without the use of any organic solvents such as ethanol, dimethyl sulfoxide, propylene glycol or polyethylene glycol. Sweet leaf tea is water-soluble (Figure 1B), but tea tree oil is not (Figure 1C). Dispersion in water was done by using a botanical solubilizer from the steviol glycosides family. The LSU AgCenter holds several patents on the use of some steviol glycosides as solubilizers. The use of the botanical solubilizer created a water-miscible tea tree oil solution (Figure 1D).

The aqueous solutions of the extracts were tested against bacteria known to cause mastitis. The test was run based on a standard protocol. The tested organisms included two gram-positive bacteria, *Staphylococcus aureus* and *Enterococcus faecalis*, and two gram-negative bacteria, *Escherichia coli* and *Pseudomonas*

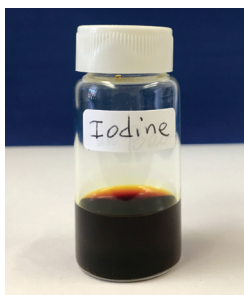


Figure 1A. Iodine used to sanitize teats before milking to control mastitis.



Figure 1B. Water-soluble sweet leaf tea extract.

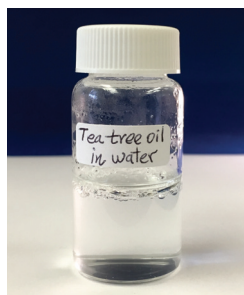


Figure 1C. Tea tree oil on top layer not mixable in water.

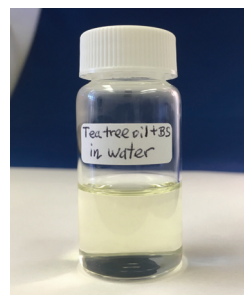


Figure 1D. Tea tree oil dispersed in water in the presence of a botanical solubilizer.

aeruginosa. Small samples of each 24-hour bacterial culture were standardized and added to samples of the test extracts as well as iodine as a positive control. After 30 seconds and again after 10 minutes, samples were removed and plated to create colonies, which were incubated for 24 hours and then counted.

Both sweet leaf tea and tea tree oil showed antibacterial activity. Sweet leaf tea inhibited the growth of *S. aureus* by 56 percent in 30 seconds and 64 percent in 10 minutes; *E. fecalis* by 92 percent in 30 seconds and 91 percent in 10 minutes; *E. coli* by 86 percent in 30 seconds and 90 percent in 10 minutes; and *P. aeruginosa* by 93 percent in 30 seconds and 99 percent in 10 minutes. Tea tree oil was much quicker in action and more potent; in 30 seconds, it killed 99 percent of the gram-positive bacteria and greater than 99 percent of the two gram-negative bacteria. In 10 minutes, tea tree oil killed essentially all bacteria with a greater than 99 percent reduction of every organism that came into contact with it. Iodine, as expected, killed essentially all the bacteria in contact. It is evident that the tea tree oil formulation has a comparable antibacterial effect to the standard iodine product. The solubilizer used in the tea tree oil formulation alone showed some inhibitory effect against these bacteria, but it is the tea tree oil that acts as the antibacterial ingredient (Figure 2).

The sweet leaf tea showed some antibacterial activity, but in its current form maxed out at 90 percent. Because the sweet leaf tea extract is a mixture of compounds, its antibacterial activity may be further enhanced by optimizing the components. But this remains to be seen.

The tea tree oil formulation, on the other hand, showed excellent antibacterial activity. It killed both gram-positive and gram-negative bacteria instantly and completely upon contact, as did the iodine. Using the bioequivalent botanical formulation instead of the standard antibacterial iodine product opens the door to safer and better products in preventing mastitis and bacterial infection. Stevia extract, which was used as a botanical solubilizer in the tea tree oil formulation, is on the Food and Drug Administration GRAS (generally regarded as safe) list for food sweetening. The formulation consisting of an active essential oil and inactive food sweetener would be much safer to humans than iodine and its formulating ingredients. The combined efficacy and safety offer a better way to control bacteria in food production than is currently available. Iodine is a synthetic antimicrobial agent. Although it has been listed as a material allowable for restricted organic food production, iodine is closely monitored for its residue in milk. An increasing level of iodine in milk has been a concern to human health.

Tea tree oil for inhibiting bacterial growth in a 100 percent

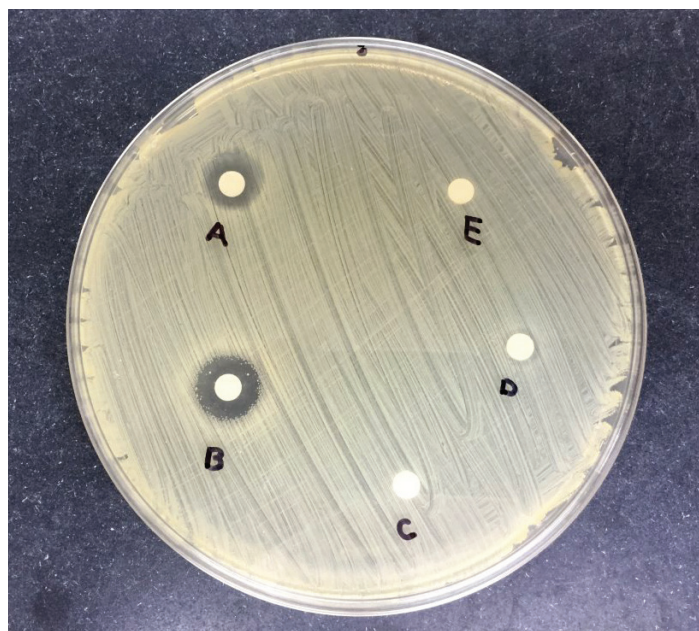


Figure 2. A plate on which *Staph. aureus* is being grown. Paper discs were saturated with samples of A: tea tree oil in water with a botanical solubilizer (TTO+BS), B: tea tree oil solubilized in DMSO (dimethyl sulfoxide) solvent (TTO+DMSO), C: DMSO (dimethyl sulfoxide) by itself, D: a botanical solubilizer as a carrier by itself, and E: saline as negative control. Bacterial growth around the samples can be seen. A and B containing the antibacterial tea tree oil produced a clear inhibitory zone, showing no bacterial growth, whereas C and E produced no zone, showing full bacterial growth. D produced a visible but much smaller zone compared to A and B, each containing tea tree oil. This is a clear indication that tea tree oil is antibacterial and can be solubilized without the use of organic solvents such as DMSO.

botanical formulation is bioequivalent to, and has a safer profile than, iodine. This raises promise in finding alternative methods for preventing mastitis. The laboratory results reported here warrant more tests for preventing surface bacterial infection such as bovine mastitis and postharvest food sanitation. The success in formulating tea tree oil also sets the stage for formulating other antimicrobial essential oils, such as those in cloves, cinnamon and thyme, that are even more potent and safer. Essential oils of cloves, cinnamon and thyme are listed as GRAS and as active ingredients eligible for minimum risk pesticide products by the Environmental Protection Agency.

Zhijun Liu is a professor in the Medicinal Plant Lab in the School of Renewable Natural Resources; William Owens is a professor and resident coordinator of the Hill Farm Research Station, Homer, Louisiana; Yixuan Dong is a former postdoctoral researcher; and Jian Zhang is a former research associate in the Medicinal Plant Lab in the School of Renewable Natural Resources.

Size Matters: Crystal Size Analysis for the Louisiana Sugar Industry

Franz Ehrenhauser, Daira Aragon, Cy Gaudet and Iryna Tishechkina

Size matters when it comes to sugar crystals and the efficient processing of cane juice into refined sugar for human consumption. More than a third of the U.S. domestic cane sugar production, 1.4 million tons, is grown and processed into raw and white sugar in Louisiana. The basic processing steps at each of the 11 raw sugar factories in Louisiana are milling and extracting the juice from the cane, then clarifying and concentrating the juices to syrups. Out of these syrups raw sugar is crystallized in the raw sugar factory. The raw sugar is further processed into refined sugar for human consumption at one of two Louisiana refineries. Recovery during the crystallization is key to efficient operation and to maximize the return to factory and grower. To aid the sugar industry, the LSU AgCenter Audubon Sugar Institute provides educational and technical support and has since 1891, when the first Audubon Sugar School was held.

Since 2007, the Audubon Sugar Institute has been providing crystal size analysis based on laser diffraction. Before then, crystal size measurement was done manually by measuring sugar crystals under a microscope, which is time con-

suming and lacks reproducibility unless a large number of crystals are counted. The laser diffractometer is capable of measuring thousands of particles in suspension from the nanometer to the millimeter scale within a few minutes. As the instrument assesses diffractive properties, it measures a size-equivalent sphere, giving a better volume representation than the two-dimensional measurement under the microscope. During the grinding season more than 500 samples undergo analysis, and reports are sent to the industry to help them improve their process.

Seed Slurry

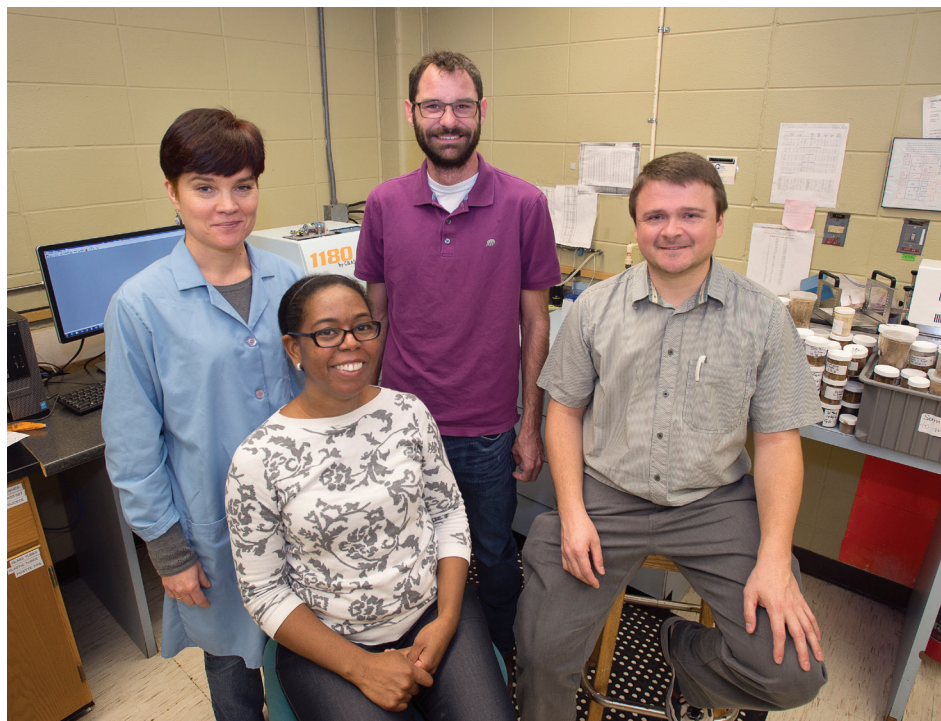
Tiny seed crystals are used to initiate crystallization from the syrup or molasses. As such the seed is the heart of every sugar crystal leaving the factory. The modern practice in sugar crystallization is to use full seeding, where every crystal is deliberately initiated with a seed crystal from seed slurry. Three slurry types are typically used – powdered sugar, ball-milled sugar and ball-milled powdered sugar. All are suspended in isopropanol. The ball-milled type involves putting the sugar in a mixer with lots of steel balls inside. A consistent quality and quantity

of seed crystals is important to operate the sugar crystallization efficiently.

Table 1 gives an overview of the basic properties for analysis. D10%, the 10-percentile, describes the smallest crystals in the distribution, i.e. 10 percent of the mass of all crystals are below this size. D50% is a descriptor also called the median, and D90% describes the largest crystals in the distribution. The coefficient of variation (CV) describes the width of the distribution, where a smaller number means a more favorable, narrower distribution. The size of powdered sugar ranges from 3 microns to 50 microns (a human hair is between 40 microns and 60 microns thick) with a typical coefficient of variation from 0.62 to 0.76 and a seed content of 51 to 86 million crystals per gram. Ball-milled seed slurries have substantially smaller crystals with a D90% of only 19 microns providing at least 10 times more seed per gram of sugar than powdered sugar. Other important factors found to provide consistency for the seeding are proper (dry) storage of powdered sugar, proper mixing and sufficient ball milling time (minimum four hours for powdered sugar, five hours for granulated sugar).

C-sugar and Centrifugal Recovery

Typically, the seed slurry is used to produce so-called C-sugar. This C-sugar is not pure enough for the refinery, and it is used as seed for the commercially valuable, high purity A- and B-sugars. The crystal size and uniform distribution of the C-sugar are therefore important because affect production into commercial raw sugar. The size of the C-sugar is also relevant for overall sugar recovery because C-sugar is the last sugar crystallized before the syrup becomes blackstrap molasses (used for animal feed), and no further sugar can be obtained from it. Any losses to the blackstrap molasses are final. Figure 1 shows the variation of the measured C-sugars for the 2015-2016 season for all 11 raw sugar factories. The size ranges from 14 microns to 428 microns with an overall average median of 184 microns. In Louisiana, C-sugar



Left to right are Iryna Tishechkina, Daira Aragon, Cy Gaudet and Franz Ehrenhauser. Photo by Olivia McClure

size rarely exceeds 450 microns, with a typical 90-percentile season average of 405 microns. This seemingly arbitrary upper limit is most likely associated with a slowing down of crystal growth as the process proceeds.

While smaller crystals provide more surface area for crystallization, they also challenge the separation. The loss of sugar in C-station centrifugal machines, where the molasses-sugar mixture is separated, is particularly troublesome

because these losses are unrecoverable losses to molasses. Figure 2 shows the purity rise (loss to molasses) across a C-sugar centrifugal machine in dependence of the median crystal size. The purity rise ranges from 3.5 to 6.5 with seemingly no direct correlation to the crystal size. However, the data exhibit no points in the lower left corner of the graph, where low purity rises (low loss to molasses) would be achieved with low crystal sizes. While there are many

factors contributing to the purity rise, it is clear that a low purity rise is rarely achieved with small crystal sizes. As such, the factory should aim at an optimum crystal size where there is sufficient surface area for crystallization and the crystals are large enough to keep centrifugal purity rise to a minimum.

Sugar crystal size analysis can give quick and valuable insight to help factories maximize sugar recovery. While some general recommendations are possible, there is no one-size-fits-all answer when it comes to sugar crystallization. Every sugar mill is unique in its process and the seed slurry and C-sugar sizes need to be optimized to the individual mill's need.

Franz Ehrenhauser and Daira Aragon are assistant professors, and Cy Gaudet and Iryna Tishechkina are research associates at the Audubon Sugar Institute.

Table 1. Size distributions of seed slurries used in Louisiana.

Type of slurry	D10% micron	D50% micron	D90% micron	CV	Mean micron	# crystals per gram
Powdered sugar (Brand I)	3.6	18.8	50	0.76	23.5	51×10 ⁶
Powdered sugar (Brand II)	4.9	19.4	40.6	0.62	21.5	66×10 ⁶
Powdered sugar (Brand III)	3.6	16.4	40.5	0.71	19.8	86×10 ⁶
Ball-milled granulated sugar (5 hours)	2.6	8.4	19.3	0.67	9.8	701×10 ⁶
Ball-milled powdered sugar (4 hours)	2.6	8.7	18.4	0.63	9.8	715×10 ⁶

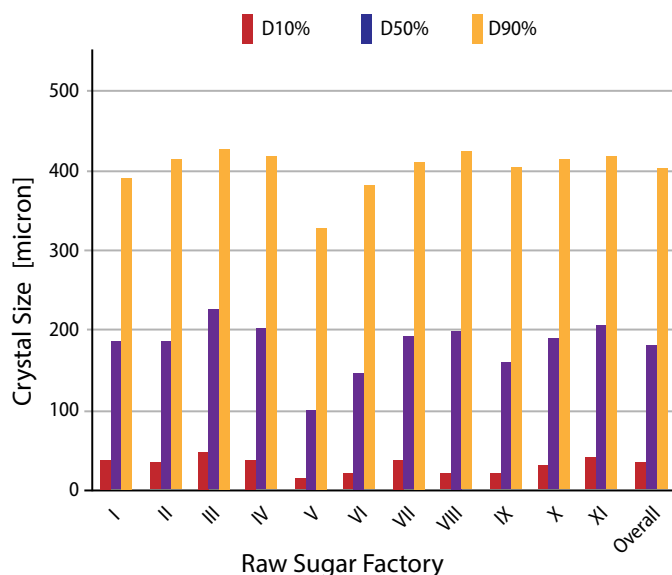


Figure 1. Average C-sugar crystal size in Louisiana during the 2015-2016 season with 10- and 90-percentile (D10% and D90%) and median value given.



A-, B- and C-sugar (from left to right)

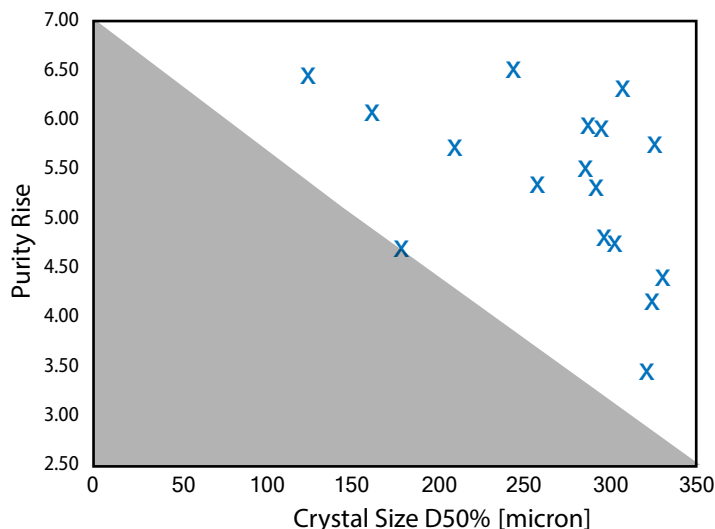
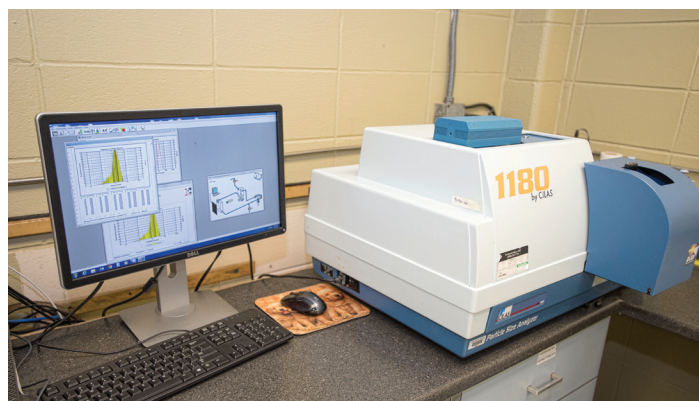


Figure 2. Purity rise across a C-centrifugal machine versus the median diameter of the C-sugar.



Cilas 1180 Laser Diffraction Particle Size Analyzer

Healthy Communities: Making Healthy Choice Easy

Denise Holston and Elisabeth Altazan

According to the Behavioral Risk Factor Surveillance System data of 2012, the U.S. had an adult obesity rate of 28.1 percent while Louisiana had a rate of 34.7 percent. Further, according to these same data, 16 Louisiana parishes had adult obesity rates greater than 40 percent. Obesity places a person at increased risk of chronic diseases such as cardiovascular disease, hypertension, hypercholesterolemia, type 2 diabetes, some forms of cancer, osteoarthritis and gall bladder disease. Failure to meet dietary and physical activity recommendations can place a person at risk for obesity. The physical environment can further influence a person's health outcomes. Community-level environmental factors, such as lack of access to nutrient-dense foods or safe places to be physically active, contribute to the obesity epidemic and can be described as anything "external" to the individual. In terms of preventative health, changes in individual behaviors must be supported by changes in the environment in which an individual lives, works and plays to be sustainable over time.

In September 2015, the U.S. Centers for Disease Control and Prevention awarded the LSU AgCenter a grant to increase physical activity and access to healthy foods in three rural parishes with obesity rates greater than 40 percent: St. Helena, Madison and Tensas parishes. The initiative, titled Healthy Communities, uses a model based on the relationship of the individual with various environments and focuses on encouraging policy, systems and environment changes to help make the healthy choice the easy choice. The Healthy Communities initiative uses a community participatory model to ensure the communities are driving the decision-making process. With guidance from the CDC, Healthy Communities focuses on three strategies:

1. Provide education and promotional support to environmental approaches.
2. Implement strategies to increase consumption of healthy food.
3. Implement strategies to increase opportunities for physical activity.

To accomplish these strategies, the AgCenter partnered with the Southern University Agricultural Research and Extension Center, the Louisiana

Department of Health and Pennington Biomedical Research Center. These four entities as the state team engaged state-level partners such as the Louisiana Department of Transportation and Development, the Center for Planning Excellence, the Capital Region Planning Commission and local community leadership and stakeholders.

The first six months of the project focused on community needs assessments through community forums and asset mapping, coalition building and partner development. The second half of the first year and the second year focused on implementing evidence- and practice-based interventions surrounding nutrition and physical activity. The coalition-building process began in January 2015, and with no existing local health-oriented coalitions to work with, Healthy Communities successfully convened in each parish a Healthy Communities Coalition, which have been meeting monthly since March 2015. Community partners on these coalitions include elected officials, school board members, school superintendents, health-care representatives, general community members, the Council on Aging, local government representatives, youth, U.S. Department of Agriculture Rural Development representatives, health practitioners and various local nonprofits.

Community coalitions in each parish have begun programs that include increas-

ing places where people can go for walks, developing an active community transportation plan, developing joint use agreements, delivering evidence-based educational programs, hosting community events. Other activities include working with schools to implement or update their school wellness policies, developing community gardens and farmers markets, working with local grocers to increase and promote healthy options through point-of-purchase materials and social marketing, and providing technical assistance to the community as needed.

Since the development and distribution of the year 1 report, additional successes include a healthy check-out aisle and point-of purchase materials at the major grocery store as well as acceptance in the Local Food Local Places program in Madison Parish, two crosswalks approved in Tensas Parish and planting an orchard in St. Helena Parish. A fourth parish, West Feliciana, will also start the project in 2017.

Engaging community members from several sectors to guide interventions and policy changes is integral to making a community a more active, healthy environment. For more information about the Healthy Communities Initiative, please contact Denise Holston at 225-578-4573.

Denise Holston is an instructor and Elisabeth Altazan is an extension associate in the School of Nutrition and Food Sciences.



Members of the LSU AgCenter-led Healthy Communities coalition are escorted by a St. Helena Parish sheriff's deputy as they walk along La. 10 in Greensburg during a tour to identify ways to improve nutrition and exercise opportunities in the town on July 11, 2016. Mark Fenton, pointing at left, who is a nationally known public health consultant, joined the group to offer his thoughts. Photo by Olivia McClure

Homeschooling Grows in Louisiana and the United States

Mark J. Schafer and Isaiah F.A. Cohen

Homeschooling offers an alternative to enrolling children in public or private schools. Homeschooling increased in the United States from about 850,000 students (1.7 percent) in 1999 to nearly 1.8 million students (3.4 percent) in 2012, according to the most recent figures from the most reliable source, the National Center for Educational Statistics in its publication, *Homeschooling in the United States: 2012*.

Homeschooling is likely to continue to increase for several reasons. First, because more parents are college-educated, more parents view themselves as capable, effective teachers. Second, more resources are available to assist with homeschooling, and many of these resources are easily accessible on the internet. Local homeschooling organizations also provide additional resources and social support.

Parents list many reasons for choosing homeschooling. Homeschooling offers the opportunity for religion-based education and offers the opportunity for more child-centered (as opposed to group- or class-centered) approaches that consider the distinct needs, interests, aspirations and capabilities of individual children. Some parents start homeschooling in kindergarten or even before. For most parents, however, the decision to homeschool was only made after their children's initial experiences with public or private schools did not work out. For example, 75 percent of all homeschooled high school students in 2012 had previously been enrolled in school in earlier grades.

States have responded differently to the growth of homeschooling. Some have instituted regulations. Others have moved to protect parents' rights to homeschool. Some have done both.

Homeschooling has increased unevenly across the United States. This LSU AgCenter study explores how Louisiana compares to other states in terms of homeschooling rates, homeschooling organizations and homeschooling regulations.

Estimating Numbers of Homeschooled Students in Louisiana

All states, including Louisiana, keep counts of student enrollment in public and private schools. But most states, including Louisiana, do not collect data on homeschooled students. Only 12 states have kept homeschooled student counts since 2011, and these data were used to estimate homeschooling rates and counts in Louisiana from 2011 to 2015.

The percentages of homeschoolers in each of the 12 states that maintained data from 2011 to 2015 are shown in Figure 1. The percentages range from 1.5 percent to 3.5 percent for most states. The three outliers are North Carolina – with an exceptionally high rate, increasing from about 5 percent to nearly 6.5 percent – and Connecticut and Pennsylvania, both with low homeschooling rates.

The unadjusted average (bright red line) showed a slight increase over this five-year period from about 2.3 percent to 2.7 percent. Homeschooling rates increased from 2011 to 2015 in eight states but stayed the same or declined in Virginia, Delaware, Pennsylvania and Connecticut.

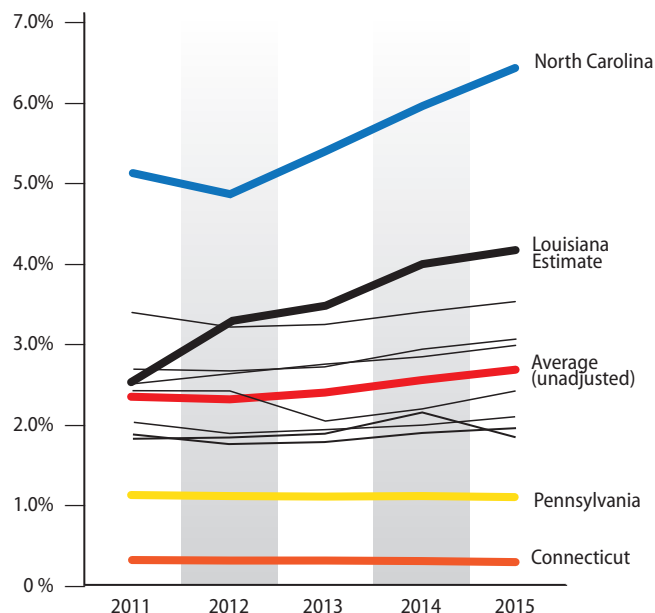


Figure 1. Percent home schooled: 2011-2015. The fine lines are the other states.

Louisiana estimates (black line) determined in the AgCenter study are statistically adjusted (both increased and decreased) based on the following six factors associated with homeschooling:

1. Homeschooling rates are higher in the South than in other U.S. regions.
2. Homeschooling rates are higher in rural areas than in urban areas.
3. Homeschooling rates are higher for higher-income families.
4. Homeschooling rates are higher among evangelical Christian groups than other religious groups.
5. Homeschooling rates are higher for two-parent households than for single-parent households.
6. Homeschooling rates are higher for whites than for other racial and ethnic groups.

Using these adjustments, researchers estimate that Louisiana's homeschooling rate increased from 2.5 percent in 2011 to 4.1 percent in 2015. This technique should provide better estimates than simply using the unadjusted average. Still, two factors reduce the precision of these estimates: (1) the small number of states for which data are available and (2) the fact that North Carolina, an outlier, shares some key characteristics with Louisiana. The AgCenter researchers suggest it is more likely that Louisiana's homeschooling rates are slightly lower, somewhere between this estimate and the unadjusted average. If correct, Louisiana's homeschooling population ranged from 18,500 to 20,000 in 2011 and increased to between 21,000 and 33,000 students in 2015.

Homeschooling Support Organizations

With expansion of homeschooling, communities have emerged to support homeschooling families. Broadly speaking, these communities consist of all individuals, groups and

organizations that provide information and support. Parents can get support from other homeschooling parents and from community organizations such as businesses, museums, libraries, zoos and 4-H.

In addition, formal organizations have emerged at the local, state, regional and national levels over the past 30 years to provide specific instructional and legal support for homeschooling families. AgCenter researchers conducted extensive searches of online databases of all support organizations available to homeschooling families in each state. They used a standardized measure, the number of all organizations per 10,000 estimated homeschooled students in 2015, to compare Louisiana's support organization prevalence to that of other states (Figure 2).

Louisiana's homeschooling organization prevalence (in gold) is 15 organizations per 10,000 students. This is the equivalent of one homeschooling organization for 682 estimated homeschooled students. Louisiana's home-schooling organization prevalence is slightly below the average of 20, and seven states have 40 or more organizations per 10,000 homeschoolers. Wyoming has the highest prevalence of support organizations (60 per 10,000), and New York has the lowest (five per 10,000). In comparison to states with similar numbers of homeschooled students, Louisiana's support organization prevalence is higher than that of Oregon (12), Wisconsin (10) and Colorado (13), but lower than that of Alabama (35), Kentucky (21) and South Carolina (21).

Regulations

Homeschooling expansion has led to both regulations and parent protections at the state level. AgCenter researchers compiled data on state homeschooling regulations in 2015 from online sources. These include state regulations specifically regarding homeschooling as well as state laws protecting parents' rights to homeschool. From a long list of regulations and protections, researchers developed a shorter list of 11 regulations and six protections that potentially pose challenges to homeschooling parents. Examples of regulations include:

1. Compulsory attendance (46 states require)
2. Specific paperwork filing (45 states require)
3. Specific documentation submissions (44 states require)
4. Specific notification procedures (42 states require)
5. Home visits by education authorities (41 states require)
6. Specific homeschool statute (38 states require)
7. Academic assessment submission (37 states require)
8. Teacher qualification specifications (24 states require)
9. Parental burden of proof (22 states require)
10. State homeschool form submission (14 states require)
11. Instruction must take place during public school sessions (one state requires)

Parental protections served to expand the range of options for parents:

1. Alternative homeschool statute (27 states had, 23 states lacked)
2. Allowance for homeschool cooperatives (48 states had, two states lacked)
3. Religious freedom guarantee (20 states had, 30 states lacked)
4. Protection against state regulation (four states had, 46 states lacked)
5. Parental rights provision (11 states had, 39 states lacked)
6. Privacy provisions of educational records (five states had, 45 states lacked)

Parental protections were reverse-coded (coded 1 for states that lacked protections), so that states with higher overall counts of regulations and lack of protections were considered the most regulatory and visa versa. The researchers then ranked the states from the most to the least regulated. See the Figure 3 map of state homeschooling regulations and protections in 2015. With 12 out of 17 regulations and (lack of) protections, Louisiana is among the majority of states with a moderate regulatory level. Three states – Georgia, Iowa and Minnesota – were considered high-regulation states. By contrast, Oklahoma and Texas were considered to have minimal homeschool regulations because they combine few or no homeschooling regulations with strong parental protections.

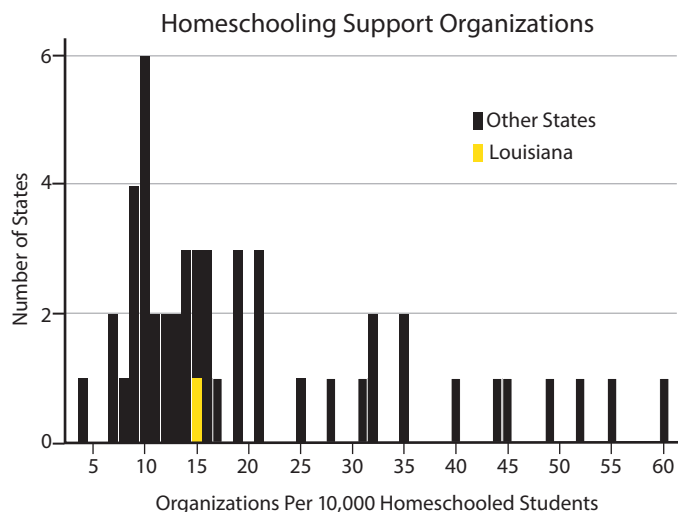


Figure 2. Each short bar represents a state. Short bars are stacked when more than one are in the same category. For example, the short gold bar represents Louisiana. It has 15 organizations per 10,000 homeschooled students along with two other states. States with more organizations provide more support for homeschooling families.

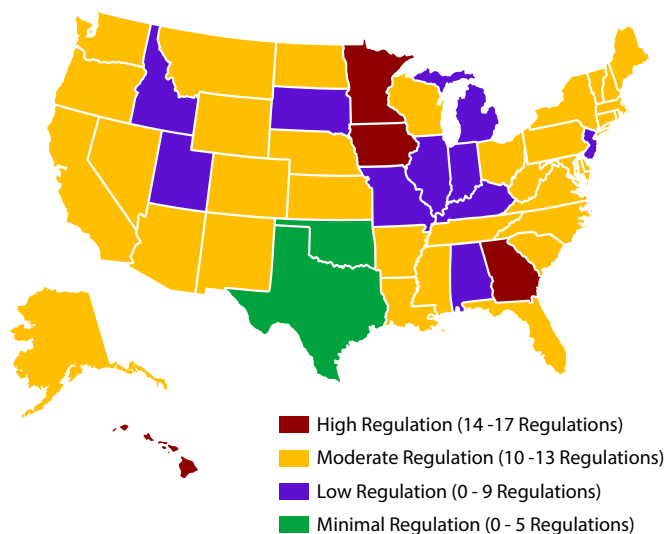


Figure 3: State Regulations and (Lack of) Parent Protections 2015.

Discussion

Louisiana is generally following national trends in homeschooling rates and counts, support organization prevalence and state regulatory environment, but additional changes over time should be expected as long as homeschooling continues to increase in popularity.

More research is needed to further explore the causes and implications of homeschooling expansion in Louisiana and across the nation. One area that needs additional research involves homeschool-school relationships. Many students classified as homeschoolers (sometimes referred to as flexischoolers or part-time homeschoolers) go to a local school for some courses or topics. Other homeschoolers take advantage of school-based extracurricular activities, including language, arts and sports programs.

A second area that needs more attention involves options for children with disabilities. On the one hand, children with disabilities can potentially benefit most from more child-centered, homeschooling approaches in which their parent-teachers take their specific circumstances into consideration. On the other hand, many technological resources and expertise for teaching children with disabilities flow through public schools.

A third area that should be studied more is the emergence of online public schools (also called e-schools or virtual schools). In many cases these schools are developed and offered through local public school systems and serve as a hybrid system in which children are technically enrolled in a public school but actually stay home and receive most or all of their instruction online.

Mark J. Schafer is an associate professor in the Department of Agricultural Economics and Agribusiness and Isaiah F.A. Cohen is a graduate teaching assistant in the Department of Sociology.

Homeschoolers in Louisiana 4-H

The LSU AgCenter 4-H program offers many educational opportunities for Louisiana school children. Many 4-H club activities are held in school settings – including public, private and charter schools. In addition, 4-H enrollment is available and encouraged for homeschooled students.

Belonging to 4-H gives homeschooled students access to the many resources of the 4-H program and the expertise of AgCenter scientists and extension agents, according to Janet Fox, head of the 4-H Youth Development Department.

Homeschooled youth can participate in 4-H camps, conferences, and competitive and educational events. Their leaders can borrow educational resources such as robotics kits and sewing machines and use curriculum materials such as for the Youth Wetlands Program.

“Through 4-H they get a chance to meet a wide range of people and enhance their social skills,” Fox said.

According to 4-H records, there are 608 homeschooled 4-H members in 29 clubs in Louisiana. Twenty-four of the state’s 64 parishes report having homeschool clubs. Additionally, homeschooled students are in activities all over the state, including special projects such as shooting sports, healthy living and dog care.

Many homeschooling support organizations provide links to local 4-H groups on their websites and describe the benefits of 4-H to homeschooling parents. For example, the Southwest Louisiana Christian Home Educators Fellowship provides a link to the Calcasieu (Parish) Home School 4-H Club.

Southern Corn Rust: Development, Risk and Management

Clayton Hollier

Southern corn rust, caused by the fungus *Puccinia polysora*, is a disease that affects the Louisiana corn crop annually, but at different incidences and severities. The total impact varies because of weather conditions, the presence of viable, wind-blown spores and the corn prices. Risk can be determined by a combination of factors investigated over a 12-year period from plots grown in strategic areas of Louisiana. The 12-year study has allowed Southern corn rust to be studied under various development levels.

Spores of *P. polysora* enter Louisiana annually in winds blowing from the Caribbean region, southern Florida and southern Mexico. These spores can survive the journey because of their hardiness, high pigment content and low sensitivity to UV light. With high survivability and potential infectivity, the inoculum poses a threat to all Louisiana-grown corn hybrids. The only resistance historically available in commercial hybrids came from the *Rpp9* gene, which was available in only a few hybrids. That gene was overcome by the disease in 2010 in southwestern Georgia and is no longer available as a resistance tool against *P. polysora*. As a result,



Southern corn rust. Photo by Clayton Hollier

all commercially available hybrids grown in Louisiana have some level of susceptibility to the pathogen.

Southern corn rust development is dependent on several factors: conducive environment (temperature, leaf wetness, rainfall intensity), susceptible corn hybrids (most available hybrids have a Southern corn rust rating of 4-8 on a 0-9 rating scale, where 0 = no disease and 9 = fully rusted plant/plant desiccation) and virulent *P. polysora* spores. All three of these factors must occur at the same time for Southern corn rust to develop.

Southern corn rust development risk is greatest when temperatures remain consistently within the 77-degree to 104-degree range, leaf wetness is greater than four hours and, if raining, the rain intensity is light, with the duration less than three hours. Heavy rains with high winds tend to wash the spores out of the air and off the corn leaves. Spore germination and Southern corn rust development can occur in an air temperature of up to 104 degrees, but that is the upper limit. Leaf wetness encourages spore germination and eventual infection. Four hours is the minimum amount of time necessary for this to happen. Research has shown that increasing the hours of leaf wetness enhances the germination and subsequent infection rate. Leaf wetness refers to the free water that resides on the leaf surface. The sources of free water are rainfall, dew and overhead irrigation; the leaf wetness period (dew period) is influenced by relative humidity. High relative humidity lengthens the dew period.

Southern corn rust management has been a guessing game for generations. With the lack of resistance, often-experienced conducive environmental conditions and the usual presence of the pathogen on some level, Southern corn rust can occur annually. Measured yield losses in a five-year loss study in Louisiana were 15.2 percent in 2010, 1.0 percent in 2011, 3.2 percent in 2012, 3.9 percent in 2013 and 18.9 percent in 2014. In this situation, growers are left with a two-pronged approach: (a) scout the corn often for Southern corn rust development and (b) under the right conditions for development, apply a rust managing fungicide.

Questions remain, however. How much Southern corn rust can corn endure before it needs an application of a fungicide? Yield losses have been measurable when 5 percent of the leaf area is covered with Southern corn rust; therefore, the ear leaf,

in particular, must be protected against further Southern corn rust development. At what growth stage is it too late to make that application? The dent (R5) growth stage is the latest stage at which one can benefit economically. At dent, total yield has not been determined, but making an application of a Southern corn rust fungicide past the beginning of growth stage R5 will benefit only biologically but not economically. Fungicide actions are not immediate; therefore, depending on the stage in the infection cycle that the Southern corn rust pathogen is in, additional rust development might occur before the fungicide takes full effect.

Table 1 is a risk assessment tool for use with Southern corn rust. It is based on 12 years of Louisiana research and verification. The assumptions are: (a) the corn was planted on time (late-planted corn will enhance the chances of greater Southern corn rust production), (b) the target corn field has adequate stand and yield potential, (c) the target field should be scouted weekly from tasseling until dent, (d) the target field has been thoroughly scouted for Southern corn rust and (e) no decision aid is perfect and some decisions are still subjective.

Table 1 includes the risk factors for Southern corn rust development and spread that can be used to determine whether fungicides are needed. First, consider the temperature. If temperatures are consistently within the listed ranges of the first row of the table, then assign the associated point value in the Subtotal Points column. For example, 50-76 degrees would be assigned zero (0) points, while the 77- to 90-degree range would be assigned three (3) points and the 91- to 104-degree range would be assigned one (1) point. The same principle is used for the Leaf Wetness (Dew Period) and Storm Intensity factors. After determining the point values for each environmental category, simply add the points. If the total point value is less than 7, it will not pay to apply a Southern corn rust fungicide because some conditions for rust development are missing. If the total point value is 7 or above, then the crop could benefit from a Southern corn rust fungicide application.

Clayton A. Hollier is a professor in the Department of Plant Pathology and Crop Physiology.

Table 1. Suggested decision tool to determine management action for Southern Corn Rust.

Temperature (point value)	50-76 degrees (0)	77-90 degrees (3)	91-104 degrees (1)	Sub-total points
enter point value →				
Leaf Wetness (dew period hours) (point value)	0-3 hours (0)	4-8 hours (2)	9-16 hours (3)	
enter point value →				
Storm Intensity (point value)	Light rain/no wind (2)	Light rain/ light wind (3)	Intermediate rain/wind (1)	Heavy rain/wind (0)
enter point value →				
Total				

Recommendation: Begin scouting for Southern corn rust at tasseling stage

Suggestion: If total points are less than 7, do not apply fungicide because some conditions for Southern corn rust development are missing.

Suggestion: If total points are 7-9, then applying Southern corn rust fungicide is recommended, especially if rust is present and the corn growth stage is R2-R5.

Note: No decision aid/risk evaluation tool is perfect, and some decisions are still subjective.

Fighting Obesity One Family at a Time

Federal Nutrition Program Nearly 50 Years Old

Tobie Blanchard

For nearly 50 years, the Expanded Food and Nutrition Education Program, referred to as EFNEP, has been addressing challenges such as obesity and food insecurity in low-income families through community educational programs.

The LSU AgCenter and Southern University Agricultural Research and Extension Center jointly oversee this federally funded program, which began nationwide and in Louisiana in 1969, and have seen families make positive changes after participating in it.

“The program teaches participants to make healthy food choices on their dollar,” said Sharman Charles, LSU AgCenter EFNEP coordinator.

The program uses a peer educator approach with nutrition educators hired from within the communities they will serve. The educators help recruit families with children under the age of 19 living in the home for the program and teach a series of eight lessons designed to improve health. The lessons focus on four priorities: nutrition and physical activity, food resource management, food safety and food security.



Eva Davis, LSU AgCenter nutrition agent in East Baton Rouge Parish, conducts an EFNEP outreach activity at Bernard Terrace Elementary School in Baton Rouge in February 2017. Photo by Olivia McClure

Charles said the nutrition portion is based on U.S. Department of Agriculture dietary guidelines, and the physical activity portion is based on guidelines from the U.S. Office of Disease Prevention and Health Promotion. Food resource management helps participants purchase healthy foods on a budget. Food safety lessons teach about safe food handling and cooking practices, while food security offers advice for making sure participants have food all month long or know where to secure food if money is tight.

Leona Camel, a nutrition educator in Caddo Parish, said she partners with groups in her community such as faith-based organizations, agencies that offer parenting classes, Head Start programs and drug treatment programs.

“We find those groups where our clients are and offer these free classes there,” Camel said.



In Eva Davis's class, the children learn that exercise should be part of a daily routine. Photo by Olivia McClure

Camel has been teaching the program since 2009. She said she has seen many successes over the years.

“We have clients that lower their blood pressure through exercise. They get off medications by changing their diets. They shop smarter. Every small change in the right direction is a success,” she said.

Camel also works in schools and said recipe sampling activities get youth participants to try new, healthful foods.

The program is taught in every region of the state, with the LSU AgCenter or Southern University Ag Center overseeing programs in Acadia, Avoyelles, Bossier, Caddo, Calcasieu, East Baton Rouge, East Carroll, Evangeline, Jefferson, Lafayette, Madison, Richland, St. Landry and West Carroll parishes. These parishes were selected because of the number of families living in poverty.

De'Shoin York coordinates Southern's EFNEP program and said it is successful because it focuses on the well-being of the family.

“It has a personal touch method of providing nutrition education, and that sometimes gets lost in today's society,” York said.

Participants evaluate the program when they complete it. Results from an LSU AgCenter survey show:

- 85 percent of participants showed improvement in one or more food resource management practice, such as plan meals, compare prices, use grocery list and not run out of food.
- 87 percent of participants showed improvement in one or more nutrition practices, such as make healthy food choices, prepare food without adding salt, read nutrition labels or have children eat breakfast.
- 45 percent of participants showed improvement in one or more food safety practice, such as thawing and storing foods correctly.
- In 2016, the LSU AgCenter had approximately 1,300 adults and more than 9,000 youth enrolled in the program.

Tobie Blanchard is assistant director of LSU AgCenter Communications and the communications coordinator for the College of Agriculture.

Inside:

As the crape myrtle bark scale continues to spread, LSU AgCenter researchers are developing ways to manage this pest. See page 11

Regular treatments with herbicides can conquer bushkiller and torpedograss – two of the most invasive weeds in home landscapes. See page 13

Grazing of beef cattle can be extended by different forage management practices, including the use of stockpiled bermudagrass. See page 15

Homeschooling continues to increase, although unevenly, across the U.S. and Louisiana. Precise numbers are hard to come by. See page 23



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