

LOUISIANA Agriculture

Vol. 56, No. 3, Summer 2013
Published Since 1957

Assuring Our Future Through Scientific Research and Education



The value of the alligator farming industry is growing. To meet demands for more research, the LSU AgCenter has a new facility – the only one of its kind in the country. Read more inside.

Two Top Extension Administrators Retire

In the first half of 2013, two LSU AgCenter extension administrators retired – Paul Coreil, the director and vice chancellor, and Dwight Landreneau, the associate director and associate vice chancellor. Both had given meritorious service to the AgCenter, Louisiana agriculture and the Cooperative Extension System for decades.

Coreil was director for 12 of his 34 years with the AgCenter. A native of Ville Platte, La., he earned his bachelor's degree from the University of Southwestern Louisiana in zoology in 1976. He earned a master's degree in wildlife management in 1984 and a Ph.D. in vocational education in 1995, both from LSU.

Except for a brief stint in 1998-1999 with private industry, he had been with the AgCenter since 1978, serving as an extension agent, specialist, assistant director and vice chancellor. Coreil was the major driving force behind the Master Farmer program, which began in 2001 as a way to help farmers learn the most current practices for soil and water conservation on their farms.

Coreil was a national extension leader, serving as chair of the Association of Southern Region Extension Directors in 2006 and chair of a committee that developed a national Web-based extension information system called eXtension.org. He also served as the chair of the Extension Committee on Organization and Policy in 2009.

He is the recipient of numerous awards, including the Association of Southern Region Extension Directors Excellence in Leadership Award in 2010.

"I see no more valuable mission for land-grant institutions than the dissemination of research findings that help build communities, solve problems, increase profitability, improve quality of life, and help feed, clothe and provide housing for the people of the United States and the world," said Coreil. "Working with 4-H'ers, Louisiana Sea Grant and starting the Master Farmer program have been the most rewarding."

Douglas Steele, director of Texas AgriLife Extension, said of Coreil, "As a national leader for the Extension System, Paul was well-respected for his thoughtful approach to working with others and dealing with difficult situations. More importantly, he truly believed in the power of extension education to change lives and improve communities."

Coreil is currently serving as the interim chancellor of LSU-Alexandria.

Landreneau had been associate vice chancellor for six years. He previously served in the AgCenter as a 4-H agent, county agent and area crawfish specialist for 20 years before leaving in 1998 for a position in state government.

He served as assistant secretary of the state Department of Culture, Recreation and Tourism before being named secretary of the Louisiana Department of Wildlife and Fisheries in 2004.

Landreneau, who makes his home in Washington, La., holds degrees from the University of Southwestern Louisiana and Louisiana State University.

During his tenure as associate vice chancellor, Landreneau provided leadership in developing the Louisiana 4-H Museum in Mansura and expanding the Grant Walker 4-H Educational Center in Pollock along with his continuing contributions to the Louisiana crawfish industry.

"It has been an honor and privilege to work with the agriculture industry and the people of Louisiana for the past 30-plus years. I have had the opportunity to watch young people grow and achieve their goals and to see farm families and agriculture-related businesses become successful by following research-based information provided by the AgCenter," Landreneau said.

Since their departure, the AgCenter administration has undergone a restructuring. Chancellor Bill Richardson serves as both the director of the Louisiana Cooperative Extension Service and the director of the Louisiana Agricultural Experiment Station. The other top administrators include John Russin, vice chancellor; and B. Rogers Leonard, Phil Elzer, Mark Tassin and Gina Eubanks as program leaders and associate vice chancellors. ■

Frankie Gould

Frankie Gould is the director of LSU AgCenter Communications and Public Relations.



In one of their final acts before leaving the LSU AgCenter earlier this year, Paul Coreil, left, and Dwight Landreneau present a check for \$50,000 in donations to the Grant Walker 4-H Educational Center to Christine Bergeron, director of the center. Photo by Frankie Gould

LOUISIANA Agriculture

EDITORIAL BOARD:

John S. Russin, Chairman
Michael Blazier
Linda Foster Benedict
Rick Bogren
Regina Bracy
Matt Fannin
Kathy Kramer
Donald Thompson
Terry Tiersch
David Weindorf

EDITOR: Linda Foster Benedict

ASSOCIATE EDITOR: Rick Bogren

DESIGNER: Kathy Kramer

PHOTO EDITOR: John Wozniak

CONTRIBUTORS: Frankie Gould, Randy LaBauve, Elm Sue McCallum and Johnny Morgan

WEB DESIGN: Ronda Clark, Kathy Kramer and Megan Smith

Louisiana Agriculture is published quarterly by the Louisiana Agricultural Experiment Station. Subscriptions are free. You may also subscribe to a Web version of the magazine, which is available at www.LSUAgCenter.com. Please go to the "Louisiana Agriculture Magazine" site if you would like to receive an email notification when a new issue is online. If you would like to download the magazine to your e-reader, go to the magazine's website, choose the correct format, and follow the directions on your mobile device. For more information or to subscribe, please contact:

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



www.LSUAgCenter.com

Louisiana State University Agricultural Center
Louisiana Agricultural Experiment Station
Louisiana Cooperative Extension Service
William B. Richardson, Chancellor and Director

The LSU AgCenter is a statewide campus of the LSU System and provides equal opportunities in programs and employment.

The mention of a pesticide or use of a trade name for any product is intended only as a report of research and does not constitute an endorsement or recommendation by the Louisiana Agricultural Experiment Station, nor does it imply that a mentioned product is superior to other products of a similar nature not mentioned. Uses of pesticides discussed here have not necessarily been approved by governmental regulatory agencies. Information on approved uses normally appears on the manufacturer's label.

LOUISIANA Agriculture

Assuring Our Future Through Scientific Research and Education



- 2 Two Top Extension Administrators Retire**
Frankie Gould
- 4 What's New**
- 6 Dietary Needs of Farm-Raised Alligators**
Robert C. Reigh, Millie B. Williams and C. Gregory Lutz
- 9 Marketing and Information Technology Use by Louisiana Blueberry Growers**
Sandamali K. Rodrigo and Roger A. Hinson
- 10 The Consequences of Rice Crop Lodging on Rice Milling Yield and Market Price**
Michael E. Salassi, Steven D. Linscombe and Michael A. Deliberto
- 12 Simazine may be a better choice than atrazine for home lawns near surface waters**
Jeffrey Beasley, Miao Liu, Ron Strahan, Jeff Kuehny, Kevin McCarter and Kim Pope
- 14 Improving Sweet Potato Production Efficiency**
Theresa F. Arnold, Tara P. Smith and Arthur O. Villordon
- 16 Local nitrogen variability alters root architecture and influences storage root formation in the Beauregard sweet potato**
Arthur Villordon, Don LaBonte and Tara P. Smith
- 18 Economic Impact of H-2B Visa Workers on the Louisiana Seafood Processing Industry**
Ashok K. Mishra, Hyunjeong Joo and Jeffrey M. Gillespie
- 22 Finding Lower-Maintenance Easy-Tea Hybrid Tea Roses**
Allen Owings
- 24 Performance Indicators of the Louisiana Dairy Refundable Tax Credit Program**
Wayne M. Gauthier
- 26 The Search for an Alternative Commercial Cricket for the U.S. Industry**
Christopher Carlton and Benjamin Adams
- 27 Possibility of virus keeps Louisiana cricket business on alert**
Johnny Morgan



The Louisiana alligator farmers have provided partial funding for a new research facility at the LSU AgCenter to find better ways to grow alligators. The alligator research unit is at the Aquaculture Research Station south of campus. The alligator industry contributed \$56 million to the Louisiana economy in 2012, and this value is expected to grow. See page 6. Photo by John Wozniak

What's New

LSU AgCenter loses two scientists

Two LSU AgCenter scientists passed away in the summer of 2013.

Charles Milton "Chuck" Rush, 72, a retired professor in the Department of Plant Pathology & Crop Physiology, passed away on August 10, 2013.



Born in Goodyear, Ariz., he grew up on a dairy and cotton farm. He received his bachelor's and master's degrees in plant pathology from the University of Arizona and his doctorate from North Carolina State University. He came to the LSU AgCenter in 1970 as an assistant professor with responsibility for rice pathology and retired in 2009.

Rush dedicated more than 39 years of service to the Louisiana and U.S. rice industry. He taught and mentored 13 master's degree and 14 doctoral students from many countries. His program pioneered the development of quantitative rating scales for rice diseases in the South, and his research enabled breeders to develop and improve varieties with partial and complete disease resistance.

Rush reported eight new diseases in Louisiana rice. His extensive fungicide testing programs were critical for labeling new fungicides for the severe foliar diseases that affected rice in the Gulf South and throughout the world. He also was involved in the labeling of Benlate 50WP, the first foliar

fungicide labeled for rice in the United States.

He and his students elucidated the importance of leaf surface interactions between the host and pathogen in resistance of rice to *Rhizoctonia solani*, the cause of sheath blight. Recently, Rush and his students and colleagues successfully identified *Burkholderia glumae* and *B. gladioli* as the causal agents of the perennial rice panicle blight disease in the United States.

During his career, Rush published more than 300 refereed journal articles, book chapters and research reports. His numerous honors include the Louisiana Agricultural Experiment Station Doyle Chambers Award for Outstanding Research Contributions in 1995.



Hanna Y. Hanna, 73, a professor at the Red River Research Station in Bossier City, passed away on July 28, 2013.

A professor of vegetable crops, Hanna was well-known regionally and nationally for his greenhouse tomato production research. He also conducted studies on cucumber, strawberries, peppers, field tomatoes, muskmelons and other important vegetable crops in Louisiana.

Hanna was awarded a bachelor's degree in 1968 in extension agriculture and horticulture and his master's degree in 1972 in horticulture from Asuit University in Egypt. He moved to the United States in 1974 and

completed a doctorate in horticulture in 1980 and a master's degree in applied statistics in 1991 from LSU.

Hanna began his service as an LSU AgCenter horticulture faculty member in 1981 at the Citrus Research Station in Port Sulphur. He later moved to the Red River Research Station in Bossier City, where he served the past 21 years of his professional career.

"Dr. Hanna was a successful researcher," said Pat Colyer, director of the AgCenter Northwest Region. "Through dedication and innovation, he took a nonexistent greenhouse tomato program and developed a very visible program with some international recognition. He was affectionately called by many as Mr. Tomato. Dr. Hanna and his contributions will be missed." ■

Rick Bogren

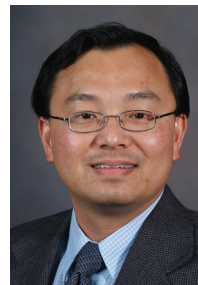
Two food scientists named IFT Fellows

Two faculty members in the Department of Food Science have been named Fellows of the Institute of Food Technologists.

Lucina Lampila, who also has an appointment with Louisiana Sea Grant, was recognized for her expertise in ingredient technology and seafood processing, products and safety. She is a leading authority on ingredient technology, particularly with food-grade phosphates, and the chemical and physical changes by ingredient incorporation into major food categories. She is also an expert in seafood processing, products and safety.



Witoon Prinyawiwatkul was honored for his dedicated research, teaching and service



work in value-added product development and sensory science. His most significant research contributions include development of value-added functional ingredients from seafood, aquaculture by-products, and wastes and their applications in foods. Another focus of his work is using sensory science methods for developing new food products.

■ **Rick Bogren**

Smart Bodies will go out to 100 schools this year

One hundred elementary schools across Louisiana are taking steps to help their students eat better and move more during this school year. These schools are participating in Smart Bodies, a program of the LSU AgCenter and Blue Cross and Blue Shield of Louisiana Foundation.

Smart Bodies, which was initiated in 2005, has been in more than 450 elementary schools around the state and has so far reached nearly 400,000 children and adults, said Denise Holston-West, LSU AgCenter nutritionist and program coordinator.

This year's program includes some new features, she said. One is an expansion of the Body Walk, which is a 35-foot-by-45-foot walk-through exhibit representing the human body.

"The children walk through the human body and explore the body's organs and how they work," Holston-West said.

New to the Body Walk this year is the addition of a cafeteria. Holston-West said students will visit the cafeteria first and learn about how foods fit into a healthful diet.

"This is where they magically turn into the food item they will be for the rest of the Body Walk tour," she said, explaining that the students pretend to be food being digested through the body during the tour.

The Body Walk travels the state visiting three to five schools a week with as many as 650 students going through it a day.

Also new this year is "2 Step in the Classroom," a lesson plan for classroom activities. Holston-West said the activities use red beans and rice characters and other Louisiana components, while also adhering to Common Core standards and grade-level expectations.

"We made sure everything was matched to all the different benchmarks and standards through the Department of Education," Holston-West said.

This component helps incorporate exercise into daily lessons. Holston-West said teachers find it easy to add in physical activity during math and spelling lessons.

Holston-West said an evaluation of "2 Step in the Classroom" has shown an increase in physical activity among students.

This year students in third, fourth and fifth grades attending schools in the program will receive Smart Bodies planners. The planners have nutrition information, stickers and a daily calendar that encourages students to set healthy goals for each day. ■ **Tobie Blanchard**



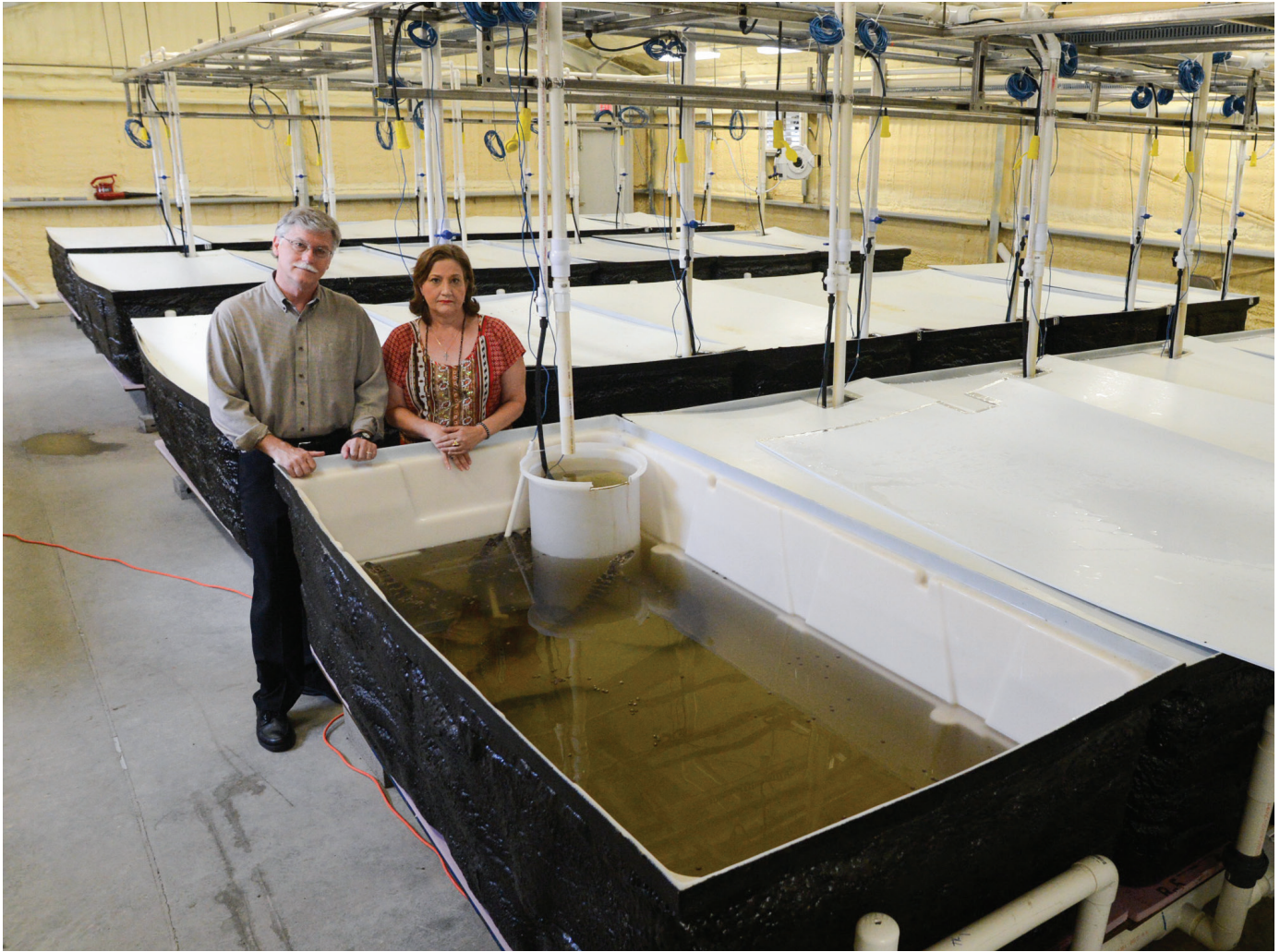
New LSU president visits Rice Station

During his first few days of becoming the new president of the LSU System and the chancellor of LSU A&M, F. King Alexander took the time to attend the Rice Research Station's annual field day on June 26. Steve Linscombe, director of the station, at left, greets President Alexander. In the center is Rogers Leonard, associate vice chancellor and program leader for plant sciences at the LSU AgCenter. Photo by Bruce Schultz



Finger named new sweet potato specialist

Mavis Finger has joined the new LSU AgCenter as the new sweet potato specialist. She replaced Tara Smith, who now serves as director for the Northeast Region. Finger has a bachelor's degree in horticultural science from LSU and a master's degree in plant pathology from the University of Georgia. She also will work as horticultural specialist in the Northeast Region and plans to expand the Master Gardener program. Photo by Theresa Arnold



Robert C. Reigh and Millie B. Williams at the Aquaculture Research Station alligator facility. Photo by John Wozniak

Dietary Needs of Farm-Raised Alligators

Robert C. Reigh, Millie B. Williams and C. Gregory Lutz

Alligator farming contributed more than \$56 million to Louisiana's economy in 2012, and the value of the alligator farming industry is expected to increase. Yet despite its high value as an aquaculture product, the nutritional needs of captive-reared American alligators remain largely unknown. A research program was initiated recently at the Aquaculture Research Station to investigate the nutritional needs of farm-raised alligators, beginning with an investigation of the dietary protein needs of captive alligators.

Dietary protein provides the amino acids that build tissues in a growing animal. Protein intake is a primary factor affecting growth because the types and amounts of amino acids consumed determine the rate of tissue synthesis. Under optimal environmental conditions, growth rate is related to protein consumption up to a biological limit. When that limit is reached, unused protein is converted to fat, and the nitrogen it once contained is excreted as waste. Nitrogen loss represents money wasted on dietary protein not used for growth, and the release of waste nitrogen

creates additional cleanup costs to maintain a favorable production environment. Thus, feeding a proper level of dietary protein can produce biological and economic benefits, such as lower feed cost, better environmental conditions for growing alligators, and cleaner water discharge from production facilities.

Alligator farmers currently feed relatively high-protein diets composed of mixtures of ingredients formulated to provide specific quantities of nutrients. These diets are expensive and constitute a major component of a farm's production cost. Although the nutritional requirements of alligators are unknown, diet manufacturers still need to ensure that their products produce the growth results their customers expect, so commercial formulations tend to be well-fortified with essential nutrients and could contain excess levels of some nutrients, such as protein. Given that protein is also the most expensive component of a diet, reducing dietary protein content to the minimum necessary to produce a desired growth response would be beneficial.

How much protein is enough?

Where is the limit beyond which feeding more protein is a waste of resources? The answer can depend on several factors and is especially affected by the ingredients in the diet. For example, a small amount of a high-quality protein source like fish meal can produce the same growth as a large amount of a somewhat lower-quality protein source like soybean meal because high-quality protein contains more of the most needed amino acids. We chose to use a single, high-quality, commercial diet as the basal diet for our protein investigation to ensure that all of our experimental diets contained the same mix of ingredients. The basal diet was fed unmodified as a control treatment for comparison purposes and was modified by us to produce the reduced-protein, experimental treatments that we compared with the control. Reductions in protein content were made by mixing different amounts of the basal diet with a non-nutritive ingredient (in this case, powdered cellulose) to produce a series of diets with graded protein content but which all contained the same relative proportions of ingredients as the basal diet. In this way conclusions relating to effects of protein reduction were comparable among treatments. We used these diets not only to determine the impact of reduced protein on alligator growth but also to measure the effect of reduced protein on air and water quality in the production system.

Eighty-eight young-of-year alligators were obtained from Rockefeller Wildlife Refuge, Grand Chenier, La., and transported to the Aquaculture Research Station. They were assigned in pairs to 20-gallon tanks with 6 inches of water depth maintained by standpipes. The tanks were operated as static-water systems, with no biofiltration, similar to the production methods of commercial producers. Tanks were flushed and refilled with fresh water three times per week. A heater in each tank maintained water temperature at approximately 89 degrees F.

The basal diet was ground and mixed with powdered cellulose to provide a series of diets with graded protein levels and re-pelletized. The experimental diets provided 37, 41, 45 and 50 percent protein; the control diet provided 55 percent protein. Each diet was assigned to eight tanks of alligators in a randomized manner for statistical purposes. Alligators weighed an average of 0.38 pounds when the feeding trial began. The experimental diets were fed for 186 days, and the alligators were weighed and measured every 30 days.

Lower protein is beneficial

Results indicated that diets containing 41-55 percent protein were not significantly different in their effects on alligator body weight (Figure 1) or chest girth (Figure 2). However, alligators fed the 37 percent protein diet did show significantly lower body weight at the end of the trial than alligators fed 45 percent or 55 percent protein (Figure 1) and significantly lower chest girth than alligators fed 41-55 percent protein (Figure 2). Also, body length (Figure 3) was significantly lower among alligators fed 37 percent protein than among those fed 45 percent or 55 percent protein. Body length followed a trend similar to body weight, though not as clearly delineated.

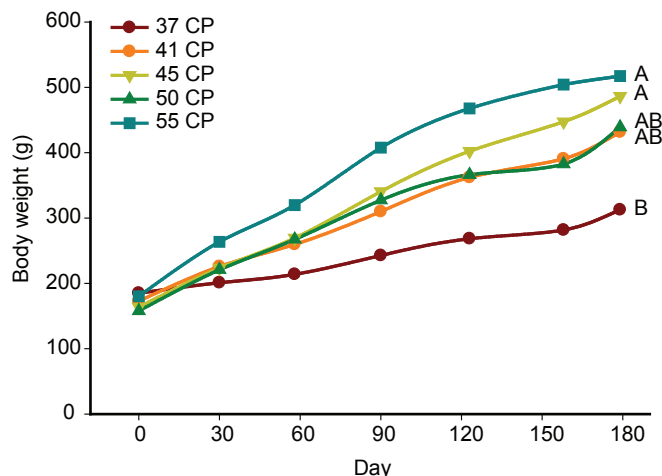


Figure 1. Body weight of American alligators fed diets containing 37-55 percent crude protein (CP) for six months. Treatments with the same letter are not statistically significantly different.

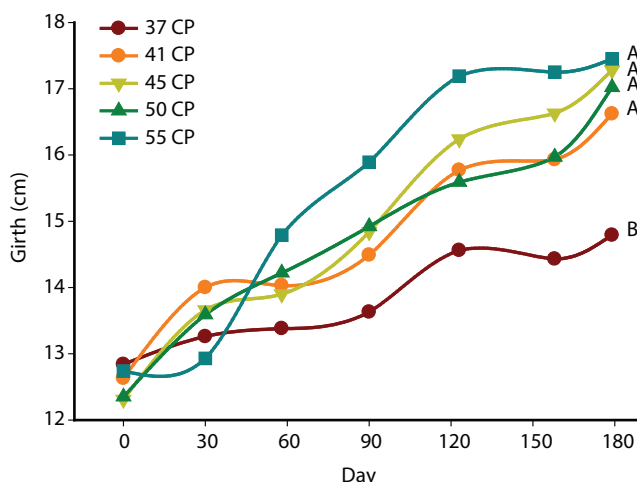


Figure 2. Chest girth of American alligators fed diets containing 37-55 percent crude protein (CP) for six months. Girth measured at seventh scale-row behind the front legs with chest expanded. Treatments with the same letter are not statistically significantly different.

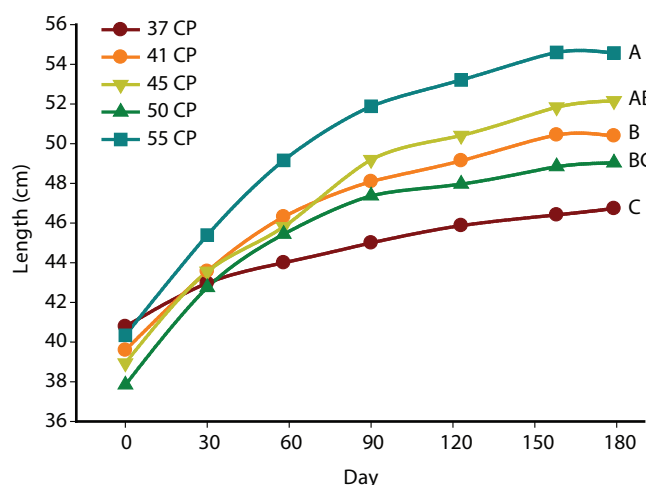


Figure 3. Body length of American alligators fed diets containing 37-55 percent crude protein (CP) for six months. Treatments with the same letter are not statistically significantly different.

Ammonia concentrations in water (Figure 4) and air (Figure 5), both of which are increased by wasted dietary nitrogen, trended toward higher concentrations at higher dietary protein levels. Dissolved ammonia concentrations in water were significantly higher in tanks of alligators fed 55 percent protein than in tanks of alligators fed 37-45 percent protein (Figure 4). Similarly, ammonia concentrations at the air-water interface were significantly higher in tanks of alligators fed 55 percent protein than in tanks of alligators fed 37 percent or 41 percent protein (Figure 5).

When taken together, a comparison of the effects of each diet on the variables measured indicated that the 45 percent protein diet was the best choice overall. This diet was as good as the control diet in its effects on body weight, length and girth. It was no different than the control diet in its effects on ammonia concentrations in air and better than the control diet in its effects on ammonia concentrations in water. It contained 10 percent less protein than the 55 percent protein control diet. These results suggest that the same growth, and equivalent or better water quality, can be produced with a lower-protein, perhaps lower-cost, diet than the standard formulation.

In a project now underway we are investigating this possibility by testing experimental diets of our own formulation, which incorporate mixtures of ingredients with known digestibility and amino acid availability for alligators to determine an optimum energy-to-protein ratio for a diet containing approximately 45 percent protein. Results of that study will be used to determine future steps in alligator nutrition research.

Robert C. Reigh is a professor and the director at the Aquaculture Research Station, Baton Rouge. Millie B. Williams is a senior research associate, and C. Gregory Lutz is a professor and extension specialist, both at the station.

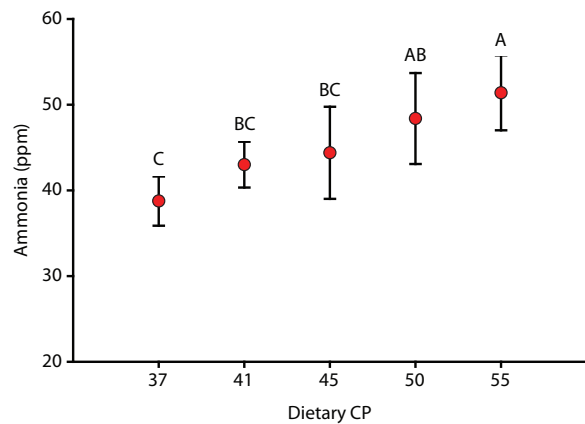


Figure 4. Ammonia concentrations in tank water of American alligators fed diets containing 37-55 percent crude protein (CP) for six months. Treatments with the same letter are not statistically significantly different.

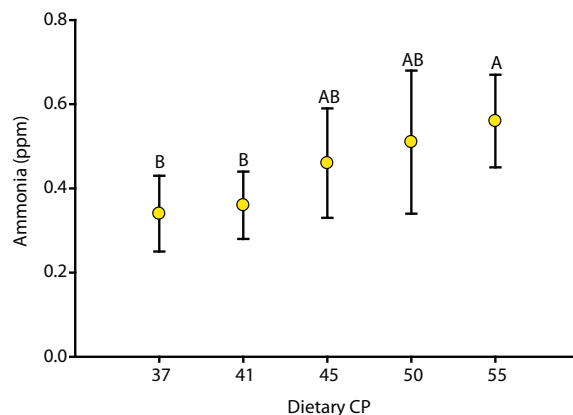


Figure 5. Ammonia concentrations at air-water interface in tanks of American alligators fed diets containing 37-55 percent crude protein (CP) for six months. Treatments with the same letter are not statistically significantly different.



The new alligator research facility at the Aquaculture Research Station began operation in the spring of 2013. Photo by John Wozniak



Marketing and Information Technology Use by Louisiana Blueberry Growers

Sandamali K. Rodrigo and Roger A. Hinson

Blueberry consumption in the United States is expanding as the result of promotion efforts that emphasize flavor, versatility and nutritional value. Blueberries contribute to a healthy diet from nutrients that include copper, selenium, zinc, iron, and vitamins B, C, E and K. They also contain antioxidants such as anthocyanins and polyphenolic flavonoids, which have potential to prevent cancer and boost the immune system.

Nationally, blueberry acreage has almost doubled over the past 10 years, and use has doubled to more than 550 million pounds. In that same period in Louisiana, the blueberry industry's value to the state's economy increased from about \$1 million to more than \$6 million.

Blueberry growers in Louisiana typically operate small or mid-size farms and frequently struggle with selling their crop. Their marketing options often reach small customer bases. Online marketing offers new opportunities. In Louisiana, online marketing is hampered by lack of high-speed access to the Internet. When these issues are addressed, online activities can improve competitiveness.

Data were collected from Louisiana specialty crop farmers in 2011. An online survey was sent to 460 email addresses received from Louisiana MarketMaker, the Louisiana Department of Agriculture and Forestry, Louisiana Vegetable Growers Association and LSU AgCenter specialists. Completed responses were received from 133 growers for a response rate of 29 percent. Blueberry sales were reported by 23 respondents. The 2011 Louisiana Ag Summary estimated the number of blueberry growers in Louisiana at 76, so the response rate was almost one-third of the blueberry grower population. This is the basis for reporting of demographics, selling options and Internet use. Questions about familiarity with a website, All About Blueberries, were included in the survey. All About Blueberries is a website developed at the LSU AgCenter and hosted by eXtension.org, which helps blueberry growers learn about production practices, find solutions to problems, network with peers and professionals, get expert assistance and join a discussion section.

Of the respondents who reported blueberry sales, nearly 73 percent were male, 91 percent were married, and 91 percent were white. About 41 percent were in the 55-to-64 age group. They were relatively well-educated; the groups with the highest education levels were those with some college (32 percent) and those having a bachelor's degree (32 percent).

Blueberry growers reported an average of 16 acres of owned land and an average farm size of approximately 23 acres. An average of 97 percent of farm sales was from blueberries. About 85 percent had sales of less than \$50,000. A majority (85 percent) were classified as either retirement or

residential farms. Similarly, most operators (53 percent) said they worked off the farm full-time, while 29 percent were full-time farmers.

Finding the most appropriate markets is important to business success. Direct-to-consumer selling was most popular. Direct options included on-farm sales with road-side stands or pick-your-own (used by 50 percent of growers), public farmers markets (17 percent) and restaurants (9 percent). Local grocers were an option used by about 17 percent of growers, and about 9 percent used restaurants and another 9 percent used wholesalers. In terms of effectiveness, blueberry growers rated on-farm sales as most effective (90 percent). Public farmers markets had an effectiveness rating above 70 percent, and restaurants and the Internet each had an effectiveness rating of about 60 percent.

Use of the Web and social media to promote farm products and locate buyers is a relatively new approach that offers access to many more potential customers. All blueberry growers surveyed had access to the Internet, but only 73 percent indicated they used it in the farm operation. They were asked about tasks such as communicating, word processing, preparing financial statements, record keeping, online banking and online marketing. None of these was used with high frequency.

The major barrier to Internet use was inadequate speed of service. For social media, 50 percent of respondents used Facebook, Twitter, blogs, YouTube and Flickr. Entertainment was identified as the most useful (36 percent), while social communication (33 percent) and promoting the business and products (33 percent) were also rated as useful. Some growers used smart phones (36 percent) in the business, and almost 75 percent frequently used Facebook.

Some growers (13 percent) used the All About Blueberries website as a business tool, but most growers were either not aware of or were not familiar with the site. Of those who used All About Blueberries, the site was rated as effective by about 38 percent. The survey was conducted only a year after the website was launched, and content was not fully developed.

In general, Louisiana blueberry growers used traditional and mostly on-farm selling options for their crop. Their use of online tools and social media was not widespread. Few used online tools such as the All About Blueberries website in ways that supported the business. Additional research will be needed to reveal the rate at which growers are integrating new technologies into their businesses.

Sandamali K. Rodrigo is an extension associate, and Roger A. Hinson is a professor in the Department of Agricultural Economics & Agribusiness.

The Consequences of Rice Crop Lodging on Rice Milling Yield and Market Price

Michael E. Salassi, Steven D. Linscombe and Michael A. Deliberto

Crop lodging is a condition under which plant stems at the base of a crop plant weaken to the point of no longer being able to support the weight of the upper portion of the plant, causing it fall in the field. Lodging usually occurs in grain crops when the plant is mature and with filled grain heads, in the days or weeks before harvest. It is usually the result of adverse weather conditions from high winds and pounding rain. Although incidences of crop lodging can vary greatly from year to year or farm to farm, lodging of rice plants in Louisiana is a significant factor to contend with in the production of a rice crop.

The variation in physical plant structural characteristics among rice varieties directly influences the optimal production practices best suited to individual rice varieties or groups of similar rice varieties. Relationships among plant characteristics – including plant height, stem strength and potential grain yield – interact with production practices to significantly influence a rice plant's ability to remain standing in the field at crop maturity and be easily harvested, despite high grain yields. The production practices include date of planting, seeding rates and fertilization rates. As a result, considerable research at the LSU AgCenter's Rice Research Station is devoted to developing rice varieties that grow well in Louisiana with some level of plant structure resistance to lodging at high grain yields.

Although usually not widespread in a field, lodging can result in significant yield losses. It has been generally known that lodging adversely affects rice grain quality and eventual market price. However, no specific research studies have been conducted recently in the southern U.S. rice-growing region to document the relational impact of lodging on rice milling quality and on the resulting market price received from the sale of the rough rice.

In 2011 and 2012, the LSU AgCenter led a four-state research project to specifically evaluate and document the economic consequences of rice lodging on rice milling yield and rough rice market price. Field trials evaluating lodging impacts on several rice varieties commonly grown in the southern U.S. rice-growing region were conducted at the LSU AgCenter Rice Research Station in Crowley, the Mississippi State University Delta Research and Extension Center in Stoneville, the University of Arkansas Rice Research Station in Stuttgart, and the Texas A&M University Rice Research Station in Eagle Lake. These four study locations represent the range of rice-growing environments and conditions typical for southern U.S. rice production.

Three lodging treatments were evaluated in this study: early lodging, late lodging and standing (no lodging). For the early and late lodging treatments, the rice crop was manually lodged in the plots at a specified time in relation to harvest. The timing of early lodging occurred when the rice panicles were first observed turning yellow (approximately five to seven days prior to field drainage). The timing of late lodging occurred approximately one week prior to harvest maturity. For the standing treatment to be used as a check, no lodging was conducted. Two planting dates were also evaluated in the study. The first planting date was at the earliest typical planting date for the specific production area and the second planting date was approximately 30 days later. For the study in Louisiana, these planting dates were approximately March 15 and April 15 of each year.

Several rice varieties were evaluated for each lodging treatment and planting date at each location. For the test location in Louisiana, the following seven rice varieties were evaluated: CL151, Cheniere, Presidio, Jupiter, Wells, Cocodrie and LAH10. The majority of these varieties are



Lodged rice in Evangeline Parish commercial fields in 2010 after a storm. Photo by Keith Fontenot



Boards are used to crush the rice plants and simulate lodging. Photo by Karen Bearb

long-grain rice varieties. CL151 is a long-grain herbicide-resistant Clearfield variety. Cheniere, Presidio, Wells and Cocodrie are conventional long-grain rice varieties. Jupiter is a conventional medium-grain rice variety, and LAH10 is a hybrid rice variety. Estimates presented here are from the results of the project, averaged over all rice varieties evaluated, for the two years of the study conducted at the Rice Research Station in Crowley, La.

Rice milling yield is estimated as the proportional quantity of whole rice kernels and total milled rice (whole kernels and broken kernels combined) produced in the milling process of rough rice. A standard rough rice milling yield reference value can be stated as a “55/70” milling yield. This value implies that the milling of 100 pounds of rough rice yielded 55 pounds of whole kernel milled rice, commonly referred to as head rice yield, and 70 pounds of total milled rice grain, with the difference being 15 pounds of broken kernel milled rice. Rice milling yield is directly affected by factors that can lead to the breakage of rice kernels during the milling process. One of the primary factors is the moisture content of the rough rice at the time of milling. Research conducted at the Rice Research Station identifies the optimal harvest moisture content for rice varieties that would minimize the breakage of rice kernels during the milling process. Crop lodging just prior to harvest, which could cause grain moisture content in the affected plants to either rise above or fall below optimal grain moisture ranges because of weather conditions at the time of harvest, would be expected to directly affect rough rice milling yield.

Rough rice milling yields from the lodging studies conducted at the AgCenter Rice Research Station are presented in Figure 1. For both rice planting dates evaluated, the reduction in both head rice milling yield and total grain milling yield from crop lodging was found to be statistically significant from the nonlodged standing crop. In the early planting date trial, rough rice milling yields were 50.2/67.6 and 51.1/67.5 for the early and late lodged treatments compared with a nonlodged standing crop milling yield of 56.0/68.9. Corresponding milling yields for the late planting date trial were 50.3/66.8 and 52.0/66.6 for the early and late lodged treatments compared with a milling yield of 53.4/67.8 for the nonlodged standing crop.

Milling yield has been shown to be a significant factor in establishing the market price for specific lots of rice. Whole grain milled rice is most commonly sold for direct food use as a stand-alone product, while broken grain rice is sold for use in more processed foods. Because of this differential product demand, whole grain rice commands a higher price in the market compared with broken grain rice. Distinct from other grains, the milling yield for rice must also be included to completely specify the market price (value) of a specific sample of rice. In the lodging study conducted at the Rice Research Station in 2011 and 2012, the effects of crop lodging on rice milling yields were estimated to reduce the market price received for the rough rice by an average of \$0.28 to \$0.60 per hundredweight (Figure 2). Assuming an average rough rice harvest yield of 6,500 pounds per acre, the adverse consequences of lodging on rough rice market price

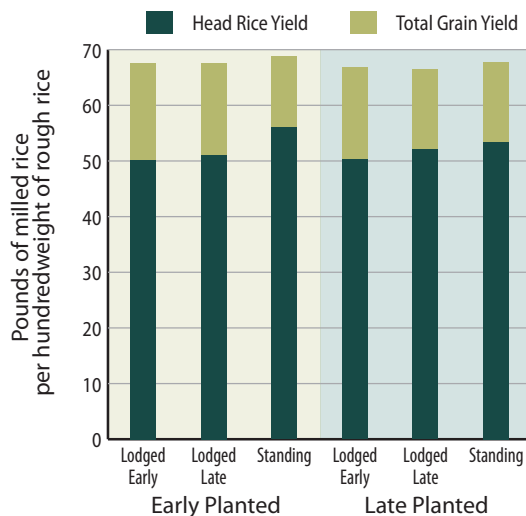


Figure 1. Rough rice milling yields from lodged rice tests conducted at the Rice Research Station, Crowley, in 2011-2012.

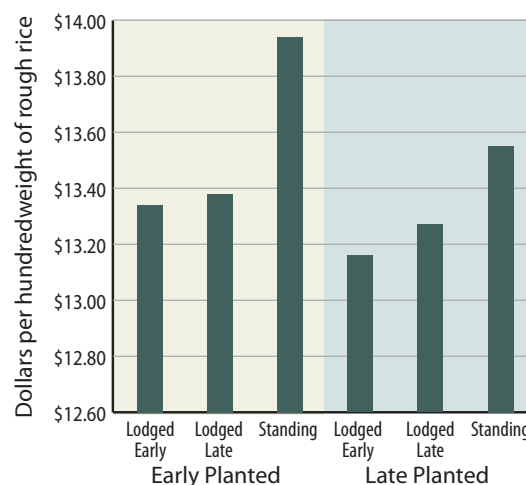


Figure 2. Estimated rough rice market price based on milling yield.

alone can reduce crop revenue from the affected area by an average of \$18 to \$39 per acre.

Lodging of rice plants, oftentimes caused by adverse weather before crop harvest, although sporadic in occurrence and severity, can represent a significant reduction in crop net returns. Reduction in crop yield, decrease in market price and increase in harvest cost all combine to reduce net returns in areas of rice fields affected by lodging. As new farm risk management tools, particularly in the area of crop insurance, are developed for use by rice producers to manage crop production and market price risk in the future, being able to quantify the probability of occurrence and likely magnitude of the effects of adverse conditions on crops is critical to the development of risk management programs which would protect producers from adverse weather impacts on crops such as lodging. Results from this two-year lodging study will provide useful information to the rice industry as new crop risk management tools are developed for use by rice producers in managing crop production risks.

Michael E. Salassi is J. Nelson Fairbanks Professor and Michael A. Deliberto is a research associate in the Department of Agricultural Economics & Agribusiness. Steven D. Linscombe is American Cyanamid Professor for Excellence in Plant Genetics, Breeding and Variety Development at the Rice Research Station, Crowley.

Simazine may be a better choice than atrazine for home lawns near surface waters

Jeffrey Beasley, Miao Liu, Ron Strahan, Jeff Kuehny, Kevin McCarter and Kim Pope

Pesticide runoff from lawns and other turfgrass areas is an increasing environmental concern because of its impact on surface waters used for aesthetics, fisheries, habitats, recreation, industry and consumption. Given the vast acreage of managed grass areas in Louisiana combined with precipitation levels and frequencies, the application of chemicals on turf in close proximity to water bodies increases the risk of pesticide movement into surface waters, especially as urbanization increases and management of grass areas expands.

Atrazine and simazine are commonly applied in the spring to turfgrass for the suppression and control of broadleaf and grassy weeds. In the southern United States, atrazine and simazine are routinely applied to home lawns to control broadleaf weed infestations or annual bluegrass in dormant bermudagrass as well as suppress weed competition during centipedegrass establishment.

Research conducted on atrazine and simazine application in agricultural systems has shown seasonal runoff losses of 15.9 percent for atrazine and 3.5 percent for simazine, but few studies in home lawns have been conducted for comparison. Research has shown that atrazine, a moderate to highly water-soluble pesticide, is more readily transported

via surface runoff compared to simazine, which is weakly soluble and more sediment-bound. Given the results of agronomic studies and differences in solubility, the application of simazine may be preferable for turf applications where turf is adjacent to surface waters.

Unlike row-crop agricultural systems that produce food and fiber, home lawns often receive inputs to achieve a certain level of aesthetic performance. Therefore, understanding factors that involve pesticide movement, such as solubility, may allow the development of more environmentally friendly guidelines for homeowner use. The objective of this research was to compare how atrazine and simazine solubilities affect surface runoff losses from a home lawn.

Surface runoff experiments were conducted in 2010 and 2011 on turfgrass on silty loam embankments with a 10 percent slope at the LSU AgCenter Botanic Gardens at Burden in Baton Rouge. General maintenance included mowing to 3 inches weekly with clippings collected. No herbicides or nutrients were applied within six months of each simulated rainfall event. Herbicides were applied to complete turfgrass areas using a pressurized backpack sprayer. Atrazine and simazine were applied at recommended label rates. No irrigation was applied post-herbicide application.



The application of simazine instead of atrazine on lawns adjacent to lakes or ponds may reduce potential runoff. Photo by Linda Foster Benedict



Steve Borst, right, former graduate student, and Bret Sparks, former undergraduate student, take readings related to runoff in pesticide experiment at the LSU AgCenter Botanic Gardens at Burden. Photo by Jeffrey Beasley

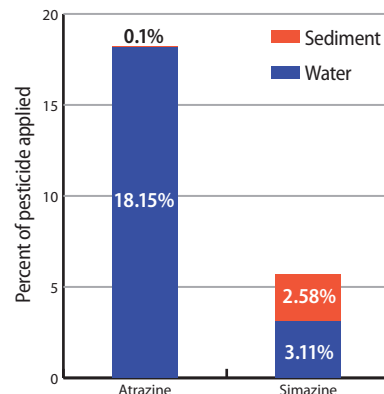


Figure 1. Total atrazine and simazine losses from surface runoff from a simulated lawn area.

Rainfall simulation protocols were followed. Stainless steel runoff trays were inserted into the ground to allow runoff water collection. To approximate local conditions, rainfall intensity for a two-year, one-hour precipitation event of 3 inches per hour was applied during rainfall simulations. Rainfall simulations were initiated 24 hours post-herbicide application. Initiation of surface runoff from each plot was demarked at the start of a continuous water flow into collection reservoirs. Runoff was collected for 30 minutes.

For each simulated rainfall event, total runoff volume for the 30-minute runoff event was collected. In 2011, 1-liter sub-samples were collected every 5 minutes for 30 minutes and analyzed for water-soluble herbicide concentrations to characterize loss patterns. All atrazine and simazine water and soil samples were extracted and quantified.

Movement of simazine and atrazine appears to differ on complete turfgrass areas such as home lawns. Total atrazine movement accounts for 18.25 percent of atrazine applied compared to 5.69 percent of simazine applied. Atrazine dissolved in the water fraction of surface runoff accounted for 18.15 percent of applied atrazine of the 18.25 percent total atrazine lost, whereas the water fraction of simazine was 3.11 percent of applied simazine of the 5.69 percent total simazine lost (Figure 1). The remaining 2.58 percent of applied simazine lost of the 5.69 percent total simazine lost was sediment-bound simazine. Grasses have long been noted for their ability to reduce sediment movement at ground coverage above 70 percent. The greater affinity of simazine to bind with organic and soil particles appears to have affected the total amount of simazine lost during the surface runoff event compared to the more highly water-soluble atrazine.

In the second year of the study, the timing of atrazine and simazine losses was examined over the 30-minute surface runoff event. As illustrated in Figure 2, atrazine exhibited high initial losses after the onset of runoff. Within 15 minutes after the initiation of runoff, 14.43 percent of applied atrazine of the 18.25 percent atrazine lost had occurred. In

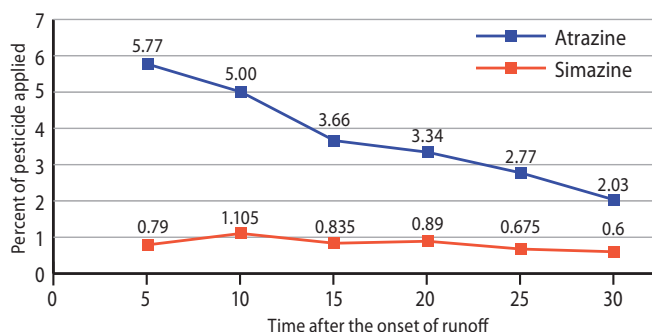


Figure 2. Loss pattern for atrazine and simazine during the 30-minute surface runoff event.

comparison, simazine exhibited more of a static loss pattern, suggesting its lower water solubility affected early losses. These data suggest that although long intense precipitation events may be equated with increased atrazine and simazine movement, precipitation events that produce as little as 15 minutes of runoff have a greater effect on atrazine movement compared to simazine because of atrazine's higher water solubility.

Based on these experiments the application of simazine to turf areas located adjacent to surface waters such as lakes, ponds, canals and bayous may reduce potential surface runoff compared to atrazine. The costs of simazine and atrazine are similar.

Jeffrey Beasley is an associate professor; Miao Liu is a graduate research assistant; and Ron Strahan is an associate professor, all in the School of Plant, Soil & Environmental Sciences. Jeff Kuehny is the resident director of the LSU AgCenter Botanic Gardens at Burden; Kevin McCarter is an associate professor in the Department of Experimental Statistics; Kim Pope is the pesticide applicator trainer with the W.A. Callegari Environmental Center.

Improving Sweet Potato Production Efficiency

Theresa F. Arnold, Tara P. Smith and Arthur Q. Villordon

Growth in the processing sector and nutrition-conscious consumers are fueling sweet potato popularity in the United States. Domestic per capita consumption increased by 36 percent from 2000 to 2011. U.S. production of the crop exceeded 2.6 billion pounds in 2012. Louisiana ranks fourth in sweet potato production in the United States, behind North Carolina, California and Mississippi. A research goal in the LSU AgCenter is to increase sweet potato production efficiency to help meet the increasing demand for this crop.

LSU AgCenter scientists have recently completed a three-year project funded through a U.S. Department of Agriculture specialty crop grant to help find ways to overcome production limitations that reduce yield while improving root quality. Through research and on-farm validation of a prototype production model, the scientists identified several conditions, including inadequate soil moisture at planting, that can lead to yield loss. The prototype production model was developed to represent the relationship between fresh market yield – the number of U.S. No. 1 grade sweet potatoes – and agroclimatic variables known to influence the critical storage root initiation stages in the Beauregard sweet potato. This predictive model can estimate the yield outcome based on agroclimatic inputs, assuming other variables such as variety suitability, clean seed stock and weed pressure are not limiting.

Recent studies have shown that under optimum field conditions, anatomical features related to the onset of storage root initiation can be observed as early as 13 days after transplanting. In sweet potatoes, storage root initiation is the most economically important physiological process wherein adventitious roots develop into storage roots. It is also well-

documented that the potential yield of the crop is determined by 30-35 days after planting. There are three documented stages of storage root initiation – SR1, SR2 and SR3. SR1 is the appearance of at least once adventitious root (Photo 1). SR2 is the appearance of anomalous cambium in at least one adventitious root in at least 50 percent of the transplants (Photo 2). SR3 is the presence of at least one visible storage root (adventitious root with localized swelling) in at least 50 percent of the plants (Photo 3).

Actual yields realized at harvest are dependent on biological, agroclimatic and other management variables. Lack of adequate soil moisture is a key limiting variable that can negatively affect root initiation and yield potential of the crop. Optimal soil moisture for sweet potatoes grown in Louisiana on a silt loam soil is 15-20 percent volumetric water content at a 6-inch soil depth. This number represents 50 percent of field capacity for soil moisture. This soil moisture threshold has to be calibrated for other soil types.

On-farm validation studies of a sweet potato production model were conducted from 2010-2012 on seven sweet potato farms across Louisiana. The validation studies were participatory in design in that cooperating producers were involved with site selection and contributed to production and pest management decisions in each evaluation year. The goal of these studies was to validate the accuracy of the model and use the findings in assisting producers with making informed production decisions about the sweet potato crop.

Portable weather stations (Photo 4) were deployed at each location prior to planting. In addition, fertility and nematode soil samples were collected at each test site. Several agroclimatic variables were recorded throughout the production season at hourly intervals, including soil moisture at 2- and



Photo 1: Storage root initiation phase 1 (SR1). Photo by Arthur Villordon



Photo 2: Storage root initiation phase 2 (SR2). Photo by Arthur Villordon



Photo 3: Storage root initiation phase 3 (SR3). Photo by Arthur Villordon

6-inch depths, rainfall or overhead irrigation events, humidity, maximum and minimum air temperatures and solar radiation. Production and pest management inputs were also recorded, including in-row plant spacing, row spacing, fertilizer applications and insecticide and herbicide applications. Stand counts (plants surviving at seven days after planting) and storage root initiation data were recorded in each of four plots. At harvest, the plots were harvested, and yield data were recorded. Actual yields were compared to predicted yields as generated by the predictive model. Comparative yield data representing actual and predicted U.S. No. 1 and total yield (all grades) at two locations from 2010-2012 are shown in Figures 1 and 2.

In all cases, with the exception of the north Louisiana field in 2012, the predicted yield exceeded the actual yield for total yield and U.S. No. 1 yield categories. Actual yields increased in each year for the north Louisiana location. The north Louisiana site did have irrigation capabilities, and, as such, soil moisture was maintained as close to an optimum level of 15-20 percent as possible. Yields realized in the south Louisiana location were reduced compared to the north Louisiana site. The south Louisiana location was not irrigated, and yields were lower and more variable as a result.

Producers who participated as case studies on this project were not only aware of the model-based decisions concern-

ing sweet potato production, but they implemented these practices on their farms. They made informed decisions and subsequently optimized results, thereby demonstrating the research effectiveness. The participatory approach contributed to the development of a decision support system for sweet potato producers, which will reduce yield variability and improve efficiencies as it is implemented on farms across Louisiana and in other states. Such a system can help model alternative management scenarios and determine the most reasonable management interventions to achieve optimum yield outcomes under different agroclimatic conditions. Ultimately, the efforts will help producers capitalize on expanding opportunities and remain profitable.

Theresa F. Arnold is an extension associate and LSU graduate student. Tara P. Smith is the Northeast Region director, former extension sweet potato specialist, and the coordinator of the Sweet Potato Research Station. Arthur Q. Villordon is a professor and researcher at the Sweet Potato Research Station, Chase.

Acknowledgements

The authors wish to acknowledge all producers that participated and collaborated on this project. The research and demonstrations were supported by USDA: NIFA project (2009-51181-06071), Participatory modeling and decision support for improving sweet potato production efficiency, quality and food safety.



Photo 4: Weather station used at each field site to measure agroclimatic variables. Photo by Theresa Arnold

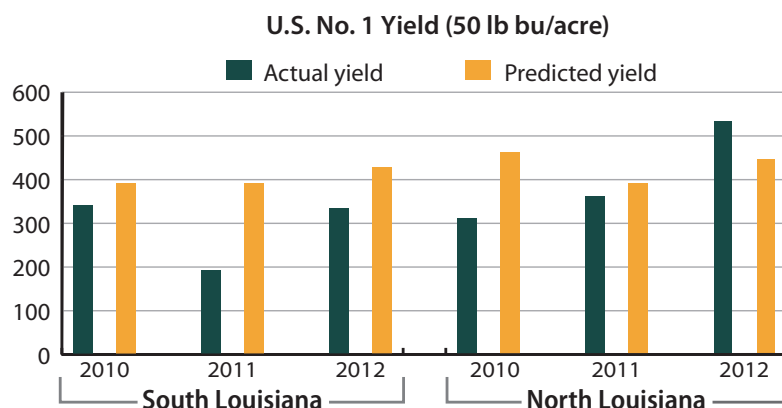


Figure 1. Actual and predicted U.S. No. 1 Yield from a south Louisiana and north Louisiana test site.

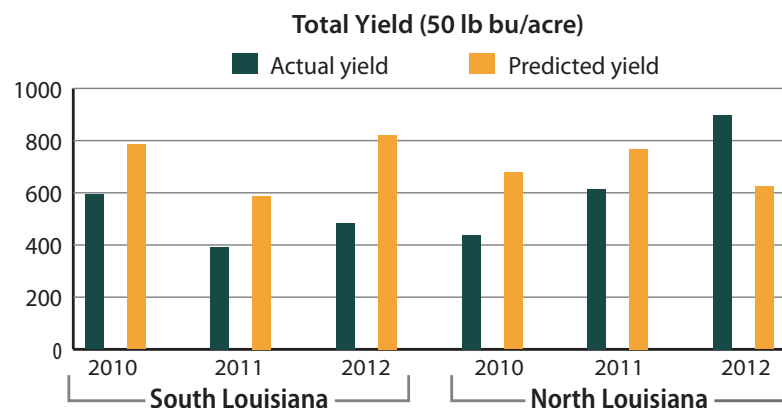


Figure 2. Actual and predicted total yield from a south Louisiana and north Louisiana test site.

Local nitrogen variability alters root architecture and influences storage root formation in the Beauregard sweet potato

Arthur Villordon, Don LaBonte and Tara P. Smith

In most agricultural soils, the distribution of water and plant nutrients is not homogeneous across space and time. Most plants respond to the nonuniformity of these soil-based resources by modifying the root system architecture. Root system architecture refers to lateral root initiation and development. Lateral, or branch, roots are mainly responsible for determining water and nutrient uptake efficiency.

In sweet potatoes, the main root axes of adventitious roots have five to six rows of lateral roots, corresponding to the number of protoxylem poles (Figure 1a), which range from five to six in the Beauregard variety. Lateral roots are derived from a layer of founder cells that surround the stele, or core tissue, deep within the main axis of the adventitious root (Figure 1a). These founder cells produce the earliest stage of lateral root development, called primordia, that progressively emerge as the main axis of the adventitious root grows (Figures 1a, b).

Recent evidence has shown that lateral root emergence and development are fundamentally associated with the capacity of a sweet potato adventitious root to become a storage root. If the growing environment is favorable, lateral roots progressively and repeatedly emerge as the main root axis grows through the soil, resulting in 10 to 20 lateral roots per inch. Adventitious roots that meet these lateral root development growth parameters are able to become storage roots, if the growing conditions are favorable (Figure 1c).

If the soil environment is unfavorable, some lateral roots fail to emerge. This failure has been associated with the development of woody tissue in the adjacent stele tissue, causing this section to quit growing. Secondary growth is a necessary step in storage root formation and involves the formation of a cambium ring within the stele tissue (Figure 1b). The cambium ring is a zone of active cell growth responsible for storage root development. If the lateral root primordia fail to emerge from the main root axis, the adventitious root will fail to become a storage root (Figure 1c). Thus, understanding the internal and external cues that determine root architecture will lead to development of management practices that optimize root development and increase production efficiency.

This research project investigated the influence of local nitrogen availability on root architecture development and its influence on storage root formation in the Beauregard sweet potato. Among plant nutrients, nitrogen is considered the most critical for growth because of its low availability in the soil and because nitrogen fertilizers can easily be lost by volatilization, leaching or denitrification. Knowledge of how fertilizer nitrogen influences sweet potato root architecture development during the critical storage root formation period can be used to improve management practices to increase nutrient use efficiency and promote consistent yields.

Recent developments in scanning and digital image analysis have increased the accuracy of the measurement of

lateral root development attributes in response to experimental treatments. These attributes include lateral root length, number, diameter, volume and surface area.

Specialized scanning equipment was used to measure advanced root architecture. The scanned images are analyzed by specialized software that differentiates root types based on thickness. This method was used in greenhouse experiments to describe how varying the availability of nitrogen influenced sweet potato root architecture and the nutrient content of leaf tissue. The experiments were timed to coincide with the onset of storage root formation.

In the Beauregard variety, this critical yield-determining physiological process can occur as early as 13 days in the field and 20 days in the greenhouse. Two greenhouse studies were

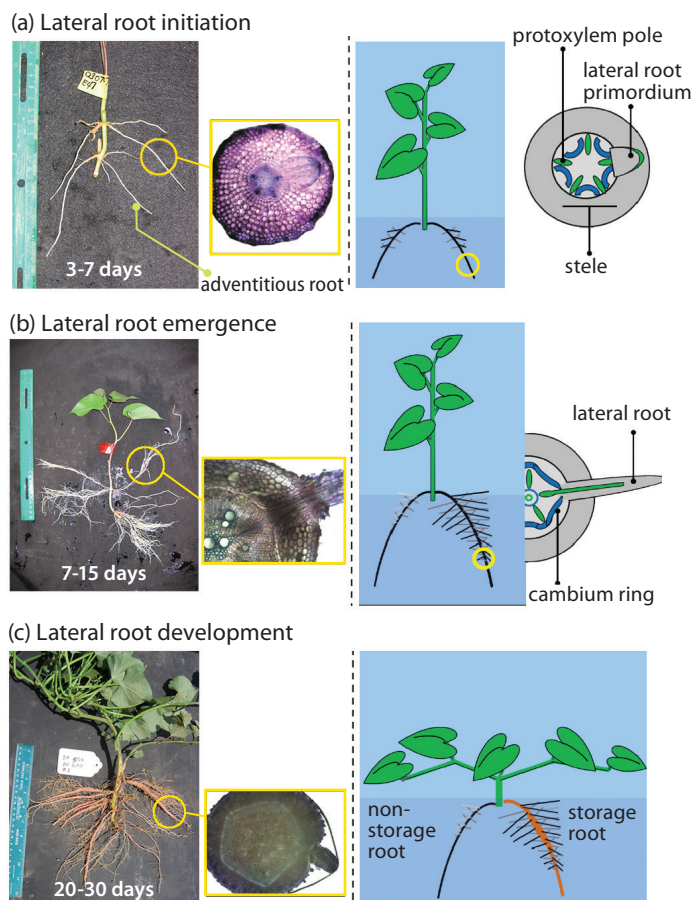


Figure 1. Schematic of key features of sweet potato adventitious root architecture associated with nutrient and water uptake and storage root formation. (a) Adventitious roots develop on nodes and cut ends of cuttings as early as three to five days after planting. Lateral root primordia develop from deep within the main adventitious root axis. (b) As the main axis of adventitious roots grows, lateral root primordia emerge through the surface of the main root axis. (c) Emerged lateral roots continue to develop and can produce secondary branches. Storage root formation occurs in adventitious roots after lateral root primordia emerge and develop.

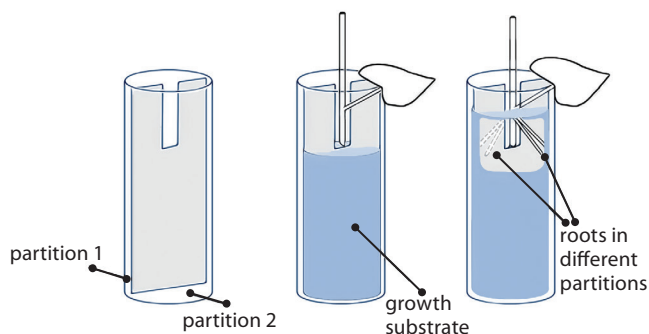


Figure 2. Schematic of the split-root system used for simulating local nitrogen variability in the vertical plane.

carried out to simulate variation in local nitrogen availability in fields.

First, a split-root culture system was developed to replicate variation of nitrogen distribution in the vertical plane (Figure 2). This simulates the localized presence of fertilizer nitrogen on one side of a ridge in agricultural fields, especially with fertilizers applied with an injector. Experimental controls included split pots with or without nitrogen fertilizer in both partitions.

Second, fertilizer placement experiments were conducted to simulate variation of nitrogen in the horizontal plane. This simulates the presence of nitrogen at a specific depth in the plow layer in agricultural fields. The experimental treatments include premixing nitrogen fertilizer in the growth substrate prior to filling the pot – top placement about 2 inches from the surface of the substrate, bottom placement about 2 inches from the bottom of the pot and an unfertilized control. In all experiments, nitrogen was added as urea at the rate of 45 pounds per acre.

In split-root experiments, the lateral root volume increased by 161 percent and surface area increased by 172 percent among root samples grown in the fertilized compartment compared with the untreated compartment. There were

no differences in root architecture attributes between compartments with similar experimental treatments.

In the nitrogen-placement experiments with root samples of plants grown in the substrate with premixed nitrogen, lateral root volume increased by 123 percent and surface area increased by 400 percent when compared with plants grown in the substrate with the fertilizer nitrogen placed at the bottom. The differences between the unfertilized controls and bottom placement were significantly less. A similar result was observed between premixed and top placement of nitrogen fertilizer. This evidence is consistent with data from model systems that indicate localized nitrogen presence is necessary for lateral root initiation and development.

These results suggest the broadcast application and incorporation of nitrogen prior to forming ridges is the application method that helps ensure optimum sweet potato root architecture development during the critical period of storage root growth.

In the nitrogen-placement experiments, leaf nutrient analysis data from the premixed and bottom fertilizer placement treatments showed that the former treatment had 75 percent greater nitrogen, 86 percent greater phosphorus, 60 percent greater potassium and 70 percent greater calcium content. The evidence suggests that nitrogen uptake can be increased by as much as 75 percent by simply altering the preplant placement of fertilizer nitrogen. Phosphorus, potassium and calcium are relatively immobile in the soil, and optimum root architecture development is necessary for the efficient use of these and other nonmobile nutrients.

Results indicate that localized nitrogen deprivation can directly alter root architecture development, which in turn diminishes the plant's ability to acquire relatively immobile soil nutrients. These results underscore the importance of gaining an understanding of nutrient effects on root architecture, especially in a crop where lateral development is associated with yield. These findings are being used to develop and evaluate management practices that seek to improve nitrogen

use efficiency and optimize adventitious root architecture development during the critical storage root formation period in commercially grown sweet potatoes in Louisiana.



Arthur Villordon is a professor at the Sweet Potato Research Station in Chase; Don LaBonte is a professor in the School of Plant, Environmental & Soil Sciences; Tara Smith is director of the LSU AgCenter Northeast Region.

Acknowledgements

Part of the funding for this research was provided by the Louisiana Sweet Potato Commission and the U.S. Department of Agriculture.

Arthur Villordon, right, professor at the Sweet Potato Research Station, explains his research during a field day at the station. Photo by Linda Foster Benedict



Photo by Randy LaBauve

Economic Impact of H-2B Visa Workers on the Louisiana Seafood Processing Industry

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

Louisiana has been the largest seafood-producing state in the contiguous United States and the largest producer of oyster, shrimp, crab, crawfish and alligator in the United States. One of every 70 jobs in Louisiana is seafood-related with a total economic impact of more than \$2.4 billion. Many of these jobs are in family-owned companies that have worked for generations to produce seafood for domestic and world markets. These jobs and natural resources are of value not only to the industry and local businesses, but also to Louisiana residents and communities. Seafood is a point of pride for Louisiana and an integral part of the coastal culture.

Louisiana's seafood industry has, however, faced a multitude of challenges over the past two decades. Beginning in the early 1990s, farm-raised seafood products from overseas stormed the domestic market, exposing Louisiana producers to fierce competition against foreign producers who rely heavily on much cheaper labor. In 2005, Hurricane Katrina displaced many seafood businesses and left lasting scars on the state's industry. It became extremely difficult for sea-

food producers to recruit local workers, most of whom found better paying jobs in the booming post-hurricane clean-up industry. In 2010, the industry was again hit by a disaster in the form of the BP oil spill.

Amid the growing challenges looms another concern to Louisiana seafood businesses – this time by new legislative actions to raise wages and extend benefits for legally-supported foreign workers under the temporary visa program called H-2B. In the face of significant labor shortages, Louisiana seafood businesses increasingly rely on H-2B workers, despite substantial upfront costs to participate in the program. Many of the participating businesses must consult with lawyers to assist with the complicated visa application procedure. Once petitions for foreign workers are approved, sponsoring employers must provide transportation, housing and meals to H-2B workers in addition to competitive wages in the local labor market.

The new legislative effort to raise wages and extend benefits for H-2B workers will make it more difficult for Louisiana seafood businesses to secure a sufficient work-

force. In this article, we provide insights into the economic impacts of H-2B visa workers on Louisiana's seafood processing industry. This analysis may aid elected officials in evaluating whether policies should be revised; extension agents in targeting gaps in their parishes that can be proactively addressed; and farm operators in assessing the landscape of their profession as they look toward the future.

H-2B Visa Workers in Louisiana

Since 2005, the Louisiana seafood processing and packaging industry has employed a considerable number of H-2B visa workers, temporary workers hired from other countries for seasonal industries (Table 1).

Table 1: Numbers of H-2B visa workers in seafood-related industries in Louisiana, 2005-2010.

Fiscal Year	Number of Workers
2005	1,515
2006	1,345
2007	2,533
2008	2,397
2009	2,421
2010	2,026

Source: Foreign Labor Certification Data Center:
<http://www.flcdatacenter.com/CaseH2B.aspx>

Table 2 shows average prevailing wages of H-2B workers for seafood-related and all other jobs in Louisiana between 2007 and 2010. Average prevailing wages are much lower for seafood-related jobs than for all other jobs. The lower average wage indicates the difficulty of seafood-related business owners in securing domestic labor.

Table 2: Average Wage for H-2B Workers in Louisiana

Average wage (\$)	Seafood-related Jobs	All Other Jobs
2007	\$6.83	\$9.14
2008	\$6.94	\$9.20
2009	\$7.20	\$9.74
2010	\$8.41	\$10.09
All Years	\$7.26	\$9.38

Source: Foreign Labor Certification Data Center:
<http://www.flcdatacenter.com/CaseH2B.aspx>

Macroeconomic Impact of H-2B Visa Workers on the Louisiana Economy

Because of a lack of information and data on several key variables, we worked from the following scenarios and assumptions to estimate the economic impact of H-2B visa workers in Louisiana. These are:

1. According to LSU AgCenter research, crawfish processors operate for nine months per year. While the majority of crawfish peeling occurs during March-May, some may also be peeled in February and June and, occasionally, in other months. Assuming that most H-2B labor comes to the United States for at least nine months, on average, and labor may be allocated to working with multiple seafood species, we assumed seafood workers work 39 weeks per

year at an average of 35 hours of work per week (H-2B visa stipulates that jobs must be temporary, full-time work of at least 35 hours per week).

2. The current wage rate is \$8.07.
3. There is some remittance of monies to the home country by workers. We assumed several rates – 5 percent, 10 percent, 15 percent and 20 percent. The World Bank reports show 20 percent to 40 percent remittance rates among foreign workers, though among seasonal California workers the remittance rate is as high as 40 percent. This may not hold true for H-2B visa workers because their families may accompany them to work in the United States.

With this in mind, we used the IMPLAN Economic Modeling program to find that:

1. The seafood preparation and packaging multiplier for Louisiana from IMPLAN is 2.81. This means that for every dollar of employee compensation created by the seafood preparation and packaging industry in Louisiana, employee compensation increases by \$2.81 across all sectors of the Louisiana economy. This includes the original \$1 of employee compensation created by the seafood preparation and packaging industry plus an additional \$1.81 of induced multiplier effects across all sectors of the state economy.
2. Total income generated by H-2B visa workers in Louisiana is substantial and ranges from \$18 million to \$21million in Louisiana (considering 35 hours per week).
3. The total economic impact of H-2B visa workers in Louisiana could range from \$50 million (20 percent remittance rate) to about \$60 million (5 percent remittance rate), if workers were working 35 hours per week.
4. The number of domestic jobs in Louisiana supported by H-2B workers ranges from 769 to 1,371.

Louisiana Sea Grant funded a study that enabled us to collect data from Louisiana seafood processors through a survey. These data were used to make some comparisons of wages and numbers of workers. They could also shed light on the demand and supply of workers, both domestic and foreign (H-2B), and preferences for workers by Louisiana seafood processors.

Employers were queried on the wage structure for domestic, immigrant (non-H-2B), and nonimmigrant (H-2B visa) workers. Employers were queried on wage rate (wage/hour) and piecemeal wages (\$/pound) for both types of workers. Table 3 indicates that: (1) during 2008-2011, wage rates for both types of workers rose; for example, the wage rate for non-H-2B workers increased from \$9.37/hour in 2008 to \$10.35/hour in 2011, while the piecemeal rate increased from \$1.66/pound to \$1.86/pound. (2) The wage rate for H-2B workers has been lower than for their counterpart. For example, in 2008, H-2B visa workers earned about 13 percent less than their counterpart, and this wage gap widened in 2011 to about 18 percent lower. Finally, the piecemeal rate for H-2B workers increased from \$1.62/pound to \$1.81/pound

during the same period. Nonetheless, the piecemeal rate for H-2B workers was about 5 cents/pound lower than for their counterparts.

Table 3: Average wage rate by year and type of worker

Year	Non-H-2B workers		H-2B workers	
	\$/hour	Piecemeal (\$/lb)	\$/hour	Piecemeal (\$/lb)
2008	9.37	1.66	8.11	1.62
2009	9.62	1.69	8.22	1.67
2010	10.13	1.83	8.70	1.78
2011	10.35	1.86	8.49	1.81

Employers were queried on nonwage, or fringe, benefits including vacation, health insurance, housing and transportation. Not surprising, among domestic and immigrant workers (non-H-2B), vacation (25%), meals (13%), other nonwage benefits (21%) and other incentives (17%) were higher; however, among nonimmigrant (H-2B visa) workers, transportation (30%), housing (25%) and other nonwage benefits (25%) were higher (Table 4).

Table 4: Nonwage benefits offered by employers.

Nonwage benefits	Non-H-2B workers	H-2B workers
Incentive	16.7%	5%
Vacation	25.0%	0%
Transportation	8.3%	30%
Meals	12.5%	5%
Health insurance	8.3%	5%
Housing	8.3%	25%
Staple foods	0.0%	5%
Other	20.8%	25%
Total	100%	100%

The most likely document kept by employers of nonimmigrant (H-2B visa) workers was Social Security cards (50%), followed by passports/visas (30%). About 80 percent of the employers were confident their H-2B visa workers had proper documents to work in the United States.

Finally, only 50 percent of the Louisiana seafood processors used the Department of Homeland Security's E-Verify program to verify their foreign-born employees. When queried on employee turnover rate, 22 percent of Louisiana seafood processors indicated a 10 percent turnover rate, while 9 percent indicated a 20 percent or higher turnover rate.

Labor Shortage and Solutions

Figure 1 shows that labor shortages could lead to increased prices for some or all products, cancelling expansion of seafood processing businesses and decreasing operational efficiency. For 32 percent of respondents, capital loss was also an important factor. Respondents were asked if they would face a labor shortage in 2013, and 60 percent indicated they anticipated one. About 29 percent of respondents

indicated they expected about a 50 percent labor shortage in 2013, followed by 21 percent anticipating about a 30 percent labor shortage. About a third of respondents indicated the reason for the labor shortage was "few applicants." About 22 percent indicated they could not offer the asking wage rate, and a similar percentage faulted the high turnover rate. Finally, 56 percent of Louisiana seafood processors indicated they had faced a labor shortage in the past two years.

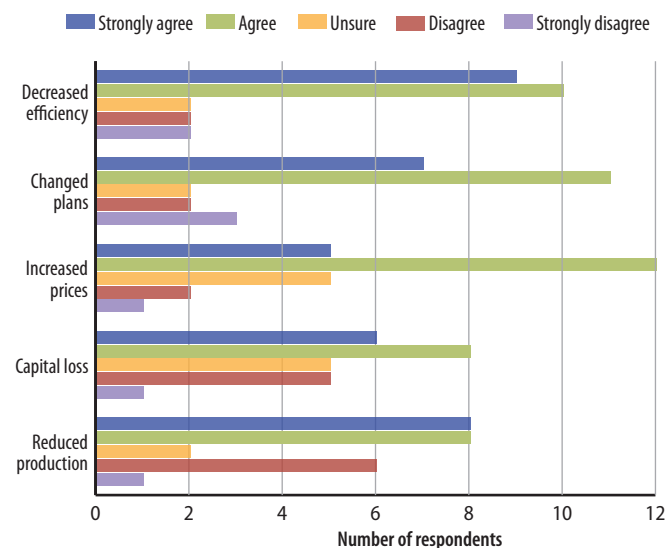


Figure 1: Labor problems and the impact on seafood processing firms

When respondents were queried on the solutions they have considered and applied to mitigate labor shortages, most of them indicated "reduced operations." According to Figure 2, seafood processors have also considered reducing raw materials and ceasing operations as possible solutions to labor shortages. Only 10 percent to 14 percent have considered raising wages.

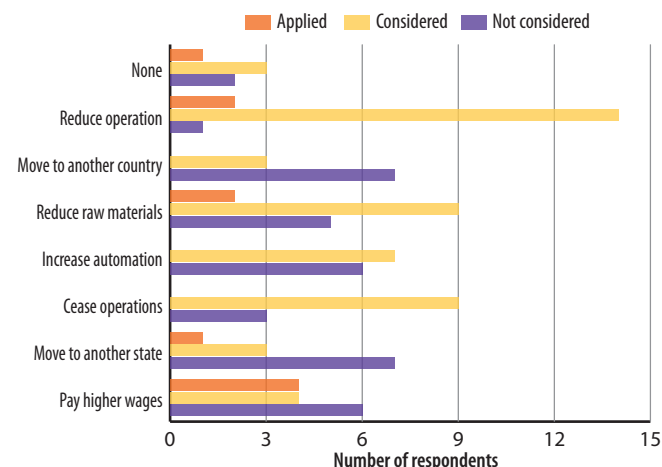


Figure 2: Possible solutions to labor shortages

Summary and Conclusions

The Louisiana seafood processing and packaging industry heavily relies on H-2B visa workers, temporary workers hired for seasonal work, mainly from Mexico and Central America. The U.S. Department of Labor proposed higher wages for H-2B workers in January 2012, after a federal court

struck down guidelines for the program crafted by the Bush administration.

Our survey of Louisiana seafood processors found that the share of labor cost in total cost could range from 20 percent to 40 percent. Findings show that over the 2008-2011 period, wage rates for both non-H-2B and H-2B workers rose. With respect to nonwage benefits for H-2B workers, employers provided workers with transportation, housing and other non-wage benefits.

We found that a labor shortage could lead to increased prices for some or all products, cancelling expansion of seafood processing businesses and decreasing operational efficiency. In response to increased wages for H-2B visa work-

ers, employers would consider decreasing/ceasing production, with some having already ceased production and some indicating increasing their product prices as ways to reduce the financial impact on their businesses. About 33 percent of employers strongly agreed that if Congress does not change wages for H-2B visa workers, then seafood processors could hire enough labor for their operations. Finally, about 92 percent of the respondents indicated that they will not exit the seafood processing industry.

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



Seafood processing workers at a dock facility in Intracoastal City. Photo by Randy LaBaue

Finding Lower-Maintenance Easy-Tea Hybrid Tea Roses

Allen Owings

Gardeners who have shied away from growing roses because of the fungicides and care needed to grow them can take heart in a recently completed research project conducted by the LSU AgCenter and the American Rose Society at the Gardens of the American Rose Center in Shreveport.

The research was initiated to identify hybrid tea varieties that will flourish under minimum-care conditions. This project began in February 2009, and the last data from this four-year study were collected in October 2012.

Based on the highly successful Earth-Kind rose program initiated and managed through the Texas Agri-Life Extension Service, the Easy-Tea Hybrid Tea project focused on hybrid tea varieties rather than the shrubs and old garden roses primarily included in the Earth-Kind research.

As with the Earth-Kind program, the Easy-Tea Hybrid Tea research attempted to identify existing rose varieties that meet the criteria to be designated earth-friendly. Thirty carefully selected varieties of hybrid tea roses were evaluated to identify those with the highest level of natural disease resistance.

Claude Graves, of Dallas, Texas, the American Rose Society member who chaired this project and solicited the LSU AgCenter to conduct the research, stated, “The American Rose Society is seeking to encourage citizens to enjoy growing our national floral emblem, the rose, by developing a testing program that will identify hybrid tea rose varieties that require a minimum of care – including minimal application of chemicals considered by many to pose potential harm to the earth’s ecology.”

Rose varieties were included in the study based on an extensive national survey of American Rose Society. Some of the criteria for the research included:

- Initial bed construction following Earth-Kind recommendations, which include tilling native soil and adding compost.
- Annual fertilization with a slow-release fertilizer in late February.
- Four applications of Fertilome systemic fungicide with propiconazole annually in late February, April, June and September for three years.
- Four applications of Bayer Advanced Garden Systemic Fungicide with tebuconazole annually in late February, April, June and September during one year.
- Pruning in February and late August as recommended for hybrid tea roses in north Louisiana.
- Irrigation applied only when absolutely necessary.
- Compost, mulch applications midway through the study.
- Blackspot susceptibility ratings and visual quality ratings taken four times annually – peak spring bloom, early June, prior to late summer pruning and peak fall bloom.

The study was designed as a randomized complete block and was properly replicated. Data were statistically analyzed. Growing conditions in Shreveport over the four-year period included one year with environmental conditions favorable for blackspot disease development; one year with conditions

Top 10 overall best-performing varieties in the Easy-Tea Hybrid Tea rose ranking based on blackspot disease ratings and visual quality ratings (2009-2012) at the Gardens of the American Rose Center, Shreveport.

	Visual Quality Rating Rank	Blackspot Disease Rating Rank	Overall Ranking
Traviata	First	Second	First
Tahitian Sunset	Second	Fourth	Second
Frederic Mistral	Third	Sixth	Fourth
Tropicana	Fourth	not ranked	---
Pink Traviata	Fifth	Third	Third
Mister Lincoln	Sixth	Seventh	Sixth (tie)
Olympiad	Seventh	not ranked	---
Tiffany	Eighth	Fifth	Sixth (tie)
The McCartney Rose	Ninth	First	Fifth
Chrysler Imperial	Tenth	Tenth (tie)	Eighth
Electron	not ranked	Tenth (tie)	---
Midas Touch	not ranked	Eighth	---
Pope John Paul II	not ranked	Ninth	---

that would be considered average for blackspot development; and two years of dry conditions that would lessen blackspot disease on roses.

After four years, the roses designated Easy-Tea varieties are Traviata, Pink Traviata, The McCartney Rose, Tahitian Sunset and Frederic Mistral. This selection was based on blackspot susceptibility and overall landscape performance in terms of flowering, vigor and visual plant appearance.

Top performers (ranked first through fifth) in visual quality of overall landscape performance are Traviata, Tahitian Sunset, Frederic Mistral, Tropicana and Pink Traviata. The top overall performers in terms of blackspot resistance (ranked first through fifth) are The McCartney Rose, Traviata, Pink Traviata, Tahitian Sunset and Tiffany.

Traviata is an older hybrid tea released in 1962 by Meilland and marketed by Conard-Pyle Roses in the United States. It has brilliant, dark red flowers with 90-100 petals per bloom. The foliage is dark glossy green. Long stems are typical, and plants in Shreveport reached 5 1/2 feet tall. This rose was the overall performer in the Easy-Tea Hybrid Tea rose trial.

Tahitian Sunset is an All-America Rose Selection winner from 2006. This brightly hued rose has flowers that start as orange-yellow buds. When flowers fully open, colors go to a peachy-apricot-pink with yellow highlights. Petal count averages 30, with 5-inch-diameter blooms. Stems are 14-16 inches long, and the flowers have a licorice fragrance. Foliage is semi-glossy. This was the second-ranked Easy-Tea rose.

Pink Traviata is a mutation of Traviata released in 2005. The deep pink flowers have the same form and petal count as Traviata. Foliage is dark glossy green. Stems are slightly shorter than Traviata. Plants reached 5 feet tall in Shreveport. Pink Traviata was the third-ranked Easy-Tea rose.

Frederic Mistral is another Meilland rose that is an Easy-Tea winner. Blooms are dusty rosy pink, double and 4 1/2 inches in diameter with 40 petals. Blooms are fragrant, and plants have rich green, semi-glossy foliage. This was the fourth-ranked Easy-Tea rose.

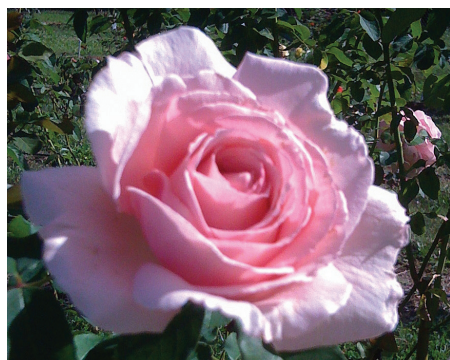
The McCartney Rose is a Meilland-introduced rose distributed in the United States by Conard-Pyle. Plants have fragrant, brightly colored, deep rosy pink flowers. This rose was offered as a birthday present to Paul McCartney by his record company. A tall, upright grower, plants reached almost 6 feet tall in the Shreveport gardens. This was the fifth-ranked Easy-Tea rose.

A few retail garden centers in Louisiana carry some of these varieties, and additional outlets for these plants for low-maintenance rose gardens will be more widely available in the future.

Allen Owings is a professor at the Hammond Research Station.

Acknowledgements

The research project was a joint effort of the American Rose Center and the American Rose Society with some financial support provided by the ARS Research Endowment Trust.



Easy-Tea Frederic Mistral



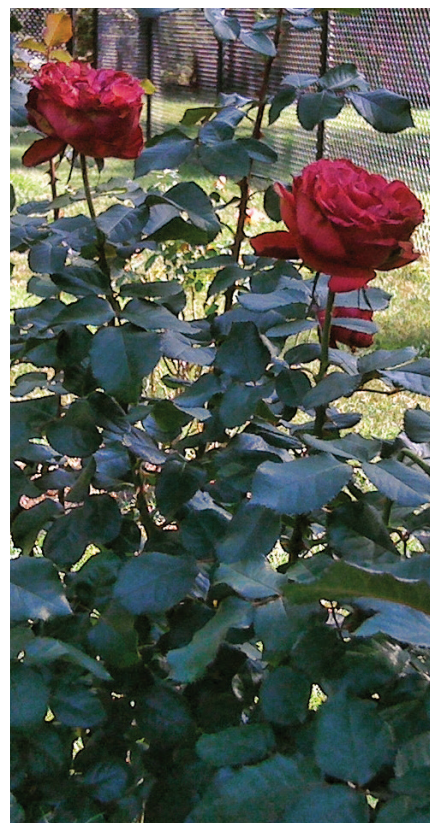
Easy-Tea Tahitian Sunset



Easy-Tea Pink Traviata



Easy-Tea The McCartney Rose



Easy-Tea Traviata

Photos by Allen Owings



Dairy calves at the LSU AgCenter Southeast Research Station in Franklinton. The dairy industry contributed \$118 million to the Louisiana economy in 2012, according to the LSU AgCenter Ag Summary. Photo by John Wozniack

Performance Indicators of the Louisiana Dairy Refundable Tax Credit Program

Wayne M. Gauthier

In the past three decades, Louisiana's total milk production has been declining annually, while total U.S. milk production has been increasing. This observation suggests that the economics of milk production have not been as favorable for milk production in Louisiana as they have been in other parts of the United States. Milk production is positive for economic development because of its multiplier implications for employment, incomes and tax receipts. Creation in 2007 of the Louisiana Dairy Refundable Tax Credit Program by the Louisiana Legislature was an initiative to enhance the economics of dairying in Louisiana by awarding subsidies to Louisiana dairy farmers in the form of refundable tax credits.

A subsidy is an expenditure of public monies. Accounting for those monies and documentation of the tax credit program's outcomes builds trust between the taxpaying providers and dairy farmer recipients of those monies. It also provides baselines for assessing both the relative effectiveness and weaknesses of the tax credit program in increasing Louisiana's total milk production over time and provides a foundation for proposals to modify the tax credit program so as to overcome its weaknesses. The purpose of this article is to use performance indicators to: (1) establish historical accountability records of annual levels of the refundable tax credits and their distributions between and within annual milk production levels of Louisiana milk produc-

ers and (2) identify and track structural changes within the annual milk production levels of the milk production sector of the Louisiana dairy industry since the inauguration of the Louisiana Dairy Refundable Tax Credit Program.

The use of performance indicators to assess structural change in an economic entity, such as the production sector of the Louisiana dairy industry, is consistent with the economic dictum that structure influences conduct, which, in turn, influences performance. The seven different performance indicators created by milk production level and year were: (1) the refundable tax credit awarded to an individual producer; (2) the number of producers; (3) the dollar value of the aggregate tax credits awarded; (4) the relative (%) value of the refundable tax credit for the year; (5) the relative (%) number of producers; (6) the relative (%) contribution of milk production within the annual milk production level; and (7) Louisiana's total pounds of milk production for the year.

For each performance indicator, unique values associated with a specific level of annual milk production and year were calculated and incorporated into a table. The totals are in Table 1. A complete table with the ranges for pounds and awards is available on the magazine's website. Go to www.LSUAgCenter.com and click on Louisiana Agriculture Magazine.

Table 1. Performance Indicators of the Louisiana Dairy Refundable Tax Credit Program 2007- 2012

Year	No. of Producers	Total Refundable Tax Credits	Total Milk Production (pounds)
2007	207	\$1,257,500	312,351,996
2008	199	\$1,160,000	291,532,024
2009	182	\$2,055,000	251,154,673
2010	152	\$1,795,000	220,960,390
2011	143	\$1,720,000	210,475,744
2012	137	\$1,665,000	209,830,549

Table entries indicate that Louisiana's annual total milk production in 2007 of 312,351,996 pounds declined every year to 209,830,549 pounds in 2012. During this period, refundable tax credits totaling \$9,652,500 were distributed annually to declining numbers of dairy farmers. The initial awarding of refundable tax credits in 2007 of \$1,257,500 was made to 207 Louisiana dairy farmers. In 2012, an awarding of \$1,665,000 in refundable tax credits was made to 137 Louisiana dairy farmers. The performance indicators document ongoing erosion in the structure of the Louisiana dairy industry as assessed by declines in the number of producers and in annual total milk production. However, this interpretation should not prompt a conclusion that the tax credit program has not been an effective dairy policy in maintaining and increasing total Louisiana milk production.

Consideration should be given to the contention that there is a design flaw in the tax credit schedule. This flaw effectively minimizes the number of producers for whom the program provides an incentive for increasing total milk production. The flaw exists because the schedule provides for a \$5,000 refundable tax credit increase to be awarded whenever a producer's annual milk production level increases

sufficiently to reach the threshold of the next higher annual milk production level. The difference between the threshold annual milk production levels in the schedule is 500,000 pounds. Only dairy farmers whose current annual milk production levels are at their upper ends and thus approaching the thresholds of the next higher level are likely to view an additional \$5,000 refundable tax credit as an incentive to increase their annual milk production. Increasing production increases total costs that would be offset by the additional returns from the sale of the additional milk and dairy beef plus the \$5,000 refundable tax credit.

Consider the case where dairyman A's annual milk production level is within 10 percent or 50,000 pounds of the next higher level and dairyman B's production is 90 percent or 450,000 pounds distant from the next higher level. Assume each dairyman's per cow milk production is 16,500 pounds/year. Dairyman A, by adding four cows, could increase his annual milk production level by 66,000 pounds and qualify for the higher tax credit. Dairyman B would have to add 28 cows to his herd. The magnitude of the difference in costs alone of adding 28 cows and the supporting infrastructure investment costs versus four cows in order to qualify for the same \$5,000 tax credit explains why dairyman A would be more likely to respond to the \$5,000 tax credit incentive, while dairyman B would not increase his production in response to that incentive. The prescription for remedying the flaw would be to modify the program by increasing the number of levels in the schedule from the present 6 to 60 without changing the requirements to cap program costs at \$2.5 million and the individual farmer cap of \$30,000. This can be done by changing the increments for the tax credits from \$5,000 to \$500 and changing the increments for pounds of production from 500,000 to 50,000. Thus, a dairy farmer would qualify for a \$500 credit for each additional 50,000 pounds of milk production.

Research to assess the potential of substituting a revised schedule in the program featuring sixty 50,000 pound levels and \$500 tax credit thresholds has been recommended.

Wayne Gauthier is an associate professor in the Department of Agricultural Economics & Agribusiness.



Cows at the Southeast Research Station in Franklinton. Photo by John Wozniak

The Search for an Alternative Commercial Cricket for the U.S. Industry

Christopher Carlton and Benjamin Adams

The humble beginnings of the cricket industry in the United States can be traced back to the 1950s when their use as fish bait became widespread. Bait crickets typically purchased from neighborhood bait shops or hardware stores are the species *Acheta domesticus*, the house cricket or brown house cricket. The relatively recent, and expanding, trend of keeping reptiles and amphibians as exotic pets contributed to rapid growth of the commercial cricket industry. The economic impact of cricket growers in the United States is difficult to assess, but major cricket producers may ship more than 5 million crickets a week. Individual operations may see revenue of millions of dollars annually and employ dozens of individuals.

During the first decade of this century, European cricket operations were devastated by the virus *Acheta domesticus* densovirus. It paralyzes and kills crickets before they reach reproductive age. The Europeans began replacing their cultures with an alternative species, the Jamaican field cricket, *Gryllus assimilis*, which is apparently not susceptible to the virus. Around 2009, an identical or similar virus entered North America and began wiping out domestic *Acheta domesticus* operations. Development of an alternative cricket became an urgent issue for U.S. and Canadian cricket producers. A number of operations have succumbed to the virus and suspended operations.

Researchers in Canada are exploring antivirus therapies to mitigate the effects of the virus, but so far without success. The situation in the United States is not as simple as it was in Europe. The Jamaican field cricket is a tropical species unable to survive in the wild in most of Europe. In the United States, the concern is that it may become established outside its normal range. Also, in limited trials in the United States, the Jamaican field cricket has not met expectations

for growth and productivity for optimal commercial use. Numerous other domestic species of field crickets occur in the United States. Most, however, have a resting phase (diapause) during the year that renders them unsatisfactory for year-round cultivation, and reproductive potentials are sub-optimal for commercial production.

During September 2010, LSU AgCenter scientists at the Louisiana State Arthropod Museum began a series of studies in cooperation with Fluker Farms, of Port Allen, La., to explore additional alternative species for possible use as a commercially viable alternative to *Acheta domesticus*. The studies consisted of a series of trials using various locally available cricket species. Several species underwent screening, and *Gryllodes sigillatus*, the tropical house cricket, emerged as a leading contender as a commercial alternative. The tropical house cricket is a non-native species that originated in south Asia. It is established from Florida to Texas and probably exists as scattered populations across the southern tier of states all the way to California. A local population on the LSU Baton Rouge campus was the source of the rearing stock.

Cricket husbandry is relative easy. The study used 15-gallon plastic storage totes with the tops cut out to within 2 inches of the margin. Fiberglass window screen was glued around the perimeter to form a screened lid. Cardboard egg carton inserts and layers of newspaper in the totes provided surface area, and water dishes with cotton balls or a layer of small gravel provided moisture for the crickets. Trays containing a 2-inch layer of moist peat moss served as a substrate for egg laying. This setup has proven useful for continuous rearing, with crickets transferred every couple of months to a clean tote to maintain adequate hygiene. Containers were kept at temperatures of 82-90 degrees F, with fastest growth



Figure 1. *Acheta domesticus*, the brown house cricket, is the most commonly commercialized cricket in the United States. Photo by Christopher Carlton



Figure 2. *Gryllodes sigillatus*, the tropical house cricket, is a possible alternative cricket for U.S. commercialization. Photo by Christopher Carlton

occurring at the higher temperature. Records noted onset of egg laying, the first appearance of hatchlings (pinheads), general growth and development, and ambient light and temperature conditions.

Tropical house crickets raised under these conditions completed development from egg to adult in as few as 33 days. This is more rapid growth than that of the commercial house cricket, which completed development in 48 days under the same conditions. The tropical house cricket is tolerant of a wide variety of densities and sanitation conditions and appears unaffected by light/dark cycling.

Based on experiences of LSU AgCenter researchers after three years of study, the tropical house cricket is a viable candidate for commercial rearing and marketing. Mature adult tropical house crickets are slightly smaller than those of *A. domesticus*, with adults of the former typically measuring 0.7 inch and the latter 0.8 inch. Tropical house crickets possess shorter wings than *A. domesticus* and are incapable of flight. The tropical house crickets showed no apparent reductions in size or vigor during 36 months of continuous rearing in laboratory cultures.

Efforts are now underway to address regulatory issues with the U.S. Department of Agriculture and state agencies that will allow interstate shipping of tropical house crickets. Regulatory and quarantine requirements are less stringent for this species than for non-native, nonestablished species. Although the species originated in south Asia, it is well-established across the South as a species that lives in and around human habitats. The tropical house cricket is being seriously investigated for commercialization by American growers, though some questions remain about the long-term viability of the industry.

Although the level of virulence is unclear, tropical house crickets also can be infected by the virus that infects the domestic house cricket. Crickets in the AgCenter laboratory, however, have tested negative. Growers not affected by the virus are still marketing brown house crickets as their preferred commercial crickets, but the tropical house cricket represents an immediately available alternative.

Christopher Carlton is the John Benjamin Holton Alumni Professor, and Benjamin Adams is a former graduate assistant in the Department of Entomology.

Possibility of virus keeps Louisiana cricket business on alert

Johnny Morgan

A virus that has crippled the cricket industry in Europe keeps West Baton Rouge Parish breeder and grower David Fluker alert, but optimistic.

His operation, Fluker Cricket Farm in Port Allen, has been in business since the 1950s when his father started it as a fish bait enterprise.

"There are a number of cricket farms in the state and around the country, but we're a little different," Fluker said. "We're the only farm that has crickets and other pet products. We've kind of joined the two together."

Fluker and his 24 employees ship more than 5 million crickets a week out of his facility to Petco, PetSmart, Wal-Mart and mom and pop stores across the nation.

Larger farms like his are more interested in shipping their crickets for animal feed, such as for reptiles and birds at zoos, he said. Even hedgehogs like to eat crickets.

As the threat of the virus becomes more likely, Fluker has decided to breed some wild species not affected by the virus with help from LSU AgCenter entomologist Chris Carlton.

"We pretty much have a closed industry," Fluker said. "We don't sell to any-

body here; it's all mail-ordered. We even bake our mail for sterilization."

The virus wiped out the cricket industry in Europe in the late 1990s, Fluker said. "Around 2009 is when the virus was known to be here in America. We haven't seen it in the state yet."

Fluker's business stays steady through the year, but shipping becomes an issue

during the winter when he ships to cold climates like Billings, Mont.

"There are also some summer shipping issues, and we have to adjust the packaging for the high temperatures," Fluker said.

Johnny Morgan is a writer in Communications.



David Fluker is the owner and operator of the Fluker Cricket Farm in Port Allen, La. He works with the LSU AgCenter to make sure his crickets stay virus-free. Photo by Johnny Morgan

Inside:

Rice farmers need to take into consideration the likelihood of crop damage due to adverse weather conditions as new risk management tools are developed. Page 10

Simazine may be a better choice than atrazine for home lawns near surface waters. Page 12

On-farm validation studies of a sweet potato production model were conducted from 2010-2012 on seven Louisiana farms. Page 14

Ag economists survey Louisiana seafood processors concerning labor issues. Page 18

Some hybrid tea roses can flourish under minimum-care conditions. Page 22



LSU AgCenter
128 Knapp Hall
Baton Rouge, LA 70803

NONPROFIT ORG
U.S. POSTAGE
PAID
BATON ROUGE, LA
PERMIT NO. 374



2014 Get It Growing Lawn & Garden CALENDAR

The 2014 Get It Growing Lawn & Garden Calendar offers monthly tips for Louisiana gardeners from LSU AgCenter horticulturist Dan Gill and beautiful photos from Louisiana photographers.

- Full color
- 13 1/4" x 9"
- How to's
- Zone map

- Monthly tips
- Special section on roses
- Louisiana Super Plants

\$11.95
plus shipping



Order online: LSUAgCenter.com/OnlineStore or by phone: 225-578-4646

