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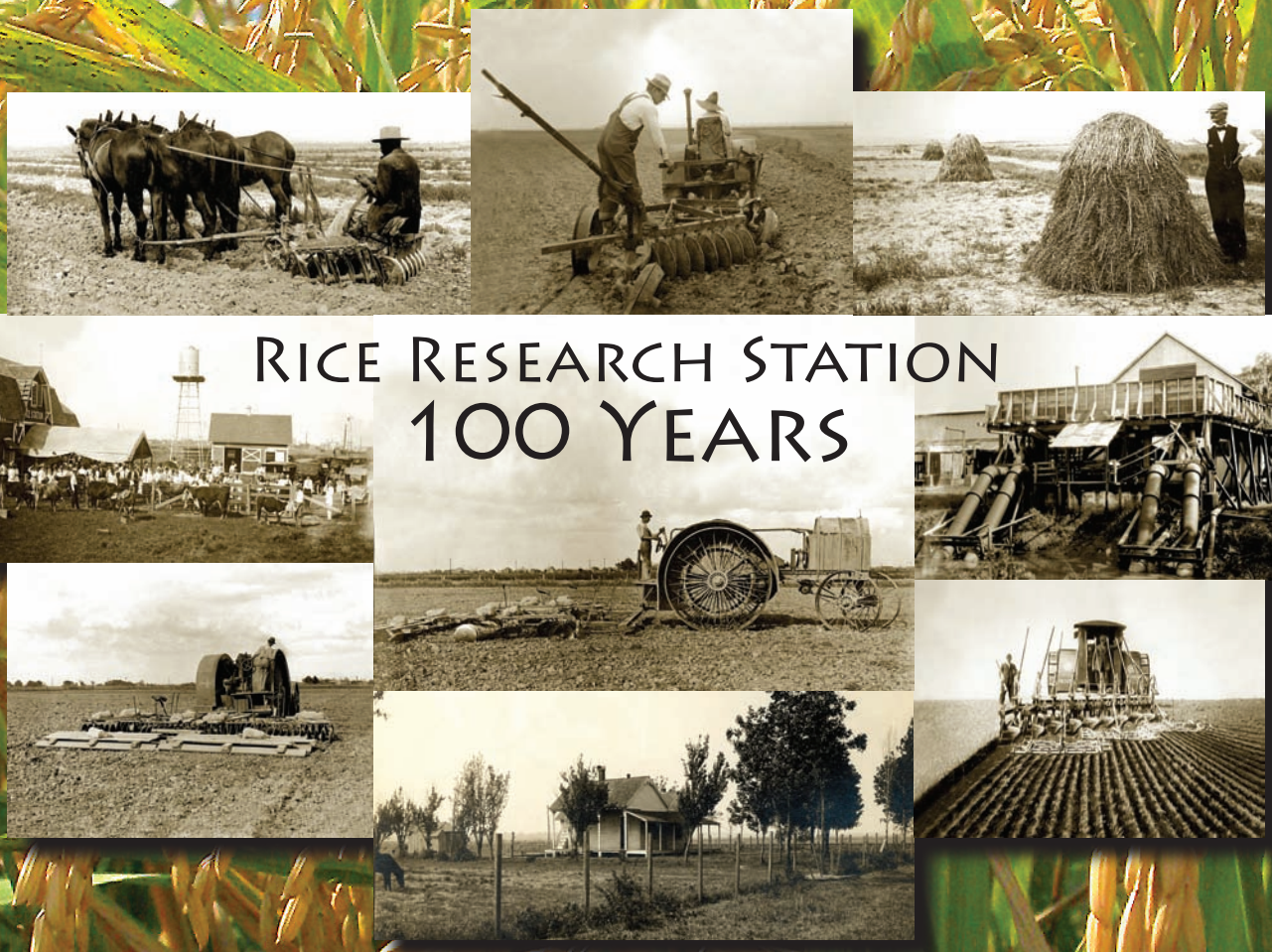
LOUISIANA Agriculture

Assuring Our Future Through Scientific Research and Education



Rice Research Station 100 Years

Birds and the spread of West Nile virus

Sweet leaf tea and cancer prevention

Crawfish tail curl and food safety

LSU AgCenter Research & Extension

LSU AgCenter research station helps lure ConAgra Lamb Weston's new sweet potato processing plant to northeast Louisiana

LSU AgCenter scientists played a key role in helping to entice ConAgra Foods to locate a new sweet potato processing plant to northeast Louisiana.

ConAgra's Lamb Weston division, which is based in Washington state, has decided to build a state-of-the-art plant near Delhi to take advantage of Louisiana's sweet potato crop, which is purported to be the best-tasting in the country.

The plant, whose exact location is still not known, is scheduled to open in the fall of 2010 and initially employ 275 people at an average salary of about $35,000 per year.

But company officials said they also chose the location to be in close collaboration with the researchers and extension specialists at the nearby Sweet Potato Research Station in Chase, which is the only facility of its kind in the United States.

"North Carolina produces more sweet potatoes than we do," said Tara Smith, extension specialist and coordinator of the Sweet Potato Station. "But ours are generally recognized and marketed as the best-tasting in the country."

Louisiana has about 15,000 acres in sweet potatoes, compared to nearly 45,000 in North Carolina. Alabama, Arkansas, Mississippi and Texas also produce sweet potatoes in the southeastern United States. The ConAgra Lamb Weston facility expects to source more than half of their product needs from Louisiana producers but will also work closely with producers in other states.

Three LSU AgCenter scientists have been working with members of the Lamb Weston research and development staff for a couple of years.

In addition to Smith, Don LaBonte, a sweet potato breeder, and David Picha, who conducts research on processing and post-harvest physiology of sweet potatoes, have been meeting with Lamb Weston officials.

LaBonte is working to develop a new

(Continued on page 5)

Photo by Linda Foster Benedict

Officials from the LSU AgCenter and ConAgra Foods Lamb Weston division enjoy sweet potato fries during an event in Delhi, La., on Aug. 5. Gov. Bobby Jindal announced that day that Lamb Weston was building a new sweet potato processing plant there. Left to right are Tara Smith, extension sweet potato specialist and coordinator of the Sweet Potato Research Station; Joe Rehder, Lamb Weston manager for agriculture services; Chris Rhynalds, Lamb Weston vice president of research and development; Paul Coreil, vice chancellor for extension; David Picha and Don LaBonte, both professors in the School of Plant, Environmental & Soil Sciences; David Smith, Lamb Weston director of North American agriculture services; and David Boethel, vice chancellor for research.

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ON THE COVER: These photos are from the early years of the Rice Research Station, which celebrates its 100th anniversary in 2009. Note the center bottom picture of one of the first offices at the station. See article on page 6.

What's New?

LSU AgCenter Master Horseman program serves as national model

What do a police officer, an Olympian and a fighter pilot have in common? In this case, they're all master horsemen. In March 2009, nearly 20 horse enthusiasts, including a National Guard pilot, a local police officer and a former Olympic equestrian gathered at Farr Horse Park in Baton Rouge for a three-hour session – the last of their eight-class course in horse training. Diverse groups like this have been successfully completing the LSU AgCenter's Master Horseman program since 2001 on a statewide level.

"We had done a number of surveys of our horse industry and found the skill level of our horse people was not as high as it ought to be. So we decided to develop a corps group that were proficient at a higher level," said Clint Depew, a professor and extension specialist, now retired, in the School of Animal Sciences and the founder of the Master Horseman program.

"As a police officer, we're always training to upgrade our skills, and I saw this class. I had heard good things about it, and I thought it would be a good way to help me do a better job at what I do," said Corporal Mary Ann Godawa with the Baton Rouge Police Department and part of the unit that on occasion rides horses to patrol events.

When you take serious horsemen and give them extensive education and training, you get better, more competent horsemen who can become better leaders, while passing on useful information to others. That's the premise Depew had in mind when he started the Master Horseman program. The courses he and other qualified instructors teach include sections on horse nutrition, health, safety, training, riding skills, basic and advanced maneuvers, and youth development.

"Most of them have told us that they thought they really knew a lot about horses until they took this course. But it has really opened their eyes," Depew said.

"Since this class started, I have used what I've learned in training my horse on a daily basis. It's all useable material," Godawa said.

"I found this to be much more helpful than the clinics I've been to. In eight weeks you have more time to practice and ask more questions. I found that to be extremely helpful," said Bob Frazier, a retired Baton Rouge resident who doesn't own but likes to ride horses.

When it began in 2001, the statewide program was the first of its kind in the United States, as far as Depew knows, and met a clear need in Louisiana. More than 500 participants have completed the program. According to Depew, about half the members of both the Louisiana Equine Council and the Louisiana Stock Association are graduates of the Master Horseman program. These master horsemen voluntarily run horse camps for children each year and teach classes for 4-H horse programs. Many of them also return to teach Master Horseman classes as well.

Photo by Randy LeBauve

Clint Depew congratulates participant Kristine Fricke after her Master Horseman final presentation.

Depew said the courses have been done in 12 locations and have included participants from from Texas, Arkansas and Mississippi. Some riders have chosen to take the course again to brush up on skills.

Since the inception of Louisiana's Master Horseman program, five states have developed similar courses, modeling them after Louisiana's regimen, Depew said.

"Ultimately, it translates to a better quality of horses and a better quality of exhibitors and people. I think it's going to lift our whole horse industry, which is our goal," Depew said.

The recent Baton Rouge Master Horseman group finished off its course with each participant giving a horse-related presentation on topics like rider safety, horse nutrition and safety. While the group consisted of many lifelong horsemen, including several horse instructors and a former Olympic rider, it also attracted horse enthusiasts like Frazier.

"I started taking riding lessons when I was 61 years old, and I've been out here (Farr Park) for seven or eight years now. When I retired, I had this list of things I was going to do, and one of them was horses, learning to ride and care for horses," Frazier said.

Because of the Master Horseman program, Frazier said he and Boxcar, the horse he regularly rides, are now communicating better. As he petted the horse's nose, he expressed well the inspiration of those who attend and complete the Master Horseman program.

"I had a longstanding desire not to just ride a horse, but to learn how to properly ride a horse and how to properly care for him," Frazier said.

Participants are supposed to have high skills and knowledge to enter the program, and LSU AgCenter extension agents select those who have the greatest leadership potential. The cost ranges from $100-$200 to cover course materials. If you're interested in the Master Horseman program, contact your local LSU AgCenter extension office.

■ **Randy LaBauve**

Order Horseman DVDs

If you're interested in learning useful horse training tips, you can purchase a two-DVD set, one on horse training and another covering rider development, called "The Master Horseman, " developed and produced by the LSU AgCenter. Go to www.lsuagcenter.com/onlinestore. The cost is $30 plus tax. There is no shipping charge.

■ **Randy LaBauve**

What's New?

Congressmen learn about biofuels research in visit to Sugar Research Station

More than a dozen LSU AgCenter scientists met with two members of the U.S. House Committee on Agriculture Aug. 12 to describe their research to identify appropriate plants as sources of feedstocks to produce biofuels, as well as the technology to convert the plants into ethanol or biodiesel.

"I appreciate the opportunity to visit the LSU AgCenter and learn about the research being conducted on sugarcane," U.S. Rep. Tim Holden, D-Pa., said. "It is exciting to hear about the possibilities of this research and its potential to help lead us down a path to lessen our dependence on foreign oil."

Holden is vice chairman of the House Committee on Agriculture, as well as the chairman of the Subcommittee on Conservation, Credit, Energy and Research. That subcommittee has jurisdiction over soil, water and resource conservation; small watershed programs; energy and biobased energy production; rural electrification; agricultural credit; agricultural research, education and extension services.

Also at the meeting was U.S. Rep. Bill Cassidy, R-La., who is also on that subcommittee. The Sugar Research Station is in Cassidy's district.

Holden was on a three-day trip to Louisiana to learn about the state's alternative energy crops and their potential as a viable feedstock for biofuels. In addition to the Sugar Research Station, he visited the U.S. Department of Agriculture's sugar research facility in Houma, the Domino sugar facility in Arabi and Verenium Corporation's facility in Jennings.

The congressmen's session with the AgCenter focused on the availability of plants capable of producing biofuel feedstocks on land not suitable for food crops and the technology for converting plant materials into fuels.

"The South has more acres available than other sections of the country to grow feedstocks for biofuel development," said David Boethel, LSU AgCenter vice chancellor for research. "We can contribute through agricultural research and education to economic development in numerous ways."

The LSU AgCenter, particularly through its Audubon Sugar Institute, has been a leader in developing the "biorefinery concept," which envisions sugarcane mills as sites that produce fuel, value-added chemicals and steam and electric power, Boethel said.

"We think Louisiana is a unique place to grow plants for biofuel because of our long growing season and land currently not in cultivation," he said. "In addition, we have the infrastructure in the state to handle large quantities of biomass."

Since 2004, the LSU AgCenter has been researching fuels from sugarcane and other crops. Researchers hope to increase the value of sugarcane residues and cellulose from other plant products by converting them to sugars, which can be fermented into ethanol.

The LSU AgCenter is participating in a Department of Energy grant that has totaled $5 million since 2004 and received an additional $500,000 from the U.S. Department of Agriculture this year, said Ben Legendre, director of the AgCenter's Audubon Sugar Institute.

The Audubon Sugar Institute's approach is to develop new technologies that can be integrated into existing sugar mills and take advantage of capital investments, which sit idle most of the year because the sugar-processing season is only about three months long, said Donal Day, a researcher there. ■ **Rick Bogren**

Research station helps lure ConAgra Lamb Weston's new sweet potato processing plant

(Continued from page 2)

variety of sweet potato with a tougher skin so it can withstand the rigors of more mechanization in harvesting and processing. Sweet potato production is more labor-intensive than many other crops.

"A sweet potato is more egg-like, more delicate, than a russet potato," LaBonte said. "It's more easily bruised, which can cause disease problems in storage and during shipment."

Chris Clark, an LSU AgCenter plant pathologist who specializes in sweet potato diseases, is helping develop sweet potatoes that are more disease-resistant.

In addition to having a tougher skin and more disease resistance, the new variety has to maintain the sweetness and uniform rich-orange color of Louisiana sweet potatoes. Its physiology has to perform well when frozen and when cooked. Lamb Weston markets its frozen sweet potato products to restaurants through its Sweet Things brand and to grocery stores through its Alexia brand.

Lamb Weston operates frozen food processing plants in the Pacific Northwest, Minnesota and Canada. Some Louisiana growers already have contracts with the company to ship their sweet potatoes to these plants.

"The acknowledgment that the research station contributed to the decision to locate in Louisiana is an example of an institution of higher education, the LSU AgCenter, fueling economic development in our state. The products developed in the plant will provide value-added income to the sweet potato industry," said David Boethel, LSU AgCenter vice chancellor for research.

"This station is celebrating its 60th anniversary this year and has a worldwide reputation for excellence in research and outreach to the sweet potato industry," he said.

Other members of the LSU AgCenter sweet potato research team include Arthur Villordon at the Sweet Potato Station, Donnie Miller and Eugene Burris at the Northeast Research Station in St. Joseph, Abner Hammond and Richard Story in the Department of Entomology, and Donald Ferrin in the Department of Plant Pathology & Crop Physiology.

"Although sweet potatoes can be highly profitable, they are difficult to grow," said Paul Coreil, LSU AgCenter vice chancellor for extension. "Our extension agents work closely with the sweet potato growers to help them solve problems and follow the best management practices."

Extension specialists Myrl Sistrunk in West Carroll Parish and Vincent Deshotel in St. Landry Parish are among the agents who focus educational efforts on sweet potato growers.

Sweet potatoes contribute nearly $50 million to the state's economy, on average, each year. Two of the three most popular varieties in the country were developed at the LSU AgCenter, Beauregard and Evangeline. The third is Covington, which was developed in North Carolina and mainly grown in that state.

"The new sweet potato processing plant will help increase income to farmers and increase sustainable acreage in sweet potato production statewide," Coreil said. ■ **Linda Foster Benedict**

Rice Research Station

Many Louisiana farmers had turned to rice at the beginning of the 20th century because of crashing sugar prices. Midwestern farmers came to Louisiana at about that time to try their luck with rice.

The LSU AgCenter's Rice Research Station in Crowley, La., is celebrating a century of operation in 2009, making it the oldest facility of its kind in the Western Hemisphere.

The station was established in the spring of 1909 by the U.S. Department of Agriculture after farmers saw the need for improved rice varieties adapted for southwest Louisiana and for help growing rice in Gulf Coast conditions.

The USDA began phasing out its role in the station in the early 1980s. For another 20 years, the station housed only one USDA scientist. And by 2000, the station was run entirely by the AgCenter.

Rice farming on a widespread commercial basis in Louisiana began in the late 19th century.

"They were using some of the same varieties, such as Carolina Gold for example, that had been around for almost 200 years," said Steve Linscombe, director of the LSU AgCenter's Rice Research Station.

Many Louisiana farmers had turned to rice after sugar prices crashed in the 1800s. Louisiana rice production went from 1.5 million pounds in 1864 to more than 40 million pounds by 1877, according to the March 1932 issue of the "Rice Journal."

By the late 1800s, developers were advertising land for sale in southwest Louisiana and boasting of the area's abundant water and mild climate. Acadia Parish, where the Rice Experiment Station would be located, became the leader in the rice industry with some of the best yields – 15-25 barrels per acre at 162 pounds per barrel.

The 1890 crop was a record breaker at 80 million pounds, making Louisiana the No. 1 rice-producing state, surpassing the former leader, South Carolina.

In the early 1900s, more Louisiana farmers switched to rice, according to the 1910 Annual Report of the USDA Office of Experiment Stations.

"The ravages of the boll weevil have made the growing of cotton less profitable than formerly and the farmers are turning to rice growing. This necessitates the installation of pumping plants, the building of levees, etc., and the cotton growers are usually entirely unfamiliar with such things," the report said.

Acadia Parish officials had waged an aggressive campaign to locate the rice research facility near Crowley. The director of the Louisiana Agricultural Experiment Station at that time was W.R. Dodson. The Acadia Parish proposal stated, "Dr. Dodson is the father of the rice experimental station, but Acadia is its wet nurse. He drew the bill and furnished the plan, but Acadia farmers and representatives helped him push it through."

The 1910 report detailed the origins of the new station: "A substation for rice culture was established at Crowley, and work was begun during the spring of 1909. The station is conducted in cooperation with this department. Local parties gave 60 acres of land for the use of the station and subscribed $3,500 for buildings. The legislature authorized its establishment by an act passed July 1, 1908, but no appropriation for the purpose was made at the time. F.C. Quereau was called from the University of Tennessee to the position of assistant director in charge of this station."

The next year's report indicates the legislature appropriated $15,000 for maintenance during the next two years. A 60-horsepower gasoline engine to pump water was installed for $2,500 in 1910. Research included testing 300 rice varieties along with studies of insects, irrigation and evaporation.

John Denison, a rice farmer from Iowa, La., said his grandfather was among a group of Midwest farmers who came to southwest Louisiana, making the move in 1890. "He was one of the original settlers," Denison said.

Land developers, such as J.B. Watkins of Lake Charles, came to Louisiana to buy large expanses of land to be sold to farmers. Once agriculture became established, railways followed.

Denison said Watkins helped bring Seaman Knapp to Louisiana and to LSU. Knapp Hall on the LSU campus in Baton Rouge is named after him.

"Seaman Knapp is regarded as the pioneer of the cooperative extension model as well as a pioneer in Louisiana rice production," said Paul Coreil, LSU AgCenter vice chancellor for extension.

Denison, 73, recalls the original Rice Research Station before it was moved to its current location between Crowley and Rayne.

"I can actually remember coming to one field day at the old station west of Crowley," Denison said.

In 1949, the station bought 720 acres of land northeast of Crowley, its current site, to establish the Rice Research Station's Foundation Seed Program to ensure a pure source of seed for rice farmers. The program has produced more than 160,000 hundredweights of seed.

In 1963, the station expanded by 320 acres with the addition of the South Farm, located two miles south of Crowley. Located there now is a crawfish research facility established in the 1970s, which has now grown to be one of the largest of its kind in the world.

starts second century

Photo by Bruce Schultz

All 42 varieties of rice developed at the Rice Research Station over its 100 years of existence were planted in small plots at the station to help celebrate the centennial.

H. Rouse Caffey, former LSU AgCenter chancellor, worked at the research facility from 1962 until 1970.

"When I came to the rice station, they had just moved it from west of Crowley to east of Crowley," Caffey said. "The old station west of town had been relegated to rice pastures and beef cattle research."

Caffey said the Rice Research Station is the best facility worldwide.

"And I've visited the international stations," Caffey said. "I'm convinced the research in Louisiana stands above all the rest, and that's because of the continued improvement of technologies by good researchers dedicated to serving the Louisiana rice industry."

In 1972, Louisiana rice producers took the initiative to increase research, forming the Louisiana Rice Research Board. Growers agreed to pay 5 cents for every 100 pounds of their rice crop to fund research projects. That program has generated more than $30 million in research funds since then.

"The Crowley station has been important to rice farmers because we are probably the most disadvantaged rice-producing state there is," Denison said. He explained that Louisiana yields are less than those of other states while disease pressure is higher.

"Without an aggressive research program, we would not be raising almost 500,000 acres of rice in Louisiana," Denison said. "We always looked to the station for new varieties to make more rice per acre."

"When we made 20 barrels to the acre, we thought we had a great crop," he said. "Then when we planted Nato (a rice variety developed in 1956), we were suddenly able to make 30 barrels to the acre. When Saturn was developed by Dr. Nelson Jodon, we were making 40 barrels to the acre. So, you can easily see how our gross income would increase with these great improvements in varieties."

Higher yields were not just the result of new varieties, however. The station's studies of production practices also helped increase yields.

The practice of land-leveling was perfected at the station in the 1960s. Any major insecticide or fungicide labeled for use in the southern United States was tested thoroughly at the station, including propanil that allowed rice breeders to develop shorter-growing rice less susceptible to lodging (falling over).

Until 1990, the station had a herd of cattle to replicate the growing conditions of farmers who also raised beef.

The herbicide-resistant Clearfield line of rice, developed at the station in the late 1990s, resulted in rice varieties that enabled farmers to make progress against red rice – a weed closely related to conventional rice.

Clearfield technology also allowed farmers to drill-seed rice into dry soil instead of seeding directly into water from the air.

The varieties developed at the station during the past 15 years dominate the rice-growing regions of the southern United States. Clearfield acreage could exceed 65 percent of rice grown in the South this year, Linscombe said.

In total, a century of rice breeding at the station has resulted in 42 varieties.

"We have close working relationships with rice stations all over the world," Linscombe said. "The Rice Research Station obtains new breeding lines and germplasm from around the globe."

Rice is unique among commercial crops, Linscombe said, because many rice varieties are still developed through publicly funded research.

Research at the station has changed drastically, thanks to improvements in technology and knowledge.

Linscombe said rice breeders 40 years ago would have chosen experimental lines from 4,000 rows a year. Now, breeders make selections from more than 30,000 rows, and more than 400,000 are grown each year at the station.

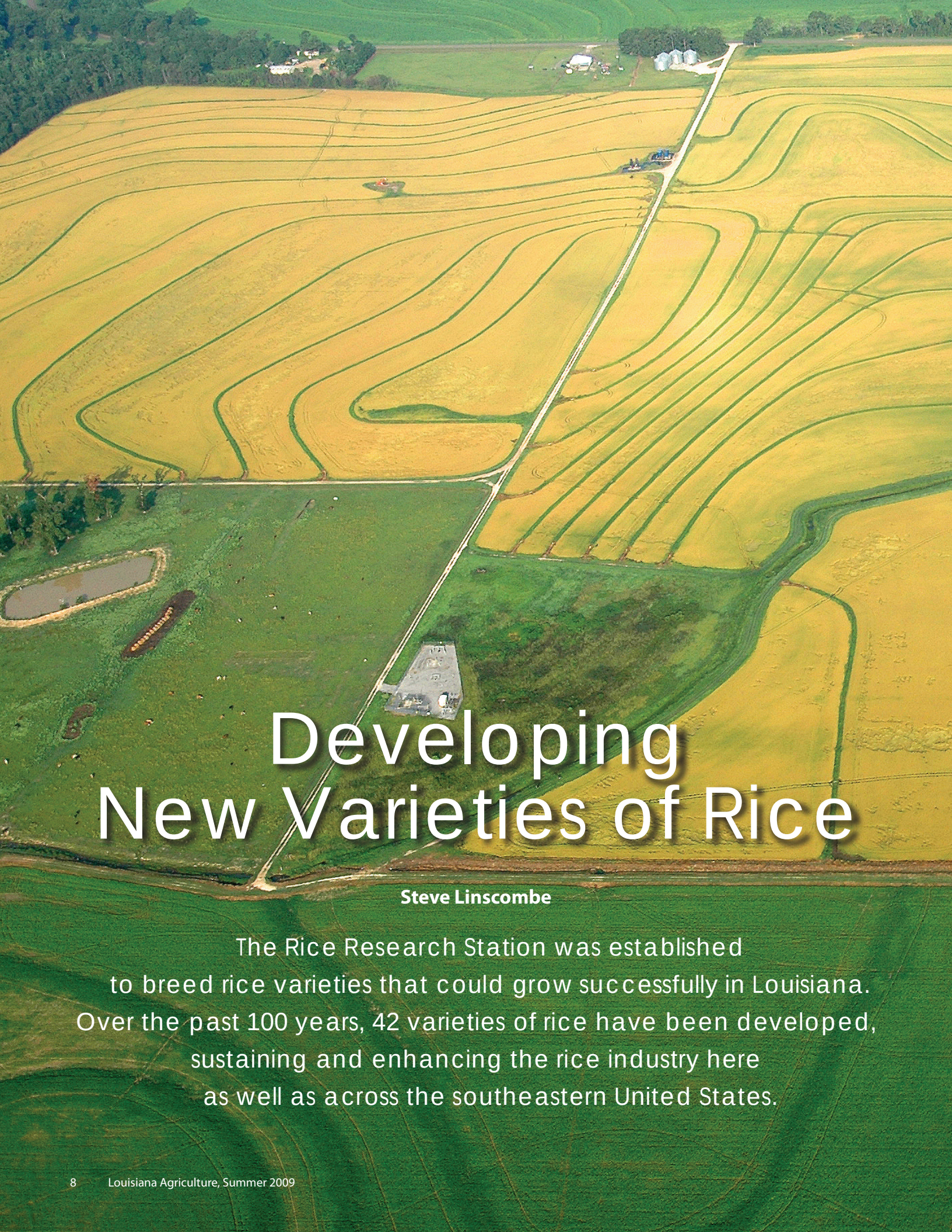
The use of DNA markers to determine if a line has desired characteristics has decreased the time required to develop a new variety. And the use of a winter nursery in Puerto Rico also enables varieties to be available sooner.

Linscombe said the DNA work is just one example of how the research facility has evolved to keep up with the demands of agriculture.

"The developments of rice research at the station during the past century represent hundreds of thousands of hours of difficult, tedious work," he said. "When the next centennial is celebrated, I'm confident that the achievements from the Rice Research Station will continue to be at the forefront of the industry."

"We often hear how institutions of higher education are the engines of economic development," said David Boethel, LSU AgCenter vice chancellor for research. "The Rice Research Station is an excellent example of this.

"Research and development by scientists both at the station and on the Baton Rouge campus in the academic departments have allowed this major industry to be sustained for a century in the Louisiana. In fact, the technology has had the same effect throughout the rice-producing area in the southern United States." ■ **Bruce Schultz**



Developing New Varieties of Rice

Steve Linscombe

The Rice Research Station was established to breed rice varieties that could grow successfully in Louisiana. Over the past 100 years, 42 varieties of rice have been developed, sustaining and enhancing the rice industry here as well as across the southeastern United States.

Development of rice varieties helps guarantee continued rice production in Louisiana and in the United States. Release of improved varieties by public breeding programs in Louisiana, Texas, Arkansas, Mississippi and California, in conjunction with advancements in rice production technology, has provided a continuous increase in rice production and quality. Considerable genetic potential exists to improve rice varieties, and rice breeding efforts should continue to help improve production in Louisiana.

Rice Varietal Improvement Program

In the early days, Louisiana rice production depended on varietal introductions by individuals. In 1909, the first rice breeding program in the United States was initiated when the Rice Research (Experiment) Station was established at Crowley, La. The rice breeding activities there were under the direction of U.S. Department of Agriculture scientists from the inception of the program until the Louisiana Agricultural Experiment Station (LAES) assumed responsibility for the program in 1981. The Rice Station has a long history of developing new varieties of benefit to the Louisiana rice industry. Additional research projects were added over the century, but variety development has always been a major focus of the station's research activities. Since its inception, the program has formally released 42 improved rice varieties (Table 1).

Variety development takes an immense amount of: 1) time, 2) money, 3) hard work and travel on the part of many people, 4) specialized field and laboratory equipment, and 5) cooperation. The first step in the development of a new variety is the generation of new genotypes (or genetic combinations). This is done by making crosses between two different rice lines. Since the rice flower is perfect (contains both the male and female flower parts), a female flower must be created artificially by removing the male flower parts (anthers) from a rice floret. Normally, this is accomplished by using a small pipette connected to a vacuum pump that basically vacuums the anther out of the flower, which is a tedious process. The next step is to introduce pollen from a different line and pollinate that (female) flower.

More than 1,000 such crosses are typically made at the Rice Research Station each year. The resulting seed from these crosses will contain genetic information from both parents. This seed is called the F1, and these seed are germinated to produce F1 plants. At maturity, seed is harvested from the F1 plants. This seed is bulk-planted the following growing season to produce a population of segregating F2 plants. These plants exhibit much variation in appearance because they are expressing traits from both parents in many different combinations. Selection in the F2 populations is a very important step in the variety development process. Breeders want to select those plants with the best combination of traits. Selection criteria here include (but are not limited to) seedling vigor, maturity, height, tillering (number and uniformity), panicle size, completeness of panicle exertion, grain shape and appearance, disease resistance, and overall plant appearance. Individual panicles are selected from those plants expressing the best combinations of the traits listed above for advancement to the next generation and beyond.

From this point on (F3-F?), most of the breeding material is grown as panicle (head) rows. A panicle row is a row of plants all coming from seed off a single panicle produced the previous generation. The best rows will be selected (not individual plants) to advance to the next generation. Important to remember here is that each generation that a line is advanced, the amount of segregation is decreased (or the level of uniformity is increased). Each year approximately 95,000 to 110,000 panicle rows are grown at the Rice Station in the various breeding projects. Each of these rows is a different genotype, and any of them could theoretically become a new variety.

There is a tremendous amount of meticulous work that must be done before these rows are planted. The seed for each row must be individually threshed with a specialized panicle thresher. Not too many years ago this was all done by hand. Also, specialized planters are used to plant the individual rows. Great care is taken to load this seed for planting in such a way as to avoid mistakes.

Lines from most of the crosses have reached sufficient uniformity by the F4 to F5 generation to enter a line into initial yield evaluation. Lines selected for potential yield evaluation are bulk-harvested (after a selected number of panicles have been removed). Bulk-harvesting of individual rows is done the old-fashioned way in that each selected row is harvested by cutting the stalks with a sickle and tying the harvested stalks with a length of twine. Each individual row is threshed, aspirated and dried on a small sample drier. Several thousand rows are handled this way each summer.

During the following winter, a number of laboratory analyses are conducted on each harvested sample (grain appearance and milling, cereal chemistry, seedling vigor), and the superior lines are entered into the initial yield testing program, which is called the Preliminary Yield Tests. These are primarily two replication tests, though a number of lines are evaluated each year in single plot tests. These trials are planted in late March and early April on the Rice Station. This will allow a sufficient growing season to evaluate first and ratoon (second) crop performance. A plot in the Rice Breeding Project is seven drill rows spaced 8 inches apart and 16 feet in length. This represents approximately 75 square feet or 0.17 percent of an acre.

These small plots are used to minimize environmental variations that might influence the performance of genotypes (breeding lines) in the tests. Therefore, it is hoped that any differences expressed in these trials (yield, milling quality, height, etc.) are a result of true genetic differences and not caused by differences such as soil type, fertility or water depth.

Approximately three weeks after the preliminary yield trials are planted, a seed increase/purification block is planted that will include 10 headrows from each of the lines in the yield trial. This block is planted later than the test to provide time to analyze data after harvesting the yield trial to determine which lines may be advanced and thus which headrow populations should be harvested. Before harvest, these lines are evaluated and any segregating rows are removed from the population. Twen-

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Steve Linscombe, Director, Southwest Region, LSU AgCenter, Crowley, La.

AERIAL PHOTO: Rice fields in northern Acadia Parish. Photo by Bruce Schultz.

Table. 1 Principle Rice Varieties Released from the LSU AgCenter Rice Research Station. They are either short-, medium- or long-grain. The A stands for aromatic.

Variety	Grain Type	Year Released	Breeders Involved
Colusa	Short	1917	Chambliss, Jenkins
Fortuna	Long	1918	Chambliss, Jenkins
Acadia	Short	1918	Chambliss, Jenkins
Delitus	Long (A)	1918	Chambliss, Jenkins
Tokalon	Long	1918	Chambliss, Jenkins
Evangeline	Long	1918	Chambliss, Jenkins
Rexora	Long	1928	Chambliss, Jenkins
Nira	Long	1932	Chambliss, Jenkins
Magnolia	Medium	1945	Jodon
Lacrosse	Medium	1949	Jodon
Sunbonnet	Long	1953	Jodon
Toro	Long	1955	Jodon
Nato	Medium	1956	Jodon
Saturn	Medium	1964	Jodon
Della	Long (A)	1973	Jodon
Vista	Medium	1973	Jodon, McIlrath
LA 110	Medium	1979	McIlrath, Jodon
Leah	Long	1982	Trahan, Jodon
Toro-2	Long	1984	McKenzie, Jodon
Mercury	Medium	1987	McKenzie
Lacassine	Long	1991	Linscombe, Jodari
Bengal	Medium	1992	Linscombe, Jodari
Cypress	Long	1992	Linscombe, Jodari
Jodon	Long	1994	Linscombe, Jodari
Dellrose	Long (A)	1995	Jodari, Linscombe
Lafitte	Medium	1996	Linscombe, Jodari
Cocodrie	Long	1998	Linscombe
Dellmati	Long (A)	1999	Jodari, Linscombe
Earl	Medium	2000	Linscombe
CL 121	Long	2001	Linscombe, Sha
CL 141	Long	2001	Linscombe, Sha
CL 161	Long	2002	Linscombe, Sha
Cheniere	Long	2003	Linscombe, Sha
Pirogue	Short	2003	Linscombe, Sha
Ecrevisse	Short	2004	Linscombe, Sha
CL 131	Long	2005	Linscombe, Sha
Jupiter	Medium	2005	Sha, Linscombe
Trenasse	Long	2005	Linscombe, Sha
CL151	Long	2008	Linscombe, Sha, Blanche
Catahoula	Long	2008	Linscombe, Sha, Blanche
Neptune	Medium	2008	Sha, Linscombe
Jazzman	Long (A)	2009	Sha, Linscombe

ty-five panicles are picked from a representative row, and then the remaining seed is bulk-harvested. This will serve as a pure seed source for this line for further advanced testing.

A typical preliminary yield test will have 750 entries replicated twice for a total of 1,500 plots. These tests also include the currently grown varieties so that the performance of the experimental lines can be compared with these, as well as to each other. This size test involves approximately five acres. If everything goes without a hitch, this test can be planted in less than a day with our specialized planting equipment. However, preparing the seed for this planting (cleaning, cataloging, weighing, labeling and filling seed envelopes, laying out packets in planting order, etc.) is the result of many months of meticulous work during the winter. In addition, there is a great deal of data entry and record keeping involved as lines move from one generation to the next.

After planting, this yield trial is handled like any other rice field to optimize production. This includes timely water management, fertilization, and weed and insect control. Fungicides are not used in the breeding program because disease resistance is evaluated at every step of the variety development process.

These trials are evaluated at least twice weekly during the growing season, and data are collected for the following traits; 1) emergence date, 2) seedling vigor, 3) tillering characteristics, 4) heading date, 5) plant height at maturity, 6) disease susceptibility (any diseases present), 7) lodging characteristics and 8) harvest maturity date. When a plot reaches harvest maturity, a sample is taken for use in milling quality evaluation. This sample is cut with a sickle and threshed using a stationary thresher. Then it is aspirated and dried on a specialized sample drier. Because there may be up to 10 days difference in maturity among lines in these trials, taking a sample from each plot at harvest maturity puts all lines on an equal footing for milling quality evaluation.

Before harvest, all the plots are evaluated for relative susceptibility to major and minor rice diseases. Because we often do not have consistent disease pressure in these tests, these lines are also planted in disease nurseries where disease pressure is maximized by inoculation (sheath blight and bacterial panicle blight) and the use of highly susceptible spreader varieties (blast).

When all lines in a trial have reached harvest maturity, the trial is harvested using a specialized small-plot combine. This combine has a 6-foot header width so it fits these plots perfectly. The combine has the capability to harvest a plot and automatically obtain the grain weight and grain moisture for the rice from that plot. The seed then can be bagged and tagged for identification. Under ideal conditions, the 1,500-plot test can be harvested in two days.

The hand-harvested sample is milled using specialized milling equipment that will provide data on whole and total milled rice. In addition, these samples are evaluated for uniformity, chalkiness, grain shape and any other characteristic that might be a factor in the acceptability of the line as a commercial variety. The multitude of data collected will be analyzed to decide which lines will be entered into advanced trials the following growing season.

Getting to the preliminary yield testing stage normally takes a minimum of five to six years from the time the cross is made. The lines that display superior characteristics in preliminary testing are considered for advancement to the Commercial-Advanced (CA) trials, as well as the Uniform Regional Rice Nursery (URN). Only about 5 percent of lines entered into the preliminary trials will be advanced. The CA trials are conducted across the rice growing regions of Louisiana. The off-station locations are conducted in cooperation with rice producers willing to provide land, land preparation, irrigation and assistance with these trials in countless other ways. The farmer will provide an area that has independent flooding and draining capabilities. The trials are planted using the same small-plot equipment used on the Rice Research Station. After emergence, the trial is handled just as it would be on the station to optimize production and minimize any environmental variation that would affect the ability to evaluate true genetic differences among the lines in the trials. These trials are evaluated at least weekly, and data are collected for all characteristics just as is done on the Rice Station. These trials are harvested using the small-plot combine. Trials harvested before August 15 will be ratoon-cropped to provide data on this important characteristic.

The URN is a cooperative endeavor among the public rice breeding programs in Arkansas, Louisiana, Mississippi, Missouri and Texas. The nursery is a yield-testing program conducted at the primary research location in each of those states. The same rice lines are tested at each of the five locations. The test normally contains 200 rice lines (or genotypes). The 200 entries in the test are made up of the elite lines from each breeding program that the breeders think might have the attributes worthy of a new release. Each of the breeding programs contributes a number of lines to the testing program. The yield test is conducted at the research station in each state using the best management practices for that region.

All data from the testing program are provided to each cooperator. Most

Photos by Bruce Schultz

Xueyan Sha, LSU AgCenter rice breeder, selects panicles from rice plants grown during the winter in Puerto Rico. By growing lines of rice on the Caribbean island, the time required to develop new varieties is reduced.

Rice producers work to finish harvest in Jefferson Davis Parish before a thunderstorm reaches the field. Maturity date is one of many factors considered in developing a new rice variety.

of the experimental lines in the CA trials are also entered into the URN. Also, in both the URN and CA trials, current commercial varieties are included to provide a benchmark for comparison.

Therefore, between the CA and URN trials, the most advanced experimental lines in the Louisiana program are evaluated in numerous yield trials each year. The CA and URN trials are extremely important in making decisions on potential variety releases. It is critical that a line be evaluated under numerous environments. In a potential new variety, one is looking for superior and stable performance. Often a line will have excellent performance in two or three of these trials but average or inferior performance in several others. This line will be eliminated because of a lack of stability. Also, as with the preliminary trials, all of the entries in each of these trials are evaluated for relative susceptibility or resistance to major rice diseases.

Lines that show good and stable yield, milling and agronomic characteristics across all these diverse environments will be reentered into these trials the following year. A line that shows good potential as a future release will also be included in the statewide Variety by Nitrogen rate testing program. In addition, these lines will be evaluated for differential response to selected rice herbicides. This research is conducted so that if a line is released as a variety, a package of agronomic recommendations for its production is also available.

If a line displays significantly better performance than the current commercial varieties, it also may be grown as a larger headrow population as a step toward potential increase. In each generation of testing, each line that is in these testing programs is concurrently being grown as panicle rows for purification and increase. A typical headrow population for a potential release is approximately 1,000 rows, which is often grown at the winter nursery facility in Puerto Rico. Seed from this size headrow increase will provide enough seed for up to a 20-acre foundation seed field on the Rice Research Station.

Generally, at least three years of CA and URN data are required before an experimental line is considered as a new variety release. Seed will be increased on superior lines during this same period. Often, foundation seed is produced during the third year of testing. If the line has consistently shown superior and stable performance after the third year of advanced testing and adequate foundation seed is available, a comprehensive data package on the line is provided to the Director of the Louisiana Agricultural Experiment Station. If, after reviewing the data, the director agrees this is a candidate line for release, a committee is appointed to evaluate the data and make a recommendation on the release. The fi-

Don Groth, LSU AgCenter plant pathologist, tells farmers at a Vermilion Parish rice field day how to protect their crops from disease by using different fungicides. Rice breeders consider how lines of rice resist disease when making selections for variety development.

nal decision rests with the director. If the decision is positive, the director will ask for suggestions and approve the name for the new rice variety.

Rice variety development is a long-term process that demands dedication by a large number of people within the LSU AgCenter. The rice breeding project depends heavily on many cooperating projects for assistance in the development and evaluation of experimental lines. Cooperators include agronomists, entomologists, pathologists, biotechnologists, geneticists, weed scientists, food scientists and physiologists. This cooperation is essential for the success of varietal improvement efforts aimed at numerous characteristics including, but not limited to yield, milling quality, cooking quality, insect resistance, disease resistance, herbicide tolerance, seedling vigor, lodging resistance, fertilizer responsiveness, stress tolerance, earliness and ratooning.

Photo by Bruce Schultz

The Rice Breeding and cooperating projects also evaluate potential varietal releases from other breeding projects (both private and public) to determine their adaptability under Louisiana growing conditions. Many rice varieties from out-of-state breeding programs are well-adapted to Louisiana and are widely grown.

Rice Variety Characteristics

The two primary grain types grown in Louisiana are long-grain and medium-grain. Long-grains are characterized by a grain length:width ratio of more than 3:1 and typically cook dry and fluffy because of a high to intermediate gelatinization temperature characteristic and a relatively high amylose content. Medium grains typically have a length:width ratio of between 2:1 and 3:1 (usually closer to 3:1) and cook soft and sticky because of a low gelatinization temperature characteristic and a relatively low amylose content.

Southwestern Louisiana producers have historically planted from 20 percent to 50 percent of rice acreage in medium grains, and those in northeastern Louisiana grow almost exclusively long-grain varieties. In recent years, the percentage of the state rice acreage planted to medium grains has continually decreased to less than 5 percent. In 2009, medium grain acreage increased in Louisiana because of market conditions that led to a premium for this grain type.

Interest in special purpose varieties has increased in recent years. These varieties have distinctly different cooking quality attributes, such as aroma, elongation or unique cooking characteristics that may be favored by many ethnic populations living in the United States, as well as other consumers interested in gourmet or premium rice. The major specialty types include soft-cooking aromatic Jasmine; flaky-cooking, elongating and aromatic Basmati; Kokuhoe; waxy; standard long-grain aromatic Della; soft-cooking non-aromatic Toro; and other lesser-known gourmet types. Most specialty rice marketed in the United States is imported from Thailand, India and Pakistan. Efforts are under way at the Rice Research Station to develop adapted varieties that can be used in the domestic production of imported specialty types. A number of specialty varieties from the Della, Toro and Jasmine groups are under limited production in the southern United States. ■

Jazzman

A new jasmine-type rice variety

Steve Linscombe
and Xueyan Sha

The first U.S.-bred Jasmine-type aromatic rice variety named Jazzman has been developed at the LSU AgCenter's Rice Research Station and released in 2009. Jazzman was developed through cross-breeding and pedigree selection from a cross made in 1996 between the Arkansas variety Ahrent and the unreleased Chinese aromatic rice line 96a-8, which has the Jasmine-type cooking quality. Jazzman has similar physicochemical properties and cooking qualities to the imported Thai Jasmine. It has extremely translucent grains, and most importantly, a fairly strong aroma. The cooked rice is soft, sweet and glossy.

Jazzman has high yield potential and good milling quality. On average, Jazzman yielded 6,961 pounds per acre in the multi-location trials conducted in five mid-South states from 2003 to 2008, compared with 7,586 and 6,791 pounds per acre for conventional variety Cheniere and Cypress, respectively. The head rice (milled whole grain) yield of Jazzman is similar to that of the best milling conventional varieties such as Cypress and Cheniere. The average head rice yield of Jazzman was 63.6 percent. For Cypress, it was 64.3 percent, and for Cheniere, 63.1 percent. Jazzman has the maturity and conventional plant height of Cypress. With its improved resistance to sheath blight and blast, Jazzman appears suitable for organic production.

With greatly improved grain appearance and cooking quality, competitive grain and milling yield, a good disease package, and desirable physical traits, Jazzman will provide U.S. rice growers the opportunity to capture some of the significant and fast-expanding domestic jasmine rice niche markets. ■

Steve Linscombe, Director, Southwest Region, and Xueyan Sha, Associate Professor, Rice Research Station, Crowley, La.

West Nile Virus an

Wayne Kramer ar

Photos by Jessica Brauch

Year-round Residents

Brown Thrasher

Northern Cardinal

Northern Mockingbird

West Nile virus is a mosquito-transmitted virus that cycles in nature primarily between mosquitoes and birds. It was first detected in the United States in 1999 and in Louisiana in 2001. The virus can cause severe clinical disease in humans and horses. While human cases continue every year across the country, horse cases have dramatically declined because of the development and widespread use of an effective equine vaccine for West Nile virus.

After the virus was first detected in the United States, it quickly spread from coast to coast in only four years and has now been found in every state except Alaska and Hawaii. It is important to point out that the virus is transmitted by different species of mosquitoes in different parts of the country. The birds that serve as the most important reservoirs (amplifying hosts) differ by region of the country as well. Although West Nile virus has adapted to various combinations of mosquitoes and birds across the country, these variations account for some of the major differences observed in the levels of activity in different areas of the country and the number of human cases from year to year.

Since its detection n Louisiana in 2001, more than 1,000 cases and 63 human deaths have been reported to the Louisiana Department of Health and Hospitals as of the end of 2008. Many human cases result in a mild fever and flu-like illness and are never reported. Severe cases can result in encephalitis or meningitis, and deaths attributed to West Nile virus have been recorded in Louisiana every year since 2002. The cases occur across the state and, on a yearly basis, typically peak in July and August when vector mosquito populations are most abundant.

The strain of West Nile virus that arrived in the United States was unusual in that it was observed to cause significant mortality to some bird species that became infected with the virus. Bird groups especially susceptible to death from the disease were the corvids (jays and crows) and raptors (hawks and owls). This information helped document the activity and movement of the virus across the country.

From 2006 to 2008, LSU AgCenter scientists conducted a survey of wild birds and their involvement with West Nile virus. Birds were trapped weekly at two sites in East Baton Rouge Parish, using mesh mist nets and one-way door traps. Records were kept of the birds' identification, age and sex, if it could be determined. A blood sample was taken from each bird and tested for West Nile virus RNA and antibodies to West Nile virus. Birds infected with West Nile virus by the bite of an infected mosquito later develop antibodies. These birds are important in the West Nile virus cycle because they serve as amplifying hosts or

Wayne Kramer, Associate Professor, and Jessica Brauch, former Graduate Student, Department of Entomology, LSU AgCenter, Baton Rouge, La.

Winter Residents

Yellow-rumped Warbler

American Goldfinch

White-throated Sparrow

nd Louisiana Birds

nd Jessica Brauch

reservoirs of the virus. This means that uninfected vector mosquitoes that feed on these birds become infected and further the cycle. The vast majority of these infected birds have not been observed to show any negative effects of West Nile virus.

More than 2,400 wild birds were sampled. West Nile virus was detected in nearly 4 percent of wild bird blood samples, and antibodies to West Nile virus were detected in about 12 percent of samples. The species with the most infected individuals were Northern cardinal, house sparrow, American goldfinch, white-throated sparrow, yellow-rumped warbler, brown thrasher, Northern mockingbird, Carolina wren, tufted titmouse and mourning dove.

Positive West Nile virus bird species from this study can be placed in different categories based on the time of the year they spend in the state. The most important bird species relative to the summer West Nile virus transmission cycle are the year-round residents. Birds from our study in this group include Northern cardinal, house sparrow, brown thrasher, Carolina wren, mourning dove and tufted titmouse. These birds breed in Louisiana and are abundant and available as hosts during the periods of the spring and summer when vector mosquitoes are abundant and most likely to transmit West Nile virus. Summer-breeding birds present in Louisiana may also have a role in virus transmission. Birds in this category include the summer tanager, orchard oriole, prothonotary warbler, Northern parula and white-eyed vireo.

LSU AgCenter researchers also trapped Louisiana birds that can be classified as winter residents. Bird species trapped in significant numbers from this group included white-throated sparrow, yellow-rumped warbler, American goldfinch, savannah sparrow, American robin and chipping sparrow. Although they spend only the winter months in the state, they can play a role in West Nile virus maintenance and transmission because they can become infected just prior to northward migration and, thus, help disperse the disease to other Northern states during early spring. We also trapped birds migrating through Louisiana on their way northward. Birds in this group would include the indigo bunting, the magnolia warbler, ovenbird and gray catbird.

It has been reported that West Nile virus has had a significant negative impact on the populations of many bird species in North America following its introduction some 10 years ago. This impact, however, seems to have gradually diminished because the virus has started to reach an equilibrium with the most sensitive bird species. Blue jays, for example, died in large numbers at first as a result of West Nile virus, but now these birds appear to be healthy even when antibodies to the virus are detected in their bodies. ■

Research Note: All birds in this study were trapped in accordance with requirements outlined by the LSU Institutional Animal Care and Use Committee, U.S. Fish and Wildlife Service, Louisiana Department of Wildlife and Fisheries, and the LSU Institutional Biological and Recombinant DNA Safety Committee.

Photos by Jessica Brauch

Migrating

Indigo Bunting

Magnolia Warbler

Ovenbird

Summer-breeding

Summer Tanager

Prothonotary Warbler

Orchard Oriole

FUTURE of cotton ginning in Louisiana

J. Matthew Fannin and Kenneth W. Paxton

The cotton industry in Louisiana has seen major structural changes in a short time. Total cotton production was reduced by almost 75 percent between 2005 and 2008 (Table 1). While a portion of this loss was due to nonharvestable cotton acres and reduced yields caused by Hurricane Gustav in 2008, the larger trend is the downward slide in cotton acres planted.

LSU AgCenter economists have been monitoring these changes in the past four years and have conducted multiple economic-impact analyses to understand how the changes have affected the overall cotton supply chain. An economic impact study published last year showed no measurable net negative effects from the change in planted acres that switched from cotton to corn in Louisiana in 2007. A closer inspection of this analysis showed that cotton farmers benefited from a relatively high corn price and an optimum growing and harvest season that year. Other parts of the supply chain, however, saw either negative or reduced positive effects from the switch. One of the components of the supply chain most effected was cotton ginning.

A more in-depth study was performed on the cotton ginning industry in both Louisiana and the larger Midsouth cotton-producing region that includes Arkansas, Mississippi, Missouri and Tennessee. This research looked at the long-run challenge of maintaining available ginning infrastructure for cotton producers in the newer Midsouth environment of reduced cotton acreage. For example, between 1992 and 2007, the National Agricultural Statistics Service reported the total number of cotton gins in Louisiana dropped from 85 to 43. Much of this drop has been because older and less-efficient gins have gone out of business while remaining gins have upgraded equipment, such as gins stands, that increased their operating capacity.

Table 1. Cotton Bales Ginned in Louisiana and Selected States.

State	*2005*	*2006*	*2007*	*2008*	*Percent Change*	*Bale Change*
Ark.	2,099,700	2,419,500	1,807,150	1,237,300	-41.07%	-862,400
La.	1,105,650	1,257,000	695,800	279,600	-74.71%	-826,050
Mo.	864,400	994,100	785,550	698,600	-19.18%	-165,800
Miss.	2,089,300	2,029,450	1,271,250	656,850	-68.56%	-1,432,450
Tenn.	1,083,250	1,310,900	586,600	520,950	-51.91%	-562,300
Midsouth	7,242,300	8,010,950	5,146,350	3,393,300	-53.15%	-3,849,000

Table 2. Louisiana and Midsouth Selected Economic Effects.

	Louisiana		
Type	*Direct*	*Indirect*	*Total*
Output	$32,040,908	$16,528,282	$48,569,191
Value Added	$16,318,495	$8,422,326	$24,640,822
Labor Income	$9,370,368	$5,046,835	$14,417,203
	Midsouth		
Type	*Direct*	*Indirect*	*Total*
Output	$258,359,443	$180,562,614	$438,922,049
Value Added	$133,222,264	$94,101,543	$227,323,807
Labor Income	$76,090,736	$55,104,464	$131,195,200

J. Matthew Fannin, Assistant Professor, and Kenneth W. Paxton, Professor, Department of Agricultural Economics and Agribusiness, LSU AgCenter, Baton Rouge, La.

One of the major concerns for the ginning industry is that as gin closings accelerate, the remaining gins may not sufficiently increase their overall or available capacity in all historical cotton-producing regions. This poses a dilemma for cotton producers. When cotton market conditions improve in future years and the commodity becomes more profitable to grow relative to alternative crops such as corn, soybeans and rice, sufficient ginning infrastructure may not be available to capture these earnings. Without the ginning infrastructure, Louisiana farm profits may not reach their potential.

In 2007, the cotton ginning industry's economic impact on the overall economy of Louisiana totaled more than $48 million, which included more than $32 million of direct spending. Cotton gins require significant repair and maintenance in advance of and during the ginning season. Support activities such a sheet metal suppliers and contractors, electricians and retail parts suppliers – as well as their seasonal labor – are measurably affected during the ginning season.

In 2007, cotton ginning added an additional $16 million in indirect or multiplier effects to the Louisiana economy. These included the effects of retail establishments' spending to replenish their inventories and of service contractors' paying the salaries and wages of their employees. Likewise, the $48 million in total spending generated more than $24 million in value-added effects and $14 million in labor income.

Louisiana contributed approximately 11 percent to the almost $439 million in total spending by the cotton ginning industry in the entire five-state Midsouth. See Table 2 for a detailed breakdown of output (spending), value added and labor income effects for Louisiana and the Midsouth.

The economic output multiplier for the cotton ginning industry in the Midsouth in 2007 was 2.39. This means that for every one dollar increase in demand for cotton ginning services, output (spending) across all sectors of the Midsouth economy increased by $2.39. This includes the original dollar for cotton ginning service plus an additional $1.39 across all other industries of the five-state Midsouth economy. Because there are many linkages between Louisiana industries and other industries in the Midsouth, Louisiana's economy benefits measurably from these multiplier effects. Many of these multiplier effects occur locally within the rural parish where the gin is located because more than 75 percent of each gin's ownership in Louisiana resides in the same parish as the gin.

LSU AgCenter economists have additional plans for further research to better understand the economics of the cotton supply chain. Future research will focus on understanding the more detailed geographical effects of the cotton ginning contraction by estimating the maximum economically profitable distance cotton can be transported from fields to gins. Knowing this distance will better help stakeholders identify gins that require additional support in order to maintain a network of gins that continues to supply ginning to all cotton-producing regions of Louisiana and the Midsouth. ■

Tarnished Plant Bugs in Cotton

Where are they and where do they go?

Kyle A. Fontenot, Jarrod Hardke, J. H. Temple and B. Rogers Leonard

Understanding basic biological characteristics of economically important insect pests is essential for developing integrated pest management (IPM) programs. An insect's reproductive cycle, feeding habits and dispersion patterns help partially define the time and location of potential crop injury. A key component of any IPM program is the ability to successfully monitor pest populations and estimate damage levels. The cotton IPM program relies heavily on intensive pest sampling to aid in monitoring, especially when dealing with the tarnished plant bug. The tarnished plant bug is a major pest of cotton in Louisiana and several other Midsouth cotton-growing states.

Although several IPM strategies are recommended, chemical control with insecticide sprays is the main tool used to control tarnished plant bugs in cotton. Several applications are generally required each year to protect cotton from yield losses. Complete control, however, usually does not occur with any of the available products. Therefore, methods for efficiently monitoring insect populations and damage to cotton plants are vital to effectively schedule insecticide applications to assure maximum control during the entire production season.

The field dispersion and within-plant distribution of insects, either directly surviving an insecticide spray or migrating following an insecticide treatment, can be influenced by the residual properties of insecticides. This study was designed to compare the within-plant distribution of tarnished plant bug nymphs on insecticide-treated and nontreated cotton plants during the flowering stages of plant development. These results should provide insights into the limitations of the current sampling protocols and offer an opportu-

(Continued on page 35)

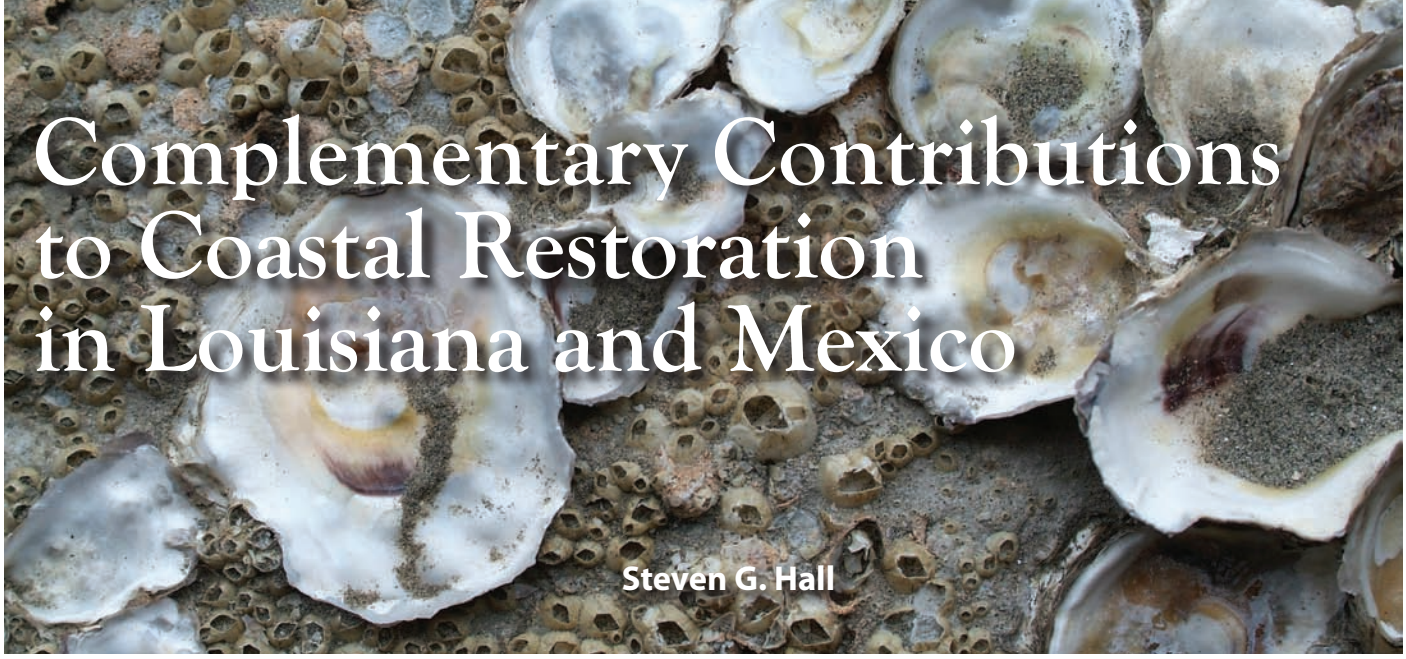
Photo by Ralph Bagwell

Tarnished plant bug on cotton.

Kyle A. Fontenot and Jarrod Hardke, Graduate Assistants, and J. H. Temple, Research Associate, Department of Entomology, LSU AgCenter, Baton Rouge, La.; B. Rogers Leonard, Jack Hamilton Regents Chair in Cotton Production, Macon Ridge Research Station, Winnsboro, La., and Department of Entomology, LSU AgCenter, Baton Rouge, La.

Complementary Contributions to Coastal Restoration in Louisiana and Mexico

Steven G. Hall

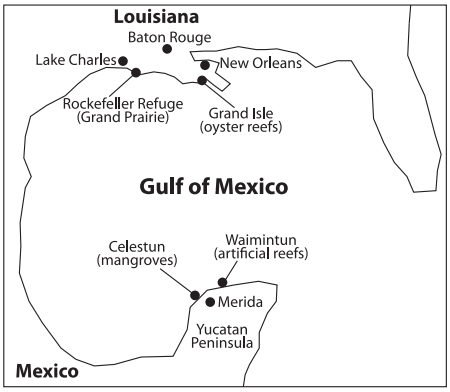


Oysters grow on an artificial reef.

Photo by John Wozniak

Louisiana shares attributes with other states and countries that border the Gulf of Mexico, including Mexico. Louisiana's coastal landscape has been uniquely shaped by the Mississippi River over millennia. The deltaic landscape has played into rich fisheries, coastal activities including shipping, oil and gas, and productive agriculture and aquaculture industries. Other border areas have similar characteristics, with significant gulf coastal frontage, and, in some cases, riverine and/or low-lying land.

LSU AgCenter scientists conducted a recent study to compare and contrast coastal restoration and related issues in the state of Yucatan, Mexico with those of Louisiana. A number of issues are similar, while, due to geography, culture and other reasons, there are also contrasts. Both Yucatan and Louisiana have significant fisheries, both have long-standing local cultures, and both have low-lying lands slowly grading back to higher land in the interior. However, contrasts include different cultural history, as well as significantly different coastal geography. Whereas Louisiana is largely deltaic, influenced by the massive Mississippi River, the Yucatan has essentially no surface water because the permeable topography drains water quickly. However, both locations have coastal challenges, as well as potential for productive growth in these rich zones.



Two sets of comparisons will be explored in this article: 1) artificial reefs for habitat restoration; and 2) hydrodynamic techniques for coastal restoration. The biology associated with these projects has similarities. For example, aquatic species common to the Gulf of Mexico and coastal plants such as black mangroves can be found in Louisiana and Mexico, while other species differ significantly due to climatic and environmental conditions.

Artificial Reefs

Artificial reefs can contribute to coastal restoration in both contexts. For example, sets of artificial reefs were emplaced and monitoried in coastal Louisiana (Grand Isle and Rockefeller Refuge) and on the north coast of the Yucatan peninsula (near Waimintun). Significant growth of eastern oysters, barnacles and tubeworms were observed on artificial reefs in the Louisiana environment, whereas in the Yucatan, growth included sponges and limited coral growth.

In Louisiana, research has shown that a number of positive effects can

Photo by Steven G. Hall

Steven G. Hall helped survey coastal wetlands on hydrologic restoration of mangrove habitat near Celestun, Yucatan, Mexico, in 2008.

Steven G. Hall, Associate Professor, Department of Biological and Agricultural Engineering, LSU AgCenter, Baton Rouge, La.

result as these bioengineered artificial reefs grow. In coastal waters, they tend to reduce wave energy, enhancing sedimentation and allowing habitat growth. They also sequester carbon because oyster shells are approximately 12 pecent carbon by mass. As the reefs grow and sink slowly into the sediments, carbon can be sequestered on long-time scales. Additionally, these structures provide a growing and sustainable protection for the Louisiana coast.

In Mexico, the artificial reefs grow native species and also provide habitat for a variety of fish species. During reef assessment there, dozens of species of finfish and other species, including sharks and rays, were observed. Coral reefs off the Mexican coast provide both habitat and protection for coastal habitats and settlements. Coral can also sequester carbon. However, biological solutions have the challenge that changes in environmental conditions (e.g. temperature or pH for coral; salinity or solids for oysters) can inhibit or stop growth, rendering these less robust under certain conditions.

In general, however, there are two reasons that "growing solutions" such as artificial reefs and coral reefs are preferred. First, they are biologically and environmentally friendly, and second, they require far less energy (often fossil fuel) both initially and over the long term. Recent work has shown that as they grow, these reefs continue to reduce coastal erosion indefinitely, as opposed to traditional stone structures that slowly sink in the soft sediment off the Louisiana coast, requiring additional work every few years to continue to provide coastal protection. In this case, it may be that techniques developed in Louisiana could be useful in Mexico or elsewhere.

Coastal Restoration via Hydrodynamics

The second set of projects focus on coastal hydrodynamics. In Mexico, poorly planned development, often related to tourism, has in some cases resulted in degraded ecosystems. Changes in hydrology may result in loss of coastal plants and wetlands. One location on the west coast of the Yucatan peninsula near Celestun lost an area of several dozen acres of mangroves because of such development.

Now that ecotourism has become popular, there is a desire to restore this area of mangroves. This is not only positive aesthetically, but mangroves, which are salt-tolerant, assist in coastal protection by their thick rooting systems. The challenge is that they require some water movement and appropriate salinities to thrive, and, in the Celestun location, road building and other development have impeded natural hydrology.

A series of experiments with plantings has done little to alleviate the visible loss of mangroves, but a somewhat larger (2 meters wide by 1 meter deep) canal brought water to a section of the dead area, and leakage from the canal (connected to the main lagoon) provided needed water flow for spontaneous regeneration of approximately four acres of mangroves.

Additional studies using high accuracy GPS assisted in designing improved hydrodynamics over a larger area, and new changes should enhance growth further. Thus, the Mexican expertise in the four species of mangroves grown there should assist in enhancing coastal protection and ecotourism.

Meanwhile, in Louisiana, our one species of mangrove, Avicennia germinans, provides some promise for coastal protection, particularly on our barrier islands. It does freeze back every few years, but the root systems appear to assist in reducing land loss and maintaining the protection of the barrier islands.

Studies on linking artificial reefs and mangroves for coastal restoration continue, and interest in such activities both within the LSU AgCenter and Louisiana in general, are growing. Ongoing activities are focused on linking Mexican institutions with the LSU AgCenter to enhance coastal restoration and aquaculture that is beneficial to both. Specifically, studies on mangrove regrowth because of improved hydrodynamics were done in Mexico that could enhance the growth of native mangroves in Louisiana, and insights about artificial reefs could help restore coastal areas in Louisiana and elsewhere. ■

Photo by Steven G. Hall

Mangroves, with their dense rooting systems, can provide coastal habitat, enhance sediment capture and protect coastal wetlands. These mangroves are growing along the Mexican coast.

Fall armyworm larva surviving on non-Bt corn tissue.

Fall Armyworm and Bt Corn

New Technology for Old Pest

Jarrod T. Hardke, B. Rogers Leonard and Karla D. Emfinger

The fall armyworm is a common insect pest of field corn in Louisiana and other states across the South. Conventional chemical control strategies used to manage the fall armyworm in corn generally provide inconsistent results because the larvae feed within the whorls of vegetative-stage plants or on immature grain in corn ears. Therefore, proper timing of insecticide applications is difficult and must target eggs or larvae as they hatch, but before they move into the plant and become protected from the sprays.

Recent developments in insect biotechnology have become available for managing the fall armyworm and other caterpillar pests attacking corn. Insecticidal proteins from Bacillus thuringiensis (Bt) are being expressed in transgenic corn plants. Both crystal (Cry) and vegetative (VIP) proteins produced from Bt are toxic to selected caterpillar pests when ingested by larvae feeding on corn plant tissue. The first commercial Bt corn (YieldGard) expressed a Cry1Ab protein with corn stalk borers as the primary targets. Since the introduction of the YieldGard technology, corn plants have been transformed to express other Cry proteins with a wider spectrum of control, including the fall armyworm.

Growers now have the option of planting corn with YieldGard technology or the new Herculex technology that expresses a Cry1F protein. Cry1F has been shown in laboratory tests to be inherently more toxic than Cry1Ab to fall armyworm. In the near future, the agrichemical and seed industries will commercialize transgenic Bt corn technologies with multiple combinations of novel insecti-

Photos by Jarrod T. Hardke

Student worker Beth Padgett inspects vegetative stage corn for fall armyworm damage.

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cidal proteins, which will provide nearly complete caterpillar pest control.

In laboratory and field studies during 2007-2008, LSU AgCenter entomologists evaluated YieldGard and Herculex technologies for their effects on fall armyworm survival and corn damage. All studies were conducted at the Macon Ridge Research Station near Winnsboro, La. The performances of YieldGard and Herculex technologies were compared with a conventional non-Bt corn line.

In no-choice laboratory tests, fall armyworm caterpillars were offered freshly harvested leaves from field plots of vegetative-stage corn. Fall armyworm survival was monitored daily. Survivors were offered fresh tissue as needed (every two to three days) until all larvae were classified as either dead or having successfully pupated. Larval consumption of leaf tissue was evaluated in separate tests by offering fresh leaf tissue of a known size to the insects. After a period of four days, leaf consumption was measured. In field trials, corn plants were artificially infested with fall armyworm caterpillars during appropriate growth stages. After 14 days, larval damage to leaf tissue was evaluated using a visual rating scale (1-9). A rating of 1 was defined as no visible leaf injury, and a rating of 9 was defined as most leaves exhibiting long (greater than 1 inch) lesions.

In the laboratory tests, no differences in fall armyworm larval survival were observed between those placed on YieldGard (71 percent) or conventional non-Bt tissue (78 percent) (Figure 1). However, leaf consumption was significantly lower for YieldGard plants compared with the non-Bt line. In field trials, leaf tissue injury ratings were similar between YieldGard (4.28) and conventional non-Bt (5.37) corn plants. Significantly lower survival of fall armyworm larvae was observed on Herculex corn tissue (34 percent) compared with that on conventional non-Bt tissue (78 percent) (Figure 2). Larvae also consumed significantly less Herculex corn tissue compared with the conventional non-Bt tissue. In another series of field trials, significantly lower leaf injury ratings were observed on Herculex corn plants (1.59) than conventional non-Bt (5.37) corn plants.

Results from these studies indicate that YieldGard demonstrates limited efficacy against fall armyworm. The Herculex technology demonstrated significant insecticidal activity against fall armyworm, which resulted in less foliage injury. These studies support previous laboratory trials with purified proteins that show a Cry1F protein is more toxic to fall armyworm than Cry1Ab in corn. Results from these studies should aid Louisiana corn producers in choosing the best corn technologies to utilize given their particular set of pest problems. ■

Photo by Jarrod T. Hardke

Typical fall armyworm injury to conventional non-Bt corn plants includes leaf window-paning, which is characteristic of early-stage larval feeding, whereas large lesions indicate feeding by older larvae.

Figure 1. Comparison of conventional non-Bt and YieldGard corn lines by larval survivorship and defoliation [percent tissue consumed by larvae].

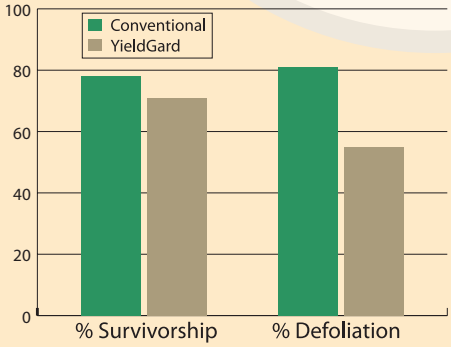
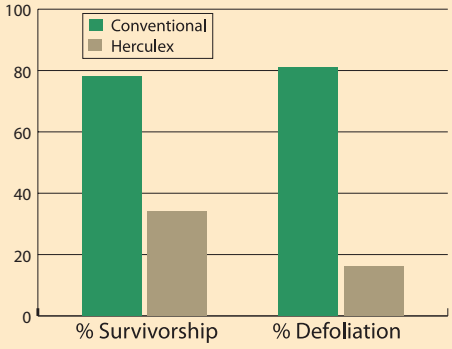


Figure 2. Comparison of conventional non-Bt and Herculex corn lines by larval survivorship and defoliation [percent tissue consumed by larvae].



McMillin receives national meat science award

Ken McMillin, professor of animal sciences and food science at the LSU AgCenter and at LSU, has been awarded the 2009 American Meat Science Association Signal Service Award. This award recognizes members for devoted service and lasting contributions to the meat industry.

McMillin is only the second recipient from Louisiana to receive this award, which is the association's oldest award, having been established in 1956. The other LSU recipient was J.B. Francioni Jr., now deceased. Francioni Hall on the LSU campus, where animal sciences professors and labs are housed, was named in his honor.

McMillin holds degrees from Purdue University and Iowa State University and is a former Fulbright Senior Specialist to Stellenbosch University, Western Cape, South Africa. He is known for developing a live animal selection classification system and carcass evaluation guides for the meat goat industry. He led the development of the Institutional Meat Purchase Specifications for fresh goat in conjunction with the U.S. Department of Agriculture's Agricultural Marketing Service and Southern University. ■ **Linda Foster Benedict**

Sweet leaf tea extract shows real promise in preventing cancer recurrence

Zhijun Liu, Eugene A. Woltering and Peiying Yang

After initial treatments of cancer through surgery, chemotherapy or radiation therapy, the next task is to prevent the cancers, especially recurrence-prone cancers, from recurring. This is because remnant cancer cells that survived the initial treatment or metastasized tend to grow, first by initiating new blood vessel formation when the environment is favorable.

Because preventing cancer recurrence requires long-term management, a safe regimen with no or minimal adverse effects would provide an optimal profile for managing the disease. Current therapeutics directed toward the prevention or treatment of cancer are often highly toxic at effective doses. Targeted therapies such as agents that inhibit angiogenesis – the process by which new blood vessels initiate and grow – offer great hope in cancer management.

Avastin, a U.S. Food and Drug Administration-approved antibody prescription drug targeted at the angiogenic growth factor VEGF, is administered by injection, but has limited efficacy and serious adverse effects. This plus its high cost make it an impractical cancer-management agent.

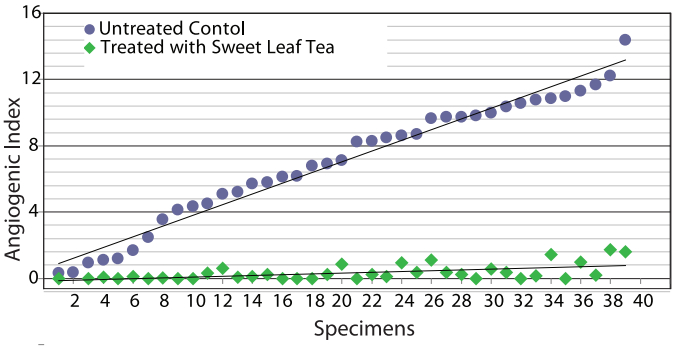
While the pharmaceutical industry searches for single-entity drugs that target angiogenesis, many efforts have also been made to search for anti-angiogenic agents from botanical sources based on their medicinal-use records. LSU AgCenter researchers have identified a number of such botanical agents. One that has shown great promise is Chinese sweet leaf tea. Sweet leaf tea water extract at a dose of 0.45 grams per pound of body weight completely and totally blocked blood-vessel initiation and growth in a human tissue-based angiogenesis test.

The sweet leaf tea plant, native to the Guangxi-Guizhou regions of southwestern China, has been consumed as a beverage tea for years, mainly for its naturally sweet taste (said to be 300 times sweeter than cane sugar). This human-use history, plus the scientific discovery of its anti-angiogenic property, prompted a multi-institutional investigation led by the LSU AgCenter and supported by the National Center for Complementary and Alternative Medicine of the National Institutes of Health. The ongoing two-year project focuses on pre-clinical evaluation of the sweet leaf tea extract, with the goal of spinning it off into human clinical investigations as a cancer-preventative agent.

Although the enormous advantages of using safe botanical extracts as cancer-preventative agents are yet to unfold, the greatest challenge is to standardize the extract so that the batch-to-batch variations are assessed and controlled. This is especially challenging given the natural variations of botanical materials and the nature of mixed compounds in a single-leaf extract compared to single-entity drugs, such as aspirin.

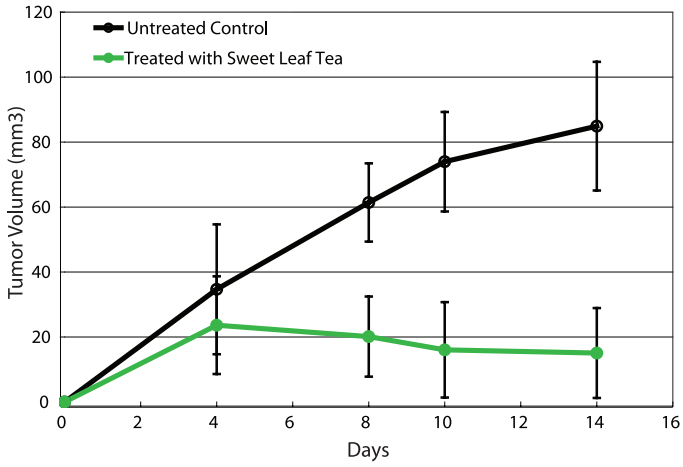
The lack of quality control of botanical extracts often results in the lack of reproducible results of clinical efficacy. This investigation placed great emphasis on achieving standardization using multiple chemical markers that have proven combined anti-angiogenic activity. A chemical fingerprinting analysis method has been developed to assess the

Figure 1. Effects of sweet leaf tea extract on the angiogenesis of tumor tissues harvested from patients with mid-gut carcinoids. The standardized sweet leaf tea extract at 0.1% w/v dose consistently suppressed overall angiogenic response (expressed as Angiogenic Index) in comparison to the untreated controls.



Zhijun Liu, Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.; Eugene A. Woltering, James D. Rives Professor of Surgery and Neurosciences, Department of Surgery, LSU Health Sciences Center, New Orleans, La.; Peiying Yang, Assistant Professor, Section of Integrative Medicine, Department of General Oncology, University of Texas M. D. Anderson Cancer Center, Houston, Texas

Figure 2. Effect of the sweet leaf tea extract on the tumor growth of xenograted SCID mice bearing human breast cancer cells (MDA231). The untreated control group continued to grow, whereas the treated group with 1g/kg body weight dose via oral gavage stopped tumor growth starting on Day 4.



similarity of overall chemical constituents among different batches against a "standard extract" with a defined efficacy. Any batch that falls outside 90 percent similarity to this standard extract is disqualified.

The standardized sweet leaf tea extract was tested against numerous and diverse tumor specimens harvested from patients, and it was found that the extract repeatedly and consistently inhibits the initiation and growth of new blood vessels regardless of each tumor's angiogenic potential (Figure 1). This is very encouraging because it shows efficacy against solid tumors of various types in which growth or recurrence depends on new blood vessel formation.

A positive anti-tumor efficacy result using appropriate animal models is a "gold standard" for beginning human clinical trials. In a preliminary study with mice that are highly susceptible to infection, two groups 25-39 days old were injected with human breast cancer cells to develop a tumor. Immediately after the injection, one group of mice received the standardized sweet leaf tea extract via tubes to the stomach (a process called oral gavage) on days zero, 4, 8, 10 and 14. The control group received only water, which is the vehicle used to prepare the sweet leaf tea extract.

The result of this study shows that tumor volume continued to increase in the nontreated control group, whereas tumor volume in the treated group remained constant starting at day 4 after the initial onset of the tumor growth (Figure 2). This encouraging finding is a proof of concept that the sweet leaf tea extract is orally active in stopping tumor growth, possibly by inhibiting angiogenesis that deprives the implanted cancer cells from accessing blood vessel networks to feed their growth.

Ongoing animal studies are determining the minimal effective dose in a multiple-dose study and variations in a different cancer type (pancreatic). A toxicity and safety study of the standardized sweet leaf tea also is being planned to define safe dose range. However, all indications are that it is safe for short-term use and predicted safe in longer-term use as a cancer-preventative agent.

To gain insight on the mechanisms of action, a number of studies were conducted using endothelial cells – the cells that become angiogenic to produce new blood vessels – from human umbilical veins. It was found that the sweet leaf tea extract markedly inhibited the expression of a basic growth factor that stimulates and promotes angiogenesis, and the suppression depended on the concentration of the extract. In contrast, it did not affect other vascular growth factors, including VEGF – the one targeted by the drug Avastin.

The extract did suppress the VEGF receptor on the cells regardless of the presence or absence of VEGF. These results suggest that the observed anti-angiogenic property of sweet leaf tea works by inhibiting receptors on the cell rather than the growth factors themselves. Moreover, the sweet leaf tea extract has the ability to slow the growth of endothelial cells and disrupt blood vessel formation. Additional investigations are ongoing to determine if and how the multiple constituents of the sweet leaf tea extract combine and work together to produce the anti-angiogenic effect.

LSU AgCenter researchers hope to develop the sweet leaf tea extract as an effective and safe cancer preventative agent that will allow cancer patients to manage cancer and keep any residual cancer cells in remission indefinitely. ■

Plants prompt search for cancer prevention

For more than 15 years, Zhijun Liu with the School of Renewable Natural Resources has been investigating plants for medicinal properties. He started by looking at plants that traditionally have been used as folk remedies to treat diseases such as hypertension, diabetes and cancer.

For the past 10 years, his focus has been on angiogenesis inhibitors, hoping to find compounds that will prevent the growth of blood vessels and can be used to treat diseases such as cancer, obesity and psoriasis.

"Inhibiting angiogenesis can prevent cancer – and perhaps even fat tissue – from developing beyond the simple limits of existing blood vessels," he said.

Turning these discoveries into practical therapies presents major obstacles, which are typical in the use of botanical extracts for health care and therapeutics, Liu said.

"To be effective, the active ingredients must be concentrated enough to achieve a therapeutic effect," he said.

Liu first screens extracts by fractionating – dividing the material into smaller segments – and then further subdivides the fraction that holds the most promise for delivering an effective compound. Finally, he purifies the extract fraction to produce an effective concentration of the compound.

"We use bioassay-directed isolation to trace down the molecules responsible, then expand to similar chemical structures," Liu said.

Through laborious isolation he has identified gallic acid as a contributor to angiogenesis inhibition. Then he began looking for derivatives – analogs of gallic acid from other sources.

In Chinese sweet tea, for example, the extract did a better job of inhibiting angiogenesis than gallic acid alone.

"Based on bioactivity, we determined that the effect was not because of a single molecule," Liu says. "Three different chemicals in an appropriate proportion behave synergistically."

Liu believes he and his colleagues are on the threshold of a breakthrough.

"I used to start with the plant and not stop until I found the molecule," Liu said. "Now, I realize it may not be one compound but several compounds. My interest now is to see if they're synergistic. That's the beauty of natural plants – they produce synergistic compounds."

■ **Rick Bogren**

Temporary structures for grain storage

Roberto N. Barbosa and Carol Pinnell-Alison

In the past four years Louisiana farmers have planted and harvested record-breaking amounts of corn, soybeans and sorghum – so much that the state's storage capacity could not handle it all (Figure 1). Lack of storage brought farmers a series of problems, such as loaded trucks being turned away from grain-filled elevators or reports of trucks waiting eight hours to unload. Louisiana farmers need to have access to readily available grain storage, but commercial elevators are not built overnight. On-farm grain storage is a viable alternative but considered a long-term investment that many farmers are not willing to make. Short-term storage may be a solution.

Short-term grain storage has been used for quite some time in other countries including Argentina, Australia and Israel. In this type of storage, grain is loaded in plastic (polyethylene) bags commonly known as grain bags. They measure 200 feet long by 9 feet high and hold around 8,000 bushels of corn. Specialized machinery loads and unloads grain in the bags. The bags can be left in the field or in a more central location for easy management.

Roberto N. Barbosa, Assistant Professor, Department of Biological & Agricultural Engineering, LSU AgCenter, Baton Rouge, La.; Carol Pinnell-Alison, County Agent, Franklin Parish, LSU AgCenter, Winnsboro, La.

Photo by Roberto N. Barbosa

Specialized machinery is used to load and unload grain in the bags.

A few farmers were willing to experiment with such a system. Their questions concerned the effects of the high moisture on grain quality because of the significantly more humid weather in Louisiana compared with weather in other countries where the grain bags are used. Research carried out by the LSU AgCenter tried to shed some light in the use of grain bags for temporary grain storage. Producers in Avoyelles and Franklin parishes agreed to allow scientists to use electronic sensors to monitor grain temperature and oxygen content inside the bag. Weather conditions such as air temperature, relative humidity and rainfall were measured with an automated weather station.

The premise of the grain bag system is that once the bag is filled with grain and properly sealed,

Photos by Roberto N. Barbosa

An automatic weather station collects weather information around a grain bag.

A simple way of creating a good seal is to use a couple of two-by-fours and a heavy weight.

oxygen levels drop considerably in the first couple of weeks. Without oxygen, bacteria, fungi or insects that may have found their way into the bags cannot survive or cause damage to the stored grain. Damage could potentially occur in the first few days of storage while oxygen levels are still high but would cease as soon as oxygen is depleted.

Grain Bag Use

The moisture level of the incoming grain is important. As a rule of thumb, the drier the grain, the better. High-moisture corn or sorghum coupled with high air temperature and high relative humidity will create spoilage points inside the bag before the oxygen is completely depleted. Results of this spoilage only would be known upon opening the bag, which, if positive, can reduce the market value of the grain.

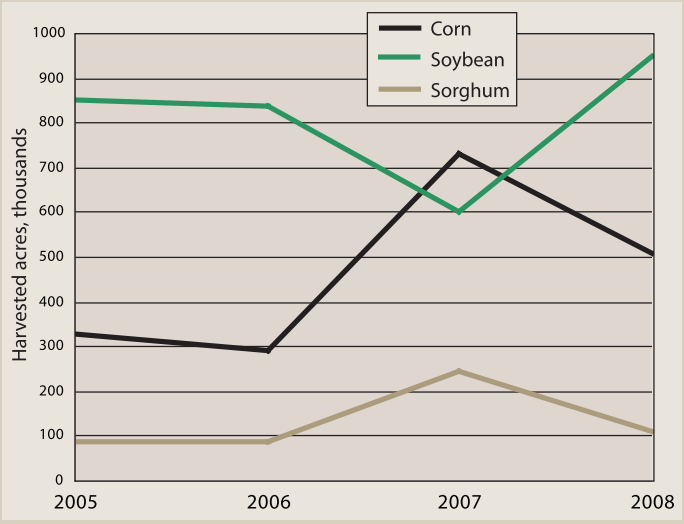
Sealing the bag after filling and maintaining it throughout storage are critical. The starting end of the bag is self-sealed by the incoming grain. But after the bag is filled, the other end has to be sealed properly to keep out water, air, insects and animals. This is crucial for the success of the storage unit. A simple way of creating a good seal is to use a couple of two-by-fours and a heavy weight. During storage, wildlife and birds may come in contact with the bag and puncture it. This damage would create entry points for oxygen and water, rendering the seal useless. Bag manufacturers usually give producers white tape that can be used to seal punctures. Constant inspections are needed to re-seal puncture sites and ensure the integrity of the bag.

Choosing where to place the bag can prove to be challenging. Preparing a site for the bag may include eliminating vegetation and rocks that may perforate the bag and modifying the terrain to steer rainfall away.

Preliminary results indicate grain bag systems are a viable alternative for the temporary storage of grain in Louisiana. During the monitoring period, internal grain temperature was held constant inside the bag, and no wide fluctuations in grain temperature were found. Grain temperature followed air temperature and became increasingly lower as the season progressed, and the air temperature fell. Oxygen levels in the bags decreased from the usual 21 percent (atmospheric content) to less than 10 percent in less than two weeks after they were filled. Overall grain quality was maintained during storage, and no increased microbial or insect activity was found in bags that had a good seal.

Perhaps the greatest and often overlooked use of the grain bag system is its ability to increase harvesting productivity. Using a grain bag system, a farmer can quickly unload his trucks and keep the combine in the field, harvesting more acres per day. This single feature may be the difference between a successful or failed season, considering how fast harvesttime weather changes in Louisiana. Once conditioned in the bags, grain can be unloaded at the farmer's own pace, taking advantage of higher prices. The emphasis of temporary storage solutions should be in the "temporary" part – it is a solution not designed to hold grain in the field for a long time but to help farmers increase productivity and make the most of their harvest. ■

Figure 1. Evolution of Harvested Area in Louisiana. Source: National Agricultural Statistics Service of the U.S. Department of Agriculture.



Foliar-applied Fungicides in Corn *Does it pay?*

Boyd Padgett, Clayton Hollier, Rick Mascagni and Myra Purvis

Photo by Boyd Padgett

Corn tassling in Franklin Parish.

Fungicides are used to manage diseases in many field crops grown in Louisiana. Until recently, this practice has not been evaluated on corn produced in the state. In the past, foliar-applied fungicides have not been promoted in corn because diseases either do not develop or develop late in the season having minimal or no impact on yield. However, with advent of newer fungicides, some sectors of the agricultural chemical industry are promoting these applications, even in the absence of disease, to increase yields and preserve stalk density to prevent lodging – the tendency of stalks to fall over.

It was uncertain if this practice would consistently benefit Louisiana corn producers because research addressing this is limited in the state. Therefore, in collaboration with industry, LSU AgCenter scientists initiated research in the spring of 2007 to determine the feasibility of this practice. The objectives of this research are to determine if selected fungicides are effective for managing diseases affecting corn in Louisiana; if yields are higher in fungicide-treated corn than in untreated corn; and if stalk density in fungicide-treated corn is greater than in untreated corn.

Field tests were conducted during 2007 and 2008 on several AgCenter research stations and in producer fields. Test sites included the Macon Ridge Research Station near Winnsboro, the Dean Lee Research Station near Alexandria and the Northeast Research Station near St. Joseph. With the assistance of county agents, tests were conducted in producer fields in Avoyelles, Concordia, East Baton Rouge, Franklin, Morehouse, Tensas, Rapides, Richland and St. Landry parishes.

In 2007 and 2008, tests were conducted at the Macon Ridge and Northeast research stations to evaluate Quilt and Headline fungicides for their effect on corn diseases, stalk density and grain yield and quality. Evaluations in 2007 included eight hybrids at the Macon Ridge Research Station and six hybrids at the Northeast Research Station. A single fungicide application was made to each variety while in the tasseling growth stage and compared with the same variety without treatment. During the growing season, plants were monitored periodically and rated for disease incidence and severity. Stalk density was assessed when corn reached physiological maturity. This was determined by collecting stalks from each plot and recording fresh and dry weights, as well as the diameters for each stalk. Densities were then calculated using this information. Yield and test weights were also recorded.

In both years, diseases either did not develop or developed late in the growing season. Therefore, the effect on disease was not evaluated.

In 2007, the effects on stalk density and yields varied within and among

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hybrids (Tables 1 and 2). At the Macon Ridge location, yield differences between the Quilt treatment and no treatment ranged from 15.7 bushels per acre to minus 14.3 bushels per acre, and treated hybrids averaged 4.6 bushels per acre less. Yield differences between the Headline treatment and no treatment ranged from 33.9 bushels per acre to minus 19.7 bushels per acre, and yields averaged 6.33 bushels per acre more when Headline was used.

Results from the test at the Northeast Research Station in 2008 were similar to those in 2007. Yield differences were from 11.4 bushels more per acre to 4.3 bushels fewer per acre between Headline-treated hybrids and nontreated hybrids (Table 3). When averaged across hybrids, corn treated with Headline yielded 2.3 bushels per acre more than nontreated hybrids. There were no significant differences between stalk densities and test weight among most hybrids.

During 2007, Headline, Quilt, Quadris and Stratego were evaluated in tests at the Dean Lee Research Station and at off-station sites. Tests with producers usually consisted of large areas in fields either treated with a fungicide or not treated. A total of 21 corn hybrids were evaluated in these tests. Applications were made to corn at or near tasseling. Disease epidemics did not develop to appreciable levels in most tests. Where diseases were observed, however, incidence and severity were lowest in fungicide-treated corn. When averaged across tests and compared to plants not treated, yields were 0.89 bushels per acre higher with Headline applications, 0.06 bushels per acre higher with Quilt and 2.38 bushels per acre higher with Quadris (Table 4). Corn treated with Stratego averaged 1.35 bushels per acre less than corn not treated.

Even though yield response was minimal or nonexistent, responses by individual hybrids varied considerably. Yield differences between fungicide-treated hybrids and untreated hybrids ranged from +12 bushels per acre to -20.4 bushels per acre for Headline, +14.9 bushels per acre to -17.2 for Quilt, +9.0 bushels per acre to -5.3 bushels per acre for Quadris and +10.7 bushels per acre to -27.7 bushels per acre for Stratego.

Because disease epidemics did not develop to significant levels in most tests, the effect of fungicides on disease development is inconclusive. In LSU AgCenter tests, fungicides did not preserve stalk densities or increase test weights in most hybrids. The effect of fungicides on yield was not consistent between hybrids or across years.

When compared with untreated corn, yields were 6 bushels per acre or higher in 33 percent of the tests with Headline or Quadris, 27 percent of the tests with Quilt and 50 percent of the tests with Stratego when compared to untreated corn. These inconsistent responses do not support the practice of automatically applying fungicides to corn. In hybrids where disease epidemics develop to damaging levels, the probability of an economic return from a fungicide application may increase.

The LSU AgCenter will continue to conduct research in this area to further evaluate the efficacy of fungicide applications to corn. ■

Table 1. Yields and stalk densities of corn hybrids treated with the fungicide Quilt (14 fl oz/acre) compared to no treatment at the Macon Ridge Research Station in 2007.

Hybrid	*No fungicide Yield (bu/A)*	*Fungicide Yield (bu/A)*	*No fungicide Stalk Density (oz/in^3)*	*Fungicide Stalk Density (oz/in^3)*
Garst 8295YG1RR	130.2	145.9	0.342	0.399
Garst 8248RR	158.7	154.0	0.304	0.335
TV26B82	129.9	126.5	0.368	0.433
TV26BR41	134.6	121.4	0.399	0.417
DKC69-71	141.8	139.1	0.342	0.355
DKC66-23	130.5	116.2	0.435	0.444
Pioneer 33R81	144.0	131.1	0.415	0.379
Pioneer 31G71	152.2	150.9	0.395	0.404

Table 2. Yields and stalk densities of corn hybrids treated with the fungicide Headline (6 fl oz/acre plus 1% crop oil concentrated) compared to no treatment at the Northeast Research Station in 2007.

Hybrid	*No fungicide Yield (bu/A)*	*Fungicide Yield (bu/A)*	*No fungicide Stalk Density (oz/in^3)*	*Fungicide Stalk Density (oz/in^3)*
Garst 8248RR	123.0	134.4	0.410	0.411
TV26B82	126.1	123.3	0.427	0.372
TV26BR41	135.3	169.2	0.421	0.445
DKC69-71	145.2	125.5	0.381	0.357
DKC66-23	150.4	155.5	0.536	0.456
Pioneer 33R81	136.5	146.6	0.445	0.459

Table 3. Yields and stalk densities of corn hybrids treated with the fungicide Headline (6 fl oz/ acre) compared to no treatment at the Northeast Research Station in 2008.

Hybrid	*No fungicide Yield (bu/A)*	*Fungicide Yield (bu/A)*	*No fungicide Stalk Density (oz/in^3)*	*Fungicide Stalk Density (oz/in^3)*
DKC64-78	106.4	107.0	0.1222	0.1292
DKC69-71	94.9	99.6	0.1001	0.1049
TV26BR41	109.8	121.2	0.1419	0.1362
TV25BR23	110.6	106.3	0.1416	0.1421
PIO31G71	115.2	111.5	0.1256	0.1200
PIO33R81	114.4	119.9	0.1200	0.1163

Table 4. Yield of corn treated with fungicides in tests conducted in producer fields and on the Dean Lee Research Station in 2007 compared to corn not treated.

Fungicide (oz product/A)	*No. of Tests*	*No Fungicide Yield (bu/A)*	*Fungicide Yield (bu/A)*	*Yield Difference*
Headline (6.0)	21	199.76	199.64	0.89
Quilt (14.0)	26	199.50	199.56	0.06
Quadris (6.0)	3	200.55	202.93	2.38
Stratego (10.0)	9	188.00	186.65	-1.35

Hole-plugging technology creates new business, jobs for Louisiana

Photos by John Wozniak

A new technology developed by an LSU AgCenter researcher has serendipitously found its way into the oil industry, resulting in a new company and the reinvigoration of an existing company in Louisiana.

The patented process, developed by Qinglin Wu in the School of Renewable Natural Resources, involves making material from recycled plastics, including used motor oil containers and wood waste, that can be used in oil and gas drilling to prevent the drilling fluid from seeping into the environment.

This material, which has been trademarked as Tiger Bullets, are marketed to oil companies by a start-up company aptly called Hole Pluggers, which is based in New Iberia, La.

"We're recycling the oil containers back into the oil business," said Tom Parker, one of the owners of Hole Pluggers, who licensed the technology from the AgCenter. "That's one of the advantages of our product."

Tiger Bullets are manufactured at Wallace Moulding & Millworks of Columbia, La., a company that also makes the parts for windows, doors and cabinets for houses. With the decline in the housing market, Dan Wallace, the owner, had been in search of new business and, after consulting with Wu, had invested in equipment to move into the manufacture of plastic lumber. Then along came Tiger Bullets.

"Talk about being in the right place at the right time," Wallace said. "We were already set up with equipment that can manufacture this material."

And he was able to hire back some of the 30 employees he'd had to lay off and hopes to have all 45 of his employees back – and possibly more employees – by the first of the year.

"This is another success story of how technology developed at a university can transform an existing business and industry, leading to new jobs and growth in the state's economy," said Wade Baumgartner, associate director of the LSU AgCenter's Office of Intellectual Property.

Qinglin Wu, professor in the School of Renewable Natural Resources, has patented a process for developing material made from recycled plastics that can be used in the oil and gas industry to prevent lost circulation.

And here's how serendipity played a role in the unfolding of this story.

On March 30, 2008, Parker, an entrepreneur in the oil business, saw an article in the Baton Rouge Advocate newspaper about Wu and his wood-plastic composites research. Wu is the Roy O. Martin Professor of Composites and Engineered Wood Products at the AgCenter.

The article described how Wu was using discarded motor oil containers in combination with cellulosic fibers, which absorbed the residual oil, to create strong composite materials.

Wu had been conducting this research at the request of Dan Cadigan, a senior official with BP Global Supply Chain in Port Allen, La., who had contacted Wu a year before, ironically, after reading an article in the Advocate about Wu's research.

"Wu's research sounded like it offered the perfect solution to recycling oil containers," Cadigan said.

Wu has spent his research career creating wood-plastic composites using waste products from the agricultural and forestry industry including wood chips, sugarcane bagasse and rice hulls.

In 2006, Wu's research team received an $800,000 grant from the U.S. Department of Agriculture and the U.S. Department of Energy to create composite products that can be commercialized in Louisiana. Wallace had been one of the Louisiana business owners Wu had talked to with ideas for new products.

In reading about Wu's and Cadigan's project, Parker saw immediate application for the composite material that included plastic oil containers as an ingredient in the drilling fluid "mud" used in drilling for oil and gas. He himself had been trying to develop the perfect mud additive that could effectively seal off fractures in the earth and permeable formations.

The drilling mud both lubricates and cools the drill bit as it goes down into the earth, sometimes as far as 30,000 feet or more. Ideally, the mud comes back up with the drill cuttings after the tunnel is dug. But when the mud seeps away, that's called "lost circulation" and is a huge, expensive problem.

"This costs money for the oil and

gas industry, and it's not good for the environment," Wu said.

Other drilling fluid ingredients on the market are not as good at filling and sealing off cracks and porous areas as Tiger Bullets, Parker said. One reason is Wu's patented process allows the material to be custom-made into multiple-sized particles to fit the particular geology of the drilling operation. The varying-sized material can immediately seal off and plug any size fissure or surface porosity, preventing seepage.

Wu's material has been used successfully with all three types of drilling fluid – synthetic, water-based and oil-based. Parker has tested the Tiger Bullets in oil drilling operations in the mountains of Colorado, the plains of Arkansas and offshore in the Gulf of Mexico, and they perform well.

"Wu did a great job of simulating the effects of drilling in the laboratory. His technology came off the drawing board and worked in the real world – better than expectations," Parker said.

Tiger Bullets' environmental advantage is another selling point. Although Wu's technology can use any kind of plastic waste in the material, used plastic motor oil containers work perfectly.

"There are few current uses for the oil container plastics, and they are very expensive to get rid of," Wu said. "This is not a problem with our process because the material is converted to a green, proprietary blend of materials that does not contain any free oil."

Cadigan said Louisiana produces more oil containers than probably any other state. So having them come back to the state after they've been used and create new business and jobs is the perfect "cradle-to-cradle" scenario.

Cadigan credits Kelsey Short with the Louisiana Economic Development office with helping connect Wallace with the Northeast Louisiana Economic Development Alliance, which provided some funding for Wallace's new equipment.

Like the rest of the economy, the oil business is down right now. But it will bounce back and bring with it a bright future for Hole Pluggers.

"The LSU AgCenter has a history of conducting research with practical application for industry," said David Boethel, LSU AgCenter vice chancellor for research. "This is another example."

And both Parker and Cadigan agree it pays to read the newspaper.

■ **Linda Foster Benedict**

Influence of irrigation, row configuration and seeding rate on grain sorghum yield on alluvial clay

Henry J. "Rick" Mascagni and Robert L. "Bubba" Bell

Production practices influence grain sorghum yield, and research has found a consistent sorghum yield response to row widths narrower than 40 inches, particularly on alluvial soils – those created by sediment deposited by flowing water. For rows less than 30 inches wide, crops are generally planted on flat seedbeds, which precludes the use of irrigation within the furrow. In recent years, newer planters have the capability of planting twin rows on raised beds. Commercial planters are available that can plant two rows, 8 to 10 inches apart, on top of 40-inch-wide raised beds. Practices such as seeding rate and nitrogen rate may interact with row configuration (twin rows versus the conventional single row). The objective of this research was to evaluate the influence of row configuration, seeding rate and nitrogen rate on yield performance of grain sorghum, with and without irrigation.

Field experiments were conducted in 2005 and 2006 on clay soils at the Northeast Research Station near St. Joseph. Two irrigation treatments were evaluated – a non-irrigated control and a furrow-irrigated treatment. The single rows were planted in mid-May of each year. Twin rows were 9.5 inches apart, centered on raised 40-inch-wide beds. The seeding rates of 78,500 and 104,500 seeds per acre are equivalent to six and eight seeds per foot for single rows and three and four seeds per foot for twin rows. Nitrogen rates of 90, 120 and 150 pounds of nitrogen per acre were injected into the soil. Production practices as recommended by the LSU AgCenter were followed.

Irrigation in 2005 increased grain yield by 361 pounds per acre (Table 1). As a result of relatively low rainfall, particularly in June, four furrow irrigations were required to maintain adequate soil moisture. Yield response to row configuration depended on whether irrigation was used. When not irrigated, yield for twin rows was 12.5 percent higher than the single-row treatments; however, with irrigation, yields for both row configurations were similar – 5,008 pounds per acre for twin rows and 4,944 pounds per acre for single rows. There was little response to seeding rate for either single row configuration. Yield response to nitrogen depended on irrigation more than the row configuration. Yield did not increase above 90 pounds per acre without irrigation but increased up to 120 pounds per acre when irrigated.

Table 1. Influence of irrigation and row configuration on grain sorghum yield on Sharkey clay at the Northeast Research Station, 2005 and 2006.

Irrigation	*Row configuration*	*2005*	*2006*	*Average*
		Pounds/acre		
Nonirrigated	Single row	4,341	6,150	5,246
	Twin row	4,889	6,559	5,724
Irrigated	Single row	4,944	6,079	5,512
	Twin row	5,008	6,389	5,699

In 2006, even though three furrow irrigations were applied, yield did not increase with the application of supplemental water. Unlike 2005, yield response to row configuration did not depend on irrigation. Yields were higher on the twin rows com-

(Continued on page 34)

Henry J. "Rick" Mascagni, Professor, Northeast Research Station, St. Joseph, La., and Robert L. "Bubba" Bell, Research Associate, Sweet Potato Research Station, Chase, La.

MYTH BUSTED

Crawfish tail curl and food safety

W. Ray McClain and John Sonnier

Few things symbolize Louisiana culture and cuisine like a festive crawfish boil. Wild crawfish are harvested each year from the vast Atchafalaya River Basin, and approximately 184,000 acres of culture ponds in Louisiana are used to produce more than 100 million pounds of live crawfish annually. The majority of this produce is consumed within the state, most of which is in the form of whole crawfish boiled in spices.

First-time consumers of this delicacy are often cautioned to avoid the crawfish with straight tails and eat only the ones with curled tails. Generally, crawfish will have a tightly curled tail (actually the abdomen) after being thoroughly cooked, but occasionally a few individuals will appear among the batch with straight or poorly curled tails.

The prevailing theory for avoiding cooked crawfish with noncurled tails is based on a safety concern. The theory goes that cooked crawfish with straight tails were dead before cooking and, without knowing how long the animals had been dead or how they were stored, it is best to avoid consuming them.

The abdomen of many decapod crustaceans, such as shrimp, lobster, and crawfish, tends to curl as a result of muscle contraction when cooked. Obviously, if muscle tissues in the abdomen are sufficiently deteriorated by degradation or decomposition, then the ability of the abdomen to contract would clearly be affected. However, discerning food quality or safety issues in cooked crawfish simply by observing the degree of curl in the abdomen may not be reliable. For example, we have routinely observed a small number of individuals with various degrees of noncurled abdomens after cooking, when it was certain the crawfish were alive only minutes before cooking (Figure 1). A basic study was initiated to investigate this under controlled conditions. Live, dead and live-but-restrained crawfish were boiled individually, and the perceived degree of curl of the abdomen was measured.

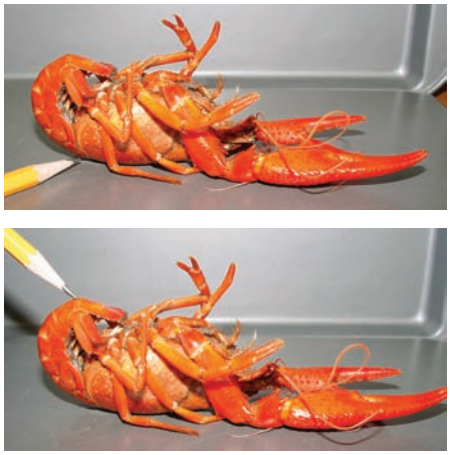
Figure 1. Note that some of the crawfish that have been boiled have straight and others have curled "tails."

Photo by Bruce Schultz

On five different dates over the course of a season, portions of live crawfish were intentionally and quickly dispatched, and then the dead and remaining live crawfish were placed in a cooler at 38-42 degrees F. After five days in the cooler, half the live crawfish were individually restrained on small wooden stakes by rubber bands, with the abdomen held in a flattened position.

Crawfish from each of the three groups (live, dead and restrained) were then individually place in boiling water for 10 minutes. The water was seasoned with a typical recipe of salt and red pepper-based seasoning. Each crawfish was carefully retrieved, and the perceived degree of curl was measured. Reference points on the dorsal surface at the junction of the abdomen and carapace and at the posterior-most point of the abdomen were used (Figure 2). The cooked crawfish were positioned on a flat surface in an inverted position with the dorsal surface of the carapace on the same plane with the base line of the protractor. The origin of the protractor was positioned at the carapace-abdomen junction, and

Figure 2. The two reference points for measuring curl were the junction of the abdomen and carapace (top) and the posterior-most point of the abdomen (bottom).



Photos by Ray McClain

Ray McClain, Professor, and John Sonnier, Research Farm Specialist, Rice Research Station, Crowley, La.

Figure 3. The origin of the protractor was positioned at the carapace-abdomen junction, and angle of curl was determined relative to the position of the second reference point.

Photo by Ray McClain

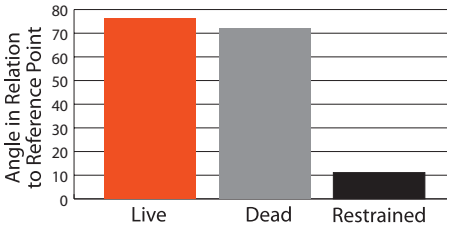
angle of curl was determined relative to the position of the second reference point (Figure 3).

Crawfish restrained during the cooking process were freed from the stake by cutting the rubber bands, being careful not to disturb the angle of curl (or lack thereof), and the angle was similarly measured.

The summarized results are presented in Figure 4. There was no significant difference in curl angle of the abdomen after boiling between live and dead crawfish that had been stored for five days in a refrigerated cooler before cooking. Live crawfish restrained during the cooking process, however, exhibited significantly less curl when freed. Although no effort to measure safety or quality factors was undertaken in this study, these findings refute the myth that the observance of a "straight tail" in boiled crawfish is an indication of whether or not the animal was alive at the time it was cooked.

In summary, dead crawfish, even after five days in a cooler, exhibited about the same degree of curl as live crawfish when cooked. Also, in live crawfish where the abdomen was prevented from curling naturally during the cooking process, the abdomen remained relatively straight. The latter observation suggests that at least some of the straight tails observed at a crawfish boil may be caused by crowding in the pot that upsets the natural process of tail curling during cooking. To verify the effects of crowding, live crawfish were intentionally crowded in a beaker of boiling water and boiled for 10 minutes. The results were several individuals displaying less-than-tightly curled abdomens. Therefore, this study suggests that the age-old adage of avoiding straight-tailed crawfish at a crawfish boil, as a means of ensuring safety and quality, may not be reliable and certainly has little to do with the living status of the animal at the time of cooking. ■

Figure 4. The average degree of curl as measured from live, dead and live-but-restrained crawfish at the time of boiling.



Department of Agricultural Chemistry helps keep food safe

From poultry feed to pesticides and from fertilizer to food, the Department of Agricultural Chemistry, which is a joint effort between the LSU AgCenter and the Louisiana Department of Agriculture and Forestry, provides analytical support for regulatory activities, research and agricultural extension work, according to Mark LeBlanc, director.

"We provide support for AgCenter research scientists and extension specialists by testing plant and animal tissues, soil, water, feeds, fertilizers, pesticides, agricultural chemicals and agricultural commodities," LeBlanc said. "We also will analyze these samples for the general public for a fee."

The department analyzes fertilizers, agricultural chemicals and other products regulated by LDAF. These include animal feeds, pet foods, fertilizers, pesticides and pesticide residues in agricultural products and environmental samples.

"It's the state's pesticide analysis lab," said Robert Beine, who retired as director on March 31, 2009.

The laboratory is home to the analytical division of the state Meat Inspection Office, which provides microbial analysis for the state's HACCP (Hazard Analysis at Critical Control Points) program as well as nutrient analyses of foods.

One component of LDAF testing is for feed adulterants such as fungal toxins as well as antibiotic residue in animal feed, Beine said. For example, in one instance feed with too much fungal toxin was killing horses.

"We try to be sure the consumer, the farmer, is fairly treated. If you feel you have a problem that relates to us – for example, a bad lot of feed – it's important that you call LDAF and let them investigate," Beine said.

Beine said LDAF agents will take official samples and maintain the chain of evidence.

Another service the lab provides is fertilizer testing for LDAF. During the fertilizer season, LDAF inspectors pull samples from fertilizer deliveries bound for farmers' fields and send the samples to the Baton Rouge lab to verify the analysis in the batch matches what the farmer is supposed to be buying.

LDAF inspectors also take samples of agricultural chemicals, termiticides and over-the-counter products, such as disinfectants, lawn-and-garden chemicals and rat poisons, to see that the products meet the analysis stated on the label. And the meat lab tests for safety in processed meats.

During Hurricane Katrina with the talk of "toxic soup," the Louisiana Department of Environmental Quality sent water samples from New Orleans for the lab to test for pesticides, "our specialty," Beine said. "We found almost nothing."

Besides serving the AgCenter and LDAF, the department provides testing for individual citizens, such as aflatoxin screening for farmers who want a second opinion from the one they get from a grain elevator.

"We can work beyond our standard list of services," LeBlanc said. "If scientists want something analyzed, the lab can work with them." ■ **Rick Bogren**

Kids learn, grow at

LOST camp steers 4-H youth to science

The LSU AgCenter Louisiana Outdoor Science and Technology (LOST) Camp is a 4-H program aimed at encouraging seventh and eighth grade students to consider careers in science and technology.

Kids are exposed to basic science concepts using forensic science, robotics, rocketry, video and other high-tech fields that grab young minds. LOST, in its second year in 2009, is held at Camp Grant Walker 4-H Educational Center near Pollock.

"We're trying to show them that science can be fun, and you can make a living at it," said David Boldt, LSU AgCenter 4-H youth development instructor.

The camp is divided into tracks, and these have been slightly different in the two years of the camp. Boldt said the 2010 LOST Camp will include a track on biofuels.

He said the United States lags many nations in college graduates who obtain degrees in science and engineering fields.

"Our camp is part of a national trend in 4-H to steer more kids into science and engineering as a career choice," Boldt said. "The aim is to help change that disturbing trend."

In addition, campers get a taste of outdoor skills, such as riflery, shotguns, archery and fishing. This year, the shooting sports were held on new ranges built at newly acquired property for the camp.

An additional benefit of the camp is the leadership skills developed by Junior 4-H leaders who help the campers, Boldt said.

The camp also is a way of filling a gap for middle-school students. Regular summer camp is aimed at 4-H Club members in grades 4-6. And 4-H University, another annual event held in mid-June, is for high school students.

The cost for LOST camp is only $110, and scholarships are available. Up to 300 youth can participate each year.

Randy LaBauve, an assistant specialist in the LSU AgCenter Communications office, taught the video course, but he said he benefited from the experience, also.

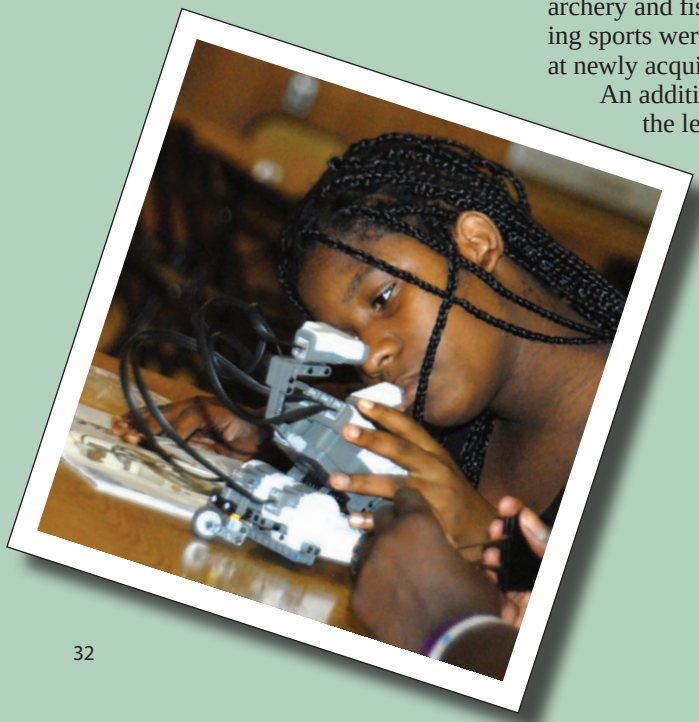
"Their excitement and creativity gave me new production ideas and energized me as well."

LaBauve said he was surprised with their creativity and their willingness to work.

"On several occasions, several counselors and I had to send the campers away after the class had ended for the day because they wanted to stay and keep editing video," he said.

LaBauve said he was impressed with their ability to learn how to operate new equipment and programs.

"They were excited to have the ability to use these tools to create a 1-2 minute video production that their team could be proud of. Six hours later, many of them were surprised and excited that they had accomplished this goal," LaBauve said. ■ **Bruce Schultz**



4-H summer camps

Camp goers immerse themselves in marsh

Zachary Cecil, a 4-H'er from Vernon Parish, rode on the side of a boat one morning during Marsh Maneuvers camp at Avery Island, La. It was his first time in the marsh, and he was enjoying the experience, even though he was soaking wet from wading in muddy marsh water.

"I could do this every day," he said. "We don't have this where I'm from."

On this July morning, the Marsh Maneuvers participants literally immersed themselves in their studies, wading in the muddy marsh, pulling from a thriving shoreline vegetation to be replanted on the barren banks of Vermilion Bay.

Brett Rogers, also from Vernon Parish, said the work was good exercise.

"I feel like I've been a week at basketball practice," he said. "Actually, it's pretty fun."

Markaye Russell, an LSU AgCenter 4-H agent from Ouachita Parish, said the grass planting was a workout.

"That's worse than the treadmill," Russell said.

It was her second time to attend Marsh Maneuvers. The program was held at Grand Isle her first time eight years ago.

Though 4-H'er Herbert Leavitt is from Avery Island, he said he was enjoying Marsh Maneuvers and found out there was a lot he didn't know about the marsh.

"We're learning a lot and doing new things," Leavitt said. "It's a cool experience."

Chad Hagan, an LSU AgCenter 4-H agent in Vernon Parish, brought eight boys from the parish 4-H clubs. He joined the group to pull grass and replant it.

"I never dreamed I'd do anything like I did today, especially with an alligator in the water," he said.

Hagan said the group went to a weir in the marsh one night and saw alligators. "There were probably 70 alligators. All the kids thought that was amazing," he said.

Mark Shirley, LSU AgCenter coastal resources agent, said the Louisiana Department of Natural Resources helps fund Marsh Maneuvers, which is a summer 4-H camping experience in its 19th year. The Louisiana Department of Wildlife and Fisheries also provides assistance with housing at Rockefeller Wildlife Refuge, and the McIlhenny Co. at Avery Island assists with boats and personnel, he said.

Shirley said the program teaches 4-H youth about the biology of the coastal environment, the life cycles of marine organisms, the commercial importance of alligators and seafood and conservation practices.

A total of 16 4-H'ers attend each of the four sessions each summer, and parishes are rotated so that a parish will be represented every four years. Participants are selected by 4-H agents.

"It's the first time for many of them to see the coast, hold crabs, see alligators and crawl in the marsh mud," Shirley said.

■ **Bruce Schultz**

Photo by B. Rogers Leonard

A New Pest of Louisiana Soybean

Paul P. Price III, Chris Carlton
and B. Rogers Leonard

During 2007, significant foliage loss and stem injury on soybean seedlings were observed in research trials and production fields within Franklin Parish. Plant injury was similar to that previously described for grasshoppers feeding on soybean plants. However, plants that retained some leaf tissue were infested with an insect displaying the characteristics of a snout-nosed weevil. Samples of this insect population were collected and processed for identification in the Louisiana State Arthropod Museum located in the LSU AgCenter Department of Entomology. The identity of this insect was confirmed to be the pea leaf weevil.

The occurrence of this insect is new to Louisiana, and it has not been described as a pest of Louisiana soybeans. This insect was detected again during 2008 in other soybean fields located in Franklin, Tensas and Catahoula parishes. The statewide distribution of this pest has not been surveyed; therefore, these observations describe the initial indication of a potential problem and are not indicative of an annual pest.

The pea leaf weevil adult is gray-brown in color and measures about 0.2 inch, with a short, blunt-shaped beak and three light-colored longitudinal stripes on the surface of the body behind the head. Pea leaf weevil adults were observed feeding on soybean seedlings in the early stages of plant development. In April-planted soybeans, infestations initially were detected on first-leaf-stage plants and persisted for nearly three weeks. Individual plants were infested with as many as 20 adults feeding on leaf tissue and stems.

The initial stages of injury appeared as semi-circular notches producing scalloped edges on leaflets and progressed to complete defoliation and eventual main-stem feeding. A significant loss in plants was observed in areas associated with the highest infestations.

In the research plots, seedling losses from feeding injury were sufficient to reduce final seed yields by 20-40 percent. In all instances, the infestations were observed in localized areas and did not cause plant injury across the entire field. The damage was consistently more severe in soybean fields adjacent to non-cropped areas.

Larvae are reported to feed on the nitrogen-fixing nodules on legume plant roots, but no larvae were detected in association with adults feeding on soybeans in Louisiana. In addition, soybeans that were planted during May were subjected to minor pea leaf weevil infestations (less than one insect per five plants) and were much lower compared with infestations on April-planted soybeans. This observation suggests only a single generation of pea leaf weevil was observed during both years in Louisiana.

In field trials evaluating the performance of insecticide-treated seed against insect pests of soybean seeds and seedlings, the insecticides imidacloprid (Gaucho), thiamethoxam (Cruiser) and clothianidin (Poncho, Nipsit) appeared to significantly reduce damage from the pea leaf weevil. Observations on foliar insecticide efficacy indicated the highest labeled rates of pyrethroids labeled on soybeans provided more than 90 percent control at five days after treatment. However, fields must be scouted immediately upon seedling emergence to detect infestations before significant injury and plant loss occur.

This exotic species from Europe was initially discovered in the state of Washington during 1942. It is now common on numerous legume hosts across the Pacific Northwest and California and most recently documented in Virginia and Florida. The insect is an established economic pest of peas.

The origin of pea leaf weevil populations found in Louisiana may have resulted from the importation of winter legume seed grown in the northwestern United States. These plants are used as an agricultural cover crop in fallow crop fields and in wildlife food plots in Louisiana. ■

Paul P. Price III, Research Associate/Graduate Assistant, Macon Ridge Research Station, Winnsboro, La.; Chris Carlton, Professor, Department of Entomology, LSU AgCenter, Baton Rouge, La.; B. Rogers Leonard, Professor and Jack Hamilton Regents Chair in Cotton Production, Macon Ridge Research Station, Winnsboro, La.

Influence of irrigation, row configuration and seeding rate on grain sorghum yield

(Continued from page 29)

pared with the single row for both irrigation treatments, averaging a 359-pound-per-acre increase.

Similar to the previous year, there was little yield response to seeding rate. The optimum nitrogen rate was 120 pounds per acre with irrigation and about 90 pounds per acre when sorghum was not irrigated, regardless of row configuration.

Averaged across the two-year trial, using twin rows rather than single rows increased yield 333 pounds (5.9 bushels) per acre – 5,712 pounds per acre compared with 5,379 pounds per acre. Optimum nitrogen and seeding rates were similar for both the twin-row and conventional single-row production systems. Both trials were planted in mid-May, the back side of the recommended planting window. Relatively low yields, especially in 2005, may have been due in part to the delayed planting.

Additional research is being conducted to further define seedbed management systems for enhancing profitability of grain sorghum. ■

Tarnished Plant Bugs in Cotton

(Continued from page 17)

nity to improve the existing recommendations for managing this insect pest.

This study was performed on transgenic Bollgard II cotton varieties at the Macon Ridge Research Station near Winnsboro, La., during 2007 and 2008. The organophosphate insecticide acephate (Orthene) and a nontreated control were examined in this trial. The insecticide was applied to cotton plants after the first week of budding and usually during weeks 3 through 5 of flowering. The insecticide was applied to the test areas when native tarnished plant bug infestations exceeded a mean of one nymph per row foot from buffer areas surrounding the test area. Each area was sampled for tarnished plant bug nymphs using a standard 3-foot-by-2.5-foot black shake sheet before treatment and 72 hours after treatment.

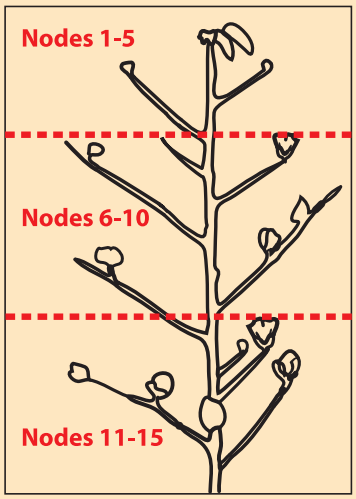
Within each plot, cotton plants were randomly selected and searched for the presence of 20 tarnished plant bug nymphs. Nymph size (large or small), fruiting form preference (bud, white-flower and boll) and vertical distribution (main-stem node) on cotton plants were recorded. Main-stem distribution was described by dividing or segregating fruiting and vegetative nodes into three vertical layers. The upper layer consisted of fruiting nodes 1 through 5, the middle layer consisted of fruiting nodes 6 through 10 and the lower layer consisted of nodes (fruiting and vegetative) 11 through 15.

The acephate treatment significantly reduced tarnished plant bug nymphs at 72 hours after treatment by approximately 64 percent from the pre-treatment sample. At 72 hours after treatment, more large nymphs were on treated fruiting forms than on fruiting forms in nontreated plots. This observation suggests the younger and smaller nymphs are more sensitive to the insecticides than the older nymphs. The majority of tarnished plant bug nymphs were observed on buds (78-93 percent) compared with white flowers (4-7 percent) and bolls (3-15 percent) pre-treatment and 72 hours after treatment, respectively, regardless of insecticide treatment.

The acephate treatment did not affect the preference for fruiting form type. The vertical distribution of nymphs within the upper levels (nodes 1-5) and middle levels (nodes 6-10) was not significantly different between the pre-treatment and 72-hours-after-treatment samples on nontreated plants. On insecticide-treated plants, significantly fewer nymphs were observed on fruiting structures in the top layer compared with the number recorded on fruiting structures within the middle level. Acephate did influence vertical distribution of tarnished plant bug nymphs at 72 hours after treatment because a greater number were detected lower in the plant profile on the treated plants.

These results support the use of a whole-plant sampling protocol such as the shake sheet for estimating tarnished plant bug infestations after insecticide treatment. This procedure is more likely to detect tarnished plant bugs throughout the entire plant profile. The most common sampling tool for this pest has been the sweep net, which only samples the upper few nodes of cotton plants. The sweep-net procedure likely underestimates infestation levels, especially after an insecticide application and may result in an incorrect assessment of product performance. This information should be used in conjunction with results from ongoing studies to further refine sampling protocols and action thresholds for tarnished plant bugs on reproductive-stage plants in cotton fields. ■

Figure 1. Distribution of tarnished plant bug nymphs on nontreated and acephate-treated cotton plants at 72 hours after treatment.



Nontreated
N = 20
(65% - Sm., 35% - Lrg.)

Fruiting Structure
82% on Squares
7% on Flowers
11% on Bolls

Mainstem Nodes
42% on Nodes 1 - 5
52% on Nodes 6 - 10
6% on Nodes 11 - 15

Acephate-treated
N = 20
(54% - Sm., 46% - Lrg.)

Fruiting Structure
78% on Squares
7% on Flowers
15% on Bolls

Mainstem Nodes
32% on Nodes 1 - 5
63% on Nodes 6 - 10
5% on Nodes 11 - 15

Photo by Mark Claesgens

Reproductive stages of cotton plants are susceptible to injury from tarnished plant bugs.

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