LOUISIANA AGRICULTURE

Assuring Our Future Through Scientific Research and Education

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LSU AgCenter Research & Extension

Research helps Louisiana's growing 'green' industry

2006 Awards Presented to Top Faculty, Staff

Six individuals and three teams won top honors during the LSU AgCenter's Annual Conference Dec. 18-19, 2006.

- *Doyle Chambers Research Award* – Lane Foil, professor, Department of Entomology.
- *Rogers Excellence in Research Award* – Donnie Miller, resident coordinator and weed scientist, Northeast Research Station, St. Joseph.
- *Excellence in Extension Award* – Johnny Saichuk, rice specialist stationed in Crowley.
- *Floyd S. Edmiston Award* – Claudette Reichel, housing specialist in the Department of Biological & Agricultural Engineering.
- *Denver T. and Ferne Loupe Extension Team Award* – Albert "Rusty" Gaude, fisheries and coastal issues agent based in Plaquemines Parish; Kevin Savoie, fisheries and coastal issues agent in Southwest Louisiana based in Lake Charles; and Mark Schexnayder, a fisheries and coastal issues agent based in Metairie, who also serves as the coordinator of the AgCenter's hurricane recovery efforts in that area.
- *Ganelle Bullock Staff Outstanding Service Award* – Tammy Heil, administrative program specialist for the Louisiana Agricultural Experiment Station.
- *Outstanding Service Award for Associates* – Franklin "Randy" Wright, research associate, Central Research Station, Baton Rouge.
- *4-H Service-Learning Award* – Angie Arnould, Jan Coussan and Charles Hebert, 4-H agents in Lafayette Parish.

Photo by Mark Claesgens

The *Tipton Team Research Award* went to the precision agriculture team, which includes, left to right, back row: Josh Temple, research associate, Northeast Research Station; Keith Morris, assistant professor, Biological & Agricultural Engineering; Ralph Bagwell, professor, Northeast Region; and Dennis Burns, research associate, Entomology. Middle row, left to right, Roger Leonard, professor, Macon Ridge Research Station; Maurice Wolcott, research associate, Plant Pathology; and Ken Paxton, professor, Agricultural Economics. Front row, left to right, Ernie Clawson, assistant professor, and Gene Burris, professor, both at the Northeast Station; Boyd Padgett, associate professor, Macon Ridge Station; Charles Overstreet, professor, Plant Pathology; and Roberto Barbosa, assistant professor, Biological & Agricultural Engineering. Not pictured is Randy Price, formerly with Biological & Agricultural Engineering.

LOUISIANA AGRICULTURE
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ON THE COVER:
Yan Chen, assistant professor at the Hammond Research Station, conducts research projects that benefit Louisiana's growing "green" industry. Studies under way at the station include weed and insect management in landscape beds.

What's New?

Two new forestry companies move to central Louisiana

More than 135 private landowners, loggers and forest industry leaders participated in the LSU AgCenter's Central Louisiana Forestry Forum on Jan. 30, 2007, to learn about the challenges still facing the industry more than a year after hurricanes Katrina and Rita.

The 2005 hurricanes caused extensive damage to the forest industry in the state – especially in the southeastern and western regions of Louisiana. The damage resulted from trees being blown down or broken off, as well as damage to the forest infrastructure, which is used to harvest and process the timber resources.

The good news, however, is that two new forest processing companies are moving into Central Louisiana – the MARTCO oriented strand board mill in Oakdale and the Jeld-Wen window and door frame mill at Dodson.

With new processing facilities locating in the area, "it is both challenging and exciting to be in forestry and growing trees," said C.A. "Buck" Vandersteen, executive director of the Louisiana Forestry Association. "It will be good for the forest landowner, forest industry and the economy of the state."

Normand Welsh, raw material manager for the MARTCO mill, said the facility was starting to produce oriented strand boards in late January.

"The mill will use pine timber purchased within 120 miles of the mill site," Welsh said, later discussing the modernization and expansion work in progress at the company's plywood mill located at Chopin.

Vandersteen also reminded the group about Jeld-Wen, a manufacturer of wooden door frames and window frames from sweet gum, being built at Dodson.

With new industries locating in the area, it will be a challenge for landowners to supply the trees to keep the industries profitable and sustainable, according to the experts.

"It is important to learn from the past and to alter practices to remain competitive in growing trees," said Barry Crain, LSU AgCenter forestry agent, "especially in controlling problems associated with weed species and forest insects."

To harvest damaged trees and repair damage caused by hurricanes, contract crews were hired from outside the hurricane-stricken areas to complete the work in a timely manner.

But that meant while completing the work in areas of the state infested with invasive species, like Cogon grass, the machinery at times became contaminated with the invasive grass and served as a means to spread the grass from infested areas to other areas of the state and country.

"Before the hurricanes, Cogon grass was found only in a few parishes in Southeast Louisiana," said LSU AgCenter weed scientist Dearl Sanders. "Now it has spread to other parishes like Vernon and probably to other states."

Cogon grass cannot be controlled by shading like most grasses in the forest – it grows densely in the shade, can shade out tree seedlings and will burn hot.

In another complication related to the hurricanes, experts said that insect problems were expected to be severe following tree damage during the hurricanes.

Experts had expected the Southern Pine Beetle to be a larger problem than it was, but the Ips and Black Turpentine beetles were the major problems.

The forest industry is the largest agricultural industry and the second largest manufacturing employer in Louisiana. In 2005, the industry contributed more than $4.5 billion to the state's economy, according to the LSU AgCenter's AgSummary. ■ **John Chaney**

Rice seed free of Liberty Link

An independent lab has determined that rice seed for sale this year by the LSU AgCenter's Rice Research Station is free of Liberty Link, according to Steve Linscombe, the station director.

"All seed stocks offered for sale have tested negative for all Liberty Link traits," said Linscombe, who is the LSU AgCenter's regional director for southwestern Louisiana, including the rice station.

The Liberty Link trait was developed to allow farmers to spray the Liberty herbicide to control weeds in genetically modified rice without killing the crop.

Liberty Link rice has not been offered for sale by its developer, Bayer CropScience. But small amounts of the trait were found in rice shipped to the European Union last year – upsetting the sale of U.S. rice to countries in the EU.

Sampling of the seed stocks was conducted by personnel from the Louisiana Department of Agriculture and Forestry, Linscombe said, and the analyses were conducted by a private, independent seed lab in Wisconsin certified to conduct such analyses.

Both the U.S. Department of Agriculture and the U.S. Food and Drug Administration have reviewed the scientific data and concluded there is no human health, food, safety or environmental concern associated with this genetically engineered rice. ■ **Bruce Schultz**

Rice farmers approve checkoff fee renewals

Louisiana rice producers have approved five-year renewals of checkoff fees on their crops to fund research and promotion.

Both measures passed with 85 percent voting in favor of the referendum and 15 percent opposed, the same margin of approval when the checkoff referendum was approved in the 2002 election, according to Steve Linscombe, director in the LSU AgCenter's Southwest Region. Voting by hand ballot was conducted in major rice-producing parishes across the state on Jan. 30. Mail-in ballots were used in parishes with fewer than 30 growers.

The result means that 5 cents on each 100 pounds of rice sold will be used to fund research for the Louisiana rice industry. In addition, producers will pay 3 cents on every hundredweight of rice to promote their product.

Rice farmer Jackie Loewer of Branch, acting chairman of the Louisiana Rice Research Board, said the vote is recognition by producers of the need for research.

"They understand that we have to invest in the future of our industry," Loewer said. "Without continuing research, rice farming in Louisiana would fade away." ■ **Bruce Schultz**

Speakers focus on ethanol at AgOutlook

With the 2007 farm bill on the horizon, speakers at the 2007 AgOutlook conference in Baton Rouge on Jan. 23, 2007, talked about issues the new bill may involve as it makes its way through Congress this year.

The AgOutlook conference had its genesis following the widespread drought in 2003 and has become an annual event sponsored by the LSU AgCenter, the Louisiana Farm Bureau and the Louisiana Department of Agriculture and Forestry.

Issues include the Conservation Reserve Program, payment limitations and extending the 2002 farm bill, said David Orden of the Department of Agricultural and Applied Economics at Virginia Tech University and a senior research fellow at the International Food Policy Research Institute.

"We have to remind ourselves that today's policy issues are not unique or new," Orden said. "Extending the 2002 farm bill could save money."

Orden pointed to ethanol as a fairly heavily subsidized industry, and those subsidies create what economists would call a "distorting policy." Ethanol could drive up commodity prices, he said.

"If we're going to be a major producer, we're going to need more feedstocks than corn for ethanol," said Jamey Cline, an ethanol plant feasibility consultant with BBI International.

Ethanol production is "a growth industry," said John Urbanchuk, director of LECG, a global expert services firm that provides independent expert testimony, original authoritative studies and strategic advisory services.

Calling the ethanol industry "one of the most interesting case studies in American industry," Urbanchuk said the benefits of ethanol production include renewability and its environmental benefits, improvements to farm income and reduced dependence on imported oil.

He also cited significant advantages to rural communities from ethanol plants. ■ **Rick Bogren**

Congressional proposal supports turtle farmers

Sen. Mary L. Landrieu, D-La., and Sen. David Vitter, R-La., have cosponsored a bill to permit the domestic sale of baby turtles in the United States.

The measure would be an economic boon for the turtle farming industry in Louisiana.

At the same time, each member of Louisiana's U.S. House delegation cosponsored the companion bill introduced by Rep. Rodney Alexander, R-La.

"For the first time in more than three decades, this legislation would allow domestic turtle sales, which will greatly help many of our struggling Louisiana farmers," Landrieu said in a press release.

"The FDA regulation prohibiting domestic sales unfairly discriminates against our farmers who can sell pet turtles without health risk. Despite technology that can nearly eradicate salmonella in turtles, the FDA has, to this point, refused to reconsider its position."

The bill requires that turtle farmers treat turtles for salmonella before sale. See related article on page 28. ■ **Rick Bogren**

Griffin receives national weed science research award

Photo by Mark Claesgens

Jim Griffin, Lee Mason LSU Alumni Association Professor in the School of Plant, Environmental and Soil Sciences, received the Weed Science Society of America Outstanding Research Award at the Society's annual meeting held in San Antonio, Texas, in February. The award is for scientists who have demonstrated originality and creativity and whose work has had an impact in the field of weed science. The award is established to recognize outstanding contributions to both applied and basic weed science research. Griffin's research emphasis has been directed toward weed-pathogen-herbicide and weed-insect interactions; herbicide drift and spray application technologies; reduced tillage weed management programs; development of diversified, sustainable and economical weed management strategies; and weed biology and interference. Research accomplishments represent collaborative efforts with plant pathologists, entomologists and agronomists as well as weed science colleagues. Much of the research represents thesis projects of the more than 30 graduate students whom Griffin has advised. Griffin currently holds a research, extension and administrative appointment with the LSU AgCenter and a teaching appointment with the College of Agriculture. ■ **Linda Foster Benedict**

Photo by John Wozniak

THE ECONOMIC FEASIBILITY of Ethanol Production from Sugar Crops

To help to improve cane quality, the immature tops of the plant should be removed. This piece of equipment has revolving discs with blades that cut and remove the immature tops.

Michael E. Salassi

Ethanol is a high-octane fuel used primarily as a gasoline additive and extender. Since the late 1970s, methyl tertiary butyl ether (MTBE) has replaced lead as the primary gasoline additive in the United States. Over the past few years, however, several states have banned the use of MTBE as a gasoline additive because of its environmental problems resulting in groundwater contamination. The reduction in use of MTBE and recent surging prices for petroleum-based fuels are dramatically increasing the demand for ethanol and the interest in ethanol production in the United States.

Michael E. Salassi, J. Nelson Fairbanks Endowed Professor, Department of Agricultural Economics & Agribusiness, LSU AgCenter, Baton Rouge, La.

Ethanol can be produced from carbohydrates such as sugar, starch and cellulose by fermentation using yeast or other organisms. Current production of ethanol around the world uses two primary feedstocks: grain crops (primarily corn and wheat) and sugar crops (sugarcane, sugar beets or molasses). A recently completed cooperative research project between the Louisiana Agricultural Experiment Station in the LSU AgCenter and the Office of Energy Policy and New Uses, Office of the Chief Economist, U.S. Department of Agriculture evaluated the economic feasibility of producing ethanol from sugar feedstocks in the United States. These sugar feedstocks included: sugarcane juice, sugar beet juice, sugarcane or sugar beet molasses, raw sugar and refined sugar.

Approximately 60 percent of world ethanol production uses sugar crops as the primary feedstock, with the remaining 40 percent using grain crops as the primary feedstock. The choice of feedstock used to produce ethanol is based primarily on the least-expensive feedstock crop available to ethanol producers in a particular country. The United States produced 3.9 billion gallons of ethanol in 2005, up from 3.4 billion gallons in 2004. Currently, corn is the dominant feedstock being used in the production process. Corn-based ethanol accounts for approximately 97 percent of the total ethanol produced in the United States. In 2005, Brazil, produced 4.2 billion gallons of ethanol, up from 4.0 billion gallons in 2004. Production of ethanol in Brazil uses sugar and molasses from sugarcane as primary feedstocks.

Production Process

Ethanol from corn in the United States is produced by one of two processes: wet milling or dry milling. In wet milling, corn grain is soaked to facilitate separation of the grain into its component parts, with the starch from the grain fermented into ethanol. In dry milling, the corn grain is first ground into flour and then mixed with water and enzymes for fermentation into ethanol. Ethanol conversion rates using corn as the feedstock are estimated at approximately 2.65 gallons of ethanol per bushel for a wet-mill process and 2.75 gallons per bushel for a dry-mill process. For the 2003-05 period, net feedstock costs for a wet-mill plant were estimated at about $0.40 per gallon with total ethanol production costs estimated at $1.03 per gallon. Net feedstock costs for a dry-mill plant were estimated at $0.53 per gallon with total ethanol production costs at $1.05 per gallon.

The majority of ethanol produced by other countries around the world uses sugar crops as the primary feedstocks. Sugarcane is the predominant feedstock in these countries, although several countries use sugar beets as the main ingredient in ethanol production. Since feedstock costs are a major cost item in producing ethanol, the relatively low market prices for sugar crops in many of these countries, compared to the United States, makes the production of ethanol from sugar crops economically feasible.

Louisiana and Florida are the major sugarcane-producing states in the United States, comprising about 80 percent to 90 percent of total production. Sugar beets are produced in several states, with the leading states of Minnesota, North Dakota, Michigan and Idaho accounting for about 80 percent of total U.S. production. Both crops are processed to produce a final product of white, refined sugar (sucrose). Sugar beets are processed directly into refined sugar, while sugarcane must first be processed into raw sugar and later refined into white sugar.

Ethanol from Sucrose

The theoretical yield of ethanol from sucrose is 163 gallons of ethanol per ton of sucrose. Factoring in maximum obtainable yield and realistic plant operations, the expected actual recovery would be about 141 gallons per ton of sucrose. Using 2003-05 U.S. average sugar recovery rates, one ton of sugarcane would be expected to yield 19.5 gallons of ethanol, and one ton of sugar beets would be expected to yield 24.8 gallons of ethanol. One ton of molasses, a byproduct of sugarcane and sugar beet processing, would yield about 69.4 gallons of ethanol. Using raw sugar as a feedstock, one ton would yield 135.4 gallons of ethanol, and refined sugar would yield 141 gallons.

Sugarcane and sugar beet feedstock and processing costs were estimated for the 2003-05 period for the purpose of estimating the cost of producing ethanol using these feedstocks. The cost of converting sugarcane into ethanol was estimated to be approximately $2.40 per gallon based on 2003-04 sugarcane market prices and estimated sugarcane processing costs. Feedstock cost was estimated at $1.48 per gallon of ethanol produced, representing 62 percent of the total ethanol production cost. The cost of converting sugar beets into ethanol was estimated to be approximately $2.35 per gallon based on 2003-04 sugar beet market prices and estimated sugar beet processing costs. Feedstock cost was estimated at $1.58 per gallon of ethanol produced, representing 67 percent of the total ethanol production cost.

Molasses, from either sugarcane or sugar beets, was found to be the most cost-competitive feedstock. Estimated ethanol production costs using molasses were approximately $1.27 per gallon with a $0.91 per gallon feedstock cost. Given the market prices of raw cane sugar and wholesale refined beet sugar in the United States, raw or refined sugar would be costly to convert into ethanol.

Estimated ethanol product variable production costs (dollars per gallon).

Cost Item	U.S. Corn wet milling	U.S. Corn dry milling	U.S. Sugar cane	U.S. Sugar beets	U.S. Molasses	U.S. Raw sugar	U.S. Refined sugar
Feedstock costs	0.40	0.53	1.48	1.58	0.91	3.12	3.61
Processing costs	0.63	0.52	0.92	0.77	0.36	0.36	0.36
Total cost	1.03	1.05	2.40	2.35	1.27	3.48	3.97

Leading ethanol-producing countries, 2005.

Country	Million gallons per year	Percent
Brazil	4,227	35.8
United States	3,904	33.1
China	1,004	8.5
India	449	3.8
France	240	2.0
Russia	198	1.7
South Africa	114	1.0
United Kingdom	103	0.9
Saudi Arabia	93	0.8
Spain	92	0.8
Others	1,366	11.6
Total	11,790	100.0

Ethanol production costs were estimated at $3.48 per gallon using raw sugar as a feedstock and were estimated at $3.97 per gallon using refined sugar. Feedstock costs using raw or refined sugar accounted for more than 80 percent of the total estimated ethanol production cost.

Potential for Sugarcane

Results from this study have several important implications concerning the production of ethanol from sugar crops in the United States, in general, and from sugarcane in Louisiana, in particular.

First, under existing fermentation technology, corn is currently the cheapest feedstock available for use in the production of ethanol in the United States. If other feedstocks are being considered, their costs must be comparable to corn for them to be economically viable over the long run. The use of molasses, from either sugarcane or sugar beets, does appear to be economically competitive with corn for use as an ethanol feedstock.

Second, given current and future projected sugar and ethanol market prices, it appears that the production of sugar is the most profitable use of sugarcane or sugar beets. With relatively high ethanol prices, several feedstocks may be profitable to use in making ethanol. However, decreases in ethanol prices, which are anticipated over the next several months, dictate that the least-expensive feedstock available be used in ethanol production to be economically viable.

Third, cellulosic conversion of biomass into ethanol offers the potential for a wide variety of feedstocks to be used in ethanol production. A great deal of research is currently being conducted across the country to develop a commercial process of converting biomass into ethanol. Sugarcane, a crop which produces a substantial amount of biomass per acre, would certainly be a viable feedstock candidate in this process. ■

Audubon Sugar Institute

Helps Meet Demand for Biofuels Research

Peter Rein

A sugarcane-based biorefinery has been discussed for many years at the Audubon Sugar Institute. In the past few years funding has become available and work has started in earnest.

A sugar mill is in a sense already a biorefinery, producing sugar and molasses as products and generating bagasse used as a fuel in boilers. The true concept of a biorefinery, however, envisages producing from sugarcane biomass a slate of products – particularly fuels and chemicals – which together provide a much-increased revenue stream. This changes a sugar mill into a sugarcane processing plant.

While in most instances cane leaves and tops (also called cane leaf matter or CLM) represent a disposal problem, they are a potential source of fiber and fermentable materials. The extraneous matter left in the fields keeps the temperature of the soil down, delaying germination of the next year's crop and reducing cane yields. The common practice is to burn this material in the fields or rake it away from the sugarcane roots. In a biorefinery, however, the leaves and tops have value. Combining the CLM with the cane can virtually double the amount of bagasse produced.

Lignocellulosic Alternative

The use of lignocellulosic material (the essential part of plants' woody cell walls consisting of cellulose and lignin) is an excellent alternative to fossil fuels because it is an abundant, renewable resource that does not generate additional carbon dioxide in the Earth's atmosphere. In addition, innovative expansion in the field of biofuel production would spur substantial job creation and stimulate the economy.

Using sugarcane to produce liquid fuels and electric power can yield considerable benefits, including:

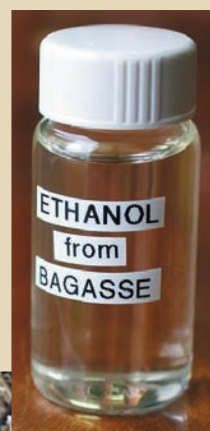
- No net increase in the generation of greenhouse gases.
- Use of renewable resources for energy production.
- Reduction in the nation's reliance on imported fuels.
- Incentive to expand agricultural production in Louisiana.
- Elimination of burning of CLM.

Because the sugarcane industry is a major contributor to Louisiana's rural economy, the effect of a new, vibrant production sector would have considerable effect because it also affects the supporting industries of equipment and process plant suppliers and providers of other goods and services. An increase of just 10 percent in cane production would enhance the state's economy by an estimated $100 million more a year.

Energy Department Funding

More than $4 million in grants from the U.S. Department of Energy over the past three years has enabled Audubon to mount a serious research effort. These grants have been in collaboration with MBI International, a nonprofit spin-off of Michigan State University. Ethanol can be produced from sugarcane biomass in two ways, which are both being investigated at Audubon:

1. The fibrous bagasse can undergo hydrolysis (the chemical reaction in which one substance reacts with water to produce other compounds) to produce sugars that can be fermented to produce ethanol. Maximum value from bagasse can in theory be obtained



Photos by John Wozniak

This small vial of pure ethanol was created from bagasse in experiments at the LSU AgCenter's Audubon Sugar Institute.

Peter Rein, Professor, Audubon Sugar Institute, St. Gabriel, La.

Photo by Benito Stradi

Chang-Ho Chung, a post-doctoral researcher at the Audubon Sugar Institute, with the hydrolysis reactor. Enzymatic hydrolysis followed by fermentation is being pursued in the development of ethanol from sugarcane bagasse. A process is being used in a small-scale pilot system to produce sufficient amounts of treated bagasse to conduct pilot-scale hydrolysis/fermentation experiments. The treated bagasse is enzymatically hydrolyzed and the sugars fermented to alcohol.

by separating bagasse into its three major components – cellulose, lignin and hemicellulose. Cellulose and hemicellulose are hydrolyzed, but lignin is not hydrolyzed and may be the source of other value-added products

2. Biomass can be subjected to thermochemical treatment, which subjects it to high-temperature pyrolysis (the use of heat to break down complex chemical substances into simpler substances), or gasification, which turns it into a gas. Pyrolysis produces bio-oils, and gasification produces a synthesis gas that can be converted to liquid fuel.

Many claims have been made of how value-added products can be produced from sugarcane biomass. Apart from the production of paper from bagasse and generation of electricity using bagasse as a fuel in boilers, few of these are economically viable. The challenge is to find those processes, which, when incorporated into a biorefinery, will lead to products that justify the capital investment. It is anticipated that the capital required could be large, and economies of scale obtained through high-volume processing would be needed.

Many different schemes have been devised in the laboratory. The approach at Audubon has been to move from the laboratory to pilot-plant scale. This enables us to obtain data that can be used to generate design data, bringing commercial realization one step closer. Active research and recent technological improvements are likely to make commercialization possible.

Thus far, major efforts have been directed toward treating bagasse and CLM, recovering of phenols from the lignin fraction of the biomass, optimizing the enzymatic hydrolysis for different treatments and addressing the challenges of fermenting both glucose and pentose sugars into ethanol and other products. Additional work has been done on producing more cellobiose (a type of sugar that is produced from the partial hydrolysis of cellulose) for the production of added-value chemicals. Gasification research is at an early stage, but progress will be boosted with additional research help.

A smaller program for producing biodiesel in a modified process using bio-ethanol rather than methanol is also under way.

What the Future Holds

A raw sugar mill already has the infrastructure in place for collecting and processing sugarcane biomass. This is a major advantage over other lignocellulosic processing options using corn stover or forest wastes. Selected add-on options, depending on the economics of individual processes, provide the route for converting a sugar mill into a biorefinery.

The economics of a biorefinery are likely to be improved by economies of scale. For instance, combining surplus bagasse and CLM from four mills in the Teche area of Louisiana can supply a plant that can process 2,000 tons of biomass dry matter per day. Augmented with molasses, this will result in a plant capable of producing about 70 million gallons of ethanol per year – a viable size for an ethanol plant. At the present average crop size of 14 million tons of sugarcane per year, the potential for ethanol production from bagasse and CLM in Louisiana is about 250 million gallons per year. This is after allowing for the use of some of the bagasse in the boilers for the generation of steam and power.

Assuming that production of ethanol from biomass becomes a commercial reality, the biorefinery potential can be greatly enhanced by processing high-biomass cane or "energy cane." Such cane bred for biomass rather than sucrose yield can substantially improve biorefinery output. Further augmentation with sweet sorghum and perhaps the perennial grass miscanthus could make the biorefinery even more attractive and enhance the agricultural opportunities in Louisiana.

Making a sugarcane biorefinery a reality is still a few years away. But the potential rewards to Louisiana and the nation are tremendous. ■

Smart Bodies

An Educational Campaign To Make Louisiana Children More Active, Healthier

Denise M. Holston, Michael T. Zanovec and Ellen P. Murphy

Obesity is a growing health care problem in Louisiana and carries with it significant costs, both in dollars and quality of life. Nationwide, Louisiana ranks fourth in adult obesity rates at 27 percent.

Childhood obesity rates (6-11 years of age) also are on the increase nationwide. Very little published data on the childhood obesity rates in Louisiana exist. According to an unpublished study in New Orleans, data from four schools suggested that the percentage of children with body mass index (BMI) above the 95th percentile, indicating overweight, averaged 31 percent and was as high as 41 percent among 6-year-olds.

Studies have shown that being overweight or obese can affect school performance. For example, in one study overweight children had significantly lower math and reading test scores at the beginning of the school year than did their healthy-weight peers. These differences persisted into first grade.

In response to the epidemic increase in childhood obesity, the LSU AgCenter, in partnership with Blue Cross and Blue Shield of Louisiana Foundation, launched Smart Bodies in March 2005. Smart Bodies is a comprehensive nutrition education and physical activity program for elementary school children, kindergarten through fifth grade, which is integrated into core curriculum objectives. The program incorporates classroom activities with hands-on learning to teach children how to build strong bodies and active minds. Smart Bodies consists of three components: Body Walk, OrganWise Guys and Take 10!

The goal of Smart Bodies is to reach 50 elementary schools each year for five years (2005-2009). In 2005, 64 elementary schools and 25 public events in 26 parishes received the Body Walk, and 56 elementary schools received the entire Smart Bodies program. During this time, 31,348 children experienced the Body Walk.

Denise M. Holston, Program Coordinator; Michael T. Zanovec, Research Associate; and Ellen P. Murphy, Associate Director, School of Human Ecology, LSU AgCenter, Baton Rouge, La.

In 2006, the numbers were 101 elementary schools in 32 parishes implementing the Smart Bodies program. By the end of 2006, there were 37,000 children who had experienced the Body Walk. The total number of children for 2005 and 2006 reached with the program was 68,348.

School Recruitment

Local AgCenter extension agents recruit schools for the program and then conduct teacher trainings in the schools selected. Once the teachers have been trained, a school assembly is used to kick off the program and build excitement and enthusiasm. Following the assembly, teachers begin using the Take 10! and OrganWise Guys curricular materials in the classrooms. At some point during the program, the Body Walk

Photo by Mark Claesgens

These kindergarteners at the LSU Laboratory School participated in the Body Walk when it was at their school on Feb. 2, 2007. Left to right, Cole Kirkpatrick, Katherine Bankhead, Karlie Williams, Emma Thompson and Fielding Woolf, holding the plastic mouth.

Photo by Mark Claesgens

John Albarado, in the door window, takes care of the setup and takedown of the Body Walk exhibit. Left to right are Albarado, Ellen Murphy, Denise Holston and Michael Zanovec.

exhibit is taken to the school and set up by volunteers either in the gymnasium or cafeteria. After the Body Walk leaves, teachers continue to implement the program in the classroom. Smart Bodies newsletters are sent home to parents to emphasize physical activity and healthy eating.

Because of the popularity of the program, there is a waiting list of schools who want to implement the program. The LSU AgCenter is hopeful new moneys will allow the program to continue beyond 2009.

Adding to the incentive to implement the program is a new federal mandate, effective in 2006, that requires school to have a wellness policy to receive federal funds. In addition, the Louisiana Legislature passed a law (Act No. 734) that requires children in grades K-6 to get at least 30 minutes of moderate to vigorous physical activity daily. The Take 10! has been a selling point because it provides the opportunity for students to be physically active during the school day without taking away from their academic learning time.

$1.8 Million Grant

The Blue Cross and Blue Shield Foundation provides the greatest share of funding for this program with a $1.8 million grant. In addition, the Pennington Family Foundation has donated $25,000, Wellness Inc. has paid for 35 Healthy School Kits worth $40,000, and the LSU AgCenter's Family Nutrition Program (FNP) provided 50 kits in 2005 worth about $64,000.

Although each of the three components of Smart Bodies has been tested and evaluated separately in other states, the effectiveness of the three components together had not been tested. Therefore, included in the five-year grant is a two-year investigation of the Smart Bodies program. The purpose of the research project is to evaluate the effectiveness of Smart Bodies in promoting child wellness and preventing childhood obesity.

The primary objectives of the Smart Bodies program are to increase students' knowledge and consumption of fruits and vegetables, to increase students' knowledge and willingness to participate in physical activity, and to decrease the number of students in the at-risk of overweight or overweight categories.

smart bodies

A Louisiana youth program for healthy bodies and active minds

Smart Bodies consists of three components: Body Walk, OrganWise Guys and Take 10!

BODY WALK

This is a 35-foot by 45-foot, colorful, walk-through exhibit representing the human body. Students explore nine organs of the body and participate in activities at 11 stations to learn the effects that different foods have on each organ. Students also receive a take-home activity book to share with their families.

THE ORGANWISE GUYS®

These 10 characters help children understand physiology and healthy behaviors. Hardy Heart, Madame Muscle, Windy the Lungs, Peri Stolic the Intestines, Sir Rebrum the Brain, Peter Pancreas, Pepto the Stomach, the Kidney Brothers, Luigi Liver and Calci M. Bone are manifested as cartoons in books, games and videos and as dolls used in nutrition lessons. Participating schools receive a free kit with eight videos, dolls, books, games and puzzles.

TAKE 10!™

This classroom program is a grade-specific educational tool that encourages short bouts of physical activity integrated into academic learning objectives. Activities provided in all curricular materials are linked to the grade-level expectations of the Louisiana Department of Education.

Photos by Mark Claesgens

Nikki Schafer, former Body Walk manager, leads an activity at the lung station while the exhibit was used at Cedarcrest-Southmoor Elementary School in Baton Rouge.

Research Shows Change

To assess program impact, researchers conducted studies at 18 schools, nine that received Smart Bodies and nine that did not. Additionally, a sub sample of 86 students from four of the schools in the study wore activity monitors on their wrists for seven days before and after the program. These monitors quantify any change in motion or acceleration in all directions. The monitors are waterproof so the students wore them all day, even during showering and sleep.

Heights and weights were measured, and Body Mass Index health reports were generated and given to the school principals and also mailed home to parents. Analysis of the research data indicated that:

■ Students who participated in Smart Bodies were twice as willing to taste fruits and vegetables served at school when compared to students that did not experience the program.

■ Students who participated in Smart Bodies increased their knowledge of the benefits of physical activity twice as much as students who did not participate in the program.

■ Students were significantly more active during a Take 10! activity than during other times in the day.

■ Body Mass Index health reports were effective in increasing both school and parent awareness of children's weight status.

The results of the research project suggest that, when implemented correctly, Smart Bodies is effective in teaching children about the importance of taking care of their bodies. If children learn how to adopt a healthy lifestyle, they will be less likely to experience the consequences associated with obesity later in life. ■

Inside the Body Walk at Cedarcrest-Southmoor Elementary School in Baton Rouge on Feb. 22, 2005.

Comprehensive, Coordinated Animal Identification

A Must for Food Safety, National Security

Christine B. Navarre and David Sanson

Photo by John Chaney

The small yellow tag in the animal's left ear, above the green tag, is an electronic animal identification tag.

Individual livestock producers have been using animal identification for decades. But not until recently has the need for a more comprehensive, coordinated national animal identification and tracking system been recognized. The ability to rapidly track livestock movements is essential to minimizing the effects of a highly contagious animal disease outbreak such as foot-and-mouth disease. Currently, this is not possible. It took months, for example, to track all the animal movements and contacts of a limited number of bovine spongiform encephalopathy (BSE, often called mad cow disease) cases, and in some instances that tracking was incomplete. BSE is not a contagious disease, so rapid tracking was not critical. We do not have the luxury of time with highly contagious diseases.

In response to the need for rapid tracking of livestock and poultry movements, the U.S. Department of Agriculture (USDA) has designed the National Animal Identification System (NAIS). The goal of the NAIS, which has been proposed as a completely voluntary program, is to be able to identify within 48 hours of a confirmed outbreak the animals exposed to a contagious disease and where they have traveled.

The three parts to the NAIS are premise identification, animal identification and animal tracking. Premise and animal identification have to occur before animal tracking. It's important to note that the premise identification information is held confidentially by each state. Private databases will hold individual animal identification numbers and animal tracking data. Only in the event of an animal health emergency or disease outbreak will state or federal veterinarians be able to have access to this information. They will not have access to other information such as performance data. The IRS and other government agencies do not have access to this data. Because of much misinformation about the NAIS, producers are urged to learn all they can about the system.

The NAIS cattle working groups, after careful consideration of many factors, decided that electronic identification with radio frequency identification (RFID) tags was the best method of identifying cattle. RFID is a method of identification not very different from using a numbered ear tag for cattle, a serial number for a piece of equipment or a VIN number for a car. The real difference

Christine B. Navarre, Associate Professor, Department of Veterinary Science, LSU AgCenter, Baton Rouge, La., and David Sanson, Associate Professor, Dean Lee Research Station, Alexandria, La.

between RFID and most other methods of identification is that RFID is capable of interacting wirelessly with a computer or other electronic data manager. This technology has been adapted by several ear tag manufacturers, resulting in several types of ear tags that contain RFID technology. These ear tags offer the ability to transmit an animal's identification information to a computer.

The technology for RFID has been around for years. Many things involve some form of wireless communication – radio, television and cell phones, for example.

An RFID ear tag contains a small electronic chip and a long, coiled, copper wire that serves as the antenna for transmitting and receiving information. These two components are encased in a plastic tag that fits into an animal's ear. An important aspect of the RFID system is the length of the antenna; the longer the antenna, the greater the distance the information can be transmitted. The RFID component of most of the RFID ear tags on the market is a thin disc. This allows for maximum antenna length for a given size.

The easiest way to explain the way an RFID ear tag works is to think of it as a radio. A radio requires a transmitter to code the information and send it into the airwaves. A receiver decodes the information and sends it to a speaker that produces the sound we hear. An RFID operates much like a two-way radio – the ear tag and the reader both serve as transmitters and receivers.

When an RFID reader is activated, it sends a signal to an RFID ear tag within signal range. The ear tag will pick up the signal that tells the tag to send out its information. At this point, the ear tag becomes the transmitter, and the reader becomes the receiver and records the information sent by the tag.

Photo by John Chaney

David Sanson uses an electronic frequency reader to identify a steer that has an electronic ear tag. The tags can be used in conjunction with computers to help producers track a variety of information about each animal.

Most RFID ear tags on the market are passive tags that do not accept data from the reader and do not have a built-in energy source. The energy to power a passive tag comes from the energy contained in the radio waves sent from the reader. A few ear tags on the market will accept information from the reader and store it in the chip, but these are more expensive.

The information a passive tag sends to the reader is a 15-digit number. The first three digits represent the country of origin of the animal, and the remaining 12 digits represent a unique sequence that identifies the animal much like a Social Security number. Each country will have a different 3-digit number. The number for the United States is 840. Although current tags do not begin with 840, this will become the standard in the near future.

The only difference between an RFID ear tag and a conventional ear tag is that one can transfer its information electronically while the other one requires visual reading. It is important to understand that the benefit of an RFID is finished once the information gets from the tag to the reader. What the user does with the information at that point is almost unlimited. The reader may display the number or send the number to a computer or some other type of data management device.

The LSU AgCenter's Rosepine Research Station has incorporated RFID technology into its data collection system. For example, tags are read as animals move onto the scale, and the identification number is sent to a computer along with the animals' weight and date. This system can provide any additional information about the animal that is stored on the computer.

The USDA specifications for private databases to be compliant with NAIS are now available, and companies are beginning to offer producers software that provides a wide variety of benefits. Some of this software combines animal health programs with age and source verification to provide health guarantees and herd production and financial data analysis. Not only are these programs NAIS-compliant, which helps protect the industry from the devastating effects of an animal disease outbreak, they also provide producers with additional opportunities to manage and market their cattle. ■

David Lanclos, second from left, is among this group checking for signs of Asian soybean rust. Lanclos is the state extension soybean specialist.

Photo by Mark Claesgens

Living With…Learning About…Keeping at Bay...

Asian Soybean Rust

Clayton A. Hollier, G. Boyd Padgett and Raymond W. Schneider

Asian soybean rust (ASR) was first detected in Louisiana at the LSU AgCenter's Ben Hur Research Farm near Baton Rouge by Raymond Schneider, professor in the Department of Plant Pathology & Crop Physiology, on Nov. 6, 2004. This discovery was not only the first sighting of ASR in Louisiana but also the first report in North America. Confirmed on Nov. 10, ASR became the chief concern of the U.S. soybean industry.

Before the discovery of ASR in the United States, the yield losses associated with this disease in many parts of the world were devastating. In Africa, yield and quality losses ranged from 10 percent to 100 percent. In South America, especially in Brazil, losses ranged from 10 percent to 80 percent. U.S. farmers feared their losses could match these because of similar environmental conditions in the United States.

Because of the introduction of ASR into the United States, funding was made available to the soybean-producing states for a network of ASR sentinel plots that would serve as an early-warning system for the presence of the disease. The LSU AgCenter's commitment to the system was to plant and monitor weekly 15 soybean sentinel plots strategically located in the state to detect the earliest occurrence of the disease introduced by short- and long-range spore showers. Sentinel plots are planted two to three weeks earlier than plantings in commercial fields.

Clayton A. Hollier, Professor, Department of Plant Pathology & Crop Physiology; G. Boyd Padgett, Associate Professor, Macon Ridge Research Station, Winnsboro, La.; and Raymond W. Schneider, Professor, Department of Plant Pathology & Crop Physiology, LSU AgCenter, Baton Rouge, La.

Planning for the detection of ASR through the sentinel plot system triggered many questions about the fungal pathogen, *Phakopsora pachyrhizi*, which causes the disease. Asian soybean rust epidemiology had not been studied in the Louisiana environment. Epidemiological studies include the source of the initial inoculum, the possibility of over-wintering on kudzu and other plant species, the quantity and viability of spores arriving from out of state, the impact of UV light on spores transported over long distances in the upper atmosphere, and, once established, the spread of the fungus and development of the disease on a local and regional basis. Yield loss studies were initiated. In addition, cultural, genetic and chemical disease management measures were developed to help manage the disease.

2005 Season

Sentinel plots were established for the first time in March 2005. Fifteen soybean plots were grown from Caddo Parish in the north to Plaquemines Parish in the south. The plots were planted in the major soybean growing parishes and in areas such as Plaquemines Parish to make sure there was a host for inoculum blown across the Gulf of Mexico. Although ASR was not found in sentinel plots during the 2005 growing season, it was discovered in October at the Ben Hur Farm and in a kudzu patch within the city of Amite in Tangipahoa Parish. The kudzu find was the first ASR found on that plant in Louisiana. No other ASR findings were reported during the year.

The winter of 2004-2005 produced freezing temperatures southward to the Gulf Coast. This may have killed any major hosts of *P. pachyrhizi*, thus reducing the chance of pathogen survival in Louisiana. Without local over-wintering, inoculum would have to be introduced from outside sources to re-establish the disease in the state. The major source of spores during the 2005 season was believed to be the southeastern United States. Inoculum survived in southern Florida on kudzu and spread to the northern Florida counties during the late spring and early summer of that year. Continual spread was noted in southern counties of Georgia and Alabama, in particular, with two sightings in southern Mississippi counties. Usually, only tropical storms bring winds from the southeast to Louisiana. Therefore, there was only a minimal likelihood of the southeast United States being a major source of inoculum for Louisiana.

In addition to the hypothesized need to re-establish the disease in Louisiana by long-distance spore showers, an extended summer drought prevented the development of the disease until late in the crop's development. The delay in disease development was attributed to lack of rain, low relative humidity and high summer temperatures during the growing season.

2006 Season

The end of the 2005 soybean growing season saw the establishment of ASR in extreme southern Texas and in three states in northern Mexico. Having inoculum sources in these areas changed the dynamic of ASR for Louisiana. Historically, prevailing winds come from a southwesterly direction into Louisiana. The establishment of an inoculum source in that direction increased the likelihood of occurrence of ASR in Louisiana in 2006. Conducive winter temperatures also increased the likelihood.

In 2006, ASR was first detected on June 30 on kudzu in Lafayette Parish. The find so early in the season coupled with a mild winter led scientists to speculate *P. pachyrhizi* may have over-wintered in the state. Later finds were on soybeans in Rapides Parish in late July. Since that time ASR was reported in 26 parishes. Incidence and severity levels have varied from trace amounts to defoliation of lower to mid-plant leaves.

Scouting efforts through the sentinel plot system and the use of Rust Tracker passive spore traps provided early warning of ASR to soybean growers. Two Rust Tracker spore traps were placed at the Northeast and Macon Ridge stations in 2005. Spores were detected at the Northeast Station, but no rust developed. In 2006, four traps were monitored (Northeast and Macon Ridge stations, Madison and Catahoula parishes). Spores were found at the Northeast Station and Madison Parish, but not at the other two locations.

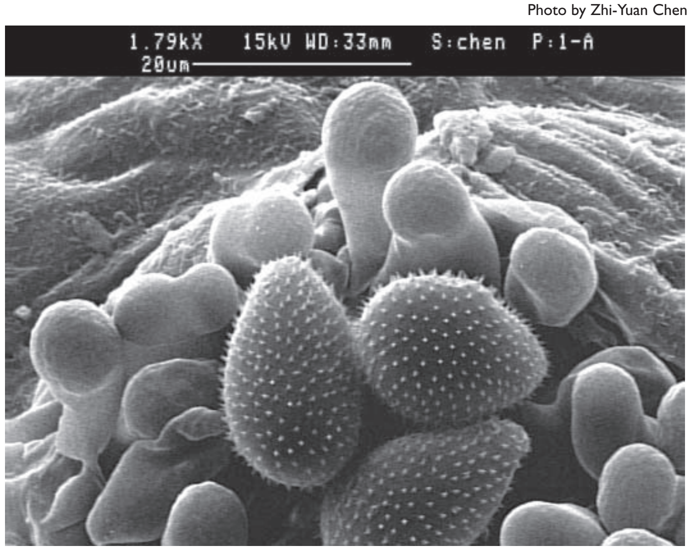
Research

LSU AgCenter scientists have initiated research directed toward answering questions about pathogen dissemination, disease establishment, epidemic progress and disease management. Numerous fungicide tests have been conducted on LSU AgCenter research stations and in producer fields. In 2005 and 2006, AgCenter scientists conducted 51 trials. Tests were designed to evaluate efficacy on ASR as well as other late-season diseases common to Louisiana.

In 2005, ASR developed after the conclusion of the season, and limited rust data were collected. Valuable information was gained regarding efficacy of these fungicides against Cercospora leaf blight and frogeye leaf spot, however. In addition, collaborative projects were initiated with scientists in Florida to accelerate the research process.

In 2006, ASR was present in a limited number of tests. Rust epidemics occurred at the Central, Dean Lee and Northeast research stations and in producer tests in Jefferson Davis Parish. All together, it occurred in 26 parishes. Data from these tests will be analyzed and used to develop cost-effective disease management programs. This research will be continued and expanded. ■

Photo by Zhi-Yuan Chen



Scanning Electron Microscopy (SEM) image of a uredium (pustule) and urediospores of *Phakopsora pachyrhizi*, which is the cause of Asian soybean rust.

Acknowledgment

Louisiana Soybean and Grain Research and Promotion Board, USDA Animal Plant Health Inspection Service (APHIS), CSREES, the North Central Soybean Research Program and numerous AgCenter faculty and pest management consultants for their help in monitoring.

Researchers try to keep soybeans safe from rust disease

The colder the weather in winter, the better Louisiana soybean farmers like it. That's because freezing temperatures kill kudzu, a noxious plant that among its many faults harbors the fungus that causes a dreaded disease called Asian soybean rust.

This globe-trotting disease, new to North America since 2004, has emerged as the major threat to the soybean industry not only in Louisiana but worldwide because it spreads quickly and is difficult to control.

Getting rid of kudzu as an over-the-winter host won't make Asian soybean rust go away, but it helps hold it at bay.

"Asian soybean rust is here to stay," said Clayton Hollier, LSU AgCenter plant pathologist. "We're learning the factors that promote and inhibit its development. That's a major research and extension focus for the AgCenter."

In 2006, the first discovery of Asian soybean rust in Louisiana was on kudzu. Agricultural consultant Blaine Viator of Plattenville found the disease in a shaded kudzu patch just south of Lafayette on June 30.

Viator is one of a team of consultants, farmers and AgCenter agents and scientists who systematically scout designated areas of the state for the disease.

But even when the rust spread to soybeans later in the season, it had little effect on yields in Louisiana.

"We were lucky in 2006," said David Lanclos, LSU AgCenter soybean specialist based at the Dean Lee Research Station in Alexandria. "Conditions in the spring were too dry for the disease to take hold."

Asian soybean rust likes warm, humid conditions — not too dry or hot, said Ray Schneider, LSU AgCenter plant pathologist and the one who found the disease for the first time in North America in a soybean production field at the LSU AgCenter's research farm near Baton Rouge.

By the end of July 2006, however, the drought was over. And the disease was found for the first time on soybeans on July 26 in a sentinel plot at the Dean Lee Station.

"Rainfall accelerates the disease," Schneider said. "It came late but it hit like a hammer. I've never seen anything like it."

LSU AgCenter scientists had planted 15 sentinel plots early in the season in strategic areas to catch the disease first.

Fortunately, most of Louisiana's soybean plants were mature and pods were set before they caught the disease. Eventually, the disease was found in 26 parishes in 2006, which is most of the soybean production area in the state.

"The only area where there was a threat was Southwest Louisiana, where the soybeans had been planted late because of unfavorable conditions," Lanclos said.

The solution was immediate treatment with fungicides. LSU AgCenter specialists worked with farmers on when, where and what to spray.

"There's a very narrow window for applying fungicides for maximum benefit," Schneider said.

For 2007, the strategy is again scouting, planting sentinel plots and continuing with research to help learn more about controlling the disease and develop varieties resistant to the disease.

"One strategy that growers will try to use this year is planting earlier-maturing beans. I applaud this effort but always caution that proper planting date is still extremely important in maximizing yields," Lanclos said.

In 2006, the disease spread as far north as southern Illinois. But because of good scouting and timely fungicide application, the effect on yields was negligible. In fact, soybean yields set a new record of 35 bushels per acre on average nationwide in 2006.

The impact on yield was minimal in 2005, where the disease was confined to the Southeastern United States. Effects were negligible in Louisiana with weather hot and dry much of the 2005 growing season.

Research projects under way at the LSU AgCenter to help keep Louisiana soybeans safe from Asian soybean rust include:

- Testing the various fungicides with different maturity groups of soybeans.
- Determining the effectiveness of spore traps. These traps catch the wind, and if any spores are aloft, they get caught on the petroleum jelly on a slide inside the foot-long tube-like device.

The only hope for eventual elimination of the disease is the development of resistant varieties. To that end, Zhi-Yuan Chen, LSU AgCenter plant pathologist, is looking at soybean proteins of plants infected with Asian soybean rust and comparing them to proteins of uninfected plants.

Photo by Bruce Schultz

Zhi-Yuan Chen, LSU AgCenter plant pathologist, is part of a team searching for solutions to the Asian soybean rust problem.

"We also want to identify fungal genes important for infection and find ways to inhibit it," Chen said.

Svetlana Oard, a researcher in the AgCenter Biotechnology Laboratory, is working with tiny proteins called peptides that provide resistance to infections from bacteria and fungi. Her goal is to transfer this resistance to Asian soybean rust in a soybean plant.

"Resistant varieties are still several years away," Hollier said. "Meanwhile, our producers will have to be vigilant and adjust their management practices to the reality of Asian soybean rust." ■ **Linda Foster Benedict**

Planting Dates for Soybean Varieties in Northeast Louisiana

Ernest L. Clawson and Donald J. Boquet

In recent years, reports of high yield potential and the advantages of an early harvest have created interest in early planting of soybeans in Louisiana. Little research information is available on the responses of Maturity Group (MG) V soybeans to early planting dates. In addition, the acreage devoted to early-maturing soybeans such as MG IV varieties has increased in recent years. The currently recommended planting dates for MG IV soybeans in Louisiana range from April 15 to May 15, but additional research is needed to confirm this recommendation. Although new to this state, MG III soybeans have been planted by some producers because of their potential for even earlier maturity.

The growth and yield responses of soybeans to planting date depend upon the environment, variety and production practices. If planted too early, soybeans may have poor emergence or limited growth because of cool temperatures. The short days of early spring also may affect the success of early-planted soybeans. When soybeans are exposed to days shorter than a critical length, they progress rapidly toward maturity. If this occurs before the plant reaches an adequate size, the soybeans are stunted and low-yielding. The day length that causes this response differs by variety. If planted at a time when low temperatures and short days may cause poor growth, narrow row spacings are often beneficial. They allow the crop to use available space even if individual plants are small. This helps to control weeds and may also increase yield.

Photo by Ernest L. Clawson

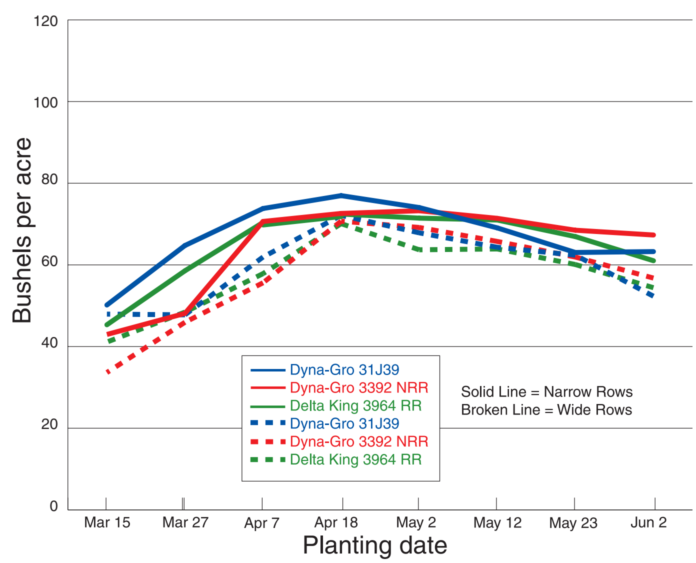
Soybean planting date study, St. Joseph, La., July 13, 2006. Maturity differences caused by planting date and variety are evident in plant appearance.

Testing Planting Date Responses

LSU AgCenter researchers conducted studies on planting dates for soybeans in 2005 and 2006 at the Northeast Research Station at St. Joseph, La. In 2005, separate, nonirrigated tests were conducted for narrow rows (20-inch average row spacing, planted flat) and wide rows (40-inch row spacing on raised beds). The studies included six MG IV and two MG III varieties. The earliest planting date was April 15 for narrow rows and March 31 for wide rows. Planting dates were established approximately 10 days apart, depending on field conditions.

In 2006, the two row spacings were established on wide seedbeds (80-inch centers) in a single irrigated study. One MG V, four MG IV and three MG III varieties were included. Planting dates ranged from March 15 to June 2. Yield and the timing of maturity were measured for each plot in all studies.

Figure 1. Maturity Group III soybean yield response to planting date and row spacing, 2006.



Ernest L. Clawson, Assistant Professor, Northeast Research Station, Saint Joseph, La., and Donald J. Boquet, Professor, Macon Ridge Research Station, Winnsboro, La.

Preliminary Results

In the narrow-row study in 2005, yields were generally high when planted April 15, April 29 and May 16. All varieties yielded poorly when planted on June 3. Some MG IV varieties produced their highest yields when planted on April 15, while others produced the greatest yield when planted on April 29. The highest yield for each of the MG III varieties was obtained when planted on April 29. MG IV varieties were higher yielding than MG III varieties in most cases. This was especially true when planting was on April 15.

In the conventional-row study in 2005, all varieties, regardless of maturity group, produced the greatest yield when planted on April 21. All varieties produced low yields when planted in June. Maturity Group III varieties tended to yield less than MG IV varieties, especially at the earlier planting dates. Low yields of MG III varieties at the earliest planting dates may have been caused to some degree by delayed harvest, which led to preharvest seed losses through shattering — pods opening and spilling their seeds before harvest.

In 2006, narrow rows generally yielded more than wide rows for all maturity groups in March and early April plantings (Figures 1, 2 and 3). For MG III and MG IV varieties, the earliest planting date for near-optimal yield was April 7 in narrow rows and April 18 in wide rows. The MG V variety yielded highest when planted between March 27 and April 18. This may indicate a major change in MG V adaptation because, in earlier research in the 1980s and 1990s, optimal planting dates for MG V varieties were in May. MG III varieties were generally lower-yielding than those of other maturity groups at all planting dates.

To obtain one week of earlier maturity, MG III and IV varieties had to be planted approximately 12 days earlier in 2005 and approximately one week earlier in 2006. For the MG V variety in 2006, one week's earlier maturity required 15 days' earlier planting. At a given planting date, MG III varieties were earlier-maturing than MG IV varieties. In 2006, each was earlier-maturing than the MG V variety, which did not mature before September 8 at any planting date.

Photo by Linda Foster Benedict

Ernest L. Clawson conducts research on soybean planting dates at the LSU AgCenter's Northeast Research Station.

Implications for Soybean Producers

The early results of this study have a number of implications for Louisiana soybean producers. First, MG III varieties did not yield as well as MG IV varieties and probably should not be planted unless early maturity is a production objective. Producers may experience yield reductions from planting MG III or IV soybeans before mid-April in wide row spacings. Although more years of data are needed, the results from 2006 suggest that these maturity groups may be planted for high yield in early April if narrow row spacings are used. The differing responses between years suggest that irrigation extends or widens the optimal planting window for MG III and IV soybeans in years where rainfall is limited. Because the MG V data represent only one variety in a single year, firm conclusions cannot yet be made about planting dates for MG V soybeans. The study will be continued at the Northeast Research Station in 2007. ■

Figure 2. Maturity Group IV soybean yield response to planting date and row spacing, 2006.

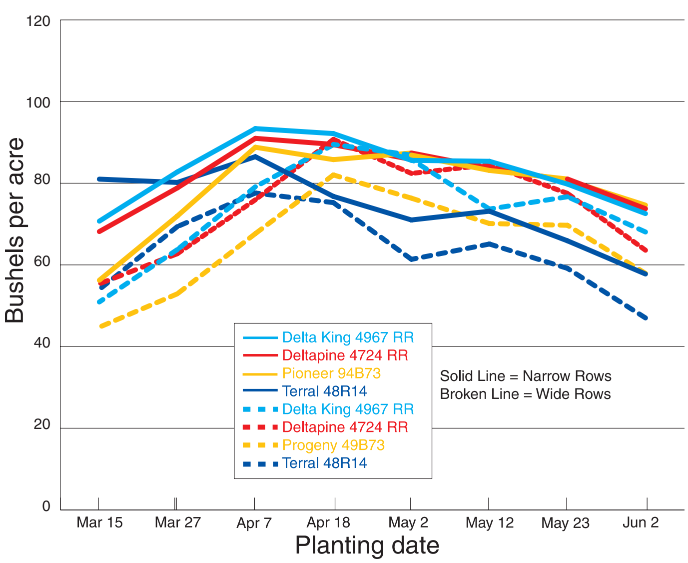
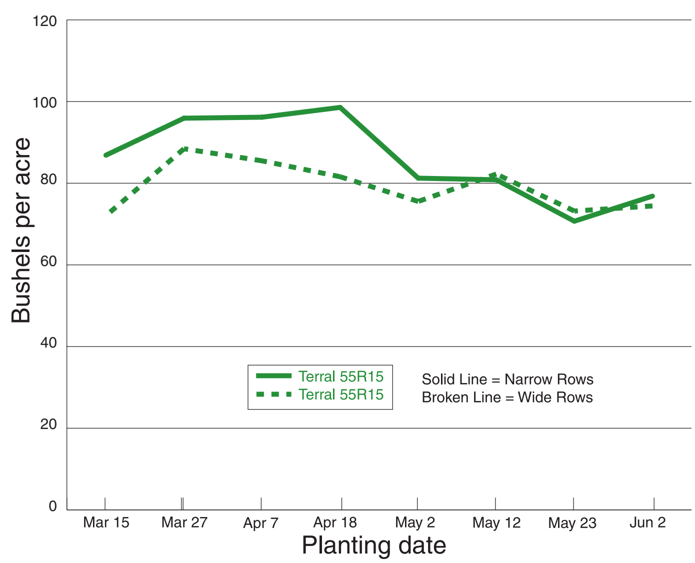


Figure 3. Maturity Group V soybean yield response to planting date and row spacing, 2006.



ECONOMICS of BMP Cropping Systems

Donald J. Boquet and Kenneth W. Paxton

The traditional farming practice for cotton in the South for 200 years was to produce one summer crop per year following winter fallow. Because cotton residue provided scarce ground cover, this monoculture practice exposed the soil to long periods with little protection from the effects of winter and spring rainfall. Soil erosion was excessive, and agricultural sediment became the primary pollutant of surface water.

Today, many cotton farmers use conservation tillage and winter cover or grain crops to increase surface residue, which helps reduce erosion and improve water quality. Cover crops are good for water quality but are also good for soil quality. In the long term, use of cover crops is economical and beneficial. In the short term, however, this may not be the case.

Year-round systems with summer crops of cotton, corn, soybeans or grain sorghum and winter crops of wheat, rye or vetch are considered best management practices (BMPs) to protect surface water quality from soil and nutrient losses. Winter crops stabilize the soil and eventually increase soil productivity by increasing soil organic matter and soil biological activity. Vetch also provides a large percentage of the nitrogen needed by cotton. Using no-till tillage systems is one of the fastest ways to build organic matter in southern soils. No-till and cover crop residues also conserve soil water, which can improve yields of the following summer crops.

The year-round system of doublecropping wheat and soybeans has been a common practice throughout the mid-South for 30 years. Acreage in doublecropping varies and relies on the perceived profitability and increased risk for the summer crop. The risk of doublecropping may be greater with cotton than with soybeans because cotton relies more on early planting and longer growing seasons to maximize yield.

A major concern for farmers has been the economics of adopting conservation systems that may increase their production costs. The LSU AgCenter has conducted research for many years on BMP cropping systems to evaluate the yield and economic benefits of these year-round diverse crop sequences. Some of these studies have evaluated irrigated systems that maintain ground cover through the use of crop residues, cover crops and no-till practices. The systems include winter cover crop/cotton, doublecrop wheat/cotton, wheat/soybeans, wheat/grain sorghum, and doublecrop wheat/cotton rotated with corn, soybeans or grain sorghum. Continuous monocropping/winter fallow of each of the summer crops was included for comparison purposes, though these are not considered BMPs.

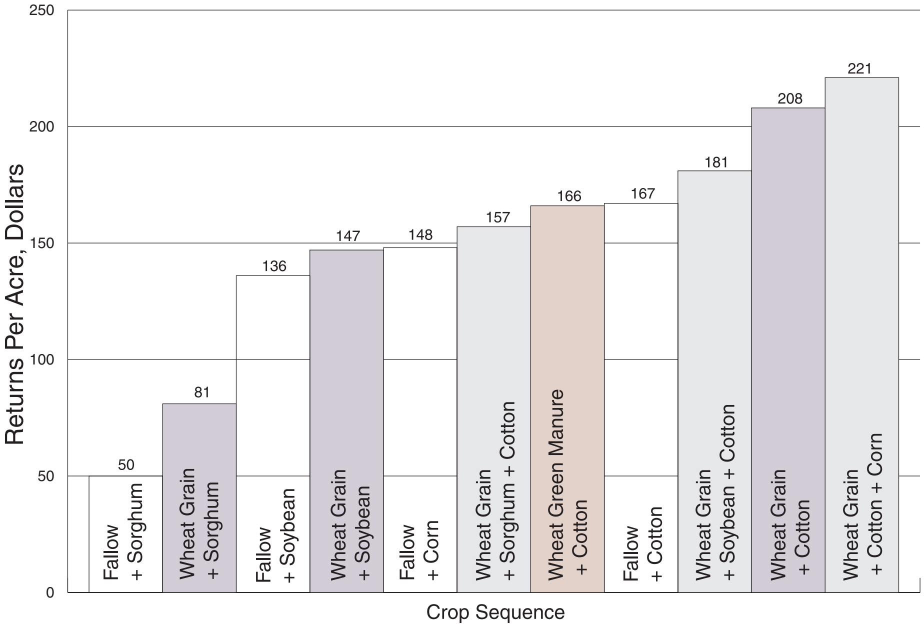
Total commodity yield of the doublecrop systems was higher than any of the monocrop systems because of the added wheat yield that averaged 65 bushels per acre. Summer-crop yields usually, but not always, sustained yield losses in doublecrop systems. For example, doublecrop cotton yield varied from a 3 percent increase to a 21 percent reduction, and doublecrop soybeans varied from a 12 percent increase to a 30 percent reduction. Sorghum produced the same whether planted as a monocrop or doublecrop. Yields of soybeans and corn were 10 percent to 16 percent higher in doublecrop rotation systems than in doublecrop systems without rotations,

Photo by Donald J. Boquet

Doublecrop cotton planted into residue after wheat harvest is one type of best management practices that can produce higher economic returns than non-BMP systems. Doublecrop systems require irrigation of the summer crop to minimize risks.

Donald J. Boquet, Jack and Henrietta Jones Endowed Professor, Macon Ridge Research Station, Winnsboro, La., and Kenneth W. Paxton, Professor, Department of Agricultural Economics & Agribusiness, LSU AgCenter, Baton Rouge, La.

Figure 1. Average annual net returns for cropping sequences in a BMP study 2001-2006.



but cotton yields were the same with or without crop rotations. Compared with monocropping, doublecrop cotton yields lost an average 67 pounds of lint per acre each year, and doublecrop soybean yields dropped an average of 5 bushels per acre each year. Any yield reduction of the summer crop yields is a significant economic penalty because it represents a loss directly from the potential net returns. Although the AgCenter research showed the BMP systems to be productive, the economics of each system relied greatly on the commodity prices received in a given year. In our studies, using AgCenter-developed enterprise budgets based on the yields and inputs for each system and annual prices, some of the most profitable systems were BMP systems (Figure 1). Doublecrop cotton/wheat produced annual net returns that ranged from $164 to $340 per acre from average yields of 65 bushels of wheat per acre and 1,043 pounds of cotton lint per acre. The system of producing three crops of corn-wheat-cotton in two years averaged annual net returns that ranged from $86 to $221 per acre.

In comparison, monocrop cotton net returns ranged from $112 to $167 per acre with average yields of 1,110 pounds of per acre. The BMP systems of doublecrop cotton rotated with corn or grain sorghum produced annual net returns that ranged from $101 to $181 per acre – approaching that of monocrop cotton but less than continuous doublecrop wheat/cotton. Continuous monocrop soybeans, corn or sorghum produced highly variable net returns that ranged from a $40 loss to a $148 gain and were usually lower than monocrop cotton or BMP systems. Negative returns occurred in some years, usually with monocrop systems and seldom with multicrop systems. Production risk was no greater with the diversity of crops in the BMP systems than with monocropping because these were irrigated studies, which prevented soil water deficiency, the primary risk factor for these types of cropping systems in Louisiana.

The BMP systems studied in the LSU AgCenter are highly productive and have potential to improve soil and water quality. Despite their value for environmental protection, farmers face limitations in fully implementing these systems because, with current inputs and variable commodity prices, not all systems will be economically competitive with monocrop cotton every year. Government conservation programs that subsidize effective BMPs with public funding are needed for practices such as winter cover crops to promote implementation and attain their valuable environmental benefits, especially in combination with no till. These studies were conducted with no till, a viable economic practice because of the associated savings in fuel, equipment and labor costs. ■

Acknowledgment

This research was funded in part by Cotton Incorporated, the Louisiana Cotton Support Committee and the Louisiana Soybean and Grain Research and Promotion Board.

Farmers predict planting 'a lot of corn'

Farmers Dan Bedgood and Erick Cherene of Madison Parish have a quick answer when asked to describe the upcoming 2007 growing season in North Louisiana. "A lot of corn," they say in unison.

The farming partners were among more than 200 people who attended the LSU AgCenter Corn and Soybean Forum on Feb. 13, 2007, at the Rayville Civic Center.

Bedgood and Cherene said they planted 1,000 acres of corn in 2006, but they will plant up to 4,000 acres of corn this year. They still plan to have some acreage in soybeans and cotton, but they said they're not sure how much of those they'll plant.

"For sure, less cotton," Bedgood said.

LSU AgCenter county agent Keith Collins of Richland Parish said last year's Louisiana corn acreage of more than 300,000 acres could double this year, and the state's soybean acreage of 830,000 acres is projected to remain static – although Collins said he expects Northeast Louisiana farmers to have an increase in soybeans.

Last year's state average soybean yield set a record with 35 bushels an acre.

LSU AgCenter grain specialist David Lanclos said with higher commodity prices, corn farmers will be considering fungicides, even though fungal diseases on a corn crop typically do not have devastating effects on yields like the diseases on rice and soybeans. He said research results are mixed concerning whether fungicides can help corn yields.

"We are not recommending fungicides be applied on corn this year," Lanclos said. "But I encourage you to try some on a few acres and leave some untreated test strips for comparison." ■ **Bruce Schultz**

Assessing Liberty Link Transgenic Technology for Weed Control in Cotton

Donnie K. Miller, P. Roy Vidrine and Alexander M. "Sandy" Stewart

The 21st century has provided producers with a number of technological advances that affect all aspects of cotton production. The overwhelming acceptance of Roundup Ready and Bt technologies on weed and insect management strategies demonstrates their positive effects. In addition to Roundup Ready cotton, a second transgenic system commercialized as Liberty Link technology offers producers the ability to control a broad spectrum of grass and broadleaf weeds that commonly infest cotton.

Like its transgenic counterpart, the Liberty Link system's potential benefits include reducing or eliminating chemical applications or tillage operations and controlling a broad weed spectrum. This technology also offers rotational flexibility to plant other crops because glufosinate – the active ingredient in Ignite, the herbicide labeled for use in this system – has no residual soil activity.

Similar to how the second generation of Roundup Ready cotton – termed Roundup Ready Flex – responds to the herbicide glyphosate, Liberty Link cotton exhibits excellent over-the-top (direct spray contact) tolerance to Ignite regardless of crop growth stage. This places less reliance on specialized spray equipment intended to reduce herbicide-plant contact and allows the use of larger, faster-moving application equipment during the growing season. This also may provide the opportunity to co-apply insecticides with Ignite, thereby reducing application trips through the field.

Crop Tolerance, Weed Control

Research conducted with Liberty Link cotton by LSU AgCenter weed scientists has focused on crop tolerance, weed efficacy and co-application effects. The lack of visual injury or negative growth effects with over-the-top Ignite application indicates excellent crop tolerance to the herbicide. Efficacy trials indicate excellent season-long control of most broadleaf and grass weeds in cotton when Ignite is applied to small (1- to 3-inch-tall), actively growing weeds. Ignite should be applied as early as possible once weeds emerge because delaying initial application may result in early-season weed competition that may reduce yield. In addition, Ignite acts primarily as a contact herbicide, so it requires thorough weed coverage, which is especially important in dense weed populations.

Although Ignite provides excellent control of most weed species, control of broadleaf Amaranthus or pigweed species and goosegrass can be erratic, especially with larger plants. In such situations where heavy pigweed pressure exists, including soil-residual herbicides (DNA herbicides, Dual Magnum or Staple LX) at planting to prevent weed emergence or co-applying Staple LX with Ignite to control existing weeds or provide soil-residual control has proved beneficial in a Liberty Link system. In addition, adding Dual Magnum to Ignite can provide soil-residual pigweed control into the growing season.

For heavy goosegrass pressure, applying DNA herbicides or Dual Magnum at planting offers the best option because Ignite can be antagonistic (reduce control) when co-applied with grass herbicides after weed emergence. Grass herbicide must be applied three days before or seven days after an Ignite application to reduce potential antagonism. Research has also shown that including additional herbicides with residual soil activity at planting can buy producers time in making the initial Ignite application and limit weed competition that can occur when the initial application is delayed by weather and weeds become larger.

Additional Benefits

Perhaps the main benefit of including other herbicides in a Liberty Link system is to introduce different modes of action to prevent weed resistance associated with the continuous use of Ignite. Each producer must determine the need for additional herbicides depending on the weed spectrum, the producer's ability to cover his acreage in a timely fashion to eliminate early-season weed competition, environmental factors that affect timeliness of application, increased costs associated with the new technology and the cost efficiency of using additional inputs.

Research conducted on weed control with Ignite co-applied with most cotton insecticides indicated no negative effects on control of most of the common weed problems in cotton in Louisiana.

Although increased costs are associated with this new technology compared with conventional varieties, producers may feel that the opportunity to use larger, faster-moving equipment and reduce the number of application trips through the field by co-applying insecticides with Ignite in over-the-top applications more than offset the increased cost. In addition, both Liberty Link and Roundup Ready Flex offer the potential to be used as highly effective alternate weed control systems in a weed-resistance management program. ■

Donnie K. Miller, Associate Professor, Northeast Research Station, St. Joseph, La.; P. Roy Vidrine, Professor, and Alexander M. "Sandy" Stewart, Assistant Professor, Dean Lee Research Station, Alexandria, La.

Photo by Rebecca A. Melanson

Large native pecan tree in Natchitoches Parish, La.

Pecan Bacterial Leaf Scorch

A new look at an old problem

Randy S. Sanderlin and Rebecca A. Melanson

Pecans are one of the few economically important horticultural crops native to North America. Louisiana is within the native U.S. range, which is primarily the flood plain of the Mississippi River and its tributaries. Louisiana produces about 12.5 million pounds of pecans each year, which contributes to the average U.S. value of about $245 million. Pecans are harvested from either ungrafted trees or from grafted varieties. As with any agricultural crop, numerous management problems, including diseases, affect production potential.

For more than two decades there was uncertainty about the cause of a common pecan disease referred to as leaf scorch. Symptoms consist of pecan tree leaflets turning tan to brown, beginning at the tip and edges and advancing toward the middle of the leaflets. Affected leaflets drop shortly after symptoms begin. The disease may appear on only one limb or throughout a tree. Symptoms and leaflet loss may begin as early as May but tend to become more prevalent as the summer progresses.

Researchers were able to distinguish this problem from several other problems such as nutritional imbalances, scorch mites and physiological problems during the mid-1970s. Their evidence pointed to a pathogen. The pathogen's identity, however, remained unclear until 1998, when the scientists discovered that this disease was caused by a bacterium, *Xylella fastidiosa*. This pathogen lives in the water-conducting tissue of a plant and infects more than 100 species of plants including grapes, peaches, almonds, coffee and citrus. When the bacterium infects hardwood trees, such as pecan, it typically produces leaf scorch-type symptoms. On pecan, the disease is referred to as pecan bacterial leaf scorch, or PBLS. As the bacterium multiplies, the water-conducting vessels become plugged, resulting in death of pecan leaflets.

Effects of PBLS

During a three-year study from 1999-2001, severely infected trees of the pecan variety Cape Fear had an average of 58 percent more defoliation by the end of the growing season compared with noninfected Cape Fear trees in the same orchard. The Cape Fear variety was very popular during the 1970s and 1980s and was widely planted in Louisiana and across the southeastern states. Most of the commercial orchards

Randy S. Sanderlin, Associate Professor, and Rebecca A. Melanson, Research Associate, Pecan Research and Extension Station, Shreveport, La.

planted during this period have some trees of Cape Fear in them, and they will be around for a long time. However, Cape Fear is no longer recommended for Louisiana orchards because it has several production problems including PBLS.

Nuts from diseased terminals had about 12 percent lower in-shell weight and 16 percent lower kernel weight compared to nuts from trees without PBLS. The growth of current season stems on infected limbs was reduced and early tree growth appeared to be stunted by the disease. PBLS occurs across the commercial production areas of Louisiana. Pecans are grown throughout Louisiana. These data indicate that PBLS is a significant problem for commercial pecan growers resulting in annual economic loss over the lifetime of infected trees.

PBLS has been identified in more than 20 grafted pecan varieties and in ungrafted trees. See the list in Figure 1. The disease has been identified in most of the varieties recommended for the southeastern United States and in some of the old standard varieties widely planted in this region. Of the popular southeastern varieties, Cape Fear is the most frequently diseased and has the most severe symptoms. The disease within a variety, however, can vary from mild to severe. The factors that determine the level of disease severity are not known.

Graft Transmission

Once a tree is infected, PBLS is usually chronic, occurring annually. There is no effective treatment to eliminate the bacterium from infected plants, so methods to manage disease caused by *X. fastidiosa* must be focused on preventing infection. Pecan trees can be infected by passage of the pathogen through grafting with either infected scion wood or infected rootstock. Pecan trees have to be propagated by grafting to maintain their variety type. Scion wood is taken from a tree of the variety to be propagated and grafted onto a rootstock. The rootstock is a small tree grown from a nut and develops the root system of the tree. The scion produces the upper portion of the tree and determines the variety type.

In tests, grafting with scion wood taken from infected trees resulted in about 10 percent of the newly developing trees having PBLS, and more than 80 percent of healthy scions grafted onto infected rootstocks became diseased within one growing season. Graft transmission may be a significant factor for introduction of the pathogen into pecan orchards because all pecan varieties are propagated through grafting. Avoiding the use of infected scion wood by identifying infected trees through symptom recognition during late summer before collecting scion wood in the winter may be one way of reducing the infection of young trees.

Insect Transmission

The primary method of pathogen spread in other plant hosts is by insect vectors. All of the insects capable of transmitting the bacterium to plants feed only in the water-conducting tissue of plants. The primary culprits are leafhoppers and spittlebugs. LSU AgCenter scientists recently determined that adult pecan spittlebugs can transmit the pathogen from infected pecan trees to noninfected trees. Commercial pecan growers can reduce infestations of spittlebugs through insecticide application. The scientists have also found evidence that some leafhopper insects can transmit the pathogen to pecan trees. Management techniques for leafhoppers on pecan, however, have not been developed.

In orchards, PBLS has been observed to sometimes remain static for several years and then exhibit rapid increases in the number of infected trees. This is likely related to the sporadic occurrence of insects that can transmit the pathogen. Observations from orchards suggest that much of the pathogen spread occurs from infected pecan trees within an orchard; however, because the pathogen has such a wide host range, it is probable that some insect vectors that feed on multiple hosts can acquire the bacterium from other species and transmit it to pecan.

Pathogen Movement

LSU AgCenter researchers at the Pecan Research and Extension Station are trying to determine how the pathogen moves into orchards, the pattern and rate of pathogen spread within orchards, the identity of insect vectors that feed on pecan, the frequency of occurrence of the disease in pecan nurseries, the relationship of the pecan pathogen to subspecies of the bacterium from other hosts and the susceptibility of new cultivars to PBLS. They also hope to evaluate a potential method of eliminating the pathogen from scion wood. ■

Figure 1. List of pecan varieties identified with pecan bacterial leaf scorch disease.

Barton	Forkert	Oconee
Caddo	Jackson	Pawnee
Cape Fear	Kiowa	Schley
Candy	Mahan	Shoshoni
Cherokee	Melrose	Stuart
Cheyenne	Moreland	Sumner
Desirable	Navaho	Woodman
Farley	Nacono	

Photo by Rebecca Al. Melanson

Pecan bacterial leaf scorch symptoms on leaves.

Don’t Let Leaf Spot Spoil Your Vincas

Once established in the landscape, vinca provides season-long color with nonstop blooms.

Photos by Yan Chen

Yan Chen and Allen Owings

Research plots for vinca disease and planting technique study at the Hammond Research Station.

Annual vinca, also referred to as periwinkle by many home gardeners and industry professionals, is one of the best-selling bedding plants in the Southeastern United States. It is adaptive to summer heat, sand and silt-based soils, acid soils and low rainfall. Once established in the landscape, vinca provides season-long color with nonstop bloom performance. A wide variety of colors and sizes is available for landscape use.

The vinca is not without its problems, however. During the spring months, vinca is susceptible to root and stem rot. Another major concern is a disease called Alternaria leaf spot. These leaf spots are prevalent in the late summer and fall months and

Yan Chen, Assistant Professor, Hammond Research Station, Hammond, La.; and Allen Owings, Professor, Department of Horticulture, LSU AgCenter, Baton Rouge, La.

Photos by Yan Chen

A vinca plant severely infested with Alternaria leaf spot.

Annual vinca,
also referred to as periwinkle,
is one of the best-selling bedding plants.

can sometimes be observed in new plantings. Individual Alternaria leaf spots are tan to black, pinhead to penny-sized lesions. The spots develop on the leaves starting at bottom of the stems and progressing to the top. Infected leaves will turn yellow and fall off. A severe infection can strip the stems and render the planting unattractive. Heat and humidity in late summer provide ideal conditions for leaf spot infection. Effective control requires frequent fungicide applications that are expensive and may pose negative environmental impact. Other factors that may affect disease incidence include planting techniques and variety selections.

A field study conducted in 2005 and repeated in 2006 at the LSU AgCenter's Hammond Research Station investigated how these factors would affect the development of Alternaria leaf spots. Four-inch pots of 6-week-old vinca plants were planted on April 1 and May 1 in a landscape bed mulched with pine bark and irrigated. Disease severity was assessed in June, July and August.

Disease-resistant Varieties

Vinca varieties can be categorized as open-pollinated upright, F1 hybrid upright, open-pollinated trailing, and cutting-propagated. In the Hammond study, the scientists compared varieties Cooler Hot Rose (open-pollinated), Titan Rose (F1) and trailing vinca Mediterranean Lilac (open-pollinated) with Nirvana Rose and Nirvana Red, both of which are cutting-propagated.

The open-pollinated Cooler Hot Rose had the least leaf spot infection. Both Nirvana varieties were as susceptible as the hybrid Titan Rose. The trailing Mediterranean Lilac was the most susceptible of all varieties grown. Because leaf spots are transmitted by raindrop splashes, trailing varieties are infected more easily than upright varieties. Based on these results, the classic open-pollinated vinca varieties are relatively resistant to Alternaria leaf spots.

Planting Late

As a warm-season plant, vinca has a wide window for planting and can be planted from April to June. Many landscapers like to plant in early April to get the color effect as soon as possible in the spring. Results indicated that planting late (May 1) significantly reduced the amount of Alternaria leaf spots over an April 1 planting date. Plants planted in May were still acceptable in August, while the plants planted in April needed to be removed. Because both planting times gave about 14 weeks of blooms, landscape professionals can choose planting date to meet their specific time frame for color display.

Fertilize Wisely

Though extremely adaptive to poor soil in their native habitat, newer vinca varieties will show nutrient deficiency symptoms when left unfertilized after planting. In the Hammond study, the trailing vinca Mediterranean Lilac performed better with less nitrogen than the other varieties. A complete formula controlled-release fertilizer such as 13-13-13 (N-P-K) at 0.5 pound nitrogen per 1,000 square feet is sufficient for trailing varieties for most soils. For upright varieties, the recommendation is 1 pound nitrogen per 1,000 square feet. Higher fertilizer rates (4 pounds of nitrogen per 1,000 square feet) did not improve plant quality but encouraged the development of disease with excessive lush growth.

We also evaluated the effects of Aliette T&O fungicide as a preventive spray applied 1) at planting, 2) at planting and after leaf spots were first observed, or 3) every four weeks over the season. Applying Aliette fungicide every four weeks only gave a slight improvement in plant quality, while applying it at planting or at disease observation did not make any difference in how much leaf spot occurred.

A colorful flower display of vinca.

Based on these findings, leaf spot lesions can be reduced with the use of less susceptible open-pollinated and upright varieties combined with the proper level of fertilizer. A fertilizer rate of 1 pound nitrogen per 1,000 square feet should be sufficient for vinca planted in most landscape soils. Planting later in the spring (May 1) will delay disease development and delay the need to replace the planting into August. ■

Resistant Starch:

A Potential Way to Add Value to Rice

This fiber-like food ingredient has many healthful benefits, and it can be produced from broken rice kernels.

Joan M. King

Any way to add value to rice can be of great benefit to Louisiana's rice industry. One of the targets for research by the LSU AgCenter is broken rice kernels. Now, these less-than-perfect kernels bring less than a third of the value of whole rice grains. They are sold primarily to breweries for brewing beer.

A growing use for broken rice kernels, however, is to make rice flour. The food industry is finding more uses for rice flour because of its many healthful properties. Not only is rice flour low in fat but it includes hypoallergenic proteins. Rice flour is used in many foods including baby foods, cereal, chips and crackers.

The unique properties of rice flour also make it a prime candidate for producing resistant starch, a food ingredient that acts like fiber in the human body and thus provides the health benefits of fiber. Insoluble fiber passes through the gastrointestinal tract intact. Soluble fiber and resistant starch, on the other hand, get fermented in the large intestine, which is where the health benefits come into play.

Benefits of resistant starch include improved glucose regulation and better weight control, reduced constipation, reduced colon cancer risk, and reduced blood cholesterol and triglycerides. Resistant starch also may lower insulin demand by the body and be of benefit to diabetics as they try to regulate their blood glucose within a normal range.

At the LSU AgCenter, research is being conducted on the use of enzymes, additives and other processing techniques on rice flour to enhance resistant starch content. Patent applications have been filed on the related discoveries.

There is a potential of a 10-fold increase in the value of rice flour through the development of rice starch-based ingredients, such as resistant starch. The results of this research will provide increased monetary returns for broken rice kernels, which make up 15 percent of milled rice in the United States. Rice varieties that may have excellent agronomic traits but lack acceptability by consumers because of negative cooking or other characteristics may also be used for value-added food ingredient development.

This research will benefit everyone in the rice industry by providing an expanded use of rice and an increased demand for rice and rice products, as well as providing a healthy choice for consumers. ■

Joan M. King, Associate Professor, Department of Food Science, LSU AgCenter, Baton Rouge, La.

Louisiana turtle farmers continue fight for domestic market

In the 70-some years since rural Louisianians first gathered turtle eggs, generally along railroad rights-of-way through swamps, and sold the hatchlings as pets, the turtle industry in Louisiana has experienced a roller coaster ride that may be at its lowest point.

By the 1950s farmers were building ponds at the swamp edges keeping the adult turtles in captivity and harvesting the eggs. The process evolved and matured into an industry that, while still following many of the old practices, now uses sophisticated methods to combat salmonella bacteria, which was revealed as a problem for the industry more than 30 years.

Today, Louisiana has about 60 turtle farmers that produce more than 10 million turtles with a gross farm value of nearly $5 million, according to the LSU AgCenter's Agricultural Summary.

Based on information from the U.S. Centers for Disease Control in Atlanta in June 1975, the U.S. Food and Drug Administration banned the U.S. sale and interstate transportation of turtles with shells less than 4 inches across because they harbored salmonella. Louisiana's turtle farmers turned to international markets and haven't had a domestic market since then.

"This is the only pet industry in the United States that has been restricted as a result of the potential health threat associated with salmonella, even though other pet industries and food-related industries also serve as potential threats," said Mark Mitchell, an LSU AgCenter veterinary researcher.

Photo courtesy of Concordia Turtle Farm, LLC

Red eared sliders – identified by the red stripe behind their eyes – are the species of turtle Louisiana farmers raise for the pet turtle market.

The fight against salmonella in turtle hatchlings began in earnest in the early 1970s when the LSU AgCenter's Ronald Siebeling, a professor of immunology, began working on a treatment for eliminating the disease from turtle eggs and subsequently the hatchlings that came from them. In 1976, Louisiana turtle farmers began using Siebeling's salmonella treatment.

That's when the Louisiana Department of Agriculture and Forestry stepped in and sponsored legislation that made it mandatory for the eggs to be treated for salmonella and specified that a sample of each batch of hatchlings be tested by an FDA-approved laboratory. All Louisiana turtle farms were using the treatment by the mid 1980s.

Producing salmonella-free turtles and having them certified by the Louisiana Department of Agriculture and Forestry led to the opening of international markets, and the state's turtle farmers developed a thriving business in Europe and Asia.

In 2003, Mitchell followed Siebeling and began developing more effective treatments to control salmonella in the aquatic habitat of the turtles. In three research projects, Mitchell showed salmonella were significantly reduced or eliminated in water, eggs and hatchlings.

"It is important to me that those individuals evaluating this research realize that these results are consistent with those reported on similar projects in other agricultural industries – poultry, swine and beef – and the pet reptile industry," Mitchell said. "Unfortunately, the FDA has placed an unfair set of guidelines on the aquatic chelonian industry."

Turtles are chelonians – reptiles with shells.

Mitchell said the guidelines – that salmonella be eliminated from hatchlings, that resistance to the treatment does not occur, and that turtles don't become recolonized with salmonella – are unacceptable.

"I can provide hundreds of documents that show that salmonella cannot be completely controlled in poultry, beef, swine, vegetables and fruit," Mitchell said. "This is a small group of farmers with a very small voice. To shut them down completely is totally wrong."

Mitchell stays in close contact with the state's turtle farmers, keeping them informed of what he's doing and encouraging them not to give up. But the bureaucratic fight is a tough one.

"We've made definite progress," said Sonny White who raises 400,000 turtles a year on what he calls an "average size" farm near Jonesville. "We can produce a 98 percent salmonella-free turtle."

Somewhere between 75 percent to 80 percent of Louisiana turtles are sold to China, where turtles are both pets and food. Mexico and Europe comprise the balance of the market.

The Chinese grow the turtles to about one pound – "sort of like we grow chickens," White said.

"We're an industry that's discriminated against," White said. "There's not any food on today's market that is 98 percent salmonella-free."

Washing eggs and treating hatchlings have been successful at preventing salmonella. But the third requirement – to demonstrate that turtles don't become re-colonized by salmonella – is "impossible to accommodate," Mitchell said. That's why the turtle farmers are asking the FDA why their industry has been singled out as no other has.

Mitchell has taken the fight to Washington, having traveled to meet with FDA representatives and staff members of Louisiana's congressional delegation to discuss his concerns with current federal regulations restricting both the interstate and intrastate sale of turtles.

"Since the FDA's ban on selling small pet turtles began in the 1970s, pet turtle farmers in Louisiana have developed methods proven by scientific research to maintain a safe turtle, but the bureaucrats at the FDA continue to abstain from changing their flawed policy," said Sen. David Vitter, R-La.

"Farmers estimate that domestic sales would be about $3 a turtle," he said. "If they receive half of their foreign market numbers domestically, our Louisiana turtle farmers could contribute up to $300 million annually to our economy. With methods to keep pet turtles safe, I believe the turtle farmers should have access to the domestic market."

Mitchell, White and Vitter hope they can persuade the FDA to rescind the strict regulations.

LSU AgCenter research on turtles has been funded by the state's turtle farmers, who contribute a half cent for each turtle they sell.

"They are investing in their own industry," Mitchell said. ■ **Rick Bogren**

Alligator Collagen
New Source for Medical, Cosmetic Uses

Alligator processors in Louisiana annually generate about 175,000 pounds of wild alligator bones and connective tissues and more than 1 million pounds of farm-raised alligator bones and associated materials. Texas, Georgia and Florida combined produce about 800,000 pounds of farm-produced alligator waste each year. Although these materials are discarded, they could be the source of a valuable product – collagen.

"Alligator bones are an excellent source of collagen," said Jack Losso, a researcher in the LSU AgCenter's Department of Food Science. "We have demonstrated alligator bones contain type I collagen with biochemical and thermal properties similar to type I collagen from the skin and bones of black drum and sheepshead fish."

Traditionally, collagen has been obtained from the skins of land-based animals such as cows and pigs. Because of the incidence of mad cow disease around the world, the use of collagen and collagen-derived products from skins of these animals has been questioned. As a result, marine collagen from warm-water fish and their by-products is in high demand, Losso said. Medical users are looking for these types of collagen because they are stable at human body temperature.

Collagen is unique among body proteins because it is the single-most important protein of connective tissue. Collagen molecules are classified into 21 types, which differ in their sequence, weight, structure and function, but they can be broadly subdivided into families. Types I and II collagens, which make up one family, are mostly found in animal skins and cartilage.

To find additional sources of collagen from cold-blooded animals, Losso led a team investigating the bones of farm-raised alligators. The research team includes fisheries agents Mark Schexnayder and Mark Shirley along with Food Science Department faculty members Masahiro Ogawa, Michael Moody, Jon Bell and Ralph Portier. They have been working with a local seafood processor, Harlon Pearce from Harlon's LA FISH in Kenner, La., on a National Sea Grant-sponsored grant to develop value-added products from fish wastes.

Their research has resulted in U.S. patent 7,109,300 issued Sept. 19, 2006, which describes a large-scale process for collagen extraction and purification from alligator bones and other calcified tissues.

The biochemical, biomedical and pharmaceutical industries are leading users of collagen, Losso said. Successful applications of collagen include the treatment of hypertension, urinary incontinence, pain associated with osteoarthritis, wound healing, tissue engineering for human organ implants, oral treatments for arthritis, and inhibiting new blood vessels to prevent cancer metastasis.

Beyond medicine, the cosmetic industry uses collagen extensively in personal care products. Traditional food applications of collagen include the preparation of gelatin and clarification of alcoholic beverages. The new areas of nutraceuticals and functional foods represent a $30 billion market that's growing rapidly.

"Alligator collagen is one type of collagen that can take advantage of these new markets," Losso said. "What we produce is almost pure. The next step is FDA certification. The nutraceutical industry is growing rapidly, and marine collagen is one of the stars of the show. We want our Louisiana business to be in a position to take advantage of these new markets." Losso said an important aspect of using alligators as a source of collagen is that the process uses food-grade materials and equipment for extracting collagen from alligator materials.

"The collagen is extracted in a water solution," he said. "Everything is a food-grade process that's generally recognized as safe."

In addition to collagen, alligator carcasses yield two other compounds – elastin and proteoglycan – which are enzyme inhibitors. Losso and Schexnayder suspect there may be other important compounds to be found in alligator wastes.

The U.S. Department of Commerce through Sea Grant initially provided funding to study collagen from fish skins, and the U.S. Department of Agriculture provided funding for collagen from alligators. The researchers have received a second grant from the Sea Grant program.

Losso and Schexnayder have applied for a proof of concept grant from Greater New Orleans Inc. to fund making small batches of the alligator collagen to give to interested potential industrial partners.

"One of our objectives," Schexnayder said, "is to make the waste stream from fish and alligator processing facilities into a positive cash flow instead of a business expense."

■ **Rick Bogren**

Photo by John Wozniak

Jack Losso, a researcher in the AgCenter's Department of Food Science, has develolped a method of extracting collagen from alligator bones. The collagen has a host of potential uses, including in medicine, cosmetics and foods.

PROFILE

From student worker to endowed chair

Roger Leonard, entomologist

When he first went to work at the LSU AgCenter's Northeast Research Station in St. Joseph, 15-year-old Roger Leonard expected it to be just a summer job during high school. What it turned out to be, however, was the first step in a career that found him being named in 2006 the Jack Hamilton Chair in Cotton Production in the LSU AgCenter.

Leonard, an entomologist at the LSU AgCenter's Macon Ridge Research Station at Winnsboro, focuses his research on the development and implementation of insect pest management strategies in cotton as well as in corn, grain sorghum and soybean.

But Leonard's route took a turn when he enrolled in the pre-pharmacy program at what is now the University of Louisiana at Monroe. He decided, however, that he really didn't want to be a pharmacist. So at the urging of Steve Crawford, a friend and mentor at the Northeast Research Station, where he continued to work during the summers, Leonard enrolled in Louisiana Tech to study agricultural engineering.

He continued to work at the research station and as a cotton scout in the summers. He enjoyed the work and decided he would pursue a career as a crop consultant. That led to an interest in agronomy and subsequent enrollment at LSU, where he completed his bachelor's degree in 1984.

Leonard continued his studies at LSU, earning his master's degree in entomology in 1987 and his doctorate in entomology in 1990. During his master's studies, he worked as an independent crop consultant in Northeast Louisiana.

Jerry Graves was Leonard's major professor during his study for the doctoral degree.

"It was a wonderful experience for me," Graves said. "He stands out above and beyond – both in intelligence and work ethic. He probably taught me as much as I taught him. I never had a son, but if I had one, I'd want him to be like Roger."

After he received his doctorate in 1990, Leonard was offered positions with the U.S. Department of Agriculture's Agricultural Research Service and with two agricultural chemical companies.

Larry Rogers, retired AgCenter vice chancellor and director of the Louisiana Agricultural Experiment Station, was the resident director of the Northeast station at that time. He had hired Leonard for his first summer job there and offered him a research appointment at the Macon Ridge location.

"I've been here ever since," Leonard said. "I planned to be an ag consultant, but I liked working for the University and decided to stay."

Leonard's specialty is cotton insect pest management.

"This field of science is always evolving and presents a range of challenges," he said. "Although the pests occasionally change, the problems just seem to continue."

> The Jack Hamilton Chair in Cotton Production was created by the Louisiana Cotton Producers Association, the Louisiana Independent Cotton Warehouse Association and the Louisiana Cotton Ginners Association.

In his role as a research entomologist in cotton integrated pest management, Leonard was appointed to replace Graves as the AgCenter's representative on the state boll weevil commission and on the technical advisory group for boll weevil eradication.

"The boll weevil was a key pest for more than a century," Leonard said. "This insect migrated from Mexico into the United States during the early 1890s." The discovery and use of organic pesticides "helped manage this beast so farmers could harvest a crop."

Although the boll weevil is not yet eradicated, Leonard expects it will, for all practical purposes, disappear from Louisiana soon. "This pest has been eradicated from Mississippi to the Atlantic Coast," he said. "All that's left is the Mississippi Delta and areas to the south and west."

Now with the boll weevil nearly gone, cotton yields have substantially increased. "But when you remove one pest in a multi-pest environment, others will pop up," he said.

"These pests have always been in cotton fields, but they were not as important because many of the sprays for the boll weevil provided coincidental controls," Leonard said. "When those sprays were no longer needed, these other pests began to emerge to fill the gap."

A primary pest that costs producers considerable yield losses and high production costs is the tobacco budworm, which over time developed resistance to the recommended foliar pesticides.

"The tobacco budworm problem was so severe in the early to mid 1980s, farmers were beginning to reduce cotton acreage and plant other crops," Leonard said. "Fortunately, Bt became available in 1996 and eliminated problems with this pest."

Bt cotton varieties contain a foreign gene obtained from bacillus thuringiensis. This bacterial gene, introduced genetically into the cotton seeds, protects the plants from damage by some insect pests. This technology, which was adopted about the same time that Louisiana was starting boll weevil eradication efforts, further reduced the frequency of broad-spectrum insecticide applications in cotton.

Leonard said the current major insect problems for cotton producers are the bollworm, cotton aphid and tarnished plant bug.

The Jack Hamilton Chair in Cotton Production to which Leonard was named was created by the Louisiana Cotton Producers Association, the Louisiana Independent Cotton Warehouse Association and the Louisiana Cotton Ginners Association to honor Jack Hamilton of Lake Providence.

Hamilton, who died in December 2001, was a cotton producer and ginner. He was an organizer and first president of the Louisiana Cotton Producers Association and served as president of the Louisiana Cotton Warehouse Association and the Southern Cotton Ginners Association.

Hamilton was named Man of the Year in service to Louisiana agriculture by Progressive Farmer Magazine, was named Cotton Ginner of the Year by the Southern Cotton Ginners Association and was awarded the Horace Hayden Memorial Trophy as National Ginner of the Year.

The endowed chair is funded by private contributions of $600,000, matched with $400,000 from the Louisiana State Board of Regents. The income from the endowment of $1 million helps support research programs, faculty travel, support staff salaries and resources for research and technology transfer projects.

"It is an opportunity for me to support the cotton industry even to a greater level than I have in the past," Leonard said.

He said that much of his research in the past has been directed by the sources of funding.

"Self-generated funds take time," Leonard said of the process of writing grants and applying for funding. "And they don't necessarily meet current needs. The chair will allow me to use this funding in lieu of chasing grants.

"My first goal is to give this support back to the producers in the form of better IPM programs because they provided the funding for this award," he said. "Cotton is an important agricultural commodity for the state of Louisiana. It can produce considerable income.

"I truly admire some of the Southern gentlemen who were or are currently plantation owners because of their contributions and dedication to southern history. Mr. Hamilton was one of those Southern gentlemen."

The Hamilton Chair is only the second chair in the AgCenter, said David Boethel, vice chancellor and director of research.

"The cotton industry showed commitment" in funding the chair, Boethel said. "With the AgCenter's current financial situation, a chair allows us to attract and retain outstanding scientists – not just for today, but for a long, long time."

Boethel said the Board of Regents' requirements for endowed chairs require a national search to identify the person who will hold the chair. And after such a search, "Dr. Leonard was truly the outstanding candidate."

"When we went through the selection process, his name definitely rose to the top," said Jess Barr, executive vice president of the Louisiana Cotton Association.

Leonard cited his family and the success of his students as major accomplishments in his life so far. He has a 20 percent appointment in the Department of Entomology and has been on the committees of 25 master's and 25 doctoral students.

When he isn't trying to solve insect pest issues in cotton, he participates in community activities. One pursuit was helping build a baseball field, which is named after him, at Franklin Parish High School so the team wouldn't have to travel to a public park for practice.

"I did it for my son and his teammates," Leonard said. "There was an obvious need. Fortunately, parents have continued to step up with the annual field and facility improvements to make this a great place for the team."

Leonard's wife, Thoy, is parish instructional technology specialist with the Franklin Parish School District. His son, Daniel, graduated from LSU in December, and his daughter, Katelyn, is a junior at Franklin Academy in Winnsboro.

"He was self-supporting at an early age," Larry Rogers said of Leonard. "I don't know of any young man who has established himself nationally and internationally at as young an age as Roger. He's the come-to person in insect management in cotton. ■ **Rick Bogren**

Photo by Mark Claesgens

Roger Leonard was named the Jack Hamilton Chair in Cotton Production, a new endowed chair for the LSU AgCenter.

Hammond Research Station targets 'green' industry

Photo by John Wozniak

After more than 80 years of service to the fruit and vegetable growers in Southeast Louisiana, the LSU AgCenter's Hammond Research Station has a new initiative. In addition to the station's mission of research in the strawberry and vegetable industry, the new Landscape Horticulture Research and Extension Center is being established to provide research and education for the green service industry. The 185-acre Hammond Research Station is about 6 miles east of Hammond in Tangipahoa Parish. Some of the new features at the station include a retention pond and constructed wetland, a shade and understory garden, an azalea research demonstration area, the W. F. "Hody" Jr. Camellia Garden, and the Margie Yates Jenkins Azalea Garden. The yellow house at the station serves as headquarters for the LSU AgCenter's Southeast Region. ■ **Johnny Morgan**

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