

LOUISIANA Agriculture

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Assuring Our Future Through Scientific Research and Education



LSU
AgCenter
Research & Extension

Volunteers help us meet our mission

Volunteers play a vital role in the delivery of research-based programs conducted by the Louisiana Cooperative Extension Service. We need well-trained volunteers to provide their expertise in a variety of areas such as gardening, youth development, agriculture, healthy living and more. Empowering volunteers as active partners of the LSU AgCenter has been key to the mission of helping people improve the quality of their lives across Louisiana.

In 2010, more than 12,000 volunteers contributed more than 367,000 hours to the LSU AgCenter. This equates to more than 200 full-time employees. Adults serve as Master Gardeners, Master Horseman, Master Cattleman, 4-H Master Volunteers, Louisiana Volunteers for Family and Community and many more. Both youth and adult 4-H volunteers serve as school and project club leaders, committee members, middle managers, school enrichment volunteers, after-school club volunteers, special activity volunteers and camp volunteers.

Taking advantage of volunteer talents is one way to help offset some of the downsizing in the LSU AgCenter because of budget constraints. In fact, we have initiated a program, called the Extension Volunteer Corps, in which former employees of the AgCenter are now active as volunteers. Eighteen are enrolled so far. Two examples are Joan

McCrory, a former state specialist with the 4-H program who helps with cataloging items at the 4-H Museum in Mansura, and Dale Pollet, former extension entomologist, who still willingly answers questions about bugs.

Based on my experience, it is critical that we as an organization continue to improve our methods of recruiting, training and using volunteers as well as recognizing their efforts accordingly. This can help us be more effective in our outreach efforts with limited resources. There are numerous reasons to volunteer, including the ability to give or share with others; to learn and develop understanding and skills; to enhance social relationships; to learn career-related skills; and to enhance one's self-worth. Volunteers do not only exist to aid in implementing programs. Research consistently indicates that volunteers have specific needs that influence their participation. My hope is that we will continue to strengthen our volunteer recruitment and retention efforts.

If you would like to volunteer to help with AgCenter programs, please contact your local extension office. A listing of the offices and contact information is on our website at www.LSUAgCenter.com. The AgCenter will benefit, you will benefit – and, most important, the people of Louisiana will benefit. ■ **Bobby H. Fletcher, Southeast Region Director**



Joan McCrory, seated, a former 4-H agent, volunteers to help Rose Anne St. Romain with research for the 4-H Museum, which includes visits to the Hill Memorial Library on the LSU campus in Baton Rouge. Photo by Johnny Morgan

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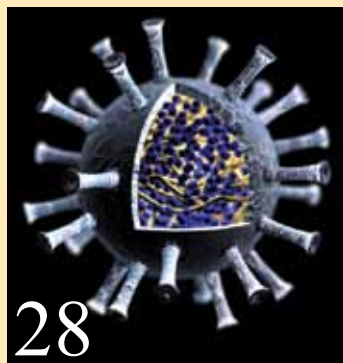
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ON THE COVER: Aaron Melancon is a crawfish, rice and hay farmer from Crowley. Photo by Bruce Schultz

What's New

Rice farmers help supply rice straw as cattle feed for Texas

Louisiana rice farmers are helping Texas ranchers by providing rice straw to be used as cattle feed in the drought-stricken Lone Star State.

The Texans are baling the rice straw for hay and hauling it back to Texas.

Allan Hardison, who has a herd near Fredericksburg, Texas, has been in the area with a partner, Sofus Nielsen, with a crew and hay baling equipment after they got a call to get as much straw as he can from the farm of brothers Fred, Phillip and Paul Zaunbrecher near Rayne.

The Zaunbrechers aren't charging Hardison for the straw, but the way Paul Zaunbrecher sees it, Hardison is doing them a favor by removing dead straw that would hurt crawfish production. The decaying vegetation will rob the water of oxygen, stressing young crawfish, Paul Zaunbrecher explained. "This is going to help us a lot."

The Zaunbrechers know Hardison from deer hunting in Texas.

Hardison said the usual rainfall by this time in his area is around 25 inches, but so far the total is only 3.5 inches.

Hardison also farms corn and wheat but the drought took care of this year's crop. "We didn't even pull the combines out of the barn," he said.

Hardison said many ranchers have been forced to sell off their herds because pastures are barren from the drought, and they no longer can afford to provide feed.

"If you sell, you are out of business, and you lose a year's calf crop," he said.

Hardison custom-cuts hay, so he has managed to have a continuous supply.

"We've never stopped feeding since last fall," he said.

Hardison said some ranchers are getting alfalfa hay from Kansas, New Mexico, Nebraska and South Dakota, but the trucking costs are becoming more expensive.

Dr. Mike Strain, Louisiana Department of Agriculture and Forestry secretary, has relaxed load restrictions for hay being hauled on the highways. Officials will allow vehicles transporting round hay bales to be loaded side by side across trailers up to 12 feet wide and 14 feet high, but the loads must be off the highways after dark.

Vince Deshotel, LSU AgCenter county agent in St. Landry Parish, has been coordinating efforts to get Louisiana hay to Texas cattle ranchers. "There's still a demand for hay," he said.

Deshotels said he traveled to Texas recently and saw the devastating effects of the drought. "This isn't something that's going to go away soon," he said.

Rice straw's protein level is roughly 6 percent, compared to roughly 12 percent in good quality hay. By working into the night, they have been able to make as much as 320 bales a day.

Jerry Leonards, president of the Acadia Parish Rice Growers Association, said other farmers have helped by giving away rice straw providing labor and equipment.

"This has been a good chance to help our neighbors," Leonards said.

Ken Lyon custom-bales hay in the Crowley area. He said several farmers have provided rice straw for hay at no cost, and he and partner Aaron Melancon have been selling it to Texans for their regular price.

"One day it's going to start raining in Texas again, and we might need help from them," he said. ■ **Bruce Schultz**



Arthur Villordon, associate professor at the Sweet Potato Research, was a speaker at the field day at the Lee Jones and Sons Farm near Oak Grove. Photo by Mary Ann Van Osdell

Sweet potato growers learn latest at LSU AgCenter field day

OAK GROVE, La. – Researchers from the LSU AgCenter's Sweet Potato Research Station showed growers how to optimize production at a field day on the Lee Jones and Sons Farm on Aug. 24.

Chris Clark, LSU AgCenter plant pathologist, said a new sweet potato variety similar to Evangeline, but with even better tolerance to field flooding, is slated for release this fall.

Other characteristics of the new variety include red skin and deep orange flesh, less bent roots than the Beauregard variety, high sugar content, excellent plant production and resistance to disease.

Clark said the LSU AgCenter screens all breeding lines for various diseases.

"Around the world, 30 viruses occur in sweet potatoes," Clark said, explaining that researchers look at how, where and when viruses spread in the field.

Arthur Villordon, LSU AgCenter associate professor, said this has been a challenging year to grow any crop because of the drought. He discussed deploying sensors in sweet potato fields to collect soil moisture data and rainfall.

Ted McDermott, sweet potato manager for R.D. Offutt Co., said he recommends the moisture probe.

Rick Story, LSU AgCenter entomologist, said there has been advancement in pesticides, with a lot more choices available.

Tara Smith, extension sweet potato specialist, said the LSU AgCenter is working with four producers to evaluate labeled insecticides at different timings in large strip trial tests to help manage the sugarcane beetle.



Texas rancher Allan Hardison, center, talks with rice farmers Paul Zaunbrecher, left, and Jerry Leonards about baling rice straw to be used for cattle feed. Texas has been hit with the worst droughts in the Lone Star state's history. Photo by Bruce Schultz

She said the AgCenter is also sampling sugarcane beetle populations with black lights and sticky traps. "I don't see this beetle as a sporadic pest any longer," Smith said. "Seed treatments are not catching this insect."

Donnie Miller, LSU AgCenter weed specialist, said researchers are looking to broaden the options in weed management. "We don't have a whole big arsenal we can look at," he said.

He said most of his calls are about alligatorweed and that Sept. 15-Oct. 15 is the optimum time to initiate treatment with glyphosate.

Attending the field day were 85 producers, processors and agrichemical company representatives from as far as North Carolina and Oklahoma. ■ **Mary Ann Van Osdel**

Breakfast cereal eaters do better in school

A bowl of cereal can be a great way for school children or anybody to start the morning. Studies show cereal eaters have better nutrient intakes, said LSU AgCenter nutritionist Beth Reames. Studies also suggest that cereal can help with weight control.

"Cereal eaters have better weights compared to those who don't eat breakfast or perhaps eat other breakfast items that might not be as healthful," Reames said.

Choose the cereals your children will want to eat, but try to pick those that give you the most health benefits.

"It's important to read the nutrition facts label," Reames said. "That helps you compare products."

It's best if the first ingredient is something like whole-grain oats or whole-grain wheat, said Denise Holston, LSU AgCenter nutritionist.

"The food companies are using more whole grains in their cereal products," Holston said. "Some cereals that didn't contain whole grains before, now do."

"Parents should look for cereals with the 'whole grain stamp' developed by the Whole Grains Council," Holston said. "The stamp is a quick and easy way to determine if a product has a minimum of 8 grams of whole grains per serving."

Because the Dietary Guidelines for the United States recommend less sugar in the diet, choosing cereals that do not have added sugars would be a good choice. Other names for sugar on labels include fructose

and high fructose corn syrup.

"If you choose a cereal without added sugar but add three or four teaspoons of sugar, this would be worse. Manufacturers have reduced the amount of added sugar in many cereals, and some studies have found that consumers added more sugar to unsweetened cereals than is in presweetened. One teaspoon sugar would be 4 grams, so you can look at the nutrition facts and determine approximate amounts of sugar," Reames said.

Eating a presweetened cereal for breakfast is better than not eating any breakfast at all, Holston said.

"Research shows that kids who eat breakfast can concentrate better, are less likely to miss school because they're sick, and they're less likely to have a weight problem," Holston said.

If they're not starving by lunchtime, they're less likely to overeat at lunch, which can lead to obesity. ■ **Tobie Blanchard**

4-H volunteer receives First Lady Award

LAFAYETTE, La. – Louisiana's First Lady honored a Lake Charles woman on Aug. 25, 2011, for her volunteer work with 4-H.

Brett Wicke Bordelon received the First Lady Award from Supriya Jindal for making a positive difference in the lives of youth.

"I am honored to present Brett with this award and thank her for introducing the great outdoors to children across Louisiana," the governor's wife said. "The work she does

inspires a love of the outdoors, while also encouraging children and adults in their lives to come together and spend more time exploring Louisiana's beauty together."

Bordelon formed a partnership between 4-H and the Coastal Conservation Association of Louisiana, recruiting volunteers to teach children and youth about fishing and conserving marine resources.

Ruby Miller, LSU AgCenter county agent in Cameron Parish, was among those nominating Bordelon for the award.

"I like having her with our kids because she's such an outstanding role model," Miller said of Bordelon. "She has been a chaperone at many 4-H events."

Bordelon was active in 4-H as a girl, and her father is Gary Wicke, retired LSU AgCenter county agent. Her mother, Cindy Boated Wicke, was a 4-H volunteer.

Bordelon works for LHC, and the award was made in a surprise ceremony at the company's headquarters in Lafayette.

Jarrett Thibodeaux, 14, of Creole community in Cameron Parish, also attended the event. He said Bordelon and the other volunteers have passed along tips for fishing and their ethical approach to the environment.

"Simple things like that help a lot," Thibodeaux said.

Bordelon is the president of the Lake Charles CCA Chapter, the oldest in the state, according to CCA director David Cresson. "We believe that through her work as a CCA volunteer, she has had a profound impact on local kids." ■ **Bruce Schultz**



At a ceremony in Lafayette, Brett Wicke Bordelon, second from right, received the First Lady's Award for her work with 4-H students in Cameron Parish. Also pictured, left to right, are Supriya Jindal; Brett Thibodeaux, Jakin Morales, Maeleigh Conner, all Cameron Parish 4-H students; Bordelon, and Ruby Miller, LSU AgCenter 4-H agent in Cameron Parish who helped nominate Bordelon for the award. Photo by Bruce Schultz

Jazzman Rice

Development of a Jasmine-Type Variety for the Southern United States

Xueyan Sha and Steven D. Linscombe

The United States is one of the largest rice exporters in the world with about half its annual production going overseas. Meanwhile, about 12 percent of domestic rice consumption comes from imports, and the majority of those are Jasmine rice from Thailand and Vietnam. To gain a share of the fast-growing, high-value niche market for aromatic rice, LSU AgCenter rice breeders began the development of a Jasmine-like rice that could be successfully grown in Louisiana and other Southern states. This is the story of the development of Jazzman, which released by the AgCenter in 2009, and Jazzman-2, which was released by the AgCenter in 2011.

Xueyan Sha, Associate Professor, and Steven D. Linscombe, American Cyanamid Professor in Plant Genetics/Breeding/Biotechnology, Rice Research Station, Crowley, La.

Most commercial Thai Jasmine rice is produced with two varieties, Khao Dawk Mali 105 (KDML 105) and RD-15. KDML 105 is a tall long-grain rice susceptible to lodging. It is photoperiod-sensitive, which means it flowers only under short daylength. RD-15 is a mutant variety derived from KDM 105, with improved yield and lodging resistance, less photoperiod sensitivity, and slightly inferior cooking and aromatic characteristics compared with its parent variety. Neither variety is available to U.S. rice growers nor adapted to U.S. growing conditions.

In 1989, the Texas Agricultural Experiment Station, in cooperation with the U.S. Department of Agriculture, released Jasmine 85, which was developed at the International Rice Research Institute in the Philippines. It was the only Jasmine variety available in the southern United States. Since then, it has been grown on limited acreage because of its inferior specialty attributes, which include off-white grain color, weak aroma, weak flavor, creamy grain appearance, and the undesirable characteristics of poor and unstable milling yield, rough leaf and sheath, and strong



Xueyan Sha at the Rice Research Station in Crowley. Photo by Bruce Schultz



Jazzman-2 grows in a field at the Rice Research Station in Crowley. Photo by Xueyan Sha

seed dormancy, which means seeds cannot germinate for extended periods after harvest either in storage or in the field. Development of improved Jasmine-type rice varieties adapted to southern U.S. environmental conditions will help the Louisiana rice industry capture a sizable portion, both domestic and international, of the aromatic rice market.

Breeding for commercially viable Jasmine-type rice varieties is far more complicated and difficult than breeding for conventional rice varieties. Typical Jasmine rice has a strong popcorn-like aroma and translucent, slender kernels, an amylose content of 15 to 18 percent and alkali spreading value of 6 to 7, and soft-cooking characteristics. Such specialty characteristics are always placed at the same priority as grain and milling yield. Furthermore, most of them can only be evaluated in the laboratory by sophisticated instruments and trained sensory panels, which also require large amounts of seed. This added complexity demands a larger breeding population and a longer testing time. Unfortunately, because of limited resources, only a fraction of AgCenter rice breeding efforts can be devoted to breeding for Jasmine-

type rice varieties. This left one option – a small but productive Jasmine-type rice breeding program.

Development of Jazzman

To ensure success, a number of approaches were proposed, tested and applied. These included:

- Development of a simple but reliable aroma detection method that can handle a large number of small samples in a timely manner and the intensive or rigorous selection for specialty traits, such as aroma and grain appearance, in the early and mid generations.
- Pre-breeding germplasm through stepwise improvement of specialty and agronomic traits.
- Generation of well-planned recombinant populations among parents that only differ in a few traits.
- Extensive use of the AgCenter's Puerto Rican winter nursery, which is shared with five other U.S. rice-breeding programs (Arkansas, Mississippi, Missouri, Texas and the U.S. Department of Agriculture), to expedite the breeding efforts.

- All of these accumulative measures led to the development and release of the first U.S.-bred, Jasmine-type rice variety – Jazzman – in 2009. Two years later, Jazzman-2 was released for commercial production, with improved specialty profiles. To meet further demands, a number of additional experimental lines with the improvement on grain yield, specialty characteristics and resistance to the Newpath herbicide are in the pipeline and expected to be released in the near future.

Jazzman is a high-yielding, conventional height, Jasmine-type aromatic, long-grain rice with very good milling and excellent grain quality. Jazzman was developed through cross-breeding and modified pedigree selection from the cross 96 a-8/Ahrent made in 1996. Ahrent is a long-grain rice variety of conventional height developed in Arkansas, while 96 a-8 is an unreleased long-grain aromatic rice line with Jasmine-type cooking quality introduced from China.

Jazzman was initiated in the breeding nursery at the Rice Research Station in



Jazzman has a fairly strong aroma, and the cooked rice has a glossy and moist appearance, a soft texture and a flowery sweet flavor.

Crowley in 2002. It was evaluated in the preliminary yield nursery in 2003 and entered into the Cooperative Uniform Regional Rice Nurseries in Puerto Rico in 2004 with the permanent designation RU0402125. Jazzman averaged 40 inches in height in yield tests across Louisiana compared with 37 and 39 inches for Cypress and Dellrose, respectively.

Jazzman is similar in maturity to Cypress but later than Dellrose. The average number of days from emergence to 50 percent heading is 87 for both Jazzman and Cypress and 85 for Dellrose. The grain is aromatic. Jazzman is moderately susceptible to rice sheath blight, bacterial panicle blight and straighthead disorder, and moderately resistant to blast.

Jazzman has the typical Jasmine cooking quality with low amylose content and low gelatinization temperature, which means the cooked rice is soft and sticky. The milled Jazzman rice is similar to the Thai Jasmine rice in grain dimension and slenderness. Jazzman also has similar physicochemical properties and cooking qualities as the Thai Jasmine rice. Jazzman has a fairly strong aroma, and the cooked rice has a glossy and moist appearance, a soft texture and a flowery sweet flavor.

Development of Jazzman-2

Jazzman-2 is a semidwarf, early-maturing, Jasmine-type aromatic long-grain rice with good grain and milling yields and excellent grain quality. It was selected from a 2003 cross 0302195/0302125. The female parent 0302195 is an unreleased Louisiana conventional long-grain line with the pedigree of 9502008//Katy/902207x2, while 0302125 is an unreleased Louisiana Jasmine-type aromatic rice line with the pedigree of Jasmine 85/Della//Leah/Della.

Jazzman-2 originated in the winter nursery in Puerto Rico in spring 2006. It was evaluated in the preliminary yield test the Rice Research Station in summer 2006 and 2007 before it was tested in 2008 with the permanent designation RU0802149. Jazzman-2 aver-

aged 36 inches in height in yield tests across Louisiana compared with 36 for Cheniere and 39 for Jazzman. Jazzman-2 matures earlier than both Cheniere and Jazzman. The average number of days from emergence to 50 percent heading is 83 for Jazzman-2, 86 for Cheniere and 87 for Jazzman.

Jazzman-2 has typical Jasmine cooking quality with low amylose content, low gelatinization temperature and a very strong aroma. The average amylose content of LA2149 is 15.1 percent compared with 15.6 for Jazzman and 24.3 for Cheniere. The average alkali spread value of Jazzman-2 is 6.0 compared to 6.3 for Jazzman and 4.7 for Cheniere. Jazzman-2 is susceptible to rice sheath blight, bacterial panicle blight and straighthead disorder, but moderately resistant to blast.

Future

Assisted by aggressive marketing by distributors and processors like Hoppe Farms, Jazzmen Rice LLC, Louisiana Rice Mill and Falcon Rice Mill, the acreage of Jazzman rice has increased rapidly since the initial release in 2009. Because most Louisiana rice fields are infested by noxious red rice, such rapid acreage expansion will inevitably lead to Jazzman rice being grown in red rice-infested fields. To maintain the pure and premium quality of Jazzman rice, work started in 2009 to breed a herbicide-resistant Jazzman variety by incorporating the AgCenter-invented Clearfield trait into Jazzman varieties through molecular marker-assisted backcrossing and selection. By combining Jazzman varieties with Clearfield technology, the purity of Jazzman rice should be enhanced.

Research is under way for the further enhancement of specialty attributes such as aroma, whiteness, cooked rice texture and kernel slenderness, which will improve Jazzman competitiveness over imported Thai Jasmine rice. Further improvement of yield potential is also essential for further expansion of Jazzman-type rice production in Louisiana and the southern United States. Successful development of Jazzman rice can potentially decrease imports as well as increase exports. ■

Jazzman competes well in aromatic rice market

If you drive by a field of Jazzman rice, its pleasant, nutty aroma is unmistakable. For farmers, the pleasant fragrance is the smell of money.

The LSU AgCenter Rice Research Station developed Jazzman rice varieties to compete with Thai Jasmine.

Of the 600,000 tons of rice imported into the United States annually, more than 60 percent is Thai Jasmine. The Far Eastern variety can only be grown in regions of the world with short day lengths, such as Thailand, something not found in Louisiana's growing season.

But breeding work by Xueyan Sha at the Rice Research Station has led to varieties of rice with taste and smell similar to Jasmine. Sha's work first produced Jazzman in 2009, then an improved version, Jazzman-2, came last year. Sha is now working on a Clearfield version of Jazzman.

Bobby Hanks, chief executive officer of Louisiana Rice Mill, said Jazzman-2 is proving to be a solid competitor to Thai Jasmine. "There's a real good chance the U.S. Jazzman could get a good share of that market."

Hanks said the 2011 Jazzman crop totals more than 11,000 acres in Louisiana, and farmers will get a premium for the aromatic rice. Louisiana Rice Mill contracted with farmers to grow Jazzman-2 for either a flat price or a price of \$5 a barrel more than the price for regular long grain rice.

It is critical that this year's crop do well to produce enough rice to make it widely available, he said. "We need for them to do well this year yield-wise."

Louisiana Rice Mill supplies Jazzmen Rice LLC with its supply of Jazzman.

Andrew Wong of the Jazzmen Rice Company said U.S. Jazzman competes with Thai Jasmine in countries where importing U.S. rice is cheaper than importing Thai rice. The U.S. rice has been exported to Canada and France, he said.

Wong's company, which sells Jazzman rice under the Jazzmen brand, has widespread distribution on the U.S. West Coast. "We will be trying soon to

get into the East Coast," he said. The company participates in culinary trade shows and has attracted the attention of top chefs, including John Besh, of New Orleans.

Jazzmen rice is sold in groceries, and institutional food distributors sell it to restaurants. The company has obtained rights to use the image of the late Louis Armstrong in its trademark. "We spend a lot of money on branding, promoting and marketing it," Wong said.

Falcon Rice Mill of Crowley also sells the Jazzman rice variety.

"We're excited about it," said Robert Trahan, of Falcon. "We've seen increased demand every year. I think we finally have a product that is close to the aromatics."

Last year the company increased its acreage by 20 percent, and this year the acreage will double. "We've sold everything we contract," Trahan said. "We probably could squeeze out more sales, but we only have so much room for storage."

To meet increased demand, Doug and Jerry Foreman, of Lafayette Parish, contracted to grow rice for Falcon this year. Farmer Jimmy Hoppe of Fenton has grown aromatic rice for Falcon for several years.

Hoppe said his sales of Jazzman have increased his rice sales dramatically. "Actually my sales have about doubled, and I've probably picked up a third more customers," he said.

Hoppe increased his acreage of the aromatic rice this year by a third to meet the demand. He also said his farm is now represented by a food service company that supplies specialty stores and groceries along the I-10 corridor.

Hoppe also sells directly to customers who visit his farm. "It becomes not only a sale, but actually an opportunity for me to share what goes on at the farm."

He said it didn't surprise him to hear from a returning customer that they prefer his rice to Thai Jasmine. Hoppe said he explained to the customer that Thai Jasmine is often blended with non-aromatic, long-grain rice.

Kurt Unkel, of Kinder, is a small grower. This year he has 25 acres of Jazzman, and he sells in niche markets, including farmers markets in New Orleans and Baton Rouge. His rice also is available in local food stores and on the Internet.

Last year, Unkel's field was infested with red rice, resulting in a mix of domestic rice and the unwanted plant. But he chose to sell the rice anyway, even pointing out the red rice on the packaging labels.

He said buyers of his rice liked the red rice, and they like the new Jazzman. "My customers like it. I work for them."

■ **Bruce Schultz**



Photo by Bruce Schultz

The rice water weevil life cycle. The insect spends its winters as adults in bunch grasses and leaf litter, often in riparian areas. Adults emerge in the spring and fly to rice fields, where they feed on the leaves of rice and grassy weeds. Mating and egg-laying begin after rice is flooded. Larvae move down to flooded soils, where they pass through four larval stages and a pupal stage in about 30 days. Larvae obtain both food and air from rice roots, and feeding by larvae can result in severe root pruning. Adults that emerge from pupae can fly to new rice fields to begin the cycle of mating, egg-laying and larval feeding anew, or they can return to overwintering sites.





Rice Water Weevils

New Tactics for Managing This Insect Pest

Michael J. Stout, Natalie A. Hummel, Srinivas Lanka, Jason C. Hamm,
Anna Mészáros, W. Ray McClain, Marty J. Frey and Gary C. Barbee

The rice water weevil is the most destructive early-season insect pest of rice in Louisiana. Both the adult and larval stages of this insect attack rice (Figure 1), but, generally, the larvae cause the economic losses by feeding on the rice roots. Infestations of rice water weevil larvae usually begin when rice fields are flooded. Egg-laying by females is strongly dependent on the presence of standing water, and females prefer young rice plants for egg-laying. The immature stages of this pest are spent entirely underground in flooded soils; larvae obtain both food and air from rice roots. In rice fields in south Louisiana, densities of this insect can reach 2,000 larvae per cubic meter of soil. Root pruning by larvae causes reduced plant growth and leads to reduced plant heights, panicle densities and grain weights at harvest.

The extent of economic losses caused by rice water weevils in Louisiana is not fully known, but all available data indicate this insect is one of the most important yield constraints in Louisiana rice. Studies in which yield losses have been correlated with densities of weevil larvae on roots have shown that each larva is associated with a 0.5 percent to 1 percent yield loss. In small-plot studies conducted at the LSU AgCenter Rice Research Station, yield losses from rice water weevils often exceed 25 percent. However, this figure may not accurately represent losses in commercial fields because weevil populations appear to be consistently higher at the Rice Station than at other locations across the state.

Ongoing demonstration tests are helping to clarify the economic importance of this insect. In sampling of commercial rice fields not treated for weevils over the past four years, weevil densities have averaged 10 to 14 larvae per core sample. These data suggest yield losses of 5 percent to 14 percent in fields where the insect is not controlled. Even using the conservative figure of 5 percent yield loss in untreated fields, economic losses from this pest would exceed \$10 million statewide if effective management practices were not available.

Insecticide Use

Before 1998, the only insecticide available for rice water weevil control was Furadan, a granular formulation of the insecticide carbofuran, which was applied to flooded soils several weeks after flooding to kill larvae as they fed on roots. Carbofuran, however, is highly toxic to birds, and its use in rice was banned by the U.S. Environmental Protection Agency in the mid-1990s.

Following this regulatory action, researchers began evaluating new insecticides for rice water weevil management. These new insecticides included several pyrethroids (Mustang Max, Karate Z and Prolex), which targeted the adult rice water weevil, and Icon, an insecticidal seed treatment, which targeted rice water weevil larvae. These new insecticides were quickly adopted by Louisiana

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rice farmers and gave control equal to or better than that formerly given by Furadan. However, the introduction of Icon coincided in 1999 and 2000 with sharp declines in crawfish production in southwest Louisiana, and a class action lawsuit was brought against the manufacturer of Icon alleging that it had contributed to crawfish kills. A \$45 million settlement was reached in 2004 with crawfish farmers, and Icon was withdrawn from the rice market in the same year. This litigation brought about a heightened awareness of the need to consider the effects of practices used to manage the rice water weevil on crawfish production.

Following the loss of Icon from the rice market, agrochemical companies again began to express interest in introducing new insecticides for rice water weevil management. Once again, scientists with the LSU AgCenter played a key role in evaluating the effectiveness of potential new products and in cooperating with industry and state and federal regulatory agencies to bring the new products to market. Small-plot evaluations identified several potential replacements for Icon and the pyrethroids. Since 2008, two new insecticidal rice seed treatments, Dermacor X-100 and Cruiser Maxx, have been introduced for use in rice, and a third seed treatment, NipsIt INSIDE, is expected to be approved in the near future.

An added dimension to insecticide evaluations over the past several years has been testing for effects of insecticides on crawfish. (See article entitled "Making Rice Fields Safe for Crawfish.") A mix of laboratory and field experiments has demonstrated that the insecticides being considered as alternatives to the pyrethroids are much less toxic to crawfish, and it should be possible to more safely integrate the use of these newer products in areas where crawfish and rice are produced in proximity.

Demonstration Trials

The LSU AgCenter insecticide evaluation program is a series of field demonstration tests conducted over the past several seasons on commercial farms across the state. These demonstration tests compared the efficacy of the new insecticidal seed treatments to an untreated check and pyrethroid standards. Efficacy was assessed by counting weevil larvae in root/soil core samples collected four weeks after application of permanent flood. Results of these demonstration tests verify that, under most circumstances, the new seed treatments provide reliable and satisfactory levels of control. The untreated check counts at each site also verified that more than 90 percent of Louisiana rice fields have severe enough weevil infestations to justify an insecticide treatment.

In addition to evaluating the efficacy of new products in small plots and in commercial fields, other studies have been conducted to better characterize how these new insecticides act to reduce densities of weevils on rice plants. This research indicates that the new seed treatments have systemic activity in the plant and that they interact with several life stages of the insect to produce a variety of lethal and sub-lethal effects. Cruiser Maxx protects rice from weevils by killing adults as they feed on leaves, deterring adult feeding and egg-laying, and by killing larvae as they feed on roots. In addition, small-plot field experiments indicate CruiserMaxx stimulates rice germination and growth for some varieties under some conditions. Dermacor X-100, on the other hand, has no effect on adult feeding or survival, but does deter egg-laying and kills larvae once they begin feeding on roots.

Alternative Tactics

Although insecticides remain the primary tactic used against rice water weevils, alternatives to insecticides are

needed to reduce management costs, improve long-term sustainability, and minimize environmental impacts of weevil management. Increased reliance on non-chemical tactics will also reduce adverse effects on crawfish. Over the past decade, LSU AgCenter entomologists have investigated the effects of management practices such as planting date, seeding rate, and water management on the rice water weevil. In small-plot studies, early planting of rice in mid to late March resulted in lower weevil populations, reduced yield losses, and increased effectiveness of insecticides. The benefits of early planting are now being investigated in commercial fields. Other studies investigated the possibility of exploiting the dependence of weevil females on standing water for egg-laying. These water management studies showed that delayed flooding and shallow flooding can help reduce weevil damage, although these practices are not always compatible with optimum disease management or crop management.

Future of Weevil Management

The introduction of new insecticidal seed treatments and demonstration of the effectiveness of several production practices have improved the overall management program for the rice water weevil. However, there is a need for more fundamental research on novel approaches to weevil management such as weevil-resistant rice varieties. An immediate need is for insecticides that can be used in water-seeded rice because insecticidal seed treatments can only be used in drill- or dry-seeded rice. Many producers still rely on draining fields as a primary strategy to control rice water weevils in Louisiana. However, the research on draining has been inconclusive so far, and more research will be conducted. ■

Making Rice Fields Safe for Crawfish

Michael J. Stout, Natalie A. Hummel, Srinivas Lanka, Jason C. Hamm, Anna Mészáros, W. Ray McClain, Marty J. Frey and Gary C. Barbee

Crawfish are Louisiana's most valuable aquaculture commodity, and Louisiana is the only state that produces crawfish for human consumption on a large commercial scale. Approximately 184,000 acres were devoted to crawfish production in 2010, with a total value of approximately \$170 million. Most farm-raised crawfish in Louisiana are produced in parishes in southwest Louisiana, and rice fields and crawfish ponds are often found in close proximity in these parishes; in fact, three of the four largest crawfish-producing parishes in the state are also the largest rice-producing parishes. Moreover, crawfish and rice are co-cultivated by many producers using rotational schemes in which rice fields are transitioned to crawfish ponds by reflooding the rice field after harvest and managing rice stubble for regrowth in late summer or fall.

Crawfish and insects are taxonomically related and share a number of phys-

iological features; as a result, insecticides used to eliminate insect pests such as the rice water weevil can also kill crawfish. In particular, pyrethroid insecticides, which are widely used to control rice water weevils in rice, are extremely toxic to crawfish. There are several routes by which crawfish may be exposed to insecticides applied to rice fields. They may be exposed through drift arising from insecticide applications made to nearby rice fields. In addition, crawfish in ponds used previously for rice production may be exposed to residual insecticides in the soil, and tailwater released from insecticide-treated rice fields may injure or kill crawfish if the water is diverted to nearby ponds.

Since 2005, new insecticides are tested in the laboratory and the field to determine their toxicity to crawfish. Laboratory assays showed that the active ingredients found in the insecticidal seed treatments Dermacor X-100, NipsIt

INSIDE and Cruiser Maxx, while still capable of killing crawfish, are approximately 1,000 times less acutely toxic than pyrethroids. Furthermore, in field tests using crawfish stocked in cages in plots treated with the new seed treatments, none of the pyrethroid alternatives caused crawfish mortalities significantly higher than observed in control plots. Overall, LSU AgCenter studies indicate these new insecticides pose much less of a threat to crawfish than do the pyrethroids.

Another way to reduce the effect of rice water weevil management on crawfish is to rely less on insecticides and more on nonchemical tactics such as early planting and water management. Also, LSU AgCenter researchers are trying to develop rice varieties resistant to rice water weevils, which will further reduce reliance on insecticides for weevil management and will increase the safety of Louisiana's rice fields for crawfish. ■



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Assessing the Efficacy of Releasing Crawfish Back to the Pond for Further Growth

W. Ray McClain, John J. Sonnier and Ricardo O. Ramalho

Louisiana is the largest producer of crawfish in the United States, where some 1,200 farmers harvest in excess of 110 million pounds of crawfish annually from about 184,000 acres of ponds. A large majority of the annual crawfish production is marketed as live or whole-boiled crawfish, with less than 20 percent processed for the tail meat. Large volumes of live crawfish are delivered to metropolitan areas within and outside of Louisiana, such as Baton Rouge, New Orleans, Shreveport, Little Rock, Dallas, Houston, Mobile, Jackson, Memphis and Atlanta. Marketing issues for live crawfish include significant variation in sizes, with the larger crawfish being the most valuable.

Although size grading of crawfish is initially accomplished by the mesh size of the wire-mesh traps, further grading is sometimes accomplished by large volume dealers at dock-side. There are logistical and cost issues with this additional step in handling, however. Some crawfish farmers have begun employing a culling (grading) operation on the boat at the time crawfish are emptied from traps. Harvesting boats are fitted with a bar grader that will effectively cull smaller crawfish from the catch and

allow those to immediately re-enter the pond. The retained crawfish are more uniform in size and easier to sell because of the greater appeal with buyers. The common assumption is that the culled crawfish will resume growth and be recaptured later at a larger, more valuable size.

This practice of using on-board graders has increased dramatically in recent years and often renders further grading at dockside unnecessary. However, the efficacy of this practice is largely unknown because the rate of recapture has not been determined. Little is known about the efficiency of trap harvesting as a means of removing crawfish from the population once they reach market size. Therefore, a series of studies was conducted at the LSU AgCenter's Rice Research Station in Crowley to estimate the percentage of recapture and to better understand aspects of trap harvesting as well as crawfish movements within the pond.

A mark/recapture technique was used in a small commercial crawfish pond and, subsequently, in the experimental pond complex of the Rice Research Station, to ascertain capture efficiency rates using baited traps.

Captured crawfish were marked with a long-lasting, waterproof marker and released back into the pond within two hours of their capture. Bold marks were made on the carapace of crawfish that could be quickly and easily observed. Various colors and/or markings distinguished the date and/or site of release. Subsequent trap catches were observed for marked individuals, which were noted for date and location of capture.

The initial trial was conducted in a 28-acre commercial crawfish pond where 200 mature and 270 immature individuals were marked and released at a central location in the pond. The subsequent harvest was monitored for one week, and only 54 marked individuals (11.5 percent) were recovered. While there was a possibility that molting occurred in some immature individuals (i.e., lost marks), the rate of recapture for mature (nonmolting) individuals was noted at 20 percent – still a low recovery. Some crawfish traveled up to 589 yards, surely passing baited traps, before being recaptured, although the average distance traveled before recapture was 147 yards. Trap spacing typically ranges between 50 and 70 feet between traps.

Trials 2 and 3 were conducted in a



Representative example of one of several types of on-board graders designed to cull smaller sizes of crawfish from the catch in commercial aquaculture ponds. Photos by John Sonnier



Culled or graded small crawfish being returned immediately to the pond for further growth.

contiguous arrangement of 1-acre experimental ponds where “mature-only” crawfish (489 crawfish for Trial 2 and 200 crawfish for Trial 3) were released in selected ponds, and recaptures were monitored from the entire pond complex. Those trials lasted for nine to 12 weeks with an average total recapture rate of 49 percent in Trial 2 and 45 percent in Trial 3. Of those crawfish recaptured, 83 percent in Trial 2 and 97 percent in Trial 3 were caught from the same pond they were released into. Most of the others were captured in adjacent ponds, indicating some movement across a levee. Recapture rates were greatest within the first two weeks of capture, with few crawfish recaptures occurring after four weeks.

For Trial 3, recaptured crawfish were marked with a different identifier and released after each capture. Also for that trial, additional marked crawfish were held in cages within the ponds from the beginning of the trial to estimate natural mortality in the marked population during the experiment. While 45 percent of the crawfish released in Trial 3 were captured only once, 17 percent were captured twice, and 5 percent were captured three times. Adjusted for natural mortality, the recovery rate for first-time recaptures remained at slightly less than 50 percent.

Precise causes for the consistent low recovery (less than 50 percent) in these trials are unclear. Factors that contributed include natural and predator-in-

duced mortality, attrition from the pond population because of burrowing, and individuals exiting the pond. However, these results also seemingly illustrate the inefficiency with which baited crawfish traps remove market-size individuals from the pond population.

In conclusion, based on the results of this study, it appears that only half (or less) of the crawfish released back to the pond are ever recaptured. These findings do not bode well for the practice of releasing less-desired sizes of crawfish back to the pond with the expectation of recapturing them later at a larger, more valuable size. With recovery rates below half, one has to closely examine the economics of such a practice. Thus, it may be far better to sell all crawfish at

the point of first capture, even if a lower price is received for the smaller size grades.

In addition to market-economic considerations, there may be a biological reason to avoid releasing crawfish back to the pond once captured. Those crawfish would only compete with other crawfish for food and space. That would only exacerbate the problem of overcrowding if pond populations were high and food resources were scarce, contributing to reduced growth and lower production. ■

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Typical mark placed on crawfish using a long-lasting waterproof marker prior to its release back to the pond in the mark-recapture study.



Random marked crawfish were maintained in cages under the same environmental conditions in Trial 3 to ascertain natural mortality over the trial's duration.

Bacterial Panicle Blight

An Emerging Rice Disease

Jong Hyun Ham and Donald E. Groth

Rice yield reductions caused by panicle blighting have long been a sporadic and chronic problem in the southern United States including Louisiana, Arkansas, Texas and Mississippi. Cause of panicle blighting remained unknown for a long time, and abiotic stresses, such as high temperatures, were considered as the major factors associated with panicle blighting. In 1996-97, LSU AgCenter research revealed that panicle blight of rice is caused by two bacterial plant pathogens, *Burkholderia glumae* and *Burkholderia gladioli*. These two bacterial pathogens were first reported in Japan as the causal agents of grain rot and seedling blight of rice. In general, *B. glumae* is more frequently isolated in infested rice fields and more virulent than *B. gladioli*. After the etiology of panicle blight was elucidated, “bacterial panicle blight” was selected as the new name of the disease because the term panicle blight had been used in the United States for more than 50 years.

Symptoms of bacterial panicle blight include seedling blighting and sheath rot in addition to panicle blighting, which accounts for most of the damage from this disease. Affected panicles have blighted florets, which initially show white or light gray on the basal third with a dark-brown margin and eventually become straw-colored. The florets then turn dark with growth of fungi or bacteria on the surface. Extensive occurrence of upright panicles because of the failure of grain-filling and seed development is a typical phenomenon observed in a severely infested field. Prolonged high temperature during the growing season is an important environmental condition that promotes the development of bacterial panicle blight. Severe epidemics of this disease, which caused up to 40 percent yield losses in some fields, occurred during the 1995, 1996, 1998, 2000 and, most recently, 2010 growing seasons, when record-high night temperatures were experienced. Suspected global warming could make bacterial panicle

blight a greater threat to rice production in the future. Indeed, occurrence of bacterial panicle blight is increasing not only in the southern United States but in other rice-growing countries of Central and South America and Asia.

The disease cycle of bacterial panicle blight is not fully understood in spite of the economic importance of the disease. The bacterial pathogens are considered to be seed-borne, but they also survive in the soil. After germination of the seed, the bacteria appear to survive on the leaves and sheath and spread upward as the plant grows. Their infection to rice panicles occurs at flowering, if the bacterial population reaches to a threshold level and environmental condition is favorable. They may also be disseminated from severely diseased panicles to neighboring healthy plants, according to the observed spatial distribution patterns of the disease in infested rice fields. However, it is not clear if long-distance dissemination can occur via insect transmission.

Unfortunately, there are few effective control measures for this disease so far. Less nitrogen fertilization reduces disease

severity but has not been successful. High temperatures at the vulnerable period can be avoided by early planting, but this cultural practice would become useless if hot weather comes early in the growing season. No pesticides are currently recommended or allowed for controlling this disease in the United States. Copper compounds are weakly effective but sometimes toxic to the plant. Oxolinic acid (brand name Starner) is useful for seed treatment, and its foliar spray is effective on moderately infected plants, but this chemical is not commercially available in the United States. Use of oxolinic acid can also be limited by the natural occurrence of antibiotic-resistant pathogen strains. Cultivating disease-resistant varieties would be a cost-effective and environmentally friendly way to control bacterial panicle blight. However, rice varieties completely resistant to bacterial panicle blight are not available. Instead, several varieties and lines including Jupiter and LM-1 have reasonably high levels of partial resistance.

The research goal on bacterial panicle blight is to develop effective disease control methods based on better un-



Bacterial panicle blight. Photo by Donald E. Groth

derstanding of the bacterial virulence mechanism and the rice defense system. To achieve this goal, LSU AgCenter scientists are conducting several different areas of research. First, scientists are making efforts to develop new rice varieties and lines resistant to bacterial panicle blight through conventional breeding and line development processes. More than 15,000 lines are evaluated annually to select promising lines showing high levels of disease resistance to bacterial panicle blight and other good agronomic

traits. The partial-resistant rice varieties and lines, such as Jupiter and LM-1, were developed from this program. Second, scientists are conducting genetic and molecular biological studies on the rice disease resistance to bacterial panicle blight. Genetic mapping to identify the rice genes associated with the disease resistance is under way. In addition, the induction of a rice defense system by pretreatment of various chemical materials, which leads to enhanced disease resistance, is being studied. Finally, scientists

are studying molecular genetics and genomics of the major pathogen, *B. glumae*, to understand the mechanism underlying its bacterial pathogenesis in rice. Genetic elements governing the production of virulence factors are being identified and characterized. ■

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Kellogg, Walmart learn about rice sustainability in Louisiana

Representatives from the Kellogg Co. and Walmart saw firsthand how Louisiana rice farmers use sustainable agricultural practices to produce a crop profitably in an environmentally friendly manner.

A June 30, 2011, field day at the LSU AgCenter Rice Research Station was a follow-up to a February planning meeting for a Master Rice Grower program in collaboration with the Louisiana Master Farmer program, Kellogg and Louisiana Rice Mill.

Steve Linscombe, director of the LSU AgCenter Rice Research Station, said the event allowed farmers to show how they are good stewards of Louisiana's natural resources.

Farmers also benefitted from the day, Linscombe said, because they learned the overall goals of Kellogg Company's sustainability effort.

Kellogg U.S. Morning Foods President, David Denholm, said he was impressed by what he saw and heard. "We have a real opportunity to help consumers understand the importance of the sustainable agriculture advancements being made here."

Denholm said Walmart sold 50 million pounds of Kellogg's Special K cereal that uses rice and 20 million pounds of Kellogg's Rice Krispies, for which the rice is grown by Louisiana farmers.

"Kellogg is the single most important customer for rice in Louisiana," said Bill Dore of Louisiana Rice Mill, based in Crowley.

Tres Bailey of Walmart said the corporation has its own sustainability initiative in effect with goals to reduce waste, conserve energy and sell products produced sustainably.

"You are the model in many cases for the best practices in agriculture," he told farmers. "The innovations we saw today are fantastic."

The sustainability movement is not intended to force environmental practices to be used, Bailey said. "This is not meant to be the stick. This is meant to be the carrot approach."

Consumers have become more conscious of products with environmentally sound origins, said Diane Holdorf, Kellogg vice president of environmental stewardship. "They want to know they are doing the right thing."

Sustainability is not a new concept for rice farming and research, Linscombe told the Kellogg and Walmart representatives.

"This station has been working for the past 102 years toward sustainability," he said. "And some of the greatest progress toward becoming more sustainable has come in the past 20 years."

Water quality is a concern in rice production, and more use of farming practices such as drill-seeding has helped farmers address that issue, Linscombe said.

LSU AgCenter rice specialist Johnny Saichuk showed the group a rice field farmed by Buck Leonards and Sam Theunissen. The field was drill-seeded, a practice that was revived with the Clearfield rice technology developed at the Rice Research Station.

Drill-seeding was once the dominant planting technique in Louisiana, but it was replaced by water-seeding with the use of aircraft. Saichuk said drill-seeding uses less water and can be used with conservation tillage methods.

LSU AgCenter agronomist Dustin Harrell told the group about the benefits of laser-leveling and a new soil test for nitrogen that has the potential to allow farmers to reduce the amount of fertilizer needed for a crop. ■ **Bruce Schultz**

EPA and the Louisiana Master Farmer Program

In July 2011, the U.S. Environmental Protection Agency Office of Water sent a memo to all of its Regional Offices urging them to work with states to investigate a Certainty Framework for Agricultural Producers. While still in the investigation stages, this strategy by EPA, if adopted, would offer incentives to encourage producers to voluntarily comply with measures deemed to be effective at reducing nonpoint pollution runoff from agricultural enterprises.

EPA's Office of Water has recently expressed great interest in the Louisiana Master Farmer Program, especially the "presumed compliance" incentive passed unanimously by the Louisiana Legislature in 2005 by Act 145. The office requested details from the LSU AgCenter about the Master Farmer Program and presumed compliance and will investigate how this may be exported to other states to be used as guidance or a template to develop similar programs around the nation. ■ **Ernest Girouard, Coordinator, Louisiana Master Farmer Program**

Residual Herbicides Improve Profits with Clearfield Rice

Eric P. Webster, Tyler P. Carlson and Michael E. Salassi

A rice line that exhibits tolerance to the imidazolinone class of herbicides was released by the LSU AgCenter in 2002 and sold under the trade name Clearfield. Clearfield rice was developed through seed mutagenesis allowing rice lines to be considered nontransgenic.

Imazethapyr is labeled for use in Clearfield rice as Newpath at 4 to 6 ounces per acre applied to the surface as a preplant-incorporated, preemergence or early postemergence treatment, followed by 4 to 6 ounces per acre postemergence applied 10 to 14 days later.

Three years after the introduction of Clearfield rice, another imidazolinone herbicide, imazamox, was labeled for use and sold under the trade name Beyond. This herbicide can be used late season for control of late-emerging weeds or as a salvage treatment without the potential of herbicide carryover to the following year's crop.

In 2011, Beyond was labeled for use as an early-season herbicide choice to replace the second application of Newpath. By planting Clearfield rice and using Newpath and Beyond for weed management, this technology offered the opportunity to control red rice with no effect on the rice crop. Approximately 70 percent of the total rice acreage in Louisiana was Clearfield rice in 2010.

Red rice and other weeds compete with rice, and these weeds reduce grain yield and cause a reduction in milling quality and grade. Red rice is one of the most troublesome weeds of cultivated rice in the southern United States, and it has been recognized as a weed in U.S. rice fields for more than 150 years. Controlling red rice, which is genetically similar to rice, was not possible with traditional herbicides before the development of Clearfield rice.

In addition to red rice and barnyardgrass, a number of other grasses and broadleaf weeds cause problems in growing rice in Louisiana. The most common weeds include broadleaf signalgrass, duckweed, hemp sesbania, spreading dayflower, alligatorweed, Texasweed and Indian jointvetch. Newpath and Beyond can effectively control many key grass weeds in rice, including red rice, barnyardgrass and broadleaf signalgrass. However, the use of Newpath provides minimal control of hemp sesbania and Indian jointvetch. Herbicide mixtures have proved to be beneficial in improving efficacy and broadening the weed control spectrum in Clearfield rice. The use of

herbicide mixtures is favorable to producers because of the increased weed control and reduced application cost.

Several herbicides can be applied at planting or through the three- to four-leaf stage of rice to allow establishment of the crop with minimum weed competition and provide residual control of weeds yet to emerge. Several herbicides labeled for use in this manner include Command, Facet, Grasp and Prowl H₂O. With this in mind, the objective of this project was to evaluate the economical effects of Command, Facet, Grasp and Prowl H₂O applied with the first application of Newpath early postemergence to 1-leaf rice, followed by a second application of Newpath or Beyond 10 days later on Clearfield rice. Data from this study could prove to be essential when considering a herbicide with residual activity in a Clearfield production system.

A study was conducted at the LSU AgCenter Rice Research Station near Crowley. The long grain rice Clearfield 131 was planted at a rate of 75 pounds per acre. The herbicide programs included a herbicide with residual activity – Command at 12.8 ounces per acre, Facet at 0.67 pounds per acre, Grasp at 2.8 ounces per acre or Prowl H₂O at 2.1 pints per acre – in mixture with Newpath at 4 ounces per acre applied early postemergence, followed by a single application of Newpath at 4 ounces per acre or Beyond at 5 ounces per acre applied two weeks later. A crop oil concentrate, Agri-Dex, was added in each application.

Economic analysis was based on an average long-grain rice price of \$0.13 per pound with price deductions based on rice grade. Actual rough rice market prices are adjusted by grade, and these grade price discounts can vary across rice mills. In this study, rice price deductions for grades 1 and 2 were zero. The price reductions for the other grades per hundredweight were: \$0.25 (grade 3); \$0.55 (grade 4); \$1.25 (grade 5); \$1.50 (grade 6) and \$2 (sample grade). Newpath was priced at \$525 per gallon, Beyond at \$605.60 per gallon, Prowl H₂O at \$38.60 per gallon, Command at \$138.15 per gallon, Facet at \$56.80 per pound, Grasp at \$1,362.60 per gallon and Agri-Dex at \$15 per gallon. Profitability of the herbicide programs was determined by evaluating the total value product, which was calculated by multiplying the rice yield by the rice price of \$0.13 per pound. Net returns above herbicide cost were also evaluated, where the net returns equal the total value of rice minus the herbicide program cost.

Compared with the standard program of two applications of Newpath, none of the soil-residual herbicides evaluated in this study increased Texasweed control. However, increased control of red rice, barnyardgrass and alligatorweed was observed with programs that included Facet or Grasp. This increase in control indicates the importance of incorporating herbicide mixtures to the standard Newpath program in

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Clearfield rice. The increase in broad-spectrum weed control with the addition of a herbicide with residual activity can be beneficial to producers by increasing weed control with little increase in herbicide cost and no increase in application cost.

Rice treated with the standard program had a rough rice yield of 5,520 pounds per acre, a milling yield of 65 percent whole over 71 percent whole plus broken rice kernels, and a rice grade of 3. Herbicide programs that included Command, Facet or Grasp followed by Beyond resulted in an increase in rough rice yield of 910 to 1,490 pounds per acre, compared with the standard program. However, no difference in milling yield or rice grade was observed for all herbicide programs evaluated. Little to no difference in yield was observed with Beyond applied following any herbicide with residual activity, compared with Newpath applied following an application of the same residual herbicide, except for Command. Herbicide programs that included Facet or Grasp increased rough rice yield, compared with Command or Prowl H₂O programs. This research indicates that the addition of Facet or Grasp in mixture with Newpath followed by Newpath or Beyond resulted in increased rough rice yield because of the increased broad-spectrum weed control observed with these herbicide programs (Figure 1).

Profitability of these herbicide programs can be determined by evaluating the total value product, which was calculated by multiplying the rough rice yield by the price of rice. Therefore, the impact of the herbicide programs evaluated on rough rice yield and quality will directly affect total value product. Also, the net returns above herbicide cost can be calculated by subtracting the cost of the herbicide program from total value product. The standard program resulted in a total value product of \$717.60 per acre. The cost for the standard program was \$35.05 per acre, resulting in net returns above herbicide cost of \$682.55 per acre. Herbicide programs with Facet or Grasp resulted in an increase in total value product of \$179.40 to \$193.40 per acre, compared with the standard program. A similar trend was observed when evaluating the net returns above herbicide cost. Herbicide programs of Facet or Grasp increased the net returns by 21 percent to 23 percent (Figure 2), compared with the standard program. Also, with a given soil residual herbicide, total value product and the net returns above herbicide cost were similar when Beyond was applied as the second herbicide application compared with Newpath applied as the second herbicide application.

When comparing herbicide programs that included a herbicide with residual activity, total value product was greater with programs that included Facet or Grasp, compared with Command or Prowl H₂O programs. These data indicate that Facet or Grasp in mixture with Newpath followed by Newpath or Beyond resulted in increased profits, even though cost of

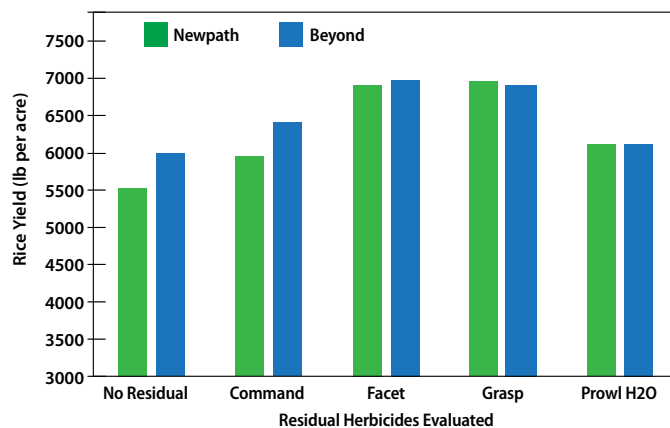


Figure 1. Rice yield with Newpath plus residual herbicides applied early postemergence followed by Newpath (red) or Beyond (yellow).

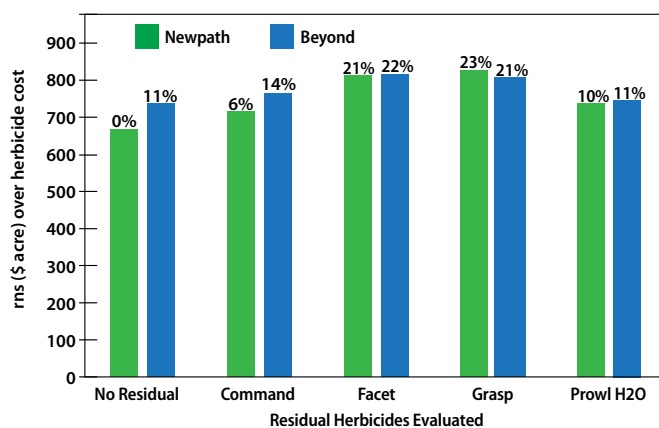
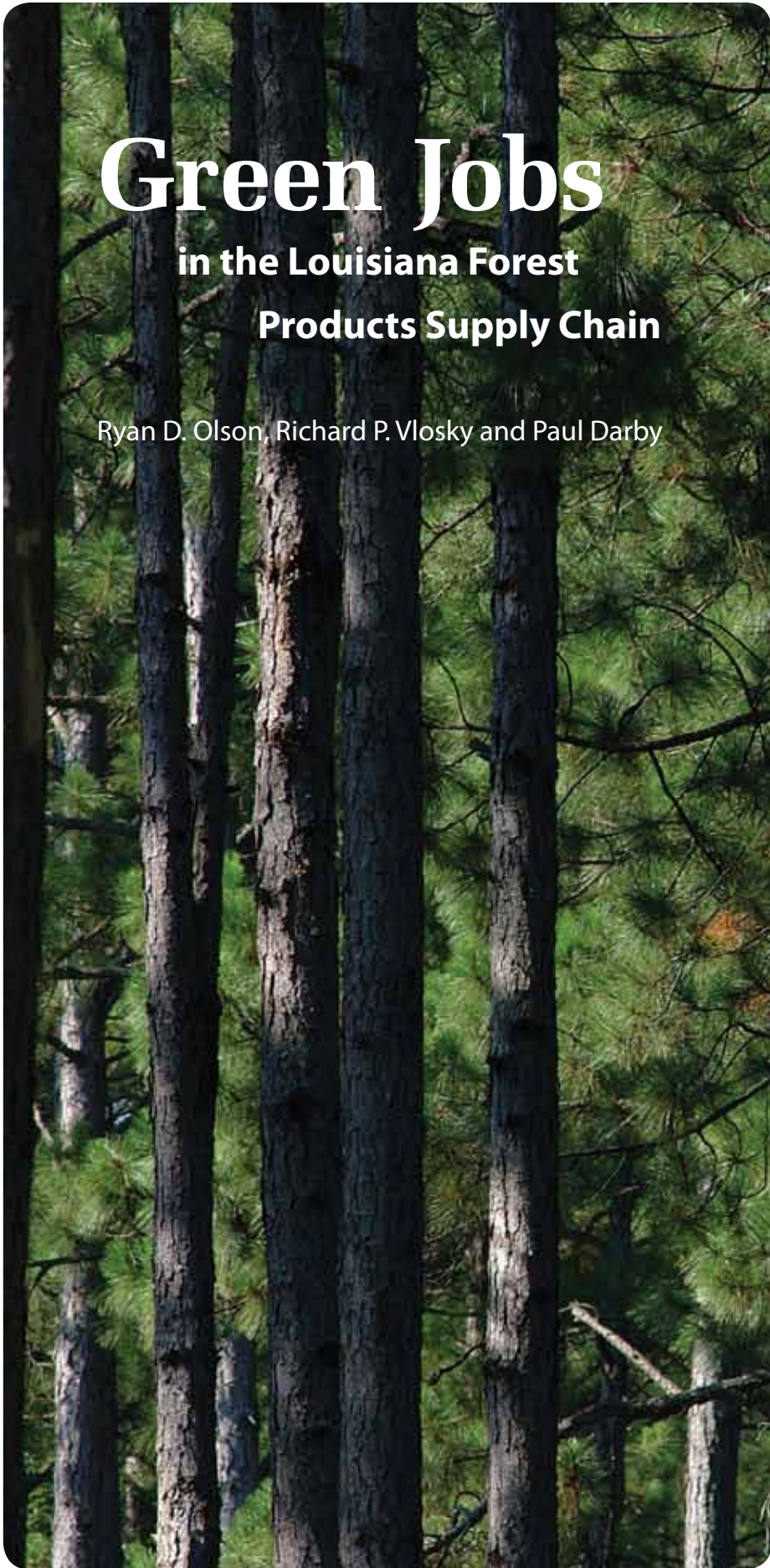


Figure 2. Net returns above herbicide cost with Newpath plus residual herbicides applied early postemergence followed by Newpath (red) or Beyond (yellow). The percent increase in returns over herbicide costs are listed above each bar, compared with standard program of Newpath followed by Newpath with no residual herbicide.

treatment increased. This increase in profit was due to increased weed control and higher rice yield (Figure 1) increasing total value product, which overcame the additional herbicide cost (Figure 2).

In conclusion, the addition of Facet or Grasp in mixture with Newpath applied early postemergence followed by Newpath or Beyond applied postemergence 14 days later proved to be beneficial in a total weed management program. However, with any given herbicide with residual activity, applying Beyond in the second herbicide application instead of Newpath resulted in little to no economic advantage, except with Command. Herbicide programs evaluated in this study resulted in higher rough rice yields and economic benefits when the initial application included Facet or Grasp, which maximized overall economic returns.

Increased weed pressure, even for a short period of time, decreases rice yield. Therefore, producers should treat weed problems early, thus reducing weed competition, which allows rice to produce higher yields and, thus, higher profits. In this study, economic returns were increased by 21 percent to 23 percent when Facet or Grasp was added to the first application of a standard Newpath program. ■



Green Jobs

in the Louisiana Forest Products Supply Chain

Ryan D. Olson, Richard P. Vlosky and Paul Darby

Forests in the United States represent 751 million acres of private and public land. This figure has remained relatively stable since 1910. In Louisiana, forests cover 14 million acres, representing 50 percent of the state's land area. The U.S. forest sector plants about 1.5 billion seedlings each year, including 128 million seedlings by industrial and non-industrial Louisiana landowners alone.

The U.S. Bureau of Labor Statistics defines green jobs as those that produce goods or provide services that benefit the environment or conserve natural resources or jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

For a particular job to be considered green, 50 percent or more of an employee's time must be spent participating in one or more of seven green-jobs categories.

- Education, Public Awareness and Compliance
- Energy Efficiency
- Green Certification
- Greenhouse Gas Reduction
- Pollution Reduction and Cleanup
- Recycling and Waste Reduction
- Renewable Energy

Green jobs include employees who oversee reforestation and land management and the production and use of wood fuels along with recycling and waste reduction. Other green activities that have potential to create jobs are production of energy-efficient products, education and training, and green certification.

The nature of the Louisiana wood products supply chain suggests a high potential for employment across a variety of green job activities. The supply chain consists of foresters who manage forest resources, loggers, processors of wood into finished products and distributors. LSU AgCenter researchers sent a mail survey to all 4,968 known members of the Louisiana wood products sup-

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ply chain. This was the first attempt to understand green jobs and their growth potential in Louisiana's forest products industries. The survey did not include forest landowners; the supply chain began with loggers and ended with wood and paper products distributors and brokers.

To explore possible misconceptions about what constitutes a green job, each respondent was asked to identify specific green jobs across the seven categories within their company. Table 1 includes examples of what are and aren't green-

job activity descriptions. Of the 166 unique green activity descriptions submitted by respondents, 81 percent were categorized accurately. Misconceptions exist not only in the reporting of green activities but also in reporting the number of employees whose primary job falls into a green-activity category. Misconceptions about green-job activities cause a dilemma because to participate in further development of green activities in the forest sector, companies must understand what constitutes a green activity and the effects green jobs

have on society. Companies should be educated on green activities and their development. Without proper education and understanding, green remains just a word tied to feel-good emotions.

Survey respondents accurately reported a total of 667 green jobs. Divided by the total number of respondents, this represents an average of 2.7 green jobs per company. Extrapolating the number of green jobs per participating company by the total number of companies implies total green employment in the Louisiana forest products supply chain

Table 1. Examples of accurate and inaccurate green-job activity descriptions

Green-job category	Accurate green-job activities	Inaccurate green-job activities
Education, public awareness and compliance	Education director coordinates training for association members	Safety officer
Energy efficiency	Insulating homes	Every employee practices energy efficiency in office
Green certification	Leadership in Energy and Environmental Design and Forest Stewardship Council certifications	Each employee in a certified operation
Greenhouse gas reduction	Carbon capture and sequestration research	Hybrid fleet drivers
Pollution reduction and cleanup	Manage facility's storm water runoff	Maintains cleanliness of repair shop
Recycling and waste reduction	Pick up, price, display and sell recycled materials	Every employee participates in office recycling
Renewable energy	Fuel grinding operations	Each employee in a facility that uses renewable energy

Table 2. Respondent attitudes toward green activities. (n=242)

	Yes	No	Don't know
Has your company ever requested green products from a supplier?	42%	49%	9%
Have your customers ever requested green products?	46%	45%	9%
Are green practices a priority to your company?	31%	58%	11%
Do you believe green practices add value to your company?	53%	27%	20%
Do you believe sustainability is important to your company?	80%	8%	11%
Does your company prefer suppliers with green certification?	25%	52%	22%
Is your company willing to incur additional costs to provide green jobs?	15%	63%	23%

is 13,199 individuals. Using an average green-job wage in Oregon's forest sector of \$18.73/hour as a proxy, an estimated \$494.3 million in total annual wages can be attributed to all green jobs in the Louisiana forest products sector in 2011.

An understanding of what drives green-job creation is important for economic development and employee training. A scale was used to determine which drivers influence green-job creation. As seen in Figure 1, for respondents, the most likely drivers of green-job creation are increased profits and government incentives. They were followed in order from most likely to least likely by environmental protection, state regu-

lations, federal regulations, creation of quality jobs, company values and public perception. The only driver that fell into the unlikely category was corporate mandate.

While companies like the sound of green, the nature of business is turning a profit and realizing the highest possible return on an investment. This is where public and government intervention comes into play. Without the public behind them and without governmental approval, companies will have a hard time realizing success in terms of profits. To determine attitudes toward specific green activities, survey respondents were asked seven questions pertaining to

different green products and practices. Table 2 illustrates the responses to each of these seven questions.

When asked about sustainability, a term that is much more familiar and well-understood to members of the forest sector, almost every respondent expressed a positive attitude. Finally, when asked, "Do you believe green practices add value to your company?" a majority of respondents agreed. This offers confidence in the continued development of green activities in the Louisiana forest sector.

Among the conclusions that may be drawn from this study, education is necessary to convey an unbiased and

Louisiana's Nursery and Landscape Industry Needs Bark and Forest Products

Allen D. Owings, Regina Bracy and Edward W. Bush



The nursery and landscape industry has many uses for bark.
Photo by Johnny Morgan

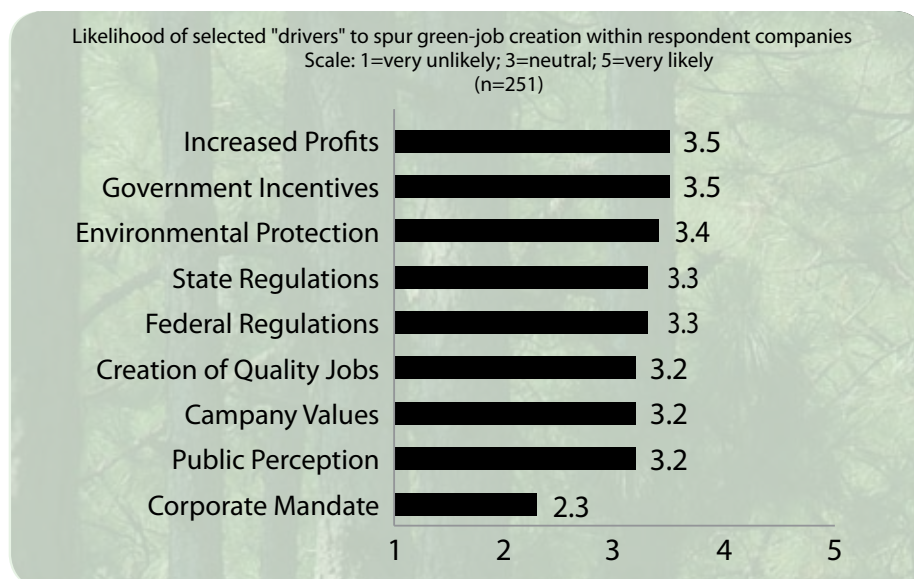
Tree and plant bark and similar resources are widely used in the Louisiana nursery and landscape industries and across the southeastern United States. At one time bark was considered a waste product of the timber industry until land-grant university research in the 1970s developed its use as a potting medium.

From using bark as a growth medium in container-grown nursery crops, to mulching our signature live oak trees, to the use of bark and similar materials in landscape soil and as square-foot-gardening media, this product is a valued and needed commodity for growers, landscape contractors, retail garden centers, arborists and home gardeners. In Louisiana, approximately 2 million cubic yards of bark-related products, in bulk and bagged forms, are used annually in the ornamental horticulture industry.

In late winter 2010, the U.S. Department of Agriculture proposed a Biomass Crops Assistance Program. This new program would provide financial support to producers or entities that deliver eligible biomass material to designated biomass conversion facilities for use as heat, power, biobased products or biofuels. This government subsidy program significantly reduced availability of wood-mill-based materials – such as bark, soils with bark additives and mulch material – all of which are widely used in the nursery and landscape industries.

Although this program may have positively affected the forest industry, it severely and negatively affected the horticulture industry. Temporary bark shortages left growers and landscapers pursuing new and additional bark resources. Retailers that sell bark and landscape soil in bags and by the cubic yard to home gardeners also were affected. The bark supplies that were avail-

accurate understanding of green jobs and the green activities that make them possible. It is promising that companies understand the value of green activities. However, if incremental costs are incurred to increase green jobs, there may be a negative effect on a company's bottom line. Sixty-three percent of respondents are unwilling to incur these costs. Many people suggest that government intervention in the form of incentives and regulations may be necessary to realize substantial green-job growth in the future. ■



able carried significant price increases, and some supplies that were available had greatly reduced quality. This action came at the worst time of year for the horticulture industry during spring when the majority of bark resources are bought, sold and used.

This action, which has now stabilized and has been capped via congressional action for the short term, made horticulture industry businesses even more aware of the current and future issues facing bark, mulch and media supplies. Nursery use of bark materials is lower than in previous years due to the economic slowdown and downsizing in production. Louisiana and other states in the Southeast, however, are showing significant nursery production increases in 2011 with more planned for 2012, so the availability of quality bark and other wood materials must increase in the next six to 18 months. Landscapers and home gardeners also continue to use mulch, bark and similar materials in increasing quantities.

The LSU AgCenter and many other land-grant universities are involved in alternative nursery media research, mulch studies, recycling forestry waste products and other applied efforts to provide affordable, quality bark, mulch and landscape soil for the horticulture industry. In Louisiana and other states, municipal and home yard waste material is being converted for use in horticultural operations.

Natural Resources Recovery in Baton Rouge is a good local example. Research being conducted at the LSU AgCenter is focusing on:

- Finding alternatives to the use of pine bark. Examples include whole-tree products, hardwood bark from oak and cottonwood, and combinations of these products. Many projects show these alternative media, when mixed in the correct proportions, fertilized properly and irrigated appropriately, can produce acceptable growth in container shrubs and trees.
- Developing fertilization practices to adjust chemical components in alternative media to produce desired pH ranges and nutrient availability for maximum plant growth. This includes the application of amendments such as sulfur, iron sulfate, copper sulfate, gypsum, Epsom salts and others to supply nutrients needed for optimum production. Many times, production costs can be decreased and applications of dolomitic lime for pH modification can be reduced or eliminated.
- Modifying particle-size distribution – an important and often overlooked physical property of nursery media – in hardwood bark can produce ornamental plants that were believed for many years to not have the capacity to be grown well in hardwood media due to pH and physical property issues.

Depth-of-mulch studies are beginning to show ideal mulching depths for Southern live oaks and other shade trees. Many times 6 inches to 8 inches of hardwood mulch or similar materials are used in landscapes when research shows that a 4-inch mulch depth is best. This could result in a 50 percent reduction in mulch use in some urban forestry areas.

In these times of reduced availability of quality mulch materials, bark and related amendments for landscape soil and bark for container production, users need to plan in advance and possibly schedule some production practices, landscape installations and other horticultural activities for times when bark materials will be available. Many commercial growers face the prospect of getting bark deliveries from multiple suppliers when a single supplier would have handled demand in the past. The quality of materials also needs to be checked on a regular basis. This includes physical properties of the materials (such as particle size distribution and water-holding capacity) as well as pH, stage of decomposition, product stability, uniformity from load to load, fungal activity, salt concentration and more. ■

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Super Plants Boost Louisiana Economy

Regina Bracy, Allen D. Owings and Dan Gill

The Louisiana Super Plant program debuted in the fall of 2010 as an ornamental plant marketing program for Louisiana. Its purpose is to benefit all sectors of the nursery and landscape industry in Louisiana, which employs more than 56,000 individuals and contributes more than \$2.2 billion annually to the Louisiana economy. The industry includes wholesale producers, retailers (independent garden centers and farm supply stores), landscape contractors, landscape architects (designers), horticulture maintenance firms, arborists and golf courses.

Traditionally, marketing programs have been regional and national in scope and developed and directed by private companies. Plant introductions, such as Encore azaleas and Endless Summer hydrangea, which have been supported by marketing campaigns, have had a better rate of adoption than similar plants that lack this promotional effort. Programs such as Proven Winners by EuroAmerican Propagators have been effective in increasing sales of plants developed and marketed by the respective companies. Participation, however, requires enrollment in the program and payment of royalty fees – limiting participation to larger growers and retail outlets.

Another drawback with these company-directed programs is the large geographic area their programs encompass. Plants that proliferate in some areas may

not do well in Louisiana. Louisiana's heat and humidity are tough on plants, and most plants recommended for northern and western locations will not perform well here. Evaluations and recommendations need to be specific to the locale in which the plants will be grown and marketed.

Marketing programs that are state-based – such as Mississippi Medallion, Texas Super Star and Georgia Gold Medal Winners – have been successful in identifying and marketing outstanding plants in their respective states. Many of these programs use university research to provide accurate plant selection and are effective in increasing brand recognition and sales.

The goal of the Louisiana Super Plants program is to develop a marketing program specific to Louisiana that benefits the nursery and landscape industry regardless of the size of the operation. Funding for this project was provided through the Louisiana Department of Agriculture and Forestry with U.S. Department of Agriculture Specialty Crop Block Grant Program funds.

The Louisiana Super Plants program has three parts. The first identifies outstanding plants.

The second makes sure the plants are available at retail nurseries and garden centers. The third gets the word out about these great plants to Louisiana gardeners.

Each Super Plant must have at least two years of rigorous evaluations and have a proven track record under north and south Louisiana growing conditions. Louisiana Super Plants must prove hardy across the state. If they survive the cold in south Louisiana, they must also survive in north Louisiana. Louisiana Super Plants must be easily produced and available for all nursery and landscape industry wholesalers and retailers to market and sell.

Louisiana Super Plants are selected two years in advance of release. The Louisiana Super Plants Selection Committee, composed of LSU AgCenter personnel, selects plants based upon observations made in replicated plots and demonstration trials across the state.

The Louisiana Super Plant Advisory Committee, which is composed of producers, retailers and landscapers from across the state, meets with the Plant Selection Committee for further scrutiny of the plant's landscape ability and marketability. This selection process gives each Super Plant the combined rating of university-tested and industry-approved.

To ensure that Louisiana Super Plants selections are available at retail nurseries and garden centers, the Louisiana Super Plants Selection Committee works closely with Louisiana wholesale growers to ensure they produce plenty of the selected plants. At the same time, retail sellers are kept informed of the selections and are encouraged to carry them in their garden centers and nurseries. In addition, logos and signs containing plant photos and growing information are provided to nurseries and garden centers to help customers find and choose Louisiana Super Plants.

Gardens are an important part of the evaluation program and visual and tactile billboards for promoting Louisiana Super Plants. The gardens at the Hammond Research Station are the primary location for plant evaluations of future Louisiana Super Plants. The gardens also provide a visual display of the complete collection of Louisiana



Flower plots at the Hammond Research Station.



Columbine



Columbine



Viola Sorbet will be a Super Plant in the fall of 2012. Photos by Igor Kamalov

Super Plants and are used as a tool for educating homeowners, students and professionals.

Super Plants are displayed around the grounds at LaHouse in Baton Rouge. This model home built by the LSU AgCenter is a teaching facility that includes an environmental landscape and provides another highly visible, heavily trafficked showcase for Louisiana Super Plants. The AgCenter has a network of enthusiastic gardeners in its Louisiana Master Gardeners Association. Several Master Gardener associations have established Louisiana Super Plants gardens in their parishes.

Commercial ornamental horticulture is the largest specialty crop industry in Louisiana.

There are currently 152 nursery and landscape industry businesses partici-

pating in the Louisiana Super Plants promotion. There is great potential to increase this number.

Louisiana Super Plants was developed to identify and market outstanding plants and ultimately increase sales, and the program has been successful. After the initial launch in fall 2010, one wholesale nursery reported sales of Super Plant Amazon dianthus were 145 percent greater than the previous year. An independent retail garden center in the Baton Rouge metropolitan area reported a 1,920 percent increase in Super Plant Camelot foxglove sales. Super Plant Shishi Gashira camellia sales at a wholesale grower were up 45 percent.

Not only did Louisiana Super Plants increase consumer awareness of plants that do well in Louisiana, but it also increased consumer interest, resulting in

Louisiana Super Plants

Fall 2010

- Dianthus – Amazon series
- Foxglove – Camelot series
- Camellia ‘Shishi Gashira’

Spring 2011

- Angelonia – Serena series
- Pentas – Butterfly series
- Vitex ‘Shoal Creek’
- Gardenia ‘Frostproof’

Fall 2011

- Columbine – Swan series
- Kale ‘Redbor’
- Rose ‘Belinda’s Dream’
- Southern Sugar Maple

Spring 2012

- Begonia – BabyWing series
- Cleome ‘Senorita Rosalita’
- Hydrangea ‘Penny Mac’

add-on in addition to sales of the promoted plants. Increased traffic through the garden centers because of customers looking for Louisiana Super Plants was also reported.

The benefits of the Louisiana Super Plants marketing program are both short- and long-term. In other state-based programs, plant sales were most significant during the initial year of selection, but wholesale and retail operators reported continued interest and sales for five years after a plant had been identified in the marketing program.

Although the Louisiana Super Plants promotion has been well-received by consumers and industry professionals alike, it is still in its infancy. Logo recognition takes time to become ingrained in the consumers’ consciousness but is critical to the long-term success of the Louisiana Super Plants program. The Louisiana Super Plants Selection and Advisory Committees will continue to evaluate and select plants for Super Plant status. ■

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Internet Use by Louisiana Farming Operations and Farm Households

Hiroki Uematsu and Ashok K. Mishra

The Internet allows people access to a vast amount of information in a wide variety of formats at considerably lower costs in much shorter time than ever before. The Internet has removed geographical and time constraints in information gathering. People can access information whenever they need it from wherever they have an Internet connection. The Internet is becoming an increasingly important management tool in production agriculture. An increasing number of U.S. farmers go online to purchase inputs, sell farm products directly to consumers, submit applications for government programs, and keep up with changes in agriculture.

This article summarizes Internet use by Louisiana farmers and farm households using data from the 2009 Agricultural Resource Management Survey conducted by the National Agricultural Statistics Service and the Economic Research Service.

In 2009, 63 percent of U.S. farmers reported they had Internet access. Of those who had Internet access, 80 percent reported using a high-speed connection. These figures are significantly lower in Louisiana. A little over half of Louisiana farmers reported having Internet access, and 76 percent of them connected via high-speed Internet. In Louisiana, 72 percent of the farm Internet users accessed the Internet from a farm residence or office, which is close to the national average of 74 percent. A desktop computer was the most popular form of Internet access both in Louisiana (66 percent) and nationally (77 percent).

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Louisiana farmers, on average, paid \$53 per month for Internet access in 2009, which was slightly more than the national average of \$51. The relatively low rate of Internet adoption and the higher average expenses among farm Internet users in Louisiana could be due to a supply-side issue; it is more expensive to subscribe to Internet services in rural Louisiana because of low availability of Internet services, which decreases Internet adoption among farm households.

What do farmers use the Internet for?

Of those farmers who had an Internet connection in Louisiana, 65 percent read farm news online. The percentage was similar in the neighboring states of Arkansas and Mississippi (63 percent), but lower than the national average in 2009, which was 73 percent. The same holds true for use of farm commerce via the Internet. While 36 percent of farmers made use of the Internet for commerce across the country, only 30 percent of them did so in Arkansas and Mississippi. The percentage was much lower in Louisiana (11 percent).

Internet use and operator characteristics

In 2009, farmers who used the Internet were younger, more educated or had fewer years of farming experience than farmers who did not use the Internet. Nationally, 46 percent of non-Internet users were 65 years old or above, compared to 23 percent who used the Internet (Figure 1). Only 27 percent of the farmers who did not use the Internet had a college degree or beyond, in contrast to 60 percent for farmers who used the Internet. Of those farmers who had 20 or fewer years of farming experience, 75 percent used the Internet. This relationship reverses for more experienced farmers. Of the farmers with 41 years or more experience on the farm, 34 percent used the Internet.

These trends were also indicated in Louisiana. Figure 1 shows that in Louisiana, a higher percentage of farm Internet users were aged 44 years or younger (27 percent), compared with non-Internet users (11 percent). Only 12 percent of the farmers who used the Internet had less than a high school education, while that figure was 24 percent for nonusers. Only 1 percent of

Figure 1. Operators' Age by Users and Nonusers of the Internet.

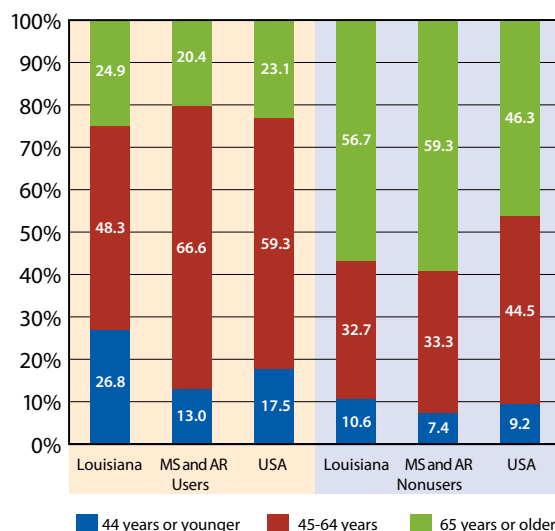
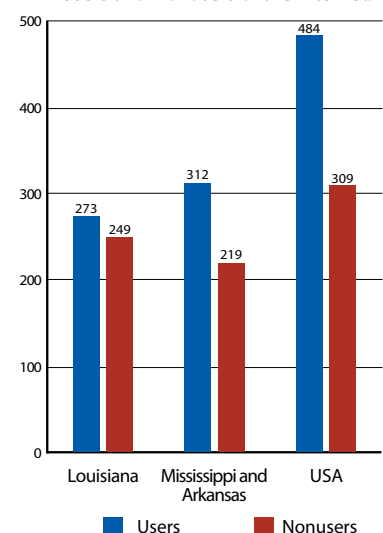


Figure 2. Average Acres Operated by Users and Nonusers of the Internet.



Louisiana farmers who used the Internet had 41 years or longer farming experience, in contrast to 22 percent for nonusers.

Internet use and farm characteristics

Use of the Internet was associated with farm characteristics such as total operated acres and farm sales. Farm Internet users, on average, operated more acres both in Louisiana and nationally than did nonusers. In 2009, Louisiana farmers who used the Internet operated an average of 273 acres, approximately 10 percent more than farmers with no Internet access (249 acres). The difference between users and nonusers of the Internet, however, was more prominent in other regions of the country. For example, in Arkansas and Mississippi, Internet users on average operated 42 percent more acres than nonusers; the difference is even more striking on the national level where Internet users operated an average of 484 acres, 56 percent more than nonusers (309 acres) (Figure 2).

Farm Internet users had higher average farm sales than nonusers. Nationally, about 20 percent of Internet users had annual sales of \$100,000 or more, while only 11 percent of nonusers were in this category. In Louisiana, 16 percent of Internet users and 8 percent of nonusers had annual sales of \$100,000 or more. In contrast, 57 percent of Internet users on the farm nationally had annual sales of less than \$10,000, compared to 63 percent nonusers. In Louisiana those numbers were 64 percent of users against 69 percent of nonusers.

Similarly, farm Internet users have higher average household incomes, a combination of on-farm and off-farm income, in all three regions considered. While farm Internet users have higher average off-farm income than nonusers in Mississippi and Arkansas and nationally, nonusers have much higher average off-farm income in Louisiana. A possible reason may be that traditional agriculture and marketing channels still play an important role in the Louisiana farm economy. It seems there was no clear association between Internet usage and off-farm income in 2009.

Conclusions

Although the Internet has drastically transformed the way farm business is carried out in the United States, the impact of the Internet on various aspects of farm business management seems to be less apparent in Louisiana as of 2009. Relative to the national average, the percentages of farmers having Internet access and Internet users having a high-speed connection are lower in Louisiana. Both in Louisiana and nationally, the majority of Internet users on the farm go online using desktop computers from a farm residence or office. They tend to be younger, more educated or less experienced but operate larger acreages, record higher farm sales or have higher house-

hold income than farmers who do not use the Internet.

More Louisiana farmers need high-speed Internet access to keep up to date with the latest developments in agriculture and stay competitive. Furthermore, the LSU AgCenter and other land-grant universities need to conduct more educational outreach programs through the Internet. These farmers will seek solutions to technical problems, determine agricultural marketing strategies, and seek to improve farm profitability via the Internet. Additionally, farmers will need assistance in all aspects of website development for an e-based agricultural business. ■

Farmers, crop consultants rank face-to-face communication as best

A recent study examined the preferences of Louisiana farmers and crop consultants related to acquiring agricultural information. A secondary purpose of the study was to determine how farmers perceived LSU AgCenter information sources on accuracy, awareness and usefulness.

Data for the study were obtained through surveys completed by 176 farmers in early 2011 and 32 crop consultants who completed an online survey.

Both groups had a preference for interpersonal communication sources over mass media sources. Overall, farmers' preferred source was crop consultants followed closely by AgCenter personnel and print materials. For crop consultants, their preferred sources were AgCenter personnel, other crop consultants and AgCenter print materials.

When comparing the usage of mass media sources, both groups scored these sources significantly lower than the interpersonal communication sources. Radio and television, newspapers and periodicals were consistently in the bottom half of the ratings.

The study sought to determine whether there were preferences among information sources when specific components of farming were analyzed. These components were crop variety selection, cultural practices, pest management issues and market issues.

For the producers, crop consultants

were the most preferred source followed closely by AgCenter personnel and print materials for crop variety selection, cultural practices and pest management issues. There was no consensus source for market issues.

For consultants, the most preferred source for cultural practices was a tie among AgCenter personnel, other crop consultants and AgCenter print material. For crop variety selection, other crop consultants were the most preferred source followed by the AgCenter. For pest management issues, AgCenter personnel was the most preferred source followed by other crop consultants and AgCenter print materials. Crop consultants were not measured on the component market issues.

Farmers were highly aware of information offered by the AgCenter, except for radio and television segments. Crop consultants were extremely aware of the AgCenter website.

Both farmers and consultants used AgCenter information sources often for issues related to crop variety selection, cultural practices and pest management issues. Producers sometimes used AgCenter information sources for market issues, but consultants rarely did.

Farmers rated AgCenter information as highly accurate. Consultants rated parish extension agents and television and radio segments as moderately accurate.

■ Craig Gautreaux

Advances in Nanoengineering

Cristina Sabliov, Todd Monroe and Dan Hayes

Protection: bioactive material protected against degradation during storage and delivery

Targeting: nanoparticles are targeted to the site of action



Controlled release: occurs by diffusion of bioactive materials and degradation of the chemical matrix

Enhanced bioavailability: improved due to nanoparticle size and controlled release abilities

Illustration by Matt Faust

While agricultural engineering has traditionally been employed for large-scale monitoring, application and production, many new discoveries at smaller scales are improving our knowledge and application in agriculture. The LSU AgCenter Department of Biological and Agricultural Engineering has a diverse set of research programs integrating biology and engineering, with approaches that span dimensions from molecular systems to ecosystems and are equally broad in areas of implementation.

The application of nanotechnology to biological systems has great potential for improving health care, food science, homeland security and energy production. Nanotechnology can be thought of as the design and synthesis of functional systems at the molecular level, where sizes are measured in nanometers – a billionth of a meter. Nanotechnology has had profound effect on material science, from newer computer processors based on nanofabrication that run faster, to stronger and safer construction materials.

The field of biology is naturally ripe for nanotechnology implementation, as the building blocks of our genetic code and the proteins critical to all living systems are literally molecular machines. The AgCenter focus on bionanotechnology research includes developing nanoscale probes for genetic therapies and next-generation antimicrobials, and

designing and developing nanodelivery systems for vitamins, antioxidants, antimicrobials, DNA and drugs.

Because they are smaller than cells, nanostructures can penetrate deep into tissues through fine capillaries and generally are effectively taken into cells, allowing for efficient delivery of therapeutic agents to target sites. Next-generation, multi-functional nanostructures with controlled physical properties are being developed for encapsulating drugs and other bioactive components and releasing them in targeted tissues. The expected outcomes include reduced toxicity, improved cellular uptake and enhanced effectiveness of the delivered active agent for disease prevention and improved medical treatment.

The development of nanocarriers with enzymes to be reused in bioenergy conversion processes may greatly increase efficiency and affordability of renewable energy processes.

These nanobioengineering approaches in the AgCenter are funded by the National Science Foundation, National Institutes of Health and the U.S. Department of Agriculture.

Food Nanotechnology

The effect of nanotechnology on the food sector is expected to be wide-ranging. Researchers and industry experts

envision better-quality and safer foods with enhanced nutritional and health benefits through nanotechnology. It is critical for food nanotechnology applications to demonstrate superior benefits that outweigh risks to ensure their acceptance by the food industry and the public. Limited information on the health and environmental risks associated with nanosize food materials has hampered immediate adoption in food applications and has triggered public interest and concern regarding the associated health risks of nanomaterials for food use. With the right science-based information on associated risks and benefits, however, the future of nanotechnology in foods is expected to be bright.

Different types of nanoparticle have been developed to deliver vitamins, antioxidants and other beneficial bioactive materials. The advantages of nanoparticles include protecting bioactive compounds from degradation, targeting and controlling the delivery of these materials and improving cellular uptake because of small particle size (Figure above).

Several AgCenter projects show that bioavailability and cellular bioaccessibility of vitamins and antioxidants are improved; in other words, more of the vitamin is available for the cell to use and is not lost. The human body does not synthesize most vitamins that are es-

essential for human health. Thus, these vitamins have to be obtained via the food and beverages we eat or by dietary supplements. Multiple issues – such as rapid degradation of vitamins during storage, handling and processing; low solubility of vitamins in the small intestine, and premature elimination – are responsible for decreased availability of the bioactive vitamins to cells.

Thus far, AgCenter researchers have shown that certain nanoparticles of controlled properties improve the uptake of vitamins such as vitamin E. This work is supported by a grant from the U.S. Department of Agriculture. Once fully developed and perfected, this technology can be extended to improve bioavailability of other vitamins (A, D, K) and components such as omega-3 fatty acids that are desired in food and dairy products. The stability and functionality of these nanostructures in a food matrix are dictated by the interaction between the nanoparticles and the foods themselves. Understanding the effect of nanoparticle properties is critically needed to better conceptualize, create and use multiple-task nanoparticles that can interact with the food matrix and the body in a predictable way for better performance and improved outcomes in animal and human health.

Research on nanoencapsulation and delivery of bioactive components carried on by AgCenter researchers has the potential to become one of the pillars of emerging nanotechnology applications in the food industry. This work includes developing a highly skilled and educated workforce and creating broad nanotechnology platforms for launching new products and manufacturing technologies applicable to food and health.

Biomedical Nanotechnology

Nanotechnology provides a flexible and powerful platform to address infections and drug-resistant microbes. Infections that result from surgery represent a significant burden on limited health care resources. Many musculoskeletal surgeries, such as total joint replacement and trauma repair, involve the use of permanent or temporary implants that can provide vectors for infection. As

the demand for such surgery increases from an aging population with traumatic injuries, the incidence of subsequent complications increases as well.

For example, the current rate of infection in total-knee-replacement surgery is between 1-2 percent. Infection in total joint replacements necessitates removal of all components, prolonged antibiotic therapy and repeat surgery. The cost of treating one infection averages approximately \$30,000. Around 570,000 knee replacements are performed annually, and that figure is projected to increase to 3.5 million knee replacements by 2030.

Preventing or reducing the number of infections among these patients alone will significantly reduce the burden on the health care system and improve clinical results. Several research projects in the AgCenter address the development of new therapeutic or theranostic (combined therapeutic and diagnostic) treatments. Researchers are exploring ways of creating nanomaterial-based coatings for orthopedic implants to reduce rates of surgical-site infection and other associated complications. These coatings, composed of silver- and ceramic-based nanomaterials, can kill resistant bacteria in and around the implant, reducing infections rates and improving integration into the surrounding bone tissue.

A related project focuses on the development of a light-activated, theranostic nanoparticle delivery system. This system is composed of a magnetic nanoparticle (for imaging) modified with a very thin silver shell (providing light activation) and a unique steroid-based molecule that targets MRSA – Methicillin-resistant *Staphylococcus aureus*, a bacterial infection that is highly resistant to some antibiotics. When developed, this technology will allow doctors to simultaneously image the location of MRSA infections in the joint or bone by MRI and then selectively activate the antimicrobial only at the site of infection. The system, which is inactive without light, will allow patients to receive higher doses of antimicrobials, resulting in more rapidly cleared infections and better outcomes.

Another project using both delivery aspects like those shown in the figure and the medical applications described

above is a project that uses light-sensitive chemistries to control the activity of DNA and RNA molecules. Manipulating these nucleic acids, which range in size from a few to several hundred nanometers long, is important because DNA and RNA function in a multitude of biological processes that govern who we are and how we feel.

Regulating DNA-dependent processes is central to the proper function of living cells, from single bacterial cells, to plant cells, to any of the trillion cells in the human body. The directed control of when and where DNA activity takes place is of interest both in clinical gene therapy trials, where DNA and RNA molecules are being tested as potential drugs, and also at the laboratory bench in developmental research or diagnostic assays.

Gene therapy is the production of therapeutic products by the cell's own cellular machinery. DNA containing the code to produce these products must be introduced into the patient's cells. Successful clinical gene therapy must both deliver these genes to the specific target cells and restrict this expression to only these target cells because off-target expression can yield unintended outcomes. One potential strategy for targeting expression of introduced genes is the non-specific delivery of "silent" genes followed by reactivation at selected sites with light exposure. An AgCenter team is working to chemically inactivate DNA by attaching photosensitive compounds that can be subsequently activated with light to restore the DNA function. This project's technique could be a new way to target genetic therapies for cancer and other diseases so that the treatments are activated only in a tumor or other intended location.

New developments in nanomaterials are being used to protect therapeutic DNA and deliver it to intended cells, as well as to enhance the reactivity to light. Ultimately, this strategy may offer a new form of engineered control over many DNA-dependent processes, including hybridization-based biosensors, and the construction of complex DNA fabrics and nanomachines. ■

Cristina Sabliov, Associate Professor, Todd Monroe, Associate Professor, and Dan Hayes, Assistant Professor, LSU AgCenter, Department of Agricultural and Biological Engineering, Baton Rouge, La.

Greenhouse Tomatoes

Simultaneous reconditioning and disinfecting perlite reduces recycling cost for repeat use

H.Y. Hanna

Growing high-cash-value vegetable crops under cover can exceed expectations. Europeans and Canadians are producing most of their fresh-market vegetables in greenhouses. Other countries are expected to do the same in future years.

The estimated gross farm value of Louisiana greenhouse tomatoes was nearly \$1.5 million for 2010. Many convincing reasons to grow fresh-market tomatoes under cover include:

- Higher yield per unit area.
- Favorable hygienic conditions that lead to vine-ripened fruit without spoiling.
- Production of a healthy fruit with less exposure to pesticides.
- Significant reduction in fresh water use.
- Great efficiency in using fertilizer without groundwater pollution.
- Using soilless culture in places that lack the existence of flat farmland

and/or topsoil to produce a crop.

Perlite, pine bark, coco fiber and rock wool are popular soilless media for growing greenhouse tomatoes. Perlite is an excellent medium to grow the crop because of good physical structure that balances nutrient and air holding for healthy roots. Also, if recycled properly, perlite can be reused time after time to grow successive crops for cost-effective tomato production, saving natural resources.

Two methods have been developed at the LSU AgCenter Red River Research Station to recycle perlite for repeat use. Each method encompasses two steps to recondition perlite – first with some mechanical means and then by disinfecting the medium with hot water. In 2010 a third method was developed to recondition and disinfect the perlite in one step for cost-effective tomato production.

To recycle perlite with the new method, all tomato plant material, includ-

ing the crown roots, is removed from the greenhouse after the last harvest, and perlite is simultaneously reconditioned and treated with hot water. This method combines the penetrating power of hot water from a water breaker (or nozzle) mounted on the wand of a pressure washer with the operator's action to do the job. The worker moves the water breaker front and back, up and down, and sideways in the grow bag for at least one minute, using at least 4 gallons of near-boiling water in each 5-gallon grow bag. This action allows the water power from breaker to loosen the plant material from the perlite, leach excess salt and disinfect the medium at the same time.

The new method is as effective as the previously developed methods in reducing residual salts in the medium at significantly reduced labor and recycling costs. Hot water at 190 degrees Fahrenheit or above raises perlite

H.Y. Hanna conducts a tomato-growing workshop at the Red River Research Station in Bossier City. Photo by Bruce Schultz



temperature higher than the temperature range that kills fungi and nematodes known to cause economic losses. Tomatoes grown in perlite recycled with this method produce similar yields to tomatoes grown in new perlite or perlite recycled with the previously developed methods.

The simultaneous perlite reconditioning and disinfecting method was the third in a series of recycling methods developed at the LSU AgCenter Red River Research Station. This method should offer the smaller grower another tool to recycle perlite for cost-effective tomato production and save natural resources. It is less time-consuming and more cost-effective than the previously developed methods.

Replacing perlite every growing season to produce a new tomato crop is costly, and recovering the expense by increasing the selling price may not work

well in a competitive market. Repeat use of old perlite as-is to grow successive tomato crops without reconditioning to restore the original structure, desalinating to remove excess salts and disinfecting to control root pathogens is risky because of media compaction, salt buildup and pest contamination.

Using the new method, a grower can recondition, desalinate and disinfect the root medium in one step. This method also eliminates labor time and effort to remove old media from the greenhouse, transport it to a land fill or a vacant field for disposal and fill other bags with new perlite. The rental of a hot-water pressure washer and the cost of a heavy-duty water nozzle can be the only out-of-pocket expenses a grower has to pay. The labor can be done by the grower.

The AgCenter has been growing tomatoes in recycled perlite for 16 years with no root disease problems or yield

reduction. The hot-water treatment is more desired than treating media with methyl bromide or any other fumigants. And fewer chemicals used in food production can contribute positively to human health and improve environmental conditions for better living. The AgCenter has produced more than 1.27 million pounds of tomatoes grown in 1,200, five-gallon grow bags filled with recycled perlite. In 1996, 800 cubic feet of perlite was purchased, and it has been recycled and reused every year since then.

Efficient management of limited space greenhouse tomato operations by reducing production costs and improving plant yield should help producers do well in a competitive market. ■

H.Y. Hanna, Professor, Red River Research Station, Bossier City, La.

Greenhouse Vegetable Gardening Grows in Louisiana

During 2010, farms in 14 parishes commercially grew vegetables in 3.4 acres of greenhouse space, up slightly from 2009.

The estimated gross farm value of Louisiana greenhouse vegetables was nearly \$1.5 million in 2010, and total value added was \$1.7 million.

Although dominated by tomatoes, growers also produce lettuce, cucumbers and herbs, said Roger Hinson, LSU AgCenter economist who specializes in specialty crops.

"Occasionally there are new investors, but it seems to be at a constant level the past five years," Hinson said. Production did not go down after hurricanes Katrina and Rita.

Tomatoes are sold on the fresh market, much of it direct-retail at local markets. "Most production stays in the state," Hinson said.

Energy costs increased as a cost of production during winter 2009 and continued to affect production decisions in 2010, although not as much, Hinson said. "If they heat with natural gas, growers haven't experienced a cost

increase, but for other forms of energy, price increases have had an impact."

Growing greenhouse vegetables is a competitive industry with large production operations in Arizona, New Mexico and Colorado, as well as Mexico and Canada. "These areas produce a lot of tomatoes, and it is difficult to compete with them for the wholesale grocery market," Hinson said.

On the other hand, direct markets and the movement toward local foods have helped local growers. For instance, more Louisiana chefs are requesting specific tomato varieties, including heirloom varieties from the past, Hinson said. The chefs are becoming acquainted with farmers and paying more for the varieties they prefer.

Greenhouses are found in in pockets all over the state – in the Florida parishes as well as in Webster, Vermilion, St. Helena, St. Charles, St. James and Pointe Coupee parishes. Hinson said more growth has been in Tangipahoa Parish, which is a traditional vegetable-growing area with many ornamental nurseries.

Traditionally, greenhouses have been a two-crop system – with planting in August for harvest into December, then planting again in January for harvest through June. "Certainly there are some systems where there is a single crop year-round with no replanting," Hinson said.

In addition, some production that is reported as greenhouse-grown may actually be produced in high tunnels that aren't heated, Hinson explained, and these tunnels are becoming more numerous.

Most growers buy a commercially bagged planting mix that includes fertilizer in it, and they plant tomatoes directly in the bags, Hinson explained.

Greenhouse growers include a combination of part-time and full-time businesses. Some growers don't have agricultural activities other than their greenhouses. Others who are more dependent on farm income are diversified and may have other production operations, such as field tomatoes and other vegetables or fruit crops, Hinson said.

People interested in starting a greenhouse operation should talk with their extension agent and look at the market first, Hinson advised. "Do a thorough analysis." ■ **Mary Ann Van Osdel**

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