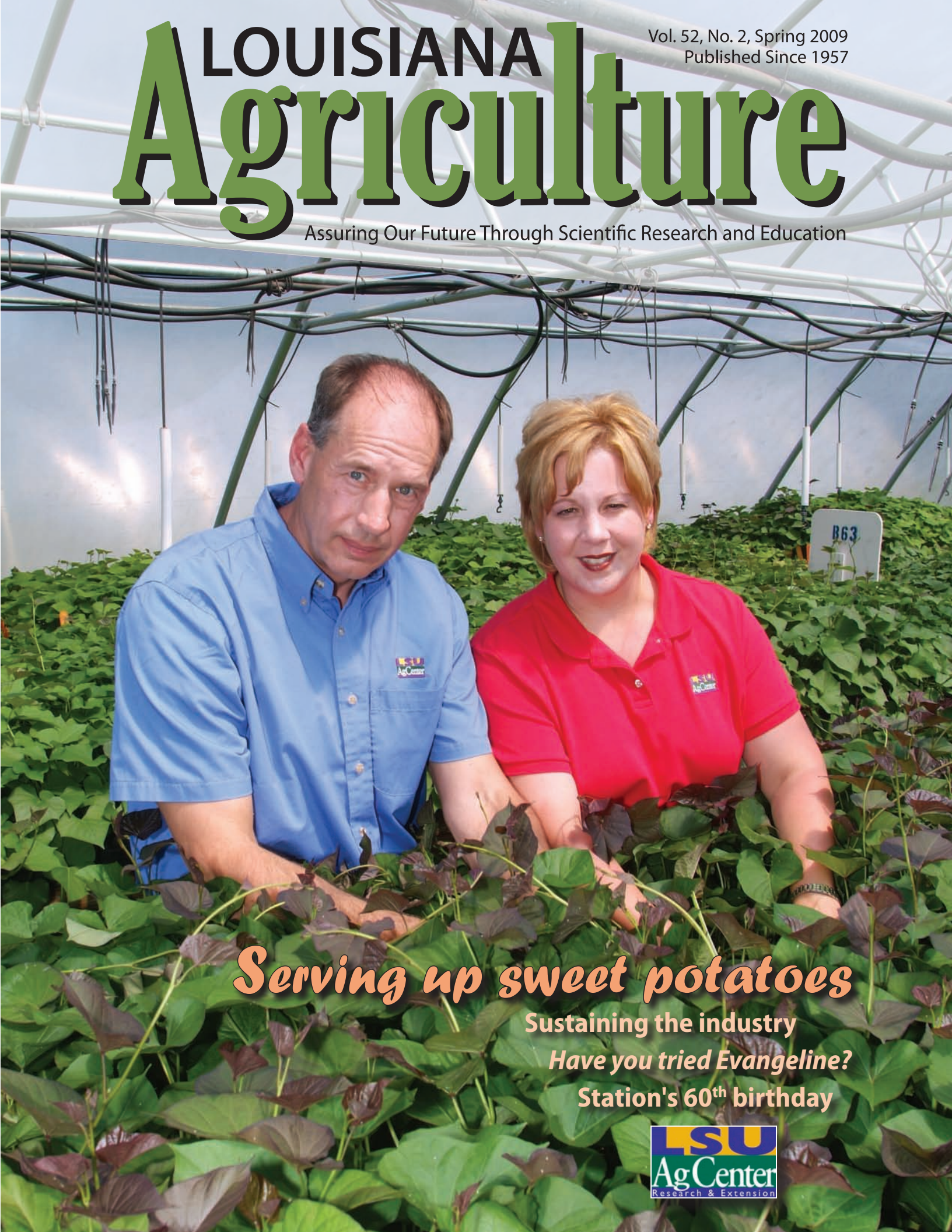
Vol. 52, No. 2, Spring 2009
Published Since 1957

LOUISIANA Agriculture

Assuring Our Future Through Scientific Research and Education



Serving up sweet potatoes

Sustaining the industry

Have you tried Evangeline?

Station's 60th birthday

LSU AgCenter Research & Extension

Commercialization of Intellectual Property at the LSU AgCenter

Success breeds more success

The LSU AgCenter has the most successful record of commercialization of intellectual property within the LSU System and, in fact, within higher education in Louisiana. Since 2000, nine new companies have been started based on licensing technology from the AgCenter. Royalties from these companies and from other licensing agreements have generated more than $29 million since 1999. This income is distributed among the LSU System, the inventors and the AgCenter, where it is funneled back into more research. The most lucrative of these licensing agreements has been with the international chemical company BASF for a herbicide-resistant line of rice varieties known as Clearfield.

The successful commercialization of intellectual property has come about because of the research culture within the LSU AgCenter. This culture has focused on applied research – research conducted with practical implications for the clientele. Since 1887, when research first began in the Louisiana Agricultural Experiment Station – the research arm of the AgCenter – scientists have aimed their efforts at practical solutions for the problems of growing food and fiber and raising livestock in a subtropical climate. To advance the adoption of new technology, the research culture in the AgCenter also has involved close working relationships with businesses and industry.

Crop variety development has historically been one of the principal research activities of the LSU AgCenter. The LSU AgCenter's Rice Research Station, which celebrates its 100th birthday this year, was established for the purpose of developing rice varieties that could grow in Louisiana. Clearfield rice is a recent example. Development of a variety of rice that could be grown to withstand the use of a herbicide that would kill the rice-like weed known as "red rice," which plagued southwest Louisiana and much of the rice-growing area in the South, began in the 1980s. Finally in 2002, a high-yielding variety of rice that allowed for the use of this revolutionary technology was released for commercialization. This would not have happened without a collaborative partnership with industry – in this case, BASF. Clearfield rice now accounts for about 60 percent of the rice grown in the southeastern United States.

Facts about LSU AgCenter intellectual property:

- The Office of Intellectual Property in the AgCenter was established in 1991.
- As of December 2008, the total number of patents issued to the LSU AgCenter is 89, and the total number of plant variety protection certificates (PVPs are like patents, only for plant varieties) is 35.
- The number of AgCenter faculty who have received patents or PVPs is 52, and 40 of them are currently on the faculty, which comprises 11 percent of our total research faculty.
- The first LSU faculty member to receive a patent was a Louisiana Agricultural Experiment Station scientist; this patent was issued to Donal Day at the Audubon Sugar Institute in 1984.
- Inventors receive 40 percent of the income from royalties. The LSU System receives 10 percent, and the LSU AgCenter, 50 percent, which goes back into the research program.

An example of how crop variety development saved an industry in Louisiana is the sweet potato. This crop can be highly profitable but difficult to grow. By the 1980s, the once-thriving sweet potato industry was dying in the state because of destructive diseases and insects. In 1987, however, the Louisiana Agricultural Experiment Station released a variety resistant to pests, attractive and good-tasting. It was named the Beauregard and has been hailed as the savior of the sweet potato industry in Louisiana. It is still the most widely grown sweet potato in the country.

The Beauregard sweet potato is an example of technology released before there was a coordinated system for such technology to be licensed. Since then, LSU policies have been updated so that the university, individual inventors and the state's economy

(Continued on back cover)

LOUISIANA Agriculture

EDITORIAL BOARD:
David J. Boethel (Chairman)
Linda Foster Benedict
Rick Bogren
Barbara Groves Corns
Marlene E. Janes
Boyd Padgett
D. Allen Rutherford
Cristina M. Sabliov
Michael E. Salassi
Guillermo Scaglia

EDITOR: Linda Foster Benedict
DESIGNER: Barbara Groves Corns
ASSOCIATE EDITOR: Rick Bogren
PHOTO EDITOR: John Wozniak
CONTRIBUTORS: Mark Claesgens, Craig Gautreaux and Randy LaBauve
WEB DESIGN: Kathy Kramer and Megan Smith

Louisiana Agriculture is published quarterly by the Louisiana Agricultural Experiment Station. Subscriptions are free. You may also subscribe to a Web version of the magazine, which is available at www.lsuagcenter.com. Please go to the "Louisiana Agriculture Magazine" site if you would like to receive an e-mail notification when a new issue is online. For more information or to subscribe, please contact:

Linda Foster Benedict, Editor
Louisiana Agriculture
P.O. Box 25100
Baton Rouge, LA 70894-5100
tel (225) 578-2263
fax (225) 578-4524
lbenedict@agcenter.lsu.edu

www.lsuagcenter.com

William B. Richardson, Chancellor

David J. Boethel, Vice Chancellor and Director of Research

Paul D. Coreil, Vice Chancellor and Director of Extension

The LSU AgCenter provides equal opportunities in programs and employment.

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











LOUISIANA Agriculture

Vol. 52, No. 2, Spring 2009
Published Since 1957

Assuring Our Future Through Scientific Research and Education

2 **Commercialization of Intellectual Property at the LSU AgCenter**
Linda Foster Benedict
4 **What's New?**
6 **The Sky's the Limit: Change in the Sweet Potato Industry**
Tara P. Smith and Don LaBonte
8 **Happy 60th Birthday: Sweet Potato Research Station and Foundation Seed Program, 1949-2009**
Tara P. Smith, Don LaBonte, Christopher A. Clark and Arthur Villordon
10 **Breeding High-yielding, Delicious Sweet Potatoes**
Don LaBonte
11 **A really SWEET sweet potato – that's Evangeline**
Don LaBonte, Christopher A. Clark, Arthur Villordon and Tara P. Smith
12 **Virus-tested foundation seed works**
Christopher A. Clark, Tara P. Smith and Donald M. Ferrin
13 **Sweet potatoes get grades**
Tara P. Smith
14 **Managing Rhizopus Soft Rot on Sweet Potatoes**
Christopher A. Clark, Donald M. Ferrin, Don R. LaBonte, David H. Picha, Tara P. Smith and Arthur Villordon
16 **Sweet Potato Scientist: Chris Clark devotes career to better production, higher yields**
Craig Gautreaux
18 **How to Grow Sweet Potatoes**
20 **'Or you can call me Yam. . .'**
Randy LaBauve
22 **Research Verification Program for Louisiana Sweet Potato Production**
Tara P. Smith, Kurt M. Guidry, Myrl Sistrunk, Gerald Roberts, Vincent Deshotel and Eugene Burris
24 **Nutraceutical Compounds and Antioxidant Content of Sweet Potatoes**
David H. Picha and Malkeet S. Padda
25 **Resistant Starch and the Sweet Potato**
Joan M. King
26 **Individual Shrink-wrapping of Sweet Potatoes: An Emerging Value-added Marketing Technique**
David H. Picha
28 **GIS/GPS Techniques help evaluate soil insect and nematode pest control strategies in sweet potatoes**
Eugene Burris, Dennis Burns, Tara P. Smith, Charles Overstreet and Maurice C. Wolcott
30 **Season-long Management of the Banded Cucumber Beetle in Louisiana Sweet Potatoes**
Abner M. Hammond, Rick Story, Tara P. Smith and Jeff Murray
32 **Nitrogen Management: New Insights and Opportunities**
Arthur Villordon, Don LaBonte and Tara P. Smith
33 **Harvesting Sweet Potatoes**
Tara P. Smith
34 **Managing Weeds in Louisiana Sweet Potatoes**
Donnie K. Miller and Tara P. Smith
35 **Ornamental sweet potato options continue to expand**
Allen D. Owings



ON THE COVER: Don LaBonte and Tara Smith are two of the LSU AgCenter faculty members who devote their careers to enhancing and expanding the sweet potato industry in Louisiana. LaBonte is a horticulture professor in the School of Plant, Environmental & Soil Sciences, and Smith is an assistant professor of entomology and coordinator of the Sweet Potato Research Station in Chase, La. They are in a greenhouse at the station. Photo by John Wozniak

What's New?

What's New?

New LSU AgCenter rice varieties may be on tap this year

MAMOU, La. – Two new long-grain rice varieties could be released by the LSU AgCenter this year if they continue to show solid results, according to Steve Linscombe, LSU AgCenter rice breeder.

Linscombe told farmers at the Evangeline Parish rice field day May 19 that one of the lines is a Clearfield long-grain that would be named CL111 if it is released. It has early maturity – a week earlier than CL131 or CL151 – with good yield potential and good grain quality.

Linscombe said 52 acres of the line have been planted at the LSU AgCenter's Rice Research Station, and Horizon Ag has a considerable acreage planted in Texas.

A Clearfield medium-grain line similar to Neptune also may be released, depending on its performance this year, he said.

The LSU AgCenter has taken the plunge into exploring the possibility of developing rice hybrids, Linscombe said. RiceTec, a private company, has been successful with hybrids, and now Bayer CropScience is developing hybrids.

Hybrid rice production requires male-sterile rice lines, and some recently were obtained from China, Linscombe said. In addition, the LSU AgCenter has hired a hybrid rice breeder from China.

He said a hybrid line would require additional funding and an expansion of the LSU AgCenter's winter nursery in Puerto Rico.

"Even if we are successful, it's going to be a number of years before you see a hybrid come out of the research station," Linscombe said. ■ **Bruce Schultz**

Coreil, Lima win top awards from LSU Kiwanis Club



Paul Coreil, vice chancellor of the LSU AgCenter, left, and Marybeth Lima, professor in the Department of Biological and Agricultural Engineering, right, received the 2009 top awards from the LSU Kiwanis Club. Coreil received the Outstanding Leadership Award for his efforts in obtaining local funding for the first time from all 64 parishes for support of the Louisiana Cooperative Extension Service, said Mary Grodner, professor in the Department of Entomology and president of the LSU Kiwanis Club, center. Lima received the Distinguished Service Award in recognition of her creative and diligent work in the design and construction of 18 playgrounds at East Baton Rouge Parish schools. Lima is exemplary in garnering community support, involving students in service-learning projects and calling attention to the need for safety in school playgrounds, Grodner said. Photo by Johnny Morgan

Allay children's fears about flu

With flu in the news, it's a good idea to reassure your children you're going to keep them as safe as possible. This is advice from two LSU AgCenter family life specialists, Diane Sasser and Becky White.

Officially known as H1N1, this flu outbreak has captured attention across the country and could result in children being fearful about it.

Sasser and White say help children keep everything in perspective.

"In instances like these, we adults forget that children can pick up on our fears and hear conversations filled with our own speculations," White said. "A child can mix up real fear and make-believe fear. This is normal, but he or she will need your help to separate the facts from fiction."

Talking to your child about a flu outbreak or any hazard is helpful in preventing fear and in reducing the risk of infecting others, the experts advise. They provided these tips on actions you can take to help your children:

- Be sure to get the facts from reputable sources rather than rumors and guesswork.
- Explain what flu is and dispel the myths that your child could catch this particular strain of flu from being around pigs or eating pork.
- Talk to your children about flu and what your family can do to try to stay healthy.
- Keep working to make things better, such as showing your children how to wash their hands thoroughly, which can help to protect them from catching flu or other diseases.
- Show your children how to cover their mouths and noses with a tissue when they cough or sneeze. Also teach them what to do if there is not a tissue immediately available – how to trap the sneeze or cough with the inside of the elbow or with cupped hands covering nose and mouth. Encourage them to throw away a tissue after using it once and to wash hands after sneezing into them.
- Remind your children to wash their hands before meals, after going to the bathroom and when they come in from playing outside.
- Praise your children when they wash their hands or cover their mouths after coughing or sneezing. ■ **Tom Merrill**

LeBlanc named ag chemistry head

The LSU AgCenter announced the appointment of Mark LeBlanc as head of the Department of Agricultural Chemistry effective April 1, 2009. LeBlanc was previously assistant director of the agricultural chemistry programs and director of the Louisiana Fertilizer Commission for the Louisiana Department of Agriculture and Forestry. A joint effort between the LSU AgCenter and the Louisiana Department of Agriculture and Forestry, the Department of Agricultural Chemistry provides analytical support for regulatory analyses, research and agricultural extension work. In the LSU AgCenter, the department provides analytical support for research scientists and extension specialists. It conducts analyses on plant and animal tissues, soil, water, feeds, fertilizers, pesticides, agricultural chemicals and agricultural commodities. The department also performs chemical analyses of animal feeds, pet foods, fertiliz-

What's New?

ers, agricultural liming materials, pesticides and pesticide residues in agricultural products and environmental samples for LDAF. In addition, the laboratory is home to the analytical division of the LDAF's meat inspection office and provides microbial analysis for the LDAF Hazard Analysis at Critical Control Points program as well as the nutrient analysis. ■ **Rick Bogren**

Interstate 69 realigned to avoid Pecan Station

The LSU AgCenter Pecan Research-Extension Station in Shreveport will not be affected by the alignment of Interstate 69 in southern Caddo Parish after all, according to the Louisiana Department of Transportation and Development (DOTD).

LSU AgCenter officials received the word through a letter signed by Richard Savoie, deputy chief engineer of DOTD.

He said his department and the Federal Highway Administration have met with LSU AgCenter representatives and "after hearing their concerns, have engaged our consultant to develop an alignment that will avoid any required right-of-way from the facility."

The new alignment misses the southeast side of the Pecan Station by approximately one-tenth of a mile, said Randy Sanderlin, research coordinator at the station. The route is just north of the Caddo-Bossier Port Commission docks, he said.

"The original route would have destroyed this station and the pecan groves that took years to develop," said David Boethel, LSU AgCenter vice chancellor for research. "We want to thank all those who supported us in getting this route changed. The station has served the commercial pecan industry for 79 years, the last 36 years under the leadership of the LSU AgCenter."

"This was a team effort," said Patrick Colyer, LSU AgCenter Northwest Region director. "We had support from the growers in Louisiana, Mississippi and Arkansas. We also want to thank Dr. Mike Strain, commissioner of the Louisiana Department of Agriculture and Forestry, members of the Louisiana Congressional delegation, state legislators, the Louisiana Farm Bureau and William Ankner, secretary of the Department of Transportation and Development, for recognizing the importance of this program to the state."

The commercial pecan industry represents an annual value of about $300 million to the nation, Sanderlin said. The average annual value to the Louisiana economy is approximately $15 million, which ranks about fourth in the nation. ■ **Mary Ann Van Osdell**

New weed science building at Rice Station



Eric Webster, LSU AgCenter weed scientist, works at the new weed science building on the South Farm of the LSU AgCenter Rice Research Station near Crowley. The building was constructed with revenue generated by LSU AgCenter royalties. Previously, Webster and his staff were working out of a small warehouse with no office space. Photo by Bruce Schultz

Besh tells Master Gardeners to encourage local food production

KENNER, La. – Although he may be known to the culinary world as a leading New Orleans chef, John Besh also is a leading proponent of serving locally grown foods in his four restaurants.

"Our restaurants spend $8 million to $9 million a year on groceries," Besh told 260 Master Gardeners gathered for a state conference here May 21.

The Louisiana Master Gardener program is an LSU AgCenter service and educational activity that recruits and trains volunteers to help meet the educational needs of home gardeners in Louisiana. Volunteers provide the public with unbiased, researched-based educational assistance and programs in consumer horticulture, according to Bobby Fletcher Jr., LSU AgCenter assistant director for extension.

Besh, who was the keynote speaker for the conference, said Crescent City restaurateurs were scrambling for produce following Hurricane Katrina in late 2005, and they realized much of the historically available produce from local truck farms disappeared over the years.

"It opened my eyes to a great world of opportunity," said Besh, who began working with residents of New Orleans to grow produce to supply the New Orleans restaurant market. "Until you toil in the soil, it doesn't hit home," Besh said, adding that his restaurants now serve as much locally grown food as possible, including eggs and pork. ■ **Rick Bogren**

Morrison receives regional award

David Morrison, LSU AgCenter assistant vice chancellor for research, received the Southern Association of Agricultural Experiment Station Directors Excellence in Leadership Award in mid-April during the association's meeting in Puerto Rico. The award recognizes those who have served "with exemplary distinction" in the research branches of the national land-grant university system and "have personified the highest level of excellence," according to David Boethel, LSU AgCenter vice chancellor for research. ■ **Tom Merrill**



OVERVIEW

The Sky's the Limit

Change in the Sweet Potato Industry

Tara P. Smith and Don LaBonte

Change is going on in the sweet potato industry. The variety Beauregard, released by the AgCenter in 1987 and hailed as one of the best and most popular sweet potatoes, is being replaced in part by two new varieties – Evangeline, released by the LSU AgCenter in 2007, and Covington, a 2005 release from North Carolina. Sweet potato consumption in the United States is increasing – a dramatic 13 percent from 2006-2008. Likewise, exports of U.S. sweet potatoes are rising. There was nearly a three-fold increase over the past decade, from $8.3 million to $31.3 million. And the technology is rapidly changing. New advances in packaging and preserving sweet potatoes offer expanded marketing opportunities.

Not Just for Thanksgiving

Finally, people are beginning to realize that sweet potatoes aren't just for Thanksgiving. These tasty roots are a nutritious treat to be enjoyed year-round. An increasingly health-conscience public, combined with value-added product diversity, is bringing the once lowly sweet potato to a respected and reserved place on everyday menus. Only 10 years ago, it was rare to be offered a sweet potato as a side option with your steak; now, many fine restaurants across the country offer sweet potatoes on the menu. What about those sweet potato fries you had with your fish last night or the yam and black bean wraps you had for lunch last week? Sweet potatoes may not be everywhere, but they are more accessible than ever before. Value-added product development, such as the burgeoning sweet potato fry, is driving much of the new-found fame of the sweet potato. Producers are beginning to understand that they can make a sizable return by supplying the processing industry with bulk sweet potatoes as an adjunct to their domestic fresh market and growing export business.



Tara P. Smith, Assistant Professor and Coordinator, Sweet Potato Research Station, Chase, La.; and Don LaBonte, Professor, School of Plant, Environmental & Soil Sciences, LSU AgCenter, Baton Rouge, La.

Profitable But Precarious

Though prices remain solid in the sweet potato industry, production costs have soared with the increased costs of fuel and fertilizer. In the past, a field lost to low yield, insect damage, disease or weed infestation could be easily compensated by other acreage. A large-scale farmer can still do this, but a small-scale farmer can't. We are optimistic that those remaining in the business are here to stay, but total acreage in the state has not risen in several years.

Sweet potatoes are one of the most profitable crops to grow in Louisiana. All growers have experienced fields each and every season that produce amazing yields of attractively shaped roots, if only they could consistently repeat this on more of their acreage.

Producers have high expectations every season. What they want is a uniform crop consisting of the prized U.S. #1 grade at $13.50-$20 for a 40-pound box and few small and oversized grade roots (jumbos). What they lack is predictability. This can be seen on individual plants, which vary in the number of storage roots from none to four or more per plant. This also extends to entire fields, which vary in yield by up to half in a given season. Growers are both comforted and confounded by the indeterminate nature of the sweet potato. It can withstand adverse environments and resume growth once favorable conditions return. Unfortunately, a delay in harvest permits U.S. No.1 grade roots to oversize into the less desirable jumbo grade, and there's more time for insect damage and the accompanying rise in insecticide costs.

Research Breakthroughs

The LSU AgCenter conducts a comprehensive research program on cultural practices with emphasis on early season management of the sweet potato crop. This knowledge is delivered to the growers through the AgCenter's extension education program. Growers are beginning to understand how critical early season management of the crop is. Soil moisture, fertility regimes and transplant characteristics can all improve production efficiency and enhance profitability, if managed correctly.

The LSU AgCenter sweet potato breeding program continues to look for high-yielding, attractive, disease- and insect-resistant varieties, which also taste good. Can the fresh market accept a sweet potato variety with a durable and rough skin that could be harvested with less labor? We know the processing industry would welcome this. Is it possible to reduce pesticide use and loss by modifying postharvest handling and use of resistant varieties?

Virus and disease research, in conjunction with the virus-tested foundation seed program, allows producers to maintain healthy planting stock and viable on-farm seed programs, which are critical to a successful sweet potato operation.

Insect management research and the sweetpotato weevil trapping and spray program conducted by the Louisiana Department of Agriculture and Forestry continue to be of immense help to the sweet potato industry. The sweetpotato weevil is successfully being managed in south Louisiana and has not been a severe threat to the industry in several years. Research on other problematic pests, such as the sugarcane beetle and white grubs, is ongoing.

In addition, there are sweet potato research programs in food science, postharvest physiology, weed science and value-added product development.

Photo by John Wozniak



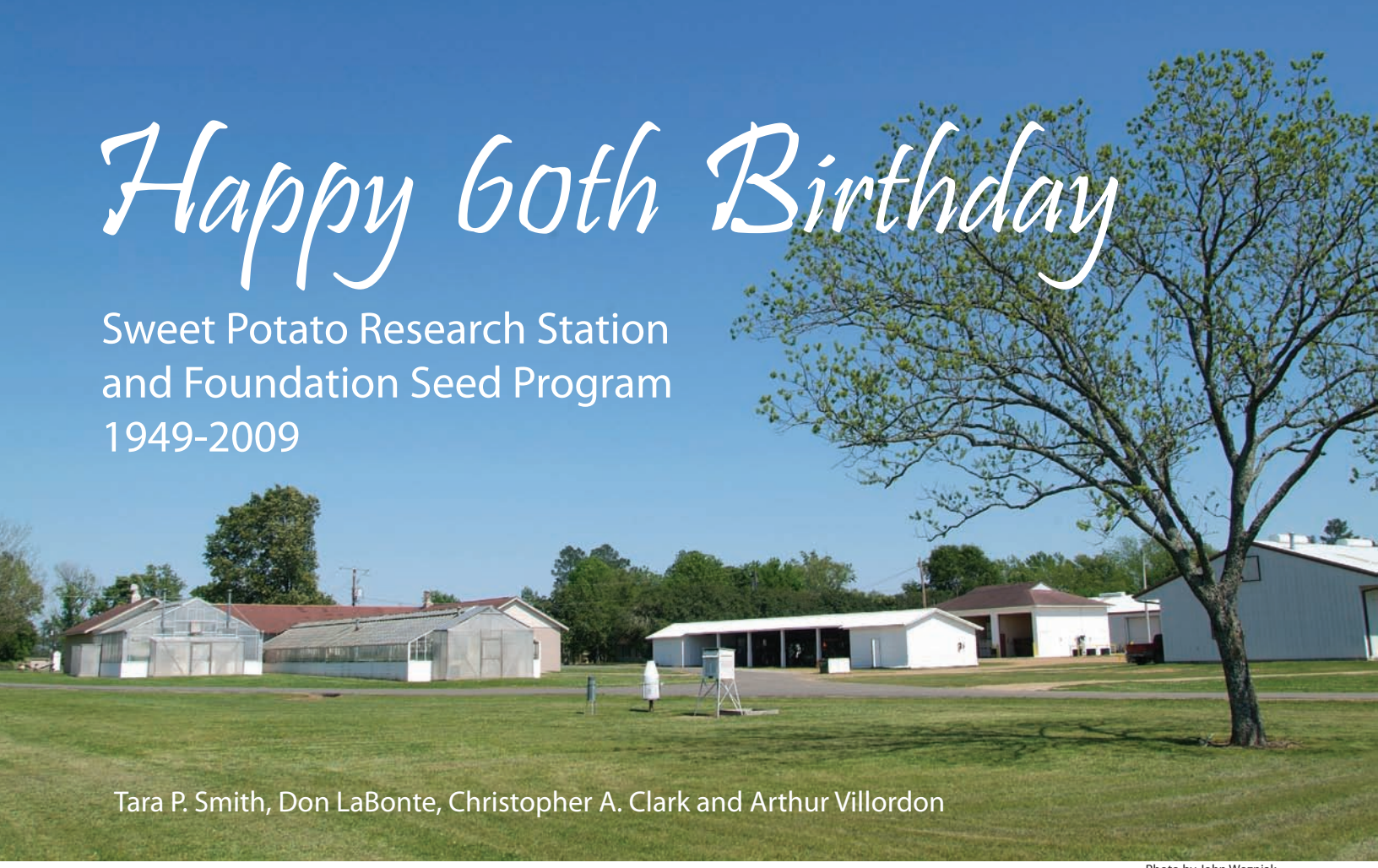
Prosperity and Hardships

The Louisiana sweet potato industry has experienced both prosperous and trying times throughout its history. Weather-related disasters, insect outbreaks, disease issues, struggling markets and variety decline have all threatened the integrity of the industry at various times. Yet, the industry has always prevailed. Sustaining the industry along the way has been the work of a diverse group of LSU AgCenter research and extension personnel. Their goal has been to improve production and pest management of the crop and address what really matters, the bottom line.

Because of the LSU AgCenter's diligent research and extension programs, because of health-conscience consumers and their desire for more sweet potatoes in their diets, and because of new value-added products, the future of Louisiana's sweet potato industry looks bright. We can truly say the sky's the limit. ■

Happy 60th Birthday

Sweet Potato Research Station and Foundation Seed Program 1949-2009



Tara P. Smith, Don LaBonte, Christopher A. Clark and Arthur Villordon

The 308-acre Sweet Potato Research Station in Chase, La., is the only research station of its kind in the United States.

Photo by John Wozniak

The LSU AgCenter Sweet Potato Research Station is the only research station in the United States devoted solely to sweet potato research and development. The 308-acre station in Chase, La., was established in 1949 through a direct appropriation of the Louisiana Legislature and celebrates its 60th birthday this year.

The idea for the station started with the late Julian C. Miller, a former LSU department head and the nation's first sweet potato breeder. In the 1930s he was able to garner enough federal grant money to conduct sweet potato research and was the first to discover how to cross the sweet potato. An office building on the LSU campus is named for Miller.

In 1949, the first foundation seed was planted at the newly established station, which was located in northeast Louisiana outside of the south central part of the state, where most of the sweet potatoes were grown at that time. By being outside the growing area, the station was also more likely to be free from the primary pest of the sweet potato – the sweetpotato weevil.

The station's mission was to produce top-quality planting stock to serve the commercial sweet potato industry in Louisiana and also to conduct research in various disciplines to enhance production of the sweet potato, including breeding, cultural practices and pest management. Since its establishment the station has remained the hub through which sweet potato research is conducted.

The LSU AgCenter sweet potato foundation seed program has long served the Louisiana sweet potato industry by providing high quality seed to commercial producers. The station serves all parishes involved in sweet potato production in Louisiana. Foundation seed and information derived from the various research programs are available for all commercial producers and home gardeners in the state. The main sweet potato-producing parishes are West Carroll, Morehouse, Franklin, Richland, Avoyelles, Rapides, St. Landry, Evangeline and Acadia.

In addition to satisfying in-state needs, the station also supplies seed to out-of-state producers, if a supply is available. In 2007, the station began working with domestic and international entities to supply transplants for propagating purposes. This is a testament to our national and international reputation as a premier supplier of sweet potato planting stock.

The main goal of the foundation seed program is to maintain the integrity and quality of commercial varieties. The program has long worked to minimize mutations. Furthermore, because sweet potatoes are vegetatively propagated, viruses and other pathogens can accumulate and lead to variety decline, ultimately affecting yield and appearance. The

Tara P. Smith, Assistant Professor and Research Coordinator, Sweet Potato Research Station; Don LaBonte, Professor, School of Plant, Environmental & Soil Science, LSU AgCenter, Baton Rouge, La.; Christopher A. Clark, Professor, Department of Plant Pathology & Crop Physiology, LSU AgCenter, Baton Rouge, La.; and Arthur Villordon, Associate Professor, Sweet Potato Research Station, Chase, La.

cumulative effect of infection of sweet potatoes with various naturally-occurring viruses can cause yield reductions in Beauregard sweetpotato in excess of 30-40 percent, as well as cause changes in skin color and shape that reduce quality and marketability of the crop. In addition, the yield of U.S. No. 1, the highest grade, may be affected to a greater extent than total yield of the crop. As a result, the foundation seed program was converted to a virus-tested foundation seed program in 1999 to provide farmers with healthier planting stock.

Each year 10,000-15,000 bushels of foundation seed of popular commercial cultivars, including Beauregard, Evangeline, Porto Rico, Hernandez, Jewel, O'Henry and Heart-O-Gold are produced at the Sweet Potato Research Station. Quality as it relates to foundation seed is defined as seed that has been virus-tested, is free from obvious mutations or other defects, has a uniform skin, flesh color and shape and is devoid of major insect damage.

The virus-tested portion of the research is conducted at the LSU AgCenter Plant Pathology Sweet Potato Laboratory. Virus-tested tissue culture plants (Figure 1) are produced by a process termed meristem-tip culture. In this process, a tiny section (0.5 millimeter) is removed from the growing tip of a selected plant. The meristem tip is then regenerated in tissue culture into a new plant, which is then tested to ensure that all viruses have been eliminated.

Virus-tested tissue culture plants are obtained each year from the Sweetpotato Plant Pathology Laboratory and through Certis USA, a private company that increases the tissue cultures through nodal propagation techniques. Beauregard and Evangeline, the dominant commercial varieties grown in Louisiana constitute the majority of the tissue cultures received by the station, but other varieties are also increased and integrated into the program as necessary to supply the industry with planting stock of new varieties, such as the Evangeline variety initially released by the AgCenter in 2007.

The tissue culture plants are increased and transplanted into one of five greenhouse facilities at the Sweet Potato Research Station (Figure 2). All greenhouse facilities are climate-controlled and designed to exclude insects that can transmit viruses, namely aphids and whiteflies. In late spring each year, cuttings from the greenhouses are planted into production fields at the station. The foundation seed crop is grown under strict guidelines set forth by the Louisiana Department of Agriculture and Forestry. The foundation seed is sold to Louisiana sweet potato producers, who then incorporate the seed into their on-farm seed programs. The funds generated from seed sales each year constitute a portion of the operating budget for the station.

In addition to the foundation seed produced each year, sweet potato research is conducted on 15-20 acres on the station. One of the more unique projects at the station is the planting in greenhouses of approximately 15,000 true seed from the breeding nursery in Baton Rouge. Each of these seedlings is a potential new variety. Additional research topics include cultural practices, viruses and insects, diseases and weed management.

The LSU AgCenter Sweet Potato Research Station's foundation seed and research programs ensure that Louisiana remains a leader in sweet potato production in the United States. ■

Photo by John Wozniak



Inside a greenhouse at the Sweet Potato Research Station.

Breeding *High-yielding, Delicious* Sweet Potatoes

Don LaBonte

The development of high-yielding and delicious sweet potato varieties began right here in Louisiana more than 70 years ago. The late Julian C. Miller and others at the Louisiana Agricultural Experiment Station discovered how to induce flowering and seed set by trellising sweet potato vines onto fences. They found that this straightforward technique stressed the plant and caused it to flower. This opened a world of opportunity to develop new varieties for the industry by genetic recombination.

A fast-paced effort ensued to collect sweet potato varieties from throughout the world and to make as many crosses as possible. Many of the varieties resisted flowering, and just a handful of seed were produced. But ever so slowly new varieties were developed to replace the original varieties grown in Louisiana, which were from the Caribbean and had little or no disease resistance, poor and erratic yield, and a muted orange flesh.

Seventy years later the sweet potato breeding program continues. We still use the nursery started by Miller in the 1930s on the LSU campus in Baton Rouge. Though the technology has changed, the breeding program builds on a legacy of methodical progress toward developing the perfect sweet potato. Diseases that once were the scourge of the industry such as fusarium wilt and soil rot are forgotten as new varieties incorporating resistance to these diseases have replaced susceptible ones. But new threats to the industry invariably arise, and we adapt our breeding program to address these new issues.

Breeding programs take years of determined work to improve a trait, and we try to anticipate industry and regulatory changes. For instance, the federal government has pressed for years to reduce the number of pesticides used by growers, thereby delivering more pesticide-free crops to consumers and reducing pesticides in our environment. Consumers clearly prefer to have pesticide-free crops, and growers are anxious to reduce pesticide usage to save on production costs.

In the mid-1990s we set out to develop resistance to Rhizopus soft rot. This is a common disease that causes roots to break down after they are boxed and sent to market. A simple puncture wound and a few Rhizopus spores is all that it takes to drastically compromise the marketability of fresh market potatoes. A couple of roots infected with this disease are enough to get a load rejected at a distant shipping terminal. An effective fungicide (dicloran) is available, but we also had the foresight to realize its days were numbered. As recently as 2008, the European Union put a zero tolerance on this fungicide, and thus all sweet potatoes exported to the burgeoning EU market must be free of this fungicide.

Our efforts to breed for Rhizopus soft rot resistance are typical of the approach we use to improve all traits. We began with a group of genetically diverse individuals (parents or genotypes, as we term them) with good flowering attributes. We allow them to cross-pollinate in an open pollinated nursery. Because of

Photo by Tara P. Smith



Laid out along a lane at the Sweet Potato Research Station in Chase, La., is a row of more than 250 bags of different varieties of sweet potatoes being evaluated for their storage quality.

Don LaBonte, Professor, School of Plant, Environmental & Soil Sciences, LSU AgCenter, Baton Rouge, La.

the sweet potato's complicated genetic structure, an individual genotype cannot cross with itself but must cross with another genotype. Thus, we arrange a nursery with 15-30 unique parents, and let bees to do the pollination. We then harvest the seeds in the fall and plant upwards of 2,000-4,000 seeds at the Sweet Potato Research Station in January each year in a greenhouse. In May, we transfer the resulting seedlings (progeny) to the field and allow them to grow and produce storage roots. At harvest we visually select those that have an attractive shape and decent yield. Through the course of this process, we usually winnow these to just a few hundred. Next we screen all those selected for resistance to Rhizopus soft rot.

In the beginning of this project few selections had notable levels of resistance. But by using an approach called mass selection, we select the best 10 percent and use these as parents in the next cycle of breeding. The entire process takes two years to complete and return to the nursery. This process is repeated, each time selecting the best of the best to use as parents. As it stands now, most of the progeny are resistant, and we are focused on selecting for all important traits including yield, appearance, resistance to all the other diseases, and eating quality. Our efforts are paying off. We are now poised to incorporate this resistance into varieties that can be commercially grown by the industry.

The LSU AgCenter breeding program has a similar effort to enhance resistance to the sweetpotato weevil, the most damaging insect pest of sweet potatoes in the world. We are also initiating efforts to improve virus resistance and skinning resistance in sweet potato. We are particularly keen on developing a sweet potato variety with Rhizopus soft rot resistance and a more durable skin. This combination will push us toward a more mechanized harvest, requiring less labor and less cost in production.

Trait breeding represents just a fraction of our breeding efforts. The bulk of our crossing efforts are among elite genotypes to produce a new variety with ever higher yield, improved quality and ease of production. We may generate 10,000 to 14,000 seeds every year from these nurseries and have only 10-15 suitable progeny after three years of trials. It can take another three years to determine if any of these have value for the industry. In a given year we are looking at progeny at all stages of the six-year process.

The breeding program is both an art and a science. It involves intuition that a given progeny has the right look, all the while using scientific investigative techniques to ensure good yield, disease and insect resistance, and eating quality. Once we identify a superior variety, we also need to figure out how to grow it – all sweetpotato varieties seem to behave a little differently, and they often require tweaking in-field variables, such as fertility, to maximize production. The LSU AgCenter Breeding Program is multidisciplinary and taps into the expertise of many in the sweet potato research group. The team approach ensures that the LSU AgCenter will meet the ever-changing needs of producers and the industry. ■

A really SWEET sweet potato – that's Evangeline

Don LaBonte, Christopher Clark, Arthur Villordon and Tara P. Smith

Why do people eat sweet potatoes? Because they are sweet! A new variety, Evangeline, just released by the LSU AgCenter, will satisfy those who want a really sweet sweet potato.

What makes Evangeline so special is its sugar profile with twice as much sucrose as Beauregard, another widely grown LSU AgCenter-developed variety. Evangeline does, however, have less maltose, a sugar produced during cooking. But this is a great tradeoff. People perceive sucrose (table sugar) as being much sweeter than maltose. Not only is Evangeline sweeter out of the oven, it also makes a great microwaved sweet potato. AgCenter research has shown it has twice the sucrose content and similar levels of maltose as Beauregard when microwaved. Evangeline also has excellent processing qualities, and the deep orange flesh color has wide appeal.

Taste aside, this sweet potato variety also has much to offer Louisiana producers. Yield and overall quality of this variety have been comparable to Beauregard. Evangeline appears to produce fewer jumbos, or oversized roots, than Beauregard, so potentially, this could translate into a few more U.S. No.1 grade roots at harvest. If growers are delayed in their harvest operations, they may have more time to capture the high-value, premium U.S. No.1 grade, which is what you whole buy in the store.

In 2008, AgCenter researchers also discovered that Evangeline did not break down and rot in the soil when torrential rains associated with Hurricane Gustav ravaged Louisiana agriculture. Fields of Evangeline sweet potatoes remained harvestable while many planted in Beauregard suffered significant loss. A variety that can tolerate flooding is a tremendous asset, given the high cost of sweet potato production. In addition, stored roots from flooded fields held up well and remained flavorful following months of storage. This lagniappe information garnered in 2008 has swayed many producers to plant larger acreages of Evangeline in 2009.

Disease resistance of Evangeline is similar to Beauregard except that Evangeline has resistance to southern root knot nematode, a disease common in some production areas. The variety is not as good a plant producer as Beauregard. Farmers are being encouraged to presprout (warm up) roots before bedding them in the ground to increase earliness and quantity of plants. Sweet potatoes are not propagated like true potatoes – roots are not cut into pieces and planted, but rather bedded in the ground. The bedded roots generate sprouts, which are cut and transferred to production fields.

Louisiana is renowned for producing the best sweet potatoes, and the taste and appeal of the famous "Louisiana Yam" is known around the world. Evangeline builds on this strong tradition and is sure to impress the palates of all who try it. ■

Don LaBonte, Professor, School of Plant, Environmental & Soil Sciences, LSU AgCenter, Baton Rouge, La.; Christopher Clark, Professor, Department of Plant Pathology & Crop Physiology, LSU AgCenter, Baton Rouge, La.; Arthur Villordon, Associate Professor, and Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.

Virus-tested foundation seed works



The Sweet Potato Research Station in Chase, La., provides virus-tested foundation seed for the industry. The seed gets its start in the greenhouses at the station.

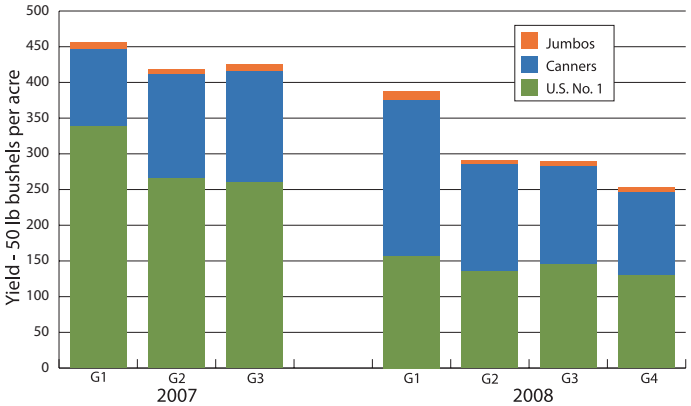
Photo by John Wozniak

Christopher A. Clark, Tara P. Smith and Donald M. Ferrin

A sweet potato crop is vegetatively propagated, which means it is grown by bedding storage roots and subsequently transplanting vine cuttings into production fields from the resulting sprouts. Mutations and pathogens accumulate over time in vegetatively propagated crops, like the sweet potato, which can lead to performance decline and yield reductions. Viruses alone can reduce yields by 25 percent to 40 percent in the Beauregard variety. One means of reducing decline is to provide pathogen-free propagating material. Tissue culture technologies for producing healthy plants have been available for several decades and have been used to produce virus-tested sweet potato plants for research purposes. In 1999, the LSU AgCenter carried this one step further by using healthy plants from tissue culture to produce virus-tested foundation seed, which is sold to sweet potato producers.

The Sweet Potato Research Station produces 10,000-15,000 bushels of virus-tested foundation seed each year, which is made available to producers. However, to produce enough plants for a commercial crop, producers must increase the seed on their farms for at least one year. It is not clear how this affects the qual-

Figure 1. A summary of yields by grade of Beauregard sweet potatoes from different generations of seed sampled from producers in north and south Louisiana.



Christopher A. Clark, Professor, Department of Plant Pathology & Crop Physiology; Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.; and Donald M. Ferrin, Assistant Professor, Department of Plant Pathology & Crop Physiology, LSU AgCenter, Baton Rouge, La.

ity of their seed because older crops on their farms can serve as a source of virus to re-infect seed. A survey was conducted during 2007 and 2008 to evaluate the performance of different generations of sweet potato seed collected on farms across Louisiana.

Virus-tested foundation seed (G1 = generation 1) was grown for one year at the Sweet Potato Research Station. Five growers each from north and south Louisiana provided a 40-pound box of their newest seed (G2 = seed one year removed from foundation seed) and their oldest seed (generally G3 or G4). Each seed sample was bedded separately at the LSU AgCenter Burden Center in Baton Rouge. Beds were covered with a woven row cover to prevent spread of viruses from one seed source to another by insect vectors. Plants from these beds were used to establish a replicated field plot to compare the yields of the different seed sources.

In 2007, a subset of plants from each seed source was tested to determine incidence of virus infection. Of the 19 seed sources indexed, 18 had 100 percent virus infection, while only 20 percent of G1 plants were infected. Thus, it is clear that re-infection with viruses occurs rapidly on commercial farms where sweet potatoes from previous crops provide a constant source of virus. Approximately 80 percent of the plants were infected with sweetpotato feathery mottle virus, an aphid-transmitted virus that by itself does not significantly affect yields. In addition, five other viruses were detected at low levels (2-10 percent).

In both years, total yields and yields of U.S. No.1 sweet potatoes were greater for the G1 foundation seed than for G2 or G3 seed, which had similar yields. In 2008, G4 yields were slightly less than yields for G2 or G3. Unfortunately, we were not able to evaluate older generations (G4 +) of seed in the current study, which may have been representative of yields expected in the absence of the virus-tested seed program.

Researchers will continue to evaluate the performance of various seed sources as they compare to virus-tested G1 seed. The current study suggests that, despite the fact that reinfection of seed is occurring rapidly, producers are still deriving benefits from implementing virus-tested technology into their on-farm seed programs. ■

Sweet potatoes get grades

Tara P. Smith

Photos by Tara P. Smith



U.S. No. 1 Evangeline

Sweet potatoes, like many commodities, are marketed in a variety of ways, and not all sweet potatoes are identical. Retailers and consumers alike demand consistency and quality along grade classes. U.S.-grown sweet potatoes are marketed using "United States Standards for Grades of Sweet Potato." Grade standards are defined primarily along size guidelines, but quality attributes are also extremely important. The premium grade of sweet potatoes in the United States is termed a U.S. No. 1, which is defined as a root between 3-9 inches in length, weighing no more than 20 ounces, and with a diameter ranging from (1 ¾ inches to 3 ½ inches). In addition, a U.S. No. 1 should be firm, smooth, well-shaped and free from damage attributed to diseases and insects.

Other grade classes vary in size and quality specifications compared to a U.S. No. 1 and include U.S. No. 1 Petite, U.S. Extra No. 1, U.S. Commercial and U.S. No. 2. Alternative terminology is commonly used to market sweet potatoes based on size and quality, including "Jumbo" and "Canner" or processor grade roots. Jumbos, as the name would imply, are larger roots that can be sold to the fresh market or to processors, where they are made into a variety of products such as sweet potato fries. Similarly, canner or processor grade roots are sold to canneries and other processors and are packaged into cans or used for a variety of other products.

Sweet potato producers in Louisiana market their crop into both fresh market and processing venues. Capitalizing on variability in root size allows producers to maximize their profit potential. Roots that do not meet a certain specification for one retailer may be highly prized by another. So whether it is a highly coveted U.S. No. 1, a Jumbo or a value-added sweet potato product, enjoy one today! ■

Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.



The process of planting sweet potato transplants, or "slips," into a field is labor-intensive.

Managing Rhizopus Soft Rot on Sweet Potatoes

Christopher A. Clark, Donald M. Ferrin, Don LaBonte,
David H. Picha, Tara P. Smith and Arthur Villordon

Sweet potatoes are susceptible to Rhizopus soft rot, a disease caused by a common fungus that can destroy sweet potatoes after they are removed from storage and washed but before they arrive at the market. For more than 50 years, this disease has been managed effectively by applying a fungicide, usually dichloronitroaniline (Botran), to sweet potatoes on packing lines after they have been washed. One area of research has been to find an alternative means of controlling this disease so that sweet potatoes could be packed safely without fungicide.

Many tests conducted in Louisiana and North Carolina have evaluated the efficacy of new chemicals categorized as either Generally Recognized as Safe (GRAS) or reduced-risk fungicides or biological control agents for control of Rhizopus soft rot. In general, the GRAS products did not provide satisfactory control while the biological-control agents gave some control but less control than the reduced-risk fungicides, which provided control equivalent to Botran. One reduced-risk fungicide, fludioxonil (Scholar), received U.S. Food and Drug Administration approval in November 2008 for use on sweet potatoes. However, in September 2008 the European Union and other countries set for this chemical maximum residue levels equivalent to the limit of detection – essentially making it impossible to use this product on sweet potatoes destined for those markets.

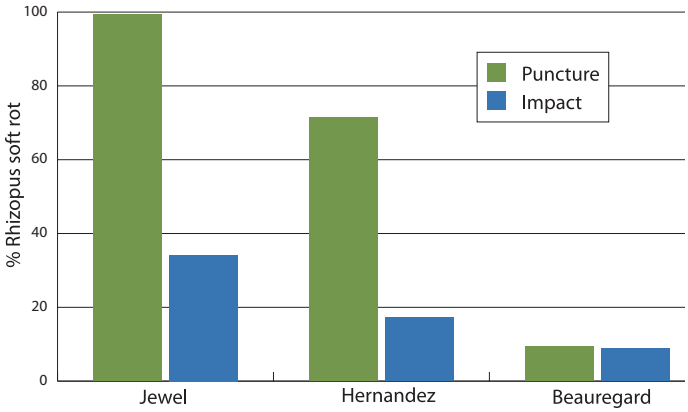
For disease to develop, all components of the disease triangle must be present: a susceptible host (in this case, sweet potato storage roots), a pathogen (*Rhizopus stolonifer*) and a favorable environment for disease to occur. To manage Rhizopus soft rot without relying on fungicides will require an integrated program that addresses each leg of this disease triangle. In the 1990s LSU AgCenter researchers began screening sweet potato varieties for resistance to Rhizopus soft rot. Those studies showed that the variety Beauregard is more resistant than older varieties. Resistance is relative, however, and Rhizopus soft rot can occur on Beauregard even though it is more resistant than the varieties Jewel or Hernandez (Figure 1).

In a survey of commercial packing lines, on many occasions Beauregard could have been packed without using a fungicide, but on some occasions Rhizopus soft rot exceeded the two percent tolerance threshold set for this disease. For several years, an effort has been made to develop breeding lines with even greater levels of resistance than Beauregard, and now several lines produce reasonable yields and are more resistant. This will allow evaluation of whether resistance can be relied on as a principal means of disease management.

Resistance is the easiest and most economical tool for controlling diseases. But in the case of Rhizopus soft rot on sweet potato, the expression of resistance also can be affected by several factors. The U.S. Department of Agriculture Risk Avoidance and Mitigation Program (RAMP) funded a large study from 2003-2008 involving scientists from the LSU AgCenter, Mississippi State University, North Carolina State University and Auburn University. The study focused on understanding the cultural and environmental factors that affect soil insects and postharvest diseases on sweet potatoes in an effort to improve their management with reduced reliance on pesticide use. Beauregard sweet potatoes were collected from more than 100 plots in Louisiana farmers' fields over three years, and their susceptibility to Rhizopus was examined in relation to weather data, cultural practices and field conditions. Figure 2 shows the extreme range of variation in susceptibility of Beauregard from different fields in 2006.

Although the factors that contribute to this variation are complex, correlations were observed with soil moisture, soil phosphorus (P) and potassium (K), and time in storage. Some

Figure 1. Differences in susceptibility to Rhizopus soft rot of three major sweet potato varieties are more evident when roots are inoculated following deep puncture wounds than when they are inoculated following impact wounding.



Christopher A. Clark, Professor, and Donald M. Ferrin, Assistant Professor, Department of Plant Pathology and Crop Physiology, LSU AgCenter, Baton Rouge, La.; Don LaBonte, Professor, and David Picha, Professor, School of Plant, Environmental and Soil Sciences, LSU AgCenter, Baton Rouge, La.,; Tara P. Smith, Assistant Professor, and Arthur Villordon, Associate Professor, LSU AgCenter Sweet Potato Research Station, Chase, La.

Figure 2. Incidence of Rhizopus soft rot on Beauregard sweet potatoes harvested from 21 different field plots in Louisiana, cured and stored under identical conditions, and then inoculated with a severe wounding method.

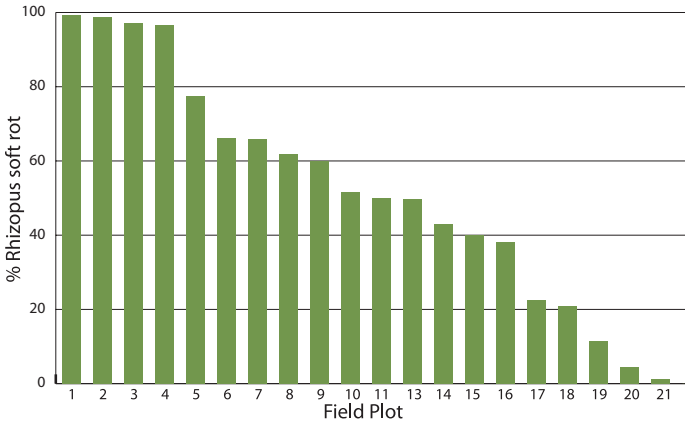
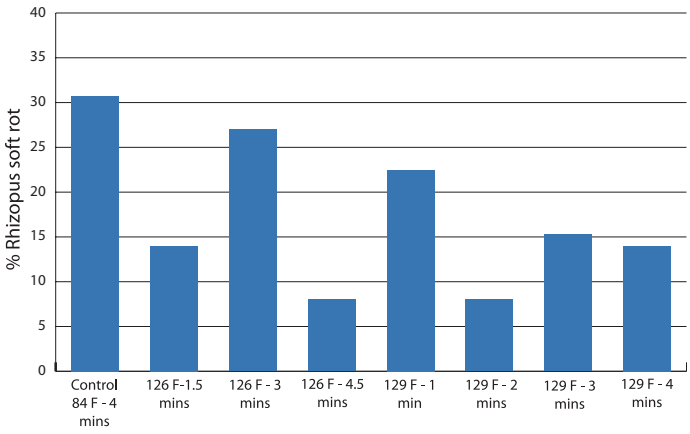


Figure 3. Incidence of Rhizopus soft rot on wounded, inoculated Beauregard sweet potatoes following dips in water at 126 degrees F or 129 degrees F for 1-4 minutes.



of the factors such as rainfall that induce this extreme range of susceptibility cannot be controlled, but monitoring them can possibly identify lots of sweet potatoes that will require treatment at packing to control Rhizopus and identify others that will not require treatment. This could potentially reduce fungicide applications. Other practices, such as P and K fertilization, are subjects of ongoing research to determine if they can be manipulated in the field to increase resistance to Rhizopus.

Rhizopus soft rot requires a wound for infection, and the type and severity of wounding determine whether disease will develop. Therefore, part of the RAMP project involved working with sweet potato packers to identify the causes of wounds on packing lines and ways to reduce them. The amount of the pathogen present also determines whether infection will occur, and sanitation of the packing area is important to reduce this inoculum. As an output of the RAMP project, an extension bulletin, Postharvest Handling of Sweet Potatoes, published jointly by the cooperating states outlines proper storage and handling of sweet potatoes to reduce wounds and improve sanitation. The publication is available through local extension sources and online at www.lsuacenter.com and by typing the title in the search box.

These improvements alone, however, have not completely eliminated the Rhizopus soft rot problem. To supplement these methods, preliminary tests were conducted to investigate whether dips in hot water for several minutes during packing can reduce disease incidence. Initial results were promising (Figure 3), and further research is in progress aimed at evaluating whether hot-water sprays can be used on packing lines.

Prophylactic applications of Botran fungicide provide growers a simple, inexpensive and highly effective means to protect their sweet potato crop from Rhizopus soft rot as it makes its way to market. The development of an integrated pest management approach requires a detailed and thorough understanding of all complex disease triangle factors that contribute to disease development. Several factors – improving the genetic resistance of sweet potatoes, modifying the environment to enhance that resistance, using proper sanitation to reduce populations of the pathogen on the packing line and using hot water to reduce the pathogen on the sweet potatoes – are all necessary and important components of an integrated management system. This, researchers hope, will allow the sweet potato industry to manage Rhizopus soft rot effectively while also reducing prophylactic fungicide use. ■

Photo by Mike Cannon



Sweet potato "seed," which are actually sweet potatoes, are saved for planting the next year. See illustration on pages 18-19.

Sweet Potato Scientist

Chris Clark devotes career to better production, higher yields

There was a time in Chris Clark's life that sweet potatoes made a one-time annual appearance – the Thanksgiving table. Little did he know that this delicious, nutritious menu item would help define his career. Since arriving at LSU in 1977, Clark has played an integral role in the development of sweet potato varieties that have kept the Louisiana industry viable.

Clark grew up in upstate New York where summers were spent assisting researchers with their cabbage and bean projects at the New York State Experiment Station. He later attended Cornell University earning three degrees.

It was his one-year post-doctoral assignment that started his trek south. "It was a cotton research program in North Carolina, and it was my introduction into large-scale one-crop agriculture production," Clark said.

In 2008, Chris Clark was selected as the LSU AgCenter's top scientist of the year and was presented the Doyle Chambers Research Award.

His next stop took him farther south into Louisiana where he was exposed to sweet potatoes. It was not the best time to be involved with them, according to Clark. "I got off to a slow start. It rained for 54 consecutive days. I can still remember the haunting aroma of rotting sweet potatoes," Clark said.

When Clark came to Louisiana, sweet potatoes were grown on nearly 30,000 acres. Today, that number has been reduced to approximately 15,000 acres. Although acreage has decreased significantly, higher-yielding varieties have kept sweet potatoes profitable for growers.

"When I first arrived in Louisiana, Centennial was the dominant variety. It was replaced for a short time by a North Carolina variety called Jewel. Unfortunately, this variety was susceptible to flooding, which is a major concern in Louisiana," Clark said.

The Louisiana sweet potato industry was at a crossroads. Growers needed a variety that had a high yield, was disease-resistant and had a consistent shape, look and taste.

Fortunately, scientists with the LSU AgCenter were about to unleash the magic bullet, a variety that would revolutionize the growing of sweet potatoes across the country.

In 1987, Beauregard was released, and its effect on the Louisiana sweet potato industry was enormous. "Prior to Beauregard's release, the sweet potato industry was about a $25 million industry," Clark said. "After the release of Beauregard, it jumped back up shortly afterward into the neighborhood of $150 million."

The variety performed well in other states and soon became the dominant variety in the industry. Beauregard was hailed as being a savior by farmers across the country and at its peak would account for nearly 80 percent of the nation's acreage.

"Beauregard was such a success that growers felt confident enough to build new storage and packing facilities," Clark said.

The development of a crop variety requires a team of many disciplines. Plant breeders, entomologists and weed scientists all play a critical role. Clark serves as the team's plant pathologist. In 2008, Clark was selected as the LSU AgCenter's top scientist of the year and was presented the Doyle Chambers Research Award.

"The LSU AgCenter's sweet potato research team, of which Dr. Clark is part, has been recognized for its excellence by receiving the Tipton Team Award from the Louisiana Agricultural Experiment Station in 2002," said David Boethel, LSU AgCenter vice chancellor for research.

"Diseases are a limiting factor in production, and Dr. Clark's research has led to the virus-tested seed program, and the management of other diseases has been instrumental in sustaining the sweet potato industry in Louisiana and other southern states," Boethel said.

Clark's primary task is to develop seed plants free from viruses. "Viruses



tend to accumulate in the planting material, so we have to go through special efforts to get rid of them so growers have clean material to plant," Clark said.

Viruses can reduce yields up to 30 percent and affect the quality of the sweet potato. Through the AgCenter's virus-tested seed program, growers now have a reliable source for seed.

Searching for a variety resistant to a specific disease can be a long and arduous task. "People began looking for soil-rot resistance in 1908. It took them to about 1977 before the first variety was released, which was Jasper," Clark said.

Clark says he screens for eight primary diseases when examining varieties for potential release. The variety does not have to show resistance to all of the diseases, but it should have a disease package that would be of benefit to growers. Although finding the right resistance package takes hard work and much testing, it can be serendipitous.

For example, Fusarium wilt is a disease that can cause significant losses. According to Clark, a line of sweet potatoes resistant to this disease was found in a rather exotic location. "A GI from south Louisiana, who was stationed in the South Pacific during World War II, found a sweet potato on the island of Tinian that he liked," Clark said, "and it turned out it was resistant to Fusarium wilt."

This South Pacific sweet potato then became part of breeding programs across the country to help overcome Fusarium wilt. Clark says this is a prime example of how difficult it can be to find a source of disease-resistant plant material.

Photo by John Wozniak



Chris Clark in a greenhouse at the Sweet Potato Research Station in Chase, La.

Unfortunately for Clark and his colleagues, sweet potatoes mutate quite frequently and are susceptible to pathogens. One characteristic that often reveals a mutation is a change in the color of the flesh. Often, a lighter color flesh will appear. A lighter flesh sweet potato will present problems because consumers seek a richer orange, uniform color.

Travel is often part of Clark's quest to find a resistant line. He has visited China in hopes of finding a line resistant to some of the common diseases found in this country. Clark estimates that 80 percent of the world's sweet potatoes are produced in China. Clark says that the eastern part of Africa is another region important for both sweet potato production and research.

Worldwide, sweet potatoes are seen as a "poor man's crop." "Sweet potatoes have helped people survive during difficult times. Examples in America include the Great Depression and World War II," Clark said.

In developing countries, sweet potatoes are prized because of their ability to grow in poor soils and in small areas. Clark says that in some parts of the world sweet potatoes are grown between the road and the sidewalks that border them.

Clark says that the LSU AgCenter's latest sweet potato release, Evangeline, is showing much promise. "It's been judged sweeter than Beauregard, and its darker orange color makes for a better appearance," Clark said.

Its yield is comparable to Beauregard, but it is more susceptible to a fungus problem. Clark says that the team is looking at alternative fungicides and treatment plans to better manage this issue. He suspects that Evangeline will eventually overtake Beauregard as the dominant variety in Louisiana.

Convincing people that sweet potatoes are not just food for the holidays is one area of marketing that can be improved. Clark had to sell this very idea to his own family. His daughter proudly proclaimed not to be a fan of the root, but now as a physician, she recognizes the health benefits that sweet potatoes provide. Sweet potatoes are a good source of beta carotene and folic acid and are better for diabetics than other types of potatoes.

Chris Clark has made a career with sweet potatoes. And these days they appear quite often on the menu at the Clark household. ■ **Craig Gautreaux**



How to Grow

January	February	March	April	May	June



Seed roots being planted.



Field with seed roots (actual sweet potatoes).



Covering seed (bedding).



Plastic mulch layer being applied over seedbed.



Three to six weeks after bedding, pull plastic off and the plants have sprouted.

Bedding Process

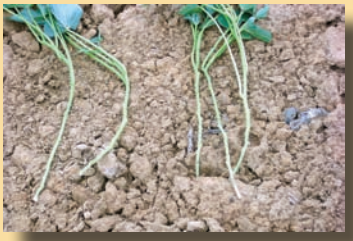


Crop goes into storage to undergo a curing process (5-7 days) where the temperature is 85-90 degrees F. The sweet potatoes can be stored up to a year at 55-65 degrees F and high humidity.

Storing an



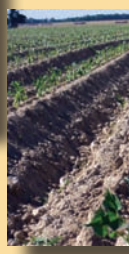
Workers cutting transplants (or slips) out of the bed.



Transplants (slips) need to be 10-14 inches.



A week lat
been prepa
are plante



Transplant
productior

Transplant



After transplant, in-seaso
ment includes cultivation
managing insects, weeds

In-season Mana

Sweet Potatoes

July | August | September | October | November | December



er the field has
ared and the slips
d.



ed slips in the
n fields.

ing



on manage-
and
and diseases.

agement



Sweet potato "seed," which are actually sweet potatoes, are saved for planting next year.

Save Seed



After de-vining (removing foliage), harvest begins in August.



Close-up of the newly harvested crop.



Close-up of chain harvester.

Harvesting





Sweet potatoes are washed and packed for market.

nd Packing

Illustration by Barbara Groves Corns

'Or you can call me Yam...'



In the 1970s, actor Bill Saluga used the line: "You can call me Ray, or you can call me Jay. . ." When talking about Louisiana sweet potatoes or yams, there seems to be a similar confusion. What should we call them and does it matter? Following is a not-so-short and rather confusing answer.

First off, a little background information. A sweet potato and a true yam are not the same thing; in fact, they're not even in the same family. Sweet potatoes are actually related to the morning glory flower. True yams, which have red or purple flesh inside, are grown in West Africa and Asia (but not in America), and they are tubers like their relative the Irish potato, meaning they have modified shoots.

Sweet potatoes are believed to have originated in South America and are grown in tropical and subtropical climates like Louisiana. They are not actually tubers, although they have tuberous or modified roots. True yams grow much larger (some over seven feet in length) and are starchier than sweet potatoes. Properly cured Louisiana sweet potatoes taste much sweeter and are also high in nutritious beta-carotene (orange-fleshed varieties), while true yams are low in that compound.

Originally, African slaves in the southern United States called sweet potatoes the Senegalese name "nyami" because the vegetable reminded them of the starchy tubers they had grown in their homeland. "Nyami" was eventually shortened to the English version "yam," but it was not a widespread name for sweet potatoes in America – at least not until the 1930s. That's when Julian C. Miller and other researchers with the LSU Horticulture Department began a brilliant national marketing campaign. These scientists decided to call Louisiana sweet potatoes "yams" to create an identifiable distinction between the sweeter, softer, moister, orange-fleshed sweet potatoes grown in Louisiana versus the firmer, dryer, white-flesh varieties grown in more northern parts of the country. Louisiana producers and marketers ran with the idea and now, nearly seven de-







Photo by Mark Claesgens

cades later, "yam" remains the trademark for the Louisiana-grown sweet potato.

Through the years, some competing states made attempts to eliminate the term "yams" on a national basis, but the efforts were met with resistance from Louisiana growers. Now, most American-produced sweet potatoes are marketed as yams – maybe a classic case of the adage, "If you can't beat them, join them." But even though the terms are still used interchangeably, the U.S. Department of Agriculture requires package labels with the word yams to also include the identification sweet potatoes.

The term "yam" has grown to mean a few other things as well. Some farmers refer to freshly harvested sweet potatoes as "sweet potatoes" and properly cured sweet potatoes (a six to eight week process) as yams. Also, in the southern United States, once sweet potatoes are canned, they are often referred to as yams.

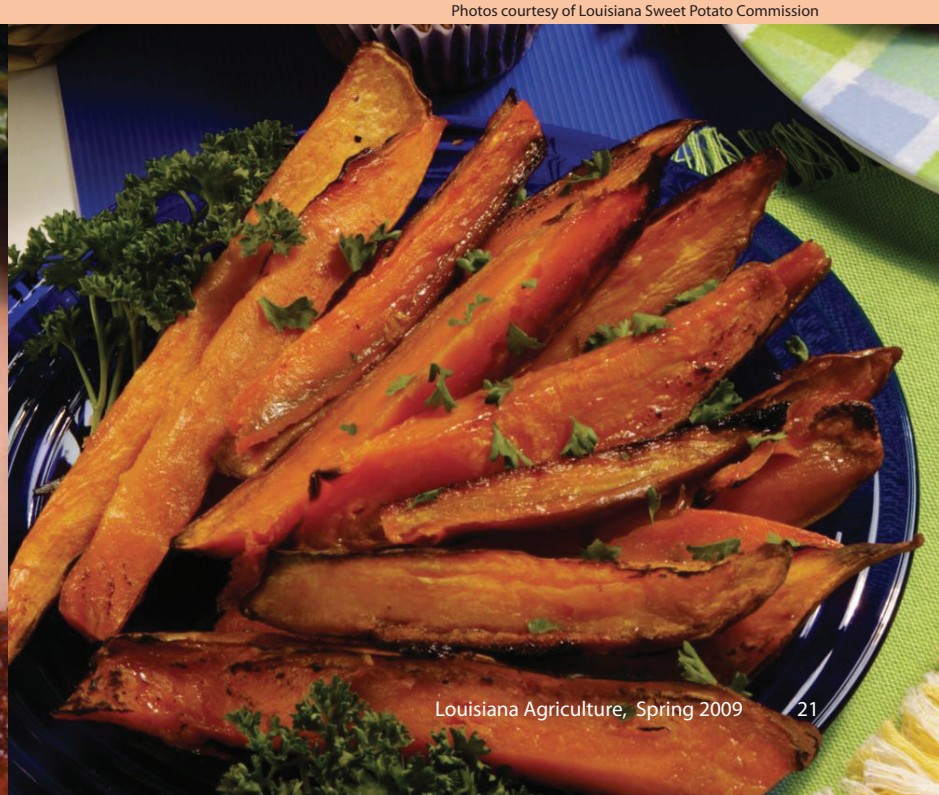
But, we're not finished with the tricky terminology. Louisiana yams are really what we would properly call sweet potatoes. But to add even further confusion, the sweet potato is not even related to the potato, nor is it really a potato in any sense of the word. It was probably erroneously given that name by Europeans sometime in the 18th century because it looked somewhat similar to a potato. So, even though a sweet potato is not a potato nor a yam, we call it by both those names. Therefore, technically, it's neither, but for practical usage, it has become both.

Do these explanations clear things up a bit? If the varied vocabulary still has you scratching your head, try to imagine it from the perspective of a sweet potato. If it could speak, it might just say: "You can call me Sweet Potato, or you can call me Yam…" ■

Randy LaBauve

Photos courtesy of Louisiana Sweet Potato Commission





Research Verification Program

for Louisiana Sweet Potato Production

Tara P. Smith, Kurt M. Guidry, Myrl Sistrunk, Gerald Roberts, Vincent Deshotel and Eugene Burris

In 2007, the LSU AgCenter started a verification program for sweet potatoes, similar to the programs for rice, soybean and corn. These verification programs are conducted in collaboration with growers to test AgCenter recommendations.

Louisiana ranks third in total sweet potato acreage planted in the United States, producing approximately 15,000 acres in 2007 and 2008. In 2007, the farm-gate value of the crop exceeded $65 million, and the value added after processing and packaging exceeded $112 million. 2008 was not a representative year because of severe crop loss caused by hurricanes Gustav and Ike.

Gross producer revenue from 2005 to 2007 averaged roughly $3,633 per acre, making sweet potatoes the most lucrative row crop in Louisiana (gross revenue per acre). With production, packaging and storage costs ranging from $2,000 to $3,500 per acre, however, a sweet potato crop also is the most expensive row crop in the state to grow. The variability in costs to growers means a high level of fluctuation in potential profitability. To help address the issues that affect production cost variability, a verification program was initiated in 2007.

Sweet potato production is a year-round process. Production starts in early spring when seed potatoes saved the previous year are bedded in plant or seed beds. Transplants – or "slips" – are cut from these plant beds after five to seven weeks and then planted into production fields from late April-July. The sweet potato crop matures in 100-120 days, and harvest occurs from late July-November.

Photo by Tara P. Smith



Myrl Sistrunk, county agent in West Carroll Parish, evaluates a verification plot in that parish.

Sweet potato production is extremely labor-intensive. Adverse weather conditions during planting or harvest often result in crop failures and reduced profits. Several other factors – including insects, diseases and weeds – can negatively affect crop performance, productivity and profit,

The sweet potato verification program encompasses all aspects of production, packaging and storage. The overall goal is to help maximize yields and increase profits. In addition to in-field production variables – plant spacing, fertilization, irrigation and insect, disease and weed management – the verification program addresses field identification, seed selection, plant bed production and management. Information regarding production and cultural practices is recorded to correlate those practices with yield.

The sweet potato verification program includes commodity storage and marketing components. Sweet potatoes are unique in that they are stored on the farm and are sold, packed and shipped to markets throughout the year. As such, in addition to tracking and monitoring the traditional cultural and production practices, the sweet potato verification program also monitors packaging and stor-

Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.; Kurt M. Guidry, Gilbert Durbin Professor, Department of Agricultural Economics & Agribusiness, LSU AgCenter, Baton Rouge, La.; Myrl W. Sistrunk, County Agent, West Carroll Parish; Gerald Roberts, retired County Agent, St. Landry Parish; Vincent Deshotel, Assistant Extension Agent, Opelousas, La.; and Eugene Burris, Professor, Northeast Research Station, St. Joseph, La.



After the field is prepared, the seed sweet potatoes are planted. See the illustration on pages 18-19 to learn how sweet potatoes are produced.



The seed are covered with soil.

Photos by Tara P. Smith



A layer of plastic mulch is then applied over the row to aid in the sprouting process.

age issues to establish the relationship between these functions and profitability.

The verification program was initiated in 2007 on a West Carroll Parish farm. The program was repeated in 2008 in the same fields and also was instituted in a 25-acre field in Evangeline Parish, which is in south Louisiana. The participating producers and AgCenter personnel recorded and collected information on inputs, equipment, labor and the time required to conduct each activity. In addition, information on land rent, crop consultant fees, crop insurance and other direct costs were collected. LSU AgCenter enterprise budgets were used in conjunction with these data to develop estimates of the cost associated with each activity. Finally, information on monthly packaging and storage costs and other associated marketing costs was collected along with monthly sales volumes and prices.

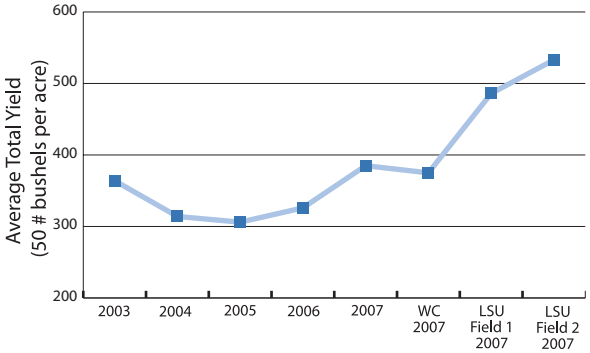
Costs associated with the verification program fields were separated into variable and fixed production costs. Variable costs include items such as fertilizer, chemicals, labor, fuel and machinery repair and maintenance. Fixed production costs include interest expense and machinery depreciation and are calculated using AgCenter enterprise budget assumptions. Based on these costs and revenue information from the participating producer, estimates of returns to the operation are developed.

The verification program produced valuable information in 2007. Both verification fields outyielded the state total average yields for 2003-2007 (Figure 1) and also exceeded the West Carroll Parish yield average in 2007. U.S. No. 1, the premium marketable yield grade for sweet potatoes, accounted for more than 65 percent of the total yield in both fields. Total production costs (direct, operating interest, fixed and packing line) were estimated at approximately $2,700 per acre for each field in 2007, and estimated returns above cost were approximately $2,000 per acre. All revenue information was generated assuming a 65 percent of the roots that were packed met U.S. #1 grade standards and were marketed as such.

The sweet potato verification program will continue and provide information to producers by evaluating the AgCenter's current recommendations for sweet potato production. With the information on production practices and economic performance of the operation, the sweet potato research verification program can identify those issues and production areas that offer the most potential for efficiency and profitability gains. As such, the sweet potato research verification program holds the potential of providing an excellent educational opportunity for LSU AgCenter personnel and producers alike.

Knowledge gained from this program can be used to improve and further develop recommendations for sweet potato production, with an end goal of improving the sweet potato industry in Louisiana and ensuring that producers remain successful.

Figure 1. Total state average yields (Louisiana) from 2003-2007. WC = West Carroll Parish 2007. LSU V1 and V2 were the two verification fields in 2007.



Acknowledgment
The authors wish to thank cooperating producers including Ted and Sharon McDermott of McDermott Farms in West Carroll Parish and Larry, Earl and Lonnie Fontenot of E & L Produce in Evangeline Parish. ■

Nutraceutical Compounds and Antioxidant Content of Sweet Potatoes

David H. Picha and Malkeet S. Padda

Sweet potatoes are regarded as one of the most nutritious vegetable crops. They are known to be an excellent source of vitamin A (orange-flesh types) and dietary fiber and contain significant amounts of vitamin C, vitamin E, vitamin B9 (folate) and various minerals. In a recent study, the Center for Science in the Public Interest, a nonprofit, independent organization seeking to improve the public's health, ranked the sweet potato No. 1 of all vegetables in nutritional content. For many consumers, the decision to purchase sweet potatoes is based the product's nutritional value and perceived health benefits, in addition to flavor.

To help enhance consumption of sweet potatoes in both domestic and export markets, postharvest laboratory research in the AgCenter recently has focused on quantifying additional health-beneficial properties of sweet potatoes, including their antioxidant content and potential nutraceutical value – contributions to health beyond simple nutrition.

Phenolic Acids in Sweet Potatoes

Phenolic acids are known to be important, naturally occurring antioxidants, which function as scavengers of damaging free-radical molecules inside the cell. In humans, the damage caused by free radicals has been implicated in the aging process and in the development of cancer, cataracts and heart disease. Phenolic compounds are important secondary metabolites in sweet potatoes. These compounds are involved in a number of biosynthetic processes, including the maintenance of cell wall integrity and chemical defense against pathogen attack. Coupled with high vitamin content and other metabolites, phenolic compounds can make a significant contribution to the nutraceutical value of sweet potatoes.

A rapid and sensitive analytical procedure was developed to quantify individual phenolic acids in sweet potato tissue using high-performance liquid chromatography. Using this methodology, the major phenolic acids in sweet potatoes were identified and the amounts were quantified in fresh root tissue and various edible preparations. Antioxidant activity in sweet potato tissue was determined using the compound Trolox to measure the antioxidant level.

Principal Phenolic Acids in Sweet Potatoes

Chlorogenic acid, caffeic acid and three isomers of the dicaffeoylquinic acids were identified as the principal phenolic acids in sweet potato root and leaf tissue. Among these, chlorogenic acid was the major phenolic acid except in young, immature leaves where 3,5-dicaffeoylquinic acid was the predominant phenolic acid.

Many factors were found to influence the concentration of phenolic compounds and antioxidant activity in sweet potatoes. These factors include growth stage of the tissue, type of tissue, genotype, postharvest care (curing, storage temperature, duration) and processing method.

Small roots at the initial stages of growth contained the highest amounts of phenolic compounds. The cortex tissue just beneath the skin tended to contain higher amounts of phenolic acids than the inner pith tissue, although the results were usually not statistically significant. Antioxidant activity in root pith tissue ranged from a high of 9.2 milligrams of Trolox equivalents per gram of sweet potato dry weight in very small-sized roots to 1.2 milligrams per gram in large-sized roots.

Sweet potato leaf tissue had a significantly higher phenolic acid content and antioxidant activity than root tissue.

Photo courtesy of Louisiana Sweet Potato Commission



Sweet potatoes are one of the most nutritious vegetable crops. They are known to be an excellent source of vitamin A (orange-flesh types) and dietary fiber and contain significant amounts of vitamin C, vitamin E, vitamin B9 (folate) and various minerals.

David H. Picha, Professor, and Malkeet S. Padda, former Graduate Research Assistant, School of Plant, Environmental & Soil Sciences, LSU AgCenter, Baton Rouge, La.

Young immature leaves had the highest phenolic acid content. Antioxidant activity in leaf tissue ranged from a high of 99.6 milligrams Trolox equivalents per gram of sweet potato dry weight in young leaf tissue to 21.0 milligrams per gram in old leaves and 9.6 milligrams per gram in leaf stems.

Sweet potato roots may be prepared for consumption in different ways. Microwaving, conventional oven baking and boiling are the most widely used preparation methods in homes and in food-service establishments. The method of heat processing and tissue location was found to influence the phenolic acid composition and antioxidant activity of Beauregard sweet potatoes. Heat processing (microwaving, boiling or baking) reduced total phenolic content and antioxidant activity in the skin tissue, but not in the cortex or pith tissue. Compared with microwaving and boiling, conventional oven baking resulted in a higher loss of antioxidant activity in skin tissue. Although the sweet potato may be considered as a rich source of antioxidants, distribution of phenolic acids in the root varies according to tissue location. Skin tissue typically contains the highest amount of phenolic compounds and antioxidant activity, followed by the cortex (tissue just beneath skin) and pith (inner flesh tissue).

Minimally processing sweet potatoes into fresh-cut products may also influence their phenolic content and antioxidant potential. In a comparison of different styles of cut, sliced sweet potatoes had a significantly higher total phenolic content than shredded. Storage of the fresh-cut products for several days resulted in an increase in total phenolic content. A holding temperature of 41 degrees resulted in a higher total phenolic content than at 32 degrees.

Implications for Industry

Results of these studies may have useful implications in developing new products and functional foods from sweet potatoes. For example, because of their high phenolic content and antioxidant activity, small, immature sweet potato roots and leaves may be useful sources of naturally occurring nutraceutical compounds for functional food manufacturers. The high phenolic content in skin tissue may also have implications in utilization of waste peelings from processed sweet potatoes. Also, these tissues may be concentrated sources of caffeoylquinic acids, which are useful to the pharmaceutical industry.

Consumers are placing increasing importance on the nutritional quality of a food product in making their purchasing decisions. The nutraceutical value and antioxidant content are important components of nutritional quality. Sweet potatoes may be important sources of phenolic acid nutraceutical compounds and antioxidants. Research to quantify the favorable nutritional and nutraceutical value of sweet potatoes will help provide important product-composition information for marketers to use in stimulating interest in sweet potato consumption. This information also will be useful to food processors interested in developing new value-added sweet potato products. ■

Resistant Starch and the Sweet Potato

Joan M. King

Finding new uses for sweet potato components, such as starch, would increase the demand for sweet potatoes and save processors money by finding a use for the waste produced during cutting and canning.

The United States produces approximately 600,000 tons of sweet potatoes annually, making it the world's 10th leading producer. About 24 percent of the nation's sweet potatoes are grown in Louisiana, accounting for more than half of the state's vegetable cash income and contributing $100 million to the state's economy.

Sweet potato roots grown in Louisiana are used for processing, mainly canning. During the season, the canning process produces 600,000 pounds of sweet potato waste per day. At least half goes directly into lagoons, creating an environmental waste issue. Much of this waste is from cutting sweet potatoes for canning, and the by-product is mainly starchy sweet potato flesh.

Increasingly stringent environmental regulations drive the need for innovative methods to remediate sweet potato waste. Creating high-value products from sweet potato by-products using value-added processing can minimize the waste stream, as well as provide a new source of income from high-value products manufactured from this waste.

Resistant starch is a type of starch that acts like fiber in the human body and thus provides the health benefits of fiber. Resistant starch is in high demand as a food ingredient. Research with resistant starch is exciting because of so many possible health benefits. They include improved glucose regulation and better weight control, reduced constipation, reduced colon cancer risk and reduced blood cholesterol and triglycerides. Resistant starch has a low glycemic index. This may lower insulin demand by the body and benefit diabetics as they try to regulate their blood glucose within a normal range.

Resistant starch can occur naturally in such foods as raw potatoes and bananas or in processed foods and starches.

Research at the LSU AgCenter involves testing of the effects on resistant starch levels by adding amino acids to starch from two types of sweet potatoes. White-fleshed sweet potato starch has significantly more resistant starch than the orange-fleshed starch in both cooked and uncooked forms. Research shows adding the amino acid lysine enhanced the level of resistant starch by 20 percent in cooked orange-fleshed sweet potato starch.

Further research is planned to increase the amount of resistant starch. This research will target reducing environmental waste for the sweet potato industry, as well as providing a new source of income from high-value products manufactured from this waste.

The sweet potato industry will realize additional and significant economic impact as a result of this work. ■

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

Individual Shrink-wrapping of Sweet Potatoes:

An Emerging Value-added Marketing Technique

David H. Picha

The majority of sweet potatoes consumed in the United States are purchased through retail fresh market outlets. They have traditionally been marketed in the form of individual roots stacked in bulk displays and priced per pound. When purchased as a fresh product, sweet potatoes are most commonly prepared as a baked root. However, product convenience and ease-of-preparation are becoming increasingly important among time-stressed consumers.

A value-added form of marketing sweet potatoes involves packaging individual roots in shrink-wrap film, followed by heat-sealing the film to adhere it tightly to the skin. Consumers may then conveniently prepare the roots by microwave with a cooking time of approximately eight minutes for a 6-ounce root.

Although individual shrink-wrapping technology in the fresh produce industry has been available for years, it was mostly confined to use on greenhouse-grown cucumbers. The potato industry began using this packaging technology about 20 years ago, followed by a slow adoption with other crops.

Research on developing a value-added shrink-wrapped sweet potato product began in the LSU AgCenter in the early 1990s. Numerous tests were conducted to identify the appropriate film type and thickness for maximizing the retail

Photo by Mark Claesgens



David Picha has conducted numerous tests to identify the appropriate film type and thickness for maximizing the retail market life of shrink-wrapped sweet potatoes. These tests have continued with the advent of new film types and formulations.

David H. Picha, Professor, School of Plant, Environmental & Soil Sciences, LSU AgCenter, Baton Rouge, La.

market life of shrink-wrapped sweet potatoes. These tests have continued with the advent of new film types and formulations.

The sweet potato industry in the United States has adopted this technology for marketing a small but significant portion of its fresh product sold through retail channels. Louisiana growers and shippers began to offer this value-added product in 2004 with small-sized U.S. No. 1 grade Beauregard roots.

According to trade industry sources, about 3 percent of the fresh-market sweet potatoes sold in U.S. supermarkets are in the form of microwavable, shrink-wrapped roots. Sales of this convenience-type sweet potato are increasing annually. The most common root sizes used for individual shrink-wrapping are 6, 7 and 8 ounces. Retail prices within the United States typically range from $0.99 to $1.59 per root, depending on the store and location.

Shrink-wrapping Process

The sweet potato root surface must be completely dry before wrapping to prevent surface mold from forming on the skin during extended periods of storage or marketing. The shrink-wrapping process involves enclosing individual sweet potato roots in polyolefin or other type polymer shrink films. The film is readily available from package-supply vendors and usually arrives on rolls cut to the desired length and width. Film thickness typically ranges from 40 to 100 microns.

The sweet potatoes are put in a feeder assembly with a spacer to separate the roots. The film is wrapped around the root and cut to the proper size by a heat-sealing device. Manual, semi-automatic and automatic film-cutting and heat-sealing equipment are available. The root with the loosely fitting film is then conveyed through a heat tunnel to create a tightly sealed package. Fully automated commercial equipment approaches a speed of one wrapped root per second. The individual roots can be conveniently labeled with product-preparation, nutritional-value and other marketing information.

Benefits of Shrink-wrapping

Shrink-wrapping adds value to fresh-market sweet potatoes by enhancing appearance, reducing weight loss and allowing for individual labeling. Weight loss by shrink-wrapped roots during retail marketing is significantly less compared with unwrapped roots. Weight-loss studies found shrink-wrapped, cured Beauregard roots lost about 0.5 percent of their weight after three weeks of simulated retail market conditions at room temperature compared with 2.5 percent weight loss by unwrapped roots.

Photo by Mark Claesgens



About 3 percent of the fresh-market sweet potatoes sold in U.S. supermarkets are in the form of microwavable, shrink-wrapped roots.

Film thickness and weight loss showed an inverse relationship, with the thicker-gauge films allowing the least amount of weight loss. Taste-panel test results indicated that film type and thickness did not influence overall root flavor or sweetness.

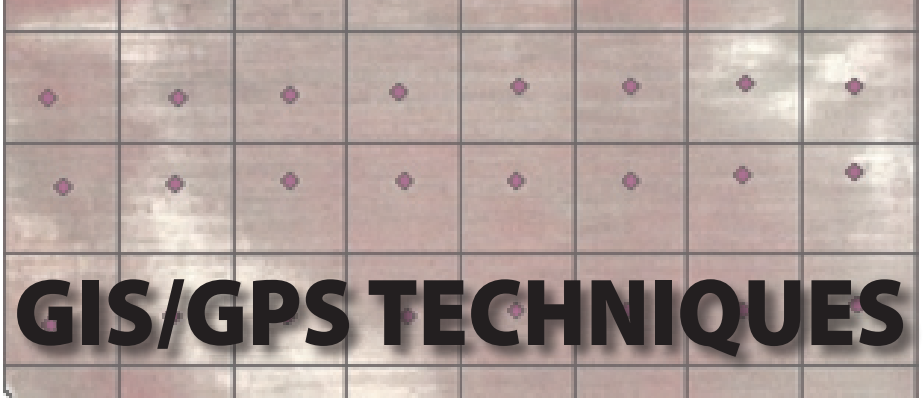
Economics

The purchase price of an automatic, sweet potato shrink-wrapping system – which includes the root feeding device, cutter/heat sealer and heat tunnel – is approximately $100,000 for a unit that will process about 60 roots per minute. Lower-capacity processing systems cost less, but the packaging cost per root is higher. Manual labor is needed to place the sweet potatoes on the feeding device, continually monitor the flow of roots, make necessary adjustments and repairs to maintain a continuous flow, and put the wrapped roots into cartons for shipping. In addition, the cost of the shrink-wrap film (not including equipment or labor) is about a half cent per root.

Although shrink-wrapping equipment does represent a major investment, grower/packers around the country generally receive a two- to three-fold premium price per pound for shrink-wrapped sweet potatoes compared with bulk-packed roots.

Significant market growth potential exists for convenient-to-prepare, value-added forms of sweet potatoes, such as individually shrink-wrapped roots in microwavable films. The technology for packaging sweet potatoes in this manner is widely available from multiple commercial vendors. Shrink-wrap packaging and heat-sealing equipment can be obtained to match any size of operation, from small gift-pack enterprises to large grower-shippers who market sizeable volumes to large retail supermarket chains.

Added benefits of packaging sweet potatoes in this way include product cleanliness, ease of labeling, traceability, reduced shrivel and the ability to include advertising and preparation information on each root. Buyers and consumers alike pay a premium price for this value-added fresh product. ■



help evaluate soil insect and nematode pest control strategies in sweet potatoes

Eugene Burris, Dennis Burns, Tara P. Smith, Charles Overstreet and Maurice C. Wolcott

Most sweet potato production in Louisiana lies within the Macon Ridge terrace that starts near Eudora, Ark., and ends near Sicily Island, La. Terrace uplands of the ridge make up about 75 percent of West Carroll and Franklin parishes. The prominent ridge consists of almost entirely early-Wisconsin glacial outwash. The eastern edge of the region is higher by 20 to 30 feet compared with the western edge. A veneer of loess soil covers 75 percent of the region. Managing crops on these loess soils of the Midsouth is difficult because they contain little organic matter, have a permanent hardpan, are droughty and erode easily. Generally, these fields are small compared to delta alluvial fields; however, they often have considerable variability in soil texture. This variability is often created by land-leveling for irrigation and drainage improvements. The reniform nematode is another problem not uniformly distributed within these fields. This variability presents producers with an opportunity to manage these problems in a site-specific manner.

Recently, LSU AgCenter research and extension personnel have attempted to characterize sources of variability within loess soils using the Veris cart, which measures apparent electrical conductivity (EC) in the soil. These data combined with real-time kinetic geographical position systems (GPS) can be used to characterize in-field soil texture variability. The Veris cart provides a method for categorizing regions of a field into low and high silt and clay content, and Veris EC values are highly correlated to clay content. Because of the narrow range of electrical conductivity measured in the loess soil regions, three ranges determined by natural breaks were typically used to characterize the field into zones (Figure 1).

Geographic information system (GIS) tools – computerized systems used to compile, retrieve, analyze and display spatially referenced data – were used in combination with GPS to develop prescriptions for site-specific applications of lime and fertilizer for correcting soil pH and nutrient deficiencies and fumigation for managing nematodes.

Research using these techniques in Louisiana sweet potato production is limited. The results from these studies, however, show GIS/GPS techniques have the potential to help sweet potato producers fine tune lime and fertilize treatments as well as provide relief from costly blanket applications of nematicides – both major expenses incurred in sweet potato production.

In initial studies conducted on the Macon Ridge, one-acre grids were used to develop soil sample plans (Figures 1 and 2). Grids overlaid on GIS maps served to organize placement of the GPS sample points. The goal for sampling was to collect soil from the dominate EC range featured in the grid (Figure 1). Therefore, the final soil sampling procedure was derived from a combination of scientific and subjective techniques. The grid-management technique also was used to track early movement of cucumber beetles on one farmer's field (Figure 2).

In 2007, researchers used these techniques to evaluate insects across irrigated and non-irrigated portions of a field (Figure 1). Insect data were collected routinely throughout the season from one-acre grid plots. Sweep-net collections from individual grids were used to provide data on cucumber beetles, click beetles, armyworms, loopers and crickets. The grid pattern allowed observations of early insect movement across an 85-acre field. Sampling using this method indicated that early emergence of cucumber beetles was variable enough to justify use of site-specific treatments for the first one to two insecticide applications. Sampling in this manner, however, is time-consuming and labor-intensive.

In 2008, fields were sampled on a farm in northeast Louisiana near Oak Grove. In cooperation with the producer, Veris data and soil samples from one-

Eugene Burris, Professor, Northeast Research Station, St. Joseph, La.; Dennis Burns, Agricultural and Natural Resources Agent, Tensas Parish, St. Joseph, La.; Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.; Charles Overstreet, Professor, and Maurice C. Wolcott, Instructor and Extension Specialist, Department of Plant Pathology & Crop Physiology, LSU AgCenter, Baton Rouge, La.

acre grids were collected prior to planting in the spring. Several opportunities for site-specific lime applications to correct soil pH were found, and grid-sampling data could be used to make site-specific treatments for reniform nematodes in some fields.

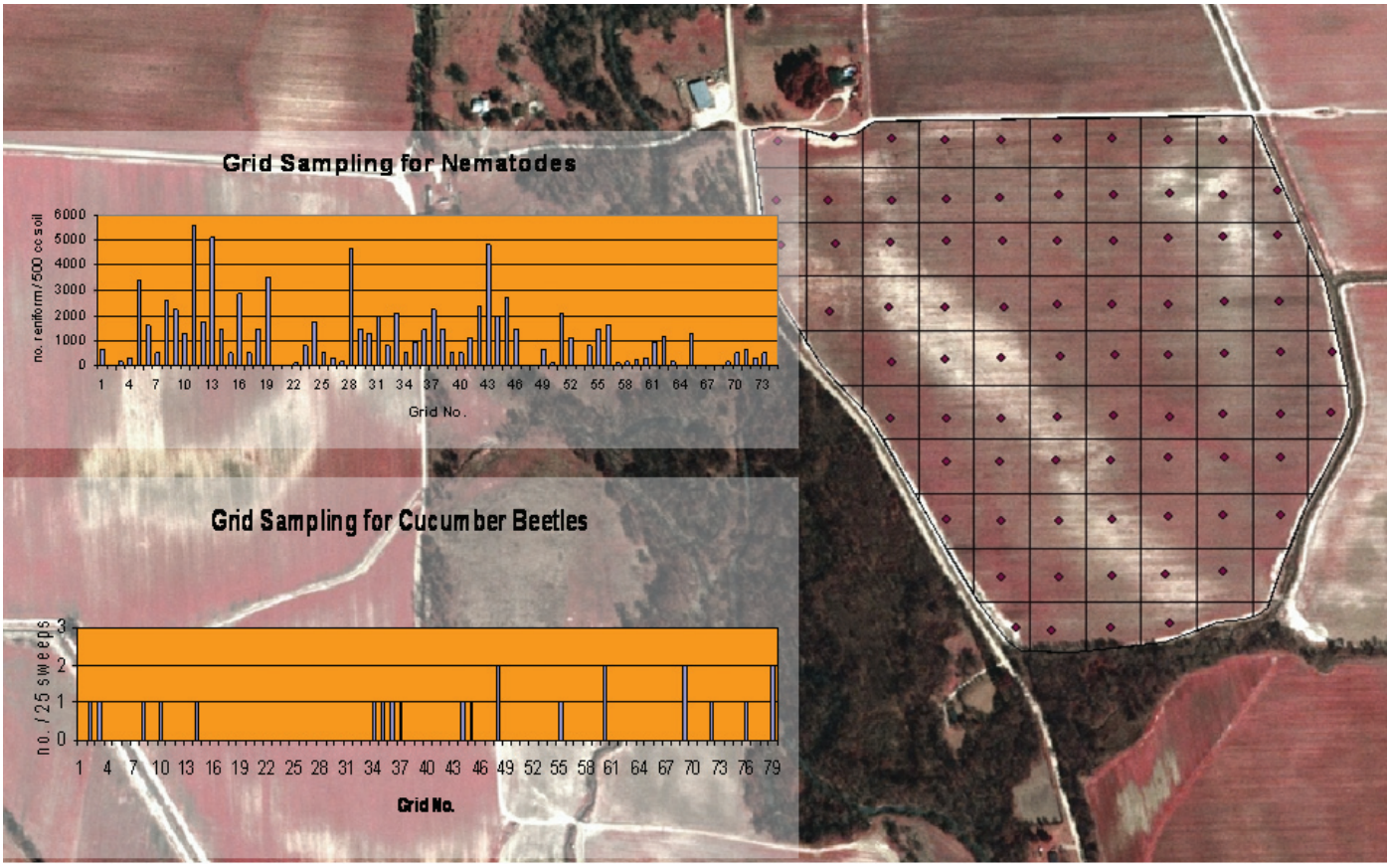
Using these methods, LSU AgCenter researchers consistently have observed and documented GIS-referenced differences in soil pH, potassium, phosphorous, zinc, boron and sulfur. Since reniform nematodes thrive and reproduce throughout all EC zones, grid sampling is the most effective means of characterizing variability in reniform nematode population densities. Site-specific prescription treatments for soil pH, soil fertility and reniform nematodes can be developed using both soil EC data and data from grid sampling.

Equipment for site-specific delivery of nematicides was generally not available at the farms; however, several farmers recently purchased fumigation equipment with GIS/GPS capability. ■



Figure 1. Veris EC data represent low, medium and high values that highly correlate to clay content. Within the three zones, nine feature classes are indicated as contours. The GPS point used to indicate sample location can be manually placed if the centroid does not represent the desired sample location. Therefore, selection of sample locations combines both science and subjectivity and allows an equal number of samples to be collected from each zone.

Figure 2. One-acre grids overlaid on a sweet potato field near Gilbert, La., were used to capture the early emergence of cucumber beetles and evaluate nematode population densities. Sweep-net samples indicated 1 beetle / 25 sweeps in 15 of 79 samples and 4 samples were above the economic threshold of 2 beetles / 25 sweeps. Nematode samples taken from the field on July 5, 2008, indicate a uniform distribution, with a few zeros and 29 counts below 1,000 / 500 cc of soil. The samples indicate site-specific pesticide treatments could be used for both pests. Also, several soil samples indicated low pH values along the ridge.





Season-long Management *of the Banded Cucumber Beetle in Louisiana Sweet Potatoes*

Abner M. Hammond, Rick Story, Tara P. Smith and Jeff Murray

Several insects feed on the foliage and roots of sweet potatoes throughout the growing season. The sweet potato root can be injured by several soil insects, including sweetpotato weevils, rootworms, sugarcane beetles, wireworms, whitefringed beetles, white grubs and flea beetles. Research conducted from 2002-2007 in conjunction with a multistate U.S. Department of Agriculture Risk Assessment and Mitigation Program project identified the banded cucumber beetle as the most prevalent and problematic insect affecting sweet potatoes in Louisiana. In a three-year survey of untreated plots in grower fields, rootworms (cucumber beetle larvae) damaged 15 percent of the roots (Table 1). This damage was greater than that of all other soil insect pests, including white grubs, whitefringed beetles, sugarcane beetles, wireworms and flea beetles.

Adult banded cucumber beetles feed on the foliage of sweet potatoes, but this feeding causes no apparent injury to the plants. Adults deposit eggs on the soil at the base of plants, and the larvae (rootworms) feed underground on the roots. Eggs in the soil hatch in approximately two weeks. The larval stage may last eight to 30 days depending on the food supply and temperature. Pupae – the stage between larva and adult – are found just below the soil surface, with adults emerging in about a week. Found in multiple, overlapping generations per year in Louisiana, banded cucumber beetles feed on a wide variety of crops, including soybeans, corn and various vegetables. Rootworms do not reduce sweet potato yield, but their feeding produces shallow holes and cavities on the root surface. The blemishes reduce the value of the crop by preventing the roots from being marketed as a U.S. No. 1 grade.

Season-long management of cucumber beetles is necessary because these insects are present throughout the entire growing season. Producers are advised to use a multi-faceted approach to manage cucumber beetle damage:

- Apply soil insecticides just before planting or at lay-by (the last cultivation approximately 30 days after planting).
- Scout fields for adult beetles during the growing season.
- Apply foliar insecticide sprays when populations reach or exceed the threshold level.

A limited number of soil insecticides available for use in sweet potatoes include chlorpyrifos (Lorsban), ethoprop (Mocap), bifenthrin (Capture and several generics) and imidacloprid (Admire). Chlorpyrifos and ethoprop are labeled only for preplant applications, while the other insecticides can be used for preplant and lay-by applications. When preplant insecticide applications are made, it is paramount they are made in accordance with label directions and as close to transplanting as possible. The soil insecticides protect the sweet potato

Table 1. Percentage of roots damaged by soil insect pests in untreated plots – 2004, 2005 and 2006 (60 grower fields).

Insect	2004	2005	2006
Rootworms	14.4	14.0	18.0
White grubs	4.6	2.7	9.1
Whitefringed beetle	0.0	0.0	0.2
Sugarcane beetle	0.0	1.25	0.2
Wireworms	0.6	0.5	0.2
Flea beetles	0.5	1.2	0.0
Average	**18.1**	**19.7**	**27.7**

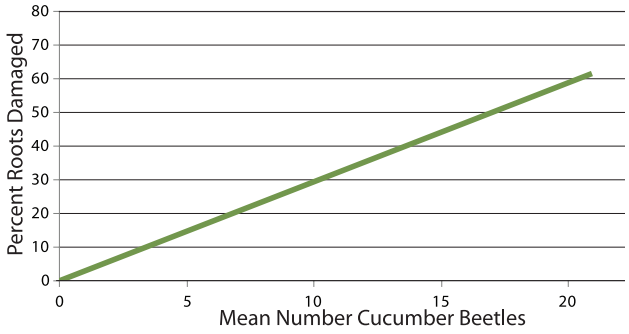
Table 2. Rootworm damage reduction (%) with soil insecticides applied either preplant or lay-by.

	Percent damage reduction	
Insecticide	**Preplant**	**Lay-by**
Mocap	43	47*
Lorsban	50	37*
Capture	56	55
Admire	36	62

*not labeled for lay-by application

Abner M. Hammond, Professor, and Rick Story, Professor, Department of Entomology, LSU AgCenter, Baton Rouge, La.; Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.; and Jeff Murray, Research Associate, Department of Entomology, LSU AgCenter, Baton Rouge, La.

Figure 1. Relationship between beetle counts in sweep net samples (100 sweeps) and subsequent root damage caused by rootworms.



roots from insect damage for four to six weeks. However, current sweet potato varieties require 100 to 120 days to reach marketable size.

These insecticides are evaluated along with experimental compounds each season to examine their efficacy in controlling soil insects, including cucumber beetles (Table 2). Percent damage reduction presented in the table reflects the level of control attributed to the specific treatment without any additional control measures applied throughout the growing season.

To protect roots from mid-to-late-season damage, growers monitor their fields for the presence of adult beetles. Several studies conducted in recent years examined the relationship between beetle counts in sweep nets and subsequent root damage caused by rootworms (Figure 1). A significant positive correlation exists between beetle counts in sweep nets and rootworm damage levels at harvest. Based on these studies, the AgCenter recommends growers apply a foliar insecticide when beetle numbers exceed two beetles per 100 sweeps. If beetle numbers are kept below the two-beetles-per-100-sweeps level, rootworm damage should be held below the 5 percent damage level.

Growers are advised to sample fields every week because the beetles are highly mobile and may enter fields in large numbers throughout the growing season. The foliar-applied insecticides are used to kill the beetles and thereby prevent them from depositing eggs in the fields. Several foliar insecticides are labeled for use on sweet potatoes. Most products have a residual control of three to five days. Studies in grower fields suggest the scouting program can reduce rootworm damage by 50 percent or more, while at the same time eliminating unnecessary spray applications.

Soil insect pests are difficult to control because of their subterranean habits. Growers combine preplant and lay-by applications with a scouting program to monitor adult beetle populations and apply foliar insecticides when the treatment threshold is exceeded. This strategy is effective in managing banded cucumber beetles and keeping root injury below 5 percent. Researchers will continue to evaluate new insecticides as they become available for use in sweet potatoes to ensure producers have the most effective tools available to manage problematic insect pests, such as the banded cucumber beetle. ■

Photo by Tara P. Smith



A sweet potato field at the Sweet Potato Research Station in Chase, La.

NITROGEN Management

New Insights and Opportunities

Arthur Villordon, Don LaBonte and Tara P. Smith

Sustainable and profitable commercial sweet potato production requires optimum nitrogen fertilizer. Although sweet potatoes can be grown in marginal production environments, a certain amount of nitrogen is necessary for normal shoot development and photosynthetic activity required for storage-root growth. If the nitrogen supply is suboptimal, the nutrient becomes a limiting factor, and this condition generally reduces marketable yield. On the other hand, excessive or improperly timed nitrogen fertilizer applications can potentially decrease marketable yield and represent an unnecessary waste of resources.

The objective of nitrogen management is to maximize the use of the nutrient and minimize potential leaching and possible contamination of surface and ground water. The need for optimum nitrogen management information for Louisiana-grown sweet potatoes is especially critical in view of increasing farm input costs.

Several past studies of the nitrogen fertilizer requirement for sweet potatoes have concluded that yield response to nitrogen fertilizer varies from location to location and from year to year. This response has been attributed to variability in nitrogen soil availability, climate and sweet potato variety. This suggests that nitrogen management needs to be optimized for a specific variety grown under a specific range of production environments.

These approaches include delaying or "splitting" nitrogen fertilizer application. Delayed application means the entire amount of nitrogen fertilizer is side-dressed three to four weeks after transplanting. In a split application, a portion of the nitrogen fertilizer (typically half) is applied preplant, and the remainder is applied three to four weeks later. The positive yield response generally associated with these approaches is partly attributed to the fact that a high nitrogen level is not required for storage root initiation. Storage root initiation, defined as the appearance of secondary meristematic activity in adventitious roots, signals the onset of storage root development. In Beauregard, this critical developmental phase has been observed to occur as early as 13 days after transplanting (DAT).

Synchronizing storage root initiation with delayed nitrogen fertilizer application helps to explain the yield response associated with this management approach. In Louisiana, research has indicated that the favorable period for in-season nitrogen application is about three to four weeks after transplanting. To help explain this time frame, 15N-labeled nitrogen fertilizer was applied at various days after transplanting to determine how much applied nitrogen fertilizer was recovered in a specific period (Figure 1). 15N is a label or tracer that enables specialized equipment to detect and precisely quantify the presence of the labeled material in plant samples.

The results of this study indicated that maximum recovery of nitrogen by leaves occurred at 40 DAT. Recovery of nitrogen

Arthur Villordon, Associate Professor, Sweet Potato Research Station, Chase, La.; Don LaBonte, Professor, School of Plant, Environmental & Soil Sciences, LSU AgCenter, Baton Rouge, La.; and Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.

Figure 1. 15N enrichment of storage roots and leaf samples collected at harvest from plots subjected to various 15N-labeled ammonium nitrate fertilizer application times in Beauregard sweet potatoes grown in Louisiana. Number of replications ranged from 2 to 9. Pre-preplant application of fertilizer N. Total amount of N=45 lb/acre. Atom% 15N of non-enriched storage roots=0.43 ± 0.03.

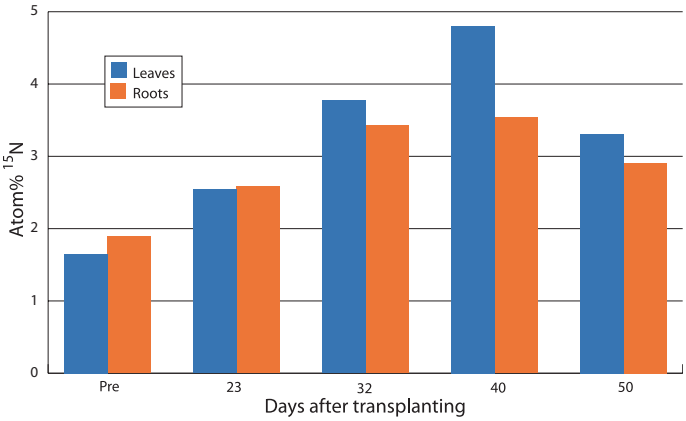
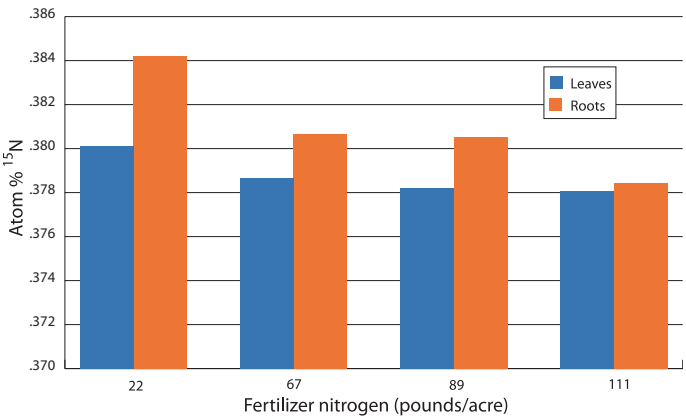


Figure 2. 15N enrichment of storage root and leaf samples collected at harvest from plots subjected to various preplant N rates in Beauregard sweet potatoes grown in Louisiana. Transplants were cut from beds applied with 15N-labeled ammonium nitrate. Number of replications ranged from 5 to 10. Atom% 15N of non-enriched storage roots=0.378 ± 0.001.



by storage roots gradually increased beginning at 23 DAT and was maximum at 40 DAT. Compared to preplant-applied nitrogen fertilizer, delayed or split application potentially increases the recovery of the nutrient from 31 percent (nitrogen fertilizer applied at 23 DAT) to 81 percent (nitrogen fertilizer applied at 32 DAT). Some earlier studies have suggested that applying nitrogen fertilizer past 40 DAT favored shoot growth at the expense of storage-root growth.

Bedding seed roots represents the initial phase of each year's sweet potato production activities. Despite its importance, relatively little information is available about the role of bed-applied nitrogen fertilizer in crop performance. To document how plant bed-applied nitrogen fertilizer interacted with field-applied fertilizer, researchers incorporated 15N-labeled ammonium nitrate in plant beds and set transplants in plots applied with various rates of non-labeled nitrogen fertilizer. At the end of the season, storage-root and leaf samples were collected and analyzed for the presence of the 15N label (Figure 2).

Compared to the natural amount of 15N in control samples, only storage roots from plots applied with the lowest rate of nonlabeled nitrogen fertilizer showed a slight increase in the labeled compound. The results suggest that transplants (specifically the developing adventitious roots) used or metabolized relatively more of the plant bed-applied nutrient under a reduced rate versus higher rates of field-applied nitrogen. This indicates that the potential benefits of split or delayed in-season application of nitrogen fertilizer appear to be somewhat influenced by the fertility regime in plant beds, assuming other variables such as soil moisture are not limiting during the critical storage root initiation phase. The results also indicate the need to optimize the fertilizer regime in plant beds.

Results from this research can be used in future studies that seek to further reduce the total nitrogen fertilizer required to produce a profitable sweet potato crop. The apparent link between plant bed-applied nitrogen and its uptake and recovery by storage roots also provides clues about the role of the nutrient in adventitious root initiation, early storage-root development and yield. ■

Acknowledgment
Louisiana Sweet Potato Commission for providing funds for the 15N study.

Harvesting Sweet Potatoes

Tara P. Smith

Commercially produced sweet potatoes in Louisiana are most often harvested using a two-row mechanical chain harvester, more commonly known as a two-row sweet potato digger. With this method, roots are exposed and then conveyed along a chain, where workers on each side of the equipment sort the roots into various grades. One-row chain harvesters are also used occasionally, and some larger producers use four-row bulk harvesters, both of which operate similarly to the two-row harvester. Ten to twelve people are required to operate one two-row digger, and each two-row digger can harvest two to four acres per day under ideal conditions. Larger operations employ the use of several diggers at any given time during the harvest season.

An alternative harvest method, which has become more popular in Louisiana in recent years, is to harvest using a shaker digger. This harvest method also utilizes chains once the roots are exposed. In contrast to the two-row mechanical harvester, the shaker harvester lays the roots on top of the soil, where they are subsequently collected by hand by several workers, placed into buckets and eventually into large storage bins. A producer using a four-row shaker digger can harvest approximately 20 acres per day with 20-25 hand laborers collecting roots.

Both harvest methods have advantages and disadvantages. The shaker method is used more in areas with lighter soil textures, where the roots are easily seen and can be graded easily by workers. This method is also preferred in smaller fields not amenable to maneuvering the large equipment used in the conventional mechanical chain harvester method. Both types of harvest are extremely labor-intensive. ■

Photos by Tara P. Smith



The shaker harvester is becoming more popular for use in areas with lighter soil textures and in smaller fields not amenable to maneuvering larger equipment.



The shaker harvester lays the roots on top of the soil, where they can be picked up by hand.

Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.

Managing Weeds
in Louisiana Sweet Potatoes

Donnie K. Miller and Tara P. Smith

Weeds compete with sweet potato plants for nutrients, water and sunlight and impair crop yield and quality, making effective weed management a critical aspect to successful production. When combined with timely cultivation, herbicide applications can effectively reduce weed competition, improve harvest efficiency and increase crop productivity. Most producers rely on herbicides to manage troublesome weeds.

Herbicide labels should always be consulted for activity on weed species present, rates for soil type, potential for crop injury, specific restrictions and preharvest application intervals. Sweet potato growth is generally slower in cooler temperatures and, when combined with excessive rainfall, can result in increased herbicide injury.

Herbicide effectiveness is generally greatest when the chemical is applied to small, actively growing weeds. The action of herbicides with soil activity is greatly enhanced by rainfall, irrigation or mechanical cultivation within seven days after application.

In general, one-half inch of rainfall or irrigation, preferably in one occasion, is adequate for activation of most soil-active herbicides. In contrast, excessive amounts of rainfall over a short period may result in herbicide leaching and reduced efficiency, especially in lighter-textured soils. Rain-free periods required for adequate herbicide absorption following leaf contact on emerged weeds can differ depending on the herbicide used. Specific labels should be consulted concerning this and specific surfactant requirements.

Research has indicated that adding ammonium sulfate to herbicides such as glyphosate can be beneficial when they are used with hard water, which contains iron, calcium or magnesium ions. Proper nozzle selection and sprayer calibration are also key factors in maximizing herbicide activity and reducing crop injury. Information on nozzle selection is available in the "Louisiana Suggested Chemical Weed Control Guide" available at www.lsuagcenter.com or from nozzle manufacturers.

Compared with most crops grown in Louisiana, sweet potatoes have few effective herbicides labeled for use. Weed management can be aided by selecting a field without a history of serious weed problems. Frequent crop rotation with soybeans, corn and grain sorghum also can be beneficial in weed management programs by introducing alternative herbicides to increase the spectrum of weeds controlled. Because crop rotation intervals can vary among herbicides, labels should be consulted when planning initial crop rotations. Cultivation should be used to control weeds during early growth stages. In addition, sweet potato vines can effectively compete with weeds after good root systems are established.

Long-term management of perennial weeds – including Johnson grass, Bermuda grass, alligatorweed, and yellow and purple nutsedge – is best achieved through a fall fallow-ground herbicide application. Ideally, treatment should be initiated once weed growth has occurred after harvest and when actively growing plants are in the boot/heading stage but prior to first frost. The optimum recommended time to initiate treatment is September 15 to October 15. Best results occur with fall fallow-ground applications over multiple years. ■

Photo by Tara P. Smith



Timely cultivation, in combination with herbicide applications, can effectively reduce weed competition, improve harvest efficiency and increase crop productivity.

Donnie K. Miller, Associate Professor, Northeast Research Station, St. Joseph, La.; and Tara P. Smith, Assistant Professor, Sweet Potato Research Station, Chase, La.

Ornamental sweet potato options continue to expand

Allen D. Owings

Ornamental sweet potatoes have gained considerable interest among landscape industry professionals and home gardeners over the past 10 years. Varieties include plants that are chartreuse-lime green (Margarita), blackish purple (Blackie) and tricolored (Pink Frost). Other older varieties in the trade include Lady Fingers (with deep lobes and green foliage), Black Beauty and Ace of Spades (both heart-shaped, blackish foliage plants).

New ornamental sweet potatoes have various leaf shapes and growth habits in addition to new foliage colors. These sweet potatoes have been selected for shorter stem lengths between the leaves and reduced root size. They are more compact than most other ornamental sweet potato varieties.

Some of the new sweet potatoes are more conducive to trellising and container plantings when compared with older varieties. Some of these new varieties may produce significant flowering in the landscape during the summer through fall, while others seldom flower.

The most widely available line of ornamental sweet potatoes for home gardeners and commercial landscapers is the Sweet Caroline group, originally developed by researchers at North Carolina State University in 2002. The Sweet Caroline series is readily available in Louisiana with green-yellow, red, light green, bronze and purple foliage. The Sweet Caroline Sweetheart series (with heart-shaped leaves) is available in light green, red and purple while the standalone Bewitched variety has maple-leaf-shaped purplish-black foliage. The best foliage colors come when plants are in full sun. There will be less colorful foliage in a shaded or partially shaded planting. Even more new varieties will be available soon.

New ornamental sweet potato series for 2009 include Sidekick from Syngenta Flowers. This series is available in black, black heart and lime colors. The plants are being evaluated in landscape trials at the LSU AgCenter's Hammond Research Station. The lime-colored variety is lighter in color than the chartreuse-lime green foliage of Margarita, and the growth habit is low-growing and less spreading.

New Desana ornamental sweet potatoes are available from Suntory Flowers in lime, maple, compact red and bronze colors. Lime is the most compact and will not overgrow other plants in landscape beds. The compact red is less vigorous than the Sweet Caroline red-foliaged varieties, and the new foliage opens in shades of red that evolve to green with maroon veins as the leaves mature.

Chillin and Illusion are two new ornamental sweet potato series from EuroAmerican Propagators/Proven Winners. Chillin colors come in limeade, blackberry star and blackberry heart, while Illusion has some of the finest textured foliage in ornamental sweet potatoes and is available in varieties called Emerald Lace and Midnight Lace.

The LSU AgCenter has seven newly developed ornamental sweet potatoes being considered for future release. These new plants originated from the AgCenter's sweet potato breeding program. These lines were planted at the Hammond Research Station in May 2009 for landscape evaluation/observation studies.

Photo by Mark Claesgens



Allen D. Owings, horticulture professor at the Hammond Research Station, shows varieties of ornamental sweet potatoes at the Burden Center in Baton Rouge.

The sweet potato weevil quarantine has resulted in regulation of where ornamental sweet potatoes can be grown and transported. In Louisiana, distribution of ornamental sweet potatoes into sweet potato weevil-free areas is regulated by the Louisiana Department of Agriculture and Forestry. The sweet potato weevil-free parishes are Claiborne, Lincoln, Jackson, Union, Winn, Ouachita, Caldwell, LaSalle, Morehouse, Richland, Franklin, Catahoula, West Carroll, East Carroll, Madison, Tensas and Concordia. These parishes are contiguous and are located in the northeastern portion of the state. Ornamental sweet potato plants originating from or grown in a sweet potato weevil-infested area may not be shipped to sweet potato weevil-free areas in Louisiana or to sweet potato weevil-free areas of other states. ■

Allen D. Owings, Professor, LSU AgCenter, Hammond Research Station, Hammond, La.

Inside:

Consumption of sweet potatoes is increasing in the United States and Europe. Louisiana's producers are taking advantage of that. *Page 6*

Virus-tested seed helps maintain the industry. *Page 12*

Here's how sweet potatoes are grown. *Page 18*

'Or you can call me Yam…' *Page 20*

Learn about resistant starch, a healthful ingredient, and the sweet potato. *Page 25*

Ornamental sweet potatoes are popular. *Page 35*

LSU AgCenter
P.O. Box 25100
Baton Rouge, LA 70894-5100

Non-profit Org.
U.S. Postage
PAID
Permit No. 733
Baton Rouge, LA

Commercialization of Intellectual Property at the LSU AgCenter

Success breeds more success

(Continued from page 2)

can benefit from technology transfer. The licensing of technology to private businesses, which have the resources that universities do not have, makes it possible for these inventions and discoveries to be further developed, manufactured and brought to market. The newer releases of sweet potato, such as Evangeline, are being licensed for production in other states.

Not only are the researchers highly productive, but in 2007, the percent return of royalty income based on direct research expenditures of $62.9 million was 6.86 percent. When all research expenditures, including indirect costs and unrecovered indirect costs associated with research, are considered, the AgCenter's return on research expenditures was 4.87 percent. When comparing this return (based on figures from the Association of University Technology Managers) with Tulane, which spent $162 million for a return of 4.12 percent; Harvard, which spent $630 million for a return of 1.97 percent; and MIT, which spent $1.2 billion for a return of 5.06 percent, the AgCenter fares very well. Certainly, these statistics change each year, and the returns may not always be as great; however, for the past few years, the returns have been relatively consistent.

The LSU AgCenter is one of the nation's best examples of how an institution of higher education can serve as a stimulus to economic growth. Our history is one of keeping the agriculture industry in the state alive and thriving. Our record is one of conducting research with practical, immediate application and in collaborative partnerships with business and industry. ■ **Linda Foster Benedict**

Start-up companies resulting from LSU AgCenter licensing agreements so far are:

University Products (2000). This company, based in Baton Rouge, produces vaccines for the cattle industry.

Reprostat (2001). This Baton Rouge company produces veterinary drugs that can be used to sterilize dogs and cats.

TransGenRx (2003). This biotechnology company produces specialized proteins, including vaccines and growth hormones, and is housed in the Louisiana Emerging Technology Center.

TermiTech (2003). This Baton Rouge-based company licenses pop-up technology developed as an inexpensive, efficient way to monitor termites. The pop-up devices are available at a major national "big-box" store.

OX-B (2003). This company produces cold sterilants used in the dental industry to sterilize dental equipment. The company is in Baton Rouge.

NanoSolutions (2006). This company produces fabric dyes from miniscule amounts of precious metals. This dyeing technique creates lush colors that are permanent and not susceptible to bleaching or fading. The company is in Baton Rouge.

Esperance (2006). This biotechnology company, housed in the Louisiana Emerging Technology Center, produces cancer-treating drugs.

Energenetics (2006). This company produces resistant-starch products with the same cooking quality as regular food starch. The resistant starches have many health benefits such as preventing colon cancer and lowering the risk of heart disease. The technology will also allow for the introduction of recipes containing rice into low-carbohydrate diet programs, increasing the demand for rice and rice products, which will have a beneficial impact on Louisiana's economy.

D&S Electrostatic Samples (2008). This Baton Rouge-based company has developed air-sampling technology that can screen for disease-causing spores.