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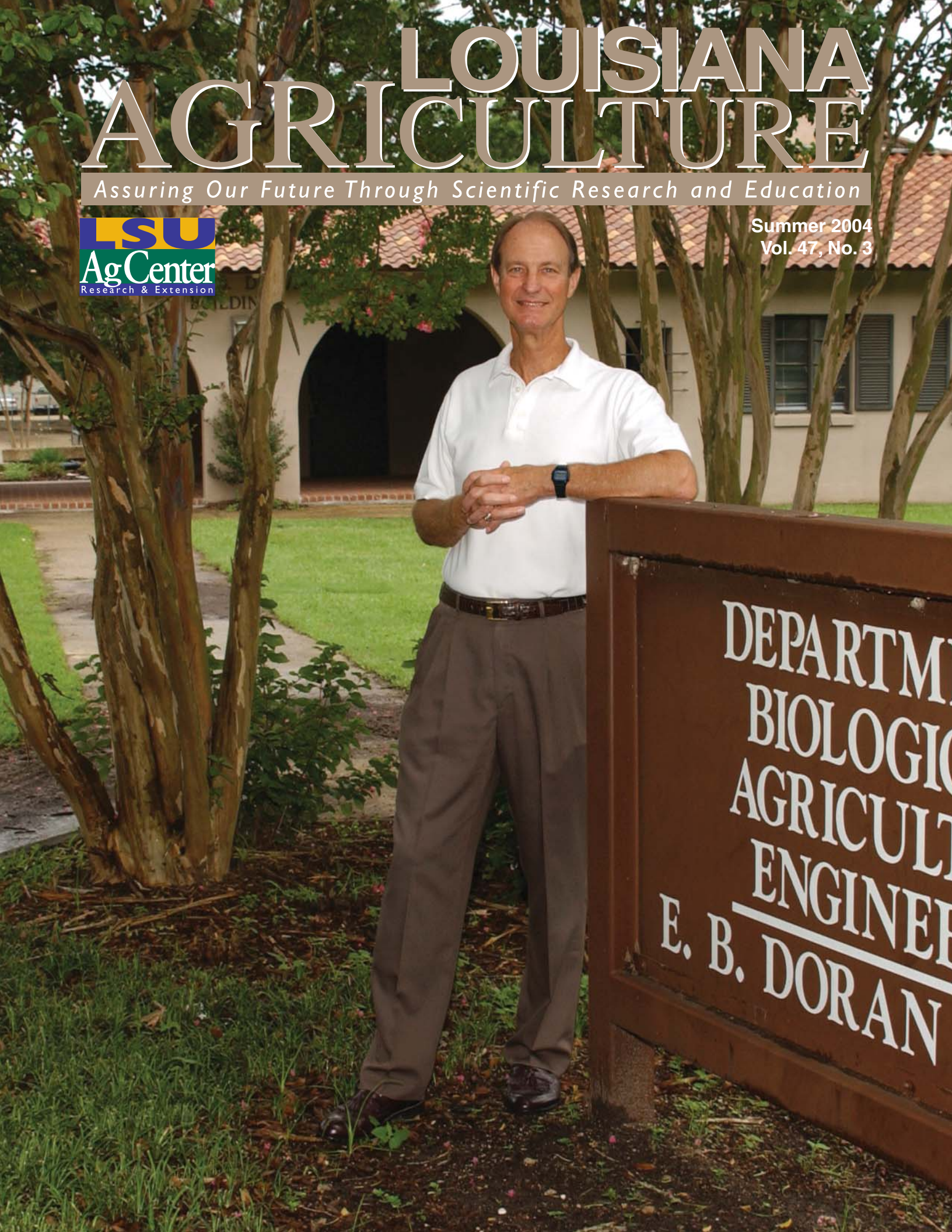

ON THE COVER: *William H. "Bill" Brown is back where he started – in an office in the Department of Biological and Agricultural Engineering. He came to LSU in 1976 as the new head of the department. He retired as vice chancellor for research on April 16, 2004. Photo by Mark Claesgens.*

Though retired, Brown stays engaged

Old LSU AgCenter administrators don't fade away, they stay engaged.

And that's the case with the latest retiree, former vice chancellor for research and director of the Louisiana Agricultural Experiment Station, William H. "Bill" Brown.

Brown is not really "old" – only 62, still young enough to make contributions to agriculture and economic development. He's already begun planning more involvement in international work.

But, first, he has to decide what to do with four decades of books that line his new office in the E.B. Doran Building, which houses the Department of Biological and Agricultural Engineering (BAE).

"I may send some to Turkey," he said. Former colleague Fred Sistler is working on a project in that country and has identified a dire need for books, even used ones.

Brown's road to spacious retirement digs, rather than an emeritus closet, began with a move from Mississippi State University to LSU to take over the department in 1976, which then lacked the "B" word.

"'Biological' came later as the mission expanded," said Brown, who earned three degrees (B.S., M.S., Ph.D.) in agricultural engineering, all from the University of Missouri-Columbia.

While department head, he developed a plan, hired faculty and increased the undergraduate and graduate student enrollment.

His organizational ability and positive outlook did not go unnoticed. In 1983, he was put in charge of grants and contracts for the LAES, which grew into a position that oversaw intellectual property, patents and license agreements.

"This was the beginning of looking outward for more of our funding," Brown said. That effort grew from about $1 million per year then to more than $15 million per year in non-state funding now.

In 1989, he was named associate director of the LAES. In 2001, he was promoted to vice chancellor and director. He retired effective April 16, 2004.

One of his biggest contributions to agriculture, research and the LSU AgCenter was his open and accepting attitude toward change. And perhaps the biggest change during his tenure at the AgCenter was more cooperation between education and industry.

"On balance, that's good," Brown said. "We can't bring our discoveries to market without help from industry."

A case in point was a cotton variety developed at the LSU AgCenter in the early 1980s, which never caught on with farmers, though an excellent product.

Now, the AgCenter has licensing agreements with several companies including BASF, a multi-national corporation, which produces and markets the Clearfield line of herbicide-resistant rice developed at the AgCenter. Another example is the licensing agreement with a biotech start-up company called TransGenRx to make and market protein products from the egg whites of genetically modified chickens.

Technology is the future of U.S. agriculture. And that takes the know-how of university scientists combined with the resources of industry.

"We will struggle with Brazil, Argentina – and soon China – when it comes to producing bulk agricultural commodities. U.S. agriculture has to have the edge with technology," Brown said.

Watching the economic development brought about through the discoveries of AgCenter research, especially new crop varieties, gave him the most joy as an administrator.

"Our future is growing new companies," he said. "They might as well be in Louisiana." ■ **Linda Foster Benedict**

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

www.lsuagcenter.com

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IN THE NEXT ISSUE: *The focus of the fall issue of Louisiana Agriculture will be the research we are conducting with nonruminant farm animals. The nonruminant animal is a mammal with a simple stomach as compared to ruminant animals (cattle, sheep, goats) with stomach compartments. Nonruminants include chickens, horses and pigs.*

What's New?

Expanded animal reproduction research facility officially opens

Research on livestock reproduction has been given a boost through the expansion and remodeling of one of the country's top facilities – the LSU AgCenter's Embryo Biotechnology Laboratory.

An open house and dedication of the facility's new William Hansel Conference Room was held May 26.

The Embryo Biotechnology Laboratory, which was expanded to 10,000 square feet, is part of the newly created Reproductive Biology Center. The center also includes support facilities and pastures.

Research at the center focuses on developing both basic and applied assisted reproductive technologies for use in livestock improvement, biomedical applications, and propagation of exotic and endangered species, according to Richard Denniston, the center's director.

Many "firsts" in animal reproduction history have occurred at the center since its establishment in the early 1970s by Robert Godke, LSU Boyd Professor of Animal Sciences.

One of the latest was announced during the May 26 activities. Godke told a group of journalists that one of his graduate students has successfully produced a calf using sperm from a dead bull.

A "first" announced in 2003 was the successful cloning of a Brahman using a cryo-preserved oocyte thawed with a super-cold gel, which prevents the problem of cell destruction from ice crystals.

LSU AgCenter scientists collaborate with scientists from other institutions, including Pennington Biomedical Research Center, also in Baton Rouge. One of the Pennington researchers is William Hansel, who also has a joint appointment with the LSU AgCenter.

Hansel's research activities span four decades and include many accomplishments. One of his latest is developing a drug that attaches to and destroys the membrane of prostate, breast, ovarian and testicular cancer cells.

Although professing pride in the breakthroughs in cancer research, he acknowledged at the dedication ceremony that the main focus of research in animal sciences needs to continue to be helping the farmer and rancher with livestock productivity. ■ **Linda Foster Benedict**

Photo by Mark Claesgens

The Brahman at right was donated to the LSU AgCenter by Coleman Locke of the Locke Division of J.D. Hudgins of Hungerford, Texas. She provided the cells used to create the Brahman at left, which is a clone named "Gracie." Gracie was born in 2003 on Elvis Presley's birthday, January 8, and is the first clone produced from a cryo-preserved oocyte thawed with a super-cold gel. This procedure prevents ice crystals, which can destroy a cell.

Researchers try to get handle on wheat rust problems

Stripe rust, a fungal disease, has begun causing problems for Louisiana wheat growers. And LSU AgCenter researchers are developing a disease forecasting system to try to head off an epidemic.

"We are evaluating fungicides such as Tilt, Stratego, Headline, Quilt and Quadris for control of stripe rust across Louisiana," said Boyd Padgett, plant pathologist, adding that the disease is "driven by cool nights and moisture."

Steve Harrison, wheat breeder, said the physiology of the disease may be changing – making it even more of a problem.

"The rule of thumb is that when the nighttime temperatures reach 65 degrees, stripe rust goes away," Harrison said. "But it didn't this year."

Researchers are screening wheat varieties for resistance to the disease. Excellent stripe rust data was collected in wheat variety trials conducted at the Macon Ridge Research Station in Winnsboro this past spring by LSU AgCenter researcher Rick Mascagni. This data will enable growers to choose high-yielding resistant varieties this fall. New resistant varieties adapted to Louisiana are being developed in the wheat breeding program coordinated by Harrison.

Stripe rust is a disease that causes individual yellow pustules, usually at the top of every leaf. Later, pustules will develop in rows giving the characteristic of resistant stripe appearance. Leaves, sheaths, stems and glumes may be attacked. The outbreak of stripe rust in Louisiana wheat fields this year was the worst it has been in years, researchers said. ■ **A. Denise Coolman**

Patriotic crawfish?

Few people know crawfish come in several colors besides the traditional red or brown.

Ray McClain, crawfish researcher at the LSU AgCenter's Rice Research Station in Crowley, said he had heard of pure white and has seen a few sky-blue crawfish over the years.

But earlier this year some white crawfish found near Iota and some blue

Photo by John Sonnier

Yes, these are the true colors of these red swamp crawfish. The blue is rare. The pure white is even more rare.

ones located near Mowata were brought to him.

"The blue is rare. And the white is even more rare," McClain said.

John Sonnier, McClain's research assistant, tried to line up the crawfish in the order of red, white and blue for a photo. But the white and blue started fighting.

"It was very difficult to shoot a photo of all three," he said. "I tried about 50 or 60 times."

Sonnier has just mated the two unusually colored females with ordinary crawfish males and is anxious to see the color of the babies, which won't be born until sometime in the fall.

McClain said there is a species of crawfish called white river. But they are more of a light tannish brown than white. Most crawfish in Louisiana are of the red swamp species. ■ **Linda Foster Benedict**

Burden expands ornamental, turfgrass research

Nearly 80 visitors attended the inaugural nursery, landscape and floriculture open house at the new ornamental and turfgrass research facility at the LSU AgCenter's Burden Center in Baton Rouge on April 23.

A former 25-acre hay field is now horticulture research space. "This is a welcomed and valuable addition to Burden Center," said Pat Hegwood, the center's resident director.

Burden Center is a 420-acre research facility that includes 15 acres of formal gardens and 150 acres of forest. The center originally was owned by the Burden family from the mid 1800s until the final segment was donated to LSU in the early 1990s.

The new research area was developed initially because of limited expansion and tree competition for turfgrass research, Hegwood said. Other research plots were moved along with the turfgrass research into what is now called the ornamental and turfgrass research area.

Allen Owings, an ornamental horticulture specialist with the LSU AgCenter, said the research programs at Burden are designed to support commercial nursery, landscape and turfgrass operators in Louisiana. Much of the research results are also adaptable to homes, he said.

Owings said the top research priorities for the industry are plant evaluation and weed, disease and insect control followed by irrigation and fertilizer usage.

Cody Arceneaux, president of the Louisiana Nursery and Landscape Association, said his organization contributed funds to the research facility with a part of a grant it received from the U.S. Department of Agriculture.

The investment in the research facility also included funds from the LSU AgCenter.

The AgCenter is planning another open house at the facility for the fall, when other plants will be available for evaluation, Owings said. ■ **Rick Bogren**

Board of Regents approve $1.4 million

LSU AgCenter researchers had nearly $1.4 million in proposals approved by the Louisiana Board of Regents in the 2004 competition.

"We fared well under these competitive conditions," said David Boethel, vice chancellor and director of research.

The LSU AgCenter grants for 2004 included about $472,000 for sugarcane research, $106,000 for forest products research and $127,000 in food science research.

Research competitiveness funding, directed to new faculty, was awarded to researchers studying value-added processing for the rice industry, Louisiana watersheds, Formosan subterranean termites, and families and parenting.

The scientist and the amount of money approved are as follows:

- Kayanush Aryana, Dairy Science, $60,000
- H. Gale Bateman, Dairy Science, $66,500
- Chris Carlton, Entomology, $69,764
- David Greenland, Biological and Agricultural Engineering, $64,000
- Claudia Husseneder, Entomology, $92,100
- Robert Laird, Human Ecology, $72,712
- Peter Rein, Audubon Sugar Institute, $391,740
- Cristina Sabliov, Biological and Agricultural Engineering, $145,500
- Michael Saska, Audubon Sugar Institute, $80,000
- W. Ramsay Smith, Renewable Natural Resources, $105,540
- Qinglin Wu, Renewable Natural Resources, $151,457
- Y. Jun Xu, Renewable Natural Resources, $81,750. ■ **Rick Bogren**

COMMERCIAL CORN HYBRIDS

Steve Moore uses a paper bag to collect pollen from the male part of the corn plant. Photo by John Chaney.

with Superior Resistance to Aflatoxin

Steven H. Moore, Hamed K. Abbas, Manjit S. Kang, Henry J. "Rick" Mascagni Jr., Kenneth E. Damann, James L. Rabb, Lester Brown and Warner Hall

Aflatoxin is a highly carcinogenic contaminant produced in corn grain infected with *Aspergillus flavus* fungus. Aflatoxin is especially widespread in Louisiana when high temperatures and drought conditions prevail during the grain-filling period. The U.S. Department of Agriculture (USDA) limits aflatoxin contamination to 20 parts per billion (ppb) in corn marketed across state lines. There seems to be some aflatoxin in Louisiana corn every year, but when levels are extremely high, such as in 1998 during the drought, economic losses can be devastating. Some Louisiana producers avoid growing corn because of the high risk. One way to reduce aflatoxin is to identify the most resistant commercial hybrids.

Aflatoxin occurrence in corn is highly erratic, due in part to the small levels at which it is measured. The erratic nature of aflatoxin contamination poses difficulty in separating more-resistant hybrids from less-resistant ones in variety field trials using traditional techniques. An alternative approach is to use regression analysis to evaluate the aflatoxin content of indi-vidual hybrids compared with the average aflatoxin content of all hybrids across multiple environments. This procedure provides a more powerful statistical test. Statistical models are used to predict expected aflatoxin contamination and provide a better picture of how individual hybrids perform across a range of environments differing in aflatoxin contamination.

Twenty-three commercial corn hybrids were grown at Alexandria, Bossier City, Jeanerette and St. Joseph in 2001 and 2002. Ten ears from each plot were inoculated with *Aspergillus flavus* spores after silking. The inoculated ears were harvested at maturity along with 10 non-inoculated ears. After rating for *Aspergillus flavus* fungal growth, harvested ears were shelled and kernels ground to a meal. Samples were then analyzed for aflatoxin. Data from two locations in 2002 were not used in hybrid analyses because of water contamination to grain stored in a warehouse caused by Hurricane Lily. Data for individual hybrids that exceeded the upper confidence interval after initial regression analyses were also discarded.

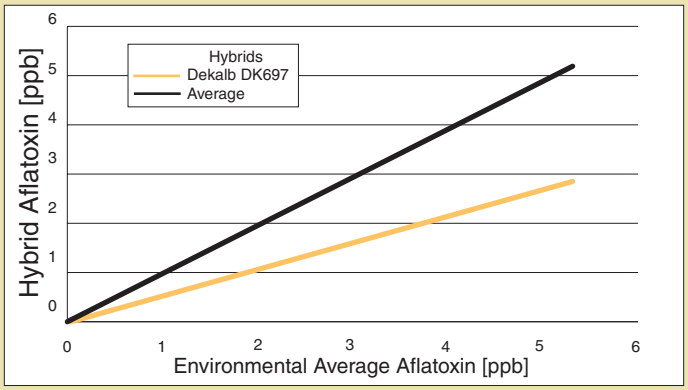
Average aflatoxin concentration for inoculated and non-inoculated ears ranged from 923 ppb to 3,728 ppb among the four locations over two years. Inoculation with *Aspergillus flavus* increased the overall average of aflatoxin concentration in corn grain from 443 ppb to 3,742 ppb. Bossier City had the highest aflatoxin contamination. This location normally has the highest temperatures and least rainfall. Alexandria followed Bossier City in degree of contamination. Both of these locations appear to be good and stable sites for aflatoxin biosynthesis and would be expected to serve well as test locations for screening hybrids and breeding lines.

Aflatoxin contamination of all hybrids was highly respon-sive to the environment. A straight-line increase of aflatoxin in each hybrid was directly proportional to the average aflatoxin content of all hybrids at each location. Aflatoxin in some hybrids followed environmental parameters more closely than others.

Graphing the interaction between hybrids and the envi-ronment provided readily visible comparisons. Using this approach, aflatoxin content of individual hybrids is depicted on the vertical axis and mean aflatoxin of all hybrids is depicted on the horizontal axis. Some hybrids had above-average afla-toxin in all environments. Others had below-average aflatoxin content in some environments but above-average aflatoxin in others.

A small group of hybrids was shown to have predictable below-average aflatoxin across all environments and was deemed to be generally superior in resistance to aflatoxin. Dekalb DK697, perhaps the best example of a resistant hybrid, is compared to the average aflatoxin content of all hybrids in Figure 1. The black line in Figure 1 is the mean aflatoxin con-tent of the 23 hybrids. Dekalb DK697 had lower-than-average aflatoxin in all environments, making it a good choice when selecting a hybrid for resistance to aflatoxin. Other hybrids that had below-average aflatoxin predicted across all environments were Croplan Genetics 733BT, Dyna-Gro 5516 RR, Croplan Genetics 827 and Garst 8288.

Figure 1. Dekalb DK697, perhaps the best example of a resistant hybrid, is compared to the average aflatoxin content of all hybrids.



Although some hybrids appear to have consistently lower aflatoxin than others, no hybrids have sufficient resistance to maintain aflatoxin levels below 20 ppb under the pressure that occurred in a year like 1998. However, progress is being made. Through the use of molecular markers, resistant genes may now be cut out of resistant inbreds and inserted into more commercially productive ones. This transformation is under way, and commercial-quality hybrids with enhanced resis-tance to aflatoxin using biotechnology or conventional breeding methods are being tested at Alexandria.

Another bright spot on the horizon for controlling aflatoxin in corn is through deployment of atoxigenic *Aspergillus flavus* strains in the production environment. Atoxigenic strains infect corn just as toxic strains, but produce no aflatoxin. A major commercial deployment of atoxigenic strains is under way in Arizona to reduce aflatoxin in cottonseed. An atoxigenic strain is also being marketed for use on peanuts in Georgia, pending clearance by the U.S. Environmental Protection Agency. Initial studies using atoxigenic strains on corn have been conducted at Alexandria, Baton Rouge and St. Joseph in Louisiana. Additional studies continue. The interaction between an atoxigenic strain of *Aspergillus flavus* (Aflaguard) and an insect-resistant (Bt) hybrid is also being investigated. Sufficient protection may be achieved by compounding several aflatoxin reduction technologies.

After 25 years of research, new hybrids and technology entering the realm of commercial production may signifi-cantly reduce aflatoxin. Perhaps in the not-too-distant future Louisiana farmers will have more security in producing a profitable corn crop. ■

ACKNOWLEDGMENT – Louisiana Soybean and Grain Research and Promotion Board and the U.S. Department of Agriculture

Steven Moore, professor, Dean Lee Research Station, Alexandria, La.; Henry J. "Rick" Mascagni Jr., professor, Northeast Research Station, St. Joseph, La.; Kenneth E. Damann, professor, Department of Plant Pathology and Crop Physiology, Baton Rouge, La.; James L. Rabb, professor, Red River Research Station, Bossier City, La.; Lester Brown, research associate (retired), Iberia Research Station, Jeanerette, La.; Warner Hall, research associate, Department of Agronomy and Environmental Management, Baton Rouge, La.; and Hamed K. Abbas, research pathologist, U.S. Department of Agriculture-Agricultural Research Service, Stoneville, Miss.

RESEARCHER HUNTS FOR GENES
to make corn resistant to aflatoxin

A big hurdle to increased corn production in Louisiana is aflatoxin, a byproduct of a fungal infection that generally occurs in drought-stressed corn. And Steve Moore, a researcher at the LSU AgCenter's Dean Lee Research Station near Alexandria, is trying to find a remedy.

The toxin is produced by a fungus called *Aspergillus flavus*, Moore said. But not all strains of the fungus produce aflatoxin, and aflatoxin becomes a problem only when the environmental conditions are right.

"Aflatoxin is considered the most potent natural carcinogen in existence," Moore said. That's why the U.S. Food and Drug Administration prohibits infected corn in interstate transportation when the aflatoxin level exceeds a mere 20 parts per billion.

Although most corn grown in Louisiana is destined as feed for livestock, the toxin is particularly harmful to cattle and horses as well as people.

"Heat affects the activity of the fungus, and drought stresses the plant," Moore said. "Any stress on a corn plant generally makes it more susceptible to aflatoxin contamination."

Moore has embarked on a research program to develop corn hybrids resistant to aflatoxin-producing strains of *Aspergillus flavus*. He is focusing on breeding genetic resistance into corn hybrids.

"There are about a half-dozen public breeding lines that show some resistance," Moore said. But he's doubtful current resistance levels are adequate to protect a corn crop when environmental conditions are favorable.

In 1998, for example, widespread drought and high temperatures led to millions of dollars in crop losses with 70 percent or more of the Louisiana corn crop infected.

Moore proposes to find resistant genes and introduce them into commercially valuable corn hybrids. He's starting by screening 800 of the approximately 50,000 breeding lines of corn throughout the world.

"We're already putting what we have in commercial hybrids," Moore said. "But I believe that more resistance is likely needed."

Moore said he's looking for genetic resistance that's carried by only a few dominant genes so they can be more easily introduced into commercial breeding lines.

In addition to searching for effective genes to resist aflatoxin, Moore also is looking at other strains of *Aspergillus flavus* that don't produce aflatoxin.

"The strains of *Aspergillus flavus* that don't produce aflatoxin are called atoxigenic," Moore said. "We're looking at different strains to find atoxigenic strains that can out-compete the others.

"If we can help farmers identify resistant varieties, we can help them improve their productivity," Moore said. "It can be worth it to give up some yield, if necessary, to protect against an outbreak of aflatoxin." ■ **Rick Bogren**

Flex-ear, fixed-ear corn and optimum plant population

Rick Mascagni and Robert Bell

Photo by Linda Foster Benedict

One of the newest research projects at the Northeast Research Station near St. Joseph involves comparing yields from dual-row corn to corn planted in single rows, the traditional method. Rick Mascagni told farmers gathered for the annual field day at the station on June 13, 2004, that the project involves different seeding rates and nitrogen rates.

Corn yield and seed quality depend on management, climate and the interaction of these factors. In Louisiana in recent years, lack of rain combined with high temperatures have caused yields to suffer. Successful, non-irrigated corn production should include optimum plant population and proper hybrid selection. Excess plant population may increase the rate of soil moisture depletion, reduce yield potential and increase risks from aflatoxin contamination of the grain.

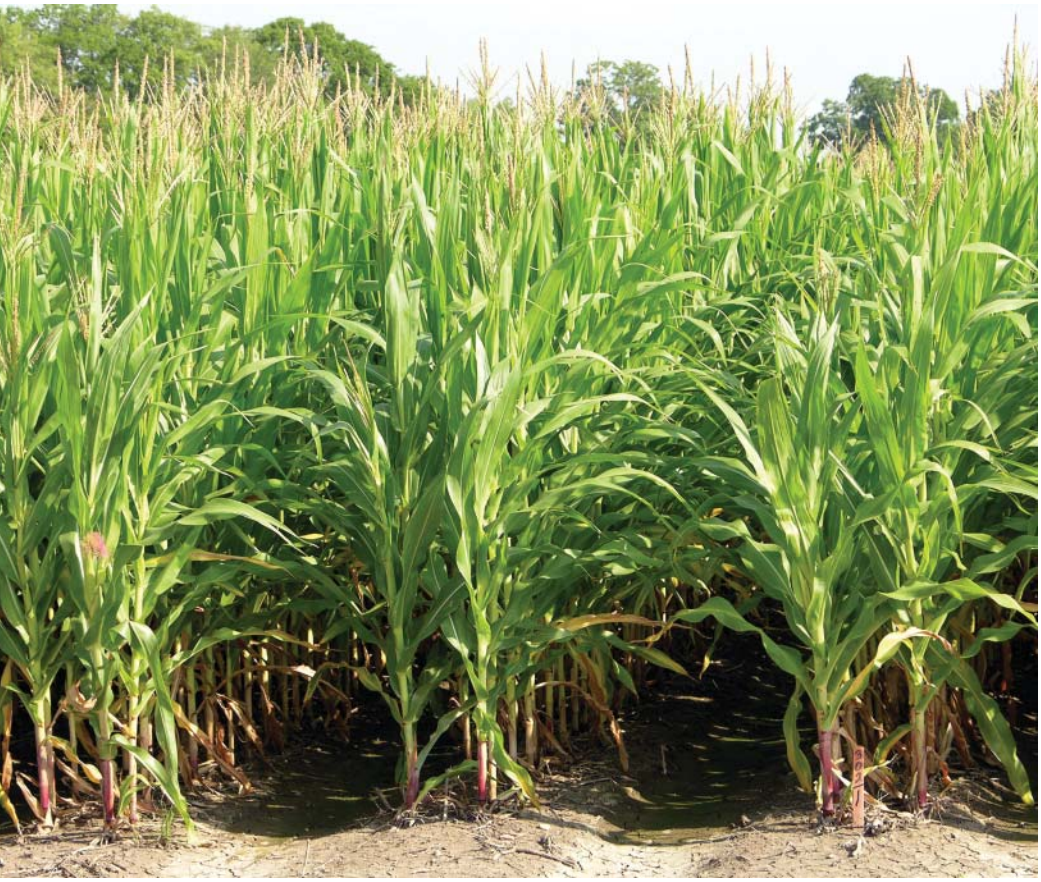
Hybrid characteristics such as drought tolerance and ear type are two traits that interact with plant population. Ear type can be determinate (ear size is fixed), indeterminate (ear size varies) or some variation of the two. Indeterminate or flex-ear hybrids have the ability to adjust ear size depending on growing conditions. Therefore, fewer plants are required for maximum yield compared to fixed-ear hybrids. More importantly, fewer plants need less soil water. This is important in dry years, particularly on drought-prone soils, where yield potential may be reduced and risks from aflatoxin contamination increase. Planting flex-ear hybrids at relatively low plant populations may be the best production strategy.

Field experiments were conducted in 2000 on a Tensas/Alligator clay at the Louisiana Delta Plantation near Jonesville, La., and in 2001-2003 on Sharkey clay at the Northeast Research Station near St. Joseph, La., to evaluate the influence of irrigation, hybrid and seeding rate on yield and optimum plant population.

Furrow-irrigation treatments were scheduled using the Arkansas Irrigation Model, a computer program. Treatments included a non-irrigated control and irrigation at 1.5- and 2.5-inch soil water deficit (SWD). The 1.5-inch SWD is considered well-watered, and the 2.5-inch SWD moderately well-watered.

Hybrids evaluated were Pioneer brand (PB) 33K81 (a fixed-ear hybrid), PB 3223 (a semi-fixed ear hybrid) and Golden Acres (GA) 8460 (a flex-ear hybrid). These hybrids were selected based on yield potential and differences in ear development traits. Seeding rates were 20,000, 25,000, 30,000, 35,000 and 40,000 seeds per acre. Recommended cultural practices of the LSU AgCenter were followed.

Planting flex-ear hybrids at relatively low plant populations may be the best production strategy.



There was an observable relationship between yield potential and optimum plant population in this four-year study, with optimum plant popula-tion increasing as yield potential increased. In 2003, highest yields occurred, and the relationship between yield and plant population was most obvious. Yields were highest for the well-watered, 1.5-inch SWD trial at 165 bushels per acre followed by the moderately well-watered 2.5-inch SWD trial at 151 bushels per acre and non-irrigated trial at 140 bushels per acre.

Averaged across seeding rates, yield rank among hybrids was PB 3223 followed by GA 8460 followed by PB 33K81. At lower yield potentials (non-irrigated and 2.5-inch SWD), yields for the fixed-ear PB 33K81 and semi-fixed ear PB 3223 generally increased with plant population up to about 30,000 plants per acre, while maximum yield for the flex-ear hybrid GA 8460 occur-red at or fewer than 25,000 plants per acre. When soil water was not limiting (in the 1.5-inch SWD), maximum yields occurred at about 30,000 plants per acre regardless of hybrid.

These findings suggest that when yield expectations are high, optimum plant populations are about 30,000 plants per acre regardless of hybrid type (fixed- versus flex-ear). In situations with lower yield expectations, however, fewer plants may be required for maximum yield, particularly when planting a flex-ear type hybrid. In these cases, producers can reduce seed cost by planting fewer seeds per acre. ■

Rick Mascagni, professor, and Robert Bell, research associate, Northeast Research Station, St. Joseph, La.

INTEGRATING HERBICIDES and INSECTICIDES in COTTON

Photo by John Chaney

Donnie K. Miller, Gene Burris, Richard W. Costello, Robert G. Downer, James L. Griffin, B. Rogers Leonard, Joseph H. Pankey and John W. Wilcut

Before the availability of transgenic technology in cotton, weed management programs consisted of herbicide applications to the soil at planting followed by multiple herbicide applications directed underneath the crop in combin-ation with tillage to control emerged weeds. Occasionally, over-the-top herbicide applications were made.

Today, more than 80 percent of the cotton grown in Louisiana is transgenic, and weed control programs have shifted to more over-the-top applications. Weeds are managed in many cases without use of at-planting herbicides or tillage. Two relatively new herbicides, Staple and Envoke, provide both contact and soil residual control of broadleaf weeds primarily. Glyphosate (numerous formulations) and glufosinate (Ignite) provide broad spectrum control of broadleaf and grass weeds in Roundup Ready and Liberty Link transgenic cotton.

For insect pest control in cotton, farmers often treat early in the season for thrips and aphids and later in the growing season for bollworms and tobacco budworms. Intense scouting of insects is recommended during the growing season, and a number of insecticides can control various insect pests once economic thresholds are reached.

Because the need for insect and weed control occurs simultaneously, it would be economically advantageous to farmers to apply insecticides and herbi-cides at the same time – as long as neither control program is compromised. A team of scientists from the LSU AgCenter and colleagues at North Carolina State University have conducted research on possible interactions between the herbicides Staple, Envoke, glyphosate and glufosinate and a range of insecticide chemistries used for early and late-season management of insect pests in cotton.

Staple and insecticides

Staple herbicide, which can be applied over-the-top of cotton until 60 days before harvest, was applied alone or with eight different insecticides (Orthene, Bidrin, Regent, Trimax, Karate Z, Vydate, Furadan and Dimethoate). The combinations were evaluated for potential interaction effects on broadleaf weed control. At 28 days after application at the three- to four-leaf stage, Staple applied alone controlled hemp sesbania (98%), entire-leaf morningglory (94%), pitted morningglory (93%), velvetleaf (87%) and prickly sida (71%). Co-application of Staple with insecticides did not reduce weed control compared to the herbicide alone.

These eight insecticides were also applied alone or in combination with Staple to evaluate possible interaction effects on thrips control. Staple applied with the insecticides Vydate and Dimethoate (in two of three studies) and Trimax (in one of three studies) reduced insecticide efficacy against thrips larvae compared to the insecticides applied alone. The effectiveness of the other insecticides applied with Staple was not reduced.

Glyphosate and insecticides

Glyphosate can be applied over-the-top of Roundup Ready cotton until the fifth true leaf stage, after which applications should be directed to the base of cotton plants. Glyphosate, formulated as Roundup Ultra, was applied alone or in combination with seven insecticides (Orthene, Bidrin, Regent, Trimax, Karate Z, Vydate and Phaser) to eval-uate the interaction effects on broadleaf weed control. Roundup Ultra applied alone in two experiments controlled hemp sesbania (68% to 96%), redweed (73% to 85%), pitted morningglory (71% to 81%) and prickly sida (62% to 71%). Less weed control was noted for hemp sesbania, which is inherently less sensitive to glyphosate.

Today, more than 80 percent of the cotton grown in Louisiana is transgenic, and weed control programs have shifted to more over-the-top applications.

Weed control was not affected when glyphosate was applied with any of the insecticides. Possible interaction effects on thrips and aphid control were investigated with the insecticides Orthene, Bidrin, Dimethoate and Trimax applied alone or with Roundup Ultra. The addition of Roundup Ultra did not reduce insect control compared to insecticides applied alone.

Envoke and insecticides

Envoke can be applied over-the-top of cotton from the fifth true leaf stage until 60 days before harvest. Envoke was applied alone or in combination with 11 insecticides (Orthene, Vydate, Karate Z, Intruder, Centric, Phaser, Steward, Denim, Intrepid, Tracer and S-1812) to evaluate control of 10 weed species.

With few exceptions, control of palmer amaranth, smooth pigweed, common lambsquarters, jimsonweed and prickly sida was significantly reduced with all herbicide/insecticide co-applications. Previous weed control studies with Envoke have identified these respective weed species as being less sensitive to the herbicide than other broadleaf weeds. Control of sickelpod, pitted morning-glory, ivyleaf morning-glory, entireleaf morningglory and tall morningglory was unaffected by insecticide co-application with Envoke.

Control of adult thrips and thrips larvae was also evaluated with co-applications of Envoke and the insecticides. Except for the control of adult thrips with the Envoke/Steward co-application in one of two experiments, the addition of Envoke did not reduce insecticide efficacy compared to insecticide applied alone.

Glufosinate and insecticides

Ignite can be applied over-the-top of Liberty Link cotton from emergence to the early bloom stage. Glufosinate is marketed under the trade name Ignite in Liberty Link cotton and Liberty in other Liberty Link crops. At the time this research was initiated, glufosinate was marketed only as Liberty. Liberty was applied alone or in combination with 12 insecticides (Bidrin, Orthene, Centric, Intruder, Trimax, Capture, Karate Z, Baythroid, Steward, Tracer, Denim and Intrepid) to evaluate broadleaf weed control. Control of hemp sesbania, redroot pigweed, pitted morningglory, prickly sida and sicklepod ranged from 85% to 100%, with Liberty applied alone at the three- to four- or seven- to eight-leaf growth stage. Insecticides co-applied with Liberty did not reduce weed control.

Herbicides had minimal impact on insecticide efficacy in cotton.

Co-application saves money

With the exceptions noted for Envoke, co-application of Staple, glyphosate or glufosinate and insecti-cides are possible without negative consequences to control of weeds or insects evaluated in this research. In general, herbicides had minimal impact on insecticide efficacy. The negative effects of insecticide co-application with herbicides were observed primarily on weeds that previous research has shown to be less sensitive to the herbicide anyway. For these weeds, another herbicide would be applied. Control of early-season insects and broadleaf weeds can be accomplished with co-applications. Producers are cautioned to consult the individual pesticide labels for restrictions on tank-mixtures when con-

Photo by John Chaney

When Crops Become Weeds:

Control Strategies for Volunteer Roundup Ready Plants

Donnie K. Miller, A. Stanley Culpepper, Steve T. Kelly, David Y. Lanclos, Alexander M. "Sandy" Stewart, James L. Griffin, Eric P. Webster, Ron E. Strahan, P. Roy Vidrine, Bill J. Williams and Alan C. York

The introduction of glyphosate-resistant transgenic (Roundup Ready) technology has offered an alternative for control of troublesome weeds in cotton, soybean and corn. One drawback to this technology is that "volunteer" Roundup Ready crop plants originating from seed produced the previous crop year have become "weeds."

A weed is any plant growing out of place, even crop plants. For example a Roundup Ready corn or cotton plant would be impossible to control with glyphosate in Roundup Ready soybeans. Left uncontrolled, these volunteer plants not only compete with the crop in the same way as traditional weeds but also provide oviposition (reproductive) sites for insect pests, such as boll weevils in the case of cotton.

A team of researchers from the LSU AgCenter in cooperation with col-leagues from North Carolina State University and the University of Georgia have been identifying optimum management strategies for control of volunteer crops that become weeds.

Success of herbicide treatments is greater when applied to plants less than six inches in height. Multiple applications or tank-mixtures of herbicides may be needed for optimum control. In many cases, volunteer plants will emerge before planting and require a "burndown" herbicide application or tillage to obtain a weed-free seedbed at planting. In most cases, pre-plant applications that include either paraquat or glufosinate (Ignite) for control of both Roundup Ready cotton and soybean, or flumioxazin (Valor) for control of Roundup Ready cotton, are most effective. Multiple herbicide applications may be needed for complete control.

Control of volunteer Roundup Ready cotton and soybean in corn and grain sorghum can be achieved

sidering weed and insect management strategies. ■

ACKNOWLEDGMENT – Louisiana Soybean and Feedgrain Research and Promotion Board and Cotton Inc.

Donnie K. Miller, associate professor, and Gene Burris, professor, Northeast Research Station, St. Joseph, La.; Richard W. Costello, former graduate assistant, Department of Plant Pathology and Crop Physiology, Baton Rouge, La.; Robert G. Downer, associate professor, Department of Experimental Statistics, Baton Rouge, La.; James L. Griffin, professor, Department of Agronomy and Environmental Management, Baton Rouge, La.; B. Rogers Leonard, professor, Macon Ridge Research Station, Winnsboro, La.; Joseph H. Pankey, former graduate assistant, Department of Plant Pathology and Crop Physiology, Baton Rouge, La.; and John W. Wilcut, professor, Department of Crop Sciences, North Carolina State University, Raleigh, N.C.

A weed is any plant growing out of place even crop plants.

Photo by Donna Morgan

A weed is a plant out of place, such as this corn plant emerging near soybeans.

with applications of atrazine alone or tank-mixed with halosulfuron (Permit), dicamba (Clarity), 2,4-D, nicosulfuron (Accent) or primisulfuron (Beacon) (corn only). In cotton, application of glufosinate over-the-top in transgenic Liberty Link cotton or under a hooded sprayer in conventional cotton will provide excellent control of both Roundup Ready cotton and soybean, if applied before the six-leaf stage.

Application of bromoxynil (Buctril) in transgenic BXN cotton will effectively control volunteer cotton plants. Most herbicides labeled for postemergence-directed applica-tion in cotton will exhibit fair to good activity on both volunteer cotton and soybean, although repeat applications will often be needed. Over-the-top cotton herbicides pyrithiobac (Staple) and trifloxysulfuron (Envoke) have similar activity on soybean as postemergence-directed treatments.

In a soybean crop, glufosinate herbicide is effective on volunteer plants. Combinations of preemergence followed by postemergence herbicides have provided the most consistent control of volunteer cotton in soybean. Cultural practices such as narrow-row soybeans, which provide a canopy cover more quickly, and tillage may be necessary to provide complete control of volunteer plants in a soybean field.

Control of volunteer Roundup Ready corn is easily accomplished in cotton and soybeans in-season or after corn harvest with graminicides (grass herbicides) such as sethoxydim (Poast Plus), clethodim (Select), fluazifop (Fusilade DX) and quizalofop (Assure II). ■

ACKNOWLEDGMENT – Louisiana Soybean and Feedgrain Research and Promotion Board and Cotton Inc.

Donnie K. Miller, associate professor, Northeast Research Station, St. Joseph, La.; A. Stanley Culpepper, extension weed scientist, Department of Crop and Soil Science, University of Georgia, Tifton, Ga.; Steve T. Kelly, assistant professor, Scott Research, Extension and Education Center, Winnsboro, La.; David Y. Lanclos and Alexander M. "Sandy" Stewart, both assistant professors, Dean Lee Research Station, Alexandria, La.; James L. Griffin, professor, Eric P. Webster, associate professor, and Ron E. Strahan, assistant professor, Department of Agronomy, Baton Rouge, La.; P. Roy Vidrine, professor, Dean Lee Research Station, Alexandria, La; Bill J. Williams, associate professor, Northeast Research Station, St. Joseph, La.; and Alan C. York, professor, Department of Crop Science, North Carolina State University, Raleigh, N.C.

Making DAIRY FOODS Healthier

Kayanush J. Aryana, Charles Boeneke and Ronald Gough

Photo by Mark Claesgens

Kayanush Aryana adjusts and monitors the pressure gauges of a homogenizing machine during the initial stages of making a healthier yogurt with folic acid.

Photos by Mark Claesgens

Far left: Two samples of Cheddar cheese made with nutritional omega-3 fatty acids and plant stanol ester, one with OmegPure and the other with Benecol. Left: OmegaPure is a refined fish oil. Below: Instron measures the texture of a cheese cube by pressing down on the sample. Data indicate how hard and springy the cheese will be.

Several new food products or ingredients have been identified as contributing to human health. Including such ingredients in manufactured dairy products would improve their health-giving benefits. LSU AgCenter researchers are testing how the incorporation of these health-beneficial ingredients in dairy products affects physico-chemical and sensory characteristics.

Replacing milk fat in Cheddar cheese

Milk fat is high in saturated fatty acids. Saturated fats contribute to gradual blockage of the arteries, reducing blood flow. The omega-3 fatty acids, on the other hand, are known to have beneficial effects on cardiovascular diseases by lowering cholesterol and triglycerides, lowering blood viscosity and decreasing blood pressure.

The focus of one research project is to replace the saturated fatty acids in a milk product, Cheddar cheese, with omega-3 fatty acids. One source of omega-3 fatty acids is a commercial product called OmegaPure, a refined fish oil that can be added to a variety of foods.

Another commercial product that can replace saturated fatty acids in milk products is Benecol. This is a cholesterol-reducing product, available to consumers at grocery stores, that includes a patented ingredient, plant stanol ester. We also tested this product in Cheddar cheese and evaluated both products with different ratios of milk fat.

Results of the study are as follows:

- Benecol and OmegaPure did not affect the overall composition of the cheeses.
- There were no differences in the lightness values of the cheeses made with Benecol and OmegaPure compared to the control. The full-fat cheeses made with Benecol were more yellow than the full-fat control, which would be desirable in a product like Cheddar cheese.
- Benecol and OmegaPure did not affect the pH of the cheeses at low and medium levels of usage. At the high usage level, the two products lowered the pH of the cheeses.
- Benecol and OmegaPure did not affect the protein profile of the cheese.
- The aerobic bacterial counts appeared to increase from two to four months and then declined at six months in both the low-fat and the full-fat cheeses made using Benecol and OmegaPure.
- When used at 25 percent in Cheddar cheeses allowed to age for 24 weeks, Benecol resulted in textural qualities comparable to the control.
- Benecol did not adversely affect the flavor in full- and low-fat cheeses. OmegaPure improved texture in the full-fat cheeses but adversely affected flavor.

Yogurt and folic acid

Folic acid is important to human health. Folic acid deficiency is a factor responsible for neural tube defects in humans. Low levels of folic acid have also been linked to coronary heart disease. Low plasma folic acid concentrations have been reported to be a risk factor for stroke. An inverse correlation has been observed between colorectal cancer and dietary folic acid.

Folic acid cannot be synthesized by humans or mammals

Folic acid was added to this strawberry yogurt to yield a healthier product than conventional yogurts. Folic acid helps combat neural tube birth defects. It is normally found in green vegetables, but including it in a dairy food expands its availability to satisfy a broader range of food and taste preferences.

and must be provided through diet. Good sources of folic acid are green vegetables such as asparagus, spinach, broccoli, turnip greens and brussels sprouts and by organ meats such as liver and kidney. Dairy products such as yogurts, however, are not good natural sources of folic acid. Folic acid is a water-soluble vitamin, and yogurt is a high-moisture, low-caloric, semi-solid dairy food, which can be consumed as a snack or dessert. Adding folic acid during yogurt manufacture would result in a healthier product.

LSU AgCenter researchers tested adding folic acid at various concentrations and various stages in plain and flavored yogurts. The results of incorporating folic acid into plain yogurt included:

- No changes in yogurt composition.
- No changes in pH or acidity.
- No differences in protein or peptide profiles.
- No differences in syneresis – the separation of liquid from the gel – when comparing stages of addition, concentrations and time of storage.

Yogurt viscosity was not affected by folic acid incorporation or by storage time. Pasteurization had no effect on the lightness of the yogurts. Lightness values were lower at week 3 compared to weeks 1 and 5. Flavor was not affected by the concentration of folic acid or stage of addition. Flavor was the highest at week 1, dropped at week 3 and increased at week 5. Body and texture scores for yogurts averaged 4 on a scale of 1 to 5.

In addition to plain yogurt, lemon- and strawberry-flavored yogurts were produced. Some differences were observed between plain and flavored yogurts.

Folic acid concentration had significant effects on the viscosity of both lemon- and strawberry-flavored yogurts. Lower viscosities for lemon yogurts were recorded when folic acid was added after pasteurization. Viscosity of lemon yogurts increased at week 3, compared to weeks 1 and 5, while viscosities of strawberry yogurts were not affected.

Acidity and syneresis of strawberry yogurts were not affected by folic acid concentration or stage of addition, and syneresis was not affected by storage time. The level of folic acid concentration was not significant for the lemon-flavored yogurts.

The stage of production when folic acid was added did not affect the flavor of lemon and strawberry yogurts; how-ever, the level of folic acid and storage time showed signifi-cant differences in mean flavor values of the flavored yogurts. Average body and texture scores were fairly high, recording a 4 out of a 5 for flavored yogurts fortified with folic acid.

Conclusions

Photos by Mark Claesgens

Aryana pours the yogurt mixture into containers with a chunky strawberry puree. After incubation, blending and chilling, the samples are ready for their taste test.

Incorporating OmegaPure and Benecol in Cheddar cheese is favorable at a low concentration of 25 percent fat content. At high concentrations, however, the addition of these products results in a harder cheese with a markedly altered flavor.

Folic acid can be added to yogurts without adversely affecting product characteristics. Since there were no signifi-cant losses of folic acid during pasteurization, folic acid can be added before pasteurization, enabling processors to follow the federal Food and Drug Administration's Hazard Analysis and Critical Control Point requirements in keeping with the production of safe dairy foods.

Future research

Production of functional dairy foods continues to be a primary focus of dairy products research at the LSU AgCenter. Projects include fat-free, no-sugar-added ice cream, yogurts fortified with various minerals, vitamins and fibers, and development of new dairy products with added health benefits. ■

Kayanush J. Aryana and Charles Boeneke, both assistant professors; and Ronald Gough, recently retired professor, Department of Dairy Science, Baton Rouge, La.

Improving Brahman Cattle for MEAT QUALITY

Photo by Mark Claesgens

The Brahman at right is a clone of the other and produced at the LSU AgCenter's Embryo Biotechnology Laboratory. The Brahman breed has contributed much to the commercial cow-calf industry in Louisiana because of its adaptability to subtropical conditions.

The Brahman breed has contributed much to the commercial cow-calf industry in Louisiana and the South-eastern United States because of its adaptability to subtropical conditions. The breed also contributes to hybrid vigor when crossed with Angus and Hereford breeds. Recent evidence suggests that beef from cattle with a high percentage Brahman parentage has lower marbling and is less tender on average than beef from other breeds. This has led the cattle industry to impose discounts ranging up to 15 percent on feeder steers and heifers that show high Brahman inheritance.

No effort has been made to improve carcass quality traits in the Brahman. Because of the importance of the Brahman breed to beef production in the Southeast, a study was designed to measure genetic variation for carcass quality traits in Brahman steers and to predict breeding values of Brahman sires.

Procedure

Four hundred forty-five purebred Brahman bull calves with known pedigrees and sired by 68 Brahman bulls were studied. The calves were purchased at weaning from private Brahman breeders in Louisiana from 1996 through 2000. The number of calves per sire ranged from 2 to 27.

Calves were collected in Baton Rouge and cared for in typical fashion until ryegrass was available for grazing around December 1. The steers were grazed for 100 to 140 days and then shipped to a commercial feedlot in south Texas. When about half the steers reached acceptable market weight and averaged .4 inch fat thickness, they were sold to a major packer for slaughter and data collection. The remaining steers were harvested when they were ready for market.

After the steers were butchered, the carcasses were chilled for 24 hours before data collection. A primal rib was cut from each steer and sent to the LSU AgCenter Animal Science Department's meats section for tenderness evaluation. A steak was cut from each primal rib and aged for 14 days. Steaks were cooked to a medium doneness and allowed to cool to room temperature. Six half-inch cores were taken from each steak parallel to muscle fibers. Each core was sheared in a device that measures the force necessary

to cut the meat. The six shear force measurements were averaged to determine tenderness for each steak.

In addition, other traits were evaluated using software known as Multiple Trait Derivative Free Restrict-ed Maximum Likelihood. This proce-dure estimated the additive genetic variance components and the heritability for each trait and predicted values for the individual sires.

The traits measured included feedlot daily gain, carcass weight, ribeye area, marbling score (intramuscular fat) and shear force of 14-day-aged steaks. U.S. Department of Agriculture carcass quality grade was determined by the amount of marbling in the ribeye muscle at the 12th rib.

Trait values

Feedlot daily gain of 3.3 pounds per day is similar to that achieved by Louisiana commercial steers consigned to the LSU AgCenter calf-to-carcass program. (Since 1992, the calf-to-carcass program has provided Louisiana producers feedlot performance, carcass quality and other data on more than 2,400 steers and heifers.)

Carcass weight at harvest averaged 741 pounds – about the middle of the recommended range of weights for feedlot cattle.

The average ribeye area of 13.3 square inches met industry standards. The 1.8 square inches of ribeye per 100 pounds of carcass indicated these Brahman steers had adequate muscling relative to carcass weight.

The marbling score gave an average USDA quality grade of select +. Thirty-two percent of the carcasses graded low choice.

Average shear force of 14-day-aged steaks was 8.5 pounds. The National Cattlemen's Beef Association Beef Board suggests that steaks should shear less than 9 pounds to be considered tender enough for sale in retail meat markets.

Heritability

Heritability, a measure of genetic variation, is defined as the proportion of observed variation in a trait due to additive genetic influence. Additive genetic influence comes from the cumulative small effects of all the genes that influence a trait in an individual. Heritability estimates for carcass weight and ribeye area were above 50 percent and are considered in the high range. This means that beef cattle producers can make rapid changes in these traits by selecting sires that display those traits.

The heritability estimate for daily gain was 33 percent and the estimate for marbling was 38 percent. These estimates are in the high end of the moderate range and indicate that change is possible through selection.

The heritability of shear force of 14-day-aged steaks was 21 percent, in the low end of the moderate range. One of the problems in improving tenderness is that you cannot measure tenderness on a live animal. Tenderness is meas-ured on harvested beef. The recom-mended procedure is to evaluate progeny of sires and then select the sire that had progeny with low shear-force values. It takes a long time to progeny test beef cattle for carcass traits, and the process is expensive.

Significant sire differences were found for almost all of the carcass traits. Several Brahman sires had steer progeny that gained well in the feedlot, had superior muscling, graded low choice and had shear force values below 8.0 pounds. Other sires had steer progeny on the opposite end of the range.

Breeding values

Breeding values are measures of genetic merit and are based on differ-ences in additive genetic influence. Breeding values are calculated as deviations from the group average. Half the sire breeding values will be above average and have positive signs, and the remaining sire breeding values will be below average and have negative signs.

A sire will transmit a random selection of half its breeding value for a trait because only half the genes of an individual are transmitted from parent to offspring. The amount of genetic merit transmitted is called Expected Progeny Difference (EPD) and is one-half of the sire's breeding value. The distribution of sire breeding values is given in Table 1.

The categories are based on one-half of the additive genetic standard deviation. EDPs fall into four categories: between zero and plus one-half of an additive genetic standard deviation, above one-half of an additive genetic standard deviation, between zero and minus one-half of an additive genetic standard deviation and less than minus one-half of an additive genetic standard deviation. Most of the EPDs are clustered around the mean of zero. EPDs on the extreme ends of the range indicate either superior or inferior sires, depending on the trait. The range and distribution of Brahman sire EPDs found in this study is similar to the ranges and distributions of EPDs of sires in Angus, Simmental, Hereford and other breeds of cattle.

These results confirm that genetic variation in the Brahman breed for carcass and tenderness traits is similar to that found in other breeds. These results have also led to the development of a steer feed-out program administered by the American Brahman Breeders Association to develop EPDs for carcass and tenderness traits for sires in the Brahman breed. ■

Table 1. Mean performance, heritability and distribution of sire EPDs for selected carcass traits.

Trait	Mean	Heritability	Distribution of sire EPDs				
			< – .5	– .5	zero	+.5	> +.5
Feedlot daily gain (pound/day)	3.3	.33 (.14)	11	19		31	7
Carcass weight (pounds)	741	.56 (.15)	11	18		24	15
Ribeye area (square inch)	13.3	.51 (.16)	0	37		30	1
Marbling score	Select +	.38 (16)	2	36		29	1
14-day shear force (pounds)	8.5	.21 (.11)	4	29		30	5

ACKNOWLEDGMENT – Louisiana Beef Industry Council and the Louisiana Brahman Association

Donald E. Franke, McFatter Endowed Professor, Department of Animal Sciences, LSU AgCenter, Baton Rouge, La.

LOVE MEAT TENDER

Photos by Mark Claesgens

The cut of meat labeled "choice" has more marbling than the "select" cut and thus should taste more tender. Grading meat is subjective, and consumers may find both cuts of meat equally tender.

grading beef prime, choice, select

Tenderness is a major determinant of our enjoyment in eating beef and is based on two factors, said Kenneth McMillin, professor of meat science in the Department of Animal Sciences. Connective tissue, which changes with an animal's age and type of muscle, is a primary factor, while physical attributes, including the length of the muscle fibers and their relative density also affect tenderness.

For more than 80 years, the U.S. Department of Agriculture has used a system of beef quality grading to classify beef carcasses and cuts into groups with similar characteristics. Over time, the quality grades have been associated with expected palatability or eating satisfaction.

The grades were originally established to classify cuts of meat to facilitate trade among packers, McMillin said. Beef packers in different parts of the country could buy and sell carcasses and cuts and be assured the meat met a specific standard.

"Relative animal maturity and amount of marbling – the flecks of fat in the meat – are sub-jectively evaluated to result in a quality grade," McMillin said. "It's a system developed and operated by an objective government agency, the USDA Agricultural Marketing Service."

When the USDA grading system was first established, cattle often went to market when they were several years old, so maturity was a significant measure of the quality of meat the animal would produce. Today, however, beef cattle are sent to market young enough so maturity is less a factor in grading.

"About 85 percent of beef is graded, according to USDA records," McMillin said. "More than 95 percent of retail beef is from known young animals – they're going to be relatively tender – so the quality grade is highly dependent upon marbling.

"It's easier to bite through flecks of fat, which also give juiciness and flavor," the meat scientist said. "Marbling estimates the eating characteristics of the meat. It doesn't estimate tenderness per se. Measuring tenderness requires cooking the meat and then evaluating it with an instrument or actual chewing by an individual."

Three of the several USDA beef quality grades – prime, choice and select – are most common in retail trade. About 3 percent of beef grades prime and is sold mostly through high-end restaurants, while the choice or select cuts find their way to grocery stores and butcher shops.

With current emphasis on leaner beef, consumers are willing to buy select cuts if they believe the meat will be tender and juicy. McMillin said we can either produce cattle that will result in tender beef or measure the meat after the beef is butchered to separate it into tender and less-tender groups.

"The quality grading system really doesn't predict tenderness at all," McMillin said. "The current system measures marbling, so steaks from two of every 10 cattle may still not deliver acceptable tenderness."

McMillin said LSU AgCenter research in identifying sires that will produce offspring with tender beef will help advance the industry by eliminating undesirable cattle from the beef system and reducing the current variation in beef tenderness. ■ **Rick Bogren**

Long-term assessment of pine plantation productivity in Louisiana

Zhenmin Tang,
Jim L. Chambers,
Patricia J. Young and
Mary A. Sword Sayer

Photo by Zhenmin Tang

Above: Towers were built so the scientists can take measurements in the live canopy. The trees are about 40 to 50 feet high at this stage.

Photo by John Chaney

Right: Zhenmin Tang is climbing one of the towers to take measurements.

Below: This instrument measures photosynthesis. It's about 8 inches wide.

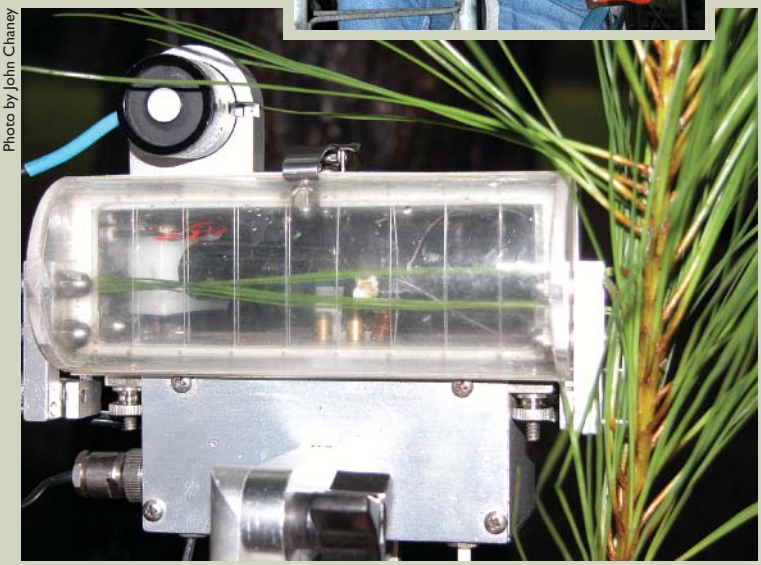


Photo by John Chaney

There are 215 million acres of timberland in the southern United States and nearly 30 percent are southern pine forests. Loblolly pine is the most extensively planted commercial pine species in the South. In Louisiana, the growing volume of loblolly pine forests is nearly 7 billion cubic feet. Timber revenues of Louisiana exceed the total revenue of all other plant and animal products. In 2003, forestry contributed $3.7 billion, including value-added, to the state's economy, according to the LSU AgCenter's most recent "Ag Summary."

The availability of resources such as light, mineral nutrients and water affects forest growth and yield. For example, soil fertility is generally low in pine plantations throughout the southern United States. On sites of poor fertility, nutrient deficiencies substantially reduce the timber production of southern pine plantations. Low light availability can limit branch expansion and trunk volume. Forest cultural practices such as thinning (the partial removal of trees), fertilization and weed control are commonly used to increase site quality and plantation productivity. Understand-ing the effects of forest management on resource availability and timber production requires extensive assessment of

the relationship between cultural treatments and environmental constraints to tree growth. With rising demands for timber and other wood products in the South and the nation as a whole, forest mana-gers and researchers continue their efforts to enhance the growth and yield of southern pines through improved management techniques.

In 1988, the U.S. Department of Agriculture's Forest Service began examining the long-term effects of cultural practices on loblolly pine productivity on the Kisatchie National Forest in central Louisiana. In coopera-tion with the Forest Service, scientists at the LSU AgCenter use advanced tech-nologies to investigate tree growth and yield under different thinning and fertilization treatments. Levels of thinning include no tree removal or precommercial tree removal at ages
8 and 14 years. Levels of fertilization include no fertilization or broadcast application of diammonium phosphate at 667 pounds per acre in late 1988 and 179 pounds urea, 18 pounds triple superphosphate and 45 pounds potash per acre in 1995. This study provides valuable information about trunk volume, leaf area production, crown physiology and root system expansion
in response to forest cultural treatments. Results help interpret how site factors and intensive management interact to influence the timber production of loblolly pine plantations in Louisiana.

The tree crown is a complex structure that regulates the radiant dynamics, energy budget, and water
and carbon balance of forest ecosystems. Crown characteristics determine the amount of intercepted light, the most important factor affecting the physiology and growth of individual trees. Other site factors such as temperature, relative humidity and mineral nutrients also affect tree volume. Presently, how these factors interact to affect tree trunk size is poorly understood. The study of large trees is generally lacking because of problems accessing tree crowns and developing instrumentation for environmental measurements. With the recent progress in measurement technologies, LSU AgCenter researchers are attempting to evaluate how site factors affect tree crown processes, what crown characteristics can be culturally manip-ulated to increase trunk height and diameter, and when intensive manage-ment needs to be prescribed for maximum trunk volume.

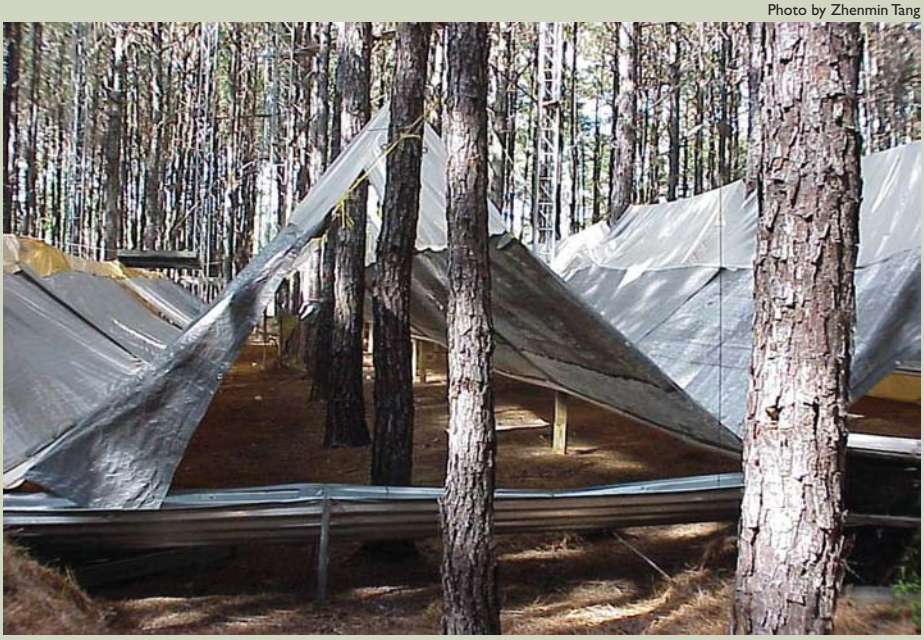
Steel tower systems were built to provide access to the live crowns of large loblolly pine trees for ecological and physiological measurements. Sensors were installed in the upper and lower crown to monitor microenviron-mental change continuously. Data acquisition systems consisting of data-loggers and fiber optic cables were used to transfer environmental data to a remote computer for analysis and summarization. Growth of shoots
and roots was measured intensively during several growing seasons. Foliage biomass, leaf area and physiological factors, such as net photosynthesis and tree water status, were also monitored intensively.

Photo by Zhenmin Tang

In dense, unthinned stands, tree growth was limited mainly by low light intensity throughout the crown. Thinning increased light penetration into the lower crown and reduced competition for available growing space, nutrients and water. Trunk diameter and volume rose considerably for four years in the thinned stands relative to the unthinned stands. We found that branch size and retention, leaf area and photosynthesis increased in response to thinning. Six years after the initial stand density reduction, however, the annual volume growth response decreased to the level before treatment, suggesting that more trees must be removed to maintain the growing space needed for high rates of growth.

At nutrient-deficient sites in Louisiana, fertilization is increasingly applied to improve soil fertility. Our findings indicate that tree trunk volume increased 30 percent to 45 percent in response to fertilization. Maximum increases in tree volume growth occurred in the third and fourth years following fertilization. The combination of fertilization and thinning

Photo by Zhenmin Tang



Tarps were constructed to keep the rain off the forest floor to study the effects of drought stress.

This is one of the research plots. It measures about 150 feet by 150 feet.

was the best treatment for timber production.

Greater nutrient availability enhanced branch growth and leaf area in the fertilized stands. However, the positive effects of fertilization on the volume growth no longer existed six years after fertilizer treatment. Thus, reappli-cation of fertilizers was needed.

In early 1999, water exclusion treatments were applied. Two levels of water exclusion included normal rainfall or rainfall exclusion. Tree trunk height, diameter and physiology were measured intensively throughout growing seasons. The latest sap-flow monitoring technology was used to monitor water movement through trees continuously. The data of water movement allowed estimation of tree-level and stand-level water consumption. This study provides insight into the links between tree physiology and trunk volume growth under a combination of fertilization and rainfall exclusion treatments, which is essential to better understand the effects of cultural practices on the carbon exchange, water use and timber production of loblolly pine plantations in a changing environment. ■

Zhenmin Tang, assistant professor; Jim L. Chambers, professor; and Patricia J. Young, former research associate, School of Renewable Natural Resources, Baton Rouge, La.; and Mary A. Sword Sayer, research plant physiologist, U.S. Department of Agriculture Forest Service, Pineville, La.

FORESTRY:

Louisiana's No. 1 Agricultural Commodity

The projected Louisiana gross farm value of forest products decreased in 2003. The 2003 total sawlog harvest fell by more than 111 million board feet (9.5%) to a cut of 1,116,383,390 board feet.

The estimated pine sawtimber harvest decreased by 9.1%, for a total statewide harvest of 1,006,519,286. The hardwood sawtimber harvest decreased to 109,864,104 board feet (a 13% decrease) in 2003. Pine chip-n-saw harvested in 2003 totaled 801,191 cords, a decrease of almost 17% from 2002 totals. The estimated 2003 Louisiana pulpwood harvest was 5,259,976 cords, down 61,698 cords (1.17%) from 2002's harvest. Pine pulpwood harvest increased 2.34%, from 3,805,550 cords in 2002 to 3,895,733 cords in 2003. Hardwood pulpwood harvest decreased by 151,860 cords (10.54%), from 1,516,124 cords in 2002 to 1,364,264 cords in 2003.

Stumpage prices for 2003 were mixed when compared to 2002. On average around the state, pine sawtimber prices were 1% higher in 2003. Oak sawtimber prices were 2% lower on average around the state in 2003. Statewide average pine pulpwood prices increased by 19% in 2003, reversing a trend of a 33% decline in prices in 2001 and 2002. Hardwood pulpwood prices increased an average of 23% around the state in 2003. Chip-n-saw prices declined 4% on average in Louisiana in 2003.

With wood-using industries and commercial timber harvesting activities occurring in all parishes, forestry provides benefits to both urban and rural areas. In 2003, Louisiana's private forest landowners received an estimated $536,706,681 from the sale of forest timber, down 6.65% from $573,743,837 in 2002. Timber harvesting contractors and their employees earned $417,816,083 from harvesting the trees and moving wood to mills. This total was down 1.21% from $422,904,659 in 2002. This income is re-spent many times throughout the economy. In addition, Christmas tree growers received $1.1 million from the sale of trees. Louisiana-produced pine straw sales made $132,530 in 2003. Louisiana's private sector forest tree seedling nurseries produced a crop worth $585,900 in 2003.

The payroll and income derived from money generated by the forestry and wood products industry totaled an estimated $3.7 billion in 2003, a 3.54% decrease from 2002 totals. The gross farm income produced by all forestry-related products, such as timber, pine straw and Christmas trees, totaled $956,351,993 in 2003, down 4.97% from $1,005,087,540 generated in 2002. The value added through further processing and delivery was $2,744,730,221, down 2.86% from the 2002 value added of $2,824,295,987. Total value (gross farm value plus value added) declined slightly in 2003, mainly because of lower harvest volumes for most forest commodities combined with only slightly improved prices for the most valuable commodities, pine and hardwood sawtimber. ■

Source: LSU AgCenter's Ag Summary 2003

BRONZE WILT in Louisiana Cotton

Photos by H. Kenneth Whitam

G. Boyd Padgett,
Patrick D. Colyer
and H. Kenneth Whitam

Bronze wilt is also referred to as "copper top," "sudden wilt" and "phloem wilt." Symptoms have been observed on juvenile plants as early as late June, but symptoms are usually observed during fruit development. Initial symptoms include bronzing and wilting of the foliage near the top of the plant.

The cotton disease called "bronze wilt" (it gives the leaves a copper color and they wilt) was first observed in Louisiana and Mississippi in 1995. While losses in Mississippi were minimal, the disease caused yield reduction in some Louisiana cotton fields.

Since 1995, bronze wilt has been reported in most cotton-producing states, but its occurrence and impact on cotton varies considerably. The variation is due in part to the cotton varieties planted and severity of the disease. LSU AgCenter research indicates several varieties are susceptible – Hartz 1215, 1220, 1244; Paymaster 1560, 1218 B/R; Stoneville 132, 373, 5599; and Suregrow 125. Furthermore, this condition is most severe in short-season varieties. Most of the susceptible varieties are no longer marketed in the state.

The cause of bronze wilt has not been determined with certainty. It has been suggested drought stress, fertility and planting date may be factors that affect bronze will development.

Symptoms

Bronze wilt is also referred to as "copper top," "sudden wilt" and "phloem wilt." Symptoms have been observed on juvenile plants as early as late June, but symptoms are usually observed during fruit development. Initial symptoms include bronzing and wilting of the foliage near the top of the plant, and the terminal of infected plants is warmer than non-affected plants. As the condition progresses, stems of affected plants turn from bronze to red, and the

entire plant wilts. Most yield losses result from the shedding of golf ball-sized bolls. In rare instances, reports of dead tissue where secondary branches attach to the main stem have been reported.

Symptoms of bronze wilt are often confused with mite injury, early maturity and potassium or magnesium deficiency. Therefore, it is crucial to identify this condition to avoid imple-menting unnecessary management practices. Since the etiology of the disease is unknown, management strategies have not been developed.

The best strategy is to avoid planting cultivars with a history of bronze wilt.

Tracking the disease

Experiments were conducted from 2000 to 2003 to monitor bronze wilt at the Macon Ridge Research Station near Winnsboro, La. The varieties Stoneville 5599 B/R, Stoneville 373 and Paymaster 1218 B/R were evaluated in 2001; Stoneville 5599 B/R in 2002; and Stoneville 373 in 2000 and 2003. Plants were monitored weekly. When bronze wilt symptoms appeared on a plant, the plant was flagged with the date. Spatial distribution of bronze wilt was recorded at the end of the growing season after plants were defoliated.

Spatial distribution varied considerably in both tests in 2001. In one test, incidence was lowest in the center of the plot and greatest adjacent to the center and on one end. Incidence in a second test was greatest 5 to 15 feet into the plot and lowest near the center. In 2002, symptomatic plants were more uniform-ly distributed throughout the plot compared to distribution in 2001. Spatial distribution of symptomatic plants varied dramatically in 2003 ranging from zero plants 15 feet into the plot to one plant on the plot ends. No established trends in spatial distribution were noticed within years; however, when data were summarized across years, there was a slight trend toward increased incidence on the plot end.

Bronze wilt increased over time in all years and spatial distribution varied considerably. Planting date may have impacted incidence in 2000, but not in 2001. In 2001, final incidence was similar in both tests, but epidemics progressed faster in the late-planted cotton. No "edge-effect" was noticed. However, this may differ in years when incidence is severe. These data suggest that this disorder is randomly distributed in fields. Therefore, scouting for this problem cannot focus on specific areas in the field. Since incidence was low in all years, additional research is neces-sary to fully understand the epidemiol-ogy of bronze wilt.

Other studies were conducted to determine the effect of planting date and nitrogen fertilization on bronze wilt incidence. Planting date studies were conducted over a two-year period. Bronze wilt was not affected by planting date. Two studies were conducted evaluating the effects of nitrogen rates on bronze wilt incidence. Nitrogen rates did not influence the disease.

A test was conducted at the Red River Research Station in Bossier City, La., on the effect of sulfur and phos-phorus nutrition on the severity of bronze wilt. There was no difference in incidence of bronze wilt among treat-ments, but incidence was very low, so it was not possible to make valid conclusions. ■

G. Boyd Padgett, associate professor, Macon Ridge Research Station, Winnsboro, La.; Patrick D. Colyer, professor, Red River Research Station, Bossier City, La.; and H. Kenneth Whitam, professor, Department of Plant Pathology and Crop Physiology, Baton Rouge, La.

Photo by Linda Foster Benedict

Boyd Padgett talks to farmers at the annual Northeast Research Station field day on June 13, 2004.

PORTRAIT

Quintessential County Agent:
Howard Cormier

Photo by Bruce Schultz

Howard Cormier, Vermilion Parish county agent for rice and sugar cane, examines the thickness of an infestation of Peruvian watergrass in an irrigation canal. Cormier made the inspection of the invasive species after getting a call from a farmer.

Howard Cormier, county agent for rice and sugarcane in Vermilion Parish, waded into a rice field near Gueydan to get a firsthand look at weeds in the fledgling crop.

"I see duck salad, sesbania, paspalum. Here's some bull's tongue."

Cormier continued to tell farmer Dwight Hardee of the possible strategy for dealing with the weed assault.

"Howard knows his weeds," Hardee remarked.

But Cormier had to admit he didn't have a quick answer for dealing with one weed species flourishing in Hardee's fields.

Cormier sees his job as a conduit for passing along information developed out of research. Cormier said farmers don't always take his recommendations, but they trust that the advice disseminated by the LSU AgCenter is unbiased.

"Our underlying goal is to make money for the farmers," he said. "I just think answering their field calls is the most important thing I can do. I really hate to put off a farmer when I can't go."

And he's also troubled when he and other AgCenter representatives can't provide a solution to a farmer's problem.

"It is frustrating when no one has the answer," he said.

On the other hand, he said, it's the new problems that make the job interesting.

"Like today, I've never seen that weed out in the field like that. This situation has not come up before."

Cormier grew up near Church Point. He earned his animal science degree at the University of Southwestern Louisiana in Lafayette, then attended seminary for a year.

After deciding the priesthood wasn't for him, Cormier began his career as a 4-H agent in Lafourche Parish. He moved to Vermilion Parish in 1978 to become the 4-H agent there.

He looks back fondly on his work in 4-H. He still gets satisfaction from knowing that many of his former students are now productive citizens.

Cormier said he took pride in his work, helping many kids win blue ribbons, especially with white Brahma cattle. He felt it was his responsibility to teach youngsters to do their best with what they had.

"My upbringing made me identify with a lot of 4-H kids who could not afford the highest priced animals," he said. "I never saw the value in spending large amounts of money on an animal because the animal becomes more important than the child."

Then fate stepped in and changed Cormier's future.

The previous Vermilion Parish county agent for rice and sugarcane, Cecil McCrory, died in an accident in January 1993. Cormier, who gave the eulogy for McCrory's funeral, considers him a mentor.

"He had the heart of a real man," Cormier said. "He definitely is someone I think about often."

McCrory grew up in the rice fields and seemed to have a sixth sense about what a crop needed, Cormier said, and his legacy continues.

"I still try to think of him when I make decisions," Cormier said.

Cormier said he had to learn not to get in a hurry when he started working with farmers, and he recalled McCrory often asked him, "You were really efficient, but were you effective?"

He started out as a county agent for rice and sugarcane by simply connecting farmers with LSU AgCenter experts.

"I did the mechanics of the work, but it took a long time before

Photo by Bruce Schultz

Cormier points out a weed problem in a rice field farmed by Dwight Hardee of Gueydan.

Cormier serves as a guide for the Rice Field Day at the LSU AgCenter Rice Research Station.

Photo by Mark Claesgens

I felt comfortable with the technical questions," he said.

He recalled he didn't even have a pair of rubber boots on his first visit with a rice farmer, who turned out to be Hardee.

At one time, he said, farmers who found a weed in their fields had to mail a pressed sample to LSU AgCenter labs in Baton Rouge before a recommendation would be made. But all that has changed with today's technology of cell phones, computers and the Internet.

"I understand they are in a rush and they've got to work in fairly narrow windows," Cormier said. "Their crop is on the line."

Paul Coreil, LSU AgCenter vice chancellor for extension, said county agents are on the front lines, acting as the liaison between research and application in the field, and technology is essential to pass along research results quickly.

Cormier has used technology to get information into farmers' hands immediately through a vast e-mail network, Coreil said.

Cormier relies heavily on the Internet and PowerPoint to get information where it's needed. En route to a farmer's request for help, he works his cellular telephone like an air traffic controller to line up more appointments and to get answers from previous inquiries.

Cormier has helped cane farmers develop harvesting techniques to reduce complaints from the public about debris on roadways and air quality. "Cane farmers are really making an effort and it's just a matter of doing it voluntarily," he said.

He also works with "Operation Quackback" to improve waterfowl hunting in the coastal marshes and has been a driving force behind the LSU AgCenter's new Master Horesman program to pass along equestrian skills.

"I do it out of a sense of commitment," he said.

Charles Broussard, owner of the Flying J Ranch in Vermilion Parish, said Cormier's concern for farmers is obvious.

"We're fortunate in Vermilion Parish to have a man as devoted as Howard," Broussard said. "He'll walk farmers' fields like they're his fields. He wants to solve the problems for you."

It's not just folks in Vermilion Parish who feel that way. Cormier received the national Rice Industry Award in 2002 for his work.

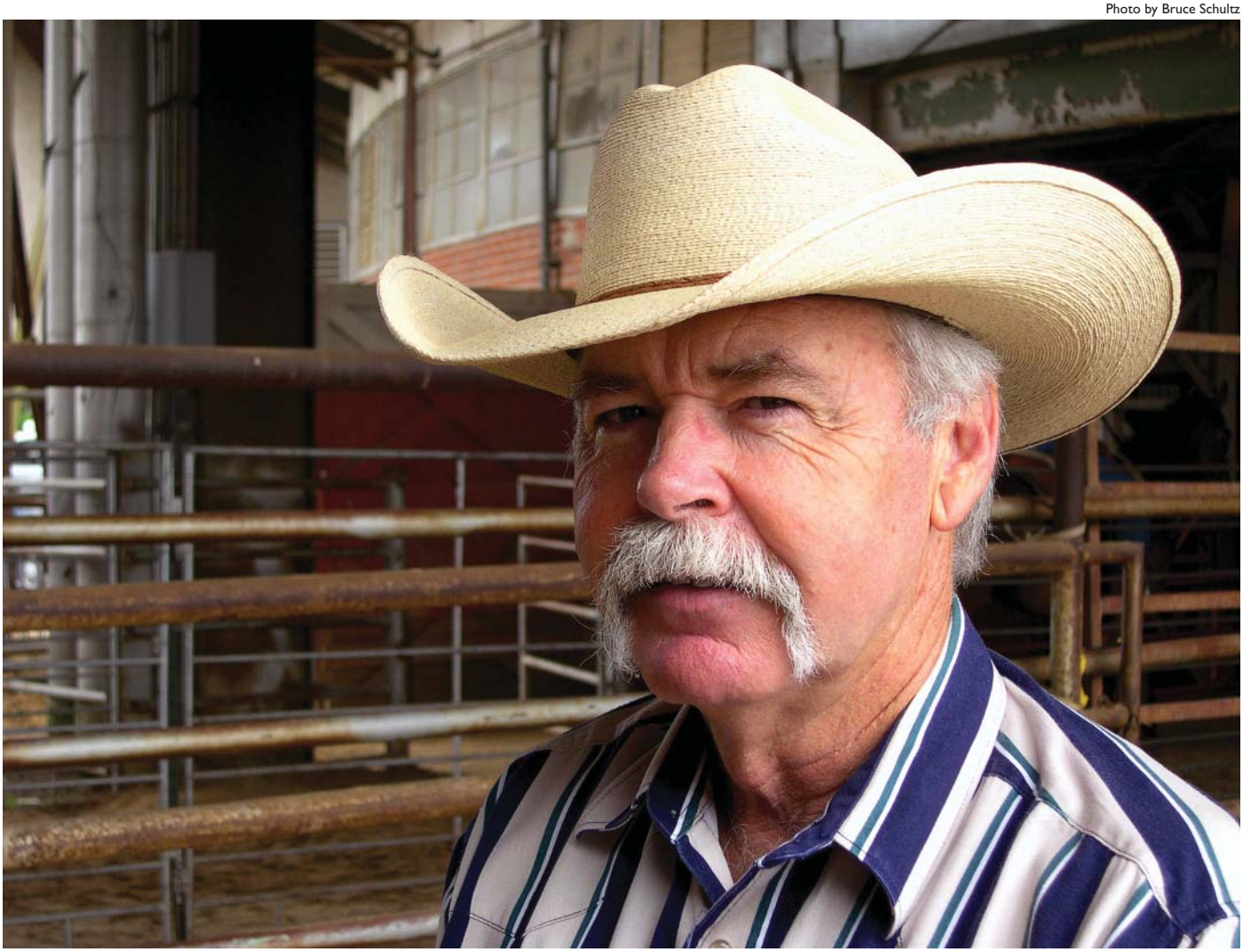
Linda Zaunbrecher, who farms rice with her husband, Wayne, near Gueydan, said Cormier is an agricultural icon in Vermilion Parish.

"He's a very special agent," she said. "We've worked him for a long time. We wouldn't trade him with anybody.

"I can always count on him. He's very precise and very detailed," she said. "His work ethic is old school, and I appreciate it."

■ **Bruce Schultz**

Photo by Bruce Schultz



Cormier combines his love of agriculture, concern for farmers and enthusiastic acceptance of technology in his work with rice and sugarcane farmers. "I just think answering their field calls is the most important thing I can do."

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Baton Rouge, LA 70894-5100

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