LOUISIANA AGRICULTURE

THE MAGAZINE OF THE LOUISIANA AGRICULTURAL EXPERIMENT STATION

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LSU AgCenter
Research & Extension

ON THE COVER: Cows graze at the LSU AgCenter's Southeast Research Station near Franklinton. The facility includes about 190 cows with plans to increase to 220 with 200 milking. See more on research at the station on page 18. Photo by John Wozniak.

Florida Group Learns to Compost Zoo 'Doo' at LSU AgCenter School

What to do with zoo doo-doo was the dilemma facing officials at the Panama City, Fla., Zoo World until they found out about the LSU AgCenter's Compost Facility Operator Training School.

Now they have a plan to recycle the zoo waste into safe, useful and nearly odor-free compost. This plan involves working with two other groups in Panama City, a local high school and Tyndall Air Force Base. Both groups sent representatives to the weeklong school this past May.

"This is the first time we've had high school students at the compost school and the first time we've worked with a zoo," said Dr. Bill Carney, coordinator of the LSU AgCenter's Callegari Environmental Center. He has been directing these workshops, which he puts on every spring and fall, since 1994.

Class size is limited to 25 because of the intensity of the activities. The participants learn the chemistry of combining waste substances rich in nitrogen and carbon to build and maintain compost piles, called windrows.

"I didn't realize we'd be doing so much science," said Andrea Colbert, 16, one of the high school students. All three of the students are juniors in an environmental science class. Their teacher Mike Sylvester could not attend because of his schedule.

Their high school, which includes about 1,200 students, has established several businesses, called the "Phoenix Project," as part of its curriculum. One business to be run by the environmental science classes is a composting facility.

Coincidentally, officials at Zoo World wanted to start composting the waste, which they now have to bury, and Tyndall had plans to set up a compost facility to handle the waste generated by the 6,000 people who live there.

"The Air Force wants all the bases to set up composting facilities," Carney said. "It's just getting too expensive to haul off all that waste."

The compost school is open to anyone wanting to learn composting on a large scale., Carney said. More information about the school can be obtained by contacting Carney at (225) 578-6998 or going to the LSU AgCenter's website.

■ **Linda Foster Benedict**

Photo by John Wozniak

The LSU AgCenter puts on a compost facility operator training school each spring and fall. The school is conducted at the Callegari Environmental Center, which just opened in December 2000. Students divide into groups and work with their own "windrows" of waste, learning how to turn it into safe, valuable and nearly odor-free compost.

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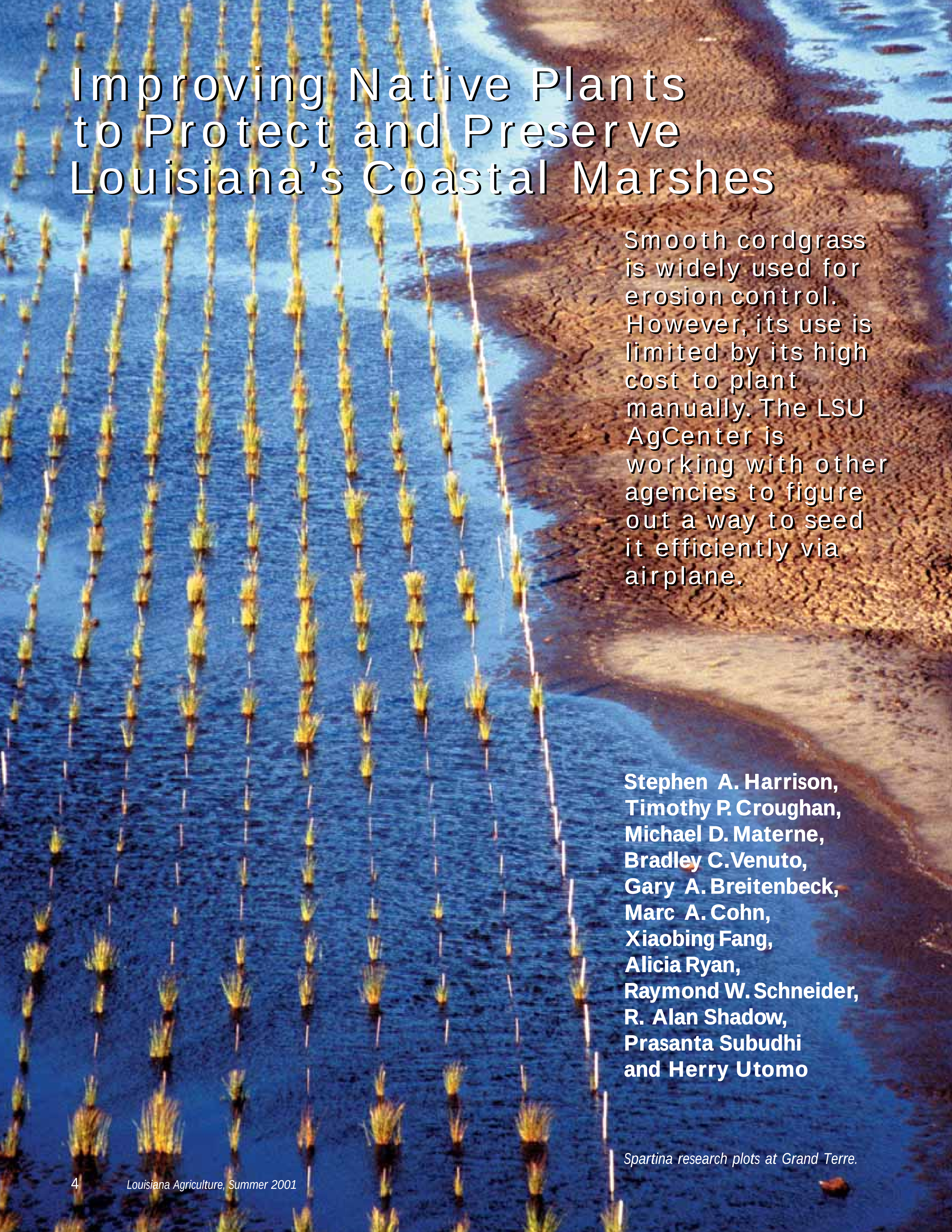
Research on bitter Panicum, at right, will be added as the coastal plants project develops. See page 4.

Photo by Michael D. Materne

Improving Native Plants to Protect and Preserve Louisiana’s Coastal Marshes

Smooth cordgrass is widely used for erosion control. However, its use is limited by its high cost to plant manually. The LSU AgCenter is working with other agencies to figure out a way to seed it efficiently via airplane.

Stephen A. Harrison, Timothy P. Croughan, Michael D. Materne, Bradley C. Venuto, Gary A. Breitenbeck, Marc A. Cohn, Xiaobing Fang, Alicia Ryan, Raymond W. Schneider, R. Alan Shadow, Prasanta Subudhi and Herry Utomo



Spartina research plots at Grand Terre.

The improvement of native plant species for use in coastal protection and restoration activities is the focus of a multi-disciplinary, cooperative effort involving scientists from the LSU AgCenter and the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

Although biotechnology and classical plant improvement methods are well established in agricultural crop production, their use in environmental remediation is still emerging. Scientists from the NRCS Plant Materials Center at Golden Meadow have collected, tested and released native plant materials with superior performance in coastal environments, including smooth cordgrass and black mangrove. The objective of the project is to develop a seed-based system of propagating smooth *Spartina alterniflora*, also known as smooth cordgrass or oystergrass, over large areas and to genetically improve the performance of native plant species for use in coastal restoration. This requires genetic improvement of seed production capability while maintaining vigor and disease resistance, and development of a system to produce, store and plant the seeds.

Louisiana's coastal marshes are highly productive ecosystems. Smooth cordgrass is the predominant salt marsh species along the Gulf Coast, and it provides food and habitat for aquatic species. This plant and its decomposition products provide the foundation of the food chain for such species as small crustaceans, shrimp, crabs, shellfish and minnows. These in turn support larger fish, aquatic birds and other wildlife.

Louisiana loses more than two acres of coastal wetlands every hour, about 30 square miles each year, from natural processes and human activities. Levee systems protect low-lying regions from flooding but deprive the coastal marshes of the sediment deposition necessary for their formation. The marsh naturally subsides as organic matter decomposes and loose sediments compact. Channeling of the marshes to support petroleum and shipping activities has resulted in rapid and frequent mixing of salt and fresh water. Natural plant systems are unable to adapt to sudden changes from fresh to saline water that result from subsidence, saltwater infiltration through channels and other ecosystem disturbances brought about by human activities. As a result, large areas of productive marsh have been lost.

Photos by Michael D. Materne

This is a healthy stand of Spartina.

The Coastal Wetlands Planning, Protection and Restoration Act of 1990 (the Breaux Act) and other legislation have provided impetus and substantial funding for reclamation activities. These activities include sediment diversion and rebuilding barrier islands and eroded areas using dredge material and rocks. Revegetation of the eroded and newly created marshland must be an integral part of reclamation activities to preserve a natural ecosystem.

Spartina Ideal for Reclamation

Spartina alterniflora is the predominant marsh grass and tolerates a wide range of salinity from slightly brackish to seawater. It can readily be produced in freshwater ponds. It is an ideal species for coastal reclamation work because of its stress tolerance and rapid growth. A single *Spartina alterniflora* plant can grow to a clump of several feet in diameter within a year. It thrives in coastal marshes and intertidal regions along the Gulf Coast. It spreads underground and its dense canopy provides a significant buffer against wave energy. It controls erosion, traps suspended sediments and produces significant amounts of organic matter. It grows parallel to the shore in water up to 18 inches deep and in clumps on mud flats.

Smooth cordgrass is widely used for erosion control along shorelines and canal banks and for stabilization of loose soil on mud flats and dredge-fill sites. Its use is limited by the high cost for plant material, up to $6 per plant, and the amount of labor required to plant it. Aerial seeding would permit planting an acre in just a few seconds at a fraction of the cost of manual transplanting.

One of the primary objectives of this research is to develop a seed-based system of establishing vegetation in large reclaimed coastal areas. The need for a seed-based system became particularly apparent with the large brown marsh dieback that occurred in 2000 and affected up to 390,000 acres of salt marsh. An estimated 17,000 acres of densely vegetated marsh were converted to open mud flats in Louisiana.

Spartina Produces Few Seeds

Spartina flowers in the late summer and produces seed each year, but the seed quality and quantity are generally low. *Spartina* seed must be stored under

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cool, wet conditions that mimic falling into the marsh in the fall and remaining in a dormant state until spring. Seed does not germinate at the time of shattering, and seed that dries out rapidly loses viability. This major obstacle to commercial seeding must be overcome.

An initial collection of native smooth cordgrass was made in 1998. Approximately 100 seed heads were harvested from each of 126 sites across south Louisiana. Seed varied significantly in weight and germination. Seedlings from 101 accessions were planted at the NRCS Plant Materials Center and under marsh conditions in Lafourche and Cameron parishes to evaluate vegetative vigor, spread, pest resistance, adaptation and seed production. Forty selected accessions were planted in replicated trials at the LSU AgCenter Ben Hur Research Farm.

In the fall of 2000, 40 genetically distinct plants, representing eight of these accessions, were chosen based on performance across two locations. These were transplanted to a pond at Ben Hur and at Grand Terre, a barrier island near Grand Isle, for additional evaluation and use as parents in the breeding program. The five best accessions from an earlier LSU AgCenter Rice Research Station collection, along with surviving plants collected from brown marsh sites in 2000, were added to this gene pool for use in development of genetically broad-based synthetic populations with superior performance.

The original Rice Research Station accessions have been evaluated extensively for vigor, adaptation and seed production. Five of these accessions are being vegetatively increased and one of these will probably be released in 2002 to enhance genetic diversity of available plant material. Vermilion, which was released in 1989, is the only commercially available cultivar and is used extensively in coastal wetland restoration projects.

Other Research Projects

Vermilion fingerprinting. Commercial contracts for coastal revegetation projects sometimes specify Vermilion smooth cordgrass because of its vigor, wide adaptation and proven performance; however, there is no easy way to determine if plants used to fulfill such contracts really are Vermilion. Two studies have been undertaken to address this dilemma. The first study is to develop genetic fingerprinting technology for rapid determination of the genetic identity of plants supplied for reclamation efforts. The second study will compare the performance of vegetative clones of Vermilion to seed-propagated plants.

Smooth cordgrass diseases. Rapid and vigorous stand establishment is essential if large areas are to be revegetated. Numerous pathogens may affect plants at different growth stages, although most can be controlled with seed-applied fungicides. Other diseases of mature plants may affect rate of colonization, biomass accumulation and seed production. These diseases will be assessed and varieties screened for resistance to the most damaging diseases.

Producing seed volume. A seed-based production system requires a method of handling seed in large volume and management practices for optimum seed production. A study was initiated at Galliano in the spring of 2001 to evaluate the effects of fertilizer, insecticide and fungicide application on seed production and quality in a freshwater pond environment. In *Spartina*, the traditional seed treatment of chilling seeds stimulates the loss of dormancy and maintenance of seed viability. The critical moisture content and rate of drying necessary to maintain viability and break dormancy will be defined. Alternative dormancy-breaking treatments of short duration that are amenable to commercial application will be evaluated as replacements for moist-chilling and seed storage methods.

Other plants with promise. Although smooth cordgrass is the main focus of the coastal plant project, research is ongoing with several other species to identify and improve the ones that work well in the many different niches within the coastal ecosystem. Black mangrove provides nesting sites for pelicans and is an important barrier island species. Native Louisiana accessions of black mangrove collected by the NRCS are being evaluated.

Sea oats have extensive root systems and are excellent dune stabilizers. In Florida, a thriving commercial sea oat industry produces plants from seed for use in dune stabilization. However, the Florida accessions do not grow well in Louisiana, and the native Louisiana sea oat is a poor seed producer. The native sea oat will be hybridized with sea oats from the Atlantic Coast to increase seed production. Cultural practices for increased seed production will be evaluated beginning in 2001. Research on bitter Panicum, marsh-hay cordgrass and other species will be added as the coastal plants project develops.

Plants provide a self-sustaining, environmentally sound and aesthetically pleasing approach to controlling coastal erosion that can persist indefinitely. Commercial enterprises to supply marsh plant material will expand as coastal reclamation activities increase over the next decade. The coastal plants project will play an important role in developing genetically superior varieties and improved technology to protect our valuable coastal ecosystem. ■

Photo by Michael D. Materne

These are research plots at the NRCS Plant Materials Center at Golden Meadow.

Enzyme Treatment of Catfish Feeds Can Reduce Environmental Phosphorus

Photo by Robert Reigh

LSU AgCenter scientists are looking at ways to reduce the amount of phosphorus in catfish ponds and thus help eliminate problems with algal blooms that can degrade water and increase off-flavor in fish.

Phosphorus is a critical nutrient for plant growth in aquatic environments. Small increases in phosphorus entering a catfish pond can produce algal blooms that degrade water quality and increase off-flavor in fish. The primary source of phosphorus in catfish ponds is feed. This could be reduced by lowering feeding rates, decreasing the amount of phosphorus in the feed or increasing the absorption of dietary phosphorus by the fish.

However, each of these options has problems. Lowering feeding rates is usually impractical because the high stocking densities used by most catfish producers dictate high feeding rates for acceptable yields. Decreasing the amount of phosphorus in feeds is difficult because of the high level of plant products used in catfish diets. A typical catfish feed contains more than 90 percent plant ingredients, primarily soybean meal and corn, which contain phosphorus in a chemical form (phytic acid) poorly digested by fish. Most of the chemically bound phosphorus in feed ingredients passes through the gut unused and is eventually released into the pond by decomposition of fish wastes. Because so little of this phosphorus is used, inorganic phosphorus supplements are added to catfish feed to satisfy dietary requirements.

Increasing the uptake of phosphorus from feed ingredients can be accomplished by supplementing diets with phytase, an enzyme that breaks down phytic acid to release its bound phosphorus. Adding phytase to fish feeds has been shown to improve phosphorus uptake in the few studies conducted to date and, in some cases, to increase use of dietary protein. Several studies have been conducted at the LSU AgCenter's Aquaculture Research Station to determine the effects of supplemental phytase on breakdown of phytic acid in catfish feed and to evaluate the effects of phytase supplementation on diet digestibility and the use of dietary protein and minerals.

Laboratory feeding trials were conducted with an all-plant diet containing graded levels of phytase (0, 500, 1,000, 2,000, 4,000 and 8,000 units per kilogram). Results indicated that weight gain, feed conversion, diet digestibility, protein availability and use of dietary protein were not improved by phytase treatment, even at the highest level of phytase tested, but adding phytase to the diet at a level of 1,000 units or higher significantly increased the mineral content of bone—especially concentrations of calcium, phosphorus and manganese. Zinc, an essential trace mineral for catfish, was deposited at significantly higher concentrations in bone of fish fed 8,000 units than in bone of fish fed 500 units or less.

Phytic acid was degraded by phytase, primarily in the stomach of catfish, within a few hours after ingestion. Two hours after feeding, stomach contents of fish fed phytase-supplemented diets contained from 5 percent to 90 percent of the amount of phytic acid present in the diet, depending on the concentration of phytase fed. By eight hours after feeding, concentrations of phytic acid in stomach contents of fish fed 1,000 units per kilogram, or more, had fallen to 6 percent or less of initial dietary levels. Phytic acid levels in digesta continued to decrease as the material moved through the intestine.

Results at this time suggest that a phytase inclusion level of 1,000 units per kilogram in the diet is adequate to significantly increase use of dietary minerals and significantly reduce the amount of phytic acid in catfish waste. At this level, the requirement for supplemental inorganic phosphorus is decreased, and the quantity of phosphorus entering the pond environment from feed ingredients is reduced significantly compared to fish fed an unsupplemented diet.

A problem with use of phytase in catfish feeds is the enzyme's inability to withstand the high temperatures of extrusion processing. Addition of phytase to floating feeds like those commonly used in commercial catfish production will require that methods be developed for applying the enzyme to finished feeds under practical milling conditions; for example, phytase might be applied at the end of the manufacturing process as a top-spray on finished pellets.

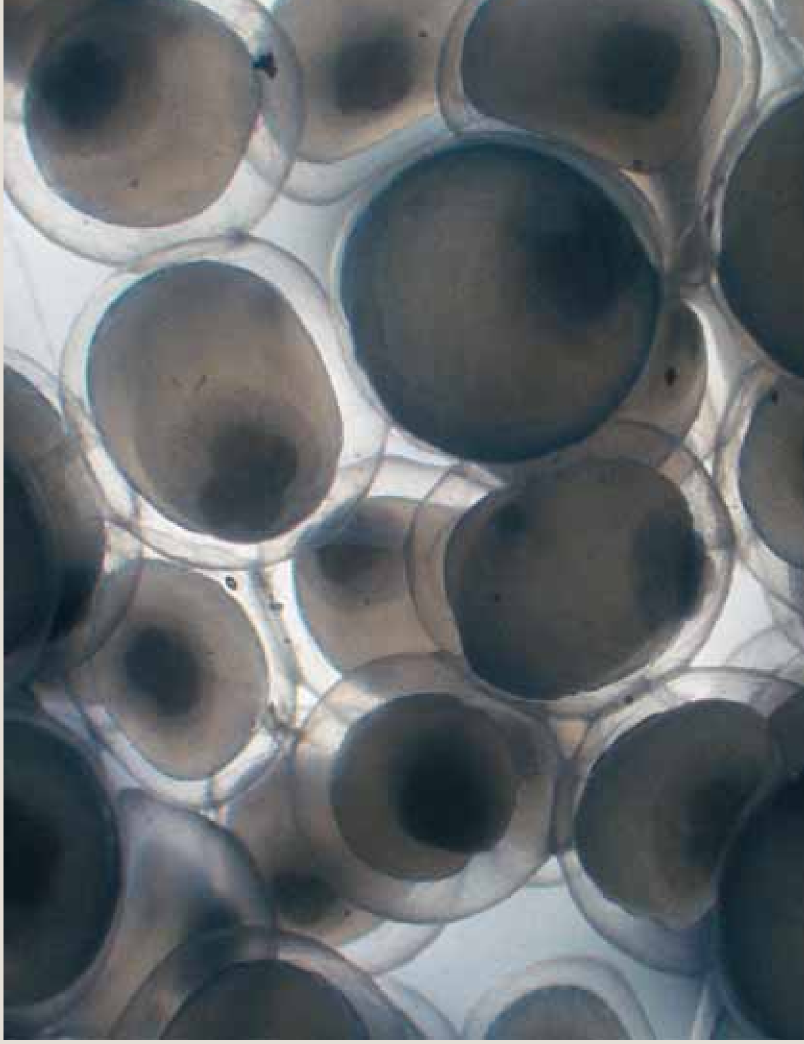
Pond feeding trials also are needed to determine if the effects of phytase that have been documented in laboratory feeding trials produce measurable benefits under practical production conditions. ■

Robert C. Reigh, Professor, and Weibing Yan, Research Associate, Aquaculture Research Station, LSU AgCenter, Baton Rouge, La.

Photo by Robert Reigh

An unobstructed pond, like this one at the Aquaculture Research Station, is desired by the catfish producer.

Preliminary Evaluation of Early-age Catfish Stocking to Enhance Louisiana Fingerling Producers' Profitability



Catfish eggs as they appear under a microscope.

In Louisiana and other catfish-producing states, most growers focus on the production of market-ready fish and purchase fingerling catfish to restock their production ponds from a smaller number of farmers who specialize in fingerling production. In Louisiana, fewer than 20 fingerling producers satisfy the annual seed stock requirements for the state's catfish industry. Production of seed stock is one of the most critical phases of the catfish production cycle.

Fingerling Production

To produce fingerling catfish, eggs are procured in the spring from ponds containing adult broodstock and transported to a hatchery where they are incubated under controlled conditions. At hatching, baby catfish (fry) possess a yolk from which they derive nourishment for the first four to five days of life and are called "sac fry." After the yolk is absorbed, fry are called "swim-up fry" because they swim to the surface in search of food. Swim-up fry are typically held in the hatchery for up to 10 days and fed a finely ground commercial diet before they are stocked into nursery ponds. After stocking, fry feed mainly on natural food organisms such as zooplankton and insect larvae. These food sources normally become depleted within four to six weeks after stocking, and fish are then fed formulated pelleted feeds until sufficient growth is obtained. At a common stocking rate of 200,000 to 250,000 fry per surface acre, four to six months are required to produce fingerling catfish 4 to 6 inches long.

Photo by Robert Reigh

Many Louisiana catfish farmers focus on producing market-ready fish and purchase fingerlings from other growers. Fingerlings are typically 4 to 6 inches long.

Early-age Stocking of Fry

Although most fingerling producers hold and feed swim-up fry in the hatchery for two to 10 days before stocking, several Louisiana catfish fingerling producers stock their nursery ponds with sac fry, usually within two days after they are hatched. This practice was initiated in an attempt to reduce hatchery operating expenses such as feed, labor and electricity. Although research has shown that fry can be stocked at the onset of yolk absorption with no detrimental effects on subsequent fingerling production, stocking sac fry has been reported to result in reduced survival rates and overall production. To further investigate this topic, production trials were conducted at the LSU AgCenter's Aquaculture Research Station to determine the effect of stocking fry of three different ages on survival, weight, yield and feed conversion ratio.

Fingerling Production Trials

Two fingerling production trials were conducted over two growing seasons, 1998 (Trial 1) and 1999 (Trial 2). Trials were conducted under simulated nursery pond conditions using 12 earthen-bottom fiber-

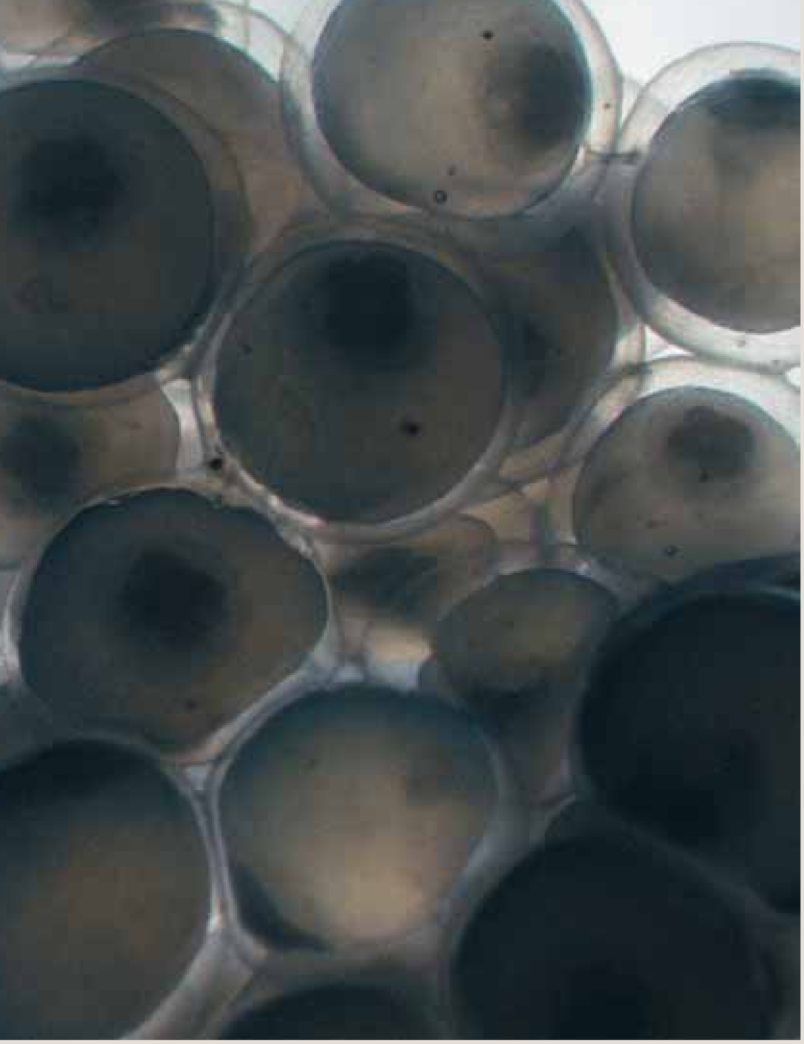


Photo by German Poleo

glass pools (0.002 acre) for Trial 1 and 15 for Trial 2. Trial 1 included four replicates per treatment (age of fry at stocking), and Trial 2 included five. Fry were stocked at two (sac fry), seven or 14 days after hatching. Fry stocked at seven and 14 days after hatching were fed in the hatchery for two and nine days, respectively, before they were stocked. Fry were stocked at a rate of 250,000 (Trial 1) or 200,000 (Trial 2) per acre.

After pools were stocked, catfish starter was applied daily to each pool until fish were observed feeding at the surface. Fish were then fed progressively larger floating pelleted diets to satiation daily as they grew. Pools were drained at 110 (Trial 1) and 130 days (Trial 2) after stocking to allow harvest. At harvest, samples of fish from each pool were weighed. Remaining fish were counted and weighed to determine percentage of survival, yield and feed conversion ratio.

Stocking Sac Fry

Results indicate that the age at which fry were stocked had no effect on subsequent survival, yield or feed conversion ratio of fingerling catfish. Based on final weight, however, fingerlings reared from fry stocked at two and seven days after harvest were significantly larger than fingerlings reared from fry stocked at an age of 14 days after harvest. These findings suggest that sac fry can be stocked with no detrimental effect on subsequent fingerling production. Indeed, based on final weight at harvest, it may actually be beneficial to stock sac fry rather than to hold and feed fry in the hatchery before stocking. Sac fry stocked in properly managed nursery ponds have unlimited access to zooplankton and insect larvae, which comprise the bulk of the diet of recently stocked fry. Under hatchery conditions, feed is more restricted. Thus, fry stocked as sac fry may gain an initial size advantage over fry stocked at an older age, which may be retained over the course of production until harvest. But because of the reduced mobility of sac fry relative to older, larger fry, proper management procedures must ensure elimination of predators.

More Research Required

Although results of this preliminary study suggest that the practice of stocking sac fry may be an alternative to the traditional procedure of holding and feeding fry under hatchery conditions before stocking, experiments were conducted under simulated conditions. In a typical production pond, there is less control of certain variables such as predator populations, water quality parameters and disease organisms. Therefore, more experiments will be conducted in ponds at the Aquaculture Research Station and at two Louisiana catfish farms. These experiments will include comprehensive cost and return information to determine the economic impact of early-age stocking of catfish fry before recommendations can be made to the state's commercial catfish industry. ■

Acknowledgment
This research was supported by the U.S. Department of Agriculture and the Louisiana Catfish Promotion and Research Board.

C.R. "Chuck" Weirich, Assistant Professor, and C. Greg Lutz, Extension Specialist, Aquaculture Research Station, Baton Rouge, La.

Photo by German Poleo

At hatching, baby catfish (fry) possess a yolk from which they derive nourishment for the first four to five days of life and are called "sac fry." This is how they appear under a microscope.

Photo by James L. Griffin

Weed Control with Roundup Ready, Liberty Link and Clearfield Corn

The Clearfield corn on the left was treated with Lightning, a postemergence herbicide. The row on the right was not treated, and itchgrass and broadleaf signalgrass are growing there.

D. Alan Peters, Jason A. Bond, James L. Griffin and Jeffrey M. Ellis

The best time to plant corn in Louisiana is from mid to late March. During that time lower soil temperatures can inhibit germination of weed seeds and delay growth of emerged seedlings, which helps with weed management. The critical time to remove weeds from corn for maximum yield ranges from four to six weeks after planting.

In some cases, depending on weed spectrum, use of soil-applied herbicides alone can be sufficient for season-long control, especially when corn growth is rapid and canopy closure occurs early in the season. Producers in the mid-South have traditionally relied on soil-applied residual herbicides in corn weed control programs; however, the development of herbicide-tolerant corn may mean a change in strategy. Use of effective postemergence herbicides could eliminate the need for a soil-applied treatment.

The herbicide-tolerant technologies developed for postemergence control of weeds in corn include Roundup Ready, Liberty Link and Clearfield. Roundup Ready corn is tolerant of glyphosate, the active ingredient in Roundup formulations and Touchdown. Liberty Link is tolerant of glufosinate, the active ingredient in Liberty. Clearfield corn is tolerant of a combination of imazapyr and imazethapyr, the active ingredients in Lightning. Each offers alternative weed management options for corn producers in the South.

Roundup Ready, Liberty Link

Experiments were conducted over two years (1998 and 1999) to evaluate weed control programs and corn response using the corn hybrids Dekalb 580 RR (Roundup Ready) and Cargill 7750 LL (Liberty Link) planted in late March. Treatments included:

- Bicep (Dual plus atrazine) as a stand-alone preemergence program
- Bicep, Dual, Prowl or atrazine preemergence followed by Roundup Ultra at 1.5 pints per acre or Liberty at 20 ounces per acre early postemergence
- Atrazine plus Roundup Ultra at 1.5 pints per acre or Liberty at 20 ounces per acre early postemergence
- Roundup Ultra or Liberty at the same rates early postemergence
- Roundup Ultra at 2 pints per acre or Liberty at 28 ounces per acre late postemergence
- Roundup Ultra at 1.5 pints per acre or Liberty at 20 ounces per acre both early and late postemergence

Accent plus Buctril early postemergence, a standard program used in conventional corn, was included for comparison. Early postemergence applications were made in late April to early May when weeds were 0.5 inch to 5 inches tall and late applications to 1- to 14-inch weeds in late May.

In 1999, 0.6 inch of rainfall was received within seven days of application. But in 1998, rainfall of only 0.16 inch was received within 21 days of application, and no rain fell from week 7 through 10. Even though total rainfall was greater during the growing season the second year (18.2 inches as compared to 7.4 inches), rainfall was limited during grain fill.

For the two years, 28 days after application of early postemergence treatments, results were as follows:

Broadleaf signalgrass was controlled 74 percent to 93 percent with Bicep alone preemergence and, when followed by Roundup Ultra or Liberty, 96 percent to 100 percent. For comparison, Roundup Ultra or Liberty applied early controlled broadleaf signalgrass 73 percent to 100 percent and, when applied late, 91 percent to 100 percent. Broadleaf signalgrass was controlled 70 percent to 96 percent with Accent plus Buctril.

Pitted morningglory and prickly sida were controlled most consistently with Bicep or atrazine followed by Roundup Ultra or Liberty, or atrazine plus Roundup Ultra or Liberty (91 percent to 100 percent). This compares with 78 percent to 100 percent control of pitted morningglory and 83 percent to 100 percent control of prickly sida with Roundup Ultra or Liberty applied alone early. Accent plus Buctril controlled these weeds 68 percent to 100 percent.

Because of inadequate rainfall, the yield potential of the hybrids was not realized, and differences observed in weed control were not reflected in yield.

D. Alan Peters and Jason A. Bond, former Graduate Research Assistants; James L. Griffin, Professor; and Jeffrey M. Ellis, Research Associate, Department of Plant Pathology and Crop Physiology, LSU AgCenter, Baton Rouge, La.

Photo by James L. Griffin

Weed growth stops shortly after application of Lightning in Clearfield corn. By 10 days broadleaf signalgrass takes on a purple coloration and itchgrass a pale yellow-green appearance.

Roundup Ultra, Liberty

In another study, Roundup Ultra at 2, 4 and 6 pints per acre and Liberty at 28, 56 and 84 ounces per acre (1x, 2x and 3x rates) were applied to the respective hybrids at 4-, 6- and 8-leaf. Corn yield for each hybrid was equivalent to the nontreated weed-free control in 1998, when only 7 inches of rainfall was received during the growing season and in 1999, when corn was irrigated as needed. Yield the second year was more than 200 bushels per acre and averaged 1.3 times higher than in 1998. The consistency in response of the hybrids to the herbicides over the two diverse years indicated a high level of tolerance.

Clearfield Study

Experiments were conducted over the same two years to evaluate crop response and weed control with Lightning in Clearfield (Pioneer 3395 IR) corn. Weed control programs included standard preemergence and postemergence herbicides applied alone and in combination with Lightning postemergence. The hybrid was highly tolerant to Lightning applied from 5- to 9-leaf at twice the labeled rate of 1.28 ounces per acre.

Bicep or Prowl plus atrazine preemergence controlled broadleaf signalgrass 50 percent to 86 percent and itchgrass no more than 69 percent. Lightning preemergence controlled these weeds no more than 29 percent. Broadleaf signalgrass control was increased to 89 percent to 98 percent when Lightning followed Prowl, atrazine or Bicep preemergence. These same treatments controlled itchgrass 76 percent to 83 percent. When only Lightning was applied postemergence, broadleaf signalgrass was controlled 64 percent and 88 percent and itchgrass 71 percent.

In the first year, corn yield was highest when Lightning alone was applied postemergence, but in the second year, yield for this treatment was no higher than when Bicep was applied. Conditions both years were not conducive to the maximum yield potential of the hybrid.

New Systems Can Be Effective

Results indicate that depending on weed spectrum and timeliness of application, Roundup Ultra, Liberty and Lightning can provide effective postemergence control when used as stand-alone programs. Hybrids were tolerant to the respective herbicides. Consistency in season-long weed control was enhanced in many cases when the herbicides followed a preemergence treatment. Preemergence herbicides can be beneficial in delaying emergence and slowing growth rate of weeds to allow flexibility in timing a postemergence application. When only postemergence herbicide programs are used, application timing is critical to reduce weed competition and to secure maximum yield potential of the hybrid. The decision to use a soil-applied herbicide in corn also should be based on negative environmental effects associated with movement of the herbicide from fields when significant rainfall occurs soon after application and the potential residual effect on other crops should replanting be required. In none of these studies was johnsongrass a problem weed; however, past research has shown that Roundup Ultra, Liberty and Lightning all control johnsongrass and are, therefore, viable options.

Since Roundup Ultra, Liberty and Lightning do not have significant soil residual activity, multiple applications may be required to obtain season-long control. When conditions are conducive to rapid early season corn growth, coverage of weeds underneath the crop canopy with spray solution may be hindered, requiring use of drop nozzles.

Selection of herbicide programs in corn should be based on grower preference, yield potential of the hybrid and economics. At present, the LSU AgCenter does not recommend herbicide-tolerant hybrids that allow for use of glyphosate herbicides (Roundup Ready), Liberty (Liberty Link) or Lightning (Clearfield). However, when higher yielding hybrids are developed for the mid-South climate, this may change. ■

Acknowledgment
Louisiana Soybean and Grain Research and Promotion Board

The Roundup Ready corn on the left was not treated. The corn on the right was treated with Roundup Ultra at 1 quart per acre.

Photos by James L. Griffin

Benefits of Soil-applied Herbicides *in Roundup Ready Soybeans*

Glyphosate, sold under the trade names Roundup Ultra, Roundup Ultra Max, Roundup Original, Glyfos, Glyphomax Plus, Gly-Flo, Glyphosate Original, Touchdown and others, is a postemergence, nonselective herbicide that controls many annual and perennial weeds. Soybeans with the glyphosate-resistance gene (Roundup Ready soybeans) were introduced in 1996 in the United States. In 2001, more than 75 percent of the soybean acreage in Louisiana was planted to Roundup Ready varieties, and acreage is expected to increase.

Weed control with Roundup depends on weed species and their growth stage and weather conditions at application. This herbicide is particularly effective on a number of troublesome weeds in Louisiana soybeans including sicklepod, johnsongrass and annual grasses such as red rice, common cocklebur, pigweeds and wild poinsettia. However, Roundup is not as effective on hemp sesbania, morningglories, prickly sida (teaweed), spreading dayflower and nutsedges.

The availability of Roundup Ready soybeans provides postemergence herbicide alternatives for weed control, but raises questions as to how this technology will fit into current management programs. According to Monsanto, the manufacturer of Roundup formulations, soil-applied residual herbicides are not needed in Roundup Ready soybeans since a single, timely application or multiple applications of Roundup alone are sufficient for weed control. An effective soil-applied herbicide, however, can eliminate or reduce early season competition of weeds to secure crop yield and allow the grower flexibility in timing a postemergence herbicide application.

The objectives of this research were to determine if soil-applied herbicides used in Roundup Ready soybeans: 1) affect weed density and growth rate, 2) extend the number of days between weed emergence and Roundup application, 3) affect weed control with Roundup and 4) eliminate the need for a second (sequential) Roundup application.

Three Years of Experiments

Experiments were conducted for three years, from 1998 through 2000, using Asgrow 5901 RR soybeans planted in 30-inch rows in mid-May to early June at the LSU AgCenter's Ben Hur Research Farm near Baton Rouge. Soil-applied preemergence treatments included labeled and half rates of the following herbicides:

- Squadron (a premix containing the active ingredients in Prowl and Scepter)
- Prowl
- Dual
- Detail (a premix containing the active ingredients in Frontier and Scepter)
- Canopy XL (a premix containing the active ingredients in Classic and Authority)
- Canopy (a premix containing the active ingredients in Classic and Sencor).

Photo by James L. Griffin

The plot in the foreground has been treated with soil-applied preemergence herbicide. The area in back and along the sides was not treated. Notice the difference in the number of weeds present. The marked areas are where the weed counts were made.

To activate the herbicide, plots were overhead irrigated (0.75 inch) within three days after application. If plots had not been irrigated or rainfall received shortly after herbicide application, weeds would have emerged along with soybeans since soil moisture was adequate for seed germination. In this situation, preemergence herbicides would have little influence on weed emergence, and their value could not have been adequately determined. Irrigation was continued as needed throughout the growing season.

Weeds were monitored at two-day intervals beginning seven days after initial emergence to determine number of days from soybean planting required to reach the selected treatment stage of 4 inches.

When the first weeds reached this stage, Roundup Ultra was applied at 1 quart per acre. Just before the initial Roundup Ultra application, weed density and height were determined from each plot to evaluate the degree of control for each treatment and to assess the herbicide effect on weed growth rate. Weed control was visually evaluated 14 days after the Roundup Ultra application. Soybeans were harvested in late September to mid-October.

No Complete Weed Control

Weeds included barnyardgrass, ivyleaf morningglory, prickly sida, hemp sesbania and redweed. In most instances, differences in weed height and density did not change when preemergence herbicide rates were reduced from the full to half rates, and none of the herbicides provided complete weed control. The number of days after planting for weeds to reach the treatment stage for Roundup when no preemergence herbicide was used was 17, 21 and 25 for the three years. The rapid growth rate of weeds in the first year (17 days) was probably related to the late planting date in early June.

In most cases, the first weeds reaching the 4-inch treatment size were barnyardgrass or hemp sesbania, but this depended on the preemergence herbicide used. The first year, all soil-applied herbicide treatments reduced growth rate of weeds, providing an extra three to five days before the first Roundup application was needed when compared with no preemergence herbicide. For the second year, the full rate of Canopy extended the application time for Roundup by six days. The full rates of Canopy XL and Canopy were the only treatments to extend the application time the third year, providing an additional seven days.

There were no differences in control of barnyardgrass, prickly sida or redweed among the herbicide treatments evaluated 14 days after Roundup was applied. These weeds were controlled 93 percent to 100 percent over the three years, showing that use of preemergence herbicide was not beneficial. When only Roundup was applied, ivyleaf moringglory was controlled 77 percent, but control was as high as 86 percent to 93 percent when Roundup followed the high rate of Detail and both rates of Canopy XL and Canopy. When compared with Roundup alone, hemp sesbania control was increased when Roundup followed the high rate of Detail (81 percent) or Canopy XL (83 percent) and both rates of Canopy (85 percent and 95 percent). Neither half nor full rates of preemergence herbicides followed by Roundup could control hemp sesbania completely, and an application of Blazer was needed each year.

Soybean Yields Equal

Soybean yield was equivalent for all herbicide treatments and averaged 37.8 bushels per acre, further showing that a total postemergence program using Roundup was as effective as when preemergence herbicides at either half or full rates were followed by Roundup.

This research shows that the decision to use preemergence herbicides in Roundup Ready soybeans should be based on economics and grower preference rather than differences in weed control and crop yield. Where a preemergence herbicide was used, only a single Roundup application was needed. In contrast, two Roundup applications were needed in two of three years when preemergence herbicide was not used. In years where growing conditions favor the soybean crop (adequate moisture and narrow row spacing), however, a single Roundup application may be sufficient whether or not a soil-applied treatment is used.

Results show that weeds emerging with soybeans do not affect crop yield negatively when the initial application of Roundup is made within three weeks after weed emergence. The extension in the time period to make an initial Roundup application when weed growth is delayed with some preemergence herbicides (three to seven days depending on year) may be extremely important in diversified operations where time constraints exist. ■

Acknowledgment

The Louisiana Soybean and Grain Research and Promotion Board provided funds to support this research.

Jeffrey M. Ellis, former Research Associate; James L. Griffin, Professor; and Curtis A. Jones, Research Associate, Department of Plant Pathology and Crop Physiology, LSU AgCenter, Baton Rouge, La.

Photo by James L. Griffin

The area to the right of the pen has been treated with soil-applied herbicide. The area on the left has not.

Galactic *Dark red. Developed for baby leaf harvest. Like Redina but a bit smaller, frillier, slightly darker red and 2-3 days slower to flower. 30 days baby, 58 days full size.*

Royal Oak *Dark green. Highly rated for baby leaf harvesting. Large broad plant with low density and slow flowering. 28 days baby, 50 days full size.*

Cerize *Deep wine red oakleaf. Highly rated for baby leaf. More solidly red than Red Salad Bowl with fuller, more compact head. 28 days baby, 51 days full size.*

Vulcan *Brilliant red. Combines earliness, color, size and flavor. Crisp and mild. Ruffled, slightly frilled leaves are candy apple red over a light green background. 28 days baby, 52 days full size.*

Growing Leaf Lettuce in Louisiana's

As urban gardening has become more popular so has interest in growing leaf lettuce. Compared to head lettuce, leaf lettuce is quicker to mature, less prone to disease and more nutritious. Because of its relatively fast growth, leaf lettuce can provide a continuous harvest from late October to mid-February, if planted at two-week intervals. In addition to producing fresh produce throughout the winter, the variety of color and texture among leaf lettuce cultivars can add to the beauty of the ornamental garden. Tests were conducted at the LSU AgCenter's Burden Center in Baton Rouge to evaluate the suitability of different leaf lettuce cultivars for use as an edible ornamental in small urban gardens.

Eleven commercially available leaf lettuce cultivars were planted in October 1999. Although leaf lettuce seed can be sown directly into the garden soil, plants were started from seed sown in small pots and transplanted to raised beds after about four weeks. This method ensures a viable plant, eliminates the need for thinning seedlings and provides an opportunity to apply a preemergence herbicide to inhibit the germination of weed seeds. Plants spaced 10 to 12 inches apart will shade the soil within a short time, which will reduce weed growth. Lettuce needs a fertilizer with more nitrogen than flowering and fruiting plants, so the percentage of nitrogen should be at least twice that of phosphorus and potassium. A fertilizer, including micronutrients, with

Red Sails *Deep burgundy red over green. Taste stays mild for a long time without bitterness. 1985 All-America Winner. Slowest flowering red leaf lettuce. 29 days baby, 55 days full size.*

***Waldman's Dark Green** (left) Dark green, frilled, ruffled leaves form a well-bunched head. Standard green leaf lettuce of the produce trade. 28 days baby, 49 days full size. **Redina** (right) Color is an intense candy red with green butt. Pliable, non-brittle ribs. Slow to tipburn. 29 days baby, 55 days full size.*

Ornamental and Vegetable Gardens

a ratio of 12-6-6 was applied at planting and again after six weeks. More frequent applications of a liquid fertilizer would work as well. No pesticides were applied during the evaluation period.

Among all the cultivars evaluated, Galactic and Redina rated the highest for visual quality and insect and disease resistance. Royal Oak, Vulcan, Simpson Elite, Red Salad Bowl and Waldman's Dark Green also performed well. All cultivars had excellent visual quality and pest resistance ratings up to their recommended date of maturity (49 to 58 days) and continued to perform well as an ornamental for up to 90 days. Vegetative growth began to decline from 90 to 120 days and plants began to flower.

By February 15 (135 days) all cultivars were in the full stage of flowering. Except for Simpson Elite, which was slightly frost-burned, all were undamaged by freezing weather on December 16 (29 degrees) and January 5 (28 degrees). The overall appearance of all cultivars was very poor by March 1 (150 days), and the trial was terminated.

In general, all of the cultivars are good candidates for the cool-season edible ornamental garden from October through February. ■

Drew Bates, Associate Professor, and Anthony Witcher, Research Associate, Burden Center, Baton Rouge, La.

Photos by Drew Bates

***Red Salad Bowl** Wine red. Highly rated for baby leaf. Deeply lobed, delicate oak-like leaves form a full rosette. Slow to flower. 28 days baby, 51 days full size.*

***Lollo Rossa** Medium green leaves tipped with red heavily frilled edges. Mild flavor, Italian variety good for garnishes. Slow to flower. 30 days baby, 53 days full size.*

***Simpson Elite** Light green. Extra-slow flowering. More ruffly, slower growing and much slower flowering than Black Seeded Simpson. 53 days full size.*

***Carisma** Heavily frilled, medium green leaves tipped with a strong, warm red. Good for garnishes and salad mix. Slow to flower. 30 days baby, 51 days full size.*

These are some of the research plots at the Northeast Research Station used to study rate and timing of burndown of wheat cover crops. Fifteen studies were conducted between 1998 and 2000.

Wheat Cover Crops: Benefits and Management

Bill J. Williams, Donald J. Boquet and Donnie K. Miller

Growing winter wheat has multiple benefits that can lead to an increase in farm productivity. A wheat cover crop stabilizes the soil during high rainfall months and increases soil productivity by increasing organic matter and biological activity. Wheat is especially beneficial when the residue is left on the soil surface and the following summer crop is planted using no-till practices.

The residue covers the soil, which helps to prevent packing effects of rainfall. This reduces runoff and increases rainfall infiltration. The residue also protects seedlings from rapid temperature changes and wind damage. No-till planting into wheat cover crop residue consistently increases the yield of cotton and may increase the yield of other crops. With this practice, growth of the wheat is usually terminated before grain fill and not harvested for grain, so the cotton crop can be planted on time.

To obtain maximum benefits from a wheat cover crop, the wheat must be completely terminated three weeks before planting a summer crop. Wheat cover crops are typically terminated with a nonselective herbicide, such as paraquat or glyphosate, applied between jointing (stem elongation) and maturity. After jointing and before heading, wheat is less susceptible to paraquat. Inconsistent results and the reluctance of many aerial applicators to apply paraquat make glyphosate the more popular herbicide for terminating wheat cover crops. Occasionally, producers observe less than optimum results with single or sequential glyphosate applications, raising the question of varietal differences in tolerance to glyphosate.

However, differences in glyphosate tolerance among wheat varieties were not expected to account for the large differences in treatment efficacy. Wheat

Bill J. Williams, Assistant Professor, Northeast Research Station; Donald J. Boquet, Professor, Macon Ridge Research Station, Winnsboro, La., and Donnie K. Miller, Assistant Professor, Northeast Research Station, St. Joseph, La.

Table 1. Effect of glyphosate rate and wheat growth stage on wheat termination 3 weeks after treatment.

Wheat growth stage	Wheat termination	Range in termination
	%	%
Glyphosate at 0.75 lb active ingredient per acre:		
prior to jointing through two visible nodes	90	(80 to 100)
three visible nodes through last leaf just emerging	90	(85 to 100)
early boot through early heading	75	(60 to 90)
fully headed to flowering	85	(80 to 90)
Glyphosate at 1.0 lb active ingredient per acre:		
prior to jointing through two visible nodes	95	(85 to 95)
three visible nodes through last leaf just emerging	95	(90 to 100)
early boot through early heading	83	(80 to 90)
fully headed to flowering	90	(80 to 95)

Data represent the average level of wheat control observed in 15 trials conducted from 1998 to 2000. Data were averaged across 11 wheat varieties.

growth stage at the time of glyphosate application and glyphosate rate are suspected to be more likely reasons for unsatisfactory results. Therefore, the effects of variety selection, wheat growth stage and glyphosate application rate on terminating wheat cover crops were evaluated from 1998 through 2000 at the Northeast Research Station. Different formulations of glyphosate (Roundup Ultra, Touchdown and Engame) were also compared.

Glyphosate was applied at different times and rates to selected wheat varieties to evaluate the effects of wheat growth stage and variety on glyphosate effectiveness for growth termination. When glyphosate was applied (February 15, March 1, March 15 and March 25), each variety was at a different growth stage. Because of this, it was difficult to completely separate growth stage from variety effects. However, out of the 15 studies conducted between 1998 and 2000, enough observations were made for several varieties at similar growth stages to identify important trends.

Of the 11 varieties compared, only small differences in varietal tolerance to glyphosate were observed. Wheat growth stage at time of glyphosate application was one of the most important factors in determining the success of terminating wheat cover crops. Glyphosate efficacy was best (at least 90 percent) and most consistent when wheat was treated before boot growth stages or after heading (Table 1). Effectiveness varied with glyphosate applications made to wheat before jointing up to two visible nodes. While not demonstrated in Table 1, the increased variability in glyphosate efficacy was strongly associated with applications made before jointing and was a result of wheat re-growth. Glyphosate applications to wheat in early-boot to early-heading growth stages were largely ineffective, ranging from 75 percent to 83 percent. Glyphosate applications on wheat fully headed or flowering were similar in efficacy (85 percent to 90 percent) to applications made to wheat with three visible nodes or smaller.

Application rate also influenced glyphosate effect on wheat growth termination. Glyphosate used at a rate of 0.5 pound active ingredient per acre did not adequately control wheat regardless of variety or growth stage (data not shown). When applications were made at susceptible growth stages (less than three visible nodes or fully headed), the 0.75 and 1.0 pound rates were equally effective. Glyphosate at 1.0 pound active ingredient per acre was about 10 percent more effective than at a 0.75 pound rate when wheat was at a transitional or difficult to control (last leaf emerging through early heading) growth stage. All formulations of glyphosate were equally effective when applied at susceptible growth stages and recommended rates.

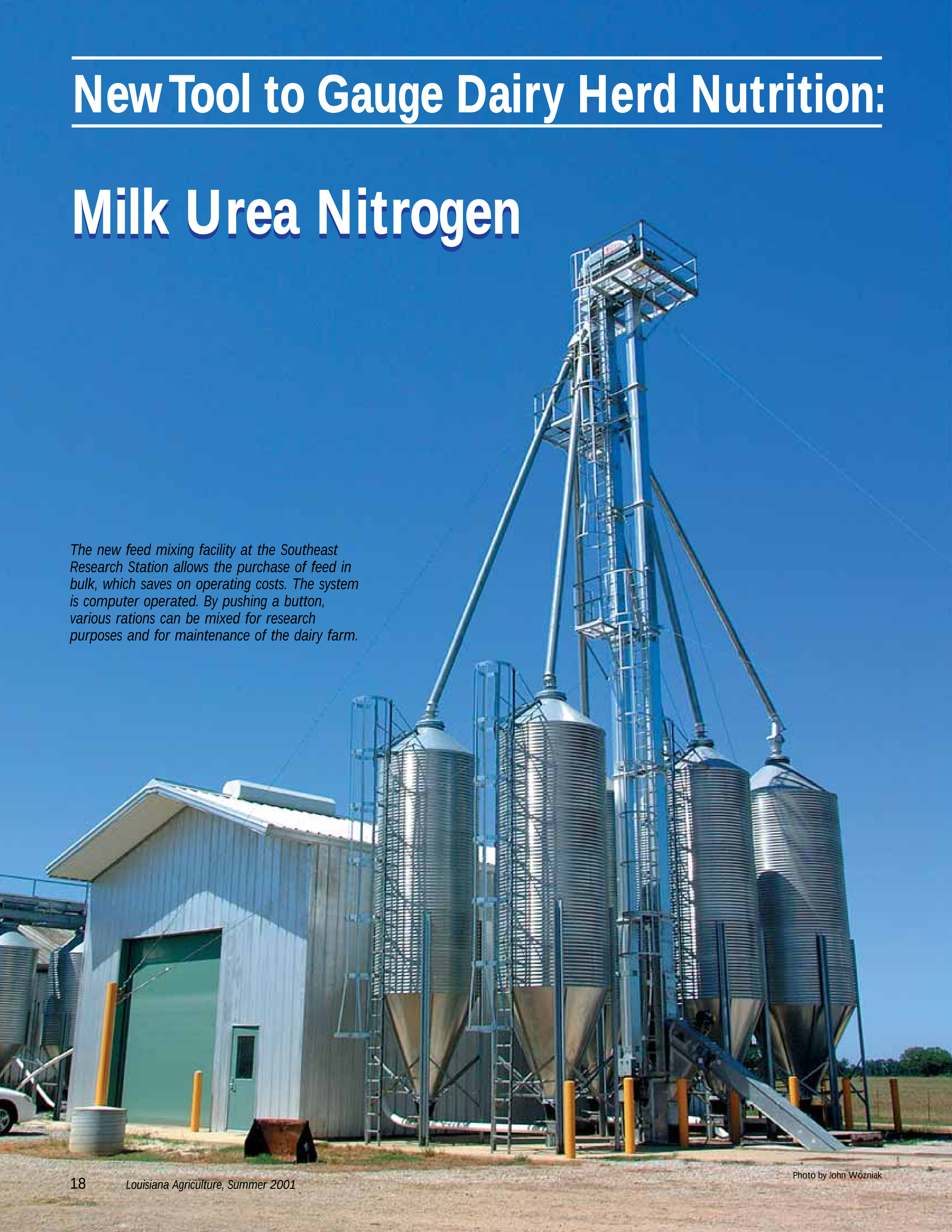
While small differences in glyphosate tolerance among wheat varieties were noted, growth stage at the time glyphosate was applied was the most critical factor in determining the degree of growth termination. Variety selection is still important, though, because variety and planting date will determine the growth stage when glyphosate is typically applied (mid to late March). The best approach for terminating a wheat cover crop is to apply glyphosate at a rate of 0.75 to 1.0 pound active ingredient per acre before wheat reaches the boot growth stage or after it is fully headed and beginning to flower. The later date is preferred because the wheat has at this point produced maximum vegetative growth and will provide full benefits of a cover crop. ■

Photos by Bill J. Williams

Wheat growth stage at time of glyphosate application was the most important factor in determining the success of terminating wheat cover crops. In this plot, Roundup Ultra was applied prior to jointing.

New Tool to Gauge Dairy Herd Nutrition:

Milk Urea Nitrogen



The new feed mixing facility at the Southeast Research Station allows the purchase of feed in bulk, which saves on operating costs. The system is computer operated. By pushing a button, various rations can be mixed for research purposes and for maintenance of the dairy farm.

Photo by John Wozniak

Dietary protein is a key nutrient for high milk production in dairy cows. But determining how much protein a cow consumes and how well it is used is difficult, particularly at the farm level. A new tool being explored is the measurement of trace amounts of nitrogen in the milk. This analysis is known as milk urea nitrogen (MUN).

Excess dietary protein is converted to ammonia by microorganisms in the rumen of the cow and is quickly absorbed into the bloodstream and converted to the less toxic urea by the liver. The level of urea in the blood is equal to the nitrogen level in the milk, thus leading to the MUN measurement.

Normal levels of MUN range from 12 to 18 milligrams per deciliter. Values below 12 indicate insufficient dietary protein intake for maximum milk yield, and concentrations above 18 indicate excess crude protein intake and soluble protein in the diet. Feeding dairy cows excess dietary protein is costly, and recent research at the LSU AgCenter's Southeast Research Station has shown a detrimental effect on reproduction. Yet, little is known about urea concentrations in the milk from Louisiana dairy herds and how they relate to season, feeding systems used and animal performance.

To answer some of these questions, a study was conducted to compare MUN levels with feeding practices, lactation performance and reproduction. Bulk-tank milk samples were taken monthly from 26 Louisiana dairy farms from March through August of 1998. All herds in the study used artificial insemination and the Louisiana Dairy Herd Improvement Association record keeping system.

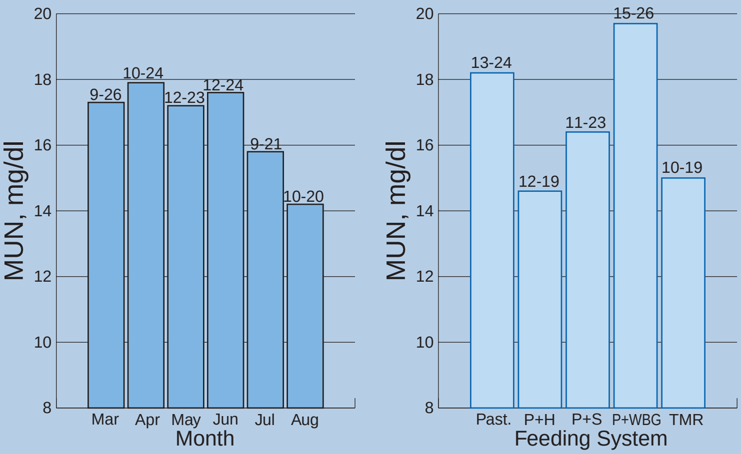
MUN Levels Higher in Spring

Average MUN levels peaked in April at 17.9 and declined to 14.2 in August (Figure 1). Although these averages seem fairly moderate, some herds experienced monthly concentrations as low as 9; others contained MUN levels as high as 26, well outside the recommended range of 12 to 18. In fact, 58 percent of the herds evaluated had one bulk-tank MUN sample above 18 during the spring months of March through May, and only 29 percent of the herds exhibited elevated MUN during the summer.

Photo by John Wozniak

Michael E. McCormick, dairy nutrition researcher, is in the milk room in the new double-five (10 stalls) milking parlor at the Southeast Research Station. This bulk milk tank stores 3,000 gallons.

Figure 1. Effect of Season and Forage System on Bulk Tank MUN Concentrations in Louisiana Dairy Herds.



MUN (milk urea nitrogen) numbers above bars indicate the range (minimum and maximum values) for each category. Past. = pasture only, P+H = pasture and hay, P+S = pasture and silage, P+WBG = pasture and wet brewers grains, and TMR = silage-based total mixed ration.

During the spring, 85 percent of the herds used annual ryegrass pasture in their forage systems. Young ryegrass pasture often contains 30 percent or more crude protein, of which as much as 45 percent may be in the soluble form. These high concentrations of ryegrass protein, coupled with a relatively high protein concentration in grain supplements (80 percent of grain supplements contained 18 percent or more protein), likely provided more dietary protein than required by the lactating dairy cow. Only 15 percent of milk samples tested had MUN concentrations below 12, indicating that dietary protein shortage was not common among the herds evaluated.

Variations in MUN with Feeding System

The dairies in the study used several different forage feeding systems. In the spring, about 20 percent used pasture (ryegrass) alone, 35 percent used pasture plus some form of ensiled forage, 20 percent used pasture and hay and 15 percent used pasture supplemented with wet brewer's grains. Fewer than 10 percent used total mixed rations (TMR), which is grain and forage mixed.

In summer, pasture (bahiagrass, bermudagrass or crabgrass) usage was similar to that recorded in spring, but the proportion of herds using TMR increased to nearly 20 percent of the total.

Milk samples from herds that relied on pasture and hay or TMR to meet forage needs generally had acceptable MUN concentrations (Figure 1). In contrast, bulk tank MUN samples from herds that received only pasture or pasture supplemented with wet brewer's grains were high, averaging between 18.3 and 19.5. A few herds receiving ensiled forages had MUN concentrations below the recommended threshold of 12, suggesting a protein shortage. Most of the silage used in the dairy herd feeding systems was made from whole-plant corn, a low-protein forage.

MUN Levels and Herd Performance

In this study, milk production (average test day milk yield) was not closely correlated with bulk tank MUN concentration; however, average milk fat and protein percentages tended to be lower when MUN was higher than 18. A poor correlation between MUN and milk yield may be because most herds with MUN concentrations outside the range indicative of optimum protein nutrition were high, suggesting that more than enough protein was available for maximum milk production.

An examination of reproductive data revealed that estrus activity was not affected by milk urea nitrogen concentration, but pregnancy rates tended to be higher in herds with normal MUN levels. This supports recent research at the Southeast Research Station in which dairy cows within the recommended range of urea nitrogen in milk and plasma experienced 29 percent higher pregnancy rates than those cows with high urea nitrogen (25 milligrams per deciliter).

Implications for Dairy Producers

The results of this study show that bulk tank milk urea nitrogen can be used as an indicator of dietary protein excess or deficiency in dairy cattle. Since Louisiana dairy herds showed a higher concentration of milk urea nitrogen in spring, when most cows were grazing ryegrass, some herds may benefit from lowering the protein content in grain supplements, particularly when ryegrass is immature and abundant. Producers may be able to use bulk tank MUN to monitor dairy herds after a ration change, when cows change pasture or when a new forage is used. Bulk tank samples are useful for monitoring protein nutrition on a herd level. To diagnose a particular problem, individual cows or cow groups may need to be sampled. MUN analysis offers dairy producers another tool to help fine-tune nutritional needs of cows, which may improve profitability by reducing protein costs, improving milk yield and lowering reproductive costs. Commercial laboratories are available that will measure MUN concentrations for a nominal fee. ■

Michael E. McCormick, Associate Professor, Southeast Research Station, Franklinton, La.; Angelica M. Chapa, Graduate Assistant, and J. Marcos Fernandez, Professor, Animal Science Department, LSU AgCenter, Baton Rouge, La.; James F. Beatty, Professor and Resident Director, Southeast Research Station, Franklinton, La.

Photo by John Wozniak

Ryegrass, bahiagrass and bermudagrass are grown at the Southeast Research Station. The cows graze on pastures November through May.

Dairy industry's contribution to Louisiana's economy:

More than a drop in the bucket

Louisiana's dairy industry continues to hold its own despite a threat from the West's rapidly growing dairies and fast-changing technology that may eventually erode any advantages over other regions.

The dairy industry generates nearly $100 million in farm income and more than $150 million in value-added income for the state, according to the 2000 Louisiana Summary of Agriculture and Natural Resources published by the LSU AgCenter.

The three parishes of St. Helena, Tangipahoa and Washington comprise the vast majority of Louisiana's current milk production with a few farms scattered in northwest Louisiana.

Generally speaking, says Jim Beatty, resident director of the LSU AgCenter's Southeast Research Station in Franklinton, La., both milk prices and production costs are higher as you move from north to south in the United States. And because Louisiana is so far south, shipping milk north is not profitable. Northern dairy producers, on the other hand, can ship milk south, taking advantage of those higher prices to offset transportation costs.

Approximately 700 dairy farms operate in an 80-mile radius of Franklinton. This area represents about 80 percent of all Louisiana production and about 55 percent of all Mississippi production, accounting for about 1 billion pounds of milk per year.

"This is the only concentration of milk production between central Texas and Florida," Beatty says.

During the mid 1990s, experts were fearful Louisiana's milk industry would vanish completely.

"Twenty years ago Louisiana had more than 1,000 dairy farms. Today there are about 430," says Wayne Gauthier, an economist in the LSU AgCenter's Department of Agricultural Economics. "The dairy industry is moving to fewer, larger farms with more geographic pockets of milk production.

"Generally, the initial investment in any dairy-specific technology constitutes a high fixed cost," he says, adding that if farmers decide to invest in technology, they must also get larger to spread the high fixed costs over more units to reduce their average costs and remain competitive.

After the mid 1990s, the producers left are efficient operators who have been in business for a long time and have a low debt burden, Beatty says.

"They practice dairying because there are few alternatives to crop the land," he says.

To gauge how well a dairy farm performs, Beatty says the LSU AgCenter research programs look at productivity per cow.

"A living wage requires a critical mass," he says. "Dairy producers with low margins but with enough production can realize a reasonable income."

Average herd size in Louisiana is about 140 cows, much smaller than large operations in California and the Pacific Northwest, where production is growing while other states are declining. The national average herd is 111 cows, Beatty says.

For northern Louisiana, the diminishing number of dairy farms is lowering the critical mass and making such things as hauling more expensive. Southeast Louisiana still has enough concentration.

"The dairy industry in local areas must be careful of falling below the critical mass needed to maintain the industry," he says. "There must be enough production to make hauling, feed production and equipment dealers profitable enough to be in business in close proximity to the producers."

In cooler climates, cows produce well in summer months while production falls off in colder winter months. For southern producers, winter is prime time.

"Heat and high humidity depress production," Beatty says. "Summer forage of bahiagrass and bermudagrass provides low-quality feed, and farmers can't afford to haul in forage."

Winter and spring, however, are different.

"Ryegrass in winter has kept us in business," Beatty says. "November to May, we have excellent pastures and cool weather.

"Around here, it's cheaper to let the cows get the grass for themselves," he says. "About 250 head appears to be the limit for pasture-based production in Louisiana."

Scientists at the Southeast Research Station have been experimenting with ryegrass "baleage," wrapping plastic around bales of ryegrass hay to provide summer feed. It's proving to be effective in improving milk production and summer profitability.

Unlike those in other parts of the country, Louisiana farmers keep their cows on pasture rather than in confined lots. Along with year-round pastures, Louisiana dairy farmers don't have to invest in warm, weather-tight barns or confinement facilities.

Louisiana consumers would face higher milk prices without local producers, Beatty says.

"Our advantage is distance our competitors have to travel," he says. "We're going to have to keep our costs low enough to compete with other parts of the country."

The state's dairy farmers have proved adept at low-cost production, even though average per-cow productivity is the lowest in the United States. But many established dairy producers have few alternatives for their labor and their past investments in dairy-specific assets, Gauthier says.

Until urban pressures drive up the costs of land, the limited alternative uses will continue to allow dairying in southeast Louisiana.

A looming concern is milk production's movement away from consumers. Comparing the first quarter of 1995 with the first quarter of 2000, national milk production increased 8 percent. Regionally, however, production fell 9 percent in the Southeast, rose 6 percent in the Northeast, rose only 2 percent in the North Central and rose a whopping 27 percent in the West.

This means more milk is coming to market from farther away. If milk marketing programs do not change, Beatty and Gauthier say, local milk production and the accompanying economic benefits could disappear as technological advances reduce production and transportation costs. ■ **Rick Bogren**

Profitability of Cotton Crop Rotation Systems in Northeast Louisiana

Kurt M. Guidry, Amos Bechtel, Steve Hague, Robert Hutchinson and Donald Boquet

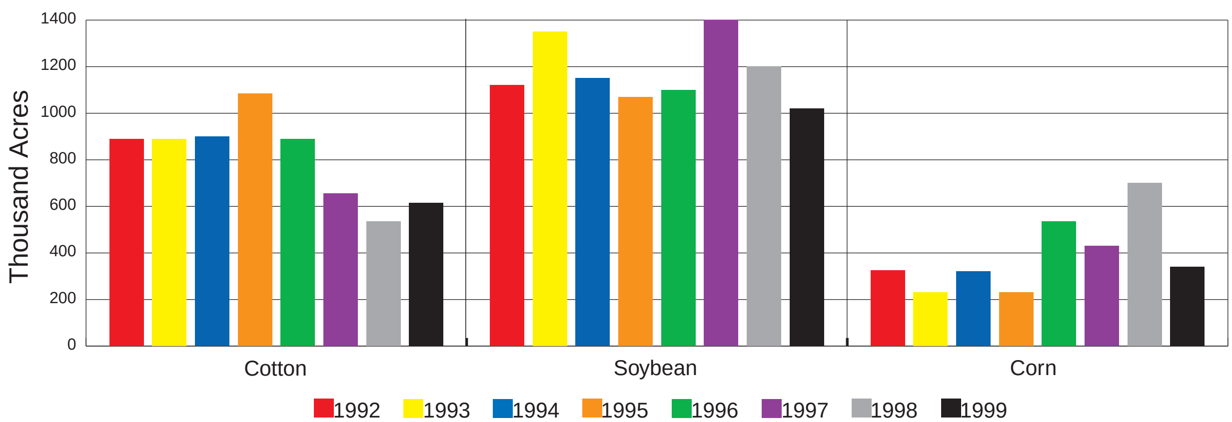
The production and marketing environments of row crop agriculture have changed dramatically since passage of the 1996 Farm Bill. Under previous Farm Bills, price support systems let producers establish continuous or monocrop cropping systems with less concern for market signals. For the most part, as long as producers could grow the crop efficiently, the price support system provided sufficient returns to assure profitability. The farm program provisions encouraged year-after-year planting of a single commodity, which prevailed as a primary cropping system used by farmers in Louisiana's Mississippi River Delta.

Current agricultural policy, however, is more market-driven. Producers have to be more responsive to market signals because of increased income risk and uncertainty. The removal of acreage restrictions along with government payments no longer tied to production have given the producer the flexibility to select crop mixes and cropping systems based on market signals rather than policy provisions. This has brought increased interest in the use of crop rotation systems as both a production and marketing risk management tool. To use crop rotation effectively, however, requires an understanding of the production costs and yield effects of the annual crop selection decision.

Why Crop Rotation?

Recent trends in cotton, corn and soybean acres in Louisiana indicate that producers may become more receptive to crop rotation systems (Figure 1).

Figure 1. Louisiana Planted Acres, Selected Crops, 1992-1999



Cotton acreage in Louisiana before the 1996 Farm Bill had increased from 810,000 in 1990 to nearly 1.1 million acres by 1995. By 1998, however, cotton acreage had decreased to 535,000, a decline of more than 50 percent from the peak reached in 1995. During this same period (from 1995 to 1998), corn acreage increased by more than 200 percent, and soybean acreage increased by more than 12 percent.

Crop rotation is not a new phenomenon in production agriculture. Benefits include improved soil productivity and pest management and enhanced risk management with greater enterprise diversity. Rotation can provide more plant residue to soil than monocrop systems, thus improving tilth and water-holding capacity. By alternating between the different types of root systems of the various crops, more of the soil profile is used for crop production. In addition, rotating crops aids integrated pest management strategies. Rotation may disrupt life cycles of many insect pests and pathogens. Increasing plant diversity also may encourage beneficial insects, nematodes, fungi and bacteria to flourish. Moreover, rotation provides growers with an opportunity to alternate herbicides. For instance, weeds difficult to control in corn, such as johnsongrass, may be easier to manage with herbicides labeled for cotton or soybeans.

Analyzing Crop Rotation Data

This economic analysis includes 10 years of crop rotation data from 1989 to 1998 taken from research studies done on Commerce silt loam soils at the LSU AgCenter's Northeast Research Station. The research station is located in the Mississippi River alluvial flood plain in Tensas Parish near St. Joseph, La. Three continuous cropping systems and five rotational systems were included in the study. Both two- and three-year rotations were considered with cotton as the base crop rotated with either corn or soybeans or both.

All continuous crops were planted each year of the study. But, because of space limitations, all rotation treatments were not grown in the same year. For example, the cotton-corn rotation did not include both the corn and cotton portions of the rotation in the same year, so averages of each crop's yields were inadequate to determine the effect of the rotations on crop yield within each rotation. Therefore, the missing years'

Kurt M. Guidry, Assistant Extension Specialist, and Amos Bechtel, former Assistant Professor, Department of Agricultural Economics, LSU AgCenter, Baton Rouge, La.; Steve Hague, Assistant Professor, and Robert Hutchinson, Resident Director, Northeast Research Station, St. Joseph, La.; and Donald Boquet, Professor, Macon Ridge Research Station, Winnsboro, La.

Table 1. Average Crop Yields 1989-1998 Under Alternative Rotations, Northeast Research Station.

Rotation	Cotton Yield (Pounds)	Soybean Yield (Bushels)	Corn Yield (Bushels)
Continuous Cotton	1,169	N/A	N/A
Continuous Corn	N/A	N/A	128
Continuous Soybean	N/A	44	N/A
Cotton-Corn	1,258	N/A	149
Cotton-Soybean	1,202	52	N/A
Cotton-Corn-Soybean	1,311	54	154
Cotton-Cotton-Soybean*	1,310	55	N/A
Cotton-Cotton-Corn*	1,287	N/A	147

*Cotton yield is the mean of both years of cotton production.

crop yields were estimated using linear regression methods. The estimated crop yields are shown in Table 1. In all cases for all crops, the crop rotations resulted in higher crop yields than continuous cropping.

To compare the profitability of the alternative rotations, the concept of a rotation acre was used. The rotation acre assumes each crop in the rotation sequence is produced in equal proportion each year or, alternatively, each acre could be thought of as being composed of an equal proportion of each crop in the rotation. This allows the direct comparison among single, two- and three-year systems.

Production cost estimates were developed for each crop using the 1999 Louisiana Agricultural Experiment Station enterprise budgets for northeast Louisiana. Primary cost savings in each rotation were the result of reduced nitrogen requirements for cotton following either corn or soybeans. Nitrogen fertilizer applications were reduced by 25 pounds nitrogen per acre for cotton following soybeans and 20 pounds per acre following corn.

Pest Management's Benefits

Although crop rotation can be a benefit to pest management, the cost savings are more difficult to quantify. Disruption of the life cycles of insect pests and pathogens, along with the ability to alternate herbicides to control weeds, can help increase the efficiency and success of pest management strategies. Rotational systems, however, do not necessarily guarantee fewer pesticide applications or the ability to use less expensive pesticides. In addition, current pest management systems specified in the 1999 enterprise budgets were assumed to be cost effective enough that substantial savings in pest management would not be experienced. As a result, the benefits of crop rotation on pest management were viewed to affect the profitability of rotational systems over monocrop systems in terms of yield response rather than cost savings.

Which cropping system to use is based upon the expected costs and returns for each alternative system. Expected returns for each alternative are determined, given the producer's expectation of yields and prices. Given the poor market conditions and prospects for cotton, corn and soybeans, expected prices were set at the average loan rate in 1999 for each commodity. Expected yields were set at the estimated average yields shown in Table 1.

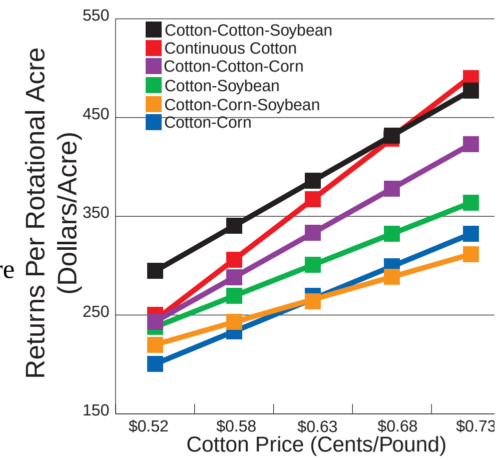
Gross revenues and net returns over direct costs per rotation acre are shown in Table 2. Under the base price scenario, the rotation having the highest return over direct costs was the cotton-cotton-soybean rotation at $294.58 per rotation acre. The returns to continuous cotton, cotton-cotton-corn and cotton-soybean rotations were similar at $244.89, $243.31 and $237.88 per rotation acre, respectively. The ranking of crop rotation strategies is, however, sensitive to the price relationships among the three commodities, and an increase in the price of one or two commodities could change the relative profitability of each rotation.

Table 2. Estimated Production Costs and Returns per Rotation Acre for Alternative Rotations, Northeast Research Station, 1999.

Rotation	Direct Costs	Gross Revenue	Returns Above Direct Costs
	Dollars Per Acre		
Continuous Cotton	452.41	697.30	244.89
Continuous Corn	198.93	255.10	56.17
Continuous Soybean	73.39	235.57	162.18
Cotton-Corn	323.47	523.95	200.48
Cotton-Soybean	260.14	498.01	237.88
Cotton-Corn-Soybean	239.73	459.74	220.01
Cotton-Cotton-Soybean	324.23	618.81	294.58
Cotton-Cotton-Corn	366.45	609.76	243.31

Figure 2 shows the change in the returns over direct costs per rotation acre for the six cotton rotations as the cotton price increases relative to the corn and soybean base price. To determine the impact of different price scenarios, cotton prices were varied in 10 percent increments from the base price of 52.4 cents per pound. Results indicated that, as cotton prices trend higher, the rotations with a higher proportion of cotton increased in profitability faster than did the other rotations. Returns per rotational acre for the continuous cotton strategy experienced the highest improvement in returns with roughly a 25 percent increase for each 10 percent increase in price. Conversely, the cotton-corn-soybean rotation saw only around a 10 percent increase in returns for each 10 percent increase in cotton price.

Figure 2. Returns Per Acre Above Direct Costs for Six Cotton Rotations at Varying Cotton Prices



Varying cotton prices had little effect on how each rotation strategy ranked in terms of profitability. A 10 percent increase in cotton prices from the base price of 52.4 cents per pound replaces the cotton-corn rotation as the least profitable strategy with the cotton-corn-soybean rotation. The only other change seen was when the cotton price was increased by 40 percent from the base price. At a 40 percent increase in the price of cotton, the continuous cotton system replaces the cotton-cotton-soybean as the most profitable strategy.

Yields Higher in Rotational Systems

Crop rotations have the potential to improve crop yields and whole-farm profitability. Profitability of the selected rotational systems was affected by both improved yields and cost savings; however, results indicated that enhanced yields proved to be the most critical factor in the relative profitability of each rotation. In this analysis, yields for each of the rotational systems were higher than the monocrop systems. Potential cost savings from rotational systems are difficult to pinpoint and were assumed to be limited to savings in fertilizer application.

Using the base crop price scenario and mean rotation yields, the cotton-cotton-soybean rotation provided the highest return over direct production costs. The cotton-cotton-soybean rotation had returns above direct costs that were $49.69 per acre and $132.40 per acre higher than the continuous cotton and continuous soybean systems, respectively.

The ranking of each rotational system in terms of profitability remained fairly stable even as cotton prices were allowed to change. Only with a 40 percent increase in cotton prices did the cotton-cotton-soybean rotation lose its status of most profitable. With cotton prices at 40 percent higher than the base scenario, the continuous cotton system becomes the most profitable.

This study was initiated before the adoption of transgenic crops and the boll weevil eradication program, and both are likely to affect any crop rotation decision. These factors likely discourage crop rotation by curtailing some expenses of insect and weed control in a monocrop system. Some benefits of rotation over monocrop systems have diminished with the advent of transgenic crops and the boll weevil eradication program. ■

Llama Mamas Give Birth to Alpacas

Embryo Transfer Offers New Hope for Saving Endangered Species

Last summer, far to the north from their historic home in the Andes on a ranch near Bozeman, Mont., two llama mamas gave birth to alpacas.

These were the first cross species births between alpaca and llama brought about through embryo transfer technology.

"The first we know of anyway," said Paul Taylor, owner of Taylor Llamas, the ranch about 23 miles north of Bozeman on mountainous terrain where the historic event occurred. Taylor lives there with his wife, Sally, and about 150 llamas.

Taylor received support and advice on this project from Robert Godke, researcher with the LSU AgCenter. Godke is director of the Embryo Biotechnology Laboratory. He has been a pioneer in assisted reproductive research for more than 25 years, helping to perfect techniques for test tube fertilization, embryo microsurgery and the implantation of these embryos into surrogate mothers.

Some of the latest projects at the LSU AgCenter's lab include the cloning of goats and cattle and the first horse born through the process of test tube, or *in vitro*, fertilization that involved taking eggs from a pregnant mare. His graduate students have gone on to become leaders in both animal and human assisted reproduction.

The Taylors, who have operated a llama ranch for 25 years supplying the exotic pet industry around the world, had read of Godke's research work. Taylor, a former dentist and self-taught in embryo transfer techniques, has produced more than 100 embryo transfer llama babies from llamas. Several years ago, the Taylors made a cooperative agreement with Godke's team for help in enhancing their expertise.

Photo by Paul Taylor

"Minnie," the embryo transplant alpaca, with her surrogate llama mama.

Although the successful births are good for Taylor's business, they are also good for science, Godke said.

"We're expanding our knowledge of how to be successful in cross species embryo transfer," Godke said. "This has implications for the domestic animal industry and certainly the survival of endangered species."

Though not endangered, the alpaca is rarer than the llama and smaller in size. Alpacas stand about 3 feet high at the shoulder and weigh 120 to 250 pounds. Llamas grow to about 45 inches at the shoulder and can weigh up to 500 pounds.

The Taylors' next quest will be trying to produce the vicuna, which is a nondomesticated member of the same camelid family as llamas and alpacas. The vicuna, which is even smaller than the alpaca, is endangered. Taylor is negotiating with the Argentina government to obtain some vicuna skin cells to use for vicuna propagation.

"With adult cells we can try to produce clones," Godke said. That is the way Dolly, the sheep in Scotland, was cloned.

One of Godke's graduate students, Aidita James from Houston, Texas, assisted the Taylors in their cross species embryo transfer project.

"This success will help pave the way for saving the vicuna," she said. ■

Linda Foster Benedict

Mapping and Interpreting Electrical Conductivity in Production Fields

Soil electrical conductivity was measured in a production field at the Dean Lee Research Station and found to correlate with soil texture, organic matter, soil nutrients and crop yield. Research is under way to calibrate nitrogen needs in corn and cotton based on soil electrical conductivity, paving the way for site-specific fertilizer application.

Measuring electrical conductivity in soil has been investigated as a way to determine its fertility and productivity. This may help farmers make site-specific fertilizer applications. The end result is increased efficiency and reduced waste. A research project at the LSU AgCenter's Dean Lee Research Station was initiated to determine how closely electrical conductivity corresponded to changes in soil texture, soil nutrient concentration and crop yield.

Electrical conductivity was measured in a 166-acre field of silt loam to silty clay loam soil at the station on October 27, 1998, using a Veris 3100 sensor cart (Figure 1). Coulters on this cart are equipped with electrodes through which an electrical current is passed. The Veris sensor cart can measure conductivity at two depths simultaneously, and in this study it was measured at 12- and 36-inch depths.

Figure 1. A Veris model 3100 sensor cart used to measure soil electrical conductivity at the Dean Lee Research Station. The unit is manufactured by Veris Technologies, a Division of Geoprobe Systems, in Salinas, Kans. The coulters on the outside of the wheels measured to 36-inch depths in this study. The coulters inside the wheels measured to a 12-inch depth.

The measurements of electrical conductivity were taken by driving the Veris sensor cart over the fields at about 8 miles per hour, logging one data point per second. Costs for measuring soil electrical conductivity generally run between $4 and $9 per acre. Soil electrical conductivity is a relatively stable parameter, and a surface map may be useful for 10 years.

Conductivity measures soil texture

Soil texture affects the amount of fertilizer required to produce optimum crop yields. Usually clay soils require more fertilizer. One outstanding feature of electrical conductivity in this study was how well it corresponded to changes in soil texture.

Soil electrical conductivity is depicted in the surface map in Figure 2 using 400 square-foot grid cells. The darker the shade, the higher is the conductivity. Of note is the general increase in conductivity from west to east (left to right) across the field. This corresponds to an increase in heaviness of soil texture. The highest conductivity measurements in the eastern-most portion of the figure fairly accurately depict the denser clay soil in this area. The surface map may be used as a prescription map for fertilizer input based on soil texture.

In a separate study, soil samples were taken from eight specific electrical conductivity zones and analyzed for soil texture and organic matter (Tables 1 and 2). There was very high correlation between electrical conductivity and clay content (0.99) and between electrical conductivity and organic matter (0.99).

Conductivity measures nutrients

Soil nutrient concentration also affects the amount of fertilizer needed to produce optimum crop yields. Soils with high clay and organic matter usually have higher nutrient concentrations because there is more total surface area for nutrients to attach to, although the nutrients may not necessarily be more available to the plant. Soil electrical conductivity corresponded highly with soil nutrients in this study.

Nutrient concentrations were determined in soil samples taken from eight electrical conductivity zones (Table 1). Correlation coefficients between electrical conductivity and mean concentrations of nitrogen, phosphorus, potassium and zinc were very high, running from 0.95 to 0.99 (Table 2). Although electrical conductivity does not measure the actual concentration of soil nutrients per se, the two variables did rise and fall

Figure 2. Soil electrical conductivity can be used to create surface maps for site-specific applications. These are six production fields, totalling 166 acres, at the Dean Lee Research Station.

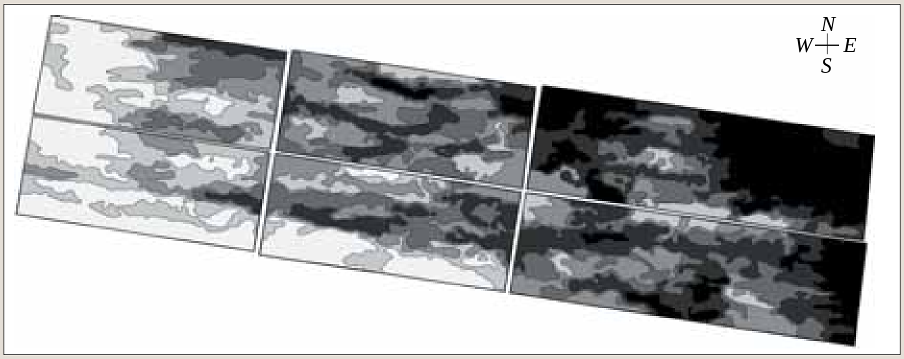


Table 1. Soil test values corresponding to soil electrical conductivity zones.

SEC Zones	P	K	N	Zn	Organic Matter	Clay
23.2 - 32.7	195	164	0.070	0.464	0.98	15.0
32.7 - 35.9	204	170	0.076	0.487	1.01	15.8
35.9 - 38.4	216	179	0.080	0.508	1.05	16.8
38.4 - 40.8	221	182	0.083	0.510	1.07	17.4
40.8 - 43.5	223	186	0.086	0.523	1.08	17.6
43.5 - 46.8	231	193	0.089	0.536	1.11	18.6
46.8 - 51.5	237	94	0.089	0.573	1.13	19.1
51.5 - 65.4	250	205	0.092	0.617	1.18	20.2

Table 2. Correlation of soil electrical conductivity with soil test values using sample data within SEC zones.

	P	K	N	Zn	Organic Matter	Clay
SEC	0.99	0.99	0.95	0.99	0.99	0.99

closely together. This finding paves the way for potential site-specific application of fertilizer, once base rates are established.

Conductivity measures crop yield

Soybean and corn yields for the past four years were correlated with electrical conductivity. To do the analysis, the field was divided into 400 square-foot grid cells, or rasters. Values from more than 15,000 rasters were used to derive the correlation coefficients in Table 3. Yield correlated significantly with electrical conductivity each season, although correlations were weak.

A somewhat puzzling finding was the negative correlation between electrical conductivity and yield in 1997. In the three other years, conductivity correlated positively with yield. The difference could be explained by rainfall patterns across the four seasons. Heavy-textured low areas of a field tend to do better

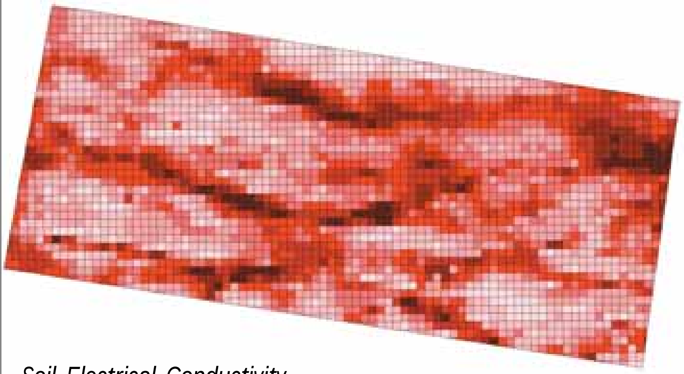
Conductivity corresponds to texture, nutrients, yield

Aerial Panchromatic 1994

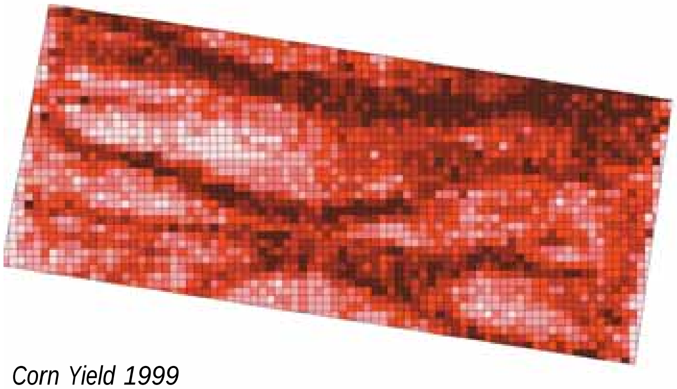
These three images are of the upper middle field shown on page 25. The photo at left, which is of the bare field, displays the unique pattern of soil variability. It was taken in 1994.

The image at bottom left is a grid cell map created with Geographical Information System (GIS) software from soil electrical conductivity data. Each square represents an area 20 feet by 20 feet. The lighter areas are of lower relative SEC, graduating to the darker areas of higher SEC.

The image below is a grid cell map created from the yield monitor data from the harvest of the 1999 corn crop. The lighter areas are of lower corn yield, 100 to 120 bushels per acre, graduating to the darker areas of higher corn yield, from 160 to 180 bushels per acre. Note the similarities in all three images.



Soil Electrical Conductivity



Corn Yield 1999

Table 3. Correlation of soil electrical conductivity (SEC) with crop yields using GIS raster analyses of field-scale data.

	Yield			
	1997	1998	1999	2000
SEC	-0.27	0.09	0.29	0.08

in dry years and worse in wet years. The 1997 season was fairly normal, whereas the 1998, 1999 and 2000 seasons all had uncharacteristically hot, dry periods. The implication is that the relationship between electrical conductivity and yield will differ each season. Fertilizer rate recommendations in site-specific agriculture will be based on average response, just as in conventional agriculture.

Correlation of means between electrical conductivity and corn yield in 1999 from the zones in Table 1 was much higher (0.97). Correlating means often results in higher coefficients.

Measuring conductivity shows promise

Soil electrical conductivity was found to highly correspond to changes in soil texture, organic matter, nutrient concentrations and crop yield. Using electrical conductivity as a prescription map for site-specific fertilizer application appears to be a promising technology. Field experiments are now under way at Alexandria to determine crop response to specific nitrogen rates within different electrical conductivity zones. If the experiments are successful, producers may be able to determine site-specific fertilizer applications using electrical conductivity measurements on their own farms as early as the 2002 or 2003 season. ■

Acknowledgment
Louisiana Soybean and Grain Research and Promotion Board for its support.

Steven H. Moore, Professor, and Maurice C. Wolcott, Research Associate, Dean Lee Research Station, Alexandria, La.

Scientists taught leadership skills

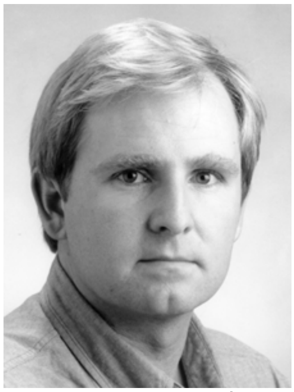
Two scientists have been named to the next Experiment Station Committee on Policy (ESCOP) and Academic Programs Committee on Policy (ACOP) leadership development course, and two have just graduated from their year's involvement. Michael Moody, head of the Food Science Department, and Roger Leonard, a researcher at the Northeast Research Station, have been selected for the national group. Their year's program begins in September. James Griffin, researcher in the Plant Pathology and Crop Physiology Department, and Regina Bracy, researcher at the Hammond Research Station, have just graduated from their year in the program.

The course is sponsored by agricultural experiment stations and colleges at the land-grant universities and involves people identified as emerging leaders from every state. The year of study includes seminars on leadership topics, such as communication and conflict resolution, as well as meetings with leaders in politics and academia.

In addition to representatives from the Louisiana Agricultural Experiment Station (LAES), the LSU College of Agriculture also sends participants. Marcos Fernandez from the Animal Science Department will join Moody and Leonard in the new class. Graduating with Griffin and Bracy was Lynn Kennedy from the Department of Agricultural Economics and Agribusiness.

William H. Brown, LSU AgCenter research vice chancellor, has been the mentor for this program. David J. Boethel, associate vice chancellor, has taken over that responsibility and will be working with next year's class. Kenneth Koonce, dean of the College of Agriculture, also serves as a mentor.

Since the program began 10 years ago, the LAES has had 20 graduates and the College of Agriculture eight. ■ **Linda Foster Benedict**


Roger Leonard


Michael Moody


Lynn Kennedy


James Griffin


Regina Bracy

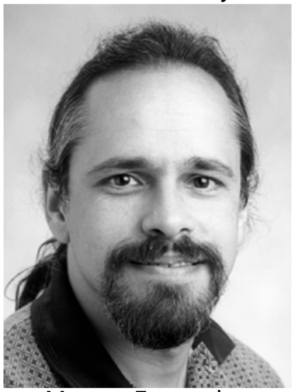

Marcos Fernandez

Photo by John Wozniak

New free-stall barn will complete Phase III of changes at Southeast Research Station

Construction of the free-stall barn at the LSU AgCenter's Southeast Research Station is expected to be completed by Sept. 1, 2001. The barn is Phase III of changes at the station that make it a state-of-the-art dairy research facility as well as dairy farm.

"Our cows will be housed and fed there when they're not on pasture, which is mainly in the summer months," said James F. Beatty, the station's resident director.

The barn is designed to be as cool as possible for the southern climate. Features include a high-pitched roof, a 2-foot vent across the peak and fans. The barn is also designed to divert rainwater from where the cows walk, which will cut down on contamination in runoff going into streams and waterbodies.

"We will be doing more waste management research," Beatty said.

The station has 192 cows now but will grow to about 220, with about 200 milking.

Phase I of the construction was the completely automated milking parlor, where 70 to 75 cows can be milked per hour.

"That's very good for a 10-stall parlor," Beatty said. "We can complete the milking shift in about four hours."

Phase II was the feed mixing facility. See photo and more about dairy research on page 18. ■ **Linda Foster Benedict**

Inside:

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