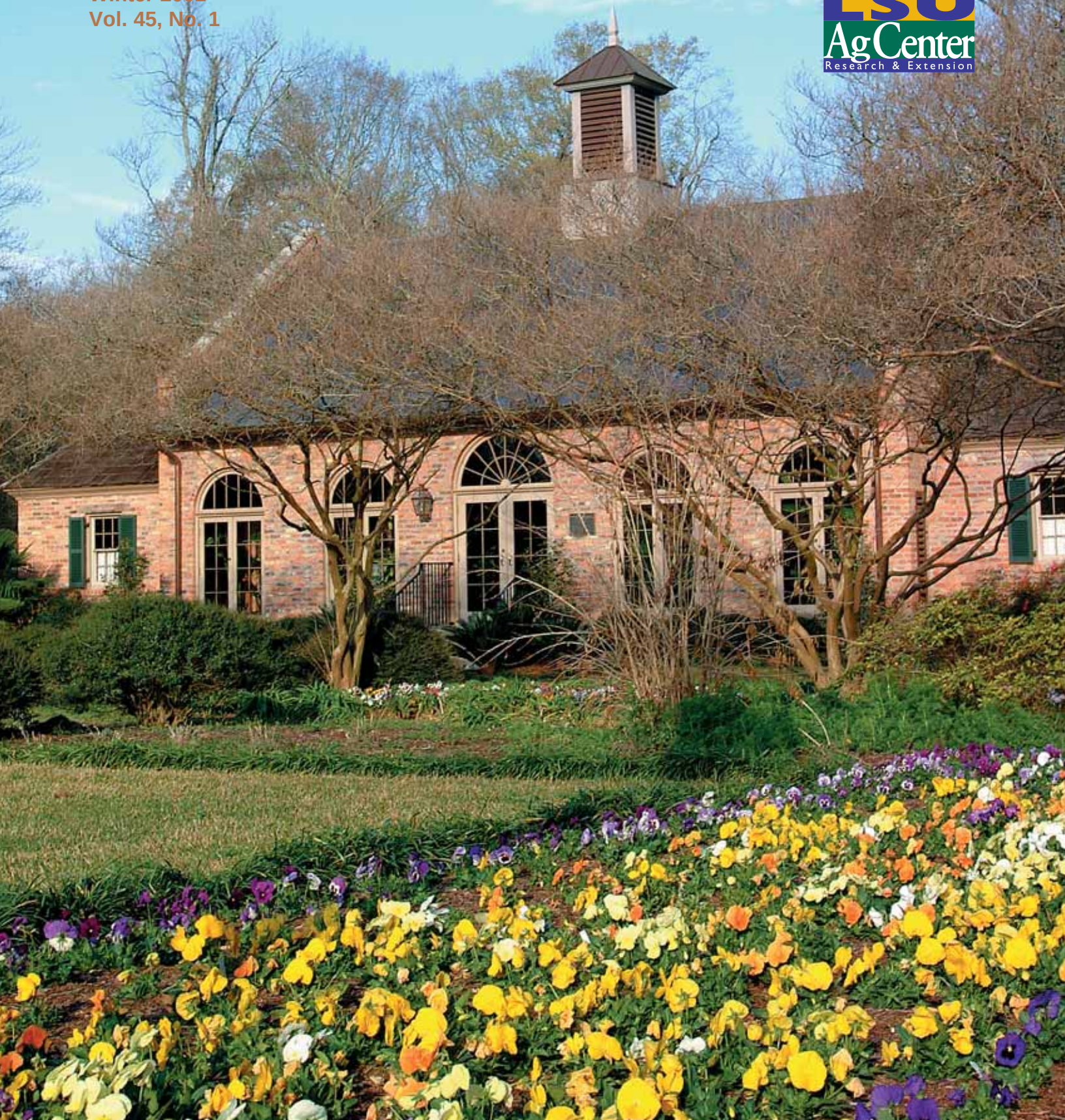


LOUISIANA AGRICULTURE

THE MAGAZINE OF THE LOUISIANA AGRICULTURAL EXPERIMENT STATION

Winter 2002
Vol. 45, No. 1



Parish, Thune and horn fly control team win research awards

Richard L. Parish, Ronald L. Thune and the Louisiana Agricultural Experiment Station's Horn Fly Control Team won the top research awards presented at the LSU AgCenter's Annual Conference Dec. 17 and 18, 2001.

Parish, a professor at the Hammond Research Station, received the Doyle Chambers Research Award for meritorious contributions to agriculture. Parish, an agricultural engineer, has invented equipment and methods to use equipment for more efficient production of various crops in Louisiana. He developed a precision cultural system for commercial vegetable crops that has been adopted throughout the South.

Thune, a professor in the Department of Veterinary Science, received the Mississippi Chemical Corporation/Triad Nitrogen Award, which is given to the scientist who has made the most significant contributions to the LAES research program during the past five years. Thune's research has led to discoveries in aquatic animal diseases that have gained national and international attention. He has helped ensure that Louisiana fish and crawfish producers stay competitive by employing preventive measures, early diagnosis and rapid and effective remediation for disease problems.

This year's Tipton Team Award was presented to a group of scientists, led by Lane D. Foil, professor in the Department of Entomology, who have combined their talents to battle one of the leading pests of Louisiana's cattle and dairy industry, the horn fly, which can cost producers up to \$70 million a year in losses.

Team members include Montgomery W. "Wink" Alison, associate professor, Northeast Research Station; Sidney M. DeRouen, professor, Hill Farm Research Station; Millard D. Kimball, research associate, Red River Research Station; David W. Sanson, associate professor, Rosepine Research Station; and Wayne E. Wyatt, associate professor, Iberia Research Station.

"This team is to be commended not only for its scientific work but also for its spirit of cooperation," said William H. Brown, LSU AgCenter vice chancellor for research. "Even though spread all over the state, they have worked closely together to find out what works best in each locale for controlling the horn fly. This has been a big benefit for our cattle producers and dairy farmers." ■ **Linda Foster Benedict**

Photos by John Wozniak



Richard L. Parish



Ronald L. Thune



Lane D. Foil



Montgomery W.
"Wink" Alison



Sidney M. DeRouen



Millard D. Kimball



David W. Sanson



Wayne E. Wyatt

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LSUAgCenter

William B. Richardson, Chancellor
William H. Brown, Vice Chancellor
and Director of Research

The Louisiana Agricultural Experiment Station provides equal opportunities in programs and employment.



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ON THE COVER

This is the Orangerie at the LSU AgCenter's Burden Center in Baton Rouge, built as a memorial to Steele Burden, the former landscape architect of the LSU campus. A. Hays Town, renowned architect and lifelong friend of Burden, designed the structure, which was opened in 1998. It contains tropical plants and is built in the same design as the orangeries in old Europe where the aristocracy would house their citrus plants in the winter. The building and its grounds serve often as the backdrop for photographs. Photo by John Wozniak.

Changes Help LSU AgCenter 'Deliver Solutions'

William H. Brown

Many changes are under way in our LSU AgCenter. These changes are for the most part internal and involve some rearranging of personnel and reallocation of resources. But we see them as having profound, positive and long-term effects on you, our clientele.

The essence of our changes is a closer working relationship between our research and extension functions. Our administrators now have joint appointments that will help them better coordinate programs and projects. Most of the campus-based extension specialists now are housed in their respective subject-matter departments, which provides a stronger science basis for extension programs and helps to focus research programs on the most critical needs of the state.

Another major change that may be more visible off campus is the reorganization of our field offices. We now are operating out of eight regional offices supervised by regional directors. These regional directors will coordinate the two functions of the LSU AgCenter with a clear focus on the needs at the local levels.

Along with any change there can be hesitation and uncertainty. It will take several months to transition to the new budget, reporting and evaluation procedures. In fact, it may take several years to fully institutionalize all of the changes and to realize their full benefits. However, they are moves in the right direction.

One way to view these changes is to use the analogy of a business model. In this hypothetical business model, the LSU AgCenter's mission is simply to deliver solutions. We don't have two separate missions but rather a single, integrated mission of visualizing and defining challenges, developing programs to overcome those challenges,

and providing the solutions to our stakeholders who can put them into practice.

To continue the business analogy, the LSU AgCenter's "CEO" (the chancellor) and "Executive Committee" (vice chancellors and associate and assistant vice chancellors) will provide overall strategic guidance. The research scientists and extension specialists in the campus-based units will provide "research, development and technical support" for the entire AgCenter. The AgCenter's regions will provide research and technical support focused on the unique needs of the respective geographic areas. Finally, and perhaps most important, the parish offices are the AgCenter's local presence and provide personal delivery of AgCenter services and solutions.

To use another business term, these changes will "flatten the organization" by pushing decisions to the lowest possible organizational level. For example, regional directors will admin-

ister all of the AgCenter's assets (fiscal, physical and human) within their respective regions. They will be empowered to make decisions and recommendations to most effectively use the resources within their regions. Another important part of the flattening process is that personnel evaluations will be done by immediate supervisors who have a day-to-day knowledge of the responsibilities and expectations of the individuals they supervise.

Finally, flattening the organization by pushing decision making to the lowest practical level also pushes responsibility to the same level. All employees must continually strive to initiate activities that will ensure that the LSU AgCenter is successful as it delivers solutions. With everyone's full cooperation and by maximizing the use of our scientific training and experience, the LSU AgCenter will continue to have a major impact on the future economic viability of Louisiana. ■

Photo by John Wozniak



Vice Chancellor William H. Brown stands in front of some of the patents on display at Efferson Hall, generated through research by LSU AgCenter scientists.

William H. Brown, Vice Chancellor, LSU AgCenter, Baton Rouge, La.



After 40 Years, Winter Cover Crops Still Produce Superior Cotton Yields

Eddie P. Millhollon

A winter cover crop of hairy vetch has resulted in the highest levels of organic matter in the upper 6 inches of soil compared with all other treatments.

The rich, fertile soils of the Red River valley of northwestern Louisiana have supported cotton production for decades. Unfortunately, as in most agricultural soils, continuous cultivation has resulted in a steady decline in native soil fertility, especially organic matter. Although organic matter makes up only a small percentage of the total soil weight, it has a significant influence on chemical and physical characteristics. Organic matter is the major source of phosphorus, sulfur and nitrogen in the soil and can hold up to 20 times its weight in water, contributing greatly to

soil water-holding capacity and water infiltration rates. It is therefore understandable why the steady decline of such a valuable natural resource in continuously cultivated soils raised the concerns of David Melville, a Louisiana Agricultural Experiment Station researcher. More than 40 years ago, he began a long-term study to see if winter cover crops could possibly arrest or reverse the decline in soil fertility, thereby maintaining cotton yields.

This study is located on the LSU AgCenter's Red River Research Station in Bossier City, La. Since 1959, eight

treatments have been studied for effects on soil fertility and cotton production (Table 1). Over the years, some of these treatments have required minor changes because of availability of cover crop seed or poor cover crop performance. Treatment plots consist of six 40-inch rows 210 feet long arranged in a randomized complete block design with four replications. Cover crops are

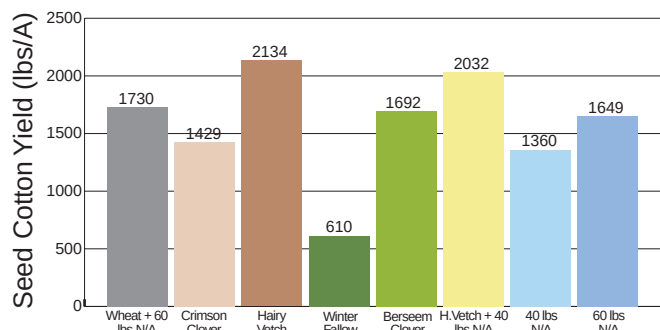
Eddie P. Millhollon, Associate Professor, Red River Research Station, Bossier City, La.

Table 1. Winter cover crop and nitrogen fertilizer treatments and the years each has been present.

1959-1963	1964-1966	1967	1968-1985	1986-1990	1991-Present
Oats + 60 lbs. N/A	Rye + 60 lbs. N/A	Wheat + 60 lbs. N/A	Wheat + 60 lbs. N/A	Wheat + 60 lbs. N/A	Wheat + 60 lbs. N/A
Austrian Winter Pea	Austrian Winter Pea	Austrian Winter Pea	Austrian Winter Pea	Austrian Winter Pea	Crimson Clover
Hairy Vetch	Hairy Vetch	Hairy Vetch	Hairy Vetch	Hairy Vetch	Hairy Vetch
Winter Fallow, zero N	Winter Fallow, zero N	Winter Fallow, zero N	Winter Fallow, zero N	Winter Fallow, zero N	Winter Fallow, zero N
Common Vetch	Common Vetch	Common Vetch	Common Vetch	Berseem Clover	Berseem Clover
Sour Clover	Sour Clover	Sour Clover	C. Vetch + 40 lbs. N/A	H. Vetch + 40 lbs. N/A	H. Vetch + 40 lbs. N/A
40 lbs. N/A	40 lbs. N/A	40 lbs. N/A	40 lbs. N/A	40 lbs. N/A	40 lbs. N/A
60 lbs. N/A	60 lbs. N/A	60 lbs. N/A	60 lbs. N/A	60 lbs. N/A	60 lbs. N/A

N/A= nitrogen per acre

Figure 1. Five-year average (1994-1998) cotton yield following winter cover crop/nitrogen treatments.



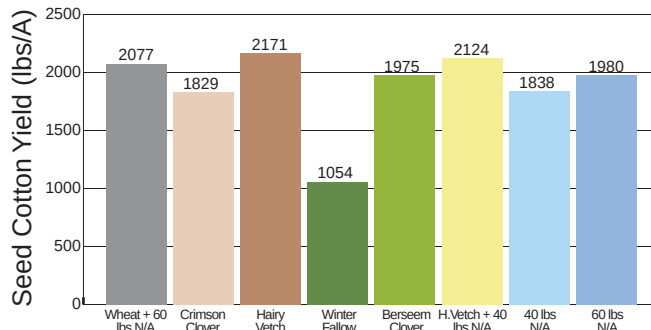
planted each fall after cotton is harvested and the remaining stalks are shredded. In mid-April of each year, cover crops are clipped using a flail cutter, then disked under. All nitrogen fertilizer is applied either pre-plant to cotton or as a sidedressing after planting. Cotton is planted approximately 10 days after incorporating the cover crops. The use of herbicides, cultivation and insecticides are the same for all plots. Cotton yields are obtained by harvesting the center rows of each plot with a two-row spindle picker. In most years, a second harvest is conducted.

Figures 1 and 2 show how cotton yields have been affected by the different cover crop treatments from

1994 to 1998 and over the entire 40-year duration of this study. Over the five-year period (1994-1998) summarized in this report, cotton following hairy vetch with no supplemental fertilizer has produced the highest yields (Figure 1). This trend has been consistent over the 40 years of this study (Figure 2). The two treatments that have been the best for cotton production are hairy vetch grown as a winter cover crop followed by no additional nitrogen fertilizer or supplemented with 40 pounds of nitrogen per acre at the time cotton is planted.

A winter cover of hairy vetch has resulted in the highest levels of organic matter in the upper 6 inches of soil compared with all other treatments. The

Figure 2. Forty-year average (1959-1998) cotton yield following winter cover crop/nitrogen treatments.



0.61 percent organic matter content in the hairy vetch plots is nearly double that measured in 1976 (0.35 percent). It is also of interest to note that the organic matter of all treatments that included a winter cover crop had higher organic matter levels than treatments that remained fallow in winter.

In summary, this long-term study continues to demonstrate the benefits of alternating a summer cotton crop with a winter cover crop, especially hairy vetch. A winter cover crop not only results in superior cotton yields, but it also supplies residue for organic matter maintenance, thus increasing the water-holding capacity and nitrogen availability of the soil. ■

Photo by Eddie P. Millhollon



Crimson clover is another crop that can be used and was part of this study.

Bollworm Larval Behavior on Bollgard Cotton

Findings May Change Scouting Procedures

Jeff Gore, Roger Leonard and Gabie Church

Genetically engineered plants are an important part of integrated pest management (IPM) programs in cotton production. One such plant, Bollgard cotton, includes a gene from a bacterium, *Bacillus thuringiensis*, that is toxic to caterpillar pests, while being safe for humans, other animals and the environment. Bollgard cotton was introduced into commercial production in 1996, and comprised only 15 percent of the total cotton acreage. Since that time acreage planted to these varieties has increased and in 2001 accounted for more than 80 percent.

Bollgard provides excellent control of the tobacco budworm and usually maintains low to moderate bollworm densities below economic injury levels. Supplemental control with insecticide applications is often needed, however, to prevent economic losses when high bollworm densities persist for several days.

In 1996, bollworm populations were extremely high in most areas of the mid-southern United States, southeastern United States and Texas. Consequently, crop advisors in those regions observed large numbers of bollworm larvae in fields planted to Bollgard cotton. Most of these populations consisted of small larvae feeding within white flowers and on small bolls under dried bloom tags (dried flower corollas). Currently, there is little information explaining why bollworms are more commonly found in white flowers of Bollgard cotton than non-Bollgard cotton. Initially, bollworm egg laying was considered to be different on Bollgard plants compared with non-Bollgard plants, but researchers in Mississippi and South Carolina found no differences in tobacco budworm and bollworm egg densities or in the distribution of eggs on Bollgard cottons compared with the non-Bollgard parental cottons.

Alternatively, early larval dispersal may be different on Bollgard cotton plants compared with non-Bollgard cotton plants. Larvae are the developmental stage controlled by Bollgard cotton, and differences in larval behavior could result in feeding preferences on specific plant parts. Therefore, studies were conducted in Louisiana to determine if differences in bollworm larval behavior occur on Bollgard cotton plants compared with non-Bollgard plants. This information is valuable in developing accurate sampling methods in Bollgard cotton. Accurate sampling will improve insecticide application timing against bollworms and reduce unnecessary applications that can be costly and disrupt natural enemy populations.



Photo by Jeff Gore

Bollgard cotton was developed to minimize boll damage and yield losses from caterpillar pests.

Bollworm Infestation

Bollgard cotton (NuCOTN 33B) and a non-Bollgard parental cotton (Deltapine 5415) were planted at the LSU AgCenter's Macon Ridge Station near Winnsboro in 2000 and 2001. Fertilization rates and general agronomic practices for cotton production followed Louisiana Cooperative Extension Service recommendations.

Bollworms were collected from crimson clover in April and sweet corn in June and maintained in the laboratory for at least one generation. Larvae hatching from eggs were provided an artificial laboratory diet. After 48 hours, bollworm larvae were removed from the diet and placed on flowering cotton plants.

Using a small paintbrush, first stage bollworm larvae were placed in plant terminals on individual cotton plants (one larva per plant). Individual plants were thinned before infestation so that no interplant movement could occur.

Jeff Gore, Graduate Student, Department of Entomology, LSU AgCenter, Baton Rouge, La.; Roger Leonard, Professor, Northeast Research Station Macon Ridge Branch, Winnsboro, La.; and Gabie Church, Instructor, Department of Experimental Statistics, LSU AgCenter, Baton Rouge, La.



Jean Dailey, student worker, uses a small paintbrush to place first-stage bollworm larvae onto plant terminals on individual cotton plants, one larva per plant.

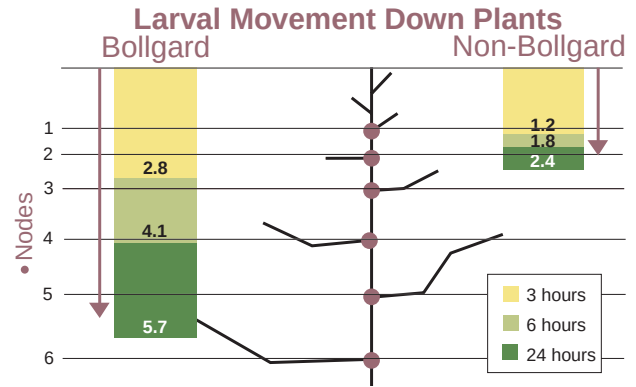
Bollworm-infested plants were examined at three, six and 24 hours after infestation. Larvae were located, and the numbers of main stem nodes they moved down from the terminal were recorded.

In addition, small plots (3 feet of row) were established in Bollgard and non-Bollgard cotton. First stage bollworm larvae were again placed in plant terminals (20 per plot). A total of 45 plots were infested for non-Bollgard and Bollgard cotton. Whole plants within each plot were inspected at 48 hours after infestation. Numbers of plant terminals, squares, flowers and bolls infested with larvae were recorded from each plot.

Bollworm Movement

Typically, bollworm larvae remain near the terminals of non-Bollgard cotton plants. Results from this study indicate that bollworm larvae tended to move a greater vertical distance on Bollgard cotton compared with non-Bollgard

Figure 1. Vertical movement of bollworm larvae on individual flowering cotton plants. Differences were observed between Bollgard and non-Bollgard at all rating intervals.



cotton. Larvae moved more than twice as far down the plant on Bollgard cotton compared with non-Bollgard cotton at all rating intervals (Figure 1). Cotton plants begin flowering from the bottom and, as they mature, flowers are closer to tops of plants. Therefore, at any given time during the season, the youngest fruiting forms (squares) are generally toward the top of the plant canopy and the older fruit (bolls) are generally closer to the bottom. Consequently, as larvae move down the plant, they are more likely to feed on cotton bolls. Fewer bollworm larvae remained in the terminals and squares on Bollgard cotton than on non-Bollgard cotton at 48 hours after infestation, where multiple larvae were infested in plots (Figure 2). A higher percentage of larvae were lower in the plant canopy within flowers and bolls in Bollgard cotton than in non-Bollgard cotton.

Implications for IPM

Bollworm moths typically use the top one-third of cotton plants for egg laying. Most eggs are usually found in or near plant terminals and small bollworm larvae remain near the



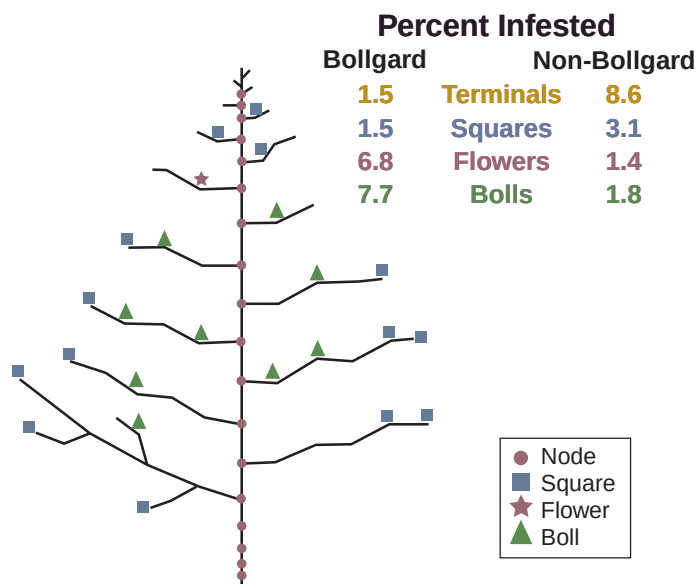
In Bollgard cotton fields, bollworm larvae are often found in white flowers, left, and on small bolls under the dried flower corollas, right.

terminals of non-Bollgard cotton plants, feeding on small squares. As larvae develop, they typically migrate down the plant's main stem and injure larger squares and bolls. Most current sampling plans for non-Bollgard cotton are based on numbers of larvae in plant terminals. Cotton pest management consultants have trouble deciding when to apply foliar insecticides to manage bollworms in Bollgard cotton. Action thresholds to initiate bollworm control with foliar sprays are based on numbers of eggs and/or larvae in terminals and numbers of larval infested/damaged squares on non-Bollgard cotton. In Louisiana, insecticide applications are recommended when at least five live larvae per 100 plants plus eggs are present. These thresholds and scouting methods may not be appropriate for Bollgard cotton, because bollworm larvae feeding on white flowers and bolls may be overlooked.

Bollworm larvae disperse more rapidly on Bollgard cotton compared with non-Bollgard cotton. Larvae remained near the top of non-Bollgard cotton plants and damaged terminal foliage and small squares. In contrast, larvae on Bollgard cotton were observed lower in the plant canopy, feeding on white flowers and bolls.

Bollworm larvae began migrating away from plant terminals within three hours after infestation on Bollgard cotton. Therefore, when eggs hatch, there is a narrow period when larvae can still be observed in or near plant terminals. Within six hours after infestation, larvae moved more than four nodes below plant terminals. Field scouts searching for bollworm infestations in plant terminals are likely not to find larvae in the terminals if sampling is begun more than six hours after larval hatching. For the plot infestations, bollworm-infested plant terminals on non-Bollgard cotton exceeded the current action threshold and would require treatment to prevent economic losses. In contrast, bollworm-infested terminals and squares did not exceed the action threshold on Bollgard cotton and would not be treated. However, if the data for infested flowers and bolls are considered, Bollgard cotton may require a foliar insecticide application to prevent economic yield losses.

Figure 2. Bollworm larval movement and location within plots of Bollgard and non-Bollgard cotton. The percent infested was determined 48 hours after infestation.



Cotton scouts typically look for bollworm larvae in plant terminals and squares, above, on non-Bollgard cotton. Below is Jeff Gore, research associate in the Department of Entomology.



Photo by Don Cook

Current scouting protocols and action levels to initiate insecticide treatments for bollworms on non-Bollgard cotton may not be appropriate for Bollgard cotton. Field scouts should sample white flowers and small bolls in addition to plant terminals and squares when scouting Bollgard cotton. Additional data indicate that, in some instances, bollworms feeding in white flowers can ultimately damage as many as 2.7 fruiting structures in Bollgard cotton. Thus bollworms may cause significant yield losses in Bollgard cotton. Therefore, insecticide applications should be directed at these populations before they become established low in the plant canopy under dried flower corollas. ■

Acknowledgment

Karla Emfinger, Ralph Sheppard and Rhett Gable, as well as fellow graduate students and numerous student workers, assisted in conducting these studies. Cotton Incorporated and Louisiana's cotton producers provided funding for this project.

Hopper Box Applied Fungicides for Management of Cotton Seedling Diseases

Boyd Padgett, Patrick Colyer, Eugene Burris and Ken Whitam

Cotton seedling diseases, caused by fungi, can reduce seedling emergence and plant establishment. The fungi commonly found attacking cotton in Louisiana are *Rhizoctonia*, *Fusarium* and *Pythium*. The detrimental effects from these pathogens are typically non-uniform plant populations and reduced plant vigor. In severely damaged fields, producers may be forced to replant, costing time, money and yield potential. In 2000, statewide losses to seedling diseases were estimated at 3 percent, or \$7,051,832.

Photo by Mark Claesgens



Supplemental fungicides can be added to cottonseed in the hopper, known as hopper box treatments.

Boyd Padgett, Associate Professor, Northeast Research Station, Winnsboro, La.; Patrick Colyer, Professor, Red River Research Station, Bossier City, La.; Eugene Burris, Professor, Northeast Research Station, Winnsboro, La.; and Ken Whitam, Plant Science Specialist, Louisiana Cooperative Extension Service, LSU AgCenter, Baton Rouge, La.

Producers manage seedling diseases using cultural practices and fungicides. Cultural practices that help avoid or reduce the incidence of seedling disease include planting when conditions are conducive to rapid seed germination and seedling emergence. Conditions are considered favorable when the 4-inch soil temperature is 65 degrees F or higher for three consecutive days, and there is no approaching cold front or excessive rain. The weather during the planting period of April and May, however, is unpredictable and extremely variable.

Fungicides help protect cotton from the effects of seedling disease pathogens. Fungicides are present on the seed at purchase, and supplemental fungicides can be applied to the seed in the hopper, known as hopper box treatments, or in the furrow at planting. Though limited by the amount of material that adheres to the seed, hopper box applications are relatively easy to perform and cost from \$1.68 to \$4.50 per acre. In-furrow fungicides treat the seed as well as the surrounding soil and cost from \$4.35 to \$22.00 per acre.

While hopper box and in-furrow applications of fungicides are effective, they may not always be economical. Therefore, to determine the efficacy of hopper box applications as options for seedling disease management, experiments were conducted at the LSU AgCenter's Macon Ridge, Northeast and Red River research stations. Fungicides Delta Coat AD (Wilbur-Ellis), Prevail (Trace Chemical Inc.) and System 3 (Setre Chemical Co.) were evaluated in 28 field tests conducted from 1991 through 2001.

Delta Coat AD was applied at 11.75 fluid ounces per 100 pounds (cwt) seed; Prevail at 12 ounces per cwt seed; and System 3 at 12 ounces per cwt seed. In three tests at the Macon Ridge location, disease pressure was enhanced with an at-planting, in-furrow application of inoculum. During this 11-year period, planting dates ranged from April 2 to May 13. Hopper box treatments were compared with commercially treated seed and in-furrow applications of Ridomil PC or Terraclor Super X at recommended rates.

Fungicide treatments were evaluated in field plots and template experiments. The field plots were four 100-foot row or 45-foot rows spaced 40 inches. Cotton was grown using conventional tillage practices. Plant densities (plants per foot of row) were recorded two, three, four and six weeks after planting, and seed cotton was harvested when possible.

Four template studies were conducted at the Macon Ridge Research Station. These plots consisted of 50 seed arranged in 10 rows, five seed per row spaced 1.5 inches apart, of a selected seed treatment. Plant emergence was recorded from six to 32 days after planting.

Eleven field plot tests evaluating Delta Coat AD were conducted at the Macon Ridge and Northeast research stations. Five tests were harvested. When compared to commercially treated seed, greater plant densities were observed in cotton treated with Delta Coat AD in five tests. Yields from cotton

treated with Delta Coat AD were increased over those with commercially treated seed in one test (enhanced disease pressure). Plant densities and yields from tests evaluating Prevail or System 3 were not improved over commercially treated seed or in-furrow fungicides. Plant densities for Delta Coat AD, Prevail and System 3 averaged across the harvested tests were not different from commercially treated seed and cotton treated with an in-furrow fungicide (Table 1).

In template studies, plant emergence for hopper box treated seed did not differ from commercially treated seed. When averaged across tests, percentage of emergence six days after planting for Delta Coat AD and commercially treated seed averaged 58 percent and 61 percent, respectively. Emergence six and 32 days after planting for cottonseed treated with System 3 and Prevail ranged from 50 percent to 76 percent and 56 percent to 77 percent, respectively, compared to 58 percent and 81 percent for commercially treated seed.

In six tests conducted at the Red River Research Station evaluating Delta Coat AD, plant densities were increased over commercially treated seed in two tests; however, yield was not affected. Plant densities and yields from cotton treated with

Prevail were not improved over those observed in commercially treated seed. Average plant densities and seedcotton yields across tests for Delta Coat AD and Prevail were similar to those observed in commercially treated seed and in-furrow treatments (Table 2).

Hopper box applications increased plant density over commercially treated seed in 25 percent of the tests and resulted in an increase in yield in 6 percent of the tests. The performance of hopper box fungicides was similar to in-furrow applications of TSX or Ridomil-PC. However, in-furrow fungicides treat the seed and surrounding soil, covering a more extensive area than hopper box applications. This increased efficacy of hopper box fungicides over commercially treated seed is most likely related to environmental conditions at planting. Consequently, planting during favorable conditions for rapid seed germination and seedling emergence should be the first line of defense against seedling disease. If cool, wet conditions prevail, additional fungicides can help preserve plant populations. These increases in plant density rarely translate to increased yield because many other factors affect plant development and yield after planting. ■

Table 1. Average plant densities and yields for hopper box evaluations conducted at the Macon Ridge and Northeast research stations, 1999-2000

Treatment	No. of Tests	Plants/Ft. 6 weeks after planting	Seedcotton Lb./acre
Treated seed	5	2.3	1618
Delta Coat	5	2.6	1689
Treated seed	2	2.1	1663
Delta Coat	2	2.6	1771
TSX/Rid	2	2.1	1668
Treated seed	2	2.3	1527
Prevail 12oz.	2	2.4	1499
TSX	2	2.4	1585
Treated seed	4	2.2	1565
Sys 3	4	1.9	1719

Table 2. Average plant densities and yields for hopper box evaluations conducted at the Red River Research Station, 1991-1996

Treatment	No. of Tests	Plants/Ft. 6 weeks after planting	Seedcotton Lb./acre
Treated seed	5	1.93	1488
Delta Coat	5	2.0	1521
TSX/Rid	5	2.2	1540
Treated seed	2	1.7	2359
Prevail	2	1.7	1950
TSX	2	1.8	2214

Photos by Al Wrather, courtesy of the University of Missouri-Columbia



Rotten areas on roots damaged by seedling diseases.



A thin, uneven cotton stand caused by seedling disease.

Using Poultry Litter and Municipal Waste for Cotton Production

James L. Rabb, Eddie P. Millhollon, W. David Caldwell and Jose Liscano



Poultry production is Louisiana's largest animal industry and is concentrated in the Coastal Plains area in north central Louisiana. Poultry litter is a byproduct of poultry production, with an estimated 180,000 tons produced in 2000. Most of this litter has historically been applied close to poultry houses on land often used for hay or pasture production. Application of litter to the same land for many years has increased levels of phosphorus and other nutrients in the soils and has caused concern that surface runoff into adjacent water bodies could degrade water quality and cause algal blooms that ultimately deplete the oxygen supply, resulting in fish kills.

Poultry litter is a combination of manure and bedding material, and the nutrient content depends on the type of bedding material and nutrient levels of the feed for broilers. The average nutrient content of a ton of poultry litter is about 50 pounds each of nitrogen and phosphorus and 40 pounds of potassium. The nutrient content is quite variable, however, with ranges of 34 to 90 pounds of nitrogen, 32 to 66 pounds of phosphorus and 16 to 48 pounds of potassium per ton of litter.

Cotton Response

Cotton responds well to the application of nitrogen, as well as other nutrients, which makes poultry litter an attractive source of nutrients. In addition, soils that have long been in cotton production are often low in organic matter, and the application of poultry litter may increase organic matter as well as nutrients for cotton production.

Although the nutrient content and soil amendment qualities make it attractive for row crop production, responsible management is an environmental challenge.

Another possible source of soil amendment for growing cotton is the solid waste matter produced by municipalities. Disposal of this solid waste has been a growing concern. Much is disposed of in landfills, but this is inefficient and costly. Although the nutrient content of municipal solid waste is relatively low, it may have a place in agricultural production as a way to improve pH, soil structure and organic matter.

Concern has been expressed that municipal solid waste contains high amounts of heavy metals. However, most are removed before it enters the waste stream. Bossier City, La., produces "Enviro soil," which contains about 0.6 percent nitrogen (N), 0.5 percent potassium (K), 0.75 percent phosphorus (P) and 27 percent calcium as well as smaller amounts of other nutrients. Heavy metals are present, but well within the U.S. Environmental Protection Agency's level of tolerances. The major nutrient content (N, P, K) is much lower than that of poultry litter and the calcium content is very high, especially for the cotton-producing soils of Northwest Louisiana that have near neutral to slightly alkaline pH values.

Hairy vetch is an ideal legume cover crop for cotton production. Cover crop research at the LSU AgCenter's Red River Research Station over a 40-year span has shown that cotton following hairy vetch will produce yields that equal or exceed conventionally applied nitrogen. An added benefit of using hairy vetch is that it will increase or maintain organic matter, resulting in improved water-holding capacity of the soil.

Three-year Experiment

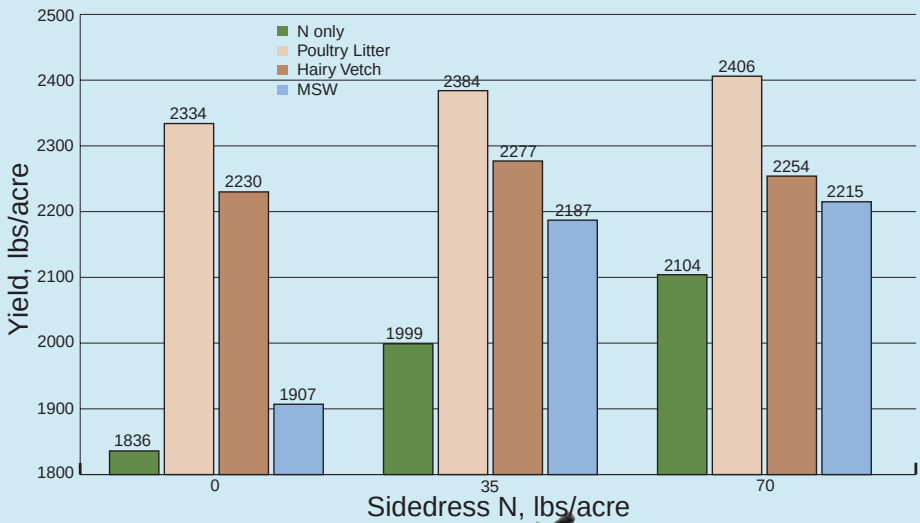
A three-year field experiment was conducted on a Norwood very fine sandy loam soil at the Red River Research Station to compare the response of cotton to poultry litter, municipal solid waste (from the Bossier City treatment facility), hairy vetch and sidedress nitrogen. Two tons per acre of poultry litter and municipal solid waste were applied, and, along with hairy vetch, incorporated before planting. Beds were formed and planted with either Paymaster 1218 BG/RR (1997) or SureGrow 125BR (1999, 2000) cotton. Nitrogen (32 percent solution) treatments of 0, 35 and 70 pounds nitrogen per acre were applied in split plots as a sidedressing four to six weeks after plant emergence. LSU AgCenter recommended cultural practices were followed.

There were no significant interactions between nitrogen rate and poultry litter, municipal solid waste or hairy vetch. Average seed cotton yields were highest for poultry litter regardless of additional nitrogen application (Figure 1). Seed cotton produced with two tons per acre of poultry litter without additional nitrogen exceeded that of the recommended 70 pounds of nitrogen per acre. A sidedressing of 35 and 70 pounds of nitrogen to poultry litter plots did not significantly affect yield. Cotton grown following a hairy vetch cover crop yielded somewhat less than when following poultry litter, but exceeded yields of all nitrogen rates without amendments. Cotton yield following hairy vetch was not affected by the application of additional nitrogen in this study. Municipal solid waste applied at two tons per acre provided a slight increase when compared with nitrogen only.

Soils in the cotton-producing areas

James L. Rabb, Professor; Eddie P. Millhollon, Associate Professor; W. David Caldwell, Professor; and Jose Liscano, Associate, Red River Research Station, Bossier City, La.

Figure 1. Yield of cotton in response to soil amendments and sidedress nitrogen, Red River Research Station, Bossier City, La.



of the Red River Valley are characteristically low in organic matter. Improvement in organic matter is one of the benefits of cover crops and soil amendments. The effect of the soil amendments on nutrient composition of the soil is unknown. Table 1 contains soil data following four years of annual applications of poultry litter, municipal solid waste and winter growth of a hairy vetch cover crop on the same plots. Although continuous nitrogen plots contained only 0.86 percent organic matter, the plots receiving four annual applications of poultry litter contained 1.19 percent organic matter, followed by hairy vetch with 1.02 percent. Municipal solid waste plots contained only 0.86 percent.

Table 2. Nutrient, organic matter content and pH of soils after four years following a hairy vetch cover crop and annual applications of poultry litter and municipal solid waste. Red River Research Station, Bossier City, La.

	PL	MSW	HV	N only
Organic Matter(%)	1.19	0.89	1.02	0.86
pH	7.75	8.20	7.60	7.80
Phosphorus (P)	187	154	141	133
Potassium (K)	135	114	101	102
Calcium (Ca)	1002	1847	882	907
Magnesium (Mg)	293	177	246	236

**Organic Matter
Increases Yields**

Although the increase in organic matter is small, research at the Red River Research Station has documented a significant increase in cotton yields from a small increase in organic matter. The increase in soil phosphorus following the use of poultry litter was higher than the other treatments; however, these levels are within acceptable limits. The calcium content of municipal solid waste is a concern in neutral to alkaline soils. Although not evident in this study, the increase in pH and calcium content of the soils following the application of municipal solid waste may cause nutrient problems for crops, including cotton. Levels of heavy metals from the use of organic wastes were not increased. Results from this study:

- Use of poultry litter as a soil amendment and hairy vetch as a cover crop increases cotton yield and soil organic matter.
- Two tons per acre of poultry litter produced yields equal to 70 pounds of nitrogen per acre.
- Adding sidedress nitrogen had little effect on cotton yield of poultry litter or vetch-treated plots.
- Organic matter increased approximately 0.3 percent, which may have enhanced cotton yield and soil water-holding capacity.
- Increased yields and organic matter following hairy vetch were less than from poultry litter, but higher than from municipal solid waste or nitrogen alone.
- Municipal solid waste had no effect on organic matter content and did not significantly increase cotton yield.
- Use of the soil amendments did not adversely affect the level of heavy metals in the soil.
- The increase in pH and calcium content of the soil associated with municipal solid waste application may affect cotton yield adversely and should be monitored. ■

2002 Winners



Love & Peace is a cross between the legendary Peace (AARS 1946) and an unknown seedling. It is described as a classic upright, disease-resistant, hybrid tea. The large fruity-scented blooms are a golden yellow edged with pink.



Starry Night is a shrub rose perfect for large plantings, borders and ground cover. At maturity it is about 6 feet by 6 feet. This rose took top honors for its large clusters of pure white blooms that resemble a dogwood flower.

Burden Center's All-America Rose Selections Display Garden

Of all the flowers to be found in gardens throughout the world, the rose is the most popular and the most widely grown. Roses can be found in every country, even where the climate is less than ideal. No other flower has been so immortalized and integrated into daily life. Fossil remains found on a slate deposit in Colorado indicate that roses existed 40 million years ago in North America. Of the 200 species of wild roses known worldwide, about 35 are considered indigenous to the United States.

The rose is a plant of incredible variety of form and growth, from the smallest miniature just 6 inches in height to the largest climbers, which can reach 40 or 50 feet. Between these two extremes is a vast array of rose types within these general categories:

- Hybrid tea roses have large flowers on long stems, like the traditional Valentine's Day red rose.
- Floribunda roses are bushy with clusters of several small flowers.
- Grandiflora roses have characteristics of the hybrid tea and floribunda, producing clusters of several medium size flowers.
- Shrub roses are vigorous and dense with a wide range of flower color.
- Landscape roses are similar to shrub roses, but tend to be lower and more spreading with clusters of small flowers.
- Tree-form roses are a result of pruning (usually a hybrid tea) to produce a woody trunk with foliage and flowers at the top.
- Antique or old garden roses were originally derived from wild roses and include those grown in Europe and Asia for several hundred years. These are becoming more popular.
- Wild roses are true species that have naturally evolved without artificial breeding or human intervention.

2004 Winners



Marmalade Skies is a floribunda with clusters of brilliant tangerine-orange blooms on each stem. This compact, round plant grows to 3 feet, making it the perfect rose for a hedge or bright addition to any existing rose bed.



Sun Sprinkles is only the fifth miniature ever to win AARS honors. Its bright yellow and cream blooms are set against a backdrop of petite, dark green, glossy foliage. The fragrance is described as moderately spicy with overtones of musk. Miniatures are ideal for lining walkways, for containers and for accents in formal rose beds.



Glowing Peace is a round, bushy grandiflora with large golden-yellow and cantaloupe-orange blended petals. Its glossy, deep green foliage is a backdrop for the luminous blooms and gives way to burgundy fall color. The fragrance is described as a light tea. This is another progeny of its grandparent, Peace, the world's most renowned rose.

In 1938, the All-America Rose Selections (AARS) program was established to evaluate and promote exceptional roses. Every AARS winning rose completes an extensive two-year trial program in which it is judged on disease resistance, flower production, color and fragrance. The LSU AgCenter's Burden Center in Baton Rouge is a designated AARS Display Garden where the public can view roses awarded

the AARS distinction. New rose selections are received annually and evaluated for performance in south Louisiana. The garden has about 1,500 plants, representing 150 varieties.

The 2003 AARS winners have been selected and are to be delivered for planting in February 2002. The official names are not to be released until the spring of 2002, but a description includes a white

hybrid tea, red/white grandiflora, yellow peach floribunda and a smoked orange blend floribunda. In the meantime, people can visit the garden any day of the week to view past winners, including recent additions. ■

Drew Bates, Associate Professor, Burden Center, Baton Rouge, La.

2000 Winners

Photos by Drew Bates



Knock Out has received the best disease resistance rating for the past two years at Burden Center. This maintenance-free, flowering shrub rose thrives in all climates. It grows to a height of 4 to 5 feet and has a rounded, bushy form. The blooms are deep, fluorescent cherry red, complemented by glossy burgundy-green foliage.



Gemini is a medium-tall, upright and vigorous hybrid tea with a pattern of color, blending deep coral pink and rich cream blooms. This classic long-stem rose features dark green foliage, mild fragrance and excellent disease resistance.



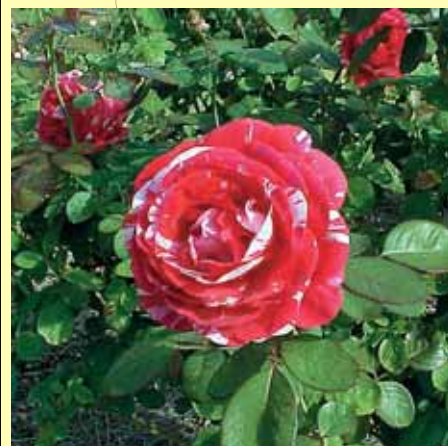
Carefree Delight (AARS 1996) is a vigorous shrub rose with a stunning display of pink and cream blooms. Its graceful arching canes are covered with brightly colored rosehips (fruit) that provide food for birds in winter.



Crimson Bouquet is a vigorous grandiflora with bright scarlet blooms. The attractively rounded plant is a classic variety that grows 4 feet tall and 3 feet wide. Glossy deep green leaves are the perfect backdrop for its showy blooms.



Chrysler Imperial (AARS 1953) is a large-flowered hybrid tea with dark red blooms. This rose was immensely popular when it was first introduced because of its vigorous growth, dark green leaves, good fragrance and velvety rich crimson petals that turn bluish as they age.



Scentimental (1997) has unique characteristics that add interest to the garden. It is a free-blooming floribunda with burgundy and cream striped blooms. The sweet spice fragrance mimics the scent of the striped hybrid roses of the 1800s. Although striped roses date back more than 100 years, it is the first striped rose to win the AARS award.

Plant Growth Regulator Offers Advantages for Herbicide-tolerant Rice

Richard T. Dunand, Steven D. Linscombe and R. Russell Dilly Jr.

Treating rice seed with gibberellic acid has improved rice production in the northeastern rice-growing area. On semi-dwarf varieties gibberellic acid improves seedling vigor by hastening emergence and increasing seedling population. With the advent of herbicide-tolerant rice, this treatment offers an opportunity to improve rice production in the major rice-producing region of southwestern Louisiana.

Gibberellic acid is currently not used much in southwestern Louisiana because rice treated in this way must be sown in a dry field. This requires a planting method called drill seeding, which involves using a seed-grain planter that places the seed just below the soil surface.

Most rice in southwestern Louisiana is sown in water or on wet soil, with seed being placed on the soil surface. Unlike drill seeding, water seeding allows early flooding and uses water management to suppress red rice, a noxious weed for which there had been no postemergence herbicide control before herbicide-tolerant technology.

Herbicide-tolerant rice can withstand certain herbicides that kill rice varieties and red rice. This new technology will permit more drill seeding in Southwest Louisiana. Depending on seed supply and governmental approvals, herbicide-tolerant rice will be a useful technology for controlling red rice. It is possible that several thousand acres of herbicide-tolerant rice will be drill seeded in Louisiana and other southern rice-growing states in 2002. Since herbicide-tolerant rice is derived from semidwarf parents, it is semidwarf in nature, prompting evaluations of the response of herbicide-tolerant rice to seed treatment with gibberellic acid.

Small Plot Tests

Two imidazolinone-tolerant (Clearfield) entries (designated CL-121 and CL-141) and two glufosinate-tolerant (Liberty Link) entries (designated LL0001 and LL0401) were evaluated for their response to seed treatment with gibberellic acid in 2000. Two studies were planted about one month apart—one on March 17 and the other on April 18. Seed of CL-141 was limited and included only in the first study. Each study was an identical comparison of seed treated with a standard fungicide and insecticide and seed treated additionally with gibberellic acid. Seed were drill planted at a rate of 100 pounds an acre and to a depth of 2 inches below the soil surface into a prepared seedbed. At this depth, seed were placed into moist soil containing sufficient moisture for germination. Seedlings grew and emerged, relying solely on existing soil moisture present at planting and rainfall following planting. There was no surface irrigation (flushing), which

Photos by Richard T. Dunand



Seedling emergence was much quicker in the plots of Clearfield rice treated with gibberellic acid (foreground) than in the plots without the treatment.



The plots on the left, which are Clearfield rice treated with gibberellic acid, show fuller, more vigorous stands than the ones on the right, which were not treated.

is a normal practice in rice production. Five rainfalls were spread evenly over the four-week evaluation period after the March planting and totaled 2.5 inches. Rainfall after the April planting consisted of 3.5 inches that fell during a four-day period slightly more than two weeks after planting. It was associated with a late spring cold front.

Two parameters, emergence and final stand, were measured to evaluate seedling vigor. Emergence was the number of days from planting until a seedling population of 10 plants per square foot was reached. This population density is considered the minimum necessary for optimum production. Final stand was the number of plants per square foot at 25 days after planting.

Richard T. Dunand and Steven D. Linscombe, both Professors, and R. Russell Dilly Jr., Research Associate, Rice Research Station, Crowley, La.

Table 1. The influence of planting date and seed treatment with gibberellic acid on seedling emergence of herbicide-tolerant rice. Rice Research Station, Crowley, La.

Breeder Entry	Seedling Emergence (days after planting)			
	March		April	
	- GA	+ GA	- GA	+ GA
CL121	17	13	20	16
CL141	19	14	-	-
LL0001	19	17	16	14
LL0401	14	14	15	12

Table 2. The influence of planting date and seed treatment with gibberellic acid on seedling population of herbicide-tolerant rice. Rice Research Station, Crowley, La.

Breeder Entry	Final Stand (plants/sq ft)			
	March		April	
	- GA	+ GA	- GA	+ GA
CL121	11	15	8	16
CL141	16	20	-	-
LL0001	13	15	12	19
LL0401	18	18	21	23

Seedling Vigor Improvement

Seedling emergence of the four herbicide-tolerant entries was quicker when seed treatment with gibberellic acid was used, and the Clearfield entries were more responsive to gibberellic acid than the Liberty Link entries (Table 1). In general, the Clearfield entries emerged four to five days earlier with the gibberellic acid seed treatment compared with two to three days earlier for the Liberty Link entries. There were two exceptions. Emergence of both Liberty Link entries planted in March was not significantly affected by gibberellic acid.

Final stand was improved by the seed treatment with gibberellic acid in much the same way as seedling emergence was (Table 2). The Clearfield entries were more responsive than the Liberty Link entries, and LL0401 was the least responsive. CL121 and CL141 planted in March had 25 percent to 30 percent higher final stands from the seed treatment with gibberellic acid. Also, CL121 planted in April had a twofold increase in final stand with gibberellic acid; without gibberellic acid, final stand was less than optimum (fewer than 10 plants per square foot). In the Liberty Link entries, stand was increased by 60 percent in LL0001 planted in April. Final stand was not significantly changed by seed treatment with gibberellic acid for LL001 planted in March and LL0401 planted in March and April.

The Clearfield entries were long-grain types, and the Liberty Link entries were medium-grain. In previous research with standard commercial rice varieties, semidwarf long-grain varieties have typically shown a higher response to seed treatment with gibberellic acid compared with semidwarf medium-grain varieties. The herbicide-tolerant entries appear to follow this same trend.

Benefits to Rice Industry

These results show that gibberellic acid will allow rice growers to plant Clearfield rice at seeding rates 25 percent to 30 percent lower than currently recommended for drill-seeded rice not treated with gibberellic acid. A reduction in seeding rate can provide two benefits: lower costs and more acreage with less seed. A lowered seeding rate can reduce the cost of the herbicide-tolerant technology, because its cost will be based primarily on price of seed, which will be higher than standard varieties. Using gibberellic acid to reduce seeding rate will allow more acreage of herbicide-tolerant rice to be planted. As with the release of any new rice variety, initially a limited amount of seed of the herbicide-tolerant rice will be available. Drill seeding at a reduced seeding rate, facilitated by seed treatment with gibberellic acid, will allow more acres of herbicide-tolerant rice to be planted. ■



Regiment Ready for Rice

Regiment, a new herbicide from Valent, will be available to rice producers for 2002. The herbicide is similar to Londax in its mode of action. Regiment controls many troublesome rice weeds including hemp sesbania, jointvetch and rice flatsedge. The herbicide has also demonstrated excellent activity on large escaped barnyardgrass. However, it is weak on sprangletop, fall panicum and broadleaf signalgrass. Regiment tank-mixes well with many current rice herbicides. Consult label for specific tank mixes. ■

Ron Strahan, Extension Weed Scientist, LSU AgCenter, Baton Rouge, La.

Timing and Rate Effects of Rice Fungicides

Donald E. Groth

Rice diseases pose a major threat to rice production. The two major diseases, sheath blight and blast, cause significant yield and quality reductions that cost rice farmers millions of dollars each year. Disease resistance is the best control method, but often it is not available or breaks down after varietal release. Most long-grain varieties are susceptible to sheath blight, and several major varieties are susceptible to blast. Cultural control can reduce disease development, but practices to reduce disease by reducing inputs can limit yield, too. As a result, rice farmers often rely on fungicides to control diseases. Several new fungicides are available, and timing is critical for maximum return. Each disease has its own cycle, and control practices are effective only at certain stages when the pathogen is susceptible to the chemical control and before irrevocable damage occurs.

Studies were conducted to determine the best rice growth stage and fungicide rate for the control of sheath blight and blast at the LSU AgCenter's Rice Research Station at Crowley, La., from 1997 to 2001. Standard commercial cultural management practices were used to maintain the plots. Application growth stages studied each year were:

- panicle differentiation, when the panicle can be first identified (2 mm in size).
- at booting, when the head is 2 to 4 inches in length.
- at heading, when 50 percent to 70 percent of the heads are starting to emerge from the boot (just after boot split) but before heads are fully exerted.

The fungicide Quadris was used at 6, 9 or 12 fluid ounces per acre. In 2000 and 2001, additional fungicide treatments were applied five, 10 and 15 days after heading. Sheath blight plots were inoculated with enough *Rhizoctonia*

solani, grown on a rice grain-hull medium, to produce an infection level above the treatment threshold of 5 percent to 10 percent of tillers infected. Blast inoculum came from natural sources. Disease development was evaluated one to two weeks before harvest by determining infection levels of sheath blight (percent tillers infected) and blast (percent heads infected). Sheath blight severity was determined using a 0-9 scale where 0 indicated no disease and 9 indicated sheath blight on the upper canopy and plants collapsing. Plots were harvested with a small plot combine, and yields adjusted to 12 percent moisture were determined. A subsample of grain was collected and milling percentages of head and broken rice measured. Studies were conducted on susceptible varieties from 1997 to 2001 in separate plots for sheath blight and blast.

Sheath blight

In multiple-year studies, yield increases were as high as 2000 pounds per acre with timely fungicide application. Disease control, yield increases and head rice yields were significantly different from the unsprayed checks for all of the Quadris applications. The yield of 6 and 9 fluid ounces per acre Quadris rates were lower than the 12 fluid ounces per acre rate at panicle differentiation, and disease control was weak for the 6-ounce rate at this



timing. At booting the 9-ounce rate was similar to the 12-ounce rate but the 6-ounce rate was weak again. At heading there was no significant difference between the three rates. Head and total milling were significantly higher than the unsprayed check but not significantly different among any of the rates or timings.

When comparing the 9-ounce rate at heading, a shift of as few as five days

Table 1. Effect of Quadris fungicide timing, applied at 9 oz/acre, at different rice growth stages on sheath blight disease control and yield and milling yields. Data are the average of 2 years/2 tests conducted at the Rice Research Station 2000-2001.

Timing	Sheath blight severity (0-9)	Sheath blight infestation (% tillers)	Yield increase over check (lb/A)	Milling %	
				Head rice	Total
Unsprayed	7.8	86	—	60.5	69.8
Heading	4.7	36	1875	64.8	70.3
H+5 days	5.8	59	1154	63.4	69.9
H+10 days	6.8	71	616	61.8	69.2
H+15 days	7.2	77	273	61.6	69.3

Heading (H) is defined as when 50%-70% of panicles start to emerge and 5, 10 and 15 days after heading.



The inoculum used in the experiments to test fungicides includes one part rice to two parts rice hulls (left). In about seven or eight days, it is ready to be used in the test plots (right).

after heading lost 721 pounds per acre (Table 1). When applications were made 10 days and 15 days after heading, the plots lost 1,259 and 1,602 pounds per acre, respectively, which were not significantly different from unsprayed levels. Disease control also decreased as treatment was delayed. Head rice milling yields were significantly lower at the two late timings.

Blast

All of the Quadris rates and timings significantly reduced blast and increased grain and head rice yields over the unsprayed check. Single applications of Quadris at heading were lower yielding and had more disease than the two applications at boot and heading. These timing differences were not significant. The low and high rates were equally effective.

When the 9-ounce rate of Quadris applied at heading was compared with later timings, there was a significant decrease in disease control and a significant reduction in yield at 15 days after heading. All application timings increased head rice but not total milling compared with the control.



Donald E. Groth prepares an inoculum containing the pathogens that cause sheath blight to use in his experiments.

Timing, rate importance

The rate of fungicide necessary to control sheath blight changed as the season progressed. A higher rate was required at panicle differentiation and boot growth stages to get maximum performance because lower rates weathered off and allowed late-season disease development to occur. There was less disease control and yield increases were lower when the fungicide was delayed until heading because sheath blight was allowed to increase unchecked for several weeks. A lower rate can save farmers significant amounts of money, but only when justified by disease development at later crop growth stages, light disease levels or higher host resistance levels. Obviously, disease scouting in the field will play a key role in determining fungicide rate, timing and necessity. The Quadris label allows lower rates if disease does not develop until heading and if more

resistant varieties are being sprayed. Using lower than labeled rates exposes a farmer to risk that the company will not support nonperformance complaints. It is extremely important to remember that if fungicide applications are delayed after heading, significant yield and milling losses can occur that cannot be corrected by fungicide.

Blast appears to be less sensitive to fungicide rate than sheath blight. Two applications can be more effective than single applications, but it may not be economically significant to justify both a boot and heading application at low disease pressure. A heading application was much more effective than a boot application (data not shown). Although later timings may not be as detrimental as late sheath blight timings, earlier applications are more effective—especially under heavier disease pressure (2001 data). ■

Integrated Management of the Rice Water Weevil

Michael J. Stout, William C. Rice and Dennis R. Ring

The rice water weevil is an important biological constraint on rice yields in the southern United States and has been recognized as such almost as long as rice has been grown in the South. Yield losses in Louisiana, where this insect is a particularly severe pest, typically exceed 10 percent and can approach 30 percent or more. In addition, this insect has been accidentally introduced into some of the major rice-producing regions of Asia and poses a global threat to rice production. For most of the past 30 years, this insect was controlled in Louisiana using granular Furadan (carbofuran). The registration for the use of Furadan in rice, however, was revoked in the late 1990s by the U.S. Environmental Protection Agency. Cooperative research conducted by scientists from the LSU AgCenter and the U.S. Department of Agriculture (USDA) has met the immediate need for alternatives to Furadan, and efforts to improve the management program continue.

The goal of ongoing research efforts is the development of a cost-effective and environmentally friendly program for management of the rice water weevil. Judicious use of insecticides will remain a large part of the management program for the foreseeable future. However, relying solely on insecticides to manage the rice water weevil sometimes results in unacceptable control and increases the likelihood of the development of resistance to insecticides. Sole reliance on insecticides also can result in toxicity to nontarget organisms. For these reasons, a major focus is the diversification of the management program through the incorporation of cultural practices and host-plant resistance. The foundation of this integrated management program is a thorough understanding of the biology of this important pest and its interaction with rice.

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Insect-rice interaction

The seasonal history of this pest in Louisiana begins in early spring, when adult weevils emigrate from their overwintering sites to rice fields. Models based on more than 20 years of flight records and weather data predict initial flights of weevils in early April in southwestern Louisiana. Upon arrival in rice fields, adult weevils feed on leaves of rice plants, leaving lengthwise feeding scars. This type of injury, although evidence of the presence of weevils in a field, usually does not result in economic losses. Serious problems do not begin until the rice fields are flooded and the weevils begin to lay eggs. The newly hatched larvae feed externally on the rice plant roots. Root pruning by larvae can damage root systems extensively, ultimately reducing grain yields. The insect has two to three overlapping generations in southern Louisiana. In August, adults of the final generation fly to overwintering sites, primarily wooded areas, and live in bunch grasses and under leaf litter.

An important peculiarity of the biology of this insect is its dependence upon flooded conditions for egg laying and development. This peculiarity makes rice fields, which are flooded for a large part of the growing season, an ideal habitat. Recent studies conducted in a greenhouse have shown that both feeding by adult weevils and egg laying by adult females are markedly reduced when rice plants are not flooded. Rate of oviposition (egg laying) is influenced by the depth of flooding also. Moreover, development of larvae of the rice water weevil is impeded in dry soil. This dependence by the rice water weevil on flooding forms the biological rationale for the traditional cultural practice of draining rice fields when an infestation of weevils occurs. It also enables the manipulation of weevil populations in rice fields through water management practices.

Injury to rice plants results from chronic feeding by weevils on rice roots. Infestations begin when rice fields are flooded and continue at least through the early reproductive stages of rice.

Feeding by large larvae in the later stages of their development is most injurious to root systems. Young plants are especially susceptible to the effects of feeding because their root systems are smaller. Removing large amounts of root tissue has several effects on the physiology of rice plants. The major physiological effects of root pruning appear to be a reduction in tillering of infested plants and a resultant reduction in panicle density at harvest. A reduction in average grain weight also contributes to yield losses.

Insecticidal control

Insecticides remain the most effective means of controlling weevils. Since the registration of Furadan was revoked, four insecticides have been registered for use against the rice water weevil: Icon (fipronil), Karate (lambda-cyhalothrin), Fury (zeta-cypermethrin) and Dimilin (diflubenzuron). Data on the effectiveness of these products generated by LSU AgCenter and USDA scientists were used by industry to support the registration of these insecticides. Use of these newly registered insecticides involves a considerable departure from past practices. Furadan was targeted against larvae, and applications were made into flooded soils when densities of rice water weevil larvae exceeded economic thresholds. In contrast, Icon is a prophylactic seed treatment, and the decision to use Icon must be made before rice is planted. Karate, Fury and Dimilin are applied to the foliage of rice plants, with Karate and Fury targeted at weevil adults and Dimilin targeted at eggs.

When used correctly, these newly registered insecticides control rice weevils as well as or better than Furadan at the same or lower cost. Evaluation of the efficacy of additional insecticides against the rice water weevil continues, with registration of one and perhaps two new products possible within the next few years.

Karate, Fury and Dimilin pose a particular challenge to use. These insecticides are not effective against larvae once they have begun feeding on

roots of rice plants. Thus, timing of application is critical and must be based on densities of adult weevils rather than on densities of larval weevils, as was the case with Furadan. Currently, applications of these products are recommended when adult weevils are found in a field and conditions for oviposition are present (fields are flooded or about to be flooded). The research necessary to develop more precise application thresholds is in progress. The most significant barrier to the development of such thresholds is the absence of a simple, inexpensive and effective monitoring tool for adult weevils.

Cultural practices for control

Although weevil management still depends heavily on insecticides, appropriate cultural practices can also contribute. Recent research has focused on the cultural strategies of delayed flooding and early planting.

Delayed flooding. One practice that can be used to reduce yield losses is to avoid applying floods to rice fields when rice is young. Historically, rice producers in many rice-growing areas of Louisiana have flooded fields within a few weeks of seeding, principally as a control for important weed pests such as red rice. Early flooding, although it effectively suppresses the germination of weeds, exacerbates the pest status of the rice water weevil by allowing infestation of young, vulnerable rice. Delaying permanent flood not only reduces the absolute number of larvae infesting plants in a season, because female weevils lay eggs only under flooded conditions, but also delays infestation until rice plants are older and more tolerant of injury. Delaying the application of permanent flood to rice fields by as little as two weeks (for example, flooding when rice plants have four to five leaves rather than two to three) can reduce the susceptibility of rice to yield losses dramatically (Figure 1).

Early planting. Another way in which losses from weevils can be reduced is to plant rice early in the growing season. Recommended dates for planting rice in southwestern Louisiana, where this research has been conducted, are from March 15 to April 15. Although rice water weevils begin to emerge from overwintering in early April, emergence is a protracted process, and populations do not build up to their highest levels until much later in the growing season. By planting early, producers can usually avoid exposing

rice to high populations of weevils. Producers who plant later in the growing season can expect to encounter higher densities of weevils and have greater yield losses (Figure 2).

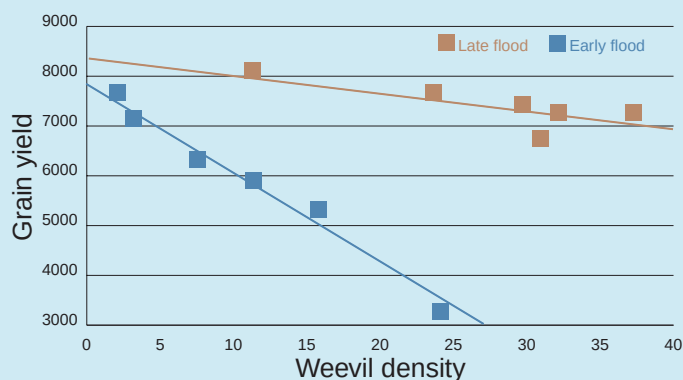
Host plant resistance

Investigation of host-plant resistance as a means of controlling the rice water weevil has a long history in Louisiana. A collaborative screening program, in which rice lines from various geographic sources are evaluated for resistance and tolerance to the rice water weevil, has been conducted by USDA and LSU AgCenter scientists for more than 30 years. A number of varieties and plant introductions with low levels of resistance or tolerance to the rice water weevil have been identified, but efforts to intentionally incorporate weevil resistance into commercial varieties have been limited. Analysis of screening experiments conducted over the past 10 years has shown, however, that many of the varieties developed and grown in the southern United States are more resistant to the rice water weevil than rice lines from other parts of the world. Furthermore, in a recent comparison of varieties commonly grown in Louisiana, some were found to be significantly less susceptible to the rice water weevil than others. Thus, it is possible that low levels of weevil resistance have been fortuitously incorporated into some varieties during the process of breeding.

Future research

Significant progress in the development of an integrated management program for the rice water weevil has been made since Furadan's removal, but more research is needed to refine the management program. Improved methods for monitoring weevils and

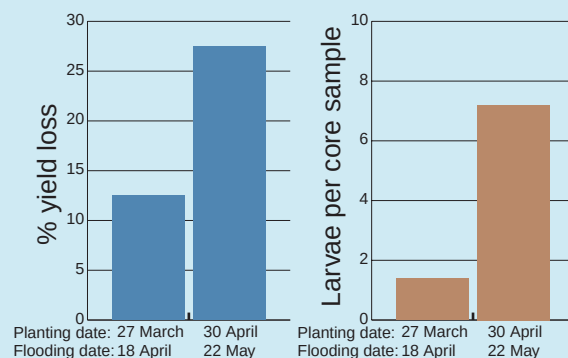
Figure 1. Relationship between density of rice water weevil larvae and grain yields, measured in kilograms per hectare, for rice flooded when plants had two to three leaves (early flood) or when plants had four to five leaves (late flood). The steeper line for early-flood plots shows that rice flooded early in the season is more susceptible to yield losses from this insect.



thresholds for the application of foliar insecticides are two areas of need. Probably the greatest need, however, is for the development of rice lines with high levels of resistance to the rice water weevil. Evaluation of rice lines from various parts of the world continues. If efforts to improve the resistance of rice to this insect using traditional breeding methods fail, the use of genetic engineering to increase the resistance of rice plants to the rice water weevil is being considered.

Rice culture is undergoing important changes because of new technologies (herbicide-tolerant and hybrid rice lines) and the increasing prominence of other practices such as conservation tillage. Continued study of the influence of these changes in rice culture on the rice water weevil is critical to an understanding of how to manage rice so as to minimize the destructive influence of this important pest. ■

Figure 2. Influence of planting date on yield losses and densities of rice water weevil larvae. Insect densities were determined three weeks after flooding. Planting rice early in the growing season reduces yield losses caused by the rice water weevil.



Carryover Potential of Staple Herbicide to Corn in Northeast Louisiana

Donnie K. Miller, Bill J. Williams and Steve T. Kelly

Staple is a selective herbicide labeled for both preemergence and postemergence control of broadleaf weeds in cotton. Since introduction in 1995, it has been used widely in the cotton-producing region of Northeast Louisiana. During this period, lower cotton market prices have resulted in a larger portion of these acres being planted to corn, and producers have observed benefits to the cotton crop when it is rotated with corn.

Research has shown that rotation to corn following cotton for a two-year period can significantly reduce reniform nematode populations that reduce cotton yields. A potential problem on corn, as a result of this shift, is possible carryover of herbicides applied on the cotton crop. When we began our research, the label for Staple specified that corn could be planted nine months after application, with specific application and tillage restrictions. According to the label, this interval was provisional upon the application being on a directed band not

to exceed 50 percent of the cotton row width and fields having a thorough soil mixing such as two diskings or a deep plowing before planting corn. Several questions were raised as to whether label provisions were too conservative.

To alert producers to the possible impact from applications not consistent with the herbicide label, research was initiated to evaluate corn tolerance to Staple using simulated carryover and rotational plantback studies over a three-year period beginning in 1998 at the Northeast Research Station in St. Joseph, La. These studies were conducted on a silt loam soil with 1 percent organic matter and a pH of 6.5. In all studies, corn plots were treated with Lorsban insecticide and a Prowl/atrazine herbicide tank mix. Recommended corn production practices were followed.

To assess possible negative effects of the Staple treatments, visual assessment of plant discoloration 21 days after planting, plant population and height 41 days after planting, plant height and 100-seedweight at harvest, and yield were determined.

Simulated Carryover

For the simulated carryover study, Staple was applied at 2, 1, 1/2, 1/4, 1/8 and 1/16 times (x) the normal use rate of 1.2 ounces per acre with a nontreated

control included for comparison. Herbicide was incorporated to a depth of 2 inches immediately preceding planting of Pioneer 3223 corn on March 22, 1999, and April 10, 2000.

In 1999, discoloration of corn plants, as observed 21 days after planting for the respective rates of Staple evaluated, was as follows: 61 percent, 45 percent, 31 percent, 28 percent, 12 percent and 10 percent. In both years of the study, rates of 1/4x or higher were required to reduce plant population significantly compared to plots receiving no Staple. With respect to plant height 41 days after planting and at harvest, only the lowest rate of Staple was equivalent to the nontreated control in 1999. All other rates resulted in at least a 12 percent height reduction.

In 2000, rates of 1/4x or higher were required to reduce plant height significantly at harvest. The 100-seedweight was not affected by Staple rates evaluated either year. Yield reduction of at least 47 percent and 43 percent was observed with rates of 1/4x and higher in 1999 and 2000, respectively. Rates of 1/8x and 1/16x resulted in yields equal to the respective nontreated controls (182 and 145 bushels per acre).

Donnie K. Miller and Bill J. Williams, Assistant Professors, Northeast Research Station, St. Joseph, La.; and Steve T. Kelly, Assistant Specialist (Weed Science), Scott Research and Extension Center, Winnsboro, La.

Photos by Donna R. Lee



The two rows, left, represent the full rate; the two middle rows the 1/2x rate; and the two rows, right, the 1/4x rate.



The two rows, left, represent the 1/8x rate, and the middle two rows, the 1/16x rate. The two rows, right, were not treated.



Severe damage was observed with the highest rate (2x).

Rotational Plantback

In the rotational plantback study, Staple was applied at one (1x) or four (4x) times the normal use rate of 1.2 ounces per acre broadcast underneath cotton plants over the entire width of each row on June 18, 1998, and July 6, 1999. A nontreated control was included for comparison. Plot rows then were only re-hipped (re-formed) immediately after cotton harvest and before corn planting in the spring on the above-mentioned dates, which correspond to nine months after Staple application.

In 1999, corn response in plots treated with Staple at 1x or 4x rates the previous year was not significantly different from those receiving no Staple. In 2000, significant differences were noted only with respect to plant height at harvest and yield. Corn height at harvest was reduced 19 percent when treated with the 4x rate of Staple compared with those in the 1x and nontreated plots, which was not different. A stepwise reduction in yield was observed for Staple at 1x and 4x rates (7 percent and 34 percent, respectively), from the nontreated control (152 bushels per acre), thereby supporting current label recommendations for band application followed by disking and thorough mixing of soil for a nine-month rotational interval to corn. Yield differences were not attributable to differences in plant population or 100-seedweight.

Variation between years may be because 45 inches of rain was received from the time of Staple application to corn planting in 1999, compared with only 32 inches for the same period with the 2000 corn planting. In addition,

average daily temperature for the winter was slightly lower for 1999-2000 compared with 1998-1999. Staple degrades slowly in soil, primarily by microbial activity, with an estimated half-life (time required to reduce initial concentration by half) of 60 days in laboratory studies. Any environmental conditions that slow microbial activity, such as drier, colder conditions, may affect the degradation rate of Staple. This may explain the negative effects observed on corn for Staple carryover in the 2000 trial, thereby justifying the conservative label restrictions.

Follow Label Restrictions

Staple rates of 1/4x or higher were required to cause significant yield reduction when applied and incorporated immediately before corn planting. Given the estimated half-life in laboratory studies of 60 days for Staple, theoretically a six-month period would be needed to reach this level with an initial application rate of 1.2 ounces per acre. However, under variable environmental conditions, the time required may be much longer.

When applied in a manner inconsistent with the label, Staple herbicide at the normal use rate in this study affected corn yield negatively in one of two years. Effects were more pronounced under drier, colder conditions following application until corn planting, indicating a greater potential for carryover effects from off-label applications when such conditions exist.

Results from the plantback study indicate that the nine-month interval would not have been sufficient to provide complete crop safety with the removal of application and soil-mixing

restrictions. Staple application and seedbed preparation were a worst-case scenario for Staple carryover potential. Staple was broadcast underneath cotton plants over the entire row width, instead of half the row width in a banded application. Therefore, when rows were only re-hipped and soil was not thoroughly mixed, treated soil from the entire row width could have been concentrated on the re-hipped row. Corn was tolerant to as much as a 4x rate of Staple in one of two years of the actual carryover study. Producers are cautioned always to adhere to label plantback restrictions because planting before the indicated interval, such as 30 days in our research, may lead to yield reduction in a subsequent corn crop.

Since initiation of these studies, the Staple label has been changed to specify that corn can be planted in Louisiana 10 months following application in cotton, if the amount applied does not exceed a total of 1.8 ounces broadcast per acre per season. No additional soil mixing (disking or plowing) is required beyond what is normally done with the various production systems (conventional tillage, minimum tillage, no-till or ridge till). ■

Acknowledgment

Donna R. Lee, A. Lawrence Perritt and Charles F. Wilson, research associates at the Northeast Research Station, for their work in the completion of this research.



Chickasaw The first release (1997) in a series of miniature hybrid crape myrtles from the U.S. National Arboretum. Reaches height of about 3 feet after 10 years in the landscape. Pinkish lavender flowers produced later than other miniature and dwarf crape myrtles but last into the fall.

Miniature and Dwarf Crape Myrtles for Louisiana

Allen Owings, Drew Bates, Gordon Holcomb and Edward Bush

The LSU AgCenter has long been actively involved in evaluating ornamental plants, providing recommendations for county agents and green industry professionals (landscape contractors, retail garden centers) to use when working with home gardeners. One group of plants that has generated considerable interest recently is the crape myrtle. In Louisiana and across the southeastern United States, crape myrtles are the most popular and widely used summer flowering tree for residential and commercial landscapes. Most people are familiar with the traditional upright-growing crape myrtles (10-30 feet). These include Natchez (white), Tuscarora (coral pink) and Watermelon Red (dark pink). However, miniature and dwarf crape myrtles are available for landscape use, too.

Miniature and dwarf crape myrtles were evaluated in LSU AgCenter studies over the 1999 and 2000 growing seasons. Industry standards generally classify miniature crape myrtles as having a mature height of 3 feet or less

and dwarf crape myrtles as being 3 to 6 feet tall at maturity. The primary objective in these trials was to evaluate the trees for growth habit, flowering performance, winter damage and disease susceptibility. Two-gallon containers of Pixie White, Delta Blush, Baton Rouge (also known as Beverly), Mardi Gras, New Orleans (also known as Passion), Lafayette, Pink Blush, Purple Velvet, Orlando, World's Fair, Bicolor, Sacramento, Cordon Bleu (also known as Louisa), Houston, Chickasaw and Pocomoke were planted in raised beds 4 feet apart on October 30, 1998, at the LSU AgCenter's Burden Center in Baton Rouge.

The raised beds were an Olivier silt loam soil amended with aged pine bark and composted rice hulls. The beds were located in full sun and plants received drip irrigation as needed throughout the growing season. Plants were mulched annually with 2 inches of baled pine straw.

Crape myrtles were fertilized annually in April

with StaGreen Nursery Special 12-6-6 at the rate of 1 pound of nitrogen per 1000 square feet of bed area and in early July with StaGreen Nursery Special 12-6-6 at the rate of 0.5 pound of nitrogen per 1000 square feet of bed area. Plants were not pruned (other than to remove winter-damaged stems) or dead-headed (flower removal) during the evaluation period, and no fungicides or insecticides were applied. Weeds were controlled with mulch, spot applications of Roundup and pre-emergent applications of Surflan.

Photos by Allen Owings



New Orleans Slightly lower growing than other dwarf crape myrtles. Purple flowers on a plant that reaches about 3 feet in the landscape. Cascading growth habit.

Allen Owings, Specialist, Department of Horticulture, LSU AgCenter, Baton Rouge, La.; Drew Bates, Associate Professor, Burden Center, Baton Rouge, La.; Gordon Holcomb, Professor, Department of Plant Pathology and Crop Physiology, LSU AgCenter, Baton Rouge, La.; and Edward Bush, Assistant Professor, Department of Horticulture, LSU AgCenter, Baton Rouge, La.

Data collected over the 1999-2000 evaluation period included plant height, date of first flower, visual quality ratings and susceptibility to *Cercospora* leaf spot and powdery mildew. Leaf spot and powdery mildew are the two primary diseases affecting crape myrtles in Louisiana. Visual quality ratings were conducted monthly during the growing season, and the criteria included a combination of growth habit, visual aesthetics, flowering and pest presence. Plant height was measured from ground level to the top of tallest shoot each July. Disease evaluations were conducted when diseases were the most prevalent (normally mid-spring through early summer).

Results from 1999 and 2000 evaluations indicated that the most ideal growth habit and foliage characteristics (weeping/cascading, compactness, red foliage) were found for New Orleans, Sacramento, World's Fair and Houston. These plants also had some of the higher visual quality ratings. Pixie White achieved a desirable visual quality rating also.

Flowering began as early as April 29 or as late as early June. Cordon Bleu was the first to flower in 1999 and 2000. Other early flowering varieties were Pixie White, Lafayette and Purple Velvet. Chickasaw and Pocomoke, new releases from the U.S. National Arboretum in the last five years, were among the later flowering varieties. Flowering generally terminated by mid to late August. Typically, flowering time for dwarf and miniature crape myrtles is equal to, and in some cases earlier and longer than, traditional intermediate and tall crape myrtles.

Powdery mildew was not seen in 1999 but was observed in early May 2000. Slightly susceptible varieties were Pixie White and Bicolor. Baton Rouge and Purple Velvet were moderately susceptible to powdery mildew. Approximately 1 percent to 10 percent of foliage on Cordon Bleu, Delta Blush and Pixie White had *Cercospora* leaf spot in June 2000. In rainy years, leaf spot can cause significant defoliation when not prevented or controlled.

A concern green industry professionals have about miniature and dwarf crape myrtles is their cold hardiness. In our studies, we observed dieback caused by winter damage on a number of varieties. Major dieback (40 percent to 50 percent of stem growth) occurred on Baton Rouge, Orlando, Mardi Gras, World's Fair, Houston and Lafayette.



World's Fair Dwarf crape myrtle featured at the World's Fair in New Orleans in 1984. Deep red flowers. Plants reach 3-4 feet in the landscape.



Sacramento Deep red flowering dwarf variety. Slightly more compact than World's Fair. Very heavy bloomer. Does well as a cascading/weeping plant in hanging baskets and patio containers. Reaches 4 feet in the landscape.

Chickasaw had 40 percent dieback in the winter of 1999-2000, and Pocomoke had 15 percent.

Miniature and dwarf crape myrtles have the potential for increased use in Louisiana landscapes. Wholesale nurseries have limited inventory of these plants now but have been increasing

production in the last two to three years. Plants are generally available at retail garden centers during the late spring and early summer. Based on this study, Chickasaw, Pocomoke, Sacramento, Houston, New Orleans and World's Fair have the most positive landscape attributes for Louisiana. ■

Ryegrass Variety and Beef Stocker Programs

Wayne Wyatt

As Louisiana cattle producers continue to improve their beef stocker programs, it is important that they choose the right ryegrass for their pastures. Three varieties were looked at in a research project at the LSU AgCenter's Iberia Research Station – Gulf, Jackson and Marshall. Researchers in other states, particularly Alabama, have found dramatic differences among these three varieties.

Pasture management

Four 20-acre pastures were each subdivided into six 3.3-acre treatment paddocks. Each pasture received an annual broadcast application of glyphosate (Roundup Ultra, 1 quart per acre) in mid-August to early September. Dormant warm-season forage was removed by burning in mid-September of each year. Pastures were lightly disked and seeded with a grain drill in mid- to late-September. Within a pasture, two paddocks each were planted with Gulf, Jackson and Marshall. The seeding rate was 30 pounds per acre for each variety. Pastures were broadcast with 2,4-D plus dicamba (Weedmaster, 1 quart per acre) in December to control buttercup and other cool-season broad-leaf weeds. Nitrogen fertilizer was applied in late fall (75 pounds per acre), winter (75 pounds per acre) and in mid-spring (60 pounds per acre) each year.

Animal management

October-weaned Angus and Brangus steer calves were allowed to graze Alicia bermudagrass hay meadows (approximately 28 to 42 day regrowth) after weaning. In two of the three years of the study, steers were able to graze hay meadow regrowth into late fall, just before being placed on ryegrass pastures. Because of inadequate forage growth of ryegrass during the early part of the 1998-1999 grazing season, steer

calves were given access to good quality hay and hand fed a daily supplement (3 pounds per steer). The supplemental ration contained ground corn (77 percent), cottonseed meal (17 percent), salt (2.5 percent), oyster shell flour (2.5 percent) and trace minerals (1 percent). Monensin (Rumensin) was added to the supplemental ration to control coccidiosis (intestinal protozoa infection). Steers had access to fresh water and mineral supplements throughout the grazing season.

Grazing management

Three Angus and three Brangus steers were assigned to each paddock. To extend the grazing season as long as possible, large round bales of good quality hay were placed in each treatment paddock and replenished as needed throughout the grazing season. Ryegrass pastures were grazed 131 days in 1997-1998 (Dec. 20, 1997, to April 30, 1998), 85 days in 1998-1999 (Feb. 3, 1998, to April 30, 1999) and 129 days in 1999-2000 (Dec. 21, 1999, and April 19, 2000). Paddocks were continuously stocked throughout the grazing season.

Results

Beginning in February of each year, measurements of the amount of forage available were made three to four times (roughly monthly intervals) using a rising plate meter. The average measurement reading indicated more forage was available for grazing with Jackson and Marshall than for Gulf ryegrass paddocks.

Although initial live weights of grazing steers were not different, the mean final weights for steers grazing Jackson and Marshall ryegrass paddocks were heavier than those of steers grazing Gulf ryegrass. This difference was consistent across years. Final weights were similar for both Jackson and Marshall ryegrass paddocks.

Overall live weight gains (three-season average) were 261, 276 and 281 pounds for Gulf, Jackson and Marshall ryegrass paddocks, respectively. Live weight gain, averaged over the three



seasons, was 6.5 percent higher (about 18 pounds heavier) for steers grazing either Jackson or Marshall than for steers grazing Gulf ryegrass paddocks. Live weight gains were consistently higher in each year of the study for Jackson and Marshall than for Gulf ryegrass paddocks. There was no difference in the three-season average of live weight gains between steers grazing Jackson and Marshall ryegrass paddocks.

Average daily gains, averaged over the three seasons, of steers grazing Jackson and Marshall ryegrass paddocks were 6 percent higher (.15 pounds per day difference) than those of steers grazing Gulf ryegrass paddocks. Average daily gains of steers grazing Jackson and Marshall ryegrass paddocks were similar (2.50 and 2.54 pounds, respectively). Ryegrass variety effects on average daily gains were not consistent across grazing seasons, and those differences were highest in 1997-1998 and lowest in the droughty 1999-2000 season.

Live weight gains per acre, averaged across three grazing seasons, were 6.5 percent higher (a 31-pound per acre difference) for steers grazing Jackson and Marshall ryegrass paddocks (502 and 510 pounds per acre, respectively) than for steers grazing Gulf ryegrass

paddocks (475 pounds per acre). Live weight gains per acre, averaged across three grazing seasons, were similar for steers grazing Jackson and Marshall ryegrass paddocks. Live weight gain per acre differences among the ryegrass varieties were not consistent across grazing seasons. Similar to that of average daily gain, the greatest range in varietal difference (565 to 486 pounds per acre for Marshall and Gulf, respectively) was in 1997-1998 season. Varietal difference in live weight gains per acre was lowest in the droughty 1999-2000 season.

Jackson, Marshall Outperform Gulf

Alabama researchers have reported more dramatic differences of ryegrass variety effects on animal performance. While certainly not achieved in the 1998-1999 grazing season, an objective of the winter-spring beef stocker program at the Iberia Research Station was to extend the grazing period that steers are maintained on ryegrass pastures. Also, 1999 and 2000 have been particularly dry years and may have affected steer performance on the different ryegrass varieties; however, steers gained relatively well (approximately 260 to 280 pounds total gain) when averaged across all three grazing seasons. The weight gain (25 to 35 pounds) per acre by steers grazing Jackson and Marshall ryegrass paddocks compared with the steers grazing Gulf ryegrass paddocks was significant.

Assuming seed prices are about 25 cents per pound for Gulf ryegrass and 38 cents per pound for Jackson and Marshall ryegrass, the difference in seed cost, at a seeding rate of 30 pounds per acre, is \$3.90. Assuming a conservative sale price of 80 cents per pound for 700-800 weight cattle, the net profit per acre with Jackson and Marshall ryegrass was \$20 to \$28 compared with Gulf ryegrass. On an individual steer basis, gross sale price for steers grazing Gulf, Jackson and Marshall ryegrass paddocks during the late fall, winter and spring season would be about \$629, \$638 and \$641, respectively. Choice of ryegrass variety in a stocker program can have an economic impact for beef producers. ■

Acknowledgment

The Wax Company, Inc., generously supplied all ryegrass seed for each planting season. Jackson and Marshall ryegrasses are commercially available varieties marketed by the Wax Company, Inc., Amory, Miss.

Photo by Wayne Bourgeois



This is LA Early, one of two new varieties released by the LSU AgCenter.

Two New Satsuma Varieties

The LSU AgCenter has released two new satsuma varieties, LA Early and Early St. Ann. Both of these early-maturing satsumas are products of the citrus breeding program, which develops fresh-market lines of citrus with improved quality, fruit characteristics and production requirements, said Wayne Bourgeois, a researcher at the Citrus Research Station at Port Sulphur, La. The station specializes in navel oranges and satsumas but also works with other citrus products. Bourgeois said both new satsuma varieties produce high quality fruits that ripen from early September to mid-October.

The two new varieties originally were selected in the early 1980s from a group of seedlings planted in the late 1960s by the late Ralph Brown, the first superintendent of the Citrus Research Station.

The taste and flavor of both varieties are excellent, Bourgeois said. The fruits are juicy and slightly acid and have an overall quality that is an improvement over other early satsuma varieties grown in Louisiana. The LSU AgCenter recommends both varieties for commercial and home planting of early satsumas in Louisiana's citrus-growing areas. Bourgeois said homeowners could expect to see either or both of these new varieties in their local garden centers in 2002. ■ **Rick Bogren**

A New Fig, Too

Louisianians have a new fig variety, called LSU Gold, to plant in their orchards, gardens and yards, said Charles Johnson, a researcher in the LSU AgCenter's Department of Horticulture.

"LSU Gold is more yellow, with a lot of good characteristics both for commercial growers and homeowners," Johnson said.

LSU Gold matures relatively early from planting to first fruiting. The fruit is attractive with good quality for eating fresh or preserving. It is larger than most varieties. The LSU Gold tree has good architecture with an open canopy that requires only light pruning.

"In Louisiana, of course, sometimes our winters are too cold," Johnson said. "This variety is fairly tolerant and can survive normal Louisiana winters without dying to the ground." ■ **Rick Bogren**



Saving Coastline

LSU AgCenter plant breeder Steve Harrison collects pollen from smooth cordgrass in a research field in Baton Rouge. Harrison will apply the pollen from this grass, known scientifically as *Spartina alterniflora*, to another plant in a program designed to develop improved plants for protecting Louisiana's eroding coastline. Smooth cordgrass is a native marshgrass species that's adaptable to both fresh and salt water, and it grows aggressively throughout

the Louisiana coastal region. Because wild cordgrass produces low quantities of seed, costly hand transplanting usually is necessary to fill spaces where the grass no longer grows. LSU AgCenter researchers are using traditional agricultural plant breeding techniques to improve seed production so smooth cordgrass can be seeded by airplanes – reducing the cost of restoring bare areas of marsh and providing another tool in the fight to save Louisiana's coast. Photo by Mark Claesgens.

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■ LSU AgCenter research will help improve scouting methods for bollworms in genetically engineered cotton. Page 7

■ Scientists investigate using poultry litter and municipal waste to improve cotton yields. Page 12

■ View three years of All-America rose selections. Page 14

■ Plant growth regulator offers advantages for herbicide-tolerant rice. Page 16

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