2010 REPORT

research
The Mississippi Rice Promotion Board is made of a group of 12 individuals appointed by the Governor of Mississippi to oversee the expenditure of funds generated by the state check-off program. In 2010, approximately $620,000 was granted to scientists to conduct research projects related to the disciplines of agronomy, breeding and genetics, pest management, soil fertility and water conservation. The 2010 edition of Research Highlights features many of the research projects conducted throughout the growing season. We hope that you will find this information beneficial to your individual farming operation. Please notify a promotion board member or contact one of the many scientists who are highlighted in this report if you have challenges on your farm that can be addressed through the research and extension efforts funded by your check-off dollars.

Thank you for your continued support of our rice industry through your service and check-off dollars.

Mississippi Rice Promotion Board

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Essentially all nitrogen fertilizer systems for rice revolve around urea. Urea has the highest concentration of nitrogen of any dry fertilizer and is typically the least expensive form of nitrogen fertilizer. Though it has been the staple nitrogen source for rice for years, urea is less than ideal because it is subjected to loss mechanisms that render some of the nitrogen unavailable to the plant.

The ideal nitrogen fertilizer source for delayed-flood rice is one that has a relatively high concentration of nitrogen and that is in the ammonium form or converts to the ammonium form at the onset of flood establishment. Since there is no perfect source, it is researchers' goal to develop products that act similarly to ideal.

Experiments are being conducted at the Delta Research and Extension Center in Stoneville, Miss., to evaluate products that assist urea in becoming closer to the ideal nitrogen fertilizer. Knowledge of the loss mechanisms that affect urea is key in developing more effective urea fertilizer.

Urea is an organic molecule that contains nitrogen in a form that is not plant available and thus has to be converted. Conversion of urea to the plant available ammonium happens in the presence of moisture and the urease enzyme that is found naturally in soil and decaying plant tissue from previous crops. When this conversion happens on the soil surface, ammonia, which is a gas, can be lost into the atmosphere.

The urea conversion to ammonium is important. However, ammonium is not stable in soils where oxygen is present. Ammonium is converted to nitrate in the presence of oxygen and *nitrosomonas* and *nitrobacter bacteria*. Nitrate nitrogen is not stable in flooded soil conditions because of the absence of oxygen.

Knowledge of the changes of nitrogen in soils has led researchers to develop products that aim to stabilize nitrogen fertilizer by two methods. Chemical methods help reduce loss by suppressing microorganisms involved in the conversion processes. Physical methods essentially create a barrier to protect the urea fertilizer until the appropriate conditions (flood) are present for maximum stability and maximum plant uptake.

The first year of a multi-year study is evaluating the effectiveness of Agrium’s sulfur coated urea (43 percent nitrogen), ENTEC® and SuperU® alongside a control of stand-alone urea.

The sulfur coat essentially acts as a physical barrier to slow the conversion of urea to ammonium and eventually nitrate. ENTEC® contains a chemical that serves as nitrification inhibitor. SuperU® contains both a nitrification inhibitor and the additional active ingredient in Agrotain® that inhibits the urease enzyme that can lead to ammonia volatization. Nitrogen loss in rice production is prone to occur when ammonium is converted to nitrate prior to permanent flood establishment. This microbiological process can cause up to half of the applied nitrogen to be lost upon flooding under the right environmental conditions and the inability to establish a flood within a few days after application.

So far, the research results are promising. A broadcast application of Agrium’s sulfur coated urea (43 percent nitrogen) applied 10 days prior to flood averaged 8,235 pounds of grain per acre, which was equal to urea being applied two days prior to flood. In comparison, urea applied 10 days prior to flood averaged 7,467 pounds per acre.

Chemically stabilized nitrogen products (ENTECC® and SuperU®) need further study to determine the appropriate rates of active ingredient. This work will be continued in 2011.
New research is finding that reducing nitrogen fertilizer rates could cut production costs without sacrificing yields. A 2010 on-farm trial in Bolivar County, Miss., demonstrated that the highest yielding strip was obtained by applying fertilizer based on the N-ST*R (nitrogen soil test for rice) recommendation of 100 pounds of nitrogen per acre applied pre-flood and 45 pounds of nitrogen per acre applied at mid-season. The grower practice of 120 pounds of nitrogen per acre pre-flood plus 45 pounds of nitrogen per acre applied at mid-season resulted in eight less bushels of yield per acre. Greater economic return was realized due to the combination of a higher yield and less nitrogen. Furthermore, many growers currently apply even greater amounts of nitrogen to silt loam soils as compared to the grower’s 165-pound rate that was applied in this test. This gives further evidence that the technologically advanced N-ST*R test developed by the University of Arkansas and cooperating rice states has the potential to help growers be more efficient without losing yield.

Currently, nitrogen is recommended based on varieties and soil texture. Trials are conducted each year with new varieties on clay and silt loam soils. After two to three years of testing a variety’s response to nitrogen, a formal recommendation can be made that considers economics, lodging, and disease. Regardless of the precision the tests are conducted under, the final recommendation is still an average. The N-ST*R allows growers the ability to make fertilizer decisions based on more knowledge of how much nitrogen is supplied by the individual soil(s) on their farm. Growers who have multiple soil types and multiple rotation systems can fine-tune nitrogen rates accordingly. The end result is that the fertilizer is applied at rates that can be greater than or less than the current state-average recommendations.

Many years of experimentation have resulted in a prediction model for silt loam soils. The model is now being tested across the southern rice growing states. The strip trial results mentioned previously are part of validating the proposed model.

The N-ST*R requires the collection of an 18-inch deep core sample of silt loam soils prior to rice planting. Preliminary information suggests that the number of samples would not exceed a few per field, and depending on the uniformity of the soil, one sample per field may be sufficient. Further validation work will be conducted on silt loam soils in 2011 and will be initiated on clay soils.

Another nitrogen management tool in the development stage is the Greenseeker®. This instrument indirectly measures yield potential by measuring biomass and canopy color. Multiple studies have concluded that using the Greenseeker to determine top-dress nitrogen needs results in greater nitrogen use efficiency. This technology, like the N-ST*R, is not ready to be released commercially. However, researchers are validating the models that have been developed in recent years of testing.
Mississippi State University is expanding its Delta Research and Extension Center in Stoneville, Miss., with plans to demonstrate ongoing agricultural research on the additional acreage. The 220-acre farm, which is located southwest of DREC’s headquarters, was obtained through a long-term 16th section lease.

Since acquiring the land in the fall of 2009, the additional acreage has been precision land formed. The new farm also is being divided into a dozen 18-acre fields. Each of the fields has a permanent pad around it and two drain pipes at the bottom of the field. This design will allow the fields to drain into a tail water recovery system, which will capture surface water for irrigation use throughout the growing season.

Beginning in 2011, the farm will host several large-scale research demonstrations showcasing new varieties, seed treatments, tillage practices, crop rotation benefits, and irrigation systems. The demonstration farm will enable scientists to more easily display research results and production components.

In addition, the ongoing tail water recovery system demonstration will allow for a better look into the long-term effects of surface water irrigation as compared to ground water irrigation. DREC’s rice breeding department also will utilize the newly transformed fields for variety testing and selection.

In 2010, eight of the 12 fields were dedicated to rice production. Two of these fields had demonstrations on them and the remaining six were grown as production fields. Due to the amount of extensive work that had to be done to the land, these fields were not planted until the first of June. However, researchers were still able to conduct a few preliminary demonstrations comparing several different varieties and seed treatment options.

The recent acquisition of this land shows Mississippi State University’s commitment to rice research and the Mississippi rice community.
Irrigation pays dividends

By Joe Massey
Associate Professor

More than one dozen commercially available rice varieties yield equally well under a water-saving and energy-saving intermittent flood system as they do in a conventional flood system, according to 2010 research results.

Although this was an unusually dry season, growers using side inlet with intermittent irrigation pumped on average 2.01-acre-feet of water per acre on clay soils as compared to the Yazoo Mississippi Delta Joint Water Management District side-inlet average of 2.7-acre-feet of water per acre. This represents about a 30 percent savings beyond side inlets, again showing that intermittent irrigation extends that water and energy savings beyond that of side-inlet irrigation, even in dry years.

In a 2010 irrigation study, 14 rice varieties were planted at the top and bottom of both a silt loam and a clay rice paddy to compare the effect of intermittent flood to conventional flood in terms of yield and milling quality. The upper clay field plots were subjected to five wetting-drying cycles over the season while the bottom plots were continuously flooded. Water use on the clay field was approximately two-acre-feet of water per acre. Study results demonstrated that rice yields and milling quality were generally not affected by these wetting-drying cycles.

On the silt loam soil, the field proved to be difficult for the grower to irrigate. The upper plots underwent 10 wetting-drying cycles using nearly six-acre-feet of water per acre. At times, the bottom plots were not covered in water, leaving the upper plots exceptionally dry. Yields overall were considerably lower than those observed for the clay soil plots, but there generally were no statistical differences in yield and milling qualities between the top and bottom plots.

In related studies, researchers have developed and lab-tested a low-cost wireless flood level sensor system that is self-sustaining and suitable for remote operation in rice fields. Each sensor is a node that can be configured as a reporting sensor or a relaying sensor. A reporting sensor periodically reports the flood level it is sensing, while a relaying sensor is like a reporting sensor with the ability to relay data from other sensors. The system can be configured to allow multiple fields to be served by one pump controller.

The decision when to pump is based on a system that tallies the number of sensors reporting a low water level. In addition, a demand cost option can be incorporated into the system so that the operation of the pump is based on both preset sensor levels and the lowest associated cost.

Research will continue in 2011 focusing on a pilot field-based test to verify the long-range data capability of the system before researchers deploy a test system in an on-farm study.
Opening niche markets

Breeding advances enhance profitability

By Brian Scheffler and Dwight Kanter
USDA-ARS Genomics and Bioinformatics Research Unit, Rice Breeder

In addition to yield potential and disease resistance, rice breeders know that developing rice varieties with unique traits and characteristics could open niche markets to producers. Soup manufacturers need specific cooking characteristics to create the chicken and rice soup that warms you up on a chilly winter afternoon. Similarly, rice encasing a seaweed-wrapped sushi roll or the rice served smothered with chicken at your favorite Mexican restaurant each require rice with a specific set of cooking characteristics, textures and flavors.

Breeding these cooking characteristics into new rice varieties could open markets previously closed to Mississippi rice growers. To that end, researchers are employing genetic technology to isolate the specific cooking characteristics food manufacturers desire. Breeders are actively searching experimental rice lines in the state’s crossing program in an effort to identify the stable genetic markers that identify characteristics such as firmness or sugar content. The presence of these genetic markers will help breeders narrow down the pool of potential lines to those with both the cooking characteristics food manufacturers desire and the yield potential and planting characteristics Mid-South rice growers require.

Among the cooking properties food manufacturers consider when choosing a rice variety are firmness, cooking time, texture, aroma, and amylose quantity, which is the starch content that is converted into sugar during the cooking process.

Breeders at the Delta Research and Extension Center and at USDA’s Agricultural Research Service, both located in Stoneville, Miss., are making significant progress in their effort to develop new varieties with desirable cooking characteristics. Scientists have been making breeding crosses for several years. However, with the development of molecular markers, they have been able to isolate more than one dozen lines that have cooking properties of interest.
In 2010, Mississippi State University’s Foundation Seed Stocks produced rice seed of Mississippi’s newest release Rex, as well as Cocodrie, Sabine, Hidalgo and Rondo. Although seed quality appears to be good this year, yields were lower than expected. Abnormally high temperatures experienced during the pollination phase of field production are being blamed for lower yields. However, sufficient seed quantities were harvested to fill a high percentage of 2011 foundation seed advance orders. This year’s foundation seed increase acreage was located at the North Mississippi Branch Station at Verona and at an on-farm location in Wayside, Miss.

Protocols designed to insure against the cross contamination of foundation seed begin during the breeding process. The breeder utilizes a combination of field rouging, equipment inspections, and genetic testing of breeder seed that then serves as the source seed from which the foundation seed is planted. Essentially, Foundation Seed Stocks (FSS) continues a similar protocol as the breeder, except on a larger scale. Inspections conducted by the Mississippi Crop Improvement Association, (MCIA) are utilized for all equipment which comes in contact with the seed including the planter, combine, truck, bin, and all seed cleaning and handling equipment. In addition, FSS utilizes land that meets the rotation restriction for foundation class rice as set forth by MCIA. In the field, FSS rogues each field of non-typical plants beginning at pre-heading and continuing through the harvest maturity stage. Lastly, foundation seed lots are laboratory tested. The Mississippi State Seed Testing Lab insures that all adopted minimum standards for germination and purity are met. Liberty Link gene testing also is performed for each variety.

During the 2010 growing season, atypical, undesirable plants were removed from the foundation seed plots beginning at the boot stage. Generally, the undesirable plants removed were taller or pubescent, or exhibited an atypical maturity.

Some degree of plant non-uniformity is almost always present in each variety every year. The complete absence of any visually identified plant anomaly in the field is very rare. With that said, each year the expectation is that the numbers of non-typical plants will be relatively low and practically manageable. This year, in terms of numbers, approximately 10 to 15 plants per acre were removed. One factor that makes this number ambiguous is the difficulty in determining between an obvious non-typical plant and a plant only slightly outside the normal parameters of the variety. Taking no chances, both types are removed.

Despite the significantly high temperatures seen in 2010, harvest of the foundation seed increase acres proceeded without delays. Due to timely plantings beginning March 25, harvest maturity was reached beginning in mid-August.
Heat damage in 2010

Searing temperatures cause sterility

By Tim Walker
Associate Agronomist

Weather conditions in 2010 reconfirmed the results of Delta Research and Extension Center’s planting date study – hitting the first part of a variety’s recommended planting window offers the greatest yield potential.

Rice planted later in the spring has a greater likelihood of reaching the pollination stage when temperatures are highest. If both of these conditions are met, as they were in 2010 when the Delta experienced high daytime temperatures and excessive nighttime temperatures over a prolonged period of time coinciding with pollination, the result can be sterile rice grains.

Many Delta growers experienced a 2010 growing season that was opposite of the 2009 growing season. Rice planting began in earnest the last week of March. By April 10, 2010, 45 percent of the state’s rice crop had been planted. By May 8, greater than 95 percent of the crop was in the ground.

In addition to the 2010 crop’s relatively timely planting, accumulated heat units allowed for rapid stand establishment and seedling growth. Approximately 50 percent of the rice planted early in the recommended planting window reached the heading stage before July 10, 2010.

By the end of July, 95 percent of the state’s planted rice acreage had reached the heading stage. Rice harvest began as early as the first week of August and was in full swing by August 15. Harvest weather was warm and dry, thus harvest proceeded at a record pace.

There is never a perfect year, however. Despite the potential for the 2010 crop, the excessive heat encountered in late July and August took its toll on a large percentage of Mississippi’s rice acreage. In Stoneville, the first seven days of August averaged 103°F as the high and 77°F as the low. Additionally, 11 of the first 15 days of August reached highs above 100°F. Excessive day and nighttime temperature during pollination caused sterility and greatly reduced the yield potential on a considerable amount of acreage. Furthermore, it contributed to lower milling quality on rice that was maturing.
Rex performs well
Mississippi releases new variety

By Tim Walker and Dwight Kanter
Associate Agronomist, Breeder

A new Mississippi conventional rice release will be available commercially as foundation seed for the first time in 2011. Rex, named for Mississippi rice pioneer Rex Kimbriel, performed among the top varieties in 2010 rice variety trials. Also known by its experimental name RU0804083, Rex resulted from the breeding cross of Rosemont, Rexmont and IR36.

The conventional variety is an early maturing semi-dwarf with excellent yield potential, excellent straw strength and above average standability. Rex grain yields have been high over the past four years of testing averaging 214 bushels per acre. In addition, yields have been extremely stable ranging from a low in 2010 of 211 bushels per acre and a high in 2008 of 219 bushels per acre. Milling yields for Rex during the same period of time has averaged 58 percent whole and 69 percent total. In 2010, Rex averaged 59 percent whole and 68 percent total milled rice. Its maturity is very similar to Cocodrie and CL151. Rex is rated susceptible to sheath blight, blast, kernel smut, and bacterial panicle blight diseases. It is rated moderately susceptible to straighthead disorder.

Currently, it is recommended that Rex be planted at a seeding rate of 75 to 90 pounds per acre with a fungicide, insecticide, and GA3 seed treatment.

The release of Rex, and Mississippi’s first Clearfield variety, CL162, are the first products of a more streamlined approach adopted in the fall of 2008 by the breeding program at the Delta Research and Extension Center in Stoneville, Miss. Researchers anticipate the breeding program enhancements will result in the release of at least one new rice variety every two to three years.

In 2010, the program was able to double most all aspects of the breeding program as compared to 2009. Approximately 3,500 populations were evaluated for yield and lodging on early generation progeny. Furthermore, approximately 200 populations were evaluated for yield and milling on advanced progeny. Approximately 50,000 progeny rows were evaluated during the 2010 growing season. The active greenhouse crosses and F2 nurseries will ensure progress of the program into the future.
Clearfield options for 2011

New hybrid increases growers’ options

By Tim Walker and Dwight Kanter
Associate Agronomist, Breeder

A limited amount of seed will be available in 2011 for those growers interested in planting Mississippi’s first Clearfield release, CL162.

Mississippi’s first new Clearfield variety, CL162 represents 10 years of Clearfield rice breeding at the Delta Research and Extension Center. CL162 was bred from the parental lines of CL161 and the Mississippi conventional variety, Priscilla.

The early-maturing variety is high yielding, performing similar to CL151, CL131 and CL111. In addition, it has shown to have low incidences of lodging, a good milling yield and good straw strength. On average, the variety will reach 40 to 42 inches in height, with a maturity similar to that of Cocodrie and CL151.

Tested two years in on-farm variety trials, CL162 has yielded an average of 203 bushels per acre. In 2009, CL162 variety trials produced a 207-bushel average yield, a 72 percent total milling yield, and a 62 percent whole grain milling yield. Plant height averaged 42 inches tall and maturity averaged 120 days. Results of the 2010 variety trials were similar with CL162 averaging 199 bushels per acre, a 69 percent total milling yield, and a 57 percent whole grain milling yield.

Limited research data suggests that CL162 is susceptible to sheath blight and blast diseases, but is moderately resistant to bacterial panicle blight. CL162 is also rated moderately susceptible to straighthead similar to its parent CL161. Current seeding rate recommendations suggest planting CL162 at a rate of 75 to 85 pounds per acre. It is recommended that seed be treated with a combination of fungicide, insecticide and GA3. Fertilization recommendations vary based on soil type with clay soils calling for 180 pounds of nitrogen per acre and silt loam soils requiring 150 pounds of nitrogen per acre.
New weapons in weevil war

Two products granted labels

By Jeff Gore and Don Cook
Entomologists

Cruiser® 5FS by Syngenta Crop Protection and Dermacor® X-100 by DuPont were granted full labels in 2010 for rice water weevil control. The insecticidal seed treatments have been put to the test in three years of studies on growers’ farms and at the Delta Research and Extension Center in Stoneville, Miss. These trials consisted of small plot replicated experiments and large plot demonstration trials with seeding rates ranging from 25 pounds per acre to 120 pounds per acre. Multiple rates of thiamethoxam (Cruiser 5FS) and chlorantraniliprole (Dermacor X-100) were included in the research.

Specifically, four-inch root core samples collected at three to five weeks post flood were washed through a one-quarter inch screen into a finer screen to collect rice water weevil larvae. The sieves were placed in a five percent saltwater solution and the numbers of larvae that floated to the surface were counted.

Both Dermacor and Cruiser provide good rice water weevil control, according to the Mississippi research results. Percent control over the three years has ranged from zero to 100 percent depending on initial larval densities. In general, little benefit is observed from either seed treatment when rice water weevil densities are low. Both seed treatments provide good control when moderate populations of rice water weevil are present on roots. When rice water weevil populations greater than 20 larvae per core occur, Dermacor provides better control than Cruiser. However, control with Cruiser is acceptable.

Both of the seed treatments provide significant benefits in terms of yield. Over the three-year period, Dermacor provided an 11.8-bushel-per-acre yield increase and Cruiser provided an 8.3-bushel-per-acre yield increase. Based on the yield results, Dermacor and Cruiser provided a 72 percent and 79 percent probability of a net return, respectively. Based on these results, insecticidal seed treatments are recommended for rice water weevil control in Mississippi.

In the pipeline

By Jeff Gore and Don Cook

Rice producers will soon have another product in their rice water weevil control arsenal. Produced and marketed by Valent, Nipsit Inside is an insecticidal seed treatment expected to become commercially available in the near future.

Prior to its commercial release, research at the Delta Research and Extension Center in Stoneville, Miss., is determining the relative efficacy of Nipsit Inside against the rice water weevil as compared to other commercially available seed treatments such as Cruiser 5FS and Dermacor X-100.

In 2009 and 2010 studies, rice water weevil infested research plots were sampled three to four weeks after permanent flood establishment using four-inch diameter core samples from the center of each plot. After being filtered and placed in a saltwater solution, the number of rice water weevil larvae were documented.

According to the study, Nipsit Inside did not provide a benefit when rice water weevil densities were low. At moderate and high densities, Nipsit Inside provided rice water weevil control similar to Cruiser 5FS. Nipsit Inside also provided an average yield benefit of nine bushels per acre.

With the product price still an unknown, an economic benefit analysis could not be conducted. The probability of seeing a net economic return with Nipsit Inside will most likely be similar to Cruiser and Dermacor.
Application timing critical
Study evaluates water weevil control

By Jeff Gore, Don Cook and George Awuni
Entomologists

Prior to the commercial release of Dermacor X-100 and Cruiser 5FS as seed treatments for rice water weevil control, a foliar pyrethroid application was the only management option available for rice water weevil control. Despite new control options, a large percentage of Mississippi’s 2010 rice crop did not have an insecticidal seed treatment and relied on foliar insecticide applications for rice water weevil control.

Application timing is critical when using foliar treatments and even then these applications may provide sporadic control. An experiment was conducted at the Delta Research and Extension Center in Stoneville, Miss., to determine the optimum application timings of Karate, a pyrethroid, and Belay, a neonicotinoid, for rice water weevil control.

In the study, Wells rice cultivar was treated with Karate at 2.56 fluid ounces per acre or Belay at 4.5 fluid ounces per acre. Application timings included pre-flood, one day post flood, and seven days post flood, with rice water weevil larval densities determined at four weeks post flood. At the end of the season, plots were harvested and yields were determined.

Based on densities of rice water weevil larvae, Karate was more sensitive to application timing than Belay. Rice water weevil densities were significantly lower for all of the Belay timings and the Karate applied seven days after flood, as compared to the untreated control, Karate pre-flood and Karate one-day post flood treatments.

There were no differences in rice water weevil densities among the Belay timings. Belay, like other neonicotinoids, has systemic activity within the plant. This systemic activity is probably an important reason why application timing does not appear to be as critical for Belay, which is not labeled for foliar applications in rice.
Hybrid rice offers producers a high yielding alternative to traditional cultivars. It may also be inadvertently reducing the effectiveness of seed applied insecticides to control rice water weevils.

Because hybrid rice produces more tillers than traditional cultivars it can be planted at seeding rates as low as 20 to 25 pounds of seed per acre. That is a significant reduction from the 70 to 90 pounds per acre of seed used to plant conventional rice varieties. This can have an impact on seed treatment rates because the rate of insecticide per acre is directly proportional to the seeding rate.

In the case of Cruiser 5FS, the labeled rate is 3.3 fluid ounces per 100 pounds of seed regardless of seeding rate. In contrast, the rate of Dermacor X-100 varies based on seeding rate. Dermacor rates range from a low of 1.5 fluid ounces per 100 pounds of seed at a seeding rate of 120 pounds per acre up to 6.0 fluid ounces per 100 pounds of seed at a seeding rate of 30 pounds per acre.

Ongoing research at the Delta Research and Extension Center and on grower farms is attempting to pinpoint the optimum hybrid rice seed treatment rates per 100 pounds of seed for Cruiser 5FS and Dermacor X-100.

In the study, hybrid rice seed was planted at 25 pounds of seed per acre using varying seed treatment rates of Cruiser 5FS and Dermacor X-100. Cruiser 5FS was applied at several rates including: 3.3 fluid ounces per hundredweight, 6.6 fluid ounces per hundredweight, 9.9 fluid ounces per hundredweight, and 13.2 fluid ounces per hundredweight. Dermacor X-100 treatment rates included: 2.0 fluid ounces per hundredweight, 3.25 fluid ounces per hundredweight, 4.75 fluid ounces per hundredweight, and 6.0 fluid ounces per hundredweight.

Four weeks after permanent flood was established, rice water weevil densities varied greatly between the treatments. In general, rice water weevil densities were higher on the lower seed treatment rates. Treatments that did not lower larval populations below the untreated control included Cruiser at 3.3 fluid ounces per hundredweight and at 6.6 fluid ounces per hundredweight. The highest seed treatment rate for each product provided the greatest level of rice water weevil control.

The hybrid rice treated with Cruiser at the 9.9-ounce rate and at the 13.2-ounce rate and Dermacor at the 6-ounce rate produced the highest yields. In addition, Dermacor at the 4.75-ounce rate had significantly higher yields than the untreated control. This demonstrates the importance of using the appropriate seed treatment rate when planting hybrid rice.

Currently, the only labeled rate of Cruiser 5FS is 3.3 fluid ounces per hundredweight regardless of seeding rate. This does not appear to provide acceptable control of rice water weevils at low seeding rates. In contrast, Dermacor X-100 has a rate range on the label based on seeding rate, making Dermacor X-100 at the six-ounce rate the best option on hybrid rice.
Rice stink bugs can significantly impact yields and grain quality depending on the timing of infestation, according to 2010 research.

Rice stink bugs can cause both direct and indirect yield losses in rice. Insect feeding during the early stages of panicle development causes reduced grain weight and blank kernels, and feeding during the later stages of panicle development causes discolored kernels. Additionally, stink bug damaged kernels can break during the milling process resulting in low milling turnout.

Current research is investigating the interactions between the rice stink bug and fungal pathogens on rice yields and quality. In the 2010 Stoneville, Miss., study, individual rice panicles were infested with adult rice stink bugs using sleeve cages. Each panicle was infested with one or two rice stink bugs and compared with caged non-infested panicles at three growth stages of panicle development including bloom, milk, and soft dough. With 20 cages placed over rice panicles in a completely randomized design, each caged panicle served as a replication.

At the end of the season, each infested and non-infested panicle was harvested by hand. The individual grains from each panicle were divided into three categories including undamaged, discolored, and blank. Numbers of kernels and weights were recorded for each category.

Regardless of infestation level, rice stink bug injury was significant both the first seven days after flowering at bloom stage and eight to 14 days after flowering at the milk stage. In 2010, extremely high temperatures during the flowering period of rice development significantly impacted overall grain yields. However, relative differences among infestation densities and timings were observed. The impact of rice stink bug infestations varied with panicle development. Mean harvestable grains were significantly lower where one or two stink bugs were infested per panicle compared to non-infested panicles during the bloom stage. Discolored kernels were significantly higher during the milk stage compared to the bloom and soft dough stages.

In general, infestations with two rice stink bugs sustained significantly more panicle damage than either infestations with one rice stink bug or the control. The results suggest that rice is most susceptible to yield loss from rice stink bug injury during flowering.

In contrast, greater reductions in grain quality were observed from infestations during the milk stage of grain development than during the flowering or soft dough stages. These results suggest that stink bugs need to be aggressively controlled during the flowering and milk stages of panicle development. Some yield and grain quality losses also can result from stink bug feeding during the soft dough stage. If high populations of stink bugs occur during the soft dough stage, insecticides should be applied to prevent economic losses.
Bacterial panicle blight of rice caused by *Burkholderia* is an emerging rice disease in the southern United States. A second year study is investigating the primary inoculum sources of the disease and evaluating tolerance within the most commonly planted rice varieties, specifically focusing on the Clearfield varieties currently planted on more than 65 percent of the state's acreage. While severe outbreaks of the bacterial disease were reported in 2010 in Arkansas, Louisiana and Texas, this was not the case in Mississippi.

During the 2010 season, 60 rice fields in seven counties (Bolivar, Sunflower, Leflore, Washington, Coahoma, Quitman and Tallahatchie) were scouted for the presence of bacterial panicle blight and other diseases potentially caused by bacteria. The results of the survey revealed that the bacterial panicle blight occurred rarely and did not cause significant impact on rice yields throughout the production area. However, bacterial disease symptoms were identified in a field adjacent to a Coahoma County field in the study, and more than 50 percent of the panicles in that field were infected by the bacterium.

Researchers have determined that the bacteria that causes bacterial panicle blight inhabits the soil throughout the rice producing areas of the Mississippi Delta. With that in mind, the current multi-year study is allowing researchers to study incidences of the disease under varying environmental conditions, which will potentially allow researchers to determine both the specific environmental conditions involved with disease development in Mississippi and susceptible varieties.

The study includes the collection of those plants exhibiting symptoms of bacterial diseases, soil from around the root zone of rice plants, and water samples from rice fields. Of the plant samples collected in 2010 with suspected bacterial disease infections, 88 percent tested positive for *Burkholderia glumae* and 12 percent were positive for *B. gladioli*. Eighty percent of the collected soil samples tested positive for *B. glumae* and three percent tested positive for *B. gladioli*. In addition, 85 percent of the water samples collected were *B. glumae* positive.

What we now know is that *B. glumae* is present in most Mississippi rice fields. However, a specific environment is required for infection of the developing panicle to occur. This environment likely includes high temperatures that would be more regularly encountered during years with drought. In addition, greenhouse screenings of Mississippi grown rice varieties are testing tolerance to the bacteria that causes panicle blight. Trials are currently being conducted in the greenhouse with the seven varieties screened in 2009 as well as with the three additional varieties of CL111, Sabine, and Cheniere. Last year it was determined that none of the varieties showed high resistance to the bacterial pathogens.
Rice sheath blight, caused by *Rhizoctonia solani*, is the single most devastating fungal disease of rice in Mississippi. And because there are no commercially available rice sheath blight tolerant varieties, fungicides are currently the best means of yield loss prevention.

A continuing Stoneville, Miss., study is using popcorn to show how well some new fungicide formulations perform against the disease. To conduct the sheath blight research, 425 pounds of popcorn were popped, and then infested with both a blended culture of the sheath blight fungus *Rhizoctonia solani* and a general growth medium to encourage fungus development.

The infected popcorn is distributed across rice test plots after a permanent flood is established. The popcorn then floats in the flooded paddy with the rice plants, aiding in the sheath blight infection process of the rice plants being studied. Popcorn is used for inoculum production since once the fungus is allowed to grow on the popped kernels the popcorn will float on the water and physically maintain contact with the stem of the rice plant. This simulates the method by which fungal structures, called sclerotia, infect the rice plant in the field. The sclerotia float from the soil, gather around the stem of the rice plant, and infection ensues.

With fungicides presently the best means of yield loss prevention when applied at the proper growth stages, the 2010 sheath blight trials tested the efficacy of several new fungicide products in the popcorn infected rice fields. The products tested included Stratego, Stratego Pro, Quilt Xcel, Headline, and tank mixes of Headline plus Ballad at panicle differentiation plus 14 days.

Tank mix combinations of Headline plus Ballad included Headline at rates of three ounces, six ounces, or nine ounces plus Ballad Plus at either the 16- or 32-ounce rate. At present, Ballad is marketed as a product that can be used in tank mix combination with a strobilurin fungicide to reduce the risk of resistance developing within fungal populations to specific fungicide classes. Tank mixing with Ballad did not enhance the protection from sheath blight in the 2010 research. This is the third year of trials with tank mixes that included Ballad. The three years of trials suggest that Ballad does not increase the level of protection of a fungicide.

Another test plot pitted fungicides in head-to-head trials. In these plots, Stratego Pro, whether applied alone or in combination with Gem or Tilt, out performed Quadris and Stratego.

While the high temperatures encountered during the summer of 2010 made it difficult for inoculum to successfully infect plots in some cases, the study did show that fungicides are continuing to prevent yield loss in response to sheath blight of rice. In addition, adding a biological fungicide is not increasing product performance.
Two weeks to yield
Barnyardgrass control tips

By Jason Bond
Weed Scientist

With unusually heavy pressure and excellent growing conditions, many producers found it difficult to adequately control barnyardgrass in 2010.

The most effective path to barnyardgrass control, research shows, is an integrated program with multiple herbicide modes of action and multiple applications. Specifically, barnyardgrass must be controlled in the first two weeks after rice emergence to avoid yield loss. Also important are a clean start and a proactive strategy instead of a reactive strategy.

Mid-South researchers have documented barnyardgrass resistance to several herbicide chemistries used in rice, including the ALS herbicide Newpath. Even in fields where barnyardgrass is not resistant, control failures could occur if herbicides are applied too late or if a follow-up treatment is not applied. Possibly as a side effect of Roundup Ready technology in row crops and the Clearfield system in rice, growers have become accustomed to delaying the first herbicide application more and more in the last few years. This can have negative consequences on rice yield and barnyardgrass control.

Research at the Delta Research and Extension Center (DREC) in Stoneville, Miss., is determining the impact of delaying barnyardgrass control, the optimum timing of control strategies, and the best control strategies for resistant populations. Mississippi rice fields contain barnyardgrass populations known to be resistant to propanil and quinclorac (Facet, Quinstar), and two populations are currently being tested for resistance to Newpath. Should resistance to Newpath be confirmed, this research will be vital to managing these resistant populations.

In one DREC study, Ricestar HT plus Command was applied at weekly intervals from planting until flood. Once a plot was treated, it was maintained weed free thereafter.

Regardless of the interval after rice emergence, all plots required at least two herbicide applications. For the later intervals, such as three to four weeks after emergence, control never exceeded 76 percent even with multiple herbicide applications. Compared with a weed free check, rice yields were reduced 15 percent by delaying herbicide application until two weeks after emergence. During the first four weeks after rice emergence, rice yields were reduced 2.4 bushels per acre for each day that a herbicide application was delayed. Due to extreme heat during pollination, 2010 rice yields were low. The yield reductions due to barnyardgrass competition may have been even greater in a higher yielding environment.

A related study evaluated potential programs in the event that barnyardgrass in Mississippi becomes resistant to ALS- or ACCase-inhibiting herbicides. ALS-inhibiting herbicides that target barnyardgrass include Newpath, Beyond, Regiment, and Grasp. ACCase-inhibiting herbicides are Clincher and Ricestar HT.

According to this research, single postemergence herbicide programs were ineffective against barnyardgrass. Multiple applications of postemergence and residual herbicides were needed to achieve adequate barnyardgrass control, and application timing was critical for control. Although they often required sequential treatments, earlier postemergence herbicide applications performed better than later ones because of the size of barnyardgrass at application. With this in mind, starting clean and utilizing a residual herbicide are critical first steps in barnyardgrass management. Postemergence herbicide applications should target barnyardgrass in the two- to three-leaf stage for adequate control. At least one application of propanil should be made immediately prior to flooding for season-long barnyardgrass control.

Barnyardgrass can be managed in rice, even if it is resistant to Newpath. However, programs must be built around residual herbicides. When barnyardgrass does emerge, the timing of the postemergence herbicide is critical, and it should always include premixes or tank-mixtures of herbicides with multiple modes of action to reduce the pressure on the few chemistries available that are active against barnyardgrass. If a propanil-resistant barnyardgrass population evolves multiple resistances to ALS- and ACCase-inhibiting herbicides, control options will be severely limited.
Battling resistant pigweed

By Jason Bond
Weed Scientist

According to weed surveys, 50 to 60 percent of the Palmer amaranth populations in the Mississippi Delta are resistant to ALS herbicides. And with glyphosate resistance documented in 10 Mississippi Delta counties, including all of the rice-producing counties bordering the Mississippi River, battling herbicide-resistant Palmer amaranth is likely to get increasingly more difficult in rice.

Also known as pigweed, Palmer amaranth has long antagonized the state’s cotton and soybean growers, and now it is beginning to impact rice production. A close relative of Palmer amaranth, waterhemp is also a very troublesome pigweed species in the area. Because a majority of rice is grown in rotation with soybeans, pigweed that is not controlled in the soybean crop will impact rice the following year. In addition, pigweeds that are uncontrolled in the rice crop (especially on levees) will impact the following year’s soybean crop where these species are more difficult to control.

Studies at the Delta Research and Extension Center in Stoneville, Miss., are evaluating single herbicides and tank mixes in single applications to determine the best treatments to control pigweeds. Herbicide programs for pigweed control also are being evaluated to determine how pigweed control fits into an overall rice weed management program.

In the research, propanil at four quarts per acre plus Grandstand at 0.75 pints per acre has provided the most consistent control in rice paddies. The new herbicide premix, Broadhead, has been found to be effective on pigweeds that are less than three inches in height. Pigweed will not survive flooding, but weeds must be treated early to avoid yield losses due to competition, especially in areas where the pigweed density is high.

Even if a herbicide treatment does not completely control pigweed, injured plants generally die rather quickly after flooding. For instance, a combination of Aim plus Permit was not effective on larger pigweeds at DREC both because Aim is a contact herbicide that will not kill large pigweeds and because Stoneville’s pigweed population is ALS resistant. However, when the resistant pigweeds were treated with Aim plus Permit one to two weeks before flood, control improved from 60 percent at the time of flood to 87 percent two weeks after flood.

Pigweeds are difficult to control on levees because levees are not covered by the floodwater and are generally sprayed later in the year when weeds are too large to achieve 100 percent control. Palmer amaranth plants left uncontrolled on levees produce seed that will impact soybean and rice crops in following years. As a result, the goal of levee herbicide applications for pigweeds is to prevent seed production.

Pigweeds, specifically Palmer amaranth, have become a primary weed in many rice-producing areas of Mississippi. This problem will likely get worse as the severity of the glyphosate resistance problem increases in row crops in the Delta. Rice growers should include Palmer amaranth management in their weed control plans for the upcoming season and target early applications to very small pigweeds.