Mississippi Rice Promotion Board

Annual Research Highlights

2008

The Mississippi Rice Promotion Board: Your Check-Off Dollars At Work!
January 29, 2008

TO: Mississippi Rice Grower

FROM: Donald Gant, Chairman

SUBJECT: 2008 Annual Report

On behalf of your Mississippi Rice Promotion Board, I am pleased to provide you with the enclosed information. Each project leader that received funding from rice check-off dollars has highlighted results from at least one aspect of their respective program. The board sets out each year to fund projects that have the most potential to positively affect your profitability.

In 2008, approximately $550,000 was awarded to University and Government scientists who have collaborated to work on the disciplines of Agronomy, Breeding, and Pest Management. In addition, the RITE program was funded to demonstrate the best management practices recommended by the aforementioned disciplines.

If you have projects that you believe are worthy of further investigation by one of the scientists at MSU or USDA-ARS, please contact them directly or let one of your board members know so that information can be passed along to those conducting the research. Feel free to contact the scientists if you have questions regarding any of the results and/or recommendations that are included in this report.

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

DG/tw
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DELTA RICE PRODUCERS INCREASE THEIR PROFITS THE R.I.T.E. WAY

STONEVILLE--The cost of inputs with rice production has increased steadily due to fuel and fertilizer, and growers are facing quandaries over maximizing profits and reducing expenditures.

Researchers at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville are helping producers find ways to reduce expenses using RITE (Rice Improvement through Technology and Education), a program funded by grower check-off dollars and initiated by the Mississippi State Extension Service and the Mississippi Rice Promotion Board.

Nathan Buehring, an Extension rice specialist at DREC, coordinates the program, now in its fourth year.

“R.I.T.E. educates rice producers about current recommendations and lets them see how those suggestions perform on their farms,” Buehring said.

For instance, research at Mississippi State showed that absorption and translocation of the rice herbicide, Regiment, increased in barnyardgrass when UAN-based adjuvant was included in the application.

“We wanted to determine if the outcome could be replicated in the field. On two fields, each with significant populations of 4-to-5 leaf barnyardgrass enrolled in the R.I.T.E. program in 2006, Regiment was applied with a UAN-based adjuvant,” Buehring said.

The Regiment applications to these two fields resulted in nearly one hundred percent control of the barnyardgrass. As a result, rice producers have felt more confident in barnyardgrass control with Regiment than previously.

“This also helped producers become more familiar with our current recommendations and ideas on how to increase profitability in rice production,” Buehring said.

Organized in 2005, R.I.T.E. is funded by the Mississippi Rice Promotion Board, and is open to any interested Mississippi rice producer. In 2008, R.I.T.E. participants included three producers and four fields.

With 230,000 acres designated to rice in 2008, Mississippi, ranks fourth behind Arkansas, Louisiana and California in rice production. Most of the state’s rice is grown in the Mississippi-Yazoo Delta area in Bolivar, Washington and Sunflower counties.

The 2008 R.I.T.E. on-farm test sites were located near Pace in Bolivar County and near Minter City in Leflore County.

To learn more about participating in R.I.T.E., contact Buehring at nathanb@ext.msstate.edu.
RESEARCH SHOWS SUCCESSFUL RICE
PRODUCTION POSSIBLE WITH LESS WATER

MISSISSIPPI STATE—As production input costs rise, Delta rice producers continue to find ways to trim their expenses, and Mississippi State University researchers Dr. Joe Massey and Dr. Filip To are helping.

The two researchers conducted field tests to determine if intermittent (less-than-full) flood management can aid in reducing water and energy input costs while maintaining acceptable grain yields and quality.

“Our goal with less-than-full flood management was to maintain freeboard in rice paddies to better catch rainfall which would reduce pumping and associated pumping costs,” Massey said.

Critical to the less-than-full flood management approach was the use of multiple or side-inlet irrigation that allows for more rapid reestablishment and better overall control of flooding (Fig. 1).

In 2008, irrigation tests were conducted on producer sites in Bolivar and Coahoma counties using intermittent plus multiple-inlet flood trials. Trials were also performed on a simplified mechanical float designed to aid producers in managing the rice flood once the rice canopy closed.

Pump controllers to control electric wells were also investigated and the results are discussed below.

Water use, rice yield and quality data were collected on a total of five field sites at two producer locations. Results are summarized in Table 1.

Compared to rice water use data collected by the Yazoo Mississippi Delta Joint Water Management District (YMD) (Table 2) growers were able to extend their water savings beyond the 2.9 A-ft water/A average for side-inlet irrigation by managing their flood using the less-than-full approach.

Producers using intermittent irrigation pumped an average of 2 A-ft water. This amounted to almost 1 A-ft of water less than the YMD average for multiple-inlet irrigation alone.

Rough rice yields ranged from 160 to 189 dry bu/A. Like in previous study results, no differences in rice milling quality were observed (Table 1).

Continued on page 6

Figure 1.
Continued

At the Kline site, a typical irrigation cycle was 8 to 10 days. The straight-levee fields were flooded to an average depth of approximately four inches, the pumps were turned off and remained so for 7 to 8 days.

During this time, the flood naturally subsided so that mud showed in the upper portions of the upper paddies in the field. The mud stage was maintained for about one day after which the flood was reestablished. Reestablishment of the 4-in. flood in the 34-acre field took one to two days and in the 60 to 70 acre field, three to four days.

The cycle then repeated itself. Approximately eight dry down cycles were performed.

At the Dulaney straight-levee site, the typical irrigation cycle was nine days from full flood to reestablishment of the flood. The first dry down cycle began two weeks after the initial 4-in. flood was established. The pumps were turned off for approximately six to seven days before the flood was reestablished.

Following this, the field was pumped to full flood and allowed to dry to wet mud in the upper portions of the upper paddies, usually taking around seven days to do so.

As before, the flood would be reestablished, taking about two days to pump the field back to full capacity if no rainfall occurred. In August, water was pumped for three days.

Growers found that standard weed control programs for conventionally flooded production provides satisfactory results in an intermittent flood regime.

“Getting a good rice stand established is key,” said Earl Kline, who has been irrigating in this manner for three seasons.

Once the rice tillers and canopies close, little if any additional weed pressure is observed, Kline said. Table 3 lists the weed control programs used in 2003.

A low-cost, simplified mechanical flood depth indicator (Fig. 3, below) was constructed and installed in a number of grower fields. The flood depth indicator was designed to help producers more easily manage rice flood depths in fields to minimize overpumping and to improve rainfall capture, especially at canopy closure proved helpful.

Growers using zero-grade systems also seemed to like the depth gauge.

Continued on page 7
This report shows that additional reductions in water use are possible using intermittent plus multiple-inlet irrigation. The system represents a method that builds upon water savings of multiple-inlet irrigation while avoiding some of the rotational cropping pitfalls often associated with a more water efficient zero-grade system.

Figure 1: Conceptual flood cycle for intermittent versus conventional rice flood management.
### Table 2. Results from 2008 YMD Water Use Surveys for Various Mississippi Rice Production Systems.

<table>
<thead>
<tr>
<th>Irrigation System</th>
<th>Contour (A-ft/A)</th>
<th>Straight Levee</th>
<th>Multiple Inlet</th>
<th>Zero-Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Use</td>
<td>3.5</td>
<td>3.3</td>
<td>2.9</td>
<td>1.3</td>
</tr>
</tbody>
</table>


### Table 3. Fertility and Weed Control Programs Used During 2008 Growing Season.

<table>
<thead>
<tr>
<th>Producer</th>
<th>Fertility</th>
<th>Weed Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kline</td>
<td>100 lb/A AMS early season. 200 lb/A 41-00-04 pre-flood. 180 lb/A 41-00-04 mid-season fb 125 lb/A 41-00-04 ten days later.</td>
<td>Touchdown + Roundup burndown + Command at planting. Prowl H2O + Clincher pre-flood. Clincher was applied as need for grasses.</td>
</tr>
<tr>
<td>Dulaney</td>
<td>300 lbs/A urea at 5-leaf + 100 lb/A urea midseason.</td>
<td>Burndown + Command at planting. Riceshot + Bolero + Grandstand at 5-leaf pre-flood. Clincher was applied as needed for grasses.</td>
</tr>
</tbody>
</table>
PHOSPHORUS IMPROVES RICE PRODUCTION

STONEVILLE—The cost of phosphorus (P) fertilizer soared past $1000 per ton in 2008, which was a dramatic increase from $240 per ton paid by growers in 2005. This price increase caused Delta rice producers problems and Mississippi Agricultural Forestry and Experiment Station (MAFES) researchers are looking for ways to help ease their situation.

"Phosphorus is vital to rice production and helps promote root growth and development as well as tiller production. The jump in the price of phosphorus was evident in the number of P deficiency related problems that were diagnosed in 2008," said Tim Walker, MAFES agronomist and rice researcher.

Since 2003, MAFES researchers at Mississippi State University's Delta Research and Extension Center in Stoneville have been correlating Lancaster extractable phosphorus (soil test P) to rice grain yield response.

"This research will help growers make decisions on phosphorus fertilization for the 2009 spring and beyond," Walker said.

Rice producer Ronnie Aguzzi opened his fields to Walker’s research.

“Tim’s applications of phosphorous really helped increase our production. Instead of anticipated yields of 60 to 80 bushels an acre in P-deficient spots, we harvested 160 to 170 bushels an acre,” Aguzzi said.

In all fields tested, the average yield loss from P deficiency ranged from less than five percent to 80 percent with an average of 15 percent.

While results showed that Lancaster-P was not reliable of predicting P fertilization needs when used alone, when combined with soil pH, the ability to predict P response increased greatly.

When soil pH rises above 6.0, the Lancaster-P concentration at which at least 90 percent of maximum yield can be obtained also increases. For example, when soil pH is 6.0, the critical level for Lancaster-P is 15 lb P/acre; however, if the pH is 8.0, then 15 lb P/ acre.

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Continued...

acre could result in a 30% yield reduction. “If a soil sampling plan has not been implemented yet, now is a good time to start. The costs of soil sampling are far less expensive than blanket application of phosphorus fertilizer,” Walker said.

Though grid sampling will be beneficial in identifying precise areas that have fertilizer needs that vary from other areas within a field, it is not necessary.

Yield monitor data may be available to serve as good tools to direct sample points while cut-sheets from land-leveling can serve as a good source of information to guide sampling strategies.

The results presented here have not been updated in MSU’s laboratory results; however, for soil sample interpretation, feel free to contact Walker.
Planting Date Important to Stabilizing Grain Yields

Investigator: Dr. Tim Walker, Associate Research Professor, DREC, P.O. Box 197, Stoneville, MS 38776; Cell: (662) 822-2291; Office: (662) 686-3278;

STONEVILLE—In an on-going study at Mississippi State University’s Delta Research and Extension Center (DREC), rice researchers evaluated newly-released cultivars over a wide range of planting dates.

Their goal was to evaluate yield stability under various environmental conditions that occurred due to planting rice over a twelve-week period.

“We tested planting windows for multiple conventional and Clearfield (CL) varieties and hybrids. The targeted date of planting each year is the first dry date after March 15, so after the first planting of rice subsequent tests are planted approximately every two weeks. The first week of June is the last planting date,” said Dr. Tim Walker, Mississippi Agricultural Forestry Extension Service rice researcher at DREC.

Table 1 lists average yields for six dates of planting for conventional and CL cultivars grown in Stoneville in 2007 and 2008. A stability factor was calculated by taking the lowest yield from the given year, dividing it by the highest yield for that year, and then multiplying it by one hundred.

In 2007, loss ranged from 22 percent for XL723 to 14 percent for Cocodrie. In 2008, the range was 36 percent for Catahoula to 17 percent for Bowman. The lowest yield was produced on the June 4th planting in 14 of 16 site years (8 cultivars x 2 years).

This research continues to show that early planting reduces the risk of yield loss. Yet, early plantings can result in seedling disease which causes decreased plant populations and stressed plants. Such can be offset in part by using fungicide-treated seeds at the highest labeled rates as well as increasing seeding rates by to 40 to 45 seeds per square foot.

Regardless of whether rice is planted on March 20 or April 20, dates of flooding and harvest have been close together in recent years. Therefore, one should expect to potentially have more expenses in weed control and irrigation

Table 1. Yield for eight cultivars planted at six dates during 2007 and 2008.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Year</th>
<th>22-Mar</th>
<th>5-Apr</th>
<th>20-Apr</th>
<th>8-May</th>
<th>21-May</th>
<th>4-Jun</th>
<th>Stability %</th>
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<tbody>
<tr>
<td>Bowman</td>
<td>2007</td>
<td>196</td>
<td>190</td>
<td>219</td>
<td>198</td>
<td>209</td>
<td>184</td>
<td>84</td>
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<tr>
<td></td>
<td>2008</td>
<td>186</td>
<td>209</td>
<td>201</td>
<td>212</td>
<td>193</td>
<td>175</td>
<td>83</td>
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<tr>
<td>Catahoula</td>
<td>2007</td>
<td>176</td>
<td>183</td>
<td>198</td>
<td>178</td>
<td>211</td>
<td>175</td>
<td>83</td>
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<tr>
<td></td>
<td>2008</td>
<td>174</td>
<td>166</td>
<td>185</td>
<td>195</td>
<td>191</td>
<td>125</td>
<td>64</td>
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<tr>
<td>CL161</td>
<td>2007</td>
<td>194</td>
<td>180</td>
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<td>186</td>
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<td>200</td>
<td>181</td>
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<td>132</td>
<td>65</td>
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<tr>
<td>CL171AR</td>
<td>2007</td>
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<td>176</td>
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<td>199</td>
<td>181</td>
<td>165</td>
<td>135</td>
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<tr>
<td>CLXL729</td>
<td>2007</td>
<td>282</td>
<td>264</td>
<td>270</td>
<td>224</td>
<td>275</td>
<td>248</td>
<td>79</td>
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<td></td>
<td>2008</td>
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<td>247</td>
<td>225</td>
<td>224</td>
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<td>78</td>
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<tr>
<td>Cocodrie</td>
<td>2007</td>
<td>211</td>
<td>197</td>
<td>208</td>
<td>189</td>
<td>199</td>
<td>181</td>
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<td></td>
<td>2008</td>
<td>183</td>
<td>196</td>
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<td>208</td>
<td>197</td>
<td>146</td>
<td>70</td>
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<tr>
<td>Wells</td>
<td>2007</td>
<td>207</td>
<td>209</td>
<td>216</td>
<td>205</td>
<td>233</td>
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<td>2008</td>
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<td>186</td>
<td>184</td>
<td>203</td>
<td>183</td>
<td>143</td>
<td>70</td>
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<tr>
<td>XL723</td>
<td>2007</td>
<td>291</td>
<td>274</td>
<td>256</td>
<td>226</td>
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<td>245</td>
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<td>231</td>
<td>217</td>
<td>234</td>
<td>237</td>
<td>245</td>
<td>185</td>
<td>76</td>
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(flushing) when planting early. However, planting the majority of the rice crop in the window of late March to early May in most years will offset expenses compared to the potential yield loss from planting in late-May to early-June window.

This study also showed that Bowman has remained relatively stable across a wide planting window. In 2008, yield loss for all cultivars except Bowman planted in June ranged from 20 to 35 percent when compared to earlier plantings. Catahoula and Cocodrie resulted in yield losses of 30 percent or more while yield loss for Bowman was 17 percent.

In addition, Bowman has shown exceptional field tolerance to straighthead and is a good variety planted behind wheat or after land-leveling, which can tend to delay rice planting until the June window.
STONEVILLE—Rice growers were inundated with tropical storms during the later weeks of August through mid-September, which corresponded to peak rice harvest season. One positive that comes from poor harvest conditions is that rice scientists at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville can evaluate lodging potential for new varieties and breeding lines.

“Severe weather systems occurring during Bowman’s on-farm tests raised concerns about likely impacts on grain filling, ripening, crop lodging, grain yields and milling quality,” said Dr. Dwight Kanter, agronomist at DREC.

In its second approved year in Mississippi, Bowman averaged 200 bu/A compared to 188 bu/A for Cocodrie, the popular commercial variety. Bowman average 53/69 percent whole/total milling yield compared to 54/68 for Cocodrie, and showed very little if any grain shattering after the storms, unlike other varieties.

Winds from the storms contributed to variable lodging at the on-farm test plots. Lodging ranged from zero to 53 percent. Bowman averaged 30 percent.

In addition to its high yield potential, straighthead resistance, and acceptable milling quality, ‘Bowman’ has cereal chemistry qualities that should allow it to have wide adaptability in the milling industry. ‘Bowman’ rice produces a bold, translucent grain that has a high amylose content and intermediate gelatinization temperature which allows it to perform well as a package, parboil, and canning rice.

**MISSISSIPPI STATE RESEARCHERS PLEASED WITH BOWMAN’S PERFORMANCE**

**Investigator:** Dr. Dwight Kanter, Research Professor, DREC, P.O. Box 197, Stoneville, MS 38776; Office: (662) 686-3284; dgkanter@drec.msstate.edu
STONEVILLE—Field testing across various geographic areas and planting times helps identify high-performing rice lines that do well in a wide range of anticipated field and weather factors.

Additionally, tolerance levels need to be evaluated under real conditions. On-farm variety trials conducted across the Delta provide ideal opportunities for DREC researchers to experience real conditions.

Six on-farm sites from Tunica to Hollandale participated in variety trials in 2008.

The top five yielding test entries were Mississippi breeding lines 0804083, 0804114, 0704197, 0604035 and Bow...
MOLECULAR GENETIC TESTING OF ‘BOWMAN’ PROVES VALUABLE IN 2008

STONEVILLE —
Bowman contains several grain qualities that make it desirable for mills wanting a variety with diversity in its end-use.

The grain’s large, translucence make it desirable for package quality long-grain rice. Bowman also has a high amylose and an intermediate gelatinization, similar to Sabine which was released for end-users specializing in parboiling and canning.

Additionally, Bowman has shown exceptional yield potential, and researchers at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville anticipate it providing an excellent option for rice growers to consider in the future.

“Bowman is a new variety for Mississippi producers, and was in both foundation and registered seed production last year,” said Dr. Tim Walker, associate agronomist at DREC.

In 2008, the appearance of purple-colored vegetation and slight variants in plant height and awned grains in Foundation and Registered seed production fields caused some concern.

Because of the Rice Promotion Board’s joint funding with Mississippi State’s Breeding Program and the ARS MSA Genomics Laboratory headed by Dr. Brian Scheffler, the seed purity issue was resolved.

Through molecular genetic testing, an outcross was discovered during the head-row seed production of Bowman. This had resulted from Bowman and a purple-colored plant used for demarcation in test plots. Fortunately, the outcross was limited to a few head-rows and thus the concentration of the plant variants that caused concern was very low.

Furthermore, none of the plant variants were “red rice”, a notorious weed that would have essentially eliminated Bowman as a promising new variety.

“The variants were aesthetic and did not affect grain yield and quality of the rice,” Walker said.

The ability to test breeding lines and varieties at the genetic level should allow for a more efficient system beginning at the initial cross and resulting in a stable variety with more desirable traits.

This technology proved valuable for maintaining the potential of Bowman being a very good variety for mid-southern growers, and will aid in the release of many more varieties in the future.
# FOUNDATION SEED DEVELOPMENT UPDATES

<table>
<thead>
<tr>
<th>Supplemental Seed Production Policy Established</th>
<th>Promising New Seed Production Location Secured</th>
<th>Current Foundation Seed Production Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>After the GMO contamination problems of recent years, the Foundation Seed Advisory Committee initiated the development and implementation of supplemental guidelines for the production of Mississippi foundation rice seed. The major areas of emphasis include enhanced seed sampling and testing requirements as well as broader equipment inspections.</td>
<td>In 2009, the plant science farm on the main MSU campus will produce foundation rice seed of one variety. This development is a realization of a long term goal designed to minimize threats to seed purity by securing and utilizing sites that have no other associations with rice production and which are preferably outside of the Delta’s rice growing area.</td>
<td>Foundation Seed of Cocodrie and Bowman varieties are currently being maintained for Mississippi registered seed producers. Efforts to insure high quality seed were prioritized through a combination of breeder seed testing, equipment and field inspections, and intensive roguing.</td>
</tr>
</tbody>
</table>

**Investigator:** Mr. Randy Vaughan, Manager, Pace Seed Technology Lab, Rm 126, Mississippi State University, Mississippi State, MS, 39759; (662) 325-2390; rvaughan@pss.mississippi.edu
RESEARCH SHOWS DIFFERENCES IN HERBICIDE TOLERANCE

STONEVILLE—Rice flourishes in numerous soil types and ecosystems, but its growth can be impacted by the weed red rice. To combat its weedy relative, Clearfield (CL) rice was developed in Louisiana in the 1990s and marketed in 2002.

Since commercialization of the CL technology, CL rice acreage has increased, with over fifty-five percent of rice in the Midsouth planted to CL cultivars in 2008.

“Red rice is a troublesome weed in southern rice production, and if not controlled, has the potential to outcross with cultivated rice,” said Dr. Jason Bond, weed scientist at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville.

Because rice is an important staple worldwide, demands have increased for higher grain yields per acre. Hybrid rice cultivars have been developed for midsouthern rice producers to help meet increased demands.

“Hybrid and CL rice technologies have evolved almost simultaneously,” Bond said.

Since CL commercialization, practitioners have recognized differential tolerance between inbred and hybrid CL cultivars.

Labeling of Newpath, the first imidazolinone herbicide for use in CL rice, requires two applications prior to flooding. Red rice plants left uncontrolled following Newpath application can outcross with cultivated CL rice, transferring the herbicide resistance trait to red rice.

The imidazolinone herbicide, Beyond, has received special local needs labeling since 2004 to combat red rice left uncontrolled following two applications of Newpath, and has proven effective. Initially, Newpath was applied to inbred CL cultivars in sequential applications of 4 oz/A. Differential tolerance between older CL cultivars like CL121 and newer CL cultivars like CL161 is a product of the CL parent lines used to develop these cultivars. Differences in tolerance between inbred and hybrid CL cultivars occur because inbred CL cultivars possess two copies of the gene conferring resistance to imidazolinone herbicides while hybrid CL cultivars contain only one copy of this gene. Newpath and Beyond labels have historically reflected these differences imidazolinone tolerance.

Until this year, Newpath applications to hybrid CL cultivars were restricted to two applications of 4 oz/A. The Newpath label has been updated for 2009 to allow a maximum of 12 oz/A of Newpath to both inbred and hybrid CL cultivars in two applications of 6 oz/A.

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![Figure 1. CL rice cultivar response to Beyond 5 and 10 oz/A applied at panicle initiation (PI) and 14 days following panicle initiation (PI+14), and Beyond at 5 oz/A applied at mid-boot in Stoneville, MS, in 2007 and 2008. Yield reductions calculated for each Beyond application rate and timing compared with the nontreated control for the respective CL cultivar.](image)
Beyond is labeled for application to inbred CL cultivars at 5 oz/A from the four-leaf stage until 14 days following panicle initiation (PI+14). However, Beyond at 5 oz/A may not be applied to CL hybrids after the panicle initiation (PI) stage.

Research in 2007 and 2008 at DREC compared responses of one inbred and two hybrid CL cultivars to application rates and timings of Beyond. The hybrid CL cultivars CLXL729 and CLXL745 and the inbred CL cultivar CL161 were evaluated. Blanket applications of Newpath at 4 oz/A were applied to all cultivars in sequential applications when rice reached the one- to two-leaf and the one- to two-tiller stages.

Herbicide treatments included Beyond at 5 oz/A applied at PI, PI+14, and mid-boot. Additionally, Beyond at 10 oz/A was applied at PI and PI+14. A nontreated control (no Newpath or Beyond applications) was included for each cultivar. Rice injury was visually estimated 14 and 28 days after each Beyond application. Rough, whole, and total milled rice yields were determined.

Visual injury was less than three percent for all cultivars at each evaluation. Beyond applications did not negatively impact rough rice yields of CL161. Rough rice yield of CLXL729 was reduced by Beyond at 5 oz/A applied PI+14 (9 percent) and mid-boot (22 percent) and by Beyond at 10 oz/A applied at PI+14 (23 percent). CLXL745 rough rice yields were reduced 8 to 23 percent by all treatments.

Rough rice yield reductions were greater for CLXL745 than for CLXL729 following Beyond at 5 and 10 oz/A applied PI and Beyond at 5 oz/A applied PI+14. Beyond treatments did not affect total or whole milled rice yields of CL161 or hybrid CL cultivars.

Hybrid CL cultivars exhibited lower tolerance to Beyond than CL161, and the response to Beyond applications varied between hybrid CL cultivars. Current labeling only allows Beyond at 5 oz/A to be applied at PI to hybrid CL cultivars. However, in commercial fields, variability in growth stages and irregularities in Beyond application may occur that would make Beyond application rates and timings from this research possible under some circumstances.

Thus, red rice populations should be carefully considered when planning where to plant hybrid CL cultivars. Based on these data, inbred CL cultivars should be planted where red rice densities are high and a Beyond application will likely be required.

Continued...
MANAGING GLYPHOSATE-RESISTANT HORSEWEED IN MISSISSIPPI RICE

STONEVILLE—Glyphosate-resistant horseweed was first documented in Mississippi in 2003, and has been a tremendous problem in the state’s cotton, corn and soybean crops. Researchers at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville are looking for ways to control it in rice.

Glyphosate-resistant horseweed is listed among the world’s ten most important herbicide-resistant species. Managing it is difficult. Rice acreage impacted by glyphosate-resistant horseweed has continued to increase, partly due to the limited amount of burndown herbicide options for use in rice.

“Burndown herbicide programs for Mississippi rice production are designed around glyphosate. Applications usually consist of glyphosate or glyphosate plus 2,4-D applied 3 to 4 weeks prior to planting and an additional glyphosate treatment before seeding,” said Dr. Jason Bond, weed scientist at DREC.

Control from burndown herbicide applications is often incomplete, and weeds may re-grow prior to planting. Neither glyphosate nor 2,4-D provide residual control, and spring rains can stimulate new emergence between burndown and rice planting. If glyphosate-resistant horseweed survives the burndown application or emerges between burndown and planting, a rice producer is left with few options.

Research conducted near DREC in 2007 and 2008 evaluated the efficacy of postemergence rice herbicides against glyphosate-resistant horseweed. Herbicide treatments included propanil (4 qt/A), Facet (0.5 lb/A), a tank-mixture of propanil plus Facet (4 qt/A + 0.5 lb/A), Grandstand (12 oz/A), Regiment (0.6 oz/A), Grasp (2.3 oz/A), Permit (1 oz/A) and Strada (2.1 oz/A).

Table 1. Glyphosate-resistant horseweed control 7, 14, 21, 28, and 35 days after treatment (DAT) with postemergence rice herbicides in 2007 and 2008.*

<table>
<thead>
<tr>
<th>Herbicides</th>
<th>Rate</th>
<th>7 DAT</th>
<th>14 DAT</th>
<th>21 DAT</th>
<th>28 DAT</th>
<th>35 DAT</th>
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</thead>
<tbody>
<tr>
<td>Propanil</td>
<td>4 qt/A</td>
<td>11 d</td>
<td>12 d</td>
<td>6 c</td>
<td>2 e</td>
<td>0 e</td>
</tr>
<tr>
<td>Facet</td>
<td>0.5 lb/A</td>
<td>31 bc</td>
<td>41 c</td>
<td>60 b</td>
<td>73 b</td>
<td>77 a</td>
</tr>
<tr>
<td>Propanil + Facet</td>
<td>4 qt/A + 0.5 lb/A</td>
<td>47 a</td>
<td>62 ab</td>
<td>80 a</td>
<td>86 a</td>
<td>86 a</td>
</tr>
<tr>
<td>Grandstand</td>
<td>12 oz/A</td>
<td>23 c</td>
<td>49 bc</td>
<td>56 b</td>
<td>65 bc</td>
<td>60 b</td>
</tr>
<tr>
<td>Regiment</td>
<td>0.6 oz/A</td>
<td>28 bc</td>
<td>50 bc</td>
<td>51 b</td>
<td>45 d</td>
<td>34 c</td>
</tr>
<tr>
<td>Grasp</td>
<td>2.3 oz/A</td>
<td>33 b</td>
<td>78 a</td>
<td>88 a</td>
<td>92 a</td>
<td>87 a</td>
</tr>
<tr>
<td>Permit</td>
<td>1 oz/A</td>
<td>29 bc</td>
<td>60 b</td>
<td>64 b</td>
<td>60 c</td>
<td>47 bc</td>
</tr>
<tr>
<td>Strada</td>
<td>2.1 oz/A</td>
<td>24 bc</td>
<td>46 bc</td>
<td>54 b</td>
<td>48 d</td>
<td>35 c</td>
</tr>
</tbody>
</table>

* Data averaged across three experiments. Means followed by same letter for each evaluation are not significantly different at p < 0.05.
propanil plus Facet controlled more glyphosate-resistant horseweed than all other treatments with control ranging from 80 to 92 percent.

By 35 DAT, glyphosate-resistant horseweed control with Facet, propanil plus Facet, and Grasp was 77 to 87 percent. This level of control was better than all other treatments.

Control from Grandstand, Regiment, Permit, and Strada never exceeded 65 percent; thus, these herbicides would be categorized as providing slight to fair control of glyphosate-resistant horseweed.

Based on evaluations 21 to 35 DAT, Facet would be classified as providing good control while control following Grasp or propanil plus Facet was good to excellent.

Weed control is one benefit of rice flooding. In rice, a herbicide application is generally made 3 to 7 days prior to flooding (dependent on herbicide or herbicide combination).

This research was conducted at a non-crop site because no irrigation was available where indigenous glyphosate-resistant horseweed was present. Control of glyphosate-resistant horseweed may have been improved had the site been planted to rice and flooded 3 to 7 days following herbicide application.

Complete control was not achieved with any of the herbicides evaluated. Although control with Grasp was 92 percent 28 DAT, glyphosate-resistant horseweed had begun to re-grow by 35 DAT. Glyphosate-resistant horseweed in this research emerged in the spring. Horseweed emerges throughout the year, with maximum emergence occurring in September to October. A new flush typically emerges in April or May.

Horseweed plants emerging in the fall are usually more difficult to control than those emerging in the spring. Therefore, control in this research may have been even less in a situation where the majority of glyphosate-resistant horseweed at herbicide application emerged in the fall.

“The lack of labeled burndown herbicide options in rice, combined with the low levels of glyphosate-resistant horseweed control with postemergence rice herbicides, emphasizes the need for management of this weed prior to planting,” Bond said.

Valor at 2 oz/A may be applied 30 days prior to rice planting for residual control of glyphosate-resistant horseweed.

Rice producers should closely monitor fields following burndown herbicide application. If glyphosate-resistant horseweed survives the burndown herbicide application or emerges between burndown and rice planting, Ignite at 22 to 29 oz/A should be applied prior to seeding.

If glyphosate-resistant horseweed emerges between rice seeding and flooding, Facet, propanil plus Facet, or Grasp should be applied to suppress glyphosate-resistant horseweed until flooding.
STONEVILLE—Red beans and rice are a tasty combination in New Orleans but Roundup Ready (RR) soybeans and rice are not good companions in rice fields.

Season-long volunteer RR soybean interference reduced rice yields by 16 percent in research at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville.

A study in 2007 and 2008 evaluated at-planting burndown herbicide applications targeting volunteer RR soybean. Herbicide treatments consisted of Gramoxone Inteon (3.75 and 1.88 pt/A), Ignite (29 and 15 oz/A), and Harmony Extra (0.6 and 0.3 oz/A). Gramoxone Inteon controlled volunteer RR soybean at least 95 percent at all evaluations both years (Fig. 1).

Control with Ignite was greater in 2007 than 2008 due to rainfall 2 hours after application in 2008. Control from Harmony Extra never exceeded 71 percent.

“All plots that received herbicide applications produced rice yields greater than the nontreated control, but only plots treated with Gramoxone Inteon and Ignite yielded similar to the weed-free check,” said Dr. Jason Bond, weed scientist at DREC.

A related study determined the efficacy of postemergence rice herbicides against volunteer RR soybean. Herbicide treatments included propanil (4 and 2 qt./A), Grandstand (16 and 8 oz/A), Regiment (0.67 and 0.33 oz.), Grasp (2 and 1 oz/A.), and Permit (1.33 and 0.67/A). Treatments were applied to volunteer RR soybean in the V5 growth stage.

Propanil controlled more volunteer RR soybean than other herbicides 7 days after treatment (DAT), but control was only 79 percent.

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Volunteer RR soybean control 14 DAT was similar for propanil, Grandstand, Regiment, and Grasp. Control across all postemergence herbicides and application rates was equivalent (>95 percent) 28 and 56 DAT except for propanil, which controlled volunteer RR soybean less than other treatments (Fig. 2).

“The limited quantity of burndown herbicide options for use in rice can exacerbate problems with volunteer RR soybean,” Bond said.

However, these results demonstrate that volunteer RR soybean can be effectively managed in rice with at-planting burndown or postemergence herbicide applications.

Rice producers should closely monitor fields following burndown herbicide application. If volunteer RR soybean survives that application or emerges between burndown and rice planting, Gramoxone Inteon or Ignite should be applied prior to seeding.

If volunteer RR soybean emerges during the interval between rice planting and flood, full or half rates of Grandstand, Regiment, Grasp, or Permit are the best options for season-long control.

A choice among these four herbicides should be based on the presence of other weeds at the anticipated time of application, rice growth stage, and field history.

Half rates of these herbicides may not be sufficient for control of other weed species. Additionally, label restrictions for rice growth stage at application vary among these herbicides.

Finally, field histories could impact the herbicide choices for controlling volunteer RR soybean. Soybean varieties stacked with the RR and sulfonylurea-tolerant (STS) traits may survive applications of Regiment, Grasp, or Permit.

Thus, if a field planted with rice has a known history of STS soybean production, Grandstand would be the preferred herbicide option.

Fig. 2. Top row from left to right is nontreated control, propanil at 4 qt/A, and Regiment at 0.67 oz./A. Bottom row from left to right is Grasp at 2 oz./A, Permit at 1 oz./A, and Grandstand at 16 oz./A.
STONEVILLE--Rice stink bug is a major pest among the Delta’s rice crops, and an investigation implemented by rice researchers at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville is examining the impact of rice stink bug density on final grain injury.

“We wanted to understand the relationship of rice stink bugs, rice grain injury and rice yields. These results are preliminary and should be interpreted cautiously,” said Dr. Jeff Gore, a DREC entomologist.

Rice stink bugs were caged on individual rice heads approximately ten days after panicle emergence using sleeve cages. The experiment consisted of three treatments which included two stink bug adults per head, one stink bug adult per head and non-infested heads.

Fifteen heads were caged for each treatment. For the non-infested treatment, sleeve cages were placed over heads of 15 plants, but were not infested with stink bugs. A white plastic tag was placed on the stem of each infested tiller with the date of infestation and the infestation level (0, 1, 2).

For all treatments, cages and stink bugs were removed after one week. At the end of the season, infested and non-infested heads were harvested by hand, and grains were re-
moved. Damaged grains and total grain weights were determined for each head.

Rice yields tended to decrease as the number of stink bugs increased (Fig. 1). Stink bug density also impacted the number of seeds per head (Fig. 2).

Heads infested with two rice stink bugs had significantly fewer seeds than non-infested heads. Similarly, grain injury increased as the level of rice stink bug infestation increased (Fig. 3).

Damage levels averaged 6, 20 and 29 percent respectively for 0, 1 and 2 rice stink bugs per head. Based on these data, a regression equation was developed to predict yield losses associated with rice stink bug injury (Fig. 4).

There was a significant relationship between percent damaged grains per head and grain weight per head. The regression equation estimates that 0.023 grams of yield per head will be lost for every 1 percent of stink bug damage.

Heads were harvested by hand rather than using a combine. Damaged grains may be lost when rice is harvested mechanically. Thus, yield loss estimates and percent damage may be different in rice that is harvested mechanically.

Future studies will investigate these relationships in greater detail. More heads will be infested to increase the replication of these experiments in future years.

Infestations will be conducted weekly from head emergence until harvest to determine times when rice heads are most susceptible to rice stink bug injury.

"When we complete these experiments, we’ll have a better understanding of how rice stink bug impacts injury and yields of rice in Mississippi," Gore said.

Based on an average population of 650,000 plants per acre and 5 till-
DREC MANAGES COSTLY SHEATH BLIGHT

STONEVILLE—Sheath blight is a leading rice disease in the mid-south, and researchers at Mississippi State University’s Delta Research and Extension Center (DREC) in Stoneville are helping area producers manage problems related to it.

“Sheath blight is the most costly rice disease that can reduce milling quality and cause premature lodging. Rice varieties grown in Mississippi vary from moderately resistant to highly susceptible to the disease,” said Dr. Tom Allen, plant pathologist at DREC.

In 2008 Allen evaluated four fungicides in on-station trials to determine their effectiveness in controlling sheath blight. He tested two strobilurin compounds and two strobilurin/triazole blends. Strobilurin compounds were first isolated from fungi a reduced risk to humans.

Stoneville researchers tested Evito, a new strobilurin from Arysta LifeSciences. Additionally, Serenade was included in some experiments at low levels, 1 to 2 quarts/A, in a tank mix. The new product is currently marketed to allow producers to apply reduced rates of fungicides.

Earlier experiments reported strobilurins were effective against sheath blight and provided economic yield responses. Additionally, past research reported that when used alone, triazole fungicides resulted in significantly higher levels of disease prevention over the untreated control.

To achieve maximum effectiveness a strobilurin fungicide should be applied prior to disease development since this particular fungicide class does not provide any ‘curative’ activity against plant diseases.

Fungicides provide reliable methods for managing sheath blight, preventing yield loss and increasing overall milling quality, yet cultural practices can also help reduce sheath blight.

Following recommendations for row spacing, seeding rates, adhering to split nitrogen applications, maintaining adequate flood levels, and timely harvesting can help reduce levels of sheath blight.

When compared with Quadris at three different rates, and two timed applications (PD+14 and Mid Boot), Quadris Mid Boot), Quadris outperformed Evito in disease control and yield (Table 1).

Combinations of fungicides were also considered (Table 2). Timed treatments included Quadris and Quilt as well as Quadris and Stratego to determine the effectiveness of the two chemistries at different timings.

Adding Serenade to a tank mix of Quadris at either 0.5, 1 or 2 qt/A did not enhance control of sheath blight over Quadris alone (Table 3). The recommended rate of 2 qt/A provided less control than the untreated control. Please note the numerous tropical weather systems in 2008 may have skewed some of the data.
### Table 1. Sheath blight control comparisons between Quadris and Evito.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (fl oz/A)</th>
<th>Growth Stage</th>
<th>Yield (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>—</td>
<td>Early Boot</td>
<td>161</td>
</tr>
<tr>
<td>Quadris</td>
<td>9</td>
<td>Early Boot</td>
<td>185</td>
</tr>
<tr>
<td>Quadris</td>
<td>12</td>
<td>Early Boot</td>
<td>182</td>
</tr>
<tr>
<td>Quadris +</td>
<td>6</td>
<td>PD+14</td>
<td>186</td>
</tr>
<tr>
<td>Quadris</td>
<td>6</td>
<td>Mid Boot</td>
<td></td>
</tr>
<tr>
<td>Evito</td>
<td>12</td>
<td>Early Boot</td>
<td>163</td>
</tr>
<tr>
<td>Evito</td>
<td>9</td>
<td>Early Boot</td>
<td>178</td>
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<tr>
<td>Evito +</td>
<td>4</td>
<td>PD+14</td>
<td>142</td>
</tr>
<tr>
<td>Evito</td>
<td>4</td>
<td>Mid Boot</td>
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</tbody>
</table>

### Table 2. Sheath blight control using Quadris with and without Serenade as a tank mix

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (fl oz/A)</th>
<th>Growth Stage</th>
<th>Yield (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>—</td>
<td>Early Boot</td>
<td>162</td>
</tr>
<tr>
<td>Serenade</td>
<td>2</td>
<td>Early Boot</td>
<td>138</td>
</tr>
<tr>
<td>Serenade +</td>
<td>0.5 qt/A</td>
<td>Early Boot</td>
<td>187</td>
</tr>
<tr>
<td>Quadris</td>
<td>4</td>
<td>Early Boot</td>
<td></td>
</tr>
<tr>
<td>Serenade +</td>
<td>1 qt/A</td>
<td>Early Boot</td>
<td>170</td>
</tr>
<tr>
<td>Quadris</td>
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<td>Early Boot</td>
<td></td>
</tr>
<tr>
<td>Serenade +</td>
<td>2 qt/A</td>
<td>Early Boot</td>
<td>163</td>
</tr>
<tr>
<td>Quadris</td>
<td>4</td>
<td>Early Boot</td>
<td></td>
</tr>
<tr>
<td>Serenade +</td>
<td>0.5 qt/A</td>
<td>Early Boot</td>
<td>182</td>
</tr>
<tr>
<td>Quadris</td>
<td>8.2</td>
<td>Early Boot</td>
<td></td>
</tr>
<tr>
<td>Serenade +</td>
<td>1 qt/A</td>
<td>Early Boot</td>
<td>193</td>
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<tr>
<td>Quadris</td>
<td>8.2</td>
<td>Early Boot</td>
<td>181</td>
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<tr>
<td>Quadris</td>
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Table 3. Sheath blight control comparisons between fungicides and application timings.

<table>
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<th>Rate (fl oz/A)</th>
<th>Growth Stage</th>
<th>Yield (bu/A)</th>
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<td>Stratego 16</td>
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<td>Mid Boot</td>
<td>138</td>
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<tr>
<td>Quadris + 6</td>
<td>PD+14</td>
<td>179</td>
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<td>PD+14</td>
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