A SUMMARY OF 2005 PROGRESS FOR THE WHITE RIVER ECOSYSTEM

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AGRONOMY

Seeding date studies were conducted near Lake Hogue, in Poinsett County, to evaluate the performance of 20 rice varieties and hybrids to various seeding dates and to compare Rice DD50 Program thresholds established at RREC to those obtained in the White River Ecozone. Across all seeding dates, Francis and Jupiter were the highest yielding conventional varieties. However, Cybonnet was the most consistent when planted late. The hybrids normally yielded higher than all conventional varieties when planted early but were similar to conventional varieties when planted late.

A total of 41 varieties, hybrids, and experimental lines were evaluated at 7 locations in the White River Ecozone during 2005. Across all locations, the two hybrids, XP 723 and XP 710, were consistently yielded higher than any of the conventional varieties and experimental lines. Jupiter, Wells, Cheniere, Francis, and Bengal were the highest yielding conventional varieties. Development of computer-assisted variety selection program is currently near completion with an anticipated protype version ready for the mid-summer and the complete version online prior to the 2007 production season.

Studies were conducted at Poinsett County (White River Ecozone) to evaluate the effects of row spacing, seeding rate, and variety on grain yield. Differences in row spacing were negligible at Lake Hogue. However, lodging resulting from high incidence of stem rot caused substantial yield reductions at this location. At other locations, Banks, Cybonnet, and Francis yields were all reduced from wider row spacing, with the greatest effect on Francis. Broadcast seeding was generally better than 10” row spacing but not as good as 7” row spacing. Adjusting seeding rates were not typically successful at overcoming yield reductions observed with 10-inch row spacing. Optimum seeding rates for these varieties generally ranged from 67.5 to 90 lbs/acre. An economic analysis using partial budgeting and enterprise budgets was conducted. At this location, the 7-inch row spacing consistently produced higher net returns than the 10-inch spacing regardless of seeding rate. At the highest seeding rate, net returns decreased substantially.

On-farm seeding rate studies were conducted at two locations in the White River ecological zone. Five varieties (Bengal, CL 161, Francis, Medark, and Wells) were evaluated at seeding rates ranging from 45 to 135 lbs/acre in 0.5 bushel increments. At each location, 67.5 lbs/acre was equal to the recommended 90 to 112 lbs/acre. Seeding rate recommendations have been reduced from 40 seeds/ft^2 to 30 seeds/ft^2 as the result of this research.

Multi-spectral aerial imagery has been shown to provide descriptive information about the plant biomass of rice. When enhanced, and then classified into a thematic map, the value of this imagery becomes very apparent as a scouting tool. Areas of plant stress can be readily identified. The objective of this project was to provide classified imagery for the fields enrolled in the RRVP to be used as scouting tool and to record field conditions for later assessments. A second objective of this work was to provide an educational component about the concepts of remote sensing to the farmer and county agent. A web site to view and download these images was developed. For 2005, there were 19 fields in the remote sensing program. Two images were acquired early and mid season. The classified images were found to be very effective as an aid to scouting and making field management decisions. Both the farmer and the agent benefited from up to date maps that described the field conditions. The value of this project as an educational tool was also apparent. Many times, the farmer and the agent did not know how to interpret the information from the classified images. Having this information during the scouting process helped to clarify many of the misconceptions of the ability of the imagery to detect stress conditions in rice.

SOIL FERTILITY/NUTRIENT MANAGEMENT

A major strength of the rice-soil fertility research program has been the delineation of N fertilizer response curves for promising new rice cultivars. The rice cultivars and experimental varieties studied in 2005 were: ‘Banks’, ‘Cheniere’, Clearfield ‘CL131', ‘Cybonnet’, ‘Jupiter’, ‘Spring’, ‘Trenasse’, USDA experimental line ‘4484', and the RiceTec hybrids ‘XP721’, ‘XP723’, ‘XP728', ‘XP729', Clearfield ‘CLXP730', ‘XP731', and ‘XP732'. Banks, Cheniere, CL131, Jupiter and Trenasse usually required 90 lb N/acre to achieve maximum grain yield when grown on silt loam soils and 150 to 180 lb N/acre when grown on clay soils. Cybonnet and Spring typically required 120 lb N/acre to achieve maximum grain yield when grown on silt loam soils and 180 lb N/acre when grown on clay soils. The RiceTec hybrids usually achieved maximum grain when 90 lb N/acre was applied preflood and 0 to 30 lb N/acre was applied at late boot. The late boot N application of 30 to 60 lb N/acre seldom resulted in a grain yield increase, but this is typical in Arkansas. The late boot N application is recommended on the hybrids mainly to minimize lodging and secondly to increase rice grain yield.

Preliminary studies were conducted to assess ammonium sulfate in combination with the nitrification inhibitor DCD and two slow release, polymer coated urea products as potential preplant N fertilizer sources for delayed, flood rice. The ammonium sulfate/DCD combination did not prove to be a viable preplant N fertilizer source for delayed, flood rice; but the two polymer coated, slow release N fertilizers showed potential.

Preliminary soil quality studies on the silt loam soils of the White River suggests that soil properties varied by field and were not necessarily consistent within classified soil type. Many of the White River soil properties were comparable to or higher than those measured in the Stuttgart soils from the Grand Prairie region. As might be expected, some of the more stable soil properties did not vary from beginning to end of the growing season (e.g. pH). In contrast, some of the labile nutrient pools did vary over the growing season. For example, microbial biomass C, which represents the size of the overall microbial community biomass and fluorescein diacetate hydrolysis, which represents microbial activity, decreased from the spring to fall samplings. Other properties, especially those related to N were more variable in magnitude and direction of change over the growing season. Further data analysis should reveal whether there are relationships in soil properties that warrant further investigation with the goal of connecting soil quality to rice yields.

A N soil test that predicts N mineralization in rice soils has long eluded researchers. The objective of this study was to compare proposed analytical methods for predicting N mineralization with the NH4+-N mineralized after a 14 d anaerobic incubation on Arkansas silt loam rice soils. The proposed methods were i.) acid oxidation, ii.) ultraviolet absorbance of NO3- reduced and unreduced soil extracts, and iii.) diffusion of amino sugar-N using the Illinois Soil N Test. Linear regression models revealed that the acid oxidation procedure, the ultraviolet absorbance of NO3- unreduced soil extracts, and the diffusion of amino sugar-N using the Illinois Soil N Test all accurately predicted the NH4+-N mineralized in silt loam soils of eastern Arkansas after a 14 d anaerobic incubation. In 2006, we will take the methods to the field.

Studies on the value of poultry litter as a fertilizer for non-leveled silt loam and clay rice soils have found after two years of study that the N contained in poultry litter is not taken up very efficiently, but the P and K is taken up well by the rice. Because poultry litter has to be applied preplant the N contained in the litter has time to be nitrified in the weeks prior to flooding and this nitrate is lost via denitrification soon after flooding. The N from poultry litter applied preplant to delay, flood rice was only be taken up by the rice with a 5 to 25% efficiency compared to typical preflood urea-N uptake of 60 to 80% efficiency. Conversely, the P and K contained in poultry litter are as available to rice as commercial P and K.

Six K rate studies and three P rate and time of application studies were established during 2005. Rice showed no significant response to P fertilization. Significant yield increases due to K fertilization were measured at four of six sites. Responsive sits had soil-test K of 64 to 94 ppm. Unresponsive sites had soil-test K of 94 and 164 ppm K. Additional sites are needed to verify the correlation between soil-test K and rice yields response to K fertilization and to calibrate the appropriate K rate for various soil-test K. The long-term K-fertilization study, conducted at the PTBS, also showed large and significant rice yield increases from K fertilization. The focus of future field tests will be on K fertilizer calibration studies.

IRRIGATION

Studies were implemented at PTBS (White River Ecozone) to determine effects of early flood removal on grain and milling yields of Bengal, Medark, Cocodrie, and Wells. However, the study was not harvested due to zinc deficiency resulting in undesired variability. The study will be conducted in 2006 at Lake Hogue, Poinsett County.

On-farm studies evaluating Multiple Inlet rice Irrigation were conducted at 6 locations in the White River Ecozone. Most producers reported less water usage as the result of Multiple Inlet Irrigation. The savings in water where direct comparisons were available ranged from 2% to 28%.

WEED MANAGEMENT

There were 3 herbicide studies conducted during 2005 in the White River Ecozone. These included 2 separate herbicide tolerance studies on high pH soils and a new Clearpath effectiveness trial under Northeast Arkansas conditions. Soil salts and pH in this region affect herbicide program effectiveness and will continue to be studied.

DISEASE MANAGEMENT

Cold-tolerance and stand trials were planted at Pine Tree in Mid-February, Mid-March and Mid-April – and included 42 previously identified rice lines with and without fungicide seed treatments. Results indicated that cold-tolerant rice lines have the best stands and do not benefit from the use of fungicide seed treatments. There were 12 lines identified in the field tests previously identified as resistant to Pythium that performed well without fungicide seed treatment protection when planted very early. Cybonnet was the only commercial cultivar tested that showed both resistance to Pythium and no response to fungicide seed treatments in the field.

Seeds infected by the rice blast pathogen were shown to develop infected seedlings that in turn results in blast disease in the field resulting in a new generation of infected seeds. The level of infected seedlings that arise from infected seeds is influenced by the resistance of the cultivar, the initial amount of infected seeds in a lot, and environmental conditions at and shortly after planting. Greenhouse inoculations with the false smut fungus were not successful in 2005. False smut spores were shown to germinate on young roots of rice and the fungus may be able to infect root tissue under laboratory conditions. Some infected seedlings died. A DNA-based PCR protocol was developed to detect the fungus in infected plants.

Bengal grain and seed lots collected from cooperators during 2004 continued to be screened using a DNA PCR protocol developed to detect the bacterial panicle blight pathogen in seed. A second set of samples were collected during the fall of 2005 for continuing analysis. Many samples came from the White River Ecozone. Preliminary results at Lonoke showed consistent detection of infected and non-infected seed lots. Validation of these results and greenhouse/field verification will be done in 2006.

Sheath blight and stem rot were major problems in the state during 2005, and both kernel smut and false smut more serious than 2004. Stem rot and hurricane winds later in the season resulted in severe lodging throughout the White River Ecozone.

Rice blast disease was minimal due to the persistent drought in the region. Nevertheless, disease monitoring showed that at least 12 'Banks' rice fields suffered some damage due to neck blast from the I-40 region in the Grand Prairie counties of Lonoke and Prairie, as well as scattered throughout northeast Arkansas. This damage indicates that blast race IE-1k has spread through much of the state after being detected in at least one field in northeast Arkansas during 2004. This resulted in 'Banks' rice no longer being considered a resistant cultivar in our recommendations.

More than 100 samples were collected from this region for the Rice Area Pest Survey with eyespot, aggregate sheath spot, bordered sheath spot and an unknown tiller elongation problem confirmed. The cause of the tiller elongation problem has not been determined.

Results from area disease monitoring plots were used to update disease reactions for 30 cultivars and advanced lines, with pertinent information published in the 2005 ARPT report. The URRN was screened for stem rot, black sheath rot, kernel smut, false smut and bacterial panicle blight in Poinsett County. Disease pressure was heavy for stem rot, kernel smut and bacterial panicle blight at this location.

Several new fungicides were evaluated on rice for kernel and false smut control, however disease was very minor. None of the products were phytotoxic. None of the products tested for control of bacterial panicle blight worked either.

Results from sheath blight fungicide trials at this location were similar to those obtained in Lonoke County with CL 161 and CL 131 severely affected by sheath blight if not controlled by early and heavy fungicide applications. CL 161 lodged severely as well and there was no reduction in lodging be any fungicide. CL 131 did not lodge, regardless of treatment.

Preventative fungicide application to non-inoculated plots of Bengal, Francis, CL 161 and CL XL8 plots did not result in yield or milling quality increases at this location.

INSECT MANAGEMENT

Field testing of the aquatic rice water weevil trapping system was completed.

Field trials were established in Poinsett County to evaluate insecticide seed treatments for grape colaspis and rice water weevil control. Yields were not different at this location for any treatment.

Rice grain samples continued to be evaluated for rice sting bug damage and other discolorations during 2005. Of 1248 grain samples collected from ARPT locations (including one in Jackson and one in Clay counties), 588 were evaluated by the end of 2005 and results reported in the ARPT report. Another 480 samples were collected from advanced breeding line nurseries and samples from the 2005 Rice DMP plots around the state were also collected. Earlier samples from the DMP (2002) were completed during 2005 and certain locations were from the White River Ecozone.

RICE QUALITY

Rice grain samples for the quality research were collected in all three ecosystems. Head Rice yield ranged from 64.0 to 70.9% and was significantly different across varieties and location. This could be due to various factors including chemical composition of the kernel or a greater proportion of immature kernels. Amylose and protein content in rice was significantly different across varieties and locations. Rice harvested in Cleveland, MS (*Delta* ecosystem) showed the highest amount of amylose compared to rice from other locations. Rice from Newport, AR (*White River* ecosystem) showed the highest protein content. Pasting viscosity as well as cooked rice texture properties varied across ecosystems and cultivars. Cocodrie yielded less sticky and firmer rice than Wells across harvest locations. Significant variability was observed for rice constituents (amylose and proteins) across harvest locations. This variability translated in quality differences for rice flour and cooked rice. The effect of harvest location was in some instances as large as varietal differences.

Ambient air temperatures and relative humidities from the R6 growth stage to the last day of harvest were monitored and recorded at hourly intervals using HOBO sensors in all yield trials. A total of 84 lot samples were collected from the ecosystem locations indicated in Table 2 at HMCs ranging from 13.5 to 26.5%. The locations were selected based on sites at different latitude within the ecosystem that had the desired varieties/hybrids for property characterization. Individual kernel MC distributions at the three different HMC levels as well as field air temperature and relative humidity measurements were completed. Samples are being analyzed in the lab to determine the following: HRY; degree of milling; individual kernel dimensional distributions; breaking force distributions; adsorption effects on fissure counts and HRYs; paste viscosities (RVA); and brown rice lipid levels.

ECONOMICS

Rice budgets were completed for the 2006 crop year and posted on the U. of A. Extension website. Rice breakeven yields required to cover variable expenses were also posted for each crop budget for the following tenure arrangements: 1) full owner; 2) 25% crop-share; 3) 20% crop-share; and 4) 50% cost-share.

The U. of A. and Texas A&M are working together to develop and maintain a database of representative Arkansas rice farms for farm policy analysis. The results highlighted differences in farm economic viability among program crops. Most rice and cotton farms were in “poor” financial position, while most wheat, feed grain and oilseed farms were in “good” to “marginal” financial position.

An assessment of the 2005 Arkansas rice crop estimated total economic losses for Arkansas rice producers of $214 million due to more irrigation, higher energy prices, prevented plantings and lower yields. Arkansas rice producers were reported to have prevented plantings of 21,513 acres and reduced yields that resulted in reduced returns of $105 million. Higher energy prices have increased irrigation, machinery and fertilizer prices. An additional 4 acre-inches of irrigation water added to normal requirements of 30 acre-inches was assumed. In areas where ground water is pumped from deeper wells, the estimated additional production cost in 2005 was $90.22/acre as a result of higher energy prices. In areas with better ground water conditions, higher energy prices are estimated to have increased production costs by $63.33/acre.

Economic analyses have been conducted on the following Arkansas Rice Research Board funded projects: Variety X Nitrogen Study of Conventional and Hybrid Rice, Midseason Nitrogen Timing Study, Influence of Nitrogen Fertilizer Source, Soil Moisture Study and Application time on Rice, Starter Fertilizer Study, On-Farm Agrotain Study, Nitrogen on Clay Soil, Northeast Arkansas Seeding Date Study, On-Farm Fungicide Trials, DD-50 Study, Commercial Rice Variety Performance and Disease Monitoring Program (DMP), Row Spacing Studies, Seeding Rate x Seeding Date Study, On-Farm Seeding Rate Studies, and the CoRoN X Fungicide Study.