A SUMMARY OF 2005 PROGRESS REPORTS FOR THE DELTA ECOSYSTEM

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AGRONOMY

Seeding date studies were conducted at NEREC, in the Delta Ecozone, 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 at NEREC. Across all seeding dates, Wells and Cybonnet were the highest yielding conventional varieties. These two varieties were also 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 Delta 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. However, Wells was the highest yielding entry at one location in the Delta. 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 NEREC and SEREC (Delta Ecozone) to evaluate the effects of row spacing, seeding rate, and variety on grain yield. At NEREC, Banks, Cybonnet, and Francis each yielded over 20 bushels higher when the row spacing is 7 inches compared to 10 inches. The broadcast seeding was approximately 25 bushels less than the 7" row spacing at NEREC. Differences in row spacing were negligible at SEREC. Optimum seeding rates for these varieties generally ranged from 67.5 to 90 lbs/acre at all locations. 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 Delta 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.

Rice can be slow to grow and develop during the seedling stage when grown on clay soils. Thus, a study was initiated to examine the benefit of the starter fertilizers, DAP, ammonium sulfate, and urea, for rice when grown on clay soils. The second year of study found that none of the starters tested resulted in a yield advantage compared to when no starters where applied. However, all three of the starters increased preflood rice growth that would allow a farmer to flood the rice sooner. As concerns preflood plant growth and height, DAP was superior to ammonium sulfate which was superior to urea.

A study on clay soil comparing urea to Agrotain (i.e., urea with the urease inhibitor NBPT) for preflood N application found that Agrotain resulted in higher rice yields than urea if the flood was delayed for 7 days or more after preflood N fertilizer application.

A soil test to measure N mineralization has long been sought to improve N fertilization recommendations. The first year of laboratory research has indicated that there are at least four methods (i.e., Illinois N soil test, permanganate/acid, and UV and NIR spectroscopy) under study that show promise in predicting N mineralization on silt loam soils. Clay soils on the other hand appear to be more difficult for the methods to predict N mineralization at this time. Further research will indicate the utility and accuracy of the methods under study.

A 12-acre field on a clay soil at the Northeast Research and Extension Center has been land leveled into two study areas to: i) ascertain the effects of deep-tillage on soil quality and rice production following land leveling and ii) to ascertain the effects of annual poultry litter additions on soil quality and rice production. Land leveling resulted in some physical changes like an increase in bulk density, however, the surface soil texture did not change dramatically. Thus far, after two cropping cycles since land leveling activities occurred, the addition of 1 ton/acre of fresh poultry litter had no significant effect on first-year soybean or second-year rice yields. Similarly, tilling the soil to a depth of about 3 inches prior to planting also had no significant effect on first-year soybean or second-year rice yields.

Data for N fertilizer infiltration and downward movement in a Sharkey clay when the flood water is applied revealed both urea and ammonium do not move as deep in a clay soil as in a silt loam soil. Both N fertilizers only moved 1 to 2 cm deep in a clay soil versus 4 to 8 cm

deep in silt loam soil. This could indicate that N fertilizer in a clay soil is more vulnerable to ammonia volatilization and nitrification/denitrification after flooding.

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.

A study to determine the value of zinc fertilization on clay soils found that the application of Zn fertilizer failed to consistently and significantly influence rice yields. Data gathered can be used to help correlate and develop tentative guidelines for zinc fertilization of clay soils.

IRRIGATION

On-farm studies evaluating Multiple Inlet rice Irrigation were conducted at 6 locations in the Delta 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

Twelve red rice types representing different heights, awned type and maturity were planted on Apr 28, May 12 and May 26 at the SEREC near Rohwer along with CL XL8 and CL 161 rice cultivars. Certain red rice types did not flower in synchrony with either CL XL8 or CL 161 at this location but about half the types overlapped the flowering period for one of the CL rice cultivars. Planting on May 26 shortened the duration of flowering for all red rice types but doubled the flowering period for the CL cultivars (2 weeks compared to 1 week when planted Apr 28). Red rice types averaged 19 tillers/plant when planted with CL161 but only 9 tillers per plant when planted with the more competitive hybrid, CL XL8. Consequently, red rice reduced CL 161 yield by 30% in this trial but only 13% for CL XL8. Certain red rice types were more competitive than others. The most competitive type reduced CL 161 yield by 70% and CL XL8 by 50% for the April planting. Seed was collected from this trial for outcrossing analysis.

There were at least 26 field studies on weed control conducted in the Delta Ecozone, primarily at the SEREC near Rohwer. Most studies conducted in other zones were carried out on the heavy clay soils at SEREC to determine effect on recommended herbicides and programs under these soil conditions. Herbicide injury studies on glyphosate, Grasp, and new experimentals were also conducted here as were programs for weed control in water-seeded systems. IR5878, Quinstar and penoxsulam studies were conducted at this location.

DISEASE MANAGEMENT

Cold-tolerance and stand trials were planted at the NEREC (Keiser) 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 had the best stands and did 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. 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. Samples represented all ecozones.

Sheath blight and stem rot were major problems in the state during 2005, and both kernel smut and false smut more serious than 2004. However, rice blast disease was minimal due to the persistent drought in the region. The rice pest survey was conducted for the second year with over 50 samples collected in the Delta ecozone. Aggregate sheath spot and bordered sheath spot were confirmed in the Delta zone during 2005. Neither disease has been officially reported in Arkansas. Rice DMP plots were examined in the Delta zone and information used to determine cultivar reactions to various diseases and reported in the 2005 ARPT publication.

INSECT MANAGEMENT

Bengal, Cocodrie, Francis and Wells cultivars were planted at the SEREC near Rohwer in 2005 to continue studies on varietal resistance to rice water weevil (RWW). RWW was intense with 25 – 35 larvae per core, depending on cultivar. Yield losses varied by cultivar with 30 bu/A lost for Bengal; 29 bu/A lost for Cocodrie; 19 bu/A lost for Francis and 16 bu/A lost for Wells.

Rice grain samples continued to be evaluated for rice sting bug damage and other discolorations during 2005. Of 1248 grain samples collected, 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.

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.