

A SUMMARY OF 2004 PROGRESS REPORTS FOR THE DELTA ECOSYSTEM

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AGRONOMICS

A total of 18 varieties, hybrids, and experimental lines were evaluated at NEREC in the Delta Ecozone. DD50 thresholds were developed for 4 new varieties, 5 hybrids, and one experimental line. Three seeding dates at NEREC were April 18, May 27, and June 10. The yields for the April and May seeding dates were similar. Some cultivars, such as Cybonnet, Medark, Rice Tec XP 710 and Rice Tec XP 716 yielded higher in April while the remaining cultivars were similar or slightly better when seeded in May. Overall the highest yielding cultivars were the five hybrids. However, Francis was the fourth highest cultivar, outperforming CL XL8 and XP 716. Francis was the best conventional variety while Ahrent, Wells and Cocodrie also yielded very well. The best conventional varieties planted in June were Francis, Wells, and Bengal. The highest yielding hybrids planted in June were XP 710 and XP 712.

A total of 25 varieties, hybrids, and experimental lines were evaluated at 5 locations in the Delta Ecozone. The hybrids, XP 723 and XP 710, were typically the highest yielding entries in the study. Francis was the highest yielding entry at one location and was the highest yielding conventional at almost all locations. Wells, Cheniere, and Medark were other conventional varieties with the good yields across several locations. Development of computer-assisted variety selection program is currently underway.

Studies were conducted at SEREC to evaluate the effects of row spacing, seeding rate, and variety on grain yield. As seen at other locations, 7 inch row spacing resulted in higher yields than 10 inch row spacing, with an average yield difference of 6 bushels per acre. Adjusting seeding rates were not typically successful at overcoming yield reductions observed with 10-inch row spacing. Banks and Francis yields were reduced from wider row spacing by 10 and 6 bushels per acre, respectively. However, yields of Cybonnet were similar for both row spacings. Economic analysis confirms that 7-inch row spacing provides greater net returns than 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 produced higher net returns than the 10-inch but not substantially at the lower seeding rates. Lower yields at this location affected net returns. Input from producers suggests that broadcast seeding should be included in future studies.

On-farm seeding rate studies were conducted at one location in the Delta ecological zone. All seeding rates provided effectively the same yield, suggesting that seeding rates may be reduced on clay soils. Yields of Francis, Wells, Bengal, and Medark were similar while CL 161 yielded significantly less. Milling yields were not affected by seeding rate.

Aerial imagery was acquired every two weeks by a small aircraft. The resolution of the image was approximately two meters. During the growing season, the rice fields were scouted weekly for signs of stress that may change the biomass zones of plant health. The imagery did make scouting more efficient. Stress from sheath blight, blast diseases, soil characteristics, and irrigation deficiencies have often correlated well with the imagery. We have found that infrared imagery is a very effective scouting tool if timed correctly. Over the past three years, our studies have shown that the optimum period to acquire imagery for rice is between the flag leaf and boot stages, which corresponds to scouting periods indicated by the rice DD50 program. When the

rice DD50 program recommends scouting for diseases, it is the optimum time to acquire an image.

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 2004 were: 'Cheniére, Cybonnet, Medark, Arkansas experimental line RU0101093, and the RiceTec hybrids Clearfield XL8, XP 710, XP 716, and XP 723. Cheniére, Cybonnet, Medark, and RU0101093 required 150 to 180 lb N/acre to achieve maximum grain yield on the clay soils of the Delta Ecosystem. The RiceTec hybrids achieved maximum grain yield on the clay soils when 90 lb N/acre was applied pre-flood and 0 to 30 lb N/acre was applied at late boot. Occasionally, the RiceTec hybrids required 120 lb N/A applied pre-flood to reach maximum grain yield they were grown on the clay soils of the Delta. The late boot N application of 30 to 60 lb N/acre seldom resulted in a grain yield increase and is recommended on the hybrids mainly to minimize lodging and secondly to increase rice grain yields.

Several studies were conducted on the influence of tillage, soil texture and N source on N loss, N uptake and rice grain yield. The first year found that ammonia volatilization from urea applied pre-flood to clay soils is slower than that from silt loam soils with only about 5 and 10% of the urea N applied lost over a 5 and 10 day period, respectively. This indicates that rice producers on clay soils have about 7 to 10 days to establish a flood. Thus, Agrotain and ammonium sulfate with low ammonia volatility may not be as advantageous on clay soils.

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 starter fertilizers for rice when grown on clay soils. The first year of study found that none of the starters tested resulted in a yield advantage compared to when no starters were applied. However, DAP and urea did result in a noticeable plant height increase to allow for earlier flooding. In addition, DAP was a better starter on clay soils compared to urea.

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. Bacterial biomass concentrations were significantly higher following land leveling in the deep-tillage study area, but were unaffected by land leveling in the poultry-litter study area. The addition of 1 ton/acre of fresh poultry litter had no effect on yield. However, tilling the soil to a depth of about 3 inches prior to planting resulted in a 7 % yield reduction compared to planting into an untilled, though not stale, seedbed.

Studies on the value of poultry litter as a fertilizer for non-leveled silt loam and clay rice soils has found after the first year 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 taken up by the rice with a 5 to 25% efficiency compared to typical pre-flood urea-N uptake of 60 to 80% efficiency. Conversely, initial studies indicate the P and K contained in poultry litter are as available to rice as commercial P and K.

Seven K rate studies and five P rate and time of application studies were established during 2004 on silt loam and clay soils. Significant yield increases due to K fertilization were measured at two grower sites that will help improve K fertilizer recommendations. Preplant applied P fertilizer was sufficient at most locations.

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. But, trends were observed and further research is needed. Data gathered can be used to help correlate and develop tentative guidelines for zinc fertilization of clay soils.

IRRIGATION-WATER MANAGEMENT

On-farm studies were conducted at 5 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%. Two locations reported slightly more water usage.

WEED MANAGEMENT

A total of 80 applied weed management trials were conducted in 2004 with 52 in the Grand Prairie, 3 in the White River and 25 in the Delta Ecozones. Newpath and Beyond herbicides performed well at all locations for red rice and many other grass and broadleaf weeds control. Newpath did not control hemp sesbania, eclipta, and northern jointvetch well but tank mixes with Grandstand, Aim, Permit and Duet were effective. Command Pre in the Newpath system provided additional grass control and made Newpath timing more flexible. Newpath and Beyond herbicides performed well in a reduced tillage study at Lonoke and Beyond herbicide controlled barnyardgrass and broadleaf signalgrass in a non-red rice situation. These trials were planted to wheat after harvest for rotation study.

Grasp herbicide resulted in root pruning of rice at 3 test sites, which appeared to be somewhat variety related, however yield effect was not determined. Grasp appears to be similar to Regiment with some activity on various broadleaf weeds. Results on overall weed control were inconclusive.

Trials were started to evaluate control options for sicklepod, pigweed, groundcherry and other unusual broadleaf weeds in rice.

DISEASE MANAGEMENT

In the first year of funding, a controlled environmental screening protocol for *Pythium* resistance was developed. The results for the genotypes screened to date show that all lines had some reduction in stand count with the *Pythium* treatment. About 26% of the genotypes had stand counts in the inoculated treatment comparable to or better than those of the resistant control, indicating at least moderate resistance to the pathogenic *Pythium* isolate used. Another 26% of the lines tested had stand counts exceeding those of the susceptible control and cold resistant standard, but less than those of the resistant control, indicating some degree of

resistance to the pathogen. The other 48% of the lines studied had extremely low stand counts in the inoculated treatment, indicating a high degree of susceptibility to this pathogen. A complicating factor is that some of these lines of rice appear to be less cold tolerant under these assays, a very low stand count in the uninoculated control under cold temperatures despite having exhibited a high percent germination. However, the majority of the lines with low stand counts in the inoculated medium are indeed very susceptible to damping-off by the *Pythium* isolate used in this study.

Flowering panicles of 5 rice varieties were inoculated with the blast fungus and various spots and blotches formed later on the seed. Very low levels (<1%) of seedborne *P. grisea* can result in blast in planted plots of M201 but higher levels appear to be necessary on Franics, Wells or Bengal. Blast was not noted in plots treated with azoxystrobin seed treatment until mid July. Lab work continued on isolation, growth and inoculation of the false smut fungus in culture and the greenhouse while strains of *B. glumae* were collected and stored for use in greenhouse experiments.

INSECT MANAGEMENT

Rice water weevil traps were evaluated in 10 counties with one field exceeding the treatment threshold. Algae interfered with traps at one location and larvae were underestimated in fields without algae scum.

The impact of nitrogen on rice water weevil injury was not researched in 2004 and the impact of tillage practices on rice water weevil, rice stalk borer and grape colaspis was not determined because research plots did not emerge evenly due to bird damage and were not usable.

Wells was the least susceptible variety to stalk borer in field tests while Banks was very susceptible at SEREC. MedArk was less susceptible than Bengal and Cybonnet was as susceptible as Cypress to the stalk borer. Even at rice water weevil levels of <10 per soil core, Banks suffered yield loss from root pruning.

There was no research completed on impact of natural armyworm damage.

Cocodrie lost 17 Bu/A with 30 RWW larvae/core; Francis 35 Bu/A with 35 larvae; Bengal 9 Bu/A at 37 larvae and Wells only 5 Bu/A with 32 larvae per core. Only Wells did not have a significant yield gain from insecticide treatment to control RWW in this SEREC trial.

A total of 1,560 samples from the Jackson and Clay counties, SEREC, NEREC, and RREC ARPT sites from 2003 were evaluated and data distributed to researchers. A total of 480 advanced breeding line samples from the RREC URRN in 2003 were evaluated and data distributed.

About 2300 samples collected from Riceland, Producers, and one independent rice buyer from the 2001 rice crop that had heavy rice stink bug damage have been evaluated now. A total of 74 lines (888 samples) from the USDA core collection have been evaluated for discolored kernels, kernel weights and measurements. Of 315 lines successfully planted in the field, only 139 lines (834 plots) were hand-cut due to observations noting that these lines were the only ones that had a good population of rice stink bugs.

RICE QUALITY

Rice grain samples for the quality research were collected in all three ecosystems. Head rice yield was found to significantly vary across cultivars and harvest locations. This could be due to various factors including chemical composition of the kernel or a greater proportion of

immature kernels. Lipids tend to decrease rice flour viscosity while proteins have an opposite effect. At the onset of storage, the proteins and lipids tend to neutralize each other as to their impact on peak viscosity is relatively equal. However, as storage progressed, proteins tended to impact viscosity a lot more than lipids. This explains the general observation that peak viscosity in rice flour will increase during the first year of rough rice storage. The implication for those in the rice industry is that first degree of milling is crucial when flour is used as a thickening agent in food formulations. There may therefore be some applications for which broken kernels could be further milled to increase the quality of the flour produced. In addition, rice flour processors and users can count on an increase in flour viscosity as rice is stored for longer durations. During storage, proteins have a tendency to oxidize and to form strong intermolecular bonds, creating a strong network of protein that tend to make kernels stronger and less susceptible to breakage during milling. The implication for the rice industry could be important if a process that could rapidly oxidize these proteins (i.e., making kernels stronger) can be found.

A total of 72 lot samples of rough rice were collected from multiple locations in the three ecosystems. Samples were collected at three HMC levels (high - 22 to 24%; medium - 18 to 20%; and low - 14 to 16%) to determine: individual kernel MC distributions at the different HMCs (Completed); individual brown rice kernel dimensional distributions (Completed); breaking force distributions (40% completed); fissure counts (Completed); adsorption effects on fissure counts and head rice yields (50% completed); head rice yields (Completed); degree of milling (80% completed); paste viscosities (75% completed); brown rice lipid levels (10% completed); millability (10% completed); and equilibrium moisture contents (10% completed). Data loggers were utilized at each location and temperature and relative humidity were recorded from the 50% heading until the last date of harvest. The intention is to determine if nighttime air temperatures during the R6 growth stage are correlated to kernel property distributions.

ECONOMICS

The basic farm price and policy effects that are incorporated into the FLIPSIM representative farm models are based on the baseline projections of the Arkansas Global Rice Model. The model was used over the past year to evaluate the potential effects of trade policy reforms. Specifically, the model was simulated to evaluate the economic effects of: 1) elimination of domestic supports in the U.S., EU and Japan, 2) elimination of tariffs and tariff rate quotas (TRQs) in major rice importing nations, and 3) elimination of export subsidies by the EU. The results suggest that the major distortion in global rice trade is import protection such as tariffs and TRQs. These policies depressing export prices and inflate consumer prices in the importing nations, resulting in significantly less rice trade. These results suggest that it will be critical to the U.S. and Arkansas rice industry to seek expansion in market access through the reduction in rice import tariffs and expansion of TRQ quota levels. Additionally, an analysis of differential tariffs on rough and milled rice was conducted to examine the effects on the domestic rice milling industry. Current tariff differences, which favor the export of rough rice result in a reduction of approximately \$80 million in rice milling activity annually in the U.S. Much of this cost is absorbed by rice producer cooperatives in the Arkansas.