Phosphorus and Potassium Management for High Yielding Varieties

Nitrogen recommendations have been updated with the release of each new variety. Phosphorus (P) and potassium (K) recommendations are at least 30 years old, or just say that no current employer can remember the last time they were changed. These recommendations were developed for ‘Labelle’ when main plus ratoon crop yields were generally less than 5,000 lb/ac. General fertilizer recommendations call for 170-40-0 on fine/heavy/clay soils and 150-50-20 on coarse/light/sandy soils.

The Texas Rice Production Guidelines state that P should be applied if the soil test results indicate P levels are less than 10 ppm in clay soils and less than 15 ppm in sandy soils. The Guidelines also state that K is rarely deficient and may be needed on extremely coarse soils when the soil test indicates K levels are below 50 ppm. The Texas guidelines are simply “yes or no” for P and K, with a single rate recommended.

Today’s total crop yield is pushing 12,000 lb/ac with the top producers looking at 15,000 lb/ac. Other southern rice producing states have updated and produced rather complex recommendations. Arkansas has 50 possible rates based on soil test and soil pH. Phosphorus rates range from 0 to 90 lb/ac, while K rates range from 0 to 120 lb/ac. This is a significant contrast to our “yes or no” single rate recommendations.

Tests were initiated this year at Eagle Lake and Ganado to evaluate the impact of P and K rates on the performance of XL723. Treatments include 0 to 100 lb/ac of P with a base application of 100 lb/ac of K and 0 to 120 lb/ac of K with a base application of 80 lb/ac of P. Initial results indicate:

- Heavier weed infestation with the higher rates, especially P. This may require an adjustment in the herbicide program
- Accelerated seedling growth and canopy closure
- Darker green coloration. This may influence visual evaluations for nitrogen requirements

We plan to continue this research for at least two more years.
Seeding Rates for Conventional Varieties

Seeding rates for conventional varieties have decreased from 100 to 120 lb/ac to 50 to 70 lb/ac over the last few years. Hybrids perform best when planted at about 35 lb/ac. During this period, each plant will have more herbicidal exposure from soil-applied herbicides. Materials like Newpath and Command may provide a higher herbicidal dose per plant compared to the higher seeding rates.

Studies were conducted at Eagle Lake and Beaumont to evaluate the interaction between planting date and Command herbicide program on rice stand, injury and yield for ‘Cocodrie’ and ‘XL723’ rice. Planting dates were in late March for the early planting and late April for the late planting. Rice was seeded at 25, 35 and 45 lb/ac. Eagle Lake Command treatments included: 1) weed-free check, 2) 1 gal to 12 acres (1:12) followed by (fb) 1:10, 3) 1:12 fb 1:8, 4) 1:10 fb 1:10, 5) 1:10 fb 1:8, 6) 1:8 fb 1:12, 7) 1:8 fb 1:10, 8) 1:8 fb 0. Beaumont Command treatments were altered to higher rates due to the higher clay content and included: 1) weed-free check, 2) 1 gal to 10 acres (1:10) followed by (fb) 1:8, 3) 1:10 fb 1:6, 4) 1:8 fb 1:8, 5) 1:8 fb 1:6, 6) 1:6 fb 1:10, 7) 1:6 fb 1:8, 8) 1:6 fb 0.

Similar studies were conducted at the same locations to evaluate the interaction of planting date and Newpath herbicide programs on rice stand, injury and yield for ‘CL161’ and ‘CLXL730’ rice. Early post-emergence Newpath treatments included: 1) 2 oz/ac, 2) 4 oz/ac, 3) 6 oz/ac, and 4) 8 oz/ac. Sequential Newpath treatments included: 1) 4 oz/ac, and 2) 6 oz/ac. Data collected includes visual injury and stand counts at 3- to 4-leaf rice, grain yield and quality.

No detectable injury could be noted in any of the plots at Beaumont two weeks after application of Command or Newpath at either planting date. The lighter soil at Eagle Lake showed some early injury from both Command and Newpath. Newpath in particular caused early stunting. However, once the flood was established, no discernible differences could be determined between any of the treatments or plant densities. Planting date did not seem to affect the amount of injury detected at Eagle Lake. The results of both the Command and Newpath applications in these studies suggest that applications of these materials would not be harmful to the hybrid rice XL723 or CLXL730.

The Use of Sub-Surface Drip Irrigation for Rice

The 2008 growing season begins the 3rd year of the Large Scale Sub-surface Drip Irrigation Study. The study consists of 4 blocks, each with a single conventional flood-irrigated plot and a sub-surface drip-irrigated plot. Plots are approximately 1.15 ac each. The drip irrigation tubing is installed at a 6-inch soil depth and 30-inch row spacing. Emitters on the tubing are spaced at 18-inch and deliver 0.37 GPH at 10 psi. The objective of the study is to determine if sub-surface drip irrigation can be used for rice, the water savings compared to conventional flood irrigation, and to determine if yields will be affected.
Results from the 2006 and 2007 growing season show that the average amount of water applied to each treatment was 16.4 and 32.2 inches for the drip-irrigated and conventionally flood-irrigated treatments, respectively. Average water savings using the sub-surface drip irrigation, over 2006 and 2007, was 49%. The yield when averaged for the two years, comparing the flood-irrigated and the drip-irrigated treatments differed by only 13 lb/ac.

In 2006 and 2007, the varieties Cocodrie and Trenasse were planted, respectively. Trenasse, which is a short-season variety, was planted in 2007 due to delays caused by excessive early season rains. The 2008 experiment was modified to include 2 rice varieties, RiceTec’s XL-744 and the conventional aromatic variety Sierra in each plot. Early observations this year show poorer germination, particularly in the drip plots. Reasons for the poor germination have not been determined.

A 49% savings in water applied is valued at ca. $25 to $70/ac depending on where the rice is being grown in Texas and whether the water is from a surface or groundwater source. Drip irrigation is probably not economically feasible with current water rates. However, escalating costs required to pump water and increasing costs of the water suggest drip irrigation is on the verge of becoming an economical alternative to conventional flood irrigation, at least in those areas of the Texas ricebelt with higher water costs. Drip irrigating rice would certainly be worth considering were government EQIP agricultural conservation funding and water districts funding provided to partially offset installation costs.

Research conducted by James C. Medley and Lloyd T. Wilson. For additional information concerning the drip irrigation study, please contact Jim Medley at (409)752-2741 ext. 2252 or email jmedley@aesrg.tamu.edu.

Hybrid Rice Management

Current research of interest to RiceTec includes: 1) validation of nitrogen rates and timings for hybrids, and 2) identification of ratoon management practices which contribute to improving hybrid ratoon yields and milling.

Nitrogen Rates and Timings: As new hybrids are released, each is evaluated to verify their optimum N requirements and application timing under Texas growing conditions. The hybrids in this year’s test are Clearfield XL729, Clearfield XL730, Clearfield XL745, Clearfield XP746, and XL723. Basic treatments are 90 or 120 lb/ac N (120 or 150 lb/ac N at Beaumont) applied pre-flood with an additional 30 lb/ac N applied late season.

Hybrid Ratoon Best Management Practices: This research is designed to identify main and ratoon crop management practices that will allow producers to maximize the high ratoon yield potential associated with hybrid rice and is being conducted at Eagle Lake and Beaumont. Some of the treatments being evaluated include...
Agronomic Management continued...

main crop stubble height, fungicide on main and ratoon crop, gibberellin applied to main crop, ratoon N rates and timing, splitting ratoon N, and insecticide applied to ratoon.

Research conducted by Lee Tarpley. For additional information, please contact Lee Tarpley at (409)752-2741 ext. 2235 or email ltarpley@ag.tamu.edu.

Management Practices for Texas Rice Production, Summary of 2007 Results

The total crop (main plus ratoon) yield advantage for early planting (March 6) compared to April 23 ranged from 185 to 2,032 lb/ac among inbred cultivars at Beaumont. The hybrid varieties XL723 and XP744 had a yield disadvantage of -814 and -534 lb/ac, respectively. At Eagle Lake, only ‘4484-1693’ (4484) yielded better from the March 7 planting. Early planting did not provide a consistent ratoon yield advantage at either location. Whole grain milling yields at both locations were 1 to 3% greater for the later planting.

Fungicide treatments were not applied to the hybrids. When averaged across the nine varieties, yield response to main crop (MC) fungicide was 300 lb/ac at both locations.

Using a flail mower to reduce main crop stubble height to 8 to 10 inches has consistently improved ‘Cocodrie’ ratoon yield at both locations. Fungicide improved ratoon yield at Beaumont, but had no effect at Eagle Lake. Applying insecticide to the ratoon to control stem borer increased ratoon yield at Beaumont by 900 lb/ac and Eagle Lake by 683 lb/ac.

The Beaumont entries with the highest total net income/ac at either planting date were XL723 ($527/ac, $504/ac for 1st, 2nd planting) and XP744 ($502/ac, $472/ac). The two top conventional varieties for the April 23 planting were Cocodrie ($416/ac) and 4484 ($288/ac). At Eagle Lake, when planted March 27, XP744 ($756/ac), XL723 ($691/ac), and ‘Sabine’ ($417/ac) were the top entries for total net income/ac.

At Beaumont and Eagle Lake, hybrid MC yields were similar at 120 lb/ac and 150 lb/ac total N. At Beaumont, there was a ratoon crop yield increase from 120 lb/ac total N compared to 150 lb/ac total N, possibly due to earlier maturity at the lower N rate.

Research conducted by Lee Tarpley. For additional information, please contact Lee Tarpley at (409)752-2741 ext. 2235 or email ltarpley@ag.tamu.edu.

Evaluating Rice Varieties and Hybrids for Texas

The rice producer has to choose from many different varieties and hybrids each year. Many of these varieties are developed in other rice producing states having soil, climatic conditions, and cultural practices different from those in Texas. This Texas Rice Research Foundation funded research helps the Texas rice producer identify varieties and hybrids that perform well under Texas growing conditions. The entries in this year’s test are being evaluated for a number of agronomic traits on sandy soil at Eagle Lake and on clay soil at Beaumont. Two planting dates are being compared.

Some of the agronomic data collected will include 1) main and ratoon crop yield and milling response with and without fungicide when nitrogen is not limiting, 2) the contribution of certain management practices to ratoon crop yield using Cocodrie as the test variety, 3) an economic ranking of an entry’s average main, ratoon, and total crop net income, and 4) variety characteristics, tillering potential, and growth stage data for
variety specific management. This year, we are evaluating 11 conventional varieties and five hybrids in various aspects of the study. The conventional cultivars and potential releases include 4484-1693, RU0401182, Presidio, Catahoula, Bowman, Cocodrie, CL151, CL161, CL171, RU0703144 and RU0703190. The hybrids include XL723, Clearfield XL729, Clearfield XL 730, Clearfield XL745, and Clearfield XP746.

Research conducted by Lee Tarpley. For additional information, please contact Lee Tarpley at (409)752-2741 ext. 2235 or email ltarpley@ag.tamu.edu.

Cropping Systems

Climatic and Soil Data
(http://beaumont.tamu.edu/ClimaticData and http://beaumont.tamu.edu/SoilData)

The climatic data program provides easy access (view, plot, and download) to both daily and hourly data for over 20,000 stations for rice countries in the world, with near real-time data for some stations. iAIMS has a graphical interface that allows a user to select a continent, country, state/province, and in many cases, sub-region. The user can view the data as graphs or tables, or download data as Excel or text files. The iAIMS climatic database is automatically updated every 1 to 4 days depending on access speed to data sources, with an automated filtering program eliminating impossible data points and filling in data gaps with estimated values using temporal or spatial interpretation algorithms. The climatic database is structured to allow dynamics access from application programs described later in this overview.

The soil data program currently provides soil data for the U.S. It allows users to view a range of soil properties for each soil layer at the national, state, and county levels. As with the climatic database, the soil database is structured to allow dynamics access from application programs described later in this overview.

This research was supported in part by funding to Ted Wilson from the Jack B. Wendt Endowed Chair in Rice Research.

Research conducted by Yubin Yang, Lloyd T. Wilson, and Jenny Wang. For additional information on the climatic database, please contact Ted Wilson at (409) 752-3045 or email lt-wilson@aesrg.tamu.edu. For additional information on the soil database, please contact Yubin Yang at (409)752-2741 ext. 2500 or email yyang@aesrg.tamu.edu.
The Post-Harvest Grain Management (RiceSSWeb) is a web-based program that allows users to predict temperature and grain moisture during rice storage and the population dynamics and damage by the lesser grain borer and the rice weevil inside the storage bins. It was jointly developed by Texas A&M University System, University of Arkansas, USDA-ARS Manhattan Kansas, and University of Missouri.

Expansion of this program is under way to 1) quantify the relationships between insect infestation levels and rice quality, 2) determine seasonal abundance of the lesser grain borer in and around rice mills, 3) assess grain protection through an experiment using the insect growth regulator methoprene and the biological pesticide spinosad, and 4) develop an economic model to determine if/when insect populations in grain bins and mills should be controlled. The final product of the proposed project will be an improved web-based application that integrates results from experiments and provides users with options for selecting an array of management measures to allow them to conduct costs/benefits analyses to optimize pest control and grain quality.

This research was supported by funding provided by grants from the USDA-CAR and USDA/RAMP programs.

Research conducted by Yubin Yang, Lloyd T. Wilson, and Jenny Wang. For additional information, please contact Yubin Yang at (409)752-3045 or email yyang@aesrg.tamu.edu.

The Rice Water Conservation Analyzer (RiceWCA) is a web-based program that allows users to rapidly estimate the costs and water savings associated with implementing a wide range of rice on-farm conservation measures, including precision grading of fields, lateral improvements (weed control and buried pipe), multiple inlet systems, tail-water recovery systems, and conservation tillage practices. RiceWCA is one of the strategic planning tools used by LCRA to determine how to best conserve water to meet demands for water in the Lower Colorado River basin and surrounding cities.

Analyses can be done at the levels of irrigation districts, sub-districts, canals, and turnouts. The ultimate beneficiary of this study will be the rice producers who implement the most cost-effective conservation measures. Initially targeted users of the program include personnel in LCRA, SAWS, and other study teams directly involved in the Colorado River water project.
This research was supported by funding provided by the LCRA-SAWS Water project.

Research conducted by Lloyd T. Wilson, Yubin Yang, and Jenny Wang. For additional information, please contact Ted Wilson at (409)752-3045 or email lt-wilson@aesrg.tamu.edu.

Cotton Crop Production Decision Support System

This project addresses the much needed synthesis and integration of information and knowledge for cotton cropping systems in Texas and the development and delivery of a crop production decision support system (CropDSS) targeted at cotton producers, consultants, and extension agents. It focuses on the delivery of an integrated cropping system program that is reliable and easy-to-use with minimal user maintenance and that is web-accessible from both desktop PCs and mobile devices such as cell phones, pocket PCs, and other wireless devices that connect to the internet.

The anticipated deliverable from the first two years of this project includes a web-accessible CropDSS that features both an irrigation- and a fertilizer-application scheduler, fully and dynamically integrated with cotton phenology, site-specific near real-time weather, soil, and production data. CropDSS will help cotton producers make real-time decisions regarding the best timings and rates of water and fertilizer applications to promote water and resource conservation, to maximize production, profit, and land sustainability, and to minimize production costs. CropDSS will also help researchers identify knowledge gaps for further research.

This research was supported by funding provided by the Texas AgriLIFE Research Cropping Systems Program.

Research conducted by Yubin Yang, Carlos Fernandez, Sailaja Koti, Lloyd T. Wilson, and Jenny Wang. For additional information, please contact Yubin Yang at (409)752-2741 ext. 2500 or email yyang@aesrg.tamu.edu.

Entomology and Insect Pest Management

Section 18 Submission for Tenchu 20SG

Based on data collected the last 2 years, the Entomology Project provided efficacy and justification information for a Section 18 Emergency Exemption for use of Tenchu 20SG (active ingredient dinotefuran) in 2008 to control rice stink bug. At the time of writing, the package had been approved by the Texas Department of Agriculture (TDA) and forwarded to USEPA for review. Ed Gage, TDA Pesticide Compliance Specialist, has worked hard to prepare this Section 18 package. Our data show this product has excellent knock-down activity and residual activity better than currently labeled rice stink bug insecticides. In addition, Tenchu 20SG
Entomology continued...

appears to possess some repellency and possibly anti-feedant properties. This product is systemic, which may be responsible for the longer residual activity. Mitsui Chemical (manufacturers of Tenchu 20SG) have assured USEPA of their intention to obtain a full federal label in the near future. Landis International has helped in this Section 18 process.

Research conducted by Mo Way. For additional information, please contact Mo Way at (409)752-2741 ext. 2231 or email moway@aesrg.tamu.edu.

Seed Treatment Research

Several rice seed treatments are being evaluated by the Entomology Project in 2008. These seed treatments target rice water weevil, but other pests may be affected, so data on rice water weevil, stalk borers, chinch bug, black bugs and leafhoppers/sharphooters are being collected. Texas received a Section 18 in 2008 for Dermacor X-100 for rice water weevil control. I thank Ed Gage for preparing the Section 18, which was approved by USEPA. Our data from the past 3 years are very positive. This year we are evaluating Dermacor X-100 for stalk borer activity at Ganado. In 2007, at the Ganado research site, Dermacor X-100 seed treatment at a high rate gave excellent control of sugarcane and Mexican rice borers, so this year we are evaluating lower rates. Other seed treatments being evaluated include clothianidin and thiamethoxam.

Research conducted by Mo Way. For additional information, please contact MO Way at (409)752-2741 ext. 2231 or email moway@aesrg.tamu.edu.

Grain Quality

Selection of Brown Rice (Whole-Grain) Varieties with Long Shelf Life

Studies have associated consumption of whole grains and whole-grain products with reduced incidence of chronic diseases such as cardiovascular disease, diabetes, and cancer. Because of the health benefits of eating whole grains, one of the key recommendations in the 2005 USDA dietary guidelines for Americans is that at least half of the Grain Group should come from whole grains or whole-grain products, which is the amount of 3 ounce-equivalents (one ounce-equivalent is, for instance, ½ cup of cooked brown rice). Brown rice is relatively high in dietary fibers, vitamins, minerals, and antioxidants compared with milled rice. However, brown rice, as with all other whole-grain cereals, has a short shelf life. This is due in part to the activity of lipase enzyme, which breaks down lipids causing development of an off-flavor. It has been suggested that de-hulling paddy or...
Grain Quality continued...

rough rice to produce brown rice disrupts the outer bran layer, resulting in the contact of lipase enzymes with the lipid. Selection for rice varieties that are low in lipase activity might prolong the shelf life of brown rice and delay the development of off-flavor. We analyzed 109 rice varieties collected from the National Small Grain Collection for their lipase activity and storage stability. We established that rice with lower lipase activity has higher storage stability. The lipase activity in this rice selection ranged from 0.92 to 5.34 units. The average lipase activity was around 2.47 units. Two commonly grown U.S. rice cultivars have higher lipase activity than average. The results suggest that opportunity exists for improving the shelf life of brown rice by lowering rice lipase activity through the use of breeding techniques.

Research conducted by Ming-hsuan Chen, Research Chemist, Rice Quality Lab, USDA ARS Rice Research Unit.

Antioxidant and Antimicrobial Effect of Colored Rice Bran Extract in Low NaCl, Phosphate-free Patties from Catfish Belly Flap Meat

Recently, consumers’ interests in health benefits from foods have rapidly increased. Many studies have shown that the consumption of whole grains and grain-based products can reduce the incidence of many chronic diseases such as cardiovascular disease, diabetes, and cancer. These health benefits from whole grains are mainly attributed to natural antioxidants primarily present in the bran of the whole grains. Colored rice bran contains very high amounts of natural antioxidants, which consist of water-soluble and oil-soluble compounds. These natural antioxidants can decrease the development of rancidity and microbial growth in meat products, so that they can improve the stability and safety of meat products, as well as sensory characteristics, such as texture and flavor. We developed low sodium, phosphate-free patties from catfish belly flap meat. This catfish patty is susceptible to the development of rancidity because of a high fat content in catfish belly flap meat. Therefore, we investigated the application of colored rice bran extract to the catfish patties in order to lower the development of rancidity, microbial growth, and changes in textural properties. The water-soluble and oil-soluble portions of natural antioxidants extracted from colored rice bran were applied separately. Both portions improved the stability of catfish patty against rancidity and retarded the changes of textural characteristics such as hardness and chewiness during storage. Only the oil-soluble portion showed retardation of microbial growth during storage. In conclusion, the addition of rice bran extract not only can improve the stability, safety and quality of the catfish patty, but also allows consumers to eat natural antioxidants with the patty to get their health benefits.

Research conducted by Byungrok Min, Ming-hsuan Chen, and Bartholomew W. Green, Rice Quality Lab, USDA ARS Rice Research Unit.

Physiology

Nitrogen Fertility and Growth Regulator Effects on Hybrid Rice Yield on Clay Soil in Texas

The yield potential of early-maturing rice (Oryza sativa L.) hybrid cultivars is high, yet studies indicate their yield is limited by current nitrogen (N) fertilization rates, at least on the clay soils. For example, in 2005 at Beaumont, Texas on a League clay, the use of 200 lb/ac N provided a total (main and ratoon) crop yield of 16,372 lb/ac (11,671 main; 4367 ratoon). However, adding additional N increases the risk of lodging. In 2006, a plant growth retardant (Palisade [Syngenta] applied two weeks post panicle differentiation) was used, for proof of concept, to decrease final plant height and the risk of lodging. A main crop N rate of 200 lb/ac as a three-way split was compared to 143 lb/ac N as a two-way split.

The additional use of the plant growth retardant resulted in yields that were 500 lb/ac less than those observed with the high N rates alone (which provided a gain of about 1400 lb/ac), but still provided a net gain due to
the combined treatments of about 900 lb/ac. Similar results were seen in Mississippi in 2007 on a clay soil (Walker, Tarpley and Bonds).

On clay soil, the higher N rate increases yield of these hybrid rice cultivars. Palisade decreases plant height, so it should help decrease lodging potential, although Palisade also decreased yield. Our research has shown the feasibility of using a combination of high N rate and a plant growth retardant to increase yield of hybrid rice cultivars without increasing the risk of lodging on clay soil.

We appreciate the cooperation of Tim Walker in Mississippi, support from the Texas Rice Research Foundation, and donation of materials by RiceTec, Syngenta, and Valent BioSciences.

Research conducted by Lee Tarpley. For additional information, please contact Lee Tarpley at (409)752-2741 ext. 2235 or email ltarpley@ag.tamu.edu.

**Seed Treatments for Planting Rice into Cool Soil**

Interest in early planting is increasing among U.S. rice producers. With early planting, crop development can often occur before the hottest periods of the season, and the probability of a favorable season for the ratoon crop is increased. However, cool soil temperatures at rice planting can result in poor germination (both the ability to germinate and the rate of germination), and slow seedling growth, sometimes with reduced growth extending into the season. A gibberellic acid seed treatment is commonly used in the Southern U.S. to stimulate seedling vigor for semi-dwarf rice cultivars. The gibberellic acid treatment, if rates are not controlled carefully, can sometimes lead to tall stemmy seedlings prone to lodging with spring breezes.

The objective of the study was to identify plant growth regulator seed treatments that can increase seed germination without the chance of tall stemmy seedling growth.

In 2006, ten seed treatments were evaluated, with five retained for additional testing. In 2007, another treatment was eliminated because of inferior seedling phenotype (too tall). Four novel seed treatments have been identified that provide higher and more consistent germination rates, while also providing at least as much leaf and tiller development, and plant biomass, but a shorter seedling relative to gibberellic acid treatment when seeds were planted into soil with an average 3 AM soil temperature of 10°C (50°F) or less for at least the first 10 days after planting.

We appreciate the support of the Texas Rice Research Foundation, and the donation of materials from Valent BioSciences.

Research conducted by Lee Tarpley. For additional information, please contact Lee Tarpley at (409)752-2741 ext. 2235 or email ltarpley@ag.tamu.edu.
Impact of High Nighttime Temperatures and Elevated UV-B Radiation on Texas Rice Yields

Along the Gulf Coast, rice crops currently experience high nighttime temperatures and UV-B radiation levels that are above optimal for critical stages of rice development. High nighttime temperature and high UV-B radiation can potentially lower rice yields by affecting photosynthesis, respiration, membrane stability, pollen germination, spikelet fertility and grain dimensions.

Two studies were carried out in the greenhouse, both addressing the effects of high nighttime temperature and high UV-B radiation on rice plants. In the first study, rice plants (cultivar: Cocodrie) were grown in two different nighttime regimes (27°C and 32°C). Plants were sprayed with 3 different chemicals (Salicylic acid, Glycine betaine and Vitamin E) to prevent damage by high nighttime temperature. In the second study, nine commercially grown southern U.S. rice cultivars (Cheniere, CL161, Cocodrie, Cypress, Sierra, Presidio, XL8, XL723 and XL729) were grown under 3 different UV-B regimes (no UV-B, ambient UV-B, and twice-ambient UV-B). This study was conducted to identify the sensitivity of commercial southern U.S. rice cultivars to enhanced UV-B radiation.

Our results showed a decrease in rice yield as a result of high nighttime temperature due to increases in respiration rates and spikelet sterility. In addition, high nighttime temperatures also decreased pollen germination, membrane stability and grain dimensions, thereby reducing rice yields. All three chemicals (Salicylic acid, Glycine betaine and Vitamin E) limited the damage due to high nighttime temperatures. The results from our UV-B study showed that southern U.S. rice cultivars differ in response to enhanced UV-B radiation with respect to yield, photosynthesis, pollen germination, spikelet fertility and membrane stability. Plants exposed to elevated UV-B radiation (twice-ambient) showed decreases in these factors in all the cultivars. However, the magnitudes of reduction in the above-mentioned parameters varied among the cultivars. Hybrids were typically less sensitive to enhanced UV-B radiation, compared to the conventional cultivars. The most UV-B tolerant rice cultivar in this study was cultivar XL729.

Generous funding for the plant physiology projects was provided by the Texas Rice Research Foundation and the Texas Rice Belt Warehouse.

Research conducted by Abdul Razack Mohammed and Dr. Lee Tarpley. For more information contact Dr. Tarpley at (409)752-2741 or email ltarpley@tamu.edu.

Physiological Basis for Rice Heterosis

In 2005, our team began to design field chambers that could be used to study and contrast the growth and development of field grown inbred and hybrid rice varieties. After three iterations, a design was developed that could withstand the high winds that often occur along the Texas Upper Gulf Coast, while providing sufficient area for subsequent measurements of canopy light interception and plant biomass. Our goal was to determine the underlying physiological basis for increased yield performance of hybrid rice and to begin to determine whether the phenotypic traits that provide hybrids with superior yield performance can be incorporated into conventional inbred varieties.
Plots were established in 2007 at the Beaumont Center. Photosynthesis was measured using canopy chambers during each of 9 recording periods encompassing main and ratoon crop production. The photosynthesis of 8 varieties was measured, 4 of which were conventional inbreds and 4 were hybrids. Photosynthesis was measured for up to 72 hours for each recording period, providing measurements for a range of temperatures and light intensities. Following each recording period, data on canopy-level light interception was estimated hourly from ca. 8 AM to 5 PM. The plants were then dissected, the number of tillers, reproductive tillers, and maximum root length recorded, and the biomass divided into its root, leaf, culm, grain, and the vegetative panicle components. Tissue samples were analyzed for total structural and non-structural carbohydrate.

The tested hybrids, on average, captured sunlight more efficiently, had a higher rate of photosynthesis, and produced a greater amount of plant biomass than did the inbreds. The higher light capture efficiency was largely due to a higher light extinction coefficient, which was due to the leaves of the tested hybrids, on average being less erect. The hybrids were able to take up a significantly greater amount of nitrogen, both on a leaf area and total biomass basis. While the photosynthesis performance of the individual inbreds and hybrids tended to group within their respective categories, considerable variability existed.

For 2008, eight hybrid and nine inbred varieties will be studies. The data will provide preliminary results on the degree of hybrid vigor that is associated with a small subset of key phenotypic traits that govern photosynthesis, tillering, and crop maturity.

This research was supported in part by funding to Ted Wilson from the Jack B. Wendt Endowed Chair in Rice Research.

Research on this study is conducted by Lloyd T. Wilson, James C. Medley, and Stanley Omar PB. Samonte. For more information, please contact Ted Wilson at lt-wilson@aesrg.tamu.edu.

Varietal Improvement

Genotype x Trait Interaction in U.S. Rice Cultivars

High performing U.S. rice cultivars are used as checks in the Uniform Regional Rice Nursery (URRN). The evaluation of these cultivars for multiple yield-related traits using Genotype plus Genotype x Trait (GGT) biplot analysis would assist rice breeders in identifying cultivars that perform high or low in specific rice traits, and hence, these cultivars could be recommended as parents of crosses in rice improvement and research projects. This study aims to compare U.S. long-grain rice cultivars on the basis of multiple traits, determine relationships among traits, and identify the best parent for these important traits.

Seventeen long-grain rice cultivars that were common across the 2005 and 2006 URRN at the Texas AgriLife Research and Extension Center, Beaumont, TX, were analyzed for 20 traits using the GGT biplot analysis. Cultivars that consistently ranked in the top three in 2005 and 2006 were Wells (plant height at 34 days after emergence [DAE] and at harvest, mass per main culm panicle [MCP], no. of filled grain per MCP, and filled grain weight per MCP, and flag leaf length, width, and area), Hidalgo (tiller density at 40 DAE), Cheniere (no. of days to heading and maturity), Banks (flowering duration, plant height at harvest, and no. of...
unfilled grain per MCP), Francis (flowering duration, no. of unfilled grain per MCP, and total no. of grain per MCP), Trenasse (panicle type, grain yield, and whole milled rice percentage), and Spring (total milled rice percentage). Cultivars that consistently ranked in the lowest three in 2005 and 2006 were Trenasse (tiller density at 40 DAE, days to heading, flowering duration, mass per MCP, no. of filled grain per MCP, total no. of grain per MCP, filled grain weight per MCP, and flag leaf length, width, and leaf area), Francis (tiller density at 40 DAE and total milled rice percentage), Spring (days to heading, flowering duration, and days to maturity), Cheniere (grain mass), Wells (panicle type), and Banks (total milled rice percentage). Inclusion in the top three indicates that the cultivar is a desired potential donor if higher value of the trait (e.g. higher mass or grain yield) is important, while inclusion at the lower three are important for traits in which lower value (e.g. shorter maturity, shorter flower duration) is desirable.

Funding for this project was supported in part by the Jack B. Wendt Chair in Rice Research.

Research on this study is conducted by Stanley Omar PB. Samonte, Rodante E. Tabien, and Lloyd T. Wilson. For more information, please contact Omar Samonte at sosamonte@aesrg.tamu.edu.

**Development of Rice Cultivars Efficient in Utilizing applied Nitrogen**

With the increasing price of fertilizer and the potential environmental hazard due to excessive N application, a cultivar that is efficient in using applied N is very important. Nitrogen utilization efficiency (NUE), the ratio of grain yield (lb grain) to plant N content (lb N), varies significantly among lines in Texan environments and is important when a comparison is made between lines with non-significantly different grain yields, but with significantly different N contents. Currently, high NUE is one of the selection criteria with which elite lines that are entered into yield trials of the rice breeding program at the Texas AgriLife Research and Extension Center at Beaumont, TX, are being evaluated and selected. Plant samples are obtained from selected yield trial entries, and the N content is determined. Grain yield is estimated from the plant samples that were obtained at harvest. The NUE of each elite line is then estimated using the grain yield and N content values.

Lines that have relatively higher NUE values and higher yield, compared to Cocodrie, are desirable genotypes. In the previous years, panicle NUE results have helped in selecting the rice lines that were dropped from a specific yield trial, retained for further testing, or advanced to the next level of yield trials. Last year, the range of panicle NUE of 36 selected rice lines entered into yield trials ranged from 17.7 to 49.6 lb panicle/ lb N, with an average of 38.0 lb panicle/ lb N. Twenty of these lines had higher panicle NUE.
than Cocodrie, which had a panicle NUE of 37.8 lb panicle/ lb N. This year, 37 of the high yielding rice lines that are being evaluated in yield trials of the rice varietal development project, funded by the Lower Colorado River Authority and San Antonio Water Systems, will be sampled for grain yield and plant N content, and their respective NUE values will be estimated.

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Research on this project is conducted by Stanley Omar PB. Samonte, Lloyd T. Wilson, Rodante E. Tabien, and James C. Medley. For more information, contact Omar Samonte at (409)752-2741 ext. 2272 or e-mail sosamonte@aesrg.tamu.edu.

Response of Very High Tillering Dwarf Rice Mutants to Nitrogen Fertilizer, Planting Density and Gibberellic Acid

Novel very high tillering dwarf rice mutants were identified in an early generation of ‘L202’ x ‘Saber’ cross and are currently being characterized. A greenhouse experiment was laid out in split-plots within a completely randomized design having three replications to evaluate the response of two mutant lines, ‘Cocodrie’ and ‘Zhe 733’ to three levels of nitrogen (179, 202, 224 kg/ha) and five planting densities (1, 2, 3, 4, 5 plants/hill).

The mutants differed significantly from Cocodrie and Zhe 733 for all studied agronomic traits across varying nitrogen levels and planting densities. The mutants nearly 18 times more tillers than Cocodrie with 83% of the tillers producing panicles. The tillers were 61.5% shorter than Cocodrie in plant height across levels of nitrogen and planting densities. The panicles of the mutants were shorter than Cocodrie by 38% and these had very few grains (30) per panicle. Results showed that the different levels of nitrogen and planting densities had significant effects on tillering capacity of the mutants, but not the semi-dwarf rice cultivar, Cocodrie. A significantly higher tiller number was observed at lower nitrogen level (179 kg/ha and 202 kg/ha) as compared to highest nitrogen level (224 kg/ha). Increasing nitrogen levels had no effect on plant height, flag leaf length, panicle length, number of filled grains/ panicle, number of non-filled grains/panicle, number of total grains /panicle and panicle exsertion length of the mutants. Highest number of productive tillers, non-productive tillers and total tillers/plant were observed at lowest planting density and it decreases as planting density increased. No response to different planting densities was detected for plant height, flag leaf length, panicle length, filled grains/panicle, non-filled grains/panicle and total grains/panicle in rice mutant unlike Cocodrie. Genotypes x nitrogen x density interactions were found non-significant for studied agronomic traits.

A separate study was conducted to determine the response of the lines and Cocodrie to gibberellic acid (GA) application. The mutants were GA-responsive, like Cocodrie, and the second leaf sheath was longer for all GA treated plants.

Research conducted by Dhananjay Mani, Rodante E. Tabien, Cherstly L. Harper and Patrick M. Frank. For more information, contact Rodante Tabien at (409)752-2741 ext. 2230 or email retabien@ag.tamu.edu.
Development of High Yielding Rice Varieties with Important Traits for Texas

The state breeding project being funded by Texas Rice Research Foundation (TRRF) has used various germplasm to produce new crosses each year, and the 133 crosses made in 2007 focused on donors with high yield, good grain quality, seedling cold tolerance, blast and sheath blight resistance, seedling vigor and herbicide tolerance. These F1s will be grown in the greenhouse in the spring of 2008 and then field-transplanted to produce more seeds. The 2006 crosses advanced in 2007 will be field-planted in 2008 for plant selection.

In 2007, a pedigree nursery (PN), observational nursery (ON), preliminary yield trial (PYT), statewide preliminary yield trial (SPYT), and uniform regional rice nursery (URRN) were established in Beaumont. The same set of SPYT and Texas elite lines at the URRN trial were evaluated in Eagle Lake and Ganado. There were 4,603 newly developed lines and segregating lines planted for selection at the PN. From the PN, the 1,573 best segregating rows were retained for further selection, while 262 most uniform lines were identified for the 2008 ON. Initial selection, based on uniformity and phenotypic appearance, identified 232 good lines at the ON out of 4,747 lines planted. The best of these lines will be advanced to the 2008 PYT. There were 80 lines included in the 2007 PYT and yield of the top ten entries ranged from 8,731 to 9,291 lb/ac for main crop, 1,965 to 3,275 lb/ac for ratoon, and total yield of 10,696 to 12,566 lb/ac. These ten lines had 10 to 17% yield advantage over ‘Cocodrie’. The SPYT, conducted in both Beaumont and Eagle Lake, had the 17 best lines from 2006 PYT and three check varieties. Two lines were consistently in the top five at both locations. Six lines at Beaumont were better than all three checks used in the trial, but only one line was better than the checks at Eagle Lake. The highest yielding line in two locations was from a population shared by LSU breeding program in 2003. The top elite lines will continue to the 2008 URRN. The state breeding project nominated its first five elite lines for inclusion in the 2007 URRN. The best line, RU0703144, had an average yield of 8,015 lb/ac in three in-state trials and 8,533 lb/ac in four out-of-state trials. In seven locations, this line had an average main crop yield of 8,274 lb/ac, and its highest yield of 9,689 lb/ac was obtained in Mississippi.

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Development of a High-Yielding Water-Efficient Cultivar

As competition for water between agriculture and urban centers increases, greater pressure is placed on more efficient water use. In 2002, the Texas AgriLife Research and Extension Center at Beaumont began an ultra high-yielding main crop rice cultivar selection project, with financial support from the Lower Colorado River Authority (LCRA) and San Antonio Water System (SAWS). It’s objective is to develop a commercially acceptable, ultra-high yielding rice cultivar, whose first crop would be economically profitable without the second crop, especially during conditions when sufficient water supplies may not be available. In comparison to existing short-season cultivars, this project focuses on developing a plant type that is slightly larger, slightly later in maturity (4 to 7 days), and has a yield potential that is greater than that of conventional short-season rice cultivars.

For the 2008 cropping season, 4,300 pedigree nursery rows and 1,850 observational nursery rows are being...
evaluated as part of the breeding project. In addition, 88 elite lines are being evaluated in an early-planted yield trial. These 88 lines are also evaluated in a second yield trial, 56 of them are in the preliminary yield trial (PYT) at Beaumont, 22 are in the Statewide PYTs at Beaumont and Eagle Lake, and 10 are in the Uniform Regional Rice Nursery (URRN). Marker-assisted selection is being used to identify lines that have genes for desired cooking quality, semi-dwarf stature, and blast resistance. Furthermore, 36 elite lines are being evaluated and selected for high nitrogen utilization efficiency. During the winter, a nursery will be established at Puerto Rico to advance selected lines and produce seed for next year’s cropping season.

Results from the evaluation of five LCRA/SAWS lines in the URRN at Beaumont in 2007 showed that four lines had higher grain yield than ‘Cocodrie’, with three of these lines having at least a 23% yield advantage.

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Research conducted by Lloyd T. Wilson, Rodante E. Tabien, Stanley Omar PB. Samonte, and James C. Medley. For more information, contact Ted Wilson at (409)752-3045 ext. 2210 or e-mail lt-wilson@aesrg.tamu.edu.

Alternate Crops

Energy Cane and Soybean Research

The Entomology Project is conducting research to determine the role of redbanded stink bug in the production of flat pod syndrome and delayed maturity, which plague soybeans grown in our area. In 2007, we generated preliminary evidence to indicate this pest is largely responsible for these problems. We also generated data to suggest this insect must feed directly on a pod to cause flat pod. We identified a MG VI cultivar - NC Roy - which performs well on the east side. However, this cultivar has a low pod height. In cooperation with Dr. Tarpley, we are evaluating gibberellic acid applied at various times in an effort to increase pod height to make harvesting easier and more efficient. In cooperation with USDA/Houma, LA, we are evaluating energy cane germplasm for adaptability to SE Texas conditions. Some of these entries have fiber content twice that of standard sugarcane varieties.

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