Large numbers of crosses have to be made annually in rice breeding programs to generate a full spectrum of recombinants for selection for different breeding goals. Because rice is a self-pollinated crop with the perfect flower that contains both pistil (stigmas, styles, and ovary) and stamens (two-celled anthers and filaments), prior to anthesis, the designated female parent must have its anthers removed before being pollinated with the selected male parent. The process to remove anthers is called emasculation. Hot water treatment and vacuum suction are two most common emasculation methods.

Pollen grains are more sensitive to high temperatures than is the stigma. When treated with water at 113 degrees Fahrenheit for 5 minutes, the pollen grains lose viability while the stigma remains functional. This differential response to high temperature is used for emasculation in artificial hybridization. Pollen grains from the spikelets that will flower the same day you make a cross will have the maximum chance to be killed by the hot water. The female panicles with the top ¼ or 1/3 spikelets already flowered make the best materials for the hot water treatment. On a sunny day, females can be treated at 8 a.m., while the whole emasculation process must be finished before 10 a.m. The starting time needs to be adjusted for the weather and materials. Immediately after being removed from the hot water, some spikelets should open. One-third of the glume must be clipped off of each spikelet, and remaining spikelets that have not opened should be cut off with a pair of sharp scissors. At least 20-30 emasculated spikelets are needed for a successful cross. Once the emasculation is finished, a glassine cross bag must be immediately placed over the panicle with the female label on the bag along with the date. Plants can be placed back into the greenhouse waiting for pollination.

Emasculation is also carried out by using a small vacuum pump to extract the unripe anthers from spikelets of selected female parents by suction force. The device contains an oil-free pump, plastic tube, and filters for filtering pollen grain and incoming air. A glass pipette is connected to the end of the plastic tube; the narrow nozzle of the pipette is used for sucking anthers from the clipped spikelets. A panicle of the designated female parent with only a few top spikelets that flowered the day before is the perfect material for vacuum emasculation. Trim the panicle from the bottom and work upward to leave 25-35 well-spaced spikelets to be emasculated. Cut an opening on each of selected spikelets separately so that the anthers come free to be vacuumed out of the spikelet. Touch the tip of the pipette to the clipped spikelet, and the vacuum sucks out anthers without damaging the stigma. After covering with a labeled glassine cross bag, the female parent is moved back into the greenhouse and is ready for pollination.

The process of transferring pollen from selected male parents to the emasculated spikelets of female parents is called pollination. It may be done immediately after emasculation or may be delayed for up to several days. It can be done either by bagging a flowering male panicle above the emasculated female panicle in a glassine cross bag or by cutting off the entire or part of a flowering male panicle and swirling around the female inside or outside the glassine cross bag. After pollinating the female, write the male label on the cross bag, place the bag back over the female panicle, and paper clip the bottom of the cross bag. Crosses are ready to be harvested in about 28 days.

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Sustainability in agricultural crop production has become a major area of emphasis for many of the major customers of Louisiana produced rice. So what is sustainability in crop production? In its simplest form, the concept can be described as the production of food and fiber using practices that will ensure the ability to continue to do the same into the future. Stated a little differently, sustainable agriculture is based on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs as it relates to food production. The LSU AgCenter has been working closely with Kelloggs and Louisiana Rice Mill to develop a program to document as well as improve the sustainability of rice produced within the state. However, going into this endeavor, many of us had an idea that currently Louisiana rice is produced at a very high level of sustainability. This was reinforced recently with the release of a study commissioned by the USA Rice Federation’s Sustainability Task Force. The study was conducted by HIS Global Insight in an effort to establish a baseline for rice resource efficiency. Several research scientists, including Dr. Mike Salassi and me, worked with this group. The goal was to develop benchmark data to evaluate improvement over time and changes in crop production practices on rice sustainability parameters, such as land use, energy efficiency, soil loss, water usage and environmental/carbon footprint. The study included the major rice producing states of Arkansas, California, Louisiana, Mississippi, Missouri and Texas. The scope of the data collected included the materials and activities needed to produce the rice crop and get it to the first point of storage after harvest. The intention was to capture the energy, carbon and other resources needed to produce and dry the crop, as well as the energy embodied in crop protection chemicals, fertilizers and seed. General conclusions from this study illustrate that the rice industry has made significant improvements in its sustainability of production over the past 20-30 years.

One important factor here is that U.S. rice yields have increased more than 60 percent in the past 30 years. This increase in productivity allows U.S. rice producers to satisfy growing demands with no additional land area in production. Specific findings show that rice producers have decreased the amount of land required to produce 100 pounds of rice by 21 percent, which has led to an 821,000-acre reduction in land used for production in 2009 compared with 20 years ago. There also has been a 43 percent reduction in soil loss associated with U.S. rice production since 1987. This has, in turn, meant that soil erosion associated with the 2009 crop production was reduced by 5.4 million tons compared with the production two decades ago. The water used to produce 100 pounds of rice has decreased by 33 percent, saving nearly 24 million gallons of water in 2009, compared with 20 years ago. In addition, more than 20 percent of the current rice farming operations use recycled or reclaimed water in production of the crop. There has been a 52 percent reduction in the energy used to produce 100 pounds of rice over this 20-year period, which is the equivalent of 280 million gallons of diesel. Perhaps, most importantly, there has been a 29 percent reduction in soil methane production per 100 pounds of rice. The climate impact net of soil methane has dropped by 42 percent during this same period. The study also noted the positive contributions that rice production provides to wildlife and biodiversity, and the report concluded that the U.S. rice industry is moving toward meeting an increasing demand while achieving a significant reduction in environmental impact per 100 pounds of rice produced.

In summary, this report shows that rice has a good story to tell in improvements of the past few years. Much of this improvement is the result of the implementation of new technology developed through research conducted at the Rice Research Station, as well as other units within the AgCenter. The Kelloggs program will look at ways to make improvements in the short- and long-term sustainability of Louisiana rice production. A major area of emphasis here will be the AgCenter’s Master Farmer program, which fits very well into these efforts. We are currently looking at ways to fine-tune the Master Farmer program to enhance this major sustainability effort. The bottom line is that while most Louisiana rice is produced at a high level of sustainability, there is always room for improvement. Our goal for the future will be to continue to assist our producers in adopting more sustainable practices in rice production while maintaining and improving profitability in the Louisiana rice industry.

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HIGHLIGHTS OF 2011 RICE FIELD DAY

Photos by Bruce Schultz
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Pest of the Quarter - Stored Grain Insects

Combines are rolling in south Louisiana, and rice is moving into bins for drying and short- or long-term storage. Make sure you have a plan to protect your crop until it moves to market. You’ve invested a lot of time, energy and dollars into the crop, and stored grain pests can substantially reduce the quality and quantity of your stored rice. We’ve received more calls this season about pest problems in stored rough rice than in any other recent year in Louisiana.

It is important to take an integrated approach to pest management in stored rice. The critical factors to maintain high quality stored rice and protect your crop investment include appropriate grain conditions at harvest (grain moisture), ambient temperature and moisture management in storage facilities, aggressive monitoring for infestations, and judicious use of insecticides.

The first step in pest management/prevention is to ensure that your bin is empty, properly sealed, clean and dry before putting the rice in the bin. Harvesting rice at ideal moisture levels is also critical. It is important to dry-down the rice after it is placed in the bin for storage. The use of controlled-ambient aeration is one method to quickly reduce the temperature at which the rice is stored below 60 degrees Fahrenheit. This is a critical temperature below which insect development does not occur. To facilitate this process, Texas AgriLife has developed a Web-based model incorporating climate data that you can use to control aeration and manage your rice to minimize injury from stored grain pests. It can be found at http://beaumont.tamu.edu/RiceSSWeb.

The second step is to know your enemy. A variety of insects – including Coleoptera (beetles – red flour beetle, sawtoothed grain beetle, lesser grain borer, rice weevil, Sitophilus spp.) and Lepidoptera (moths – Indianmeal moth and Angoumois grain moth) can infest stored rice and reduce quality and quantity. It is important to learn to identify these insects so that you know which pests you are managing in case of an infestation. Pictures of many of these insects can be found at www.insectimages.org by searching by common name. Depending on the species you are most concerned about, different methods can be used to monitor infestations in a variety of storage situations. Many moth and beetle species can be monitored using pheromone lures and sticky traps. Pheromones are chemicals insects use to communicate with each other, and they can also be used to attract insects to a trap for monitoring purposes. Food-baited traps are used to monitor pest species for which we do not have a pheromone. Monitoring around your bins will reveal which species occur during different times of the year.

Finally, when an infestation is confirmed in your storage bin, it is critical to respond quickly to the infestation. If left unchecked, the infestation can substantially reduce the quality of your stored rice. Be certain that you have correctly identified the insect or mite causing injury to your stored rice. Consult your local extension agent for the latest recommendations for pest management. There are a variety of insecticide strategies that can be used for management, including fumigation, spray applications, aerosols and diatomaceous earth. Frequent clean-up and sanitation are probably the best things you can do to maintain low insect pest numbers. This is particularly important inside and outside milling facilities.

The second research area is concerned with development and evaluation of male sterile lines for the two-line hybrid system. We are evaluating optimum environmental conditions that will facilitate high seed purity and maximum seed yields from selected male sterile lines.

A related effort deals with development of new male sterile lines that are better adapted in terms of maturity and seed production. Potential candidate material has been recently identified that will be further characterized in the 2012 field season. The final research area deals with the identification and use of DNA markers to discover and characterize new male sterile and restorer lines. Successful application of this DNA technology is expected to speed up the creation of new hybrids for the Louisiana rice industry.

The Rice Genetics Program is committed to research that will complement and enhance the Rice Station breeding efforts for hybrid development.

Rice Genetics Research Contributes to Hybrid Development

The LSU AgCenter Rice Breeding Program at Crowley is actively working toward development of new hybrid rice varieties for the Louisiana rice industry. Rice breeders Xueyan Sha, Steve Linscombe and Weike Li have made good progress in development of promising lines that can lead to new hybrids. The Rice Genetics Program is currently involved in three main research areas that complement the work carried out at the Rice Station.

The first area is focused on development of maintainer and restorer lines, primarily from Asian sources, for the three-line hybrid system. A major effort is directed toward development of restorer lines that generate hybrids with high yields along with good milling and cooking quality characteristics. We are currently selecting new lines derived from crosses to Louisiana varieties that will be evaluated in 2012 field trials.

The second research area deals with development of new male sterile lines that are better adapted in terms of maturity and seed production. Potential candidate material has been recently identified that will be further characterized in the 2012 field season. The final research area deals with the identification and use of DNA markers to discover and characterize new male sterile and restorer lines. Successful application of this DNA technology is expected to speed up the creation of new hybrids for the Louisiana rice industry.

The Rice Genetics Program is committed to research that will complement and enhance the Rice Station breeding efforts for hybrid development.

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Sheath blight is probably in every rice field every year, often causing significant damage. Other diseases like Cercospora, blast and bacterial panicle blight appear erratically at high enough levels to cause damage. Several factors cause these diseases to become severe in any given year. These include the distribution of susceptible varieties, environment, inoculum survival and management practices. All of these relate to the disease triangle, which is made up of a susceptible host, a virulent pathogen able to cause disease and a favorable environment. If one side of this triangle is missing because of a resistant host, a pathogen not present or unable to infect or an unfavorable environment, disease will not develop.

Cercospora is an excellent example of an erratic disease that can become severe if all sides of the triangle are present. In 2006, there was a major Cercospora epidemic. Varieties Cheniere and CL131, both susceptible to the disease, made up more than 50 percent of the acreage, and several other varieties grown that year were moderately susceptible and served as a susceptible host. Also, a large portion of the 2005 rice acreage that was second-cropped and used to produce crawfish survived the mild winter. These plants were heavily infected with Cercospora, which produced more spores earlier in the year than normal, resulting in the second side of the triangle, the presence of pathogen. The third side of the triangle, proper environment, was set in place with a wet, warm spring and early summer that favored Cercospora infection. The last nail in the coffin was the extensive use of the fungicide Quadris, which has little activity against Cercospora.

Since 2006, we have not seen a widespread epidemic because all three factors have not been favorable, and we have been using fungicides containing propiconazole that better control the pathogen. An exception to this is the severe Cercospora disease development in late-planted rice and in the second crop where inoculum has built up during the growing season or a fungicide cannot be used.

Blast is one of the most damaging and important rice diseases in the world. In the Southern United States it is less important and more erratic than in other parts of the world. Most of the varieties grown here have either major resistance genes to the most common blast races or have some level of field or general resistance to blast. The only times there have been major epidemics of blast are when susceptible varieties made up a high percentage of the acreage. Under this situation, spore production is higher causing the disease cycle to escalate rapidly (pathogen). Examples of this include when Newbonnet in the 1980s and Bengal in the 1990s became popular. This situation was quickly corrected by the abandonment of these varieties for more resistant ones. As with sheath blight and Cercospora, wet and warm conditions favor disease development, while hot dry conditions inhibit disease (environment). On a more local level, field resistance can be overcome by draining rice, causing a favorable environment for blast. Blast under upland, drained aerobic soil conditions is probably five to 10 times more severe than under flooded, anaerobic soil conditions because of longer dew periods (environment) or physiological changes in the host.

Bacterial panicle blight can cause significant grain sterility and damage. Serious outbreaks have occurred in 1995, 1996, 1998, 2000 and, most recently, 2010. All of these years were very hot and dry and favored the disease (environment). Under cooler conditions during heading and grain filling, little disease develops. The disease was probably not as severe in 2010 because the pathogen is primarily seed-borne, and bacteria did not have several hot, favorable years in a row to develop large populations (pathogen) on subsequent seed crops as in the 1990s. Consecutive years of hot weather increase the risk.

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Kimberly Guidry started working at the Rice Research Station two decades ago this year. She started as a word processor after completing course work at the Crowley Vocational Technical School.

She is currently the accounting specialist for the station, and her job responsibilities include purchasing, paying bills and arranging travel for station employees.

“I love my job,” she said. “I like the people I work with, and I like the work I do. The atmosphere here is professional but relaxed.”

She likes it so much, in fact, that you’ll often find her at her desk after quitting time. “If I’m working on something, I like to finish it.”

Even in the computer age, Guidry has to deal with a considerable load of paperwork, and she keeps things in order. “I like everything neat so I can find something when it’s requested.”

Dr. Steve Linscombe, director of the Rice Station, said Guidry is one of many behind-the-scenes employees who makes sure things are done properly. “Without her, our job would be a nightmare trying to find our way through the maze of paperwork and state travel rules,” Linscombe said. “She makes life easier for all of us here at the station.”

When she’s not at work, her activities away from home include her four grandchildren (three girls and a boy) and music.

Guidry plays guitar and sings, often at weddings and funerals, and she is director of a Christian music group, the Lake Arthur Prayer Coalition. She also is director of her church choir in Lyons Point.

She has two children, Kasey Guchereau, a teacher in Acadia Parish, and Kirk Aaron Guidry, a barber in Gueydan.