Texas Rice

Texas A&M University System
Agricultural Research and Extension Center
Beaumont, Texas

September 2004 Volume IV Number 7

Hybrid Rice: Another Tool in Varietal Improvement

The breeding method in which crosses are made between two plants or lines of different genotype is known as hybridization. The progeny obtained is known as a hybrid, or F1. Heterosis is a phenomenon in which F1 hybrids derived from diverse parents show superiority over their parents in vigor and yield.


Photo courtesy of RiceTec, Inc.

A production field for hybrid rice seed, clearly showing the two different parent lines. The hybrid seed is produced on the male sterile line only.

A Brief History of Hybrid Research

Thomas Fairchild produced the first artificial hybrid in 1717 when he crossed sweet william (*Dianthus barbatus*) and carnation (*D. caryophyllus*). Sixty years later, Joseph Koelreuter did extensive work crossing tobacco, and published an article on plant hybridization detailing his findings of hybrid vigor.

In 1877 Charles Darwin described the hybrid vigor of plants in his book "The Effects of Self and Cross Fertilization in the Vegetable Kingdom". Almost at the same time, in 1865, Mendel was documenting hybrid vigor in peas.

G.H. Shull first coined the term heterosis at a lecture at Gottingen, Germany in 1914. He referred to "the increased vigor, size, fruitfulness, speed of development, resistance to disease and insect pests, or to climatic rigors of any kind, manifested by crossbred organisms as compared to corresponding inbreds."

Heterosis was first exploited in the 1930's with the large-scale production of hybrid corn. However, unlike the easily emasculated maize, the inability to emasculate the seed parent had been the primary barrier to the utilization of heterosis in many self-pollinated species, such as rice. Research conducted by Jones and Clark provided a solution to the problem. They identified male sterility in the onion cultivar 'Italian Red' in 1925, and subsequently developed the Cytoplasmic Male Sterile (CMS) system for hybrid onion production. This breeding strategy, developed for hybrid onions, is used by scientists in developing three-line hybrid rice.

In 1926, the first documentation of heterosis in rice (*Oryza sativa* L.) came in a paper published by the American Society of Agronomy by J.W. Jones. Still, producing commercial hybrid seed by hand emasculation was impractical in rice, therefore the development of male sterile lines (as with onions) was essential in exploiting rice heterosis.

Research on male sterile rice was first initiated in China in 1964, although rice heterosis was not successfully exploited until after the discovery of the wild abortive male sterile cytoplasm in the wild species *O. rufipogon* Griff at Hainan Island in 1970. By 1973, China had the means to develop the three-line system of hybrid rice production, namely, a male sterile (A) line, a maintainer (B) line, and a restorer (R) line. (See fig. 1) The first rice hybrids were put into commercial

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From the Editor...

The Beaumont Center was established (as Substation No. 6) in 1909 through the efforts of Texas rice producers who lobbied Texas legislators to insure availability of superior quality seed. As a side-note, Texas and Louisiana scientists often debate as to whether construction of the Beaumont Center started before the start of construction of the Crowley Center or visa versa, both of which began that year.

In 1914, the USDA joined the Beaumont Center and since that date has played a lead role in the development of improved rice varieties. In 2003, the Texas A&M University System established a state rice breeder position to develop Texas rice varieties that are resistant to herbicides and to oversee the Texas rice varietal development program.

While USDA researchers at Beaumont continue to play an active and important role in rice research at Beaumont, their research is increasingly focused on addressing fundamental genetic, molecular, and biochemical aspects of varietal performance and less on developing new varieties.

The Beaumont Center breeding program has been very successful at providing improved varieties and improved production practices. In 1945, rice yields in Texas were around 1,600 lbs per acre, as compared to about 7,000 lbs today. About 35% of this increase is due to the development of higher yielding varieties.

The quality of Texas rice varieties has also increased 30% during this period, with the added benefit of the new varieties no longer producing panicles that shatter and drop their grain to the ground as they mature. Also, problems with plant lodging are much less common with current varieties, which are better able to withstand the strong coastal winds that frequent our region.

The Beaumont Center continues as the leader in developing improved Texas rice varieties. However, as history has shown with other crops, there is always room for other players in the rice varietal development game.

In this issue of *Texas Rice*, we present an overview of RiceTec, Inc. the only hybrid rice seed company in the U.S. RiceTec traces its origin to the Prince of Liechtenstein Foundation and International Paper Company. Through the joint venture, RiceTec acquired Chocolate Bayou Company materials and patents (including Texmati brand rice) then went through several transformations, until it received its current name in 1990.

Most of the rice Research and Extension Centers in the U.S. produce new varieties, first by crossing two varieties, each having desired traits involving grain quality, yield, maturity, and disease resistance, and then by selecting "offspring" that appear to have most or all of the desired traits of each parent variety. This is an on-going effort, with 20,000-30,000 "offspring" evaluated each year at each U.S. rice Research and Extension Center. By the time a new variety is released, which typically takes 7-10 years from an initial cross, the new variety is genetically the same for nearly every pair of genes. Because rice plants are almost totally self-pollinating, this means that the genetics of each and every seed produced by a new variety is also nearly identical.

In contrast, RiceTec uses a breeding approach that is very different from that used at the Research and Extension Centers. Instead of breeding for genetic uniformity for genes on each pair of chromosomes, RiceTec develops hybrid rice where a large number of genes differ from each other on each pair

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Matt Siebenmorgan, the son of Patty and Terry, passed away on September 2nd. Many of our researchers have worked with Terry through the years. Please keep Patty and Terry and their family in your prayers.

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Inside This Issue

Farming Rice

a monthly guide for Texas growers

Providing useful and timely information to Texas rice growers, so they may increase productivity and profitability on their farms.

Weevils to Control Aquatic Weeds

According to the Texas Parks and Wildlife Department an invasive species is an alien species whose introduction causes economic, environmental or human harm. And on their top ten list of the worst in Texas, Giant Salvinia (*Salvinia molesta*) is number three. Its range has spread from one small pond in 1998, to 10 public waterways in 2002, including Texas' largest reservoir, Toledo Bend.

The aquatic weeds *Salvinia molesta* Mitchell and *Salvinia minima* Baker are free floating aquatic ferns native to South America, and both have become major pests in the United States. These plants grow rapidly and become problematic as they cover slow moving water bodies, such as reservoirs, canal systems and sometimes rice fields.

There are a number of ways the plants can be distributed to new regions. They can cling to boat motors or trailers, fishing rods, pets or even people. They have also been spread in the aquatic plant trade. Once they become established in a rice field they can be spread by tractors, combines or other equipment.

A piece of salvinia showing the weevil, *Cyrtobagous salviniae,* which feeds on the floating vegetation. The brown, root-like hairs, are actually heterosporous reproductive structures.

S. molesta has been controlled in Australia using the weevil *Cyrtobagous salviniae* Calder and Sands. And in Florida, a genetically distinct strain of *C. salviniae* reduces the severity of *S. minima* infestations. There are numerous success stories in many parts of the world using these weevils against *S. molesta* and there is another strain of the weevils that seems to keep *S. minima* in check in Florida. USDA-ARS researchers out of Florida have been doing field releases to evaluate a strain of the weevils that were first used successfully in Australia as a biological control agent for *S. molesta* in Texas. They have also been releasing the Florida strain on *S. minima* infestations in Louisiana.

The biocontrol agents are established by placing infested salvinia plants on the salvinia mat. The weevils feed and lay eggs on the surrounding plants and walk further from the release site across the mat as the plants become damaged by larval feeding. Sometimes the salvinia at the release site is fertilized with a floating slow-release fertilizer dispenser. This makes the plants a better food source for the weevils and helps jump-start the population.

In a two-year research project conducted at Texas A&M University, Masters student Jeremiah Dye compared the suitability of S. molesta and S. minima as a host for two weevil strains. He examined the amount of damage done by each weevil strain to each plant species under three different temperature regimes representing a range of water temperatures typical of conditions experienced by these plants in the southern U.S.

In Dye's experiment, the Florida strain was able to effectively use both plant species, while the Australia strain only completed development on *S. molesta*. There were some differences in the reproductive rates of the two strains on *S. molesta*, but these differences were not consistent across all temperatures tested.

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Salvinia continued...

Overall, Dye's results indicate that the Florida strain is the better release candidate for *S. minima* infestations, while the Australia strain is better than or equal to the Florida strain for releases against *S. molesta.*

Are insects the best way to address this problem? According to Dye, "In some ways the weevils are the most practical way. They have the potential to provide long-term suppression of the salvinia infestation, whereas mechanical and chemical means of removal leave the possibility of explosive regrowth if you don't use constant vigilance."

One concern with using insects for weed control it that they will develop alternative hosts, specifically agricultural crops. According to Dye, eliminating the possibility of this threat is a top priority for scientists. Every new country that these weevils have been imported to has done extensive host-specificity testing before releasing the weevils. Said Dye, "Rice has been of particular concern because salvinia can grow very well in flooded rice fields and canals. There has never been any evidence that the weevils will lay eggs or develop on anything but plants in the genus *Salvinia*. My work is showing that different strains of the weevils can be even more specific, preferring one species of salvinia over another."*

For more information contact Jeremiah Dye at 979-862-3407 or email jedye@tamu.edu

Left unchecked, salvinia can completely cover the surface of a pond. The dense mats block penetration of light into the water, reducing photosynthesis in the water column. Also, organic matter from the dead plants cause low oxygen conditions, which are detrimental to aquatic life.

Celebrate National Rice Month in September

Why not make a rice recipe for your family tonight in honor of America's 15,000 rice farmers?

Initiated by Congress in 1991, National Rice Month helps to increase awareness of rice and recognizes the contribution made by the U.S. rice industry to America's economy. National Rice Month celebrations will take place across the country in September in grocery stores, restaurants, schools, and rice-growing communities.

According to Dr. Ted Wilson, Director of the Texas A&M University System Agricultural Research and Extension Center in Beaumont, rice research has had a tremendous impact on the industry in Texas.

"Since the Experiment Station was established here in 1909, rice yields have quadrupled," said Wilson, "and this is due in part to the dedication and commitment of our scientists." This increase can be attributed to the development of improved varieties with higher yield potential and better disease resistance, efficient fertilizer management and reliable insect control.

"These are all areas where our research has had a positive impact on the rice industry and the families who depend on it for their livelihood," he said.

Not surprisingly, rice is one of our oldest agribusinesses, dating back to 1685 when the first rice seed came in on a ship to South Carolina. From that modest beginning, rice has become one of the South's more important agricultural crops.

Wilson points out, though, that farm gate prices are only half the story. Although the Texas rice industry contributes nearly $1 billion to the state economy every year, half of that figure can be attributed to the revenue from outdoor activities such as bird watching and hunting. Clean water is the key to creating a healthy environment for these species to thrive and, according to Wilson, research has been a key factor in attaining this goal.

"One way our scientists have helped is in the area of fertilizer management," he explained. "Research over the past three decades has led to specific fertilizer recommendations to achieve optimum yield, without having excess nitrogen spill over to pollute the environment."

"That makes rice production a win-win situation for the state economy, for the environment and for the farmers," Wilson said. *

Industry Profile...

Worldwide interest in hybrid rice has grown dramatically over the past three decades due to the yield potential this technology offers. In 1996 RiceTec, Inc. of Alvin, Texas became the first U.S. company to commercialize hybrid rice seed.

RiceTec, Inc.

Hybrid rice, though, is only part of this story. RiceTec, Inc. is an integrated rice company specializing in the breeding, development, production and marketing of high value rice products. They are a leading producer, miller and marketer of specialty consumer rice products, which are sold in over 20,000 supermarkets in North America. The company operates a 500 acre research farm, test laboratories, seed processing plant, specialty rice mill and packaging plant in Texas, a research station and seed sales office in Arkansas, and a 150 acre rice breeding station in Puerto Rico.

To fully appreciate the depth and scope of this leading edge company, it is necessary to look at the history behind RiceTec, Inc. and understand the events that led to their formation.

In the early 70's, the Prince of Liechtenstein Foundation invested in farming operations in Texas and Arkansas, primarily focusing on rice production. In 1984, the Foundation entered into a joint venture with International Paper (IP) to create Farms of Texas (FOT). IP was the parent company of Chocolate Bayou Company, which developed and released "Texmati" rice for consumer sales back in 1978. The strategic intent of FOT was large-scale rice production on three farms in Texas and Arkansas, and to develop high value rice products to grow on these farms. The joint venture had one rice breeder, Gene Sarreal, who came from IRRI in 1983. He worked under the guidance of Dr. Henry Beachell, a retired world famous rice breeder. FOT also had germplasm from Dr. Glenn Crane, the Chocolate Bayou Company rice breeder who built the Alvin research farm. Dr. Crane died before FOT was formed.

Innovation is the buzzword at RiceTec, as is shown by this fully automated, floodable greenhouse. Cold water insures that temperature-sensitive genic male sterile lines (used in the 2-line breeding program) will not produce pollen.

On the consumer rice business side, staff was added in 1985 to promote the "Texmati" rice brand. Marketing consultants were hired and consumer focus groups were used to revamp the product's packaging. "Texmati" sales jumped from $500,000 in 1984 to $1 million in 1986, a 100% increase in just over 18 months.

Back to research, in 1986, FOT joined with Occidental Petroleum's Ring Around Products (RAP) Division to form Hybrid Rice, Inc. RAP had obtained germplasm and technology from China in the early 80's to develop a hybrid rice breeding program. The yield data looked promising, so FOT staff traveled to China to learn more about the technology. It was then that they formed a relationship with Professor Yuan Longping at the Hunan Hybrid Rice Research Center. (Professor Yuan is known as the 'father of hybrid rice' and will be a recipient of this year's World Food Prize.) The plan was for FOT to produce and sell the

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RiceTec continued...

seed from parent lines supplied by RAP. In 1989, FOT decided to end Hybrid Rice, Inc. while continuing the research using Chinese public domain knowledge.

In 1990, FOT was dissolved, with the Liechtenstein Foundation acquiring RiceTec and International Paper acquiring the commodity farming operation. At the time, RiceTec's assets included the 500 acre research farm and breeding germplasm in Alvin, the off-season research farm in Puerto Rico, the Alvin packaging plant and dryer, a varietal seed business, and the "Texmati" and "RiceTec" brands.

State of the art genetic analyzer, typically used for either DNA sequencing or genotyping. RiceTec uses it for genotyping microsattelite markers in rice. The system uses capillaries instead of a slab gel. They can run 16 samples in 40 minutes, and each sample may have from 1-8 markers multiplexed. Last year they produced 1.3 million data points using 3 machines, about 25,000 data points a week – or about 8,333 data points per machine per week.

Shortly after this happened, Occidental Petroleum closed the RAP division, and RiceTec purchased their hybrid germplasm and patents, further strengthening the hybrid breeding program.

RiceTec entered an agreement with the Hunan Hybrid Rice Research Institute in 1993 to acquire new germplasm and technology for the three-line and two-line hybrid production systems. It was at this time that Professor Yuan Longping officially became a consultant to RiceTec. Dr. Fangming Xie (a protégé of Professor Yuan and Texas A&M graduate) was hired to breed three-line hybrids, and Dr. Barry Tillman initiated the two-line breeding program. The first RiceTec hybrid, XL6, was released in 2000.

Missy Spaniel works in the tissue culture lab at RiceTec, Inc. in Alvin. She produces parent plants (pollinator) for the 2 and 3-line breeding programs. Plants produced by tissue culture are exact replicas of their parents.

Over the years, RiceTec has had strong working relationships with the state and federal rice research programs. Their hybrid lines are evaluated side-by-side with standard varieties, in locations across the U.S. rice belt. And for the commercial rice that the company contracts out, check-off monies are contributed that support the university programs. As Dr. Mark Walton, Executive VP, Research and Technology, said, "We are all working together for the betterment of the industry and the farmers."

The company prides itself on strong support for farmers using hybrid rice seed. Technicians are available to help growers throughout the growing season, which is especially useful for those trying hybrid rice production for the first time. Mark Spilman, Technical Representative for Texas and Louisiana, has worked closely with many rice farmers in these states since 2002.

RiceTec has 150 full time employees at the Alvin Headquarters, 30 in Arkansas, 2 in Louisiana, 1 in Mississippi and 15 in Puerto Rico. In the research branch of the Alvin operation, facilities include a grain quality lab, test kitchen, molecular marker lab, tissue culture lab, pathology department, 15,000 square feet of greenhouse space and 4 growth chambers. The company invests a tremendous amount of money in R&D, more than all the southern university rice breeding programs combined.

RiceTec currently has over 6000 hybrid combinations in the development pipeline, with a goal of releasing at least 3 per year to the seed sales division to evaluate as 'XP' hybrids. Growers can participate in the company's Product Evaluation Program which provides large field production evaluation for hybrids be-

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RiceTec continued...

RiceTec's Consumer Business Unit markets Texmati, Jasmati, Kasmati and Chef's Original rice mixes, all under the RiceSelect umbrella brand.

ing considered for commercial release. There is a tremendous emphasis placed on experimental trials for potential hybrids to be released. Hybrids are tested at 20 locations throughout the US, at company locations and in farmer fields, and over 50 test strip trials conducted by Technical Services in 2004. In addition, over 100 hybrid tests are conducted in cooperation with University agronomists and breeders each year. There were 105 hybrid yield trials this year, which means there was one yield trial for every 1000 acres of hybrid rice planted in 2004.

Reviewing the numbers, it is clear that RiceTec, Inc. has a strong commitment to excellence. What you don't get from the R&D results, you will find in the fierce loyalty and pride that RiceTec employees have for their company. When you visit the facilities and talk to the workers, their enthusiasm and dedication shine through, and they understand without question the importance of the goals they are all reaching together. After over 15 years of hybrid rice research in the United States, it is evident that this technology will benefit rice growers for years to come. RiceTec will offer five commercial hybrids on the market for 2005 in both long and medium grains, and the company intends to introduce new and improved hybrids for many years to come. *

For more information contact Richard Long at 281-393-3502, email rlong@ricetec.com, or log on to www.ricetec.com

Hybrids Hold Firm in Tough Disease Year

Mother Nature created ideal conditions for plant diseases to thrive this summer, plaguing rice in coastal Texas and Louisiana and across the Midsouth, but hybrids have held their ground.

RiceTec hybrids have excellent disease ratings from researchers at the major universities. The three primary RiceTec hybrids available for planting - Clearfield XL8, XP710 and XP712 - have the best available overall disease package for hybrids, and in most cases, should not require a fungicide application.

South of Kaplan, Louisiana, planting rice near the Intracoastal Waterway means dealing with heavy disease pressure most every year. Ernest Girouard says very seldom does a year go by that he does not have to make at least one fungicide application on his rice. For the past two years, he has been growing hybrids in side-by-side strip trials with the conventional varieties he normally plants.

"This year, which was a worse disease year than most, I did not have to spray the hybrids," he says. "Our main pressure is from sheath blight, and we find that the disease not only affects yield, but it also affects milling and the ratoon crop. In our trials with RiceTec, we have not applied fungicides on the hybrids, and the yields and milling were better than my conventional rice."

All of Girouard's conventional rice had a fungicide application this summer. Although a small number of individual hybrid plants appeared to have sheath blight symptoms, the disease did not seem to affect the overall strip trial, so no hybrids were sprayed, he says.

Like the Midsouth, coastal Louisiana and Texas experienced similar wet, humid conditions ideal for rice diseases, says Mark Spilman, technical services representative for Texas and south Louisiana at RiceTec.

"This has not been a favorable year for rice production due to disease pressure," Spilman says. "A lot of the rice was sprayed at least once for sheath blight, but generally speaking, very few of the hybrids required a fungicide application, and disease pressure has been significantly worse in coastal Louisiana and Texas this year." *

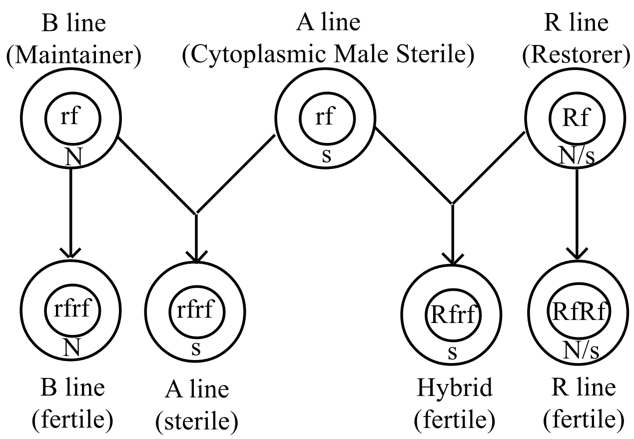

Fig. 1. Schematic description of the cytoplasmic genetic male sterility system. Male sterility is controlled by the interaction of a genetic factor (s) present in the cytoplasm and the nuclear genome. It is now known that the male sterility factor (s) is located in the mitochondrial DNA. The cytoplasmic male sterile (CMS) 'A' line is male sterile when the male sterility-controlling factor (s) in the cytoplasm and recessive alleles (rf) of fertility restoring genes are present in the nucleus. The maintainer 'B' line is identical to CMS 'A' line with regard to the nuclear genes, but differs in that it has the normal cytoplasmic factor (N), which makes it self fertile, but it has the capacity to maintain the sterility of the 'A' when crossed with it. The Restorer line 'R' possesses dominant fertility restoring genes (Rf) and it is dissimilar or diverse from the 'A' line. Crossing the 'R' line as a pollen parent with the 'A' line as a female parent restores the fertility in the derived F1 hybrid, despite the presence of sterility factor (s) in the cytoplasm derived from the 'A' line.

production in 1976. From 1976 to 1997 hybrid rice enabled China to increase rice production by more than 312 million tons.

As a result of China's success in hybrid rice production, international research efforts increased dramatically. In the United States, Ring Around Products (RAP), a division of Occidental Petroleum, Inc. received germplasm and technology from China to begin work on hybrid rice development in 1980. The company later entered into a partnership with Farms of Texas to create Hybrid Rice, Inc. Although this partnership was dissolved in 1989, RiceTec, Inc. of Alvin eventually purchased RAP's germplasm and patents to form the basis of their hybrid rice breeding program. (See full story on page 5)

In 1979, the International Rice Research Institute (IRRI) revived its hybrid rice program, and 6 years later, IRRI hosted the 16th Session of the International Rice Commission, where strong recommendations were made for scientists worldwide to pursue hybrid research. This attracted the attention of the Food and Agriculture Organization (FAO) of the United Nations, which then initiated their *Hybrid Rice Programme*. In the past decade FAO has funded hybrid rice research in Vietnam, Myanmar, Bangladesh, Philippines, Indonesia, Egypt and India.

Vietnam and Japan both initiated hybrid rice research in 1983, although Japanese scientists had been studying hybrid rice production since the 1950s. Japan released their first three-line rice hybrid in 1985, which out-yielded the inbred check by 20%.

India's hybrid rice program was started in the late 1980s, and by 1991 their network included 12 research centers. Between 1991 and 1994, over 400 rice hybrids were developed and evaluated, some for very specific conditions such as salt tolerance and increased vigor in drought conditions.

Types of Heterosis

Heterosis is apparent in many traits, including the structure of the plant and how it responds to environmental conditions. For rice, three main types of heterosis can be observed: vegetative, reproductive and environmental.

Vegetative heterosis means the hybrids generally have a higher growth rate and vegetative capacity. This could (but does not necessarily) include earlier and higher tillering capacity, wider and deeper root distribution (which leads to higher nutritional absorption), sturdier culms, greater leaf area and higher photosynthetic efficiency.

Reproductive heterosis leads to higher yields as a

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RiceTec hybrids being evaluated at the Beaumont Center.

result of larger panicles, more spikelets, and greater tillering capacity. It has been shown that the 1,000-grain weight of rice hybrids is often higher than that of either parent line.

Heterosis for resistance to adverse environmental conditions has been demonstrated to result in higher yields. These conditions may include disease and insect resistance, tolerance to drought, low soil fertility and low temperature. Some hybrids have also showed tolerance to high salt content in the soil, which is especially important in countries like India where large areas of land have salinity levels that make it less suitable for crop production.

Hybrid Breeding Methodology

Currently, there are primarily two approaches to breeding hybrid rice: two-line breeding, which makes use of environmentally sensitive genetic male sterility (EGMS), and three-line breeding, which utilizes germplasm that exhibits cytoplasmic male sterility (CMS). (See Fig. 1)

A third possible approach is the one-line method, which involves the use of apomixis to develop F1 hybrids. Apomixis is the naturally occurring ability of some plant species to reproduce asexually through seeds. Several countries around the world are involved in rice apomixis research including the Philippines, Australia, China, India and the United States. While attempts to commercially utilize apomixis in rice have not succeeded so far, genetic engineering technology offers great promise in this area.

In the two-line breeding method, one line exhibits male sterility, which is genetically controlled by recessive genes, and the other is any inbred variety with a dominant gene for that locus. Lines in which sterility is controlled by temperature are known as thermosensitive genetic male sterile (TGMS) and those in which expression is controlled by day length are called photoperiod-sensitive genetic male sterile (PGMS).

Another two-line approach for hybrid rice seed production is by spraying chemical hybridizing agents (CHAs) that selectively sterilize the male reproductive organs of one parent. This technique was used for commercial production in China, but CHAs contain arsenic, which pose unacceptable health and environmental risks, so the practice was discontinued.


Photo courtesy of RiceTec, Inc.

In producing hybrid seed, a helicopter is sometimes used to insure better pollination of the male sterile line.

The three-line method is based on cytoplasmic genetic male sterility and the fertility restoration system, and involves three lines – the CMS line (A), maintainer line (B), and restorer line (R). The seed of the CMS line is multiplied by crossing it with the maintainer line in an isolation plot. Hybrid seed is then produced by crossing the CMS line with the restorer line, which possesses the restorer gene in the dominant condition. As a result, the F1 hybrid seed is fertile.

In Conclusion

According to the FAO, in 2001 – 2002 China had over 37 million acres in hybrid rice production, roughly half of their total rice acreage. The agency believes that hybrid rice has particularly good potential to improve the food security of poor countries where arable land is scarce, populations are expanding and labor is cheap. This last factor may be critically important, since the production of hybrid seed is much more labor intensive than the production of inbred varieties.

For some U.S. producers, higher seed cost, questions about grain quality and milling yield are the biggest obstacles to hybrid production. Still, 100,000 acres were planted in hybrid rice this crop year, and grower confidence is increasing, as is the performance of hybrid rice. For the seasoned hybrid rice producers, the biggest constraint to increasing their hybrid acreage is the availability of seed.*

Jack B. Wendt Graduate Student Assistantship in Rice Research

Exceptional students who are pursuing or wish to pursue an M.S. or Ph.D. graduate degree focusing on rice integrated cropping systems management at Texas A&M University are encouraged to apply for a Jack B. Wendt Graduate Student Assistantship in Rice Research. The successful candidates are expected to become proficient in their area of research specialization and gain a broad understanding of the different facets of rice cropping system management.

It is anticipated that up to three Jack B. Wendt graduate assistantships will be supported, depending on the availability of funds and the quality of the applications.

The maximum duration is 2-1/2 years from initiation of the degree program for students pursuing an M.S. degree, 4 years for students pursuing a Ph.D degree. The amount is around $20,000/year stipend (dependent on host department stipend rate), fringe benefits, partial coverage of out-of-state tuitions, and up to $5,000/year in supplies and/or equipment.

Preference will be given to applicants whose proposed or on-going research has a strong multidisciplinary integrated systems focus that combines two or more aspects of rice systems ecology, production, or management, and has clearly identified how the proposed research will integrate expertise at the Beaumont Center with expertise in College Station or at other Research and Extension Centers in Texas.

The successful candidate's research focus should include two or more of the following disciplinary areas: agricultural communications, agronomy, applied ecology, applied statistics, applied mathematics, biochemistry, bio-informatics, computer science, developmental biology, economics, engineering, entomology, environmental management, food processing, food science, molecular biology, plant breeding, plant genetics, plant pathology, systems ecology, weed ecology and management, whole plant physiology, wildlife conservation and management.

Applications may be submitted for either a May 15 or an October 15 review. Applicants should specify which of the two dates they wish their submission to be reviewed. *

For more information see
http://beaumont.tamu.edu/graduate_assistantship/

Glyphosate Resistant Ragweed Found in Arkansas

Early reports indicate common ragweed may be the latest glyphosate-resistant weed. Found in a 22-acre patch of north-central Arkansas dryland, no-till soybeans, the hardy ragweed has survived heavy, and repeated, shots of Roundup. While lab work has yet to be completed, Extension researchers agree that all indications point to resistance.

"We're not confirming anything, but we couldn't be more suspicious," says Bob Scott, Arkansas Extension weed specialist.

On June 17, Randy Chlapecka took a call from a worried farmer just up the road from Newport. The producer reported some ragweed appeared unaffected after Roundup applications. Chlapecka, Jackson County Extension agent, then called Scott.

The field has been in a grain sorghum/soybean rotation for around a decade. Roundup has been used for that entire period. Monsanto is well aware of the problem ragweed, says Scott. The company already has sample plants in St. Louis being evaluated.

Ragweed is a very similar plant to marestail, a confirmed glyphosate resistant weed. "They're not genetically similar," says Scott, "but they are in growth habits and physiology. Like marestail, ragweed gets a woody stem and grows tougher with age. It also likes to grow in the same type of areas that marestail likes."

If proven to exist, resistant ragweed isn't going to change agriculture profoundly. Ragweed isn't a serious problem in any major crop, and there are herbicides besides Roundup to control the weed.

The larger issue, says Scott, is the path agriculture is traveling. "Two years ago, on the front page of *Delta Farm Press* was a headline saying 'Horseweed is resistant.' Now, two years later, all indications are we've got resistant ragweed. What's going to be next? Will it be pigweed?"

If, indeed, it is pigweed, as many experts believe, Scott says trouble looms. "I'll go on the record: it's a matter of when, not if, pigweed becomes resistant. Tall waterhemp or lambsquarter would also be bad news. If that scenario plays out, we'd be knocked back at least 20 years as far as herbicides." *

Excerpted from an article in Farm Press Daily
by David Bennett, email dbennett@primediabusiness.com

State, National and International News...

Rice Situation and Outlook

By January of this year the global economy once again was showing a strong level of economic growth, which was the product of a two-year rebound in global economic activity. This re-energized global economy coupled with the Western Hemisphere's demand for rough rice produced a strong appetite for U.S. rice, providing producers with excellent pricing in the second half of 2003 and the first of 2004.

What's next for the global economy and demand for commodities? The task at hand for policymakers and decision makers around the world is to transition from a recovery which achieved strong global growth and strong global demand for most commodities to a sustained level of robust global economic activity with strong demand for rice and commodities in general.

Why the pull back in rice prices? U.S. rice price weakness is at least, in part, coming as a result of the following: first, a reduced demand for long grain rough rice in the Western Hemisphere with emphasis on Brazil; second, with global rice stocks at dangerously low levels, many major rice producing countries are re-emphasizing food security and promoting production; thirdly, the transitioning of the global economy from one of recovery, with dependence on vast amounts of financial stimulus to one with a self-sustaining expansion, reducing available global liquidity and allowing for the correction in many commodity prices; and fourth, with global weather remaining fairly normal, our global competitors are responding to the increasing demand for rice.

What should rice producers expect now? In response to the mentioned stimuli, a self-sustaining global expansion will generate continued healthy export demand for commodities including rice. Tight global rice supplies are problematic and will provide strength to the rice market. A little trade fairness should be the order of the day, but with food security being such an important issue to major rice-producing countries, with China and India being great examples, trade fairness will be slow in coming to the global rice market. Assume that domestic and global rice production will become more competitive with each passing year, because it will effect farm business decisions.

Is global rice consumption continuing to exceed production? World 2004/05 rice production is projected at 397.4 million milled tons, nearly 10.5 million tons above 2003/04. World consumption in 2004/05 is estimated at 413 million metric tons compared to 2003/04's 412.9 million metric tons. Assuming no major global climatic event, global production is closing the gap on consumption. Note the world is over due for some climatic trauma, so developing global weather patterns need to be watched closely. World ending stocks are dangerously low for 2004/05 and are projected by USDA at 68.0 million tons, 15.7 million tons below 2003/04. Ending stocks are the lowest since 1982/83.

What is the current U.S. and world milled price outlook? In their August supply and demand report, USDA estimates the 2004/05 U.S. rice crop at a record 221.6 million cwt., up 11 percent from 2003/04. Long-grain production is forecast at 160.9 million cwt the second largest on record behind 2001/02's 167.6 million cwt., while combined medium and short grain production is forecast at 60.7 million cwt., the third largest on record behind 1994/95's 64.3 and 2000/01's 62.1 million cwt.

U.S. all rice ending stocks for 2004/05 are projected at 33.9 million cwt, 37 percent above the 2003/04 level. U.S. long grain rice ending stocks for 2004/05 are projected at 17.1 million cwt, 23 percent above 2003/04 and U.S. medium grain ending stocks this year are projected at 15 million cwt, 65 percent above 2003/04. USDA's season average farm price for this marketing period is projected at $6.75 to $7.25 per cwt and compares to $7.48 per cwt for 2003/04.

My expectation is for the global economy to achieve a healthy level of sustained expansion, which implies improving demand for rice globally. This coupled with dangerously low global rice stocks should continue strengthening the world rice prices. With North American and Latin American production returning to a more normal level, weakness in U.S. long grain export prices is expected, causing the spread between U.S. and Thai prices to further narrow.

For more information on the rice situation and outlook, go to http://www.aragriculture.org/agfoodpolicy/ricesitol/slides/Delta_Farm_Press_Graphics_08162004.pdf

Excerpted from an article by Bobby Coats, Extension agricultural policy analyst with the University of Arkansas Cooperative Extension Service, e-mail: rcoats@uaex.edu

From the Editor continued...

of chromosomes. An advantage of this approach is that it can produce plants that exhibit hybrid vigor. As with crossbreeds of dog and cat, hybrid rice plants are often more vigorous than either parent variety. As a result, hybrid rice varieties have a slightly higher yield potential than conventional varieties, have intrinsically greater resistance to some plant diseases, and potentially use nitrogen more efficiently. On the downside, rice hybrids typically have lower grain quality, and unless nitrogen applications are managed carefully, they tend to grow too tall and lodge.

Texas hybrid rice varieties appear to be yield competitive and with each passing year, the quality of their grain continues to increase and will probably some day reach the high quality of conventional varieties.

Some might view RiceTec as a competitor. In a short term economic sense, this may be true; however, scientists at the Beaumont Center and RiceTec have found that both groups have benefited through partnering. Who knows, maybe some day our partnership may proceed to the point where we are releasing jointly developed varieties. Food for thought!

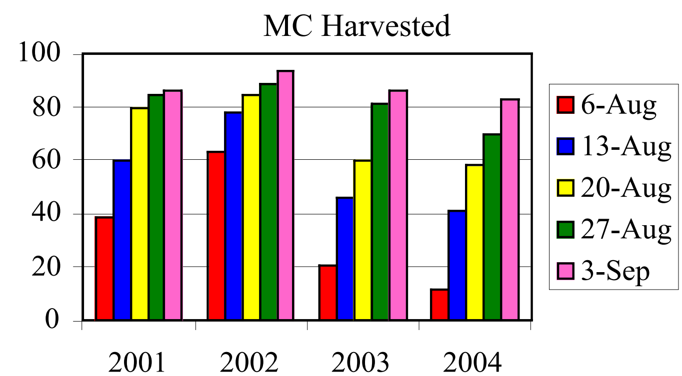
Please keep on sending us your ideas on new articles for *Texas Rice*. Remember, *Texas Rice* is your newsletter and it can only get better with your help.

Sincerely,

L.T. Wilson
Professor and Center Director
Jack B. Wendt Endowed Chair
in Rice Research

Rice Crop Update

As of September 3rd, 83% of the Texas rice crop was harvested, compared to 86% in 2003 and 94% in 2002. Texas producers planted 216,810 acres in 2004, up from 178,028 acres in 2003. Cocodrie was the top variety, covering 63% of the total acreage, with CL 161 coming in second with 10.5%.



Mark Your Calendars!

35th Annual Texas Rice Festival

Winnie-Stowell Park
September 29 - October 3

Great Food, Music, Rides
Fun for the entire family!

For more information call 409-296-4404
or log on to www.texasricefestival.org

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Access back issues of *Texas Rice* at
http://beaumont.tamu.edu

Texas Rice is published 9 times a year by The Texas A&M University System Research and Extension Center at Beaumont. Interviews, writing and layout by Jay Cockrell. Editing by Ted Wilson, Jay Cockrell and Brandy Morace, with additional support by Jim Medley. Information is taken from sources believed to be reliable, but we cannot guarantee accuracy or completeness. Suggestions, story ideas and comments are encouraged.

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