Texas Rice

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# Rice Diseases Around the World

Over 70 plant diseases have been found to affect rice in countries around the world, with around 25 found in the U.S.

For the southern rice belt, blast and sheath blight are obviously major concerns, followed by stem rot, brown spot, narrow brown spot and kernel smut. For areas that are water seeded, seedling blight and water mold can cause significant damage. Minor diseases include crown rot, leaf smut and leaf blight, but there are others that appear sporadically in isolated locations when the weather is favorable. (See insert on page 7 for a list of U.S. rice diseases.)

Some rice growing regions, such as eastern Australia, are relatively free of disease due to their isolation and strict quarantine standards. Other factors contributing to low disease occurrence include long rotations with upland crops and pastures, and a Mediterranean climate with hot, dry summers that are not conducive to the build-up and spread of disease.


There were minor outbreaks of stem rot and sheath spot in Australia in 1994-96, which served as a wake-up call for the industry to prepare for other possible introductions. The Rice Growers Association of Australia has funded extensive studies to assess possible disease problems, and has measures in place to control diseases that may arise. According to their reports, the most likely problems will come from rice blast and kernel smut, and possibly root nematodes, if introduced.

Unfortunately, older rice growing regions of the world do not have the same luxury, as rice cultivation and its associated diseases have evolved for centuries. Some countries in Asia have outbreaks of every known rice disease, with new races evolving continuously.

Keeping a vigilant watch for new diseases is important, with California serving as a perfect example. In 1999, scientists identified outbreaks of bakanae disease, one of the oldest known diseases to infect rice in Asia. Since its introduction into California, bakanae has spread to most of its rice growing counties. Current losses in California are minor, but in Asia, losses up to 70% have been reported, so the disease has garnered serious attention.


Bakanae is caused by the fungus, *Gibberella fujikuroi*, and its anamorph *Fusarium fujikuroi.* In the Ascomycetes, two forms of the same organism may occur, one fungi with the capability to only reproduce sexually (*G. fujikuroi)* and the other form capable of asexual reproduction (*F. fujikuroi*). Both are found in rice fields, although *Fusarium* is more prevalent.

The earliest symptoms of bakanae are manifested one month after planting, when infected seedlings are taller, more slender and slightly chlorotic. The rapid elongation of infected plants is due to high levels of gibberellin, a plant hormone produced by the fungus.

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# From the Editor...

The cover story for this month's issue of *Texas Rice* highlights the importance of rice diseases across the world, and the impact of research on their management and control. Rice diseases are ever present in our environment and their populations can literally explode in a matter of a few days to a couple of weeks. With their extreme ability to rapidly multiply, why don't we see greater problems with rice diseases in the U.S.?

The answer partially has to do with improved fungicide chemistries. New and highly effective fungicides has greatly lessened the occurrence of rice disease outbreaks in the U.S. Rice producers in Texas and in the other southern states are also increasingly fortunate to have rice varieties that are partially resistant to many rice diseases. Often out-of-sight and out-of-mind, this built-in resistance affords our rice producers a degree of protection whose absence would be sorely felt in the producer's pocketbook through higher fungicide use costs and decreased yields.

Even with our strong fungicide arsenal, rice diseases are estimated to cause yield losses that average about 8% of total Texas rice productivity. And, rice plant diseases have the ability to rapidly develop resistance to fungicides, and to overcome the built-in resistance that many newer rice varieties have to plant diseases. The continuing threat of new strains of the various rice disease developing resistance, highlights the importance of incorporating newly discovered disease resistance traits into future varieties.

The cover story also illustrates the value of working with researchers from other states and often from other nations. Without our national and international network of scientists, many of the solutions that we help to discover would be much slower in coming. From development of disease resistant varieties, to labeling of new fungicides, scientific cooperation is paramount to the Center's success as a research institution.

In addition to our cover story, this issue of *Texas Rice* highlights Joe Krauz, a Professor and Extension Specialist located in College Station. With Joe's administrative responsibilities as Associate Head for the Plant Pathology Department, we increasingly value the time Joe is able to provide to the rice research community and our rice industry. Much of Joe's research has contributed to improved rice disease management in Texas. Joe is a prime example of the importance of maintaining a strong link between Beaumont/Eagle Lake Center faculty and faculty on our College Station campus.

This issue also highlights Jack Wendt and his family. Jack is a superb example of a person who has given unselfishly to our rice industry. I cannot think of a person who better exemplifies what it means to give to the rice industry and to one's community. Over the past four years, I have gained strong appreciation for the role that Jack and many others in the Texas rice industry play in promoting the health and well being of rural Texas.

I would be remiss were I not to mention the upcoming field days at Eagle Lake (July 1) and Beaumont (July 10). Both field days will include presentations by several of our researchers on their current research activities, with much of this research funded by the Texas rice industry. I encourage you to take time from your busy schedules to visit us and see what rice industry funding allows the Center to accomplish. Our researchers and staff at Beaumont and Eagle Lake are dedicated to working for the future of the Texas rice industry. I encourage you to come and see some of their research and to meet with our scientists.

Please continue to send us your ideas and suggestions.

Sincerely,

L. T. Wilson

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

## Inside This Issue

# Grower Profile...

## Jack Wendt Farms

*Jack Wendt is a third generation rice farmer and has just planted his 62nd rice crop. Although he is about to celebrate his 81st birthday, you have to set a pretty good pace to keep up with him.*

**T**he day I visited Jack they were just starting water for permanent flood, so we checked the fields, made sure the cows were where they were supposed to be (one had escaped the fence and was grazing on the roadside) and monitored progress on work to improve the lake at Jack's Half Circle "E" Ranch House.

Jack and his wife Billie live in Richmond, and the house outside of Kendleton is used for social gatherings, receptions, weddings, church functions and rice industry meetings. Much of the furniture in the house is from their parents. There are several door frames dated back to 1868 from the original homestead of Billie's grandparents in Fulshear. That farm had been continuously operated by her family for over 100 years, and was designated as a Texas Century Farm by the Texas Department of Agriculture. When they sold the property in Fulshear, Jack moved one of the old buildings to their place in Kendleton and turned it into a family museum. There are old photographs of Billie's and Jack's ancestors, kitchen wear and tools that date back to the 1800's. Her grandfather was a doctor in the Confederate army, and of his nine children, 4 became doctors; however, Billie's dad, Hunter P. Harris, Sr. stayed in Fulshear to oversee the farming and ranching operation to support his Mother and family and educate his 8 brothers and sisters. In 1936 Hunter and C.C. Cardiff bought some land together, drilled an irrigation well and began a rice farming operation which C.C. Cardiff's descendant Jim Cardiff still farms today.

Jack takes great pride in their family heritage. The man Jack called Grandpa Wendt came to America from Germany in 1856 and settled in Sweet Home, Texas. In addition to farming cotton and raising cattle, he was an accomplished carpenter. He married Grandma Wendt in 1877 and the couple eventually had nine children, 6 boys and 3 girls. One of those boys was his father William George, born in August of 1886. After serving in WW1, William, called Bill by his friends and family, married Jackie Jones in 1920 and they had four children, of which Jack is the only survivor. The couple met in 1917 when Bill moved to Markham to work for B.J. Jones, Jackie's dad, who was a rice farmer. Jack's father was one of the first producers on the Richmond canal system when it began in 1928. When the company closed in 1936 Bill moved his family to Stowell, Texas and farmed rice on the Boyt Canal system for one year. The next year Richmond Irrigation Company opened under new ownership so the family moved back to Fort Bend County. In 1943, seven farmers bought Richmond Irrigation Company, Bill Wendt included.

Jack fondly remembers the early years growing up in the country. His chores included milking 5 cows (every morning and afternoon), planting and maintaining the family vegetable garden, feeding chickens and slopping the hogs. He walked 2 miles to get to school everyday, and among his many talents, Jack was a welder and carpenter by the time he was 16. He and his wife Billie were high school sweethearts, and when they graduated in 1940, they were King and Queen of the May Fete. When he finished high school he wanted to farm rice, but land was not available and his mother wanted him to go to college so he enrolled at A&M in the year of 1940 – 41. During this time he was offered land with Richmond Irrigation Company so he finished that semester in the spring of 1941. In the fall of 1941 he started preparing the land for his 1st crop to be planted in 1942.

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## Grower Profile continued...

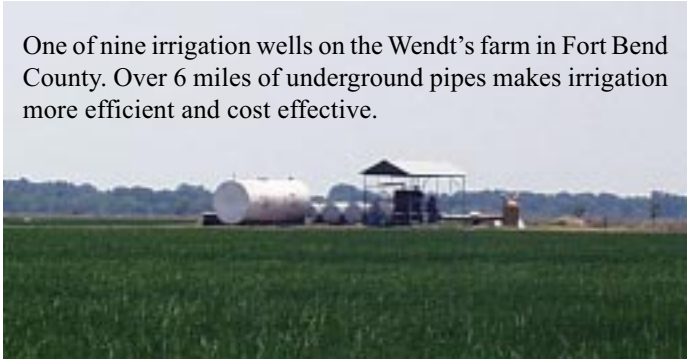
WWll interupted plans, and he spent 3 years in the Army Air Corp as a crew chief on bomber trainer planes. He was never called overseas, and he commuted back and forth from the Air base when he got furlough so he could work on the farm.

Jack and Billie were married in 1947, and they have four daughters, Evalyn, Amilee, Jackie and Laurel. In the early fifties, he created a trust for the four girls that lasted until 1977, when the youngest turned 25. That year Jack established EAJL Farms, and put all the land and leases under their control. Today the land is tenant farmed by Jack, his nephew Billy Greenwald, who has farmed with him for 30 years, and long-time friend Frank Stasney who has farmed on Wendt land for 28 years. Both are a great asset to his operation, and own their own homes, which are adjacent to EAJL's Farm. The three farm separately, but often share equipment and labor when the crunch time comes.

This year the farm has 1270 acres of rice, all in Cocodrie, 168 acres of wheat, and 160 acres of milo. He practices a one year in rice, two years in pasture or other crops. There are 9 irrigation wells on the property, 4 powered by diesel, 4 by natural gas and 1 by electricity. Billy Greenwald manages and services the 9 irrigation wells for EAJL. About 15 years ago he began installing underground irrigation pipes to move the water more efficiently from the wells to the fields. It was a long process, but now he has over 6 miles of underground pipe that has increased his watering efficiency by 25%.

Another innovation that has increased efficiency, saved money, and makes for a more uniform crop is laser leveling. Jack owns the equipment and said that roughly 2/3 of the Wendt land has been precision leveled.

For fertilizer needs, Jack sticks pretty close to the recommended rates for Cocodrie, which totals 190 units of N per season. He puts down a 40-40-15 preplant, and then goes back with more nitrogen just prior to flood and again at jointing. If they get the rice in early enough, he will grow a ratoon crop.



One of nine irrigation wells on the Wendt's farm in Fort Bend County. Over 6 miles of underground pipes makes irrigation more efficient and cost effective.

L to R: Frank Stasney, Jack and Billy Greenwald have been farming together for 30 years.

As for insect pressure, his worst pest is the rice stink bug, and some seasons they have to spray early for armyworms. Barnyard grass is his worst weed, and he may fly in herbicide several times a year to get good control. They use Lane Aviation out of Rosenberg for all aerial applications. Jack plants his levees to increase production, and he uses a ground rig attached to his planter to apply Command to keep the grass down. He doesn't use a scout, but relies on his Helena Chemical representative to stay ahead of problems.

Jack depends a great deal on his two full time employees, Mike Sanchez and Jessie Jimenez. Jessie has been working for him for 43 years, and Mike for 38 years. As ranch manager, Mike lives on the property, which means he can stay on top of things and be handy in case of emergencies.

There are approximately 500 head of crossbred cattle in his cow-calf operation, and the men use horses to move the stock around as needed. Jack helped with that until he was 70 years old, when he was thrown from a horse and broke his back. His doctor advised him to stop riding, as a bone splinter still remains in his back that is close to his spine. Watching him you would never guess there was a problem.

Jack has seen a lot of change in the rice industry during his lifetime, everything from mule driven teams to binders, threshers and 25 hp tractors. His first trac-

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tor was 40 hp and had steel wheels. In 1947 Jack was one of the first farmers in the Richmond area to convert all his tractors to rubber tires and he did all the welding to make these changes himself.

One of the big changes he has seen is the way rice is watered compared to the early days when they walked most of the levees by foot or on horseback. Today they use plastic tarps for overflows to adjust our water levels instead of using a spade to make them, and then close them up with a spade. They now have roads around most fields so they can check the water levels with a pickup or 4-wheeler. He wore tennis shoes instead of rubber boots to water his rice, now they all use rubber boots because of snakes.

L to R: The Wendt girls, Evalyn, Amilee, Laurel and Jackie with their mom Billie. On this occasion, Billie was being honored as Volunteer of the Year in Community Service in Fort Bend County.

During the many years that Jack has farmed, he has been a tireless supporter of the U.S. rice industry. As one of the driving forces in both the Texas Rice Council for over 50 years and the National Rice Council, Jack has traveled to 16 countries to help develop markets and open trade, and he and Billie have hosted trade officials and other guests from Iraq, Japan, Mexico, Russia and Africa.

In the past, Jack served as Director of the Texas Rice Improvement Association, President of the Texas Rice Council and the National USA Rice Council, President of Fort Bend Farm Bureau, Chairman of International Programs Committee, Rice Council for Market Development, member of the Board of Directors of American Rice Mill, member of the Board of Director of Blue Ribbon Rice Mill, the Rice Foundation, Agricultural Advisory Committee for trade in grain and feed (Washington, D.C.), and Chairman of the Texas Farm Bureau Rice Committee.

He is currently a board member of the Texas Rice Research Foundation, president of the American Rice Growers Cooperative Association, Richmond Division, partner of Richmond Irrigation Company, director of Needville Rice Drier, Inc., serves as Chairman of the Domestic Committee for market development for the US Rice Producers Association, a member of the Texas Rice Producers Board, the Texas Rice Legislative Group, the Fort Bend Subsidence Board and is a supporter of Rice Industry Coalition for the Environment. Jack has served his local community as a trustee of the Lamar Consolidated Independent School District, committee member for the Wells Fargo Bank of Richmond and numerous committees for the St. John's Methodist Church.

Awards include Conservationist of the Year from the Fort Worth Press, Rice Industry Meritorious Service Award in the category of Grower Achievement presented in 1990 at the Rice Outlook Conference and the 1994 Texas Rice Festival Honoree. Recently, Jack was presented with the Friends of the Beaumont Center award for outstanding service and support of research. And in June of 2000, Texas A&M University working with the Texas Rice Research Foundation honored him by establishing the Jack B. Wendt Endowed Chair in Rice Research.

When I asked Jack what he liked to do in his spare time, he just laughed, although I think he would like to go fishing since he is fixing up the lake to stock it with bass. Billie is just as active, and logs extensive volunteer hours at their church and the Fort Bend Museum in Richmond. In fact, on June 3, she was named the Volunteer of the Year in Community Services of Fort Bend County by Houston area charities. Jack and Billie have 5 grandchildren and 2 great-grandchildren which are a joy in their lives. The family is very close, and they often gather at the "E" Ranch house for Father's Day and other outings. In getting to know Jack I was impressed with his drive and determination, and his general attitude toward life was inspiring. There is a plaque on the desk in his office that reads, "I am not afraid of tomorrow, for I have seen yesterday and I love today." *

# Researcher in the News... Dr. Joseph Krausz
## Professor and Extension Program Leader in Plant Pathology

*While much of his time is now consumed by administrative duties, Dr. Krausz considers his research responsibilities a high priority.*

**J**oe was born in Red Hook, New York, the youngest of three children. His father worked in the steel industry, and while the children were young, Joe's mom didn't work outside the home.

In high school, Joe was very interested in science, and was a member of the National Honor Society. He enjoyed playing baseball and making trips to the beach. Joe was fascinated by the ocean and thought this would be his career of choice. He received a scholarship from the University of New York Maritime College and began his studies in oceanography and meteorology.

During his second summer they were on a training cruise in the North Sea and were overtaken by a storm. As the boat rocked and swayed, Joe began to rethink his choice of careers. Even though he had done extremely well in his studies (2nd in his class the first year, and 1st in his class the second year) Joe decided to transfer to the University of New York at New Paltz and major in Botany.

During this time the 'Green Revolution' was in full thrust and Dr. Norman Borlaug was conducting work in Mexico that would win him the Nobel Prize for Peace in 1970. Dr. Borlaug's work inspired Joe to continue his education in the field of agriculture, and focus his efforts on international agricultural development.

In 1971, Joe landed an assistantship position at Cornell University under Dr. David Thurston, a plant pathologist who had spent 12 years in Columbia conducting research in crop production for the Rockefeller Foundation. Joe went on to acquire his MS and PhD in Plant Pathology with a minor in Plant Breeding. One year of his doctoral research was spent at the International Center for Tropical Agriculture (CIAT) in Cali, Columbia.

Upon graduation, there were no opportunities for overseas research, so Joe went to work for the H.J. Heinz Co. in Cleveland MS., then went on to work for the SMC Seed Company in Davis, CA. Then he landed a position at Clemson University as an Extension Plant Pathologist where he stayed for nine years.

Still captivated by Borlaug's dream of helping developing countries become self sufficient, Joe accepted a position as Department Head of Plant Pathology at the Honduran Foundation for Agricultural Research. His charge was to diversify their export agriculture dependence on bananas and coffee, to include vegetables, citrus, plantain and cocoa. The work went well, but after 3 years, funding became scarce and Joe returned to the U.S. and accepted an extension Plant Pathologist position with Texas A&M University in 1989.

In 1997, Joe was named Associate Department Head of Extension in the Department of Plant Pathology. Joe has statewide responsibilities for rice, turf grass and soybeans. He has also been charged with research responsibilities for Karnal Bunt disease of wheat. Over the past few years there have been increasing infestations of the disease, and there are sections of the state where wheat cannot be grown for export due to quarantines.

Much of Joe's work in rice involves the testing of new fungicides for disease control and evaluating rates and application timing of registered products to

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## Researcher Profile continued...

improve efficacy. Saving the growers money is his utmost concern. For example, when Quadris was first registered for use in rice, the application rate was 12 oz per acre. Joe conducted research that showed 9.2 oz per acre gave equivalent control, which helped lead to a label change. For a five hundred acre farm, that would amount to over $3,000 in savings per application.

Cultural controls that reduce disease incidence have been worked out through years of Joe's research. These include judicious use of nitrogen fertilizer, seeding rates that don't overcrowd plants and maintaining a uniform flood so that the soil is not allowed to dry out. And of course, resistant varieties should be grown where there is a history of disease outbreaks.

Besides his research responsibilities in rice, turf grass, soybeans and wheat, Joe is also working on a project related to national defense through agricultural bio-security. Purdue University, Kansas State and Texas A&M are all part of a consortium working with the USDA Animal and Plant Health Inspection Service (APHIS) to analyze possible pathways by which exotic plant pathogens of rice could enter the United States. To carry out this mission the team must detail the biology of the organisms, including their potential survival in our climate, vectors that may be required for dissemination, alternative host plants, and survivability in the southern United States rice belt. They must also devise plans for rapid detection, containment, and possible eradication.

While this takes up a significant amount of Joe's time, he realizes the long-term benefits for the U.S. agricultural industry to be prepared to deal with such emergencies.

Joe and his wife Cheryl met while attending the University of New York at New Paltz and were married in 1971. They have one son, Thomas, who lives with his wife, Maria, and their son, Tommy, in Austin TX. In his spare time (what little there is) Joe enjoys hiking, raising his three dogs, reading, and investing in the stock market. *

Dr. Joe Krausz can be reached at 979-845-8001 or by email at krausz@tamu.edu. For more information on disease work conducted at Texas A&M University log on to http://www.plantpathology.tamu.edu.

## Rice Diseases in the U.S.

| Common Name | Pathogen Name |
|---|---|
| Bacterial Leaf Blight | *Xanthomonas campestris* |
| Bacterial Panicle Blight | *Burkholderia glumae* |
| Black Kernel | *Curvularia lunata* |
| Blast | *Pyricularia grisea* |
| Brown Spot | *Cochiobolus miyabeanus* |
| Crown Rot | *Erwinia chrysanthemi* |
| Crown Sheath Rot | *Gaeumannomyces graminis* |
| Downy Mildew | *Sclerophthora macrospora* |
| False Smut | *Ustilaginoidea virens* |
| Grain Spotting | *Bipolaris oryzae* |
| Kernel Smut | *Neovossia horrida* |
| Leaf Scald | *Gerlachia oryzae* |
| Leaf Smut | *Entyloma oryzae* |
| Narrow Brown Leaf Spot | *Sphaerulina oryzina* |
| Root Knot | *Meloidogyne spp.* |
| Root Rots | *Pythium spinosum* |
| Rotten Neck | *Pyricularia grisea* |
| Seedling Blight | *Bipolaris oryzae* |
| Sheath Blight | *Thanatephorus cucumeris* |
| Sheath Rot | *Sarocladium oryzae* |
| Sheath Spot | *Rhizoctonia oryzae* |
| Stackburn | *Alternaria padwickii* |
| Stem Rot | *Magnaporthe salvinii* |
| Water-Mold | *Achlya conspicua* |
| White Tip | *Aphelenchoides besseyi* |

As the season progresses, bakanae plants usually die before reaching maturity. Those that survive produce small panicles with few seeds. These classic symptoms are where the disease gets its name, bakanae, meaning 'foolish seedling'.

As the diseased plants senesce and die, fungal mycelium may emerge from the nodes, and sporulation of the pathogen is easily visible above the water level. After the water is drained, the fungus sporulates profusely on the stems of diseased plants. This appears as a cottony mass and serves to contaminate healthy seeds during harvest. When both mating types are present, perithecia, which are produced sexually, may form. Perithecia appear as dark blue flask shaped bodies on the nodes and stems of infected plants. Spores produced in the perithecia may also contaminate seed and serve as inoculum the following season.

Bakanae is primarily a seed-borne fungus, but it can overwinter in the fields. In Pakistan, researchers have found that soil amendments with organic matter can reduce survival of the disease in the soil. The best method for preventing contaminated seeds from infecting new fields is to soak the seeds in a 5% bleach solution for two hours before rinsing. Other fungicides are being tested at the California Rice Experiment Station at Biggs, but so far none have proven to be superior to bleach.

Further challenges to California researchers is the increased incidence of seed rot and seedling diseases caused by *Achlya* and *Pythium* species. The diseases are most prevalent when cool temperatures, which are unfavorable to rice growth, occur at or shortly after planting time. Under cool conditions, water-sown rice is often severely infected within a few days after seeding, resulting in reduced plant stands and a decrease in seedling vigor. Chemical fungicides are available to use as a seed treatment, and most often recommended during the early planting season, when cool temperatures are likely.

Another new disease introduction to California came in 1996 when blast was discovered in Glenn and Colusa counties. Before that time, the rice growing regions of California were free from blast, which plagues every southern rice growing state. In the two years that followed its discovery in California, the disease spread to other regions of the state. Since nearly all California varieties are susceptible to blast disease,


researchers took immediate steps to contain the problem.

Scientists at the University of California at Davis and the Biggs Experimental Station released recommendations for cultural controls to help ward off major blast outbreaks. It is well known that blast is favored by excessive nitrogen fertilization, aerobic soils and drought stress. Once a field is severely infected, the best method to avoid overwintering spores is to burn the rice stubble. However, in 1991, California passed the Connelly-Areias-Chandler Rice Straw Burning Reduction Act which required that straw burning begin a phase out in 1992, and by 2001, would only be allowed by permission from the California Department of Agriculture. Permits are not difficult to obtain though, as a grower need only go to their county office and document the incidence of disease in their fields by a certified pesticide applicator. Even with documentation, though, farmers must wait for 'burn days', which are established by state meteorologists. Burning can only take place when conditions favor atmospheric dispersion of the smoke.

Due to these restrictions, researchers petitioned for the labeling of Quadris to control blast fungus in California. This happened in 1998, but by then blast was almost nonexistent outside of Glenn County. According to Jeff Oster, plant pathologist at the Biggs Rice Experiment Station, researchers now believe that an accidental introduction occurred in Glenn County, and two years of unusual weather conditions allowed the spread of the disease. Once weather patterns normalized (no summer rains and very little dew formation) blast was no longer a major threat.

Still, breeders in California are working on blast resistant lines. Genetic markers from Bill Park's lab at

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Texas A&M in College Station, and germplasm from USDA-ARS rice breeder Anna McClung, have been sent to California for use in their breeding program. Also, due to quarantine restrictions, California breeders send advanced lines to Texas for screening in the blast nursery at the Beaumont Center.

A similar scenario occurred in the late 1950's in the southern rice growing states with the discovery of the viral disease Hoja Blanca in Florida rice fields. The viral disease was well established in South and Central America, with field symptoms including long yellowish white stripes and mottling leaves. At that time, Dr. Hank Beachell was the USDA rice breeder working at the Beaumont Station. He was familiar with the disease, and when it showed up in Florida, he began to look for a U.S. adapted variety that would have resistance. Several advanced lines were sent to Venezuela and Cuba for screening. One line showed excellent promise, and was further selected and released as the variety Gulfrose in 1960. By this time, though, it was realized that the vector plant hopper for the virus, *Sogatodes oryzicola,* could not survive winter conditions in the Southern U.S., so the disease was no longer a threat. Still, this is another excellent example of rice researchers mobilizing forces to quickly deal with a threat to the U.S. rice industry.


Another viral disease that causes widespread damage is rice tungro. Although this disease is not found in the U.S., it is a major problem in China, India and the Philippines. The disease is only spread by *Nephotettix virescens*, the green leaf hopper (GLH), which causes yellow to orange mottled leaves. Diseased plants are often stunted, and distributed irregularly throughout the field. Young plants just beginning to tiller are the most susceptible, as this is the preferred plant stage for the insect. Reducing the GLH population, and planting resistant varieties are the only known controls.

The Philippine Rice Research Institute (PhilRice) has released two sets of lines that offer some help in controlling rice tungro. The Matatag lines are resistant to the virus, while the PSB Rc lines are resistant to the insect.

PhilRice is a government owned and controlled corporation created by the Filipino government in 1985 to develop high-yielding technologies so that the country could be self-sustaining in rice production. While much of their research has been in conventional breeding, they have recently begun to work with the International Rice Research Institute (IRRI) to develop and test transgenic rice, specifically 'BB Rice' named for its resistance to bacterial blight.

The first field trials for BB Rice were scheduled to take place in 2002 at both PhilRice and IRRI, but due to the international debate over GM crops and opposition by Filipino citizens over the field testing of transgenics, only PhilRice conducted the outdoor trials in 2002.

Rice breeders in the United States have been very successful in releasing conventional varieties with acceptable disease resistance. Rice blast, caused by the fungus *Pyricularia grisea,* has been the target for rice breeders since 1953, when F. M. Latterell first recognized pathogenic specialization in U.S. rice varieties. Pathotypes are different races of the same pathogen, which makes it possible for a variety to be resistant to one race of blast but not another. Although improved blast resistance was noted in medium grain varieties such as 'Nova' and 'Saturn', released in 1964, it wasn't until the release of 'Dawn' that a variety was developed with improved blast resistance as the major goal. Since then, many Texas varieties have been released that show resistance to pathotypes found in our region.

Chemical control and variety improvement are the major tools for disease management in the U.S., but other alternatives exist. In China, there have been several innovative practices specifically suited to the small-scale sustenance farmers that dominate in that area. One such approach is the use of fish to control

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sheath blight and culm blight. Grass carp were stocked in rice paddies 7 days after the rice was transplanted and researchers found that by season's end, disease incidence had decreased by up to 20%. They found that the fish stripped the diseased leaves near the bottom of the plants, which directly diminished reinfection in the field. Also, once the bottom leaves were removed, the microclimate directly around the plants became less favorable to infection due to increased ventilation and light penetration.

Another practice in China to prevent the spread of blast disease is mixed cropping of rice varieties. Glutinous or 'sticky' rice varieties used for confections and other specialty dishes have higher market value than regular long grains, but have lower yields and are very susceptible to blast. Non-glutinous, hybrid rice varieties are less susceptible to rice blast and are attacked by a different spectrum of blast pathotypes. In field tests, farmers planted one row of glutinous rice, next to 4 rows of hybrid rice. In the 6000 acres of field tests conducted in 1999, participating farmers experienced an 89% increase in yield in their glutinous rice, and 94% less blast disease.

Bio-control is another area of alternative disease management that is gaining popularity worldwide. In California, Dr. Robert Webster, plant pathologist at UC Davis has conducted research using *Sclerotium hydrophylum*, a fungus that attacks the stem rot pathogen. In the greenhouse, tests with the beneficial fungus showed that stem rot was reduced to insignificant levels at all concentrations tested. The researchers concluded that field inoculation or enhancing natural populations might be a viable alternative to fungicide use in controlling stem rot. In Thailand, researchers are controlling blast and leaf blight using the beneficial bacteria, *Bacillus subtilis.* Lab cultures suggest that the bacteria produce water-soluble antibiotic substances that inhibit growth of the pathogens. These are but two examples of using naturally occurring fungi and bacteria to control pathogens in rice. More research in this area is certainly warranted.

Fertilizer management is another area of research that is providing solutions to disease problems in rice. While it is well known that heavy nitrogen application increases the incidence of blast and sheath blight, researchers at the University of Florida's Institute of Food and Agricultural Sciences have shown that increasing soil levels of silicon suppresses several diseases, including blast and sheath blight. According to Dr. Lawrence Datnoff, plant pathologist at UF's Everglades Research and Education Center in Belle Glade, in test plots where silica levels were low, the addition of silica suppressed disease better than did the fungicides alone.

Another innovative area of research is being conducted by Drs. Fleet Lee, Manjul Singh, Paul Counce and Julia Gibbons at the University of Arkansas Rice Research and Extension Center at Stuttgart. Just as high nitrogen rates are known to increase blast outbreaks, it has also been established that losing floodwater also causes an increase in the blast disease. Conversely, flooded rice, especially continuously deep flooded rice, becomes more resistant to rice blast. This increased resistance response serves as the scientific basis for cultural control recommendations for rice blast in Arkansas. The Arkansas researchers have found a series of events that may shed some light on this phenomenon. They determined that when the flood is applied and held, the soil around the root zone becomes oxygen deficient, and most likely leads to an increase in the ethylene production in the plant. To correlate this to blast susceptibility, the researchers applied a boll opening cotton hormone to upland rice, which forced it into higher ethylene production and, in turn, reduced the severity of the blast disease. Further, when a ethylene blocking hormone was applied to flooded rice, they found an increased blast severity. Dr. Lee speculated that ethylene was the major player in the flood response, but several hormonal pathways that could be affecting the disease resistance exist in the plant. They are continuing the research to better understand it and to develop practical applications.

While scientists haven't won the war against diseases in rice, they are certainly making progress in their efforts to help farmers be more productive and cost efficient. And as our world population continues to grow, it is crucial that every acre of arable land be as productive as possible. *

*Many thanks to Don Groth, LSU, for the excellent disease photos; Lawrence Datnoff, UF-IFAS and Fleet Lee, UA Rice Research Center, for their suggestions and technical assistance; California Rice Production Guidelines; and the many scientists who gave their time for interviews and proofing. JC*

# TRRF Funded Projects for 2003

This is the second of three sets of articles highlighting the projects funded by the Texas Rice Research Foundation in 2003. Our purpose is to provide producers, industry representatives and consumers with details of the research that is being conducted using check-off monies provided by our Texas rice farmers.

**Rice Physiology Research**
**Lee Tarpley - $49,527**

This research focuses on using plant growth regulators (PGRs) to enhance rice ratoon stand establishment, and thereby yield. The PGR research has been a primary focus for the last two years. This year, Dr. Tarpley will be making the transition to application of the findings, with cooperation from Dr. Fred Turner, Mike Jund, and the assistance of several producers for large field trials.

The project will continue work to identify the environmental causes of, and possible solutions to, the inconsistent ratoon stand establishment that has been problematic in good management of the ratoon crop, with emphasis on the processes of ratoon tiller initiation and elongation. Graduate student Tesfa Kebrom will be a key player in this area with cooperation from Turner and Jund.

A new graduate student, Abdul Mohammed, will be working on a new project that seeks to unravel the physiology of the effects of excess nighttime heat during the interval around flowering. The information will be used in cooperation with Dr. Rodante Tabien to establish a selection process for tolerance of this heat, which can cause dramatic losses in Texas rice in some years. In addition, the information will be used to seek preventive or remediative management treatments. At the same time, a study of the effect of heat at a slightly later stage upon cereal quality will be initiated with the anticipated cooperation of other scientists at the Beaumont Center.

And finally, the Physiology Project will work to identify management treatments, such as specific PGRs or selected nutrients, to increase seedling vigor in cool planting conditions. Most growers like to plant early to increase the amount of season left for the ratoon crop and to avoid main crop heat stress at flowering. Planting early, however, is associated with cool planting conditions. This area of research will simultaneously develop a seedling screening procedure for respiration, which has been shown in another crop to be related to plant vigor expressed as grain number. The methods development will be done in cooperation with Tabien and Dr. Shannon Pinson, and the screening procedure will then be used as one method to rapidly select for high grain potential.

**Entomology Research & Extension Program**
**M.O. Way - $58,202**

The Entomology Project received funding in 2003 for a comprehensive research/extension program. The research component is divided into the following eight experiments. The Entomology Project will evaluate novel insecticides for rice water weevil (RWW) control, determine best preflood application timing for Fury, determine how planting date affects RWW and main/ratoon crop yields, compare RWW populations and damage in a stale and conventionally-tilled seedbed, monitor spread of Mexican rice borer, fine-tune application timings of Karate Z for stem borer control, evaluate selected varieties for resistance/susceptibility to stem borer (and gather data on carry-over effects on ratoon crop) and determine extent of chinch bug problem on heading main crop and sprouting ratoon crop.

Also, Luis Espino, a PhD graduate student, will evaluate different methods of sampling for rice stink bug. The current method of sampling using a sweep net is cumbersome and tiring. Luis' objective is to develop a faster, labor-saving method.

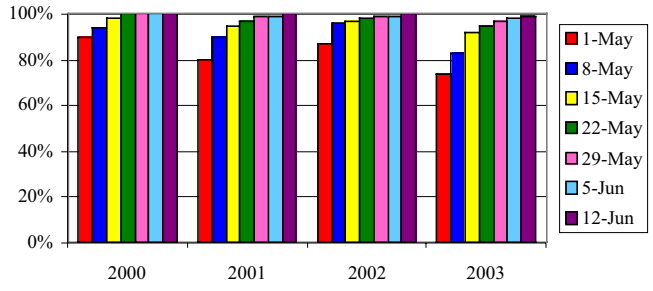
The extension component of the Entomology program will involve making at least 25-30 on-site visits with farmers to observe first-hand insect problems, continuing to coordinate publication of the Rice Production Guidelines, contributing to Rice Production Updates, *Texas Rice*, and commodity publications, participating in CEA meetings, beginning channeled apple snail and associated damage survey, following up on request to Syngenta to add stem borers to Karate Z label, and submitting Section 18 Emergency Exemption for Orthene 75S for rice stink bug.

This research/extension program is well-defined and feasible, with the underlying theme of the program being service to the Texas Rice Industry. *

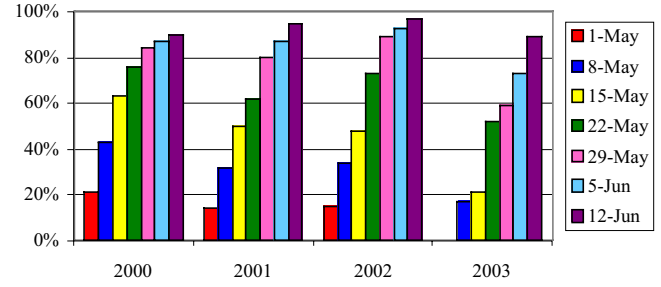
# Rice Crop Update

As of June 12th, 99% of the rice planting had emerged, closely following the three previous years. Acreage in permanent flood was 89%, 8% behind 2002 and 6% behind 2001. 47% of the acreage had reached PD, 34% behind 2002.

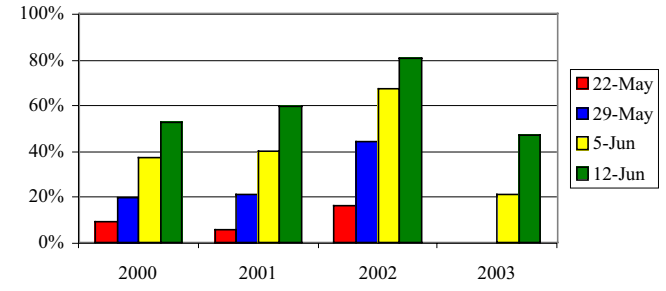
Emerged




Flooded




PD




# An Open Market to Iraq

In a letter to the Secretary of Agriculture, Ann Veneman, the U S Rice Producers Association (USRPA) applauded the USDA for their efforts to include U.S. rice in food aid and other export development programs, particularly in the humanitarian food supplies for the people of Iraq. While USRPA would prefer to see larger purchases of rice for emergency food aid for Iraq, the Association assured Secretary Veneman of their commitment to work cooperatively to reopen the commercial market for U.S. agricultural commodities in Iraq.

Iraq was the world's largest importer of U.S. rice in 1989, according to the Foreign Agricultural Service (FAS). Iraq was closed to U.S. exporters by Presidential Executive Order 12722 issued on August 2, 1990. According to Dwight Roberts, President & CEO of USRPA, the Iraqi market was developed by servicing the trade with promotional funding supplied by FAS and U.S. producer organizations, backed by GSM-102 financing. "During the 1980s, the rice industry worked jointly with several U.S. commodity groups to provide technical and other assistance under a U.S.-Iraq protocol. This was an expedient and cost effective market development program that allowed trade associations to send marketing and technical teams to Iraq or host Iraq delegations in the U.S. Together with the USDA, we can employ a similar approach today with either private or government officials, depending on the type of buying system Iraq adopts in the coming weeks and months," said Roberts.

The U S Rice Producers Association has already begun work on this important endeavor in an effort to map out the appropriate strategy for recapturing this important market for U.S. farmers. *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