Texas Rice

Texas A&M University System Agricultural Research and Extension Center
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Alternative Uses for Rice Waste

Over the past ten years there has been a strong push to investigate the potential uses of 'waste' materials from the rice industry, including straw and hulls. These projects are the result of both environmental and economic issues.

In California's Sacramento Valley, where 500,000 acres of rice are grown annually, farmers have traditionally burned their fields at the end of each season to get rid of the stubble that remains after harvest. This was necessary because cool temperatures inhibit the straw from breaking down and any material left in the fields would harbor disease organisms that could reduce yield in the next crop. But due to environmental concerns over air pollution, the state passed the Connelly-Areias-Chandler Rice Straw Burning Reduction Act of 1991. The law required that rice straw burning in the Sacramento Valley be phased down starting in 1992, and by September 2001 burning would only be allowed under specified conditions for disease control. This provided the impetus for many innovative businesses to figure out ways to use the straw.

On July 19, 2002, nearly 200 people gathered in Sacramento to learn about the currently available uses of rice straw. The products and services on display included manufactured wallboards, compost, worm castings, erosion control devices and straw bale building information. Information was on hand from each of several product manufacturers, as well as government agencies that currently use or promote the use of rice straw. To learn more about the Expo contact Jeff Lindberg at 916-324-8622.

A straw bale home in the early stages of construction. Designs for these homes vary greatly, from simple two room structures to elaborate multi-story mansions.

Photo by Athena Swentzell Steen and Bill Steen.

Additionally, the California Rice Commission launched their new website 'The Rice Straw Market' at www.ricestrawmarket.org. The objective of the site is to enhance opportunities for buyers and sellers of rice straw to exchange products and services. Visit this site to find product manufacturers, rice straw growers, or rice straw service providers.

One innovative use of rice straw bales is in home construction. Bales are stacked, and iron rods are inserted through the center for stabilization. Steel beams and concrete fortify the structure, then a 'stucco' coating is applied to the exterior and painted. The houses are sturdy and energy efficient. Chelsea Green Publishing Company offers several books on straw bale home construction. To learn more call 800-639-4099 or visit their website at www.chelseagreen.com.

The craft of making paper by hand is said to have started in China in AD 105, with rice straw being the most likely source of material. Papermaking eventually developed into a fine art and has since become part of the many exotic skills of Chinese, Japanese, and Korean artists.

In the Philippines, research on using indigenous materials for handmade paper was started in the late 1970s by Design Center Philippines and the Forest Products Research and Development Institute (FPRDI). In the mid-1980s FPRDI, the University of the Phil-

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From the Editor...

The Beaumont/Eagle Lake Center has undergone major changes since the newsletter's inception two years ago. Some of these changes have been extremely important to the Center. Although the idea for *Texas Rice* dates back to the late 1980s, its production started when Jay Cockrell was hired as the Center's Communications Specialist. *Texas Rice* remains Jay's major responsibility, which she does extremely well. However, she also plays a valuable role in leading Center tours; and, she will soon begin work with our scientists to develop a comprehensive integrated rice cropping system management book.

Two years ago, the Center was fortunate to hire Dr. Lee Tarpley. Lee is making his presence felt through his physiology research, which holds tremendous promise for increasing our understanding of how key climatic and agronomic factors affect main crop and ratoon crop yields. His research on plant hormones shows promise for increasing ratoon crop yields by about 500 lbs/ac, at minimal cost to the producer.

Shortly after Lee was hired, the Center also hired Dr. Yubin Yang. Yubin has played a major role in supervising computer equipment and software repairs and maintenance. More importantly, Yubin has been working to integrate current research knowledge of how different rice varieties responds to climatic conditions, soil type, planting date, agronomic inputs, and pest injury, into a program that will be used to predict rice growth, development, crop maturation, and yield. By the start of the 2004 cropping season, the Center will begin to make this program available through the Internet, in the form of easy to use menus and graphs.

Three months ago, the Center hired Dr. Rodante Tabien as the state's first rice plant breeder. Dante brings tremendous experience to his position, having served as the coordinator for the Philippines National rice breeding program. Within a couple of years, Dante will take the lead role in the Center's rice varietal development program.

We are also proud to announce the completion of the Beaumont Center website. This site contains a tremendous amount of information about the Center, with additional expansion planned for the next several months. If you are used to receiving *Texas Rice* via the Internet, you will need to change your address to http://Beaumont.tamu.edu, then download the newsletter from the "eLibrary" section. Credit for the web site should be given to the Center's web development team, and Center faculty and staff who provide much of the information. Members of the web site development committee met at least 100 times over the past year to design and develop the new site. I hope you will find the information useful and will let me know what additional information you would like to see.

With our gains, the Center has also experienced recent critical losses. The Center is losing Dr. Christine Bergman on at least a temporary basis, and possibly permanently. Christine is an extremely talented scientist, who brought tremendous strengths to the grain quality arena. Unfortunately, her mother's failing health pulls Christine away from the Center.

Many of our readers have heard about the financial problems faced by Texas. This year, the state imposed a monetary recision resulting in the loss of over a hundred positions within the Texas Agricultural Experiment Station, with more losses expected next year. Texas Cooperative Extension is experiencing losses as well. The Beaumont Center and the Eagle Lake Station *was* losing six positions as a result of the state's recision. Fortunately, the Texas Rice Research Foundation helped to cushion this blow by supporting two of these positions at Eagle Lake. The Texas A&M University System has had monetary recisions in the past, but it's always tough to lose dedicated, hard working people. If you know of any jobs in the Beaumont or Eagle Lake areas, please contact me (409-752-3045) or Jack Vawter (979-234-3578).

Sincerely,

T. T. Wilson

Ted Wilson
Professor and Center Director

Inside This Issue

Farming Rice

a monthly guide for Texas growers

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

Use of Poultry Litter on Laser Leveled Fields

Land leveling improves water drainage and irrigation uniformity; however, crop yields are often reduced the first year on deep cut areas. Over the past ten years, experiments have been conducted in Arkansas and Missouri using poultry litter on these cut areas to improve crop performance.

In the late 1980s, Arkansas researchers David Miller, Rick Norman, Bobby Wells and J. Mike Phillips conducted experiments to determine the rate and quality of litter necessary to increase rice yields on cut fields. The researchers determined that a minimum of 1000 lbs/ac (dry weight) was needed on lightly cut soils, and 2,000 – 4,000 lbs/ac should be applied on deep cut areas to achieve the best results.

Accounting for the moisture content of the material is important, since the recommendation is made on a dry weight basis. Thus, if the moisture content of the material is 25%, then 1,000 pounds of the fresh material actually contains 250 pounds of water and 750 pounds of the dry material.

The source of the poultry litter is also very critical. Research has shown that the most benefits are obtained when at least three flocks of broilers are grown out before the houses are cleaned. The concentration of nitrogen (N), phosphorus (P) and potassium (K), increases during the grow-out of the first three flocks but levels off after additional flocks. Litter from houses cleaned after only one or two flocks contain less manure and more bedding material. As a result, the value of broiler, hen and turkey litter varies considerably, with broilers usually having the highest N, K and Ca levels. (Table 1)

The Arkansas researchers found the optimum time to apply the litter was immediately prior to planting. They also found that on a pound-for-pound comparison, fresh litter provides the same benefit as composted litter. In many cut fields in Arkansas, phosphorus was usually the most limiting nutrient, followed by sulfur and zinc. They also found that the best yields were obtained when litter was applied in combination with inorganic fertilizers applied at rates determined by soil testing.

Another study was published in 2000 by University of Missouri researchers Gene Stevens, John Lory, Alan Sheckell, Keith Birmingham and Chris Moylan. The results of this study indicated 2.5 tons of chicken manure per acre significantly increased yields in cut areas on graded rice and cotton fields. The researchers found that P was the only nutrient reduced by grading, and that chicken litter was high in P, leading to the increased yield potential. They also found that less commercial N was needed in manure plots, compared to control plots in rice and cotton fields.

Dr. Fred Turner at the Texas A&M Rice Research Center in Beaumont is planning to conduct plot studies and on-farm studies using poultry litter on cut fields for the 2003 crop year. One barrier is securing the equipment to spread the material, and determining the best way to ensure even coverage on the field sites. Farmer suggestions and participation is encouraged. Dr. Turner can be reached at 409-752-2741 ext. 2223. *

Table 1. Selected Nutrient Content of Poultry Litter (%)

	Poultry Litter (Bedding plus Manure)					
	Broilers		Breeding Hens		Turkeys	
	Average	Range	Average	Range	Average	Range
Water	24.9	6.2-64.9	31.9	18.9-44.7	32.2	21.9-58.7
N	3.5	0.8-6.3	2.8	2.5-3.3	2.8	1.5-4.4
P	1.7	0.2-3.4	2.6	1.8-3.5	2.2	0.9-4.3
K	2.6	0.1-4.2	3.0	2.3-3.9	2.4	1.5-3.6
Ca	3.7	0.6-20.4	11.3	8.2-14.1	3.0	0.9-6.7

The "Texas Poultry Litter Hotline" was created to help farmers take advantage of this resource. Call 866-269-7448 toll free to order your litter.

Researcher in the News...

Dr. Christine Bergman
USDA-ARS Rice Research Unit

From coastal California to South Australia, Christine Bergman lived in many places before she found a home in Texas.

Christine was born in Oxnard Beach, California, the middle child of three, with one older brother and one younger sister. Her dad was an aerospace engineer, and when Christine was nine years old the family relocated to South Australia for him to oversee the construction of one of the first satellite tracking stations in the world. Christine remembers this as one of the happiest times in her young life. They rode motorcycles through the desert, mined opals, and traveled to every corner of Australia. Sadly for Christine, at fifteen, her dad was again transferred and the family moved to San Jose where Christine finished her high school education. During this time, Christine's grandparents owned one of the first health food stores in the Los Angeles area, and she remembers this as having a major influence on her decision to pursue a career in food science and nutrition.

Christine began her college education by obtaining a B.S. in clinical nutrition from Loma Linda University near Los Angeles, and then went on to complete an M.S. in food science at the University of Arizona. For her Ph.D., she attended Michigan State University, still in food science, but with emphasis in the nutritional and functional quality of cereal grains.

In 1997, Christine moved to Beaumont to begin her new career with USDA-ARS at the Rice Research Unit quality lab located at the Texas A&M Research and Extension Center.

The quality lab was established in 1955 at the request of the rice industry, State Agricultural Experiment Stations in all rice producing states, and the Federal and State breeding programs. This was in response to the 1951 release of the high yielding variety Century Patna 231, which was later determined to have inferior cooking and processing quality. The quality lab was established to develop a better understanding of cooking and processing traits of importance to the rice industry, to establish rapid screening methods for these traits, and to evaluate U.S. breeding lines to ensure that future U.S. varieties had quality traits acceptable to the industry.

Christine enjoying the Beaumont Field Day with her friend and USDA co-worker Jodie Cammack.

Drs. John Halick and Bill Webb played important roles in establishing and developing the laboratory.

The quality lab has been extremely successful in that it has become both an integral tool in U.S. rice breeding and a focus for the U.S. rice industry on matters relating to rice quality. Screening methods used by the laboratory to assess rice chemistry, structure and processability have played key roles in developing rice varieties with improved grain quality for conventional uses and in identifying unique quality characteristics that may expand rice markets. Each year the laboratory evaluates the quality of breeding lines and new varieties from the public breeding programs in each of the rice producing states. Since 1960, the quality lab has participated in the development of *all* public varieties produced commercially in the U.S. Because of their superior grain quality and high yield, these varieties have contributed to the economic success of the U.S. rice industry in both domestic and world markets.

Issues surrounding rice quality are increasingly more demanding and complex for producers, millers, manufacturers of conventional and convenience foods, rice ingredient users, marketers and consumers alike. For example, an increasing amount of rice is being imported into the U.S. (over 400,000 metric tons annually), which competes with domestically grown rice. A dominant proportion of this rice has unique taste

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Spotlight on Support in the Quality Lab

Fernando Goffman - Research Chemist
Fernando was born in Buenos Aires, Argentina, the middle child of three. His dad left when he was five years old, so he and his brothers began working at an early age. Fernando's mother worked as a secretary in a doctors office and made crafts on the side to bring in extra money. With limited income, the family got by with very little. In spite of this, Mrs. Goffman saw all her boys through college. Fernando's older brother is a physicist working in France and the younger is a computer analyst working as a director for a music company in Buenos Aires. Fernando received his B.A. in Agronomy at the University of Buenos Aires in 1992 through a scholarship with Cargill. During this time, a professor told him about the opportunity to apply for a scholarship by the German Service of Academic Exchange (DAAD), which would cover all his education and living expenses. He sent several letters to obtain an acceptance letter from a German professor in Plant Science, an essential requirement when applying to the DAAD, and finally he received an invitation from Professor Emeritus Dr. Gehard Roebbelen from the Institute of Agronomy and Plant Breeding, Georg-August University of Goettingen in Germany, a world-renowned institution for the study of plant breeding and Chemistry. In the end, Fernando was one of only 20 students from Argentina that received the scholarship. He spent four months in a crash course learning German before he began his studies, and went on to acquire his Ph.D. in Plant Breeding in the fall of 2000. While working towards his Ph.D. at Goettingen, Fernando gained experience in classical breeding techniques, diallel crosses and other mating designs, and analytical chemistry of plant secondary compounds using UV-Vis spectrometry, high performance liquid chromatography (HPLC) and gas chromatography (GC). Fernando started working at the Rice Research Unit in June 2001 as a post-doctoral research chemist. He is currently involved in two projects related to rice bran quality. The first deals with the lipid quality of rice bran, which includes the evaluation of rice germplasm for bran oil content, fatty acid composition and hydroxylic stability. The second project focuses on the variation of phenolic compounds in rice cultivars showing different bran color, the chemical characterization of such compounds, their isolation and identification.

Ming-Hsuan Chen - Research Chemist
Ming was born in Taiwan. During study for her Masters at Fresno State University and Ph.D. at Texas A&M University, Ming gained diverse experience using analytical methods to study vitamin contents in food and hormones in biological systems, as well as in the use of biochemical and molecular biology methods to identify genes and study their regulation. Ming joined the Rice Research Unit in February 2001 as a post-doctoral research chemist to study the incorporation of value-added traits, including high antioxidant levels in the bran that are beneficial to health. She has developed analytical methods to identify varieties with high antioxidant content, including vitamin E and oryzanol (even more potent than vitamin E!) from diverse germplasm. Ming also identifies genetic variations associated with rice cooking and processing qualities, including gelatinization temperature and amylase content. These molecular markers are used to speed the incorporation of these traits for improved quality of conventional and specialty rices. Ming's research during the coming year will focus on the chemistry of starch because of its strong influence on functional traits of rice, such as specific processing and cooking characteristics. Understanding the chemistry as it relates to these functional traits is an important step toward establishing the molecular markers for their rapid incorporation in varietal improvement.

Janis Delgado - Biological Science Laboratory Technician
Janis joined the USDA-ARS in 2000, after working for 8 years as a Research Assistant for TAES in Beaumont. Prior to working for TAES, she had fifteen years laboratory experience in federal laboratory positions and two years in private industry. She earned her B.S. in Microbiology at the University of Georgia. As a Biological Science Laboratory Technician (Biochemistry), her efforts are focused on gas chromatographic separations of aromatic rice sensory related components, alkali spreading value determination, instrumental texture analysis, various cooking quality tests, and DNA marker determination of apparent amylose class. In 2002, Janis won a 'USDA Spot Award' for developing a novel and streamline method for determining surface lipids on rice, which is an indicator of milling degree. She is also responsible for web page design and development for the Rice Research Unit at Beaumont. Janis and her husband Angel have two daughters, Alicia and Elena, both pursuing degrees at Texas A&M University. Her hobbies include reading and cooking.

Naomi Gipson - Biological Science Laboratory Technician
Naomi joined the USDA-ARS as a college junior as part of a Cooperative Education Program at the Delta Branch Experimental Station in Stoneville, Mississippi in the Entomology department. Upon graduating from Mississippi Valley State University with a B.S. Degree in 1974, Naomi was offered a permanent technical position with ARS. She has been a member of the team at the quality lab since May 1977. As a Biological Science Laboratory Technician, Naomi generates predictive equations to estimate protein, moisture and non-structural carbohydrate concentrations using near-infrared reflectance (NIR) technology. Her work also focuses on determining amylose content and grain chalkiness. In addition, she works with middle school students in an endeavor to expose them to the world of science and agriculture by bringing them to the Beaumont Center for tours and demonstrations. Naomi has a daughter, Mellery, and a 6-year-old granddaughter, Jai'lyn, who is the apple of her eye. Naomi's pastimes include volunteering at her church and being a positive force in her granddaughter's life. ∗

and quality traits that appeal to several ethnic groups, but are not well understood by the general U.S. domestic market. New instrumentation and technologies are being integrated which can be used to elucidate quality parameters that influence consumer acceptance. This knowledge will be critical for U.S. grown rice to remain competitive in both domestic, and export markets.

Until Christine joined the quality lab, its mission was mostly service oriented. While the lab continues to evaluate up to 10,000 lines a year from all over the U.S., Christine has expanded the focus to include not only cooking quality, but nutritional quality as well.

As Project Leader for the quality lab, Christine's research efforts have been primarily focused on collaborative projects designed to unravel the genetics controlling rice milling properties, kernel morphology traits, starch properties and most recently, rice bran traits that relate to rancidity and nutritional values.

The bran layer, which is removed from the kernel in the milling process, contains nearly all of the vitamins, minerals and phytochemicals present in rice. But due to the oil and enzyme content of the bran, brown rice will quickly go rancid if not stored at cool temperatures or heat-treated. As a result, most people worldwide eat only milled, white rice, missing out on much of the grain's nutritional value.

Dr. Bergman, along with her post-docs Fernando Goffman and Ming-Hsuan Chen, have several projects relating to the quality and components of rice bran. First they began by identifying the components of rice bran that have proven health benefits, and then established procedures for large-scale screening. These components include tocols, which have been proven to lower cholesterol in animals and humans (Kahlon et. al. 1996, Sugano and Tsuji 1997); gamma-oryzanol, which has anti-inflammatory and anti-tumor properties (Yasukawa et. al. 1998, Akihisa et. al. 2000); and phenolics, which have antioxidant or free radical scavenging potential. Phytochemicals with such activity may be protective against oxidative damage, which has been implicated in a range of diseases including cancer and cardiovascular disease (Kehrer 1993).

However, if people are eating mostly white rice because of the rancidity problems with brown rice, then these health benefits are not being realized. The next step was identifying the factors that affect rice bran rancidity, and determine the reason for variability among varieties.

During the milling process, rice bran lipids come into contact with lipases, which rapidly hydrolyse the ester bonds of triacylglycerol (esterase activity), releasing free fatty acids and glycerol. The free fatty acids increase acidity and generate unacceptable functional properties as well as off-tastes, ie. rancidity. Although this process can be inhibited by various stabilization methods, at present it is not economically feasible except on a very large scale. Therefore, what is needed is a cost effective alternative to reduce the susceptibility of rice bran to hydrolytic rancidity.

For this reason, Bergman and Goffman evaluated the bran of 24 rice cultivars for esterase activity and rancidity. They found a strong correlation between the two, with low esterase activity corresponding to lower hydrolytic rancidity in the bran. Ironically, rice with dark bran, such as red rice, had lower esterase activity and therefore lower rates of rancidity. (A separate study also showed these dark bran varieties to have higher levels of the aforementioned phenolic compounds with proven health benefits.)

The next step was to evaluate a diverse collection of germplasm, 204 *japonica* and *indica* cultivars, to determine both bran lipid content and fatty acid composition of the bran. The goal is to identify cultivars with desirable characteristics so they may be included in traditional breeding programs. This could result in improved varieties with higher bran stability and reduced incidence of rancidity in the brown rice, allowing consumers to benefit from the increase in nutritional value of this important grain. *

Author's Note: As of February 20th, Dr. Christine Bergman is on extended leave of absence from the USDA-ARS Rice Research Unit in Beaumont. Family obligations dictated that she relocate to Nevada to care for her mother. It is with great sadness that Christine leaves us, as she had come to love the people and unique culture of Southeast Texas – from crawfish boils to zydeco music. We will miss her sorely, and have great hopes that she will return to the Beaumont Center.

Grower Profile...
Representative Glenn Hegar

Glenn Hegar, Jr. is a third generation rice farmer, but his family's farming history in Waller County dates back to the early 1850s.

When Glenn was growing up in Hockley, he always knew that he would farm rice like his father and grandfather before him. But, when the recession hit the industry in the mid 1980s, Glenn determined that he would try to do more, to make a difference for farm families, like his, who depended on rice for their livelihood.

After high school, Glenn enrolled at Texas A&M University and acquired a B.A. in Political Science and History. He then went on to St. Mary's University in San Antonio, where he earned both a Masters degree in International Economic Relations and a law degree. With a goal of serving the agriculture industry, and possibly public office, Glenn continued his education by earning a second Masters degree in Agricultural Law at the University of Arkansas at Fayetteville.

In March of 2002, Glenn realized his dream when he was elected to the Texas House of Representatives to serve his family and friends in District 28, which now includes Waller, Wharton and part of Fort Bend County.

L to R: Grandfather Hegar, Glenn Sr., Glenn Jr. and cousin Darren in front of the Hegar family home.

At 31 years old, Glenn is not the youngest legislator in Austin, but he has certainly got his career off to an early start. Fellow legislator and rice farmer Robby Cook was 34 when he was first elected to the Texas House of Representatives in 1996.

"It is with a great sense of awe and respect that I walk up the Capital steps to go to work each day," explained Glenn, "and when I sit at my desk and push the button to vote on a piece of legislation, I recognize that 139,512 people that I care about have just made a decision." It is this sense of responsibility that sets Glenn apart, and endears him to the people of District 28.

It was an unseasonably mild and sunny day in February when I met with Glenn for this interview. We went to a small café in Hockley for lunch, which was obviously a favorite spot for many of the local farmers and ranchers. Glenn seemed to know everyone there, and it was quite obvious that they were all very proud of their hometown son. Many expressed congratulations and support, and one farmer chided, "You keep 'em straight in Austin, Glenn" to which he replied, "I'm sure going to try my best." To that there is no question. It's not just that his constituents *seem* like family, with six generations in Waller County, many of them *are* family.

Glenn's grandfather, A.B. Hegar, known as 'Boots' to his friends and family, started farming rice in 1946. Glenn Sr. carried on in the family business, and is the central figure in their farming operation today. Glenn's cousin Darren is also very active in the farm, and has taken on much more responsibility

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Glenn's grandfather 'Boots' Hegar in front of the computer at the headquarters office checking rice quotes on the internet.

since Glenn Jr. joined the Texas House of Representatives. "It was definitely a family decision for me to run for office," said Glenn. "Knowing that I would be away much of the time, Dad and Darren realized that their life would get a lot more hectic. It was with their support and blessing, along with my wife Dara and my mother Connie, that I made the commitment to run for public office."

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The Hegar's grow approximately 750 acres of rice and 1700 acres of corn each year. Last year they grew Saber because of the solid disease package, and were quite pleased with the results. Their rice is grown in a 2-3 year rotation, and most of the water comes from reservoirs where rain is collected and stored during the winter. In years when they have to depend on water pumped from 4 wells on the property, the Hegar's generally do not ratoon because water costs make it unprofitable.

Several years back, they had all their rice land laser leveled. Glenn said it was definitely worth the investment for the savings in water. Due to the sandy nature of the soil they have to build tall levees, and use pvc pipes for gates, which are dug out at the end of each season. Fertilizer goes out in three applications – NPK at the three leaf stage, nitrogen at preflood, and another nitrogen application just prior to PD. Glenn Sr. said sometimes they go with a fourth nitrogen application to the main crop if the plants seem to need it. They do all their own scouting. The worst pests are rice stinkbugs, and until recently, propanil-resistant barnyard grass; however, new herbicide chemistry has solved that problem. Nearly all their fertilizer, fungicide, pesticide and herbicide applications are made by plane. The only exception is Command, which is applied at planting using a modified grain drill.

In 2003, the Hegar's plan to stay with Saber, but will also plant 60 acres of the RiceTec hybrid XL8. They are considering a Clearfield line in the future on fields that are heavily infested with red rice. The family runs two of the new John Deere CTS combines, which Glenn says does the work of four older models. At harvest time everyone pitches in, including grandfather Boots and Glenn's younger brother Gordan, who attends college in Austin.

Of course, Glenn will not log as many hours on the combine this year, as he begins his career in the Texas House of Representatives. Besides the normal responsibilities of a freshman legislator, Glenn will also be serving on the Law Enforcement Committee, and as Vice-chairman of the Local Government Ways and Means Committee. While this will entail more work, Glenn was honored to be chosen for a vice-chair position by the Speaker of the House, as this is a firm show of faith in the abilities and talents of a freshman legislator.

Glenn and his wife Dara have a home in Katy, and Dara practices law in the Champions area of Houston. They met while in college at St. Mary's, although their family had ties a generation back. Glenn said Dara is very supportive of his work, as he shares his time between their home in Katy, the family farm in Hockley, and the Capital in Austin.

With so many in the agricultural industry struggling to make ends meet, it is encouraging to know we have *another* representative in Austin that has a vested interest in preserving the family farm and the unique culture of our rural communities in Texas. *

ippines at Los Baños, the International Rice Research Institute (IRRI), and the Asian Development Bank pooled their expertise and resources to encourage papermaking using rice straw as part of the *Prosperity Through Rice Project.* Papermaking from rice straw is suitable for small and medium scale enterprises. Aside from providing rural employment, the industry also helps to utilize what is normally considered waste.

There are about 100 handmade paper manufacturers today in this region. Among the more successful is a business in Los Baños, Laguna, managed by Fe Frialde. Frialde started in 1986 with five people working in one room. She now employs 70 part-time workers, mostly students and housewives from the area. Frialde produces cards, stationery, paper-mache boxes, dolls, and art paper using free rice straw from IRRI's experimental fields. Her products are exported to the U.S., Australia, Europe, and Japan.

A glimpse of the interior of a finished home, from the popular book *The Beauty of Straw Bale Homes* by Athena and Bill Steen.

A brochure is available that contains the basic materials and procedures to make paper from rice straw. It also has instructions on optional procedures such as bleaching and dyeing. For more information go to www.riceweb.org/Paper.htm for detailed instructions on using this technique.

Another innovative use for rice straw is the production of 'wattles' for erosion control. Wattles are long, tubular bundles of rice straw bound in either biodegradable or photodegradable netting. San Diego State University's Soil Erosion Research Laboratory conducted in-depth testing on *Earth Saver Rice Straw Wattles*, and scientists found that they reduce downslope sediment delivery by 58 percent for the 9" diameter wattles, and 74 percent for the 20" wattles. In fact, the 20" wattle has been shown to reduce sediment delivery by 84 percent after three consecutive rainfall events. The laboratory's rainfall simulator testing also demonstrated that the wattles reduce runoff water velocities and release water at a steady rate. Wherever bare soil is exposed to erosion by wind or water, wattles can be an important part of a comprehensive Best Management Practice system for soil stabilization, sediment retention and vegetation establishment. Go to www.earth-savers.com for more information.

Another by-product of the rice industry is rice hulls, which are removed from the kernel in the first step of the milling process. In the past, rice hulls have been used for livestock bedding material and as an amendment for compost production, but many more innovative uses are being discovered.

The California Institute of Food and Agricultural Research (CIFAR), which is part of the UC Davis system, has on-going research using rice hulls and straw for the production of ethanol. Dr. Sharon Shoemaker joined UC Davis in 1991 as founder and executive director of CIFAR. Her research interests focus on the application of cellulases in biomass conversion (e.g. rice straw, wood, mixed waste paper), the integration of various unit operations in biomass conversion processes (membrane filtration, enzymes), and the development of new analytical methods for quantifying specific cellulase activities.

According to Dr. Shoemaker, the barrier to producing ethanol on a commercial scale using straw is developing an economically feasible method for producing the enzymes necessary to break down the carbohydrates into simple sugars. Once the bulk material is broken down, the sugars are fermented using yeasts, which result in the production of ethanol. Besides utilizing a waste product of the rice industry, this research is important because the gasoline additive MTBE is being phased out and an oxygenate replacement is needed. Ethanol from rice straw could be that replacement, if economic feasibility issues are worked out.

CIFAR has been a subcontract to the Gridley Rice Straw project since 1995. This collaborative effort with the City of Gridley and Biggs, CA, the Department of

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Energy, and private enterprise has demonstrated the use of rice straw as a raw material for production of fuel ethanol and other valuable chemical intermediates. For more information on this project contact Dr. Shoemaker at 530-752-3561 or visit their website at www.cifar.ucdavis.edu/.

At the National Environmentally Sound Production Agriculture Laboratory (NESPAL) in Georgia, Dr. Randy Hudson is conducting research on a new building material that utilizes rice hulls and kenaf. The composite board is strong, but fairly light weight, and is resistant to termite infestation, mold and rotting. Currently the company that developed the product is marketing it for use as deck boards and door frames, but the product line is expected to expand rapidly. NESPAL is a unit of the University of Georgia's College of Agricultural and Environmental Sciences located at the Tifton, Georgia campus. The lab was formed in 1991 to work with private companies addressing the issues of maintaining efficient agricultural production and assuring consumers of a safe and affordable food and fiber supply while protecting our natural resources and the environment. For more information contact Dr. Hudson at 229-386-7274 or visit www.nespal.org.

On another front, rice hulls may one day satisfy the semiconductor industry's hunger for raw materials. The tough hull that encases rice grains contains 20 percent silicon dioxide, or silica, and rice millers worldwide generate millions of tons of hulls each year.

To extract the silicon that occurs naturally in this agricultural waste, scientists need to first identify the silicon-containing compounds. A team of scientists in Brazil used nuclear magnetic resonance to confirm previous work demonstrating an amorphous silica bound to water (silica gel) was present in rice hulls.

In the modern rice milling industry, rice hulls are used as a fuel source for grain drying and parboiling. In Thailand, rice is dried in high-temperature fluidized bed dryers, and drying heat is provided by cyclonic rice hull furnaces. In Arkansas, about 30% of rice produced is parboiled, and heat for process steam and rotary grain dryers is produced by burning rice hulls. In Bangladesh, rice hulls are the preferred fuel for parboiling, and rice hulls are widely used for grain drying in the larger rice mills in Northern India.

In addition, rice hulls can be briquetted to improve combustion characteristics and ease of handling. Extruder technology for rice hulls originated in Korea and is now common in rural Bangladesh (IRRI). The ash that remains from the hulls is rich in silica, so is a potential source of silicon for a variety of industrial uses. (Science News, March 2000)

Also working on silica extraction is Andrew Proctor, a food chemist for the Arkansas Agricultural Experiment Station. He obtained USDA funding for a study to develop products that would create new markets for rice hull ash and alleviate the disposal problem. "The silica in the ash is very amorphous, lacking the highly-organized crystalline structure of geological silica, such as found in sand," Proctor said. "That makes it easy to turn it into the raw material for many useful products."

This use for rice hull silica is attracting industry interest. "They're very interested because wide-scale use would reduce the environmental challenges posed by disposal of rice hulls *and* produce a useful material that requires little energy for production."

Rice hulls are a relatively low-cost container media amendment that has been increasing in popularity. A fine, uniform product is achieved by first hammer-milling particles to about 2mm, then composting for 18-24 months. According to Dan Kuczmarski, Forrest Keeling Nursery, Elsberry, MO, the outstanding feature of this product is its size, uniformity and stability over time. After a year or more in the container, there is little apparent breakdown of the hulls.

Rice hulls have a pH around 5.7. Compared to peat they have a relatively low water-holding capacity, holding about 50% of their dry weight. At the 1996 Ohio State University Nursery Short Course, Dr. Ted Bilderback presented a comparison of rice hull physical properties to those of peat and bark. These figures demonstrated that rice hulls have a high proportion of air-filled pore space.

Rice Hull Specialty Products, Inc. in Stuttgart, AR produces high quality ground rice hulls for a variety of uses. These include fiber sources, premix, and pellet binder in the animal feed industry; composite materials such as fiber in injection molding and extrusion processes; and as a carrier and extender.

Necessity is indeed the mother of invention, as researchers and entrepreneurs continue to search for ways to utilize these potentially valuable 'waste' products from the rice industry. *

Pest of the Month

Rice Water Weevil

The rice water weevil (RWW) occurs in all rice-producing states and is endemic to the southeastern United States. The insect was introduced from the South into California in the 1950s and has since spread to Asia. RWWs overwinter as adults in perennial grasses and litter surrounding rice fields. The RWW overwinters in a hibernation state. In the early spring, adults begin feeding on the new foliage of overwintering hosts. Females fly in search of suitable host plants to deposit eggs upon. Adults feed on rice foliage producing longitudinal feeding scars. Once flood is established, females lay eggs in culms underwater. Eggs hatch and larvae move down to the roots, where feeding causes root pruning, which can lead to yield losses. Larvae pass through four instars before pupating in mud cocoons attached to rice roots. Larvae and pupae living in the mud extract oxygen from rice roots. In Texas, the RWW completes two or three generations annually.

Damage caused by larva root pruning includes stunting and chlorosis. Fewer tillers are produced and damaged plants are less competitive, which allows for greater weed growth. In California, the highest RWW populations and most severe damage occur near levees and field margins, thus California rice farmers frequently apply insecticides only to the margins and adjacent to levees of their rice fields. However, in the South, RWW populations and damage are distributed more uniformly throughout rice fields. Damage by RWWs can result in substantial yield reductions. The U.S. Department of Agriculture estimated that on average yield losses would range between 10% and 33%, if RWWs were left uncontrolled. In some areas and years, yield reductions are much greater. Also, the economic injury level (EIL) varies across states. For instance, in Texas the EIL is three to five larvae per plant, whereas in Arkansas the EIL is about 10 per plant. Data from Texas show that an average of one larva per plant reduces main crop yield by 80 lb/acre, and the subsequent ratoon crop yield by 20 lb/acre.

Management options for RWW have changed dramatically over the last several years, mainly due to changes in government regulatory policies. In the late 1980s, the U.S. Environmental Protection Agency began a gradual phase-out of carbofuran, the only RWW labeled insecticide. Withdrawal was due to avian kill incidents attributed to use and misuse of the chemical.

During the phase-out of carbofuran, U.S. rice entomologists, the U.S. rice industry, and various agrichemical companies worked cooperatively to develop and evaluate new insecticides as replacements for granular carbofuran. The Beaumont Entomology Project played a significant role in this process. By the spring of 1999, Karate Z, Icon 6.2FS, and Dimilin2L were labeled as replacements for granular carbofuran. Last year, Fury received a RWW label and this winter, Mustang Max was also registered for RWW control.

Cultural controls for RWWs exist, mostly involving manipulation of irrigation practices. Draining fields to kill larvae is still practiced on a limited scale. However, nutrient loss, compromised weed control, creation of a blast-favorable environment, increased water use, possible rainfall during the drying period, and potential reinvasion of reflooded rice by RWW usually preclude recommending this cultural control tactic. Data also show that rice which is flooded early, relative to emergence, suffers more RWW damage than later flooded rice. Sparse rice stands are usu-

continued on next page

Table 1. Results of March 8 Planting Date vs RWW. Beaumont, TX 2002

Treatment formulation	Rate/Timing (lb AI/ac)	No. of larvae/5 cores May 6	May 16	Yield (lb/ac) @ 12% moisture Main crop	Ratoon crop	M+R
Untreated	-	41.0 a	44.0 a	7750 c	1711	9461 b
Icon 6.2FS	0.0375 / ST	2.0 bc	3.0 c	9626 a	2057	11683 a
KarateZ	0.03 / BF	0.5 c	2.5 c	8676 b	1994	10670 a
Fury	0.04 / BF	5.3 b	19.3 b	8926 ab	1937	10863 a
Fury	0.04 / 3DAF	0.5 c	2.0 c	9002 ab	2013	11015 a
Dimilin	0.188 / 3DAF	0.3 c	5.0 c	9296 ab	2032	11328 a

ST - Seed Treatment BF - Before Flood DAF - Days After Flood
Means in a column followed by the same letter are not significantly different at the 5% level

ally associated with more RWW damage. In addition, certain rice varieties are more susceptible than others to RWW damage. In general, higher RWW populations are found on medium-grain than long-grain varieties. And among long grain varieties, Cocodrie is relatively susceptible, while Jefferson is relatively resistant.

Highlights of RWW Research in 2002

The Beaumont Entomology Project conducted several RWW projects in 2002. One study evaluated preflood nitrogen as it relates to RWW damage. The objective was to determine if increasing preflood N resulted in less RWW damage. They found that, across RWW treated and untreated plots, increasing preflood N did not increase or decrease RWW populations, although it did increase the yield of main and ratoon crops. When averaged across fertilizer treatments, treating for RWW increased yield of main and ratoon crops by 548 lb/acre and 200 lb/acre, respectively. Unfortunately, increasing preflood N did not decrease RWW damage.

Another study was conducted to determine RWW and plant response to stale vs. conventionally tilled seedbed planting. They found that RWW populations were slightly higher in the conventionally tilled seedbed. Both Icon 6.2FS and Karate Z gave excellent control of the RWW, regardless of tillage method. Averaged across insecticide treatments, stale seedbed treatments out yielded conventionally tilled seedbed treatments by 584 lb/acre. Soil type in these experiments was League (heavy clay) and results showed that the rice emerged more uniformly in the stale seedbed treatment than in the conventionally tilled seedbed treatment.

Another study was conducted to compare RWW populations across three planting dates; March 8, April 16 and May 25. The highest populations of RWW larvae were recovered from the earliest planting, with RWW control on the earliest planting producing the highest economic return. All of the insecticides performed well. For the March 8 planting, average main crop yield response to RWW control was 1355 lb/acre, while average ratoon crop yield response to control of RWW on the main crop was almost 300 lb/acre. (Table 1) These results suggest that farmers who plant early will derive the greatest benefit from RWW control.

Plans for RWW Research in 2003

The Entomology Project will continue extensive RWW research in the coming season. They will look closer at stale seedbed vs RWW infestation, with 2003 studies planned for clay *and* sandy soils. The planting date study will be continued along with the evaluation of new RWW insecticides such as Mustang Max, GF-317, and seed treatments for control on main and ratoon crop rice. And with the goal of reducing pesticide use, and farmer input costs, the Entomology Project will evaluate varieties for host plant resistance to this potentially devastating pest.

If you believe the Entomology Project should be working in another area of RWW research, please contact Mo Way at 409-752-2741 ext. 2231.*

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