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Rice Research Station News

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Potential for Using Markers to Breed for Resistance to Chalk

Grain quality is an important aspect of the U.S. rice industry that has received increased scrutiny in the past three years. The USA Rice Federation has created the Rice Marketability and Competitiveness Task Force to address rice quality issues. U.S. public rice breeders have always been aware of the need to develop superior varieties with stable grain dimensions, acceptable cereal chemistry, and little or no chalk. DNA markers are used routinely to identify rice lines with appropriate classes for amylose content and gelatinization temperature. We are now testing the potential to identify markers for resistance to chalk.

Genetic analyses have shown that different heritable factors interact with the environment to produce different levels of chalk among varieties. A four-year field study in Arkansas demonstrated that under high night temperatures, different varieties such as Cypress, Wells and LaGrue produced low, intermediate and high levels of chalk, respectively. A recent study across seven Asian countries identified five genetic factors from the variety Lemont that contributed to low chalk in different breeding lines. Other research groups have identified additional regions or genes that presumably influence chalk formation, which appears to be variety specific.

We have identified candidate markers for resistance to chalk from DNA sequence information obtained from 13 rice varieties of the USDA-funded RiceCAP project. The low-chalk varieties – Cocodrie, Cypress and Lemont – and the high-chalk variety, LaGrue, were included in this study. Several of the markers were found in genes that contribute to starch formation and response to stress in the developing grain. A total of 17 genes were found in common for Cypress, Lemont and Cocodrie, of which three have been reported by other researchers to respond to high temperature during the grain-filling stage. In 2012, we began to evaluate potential of the selected markers by obtaining DNA profiles of known low- and high-chalk varieties along with a segregating population derived from a cross between Cypress and LaGrue. Results from this study will help determine the potential of DNA markers to assist in breeding for low-chalk varieties.

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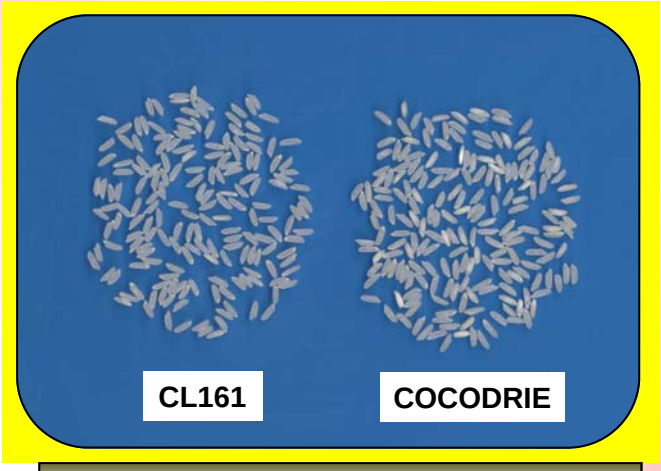

CL161 has inherently less chalk than many other currently grown varieties.

Louisiana Agricultural Experiment Station 1887-2012 LSU AgCenter 125 YEARS Excellence in Research

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Special Dates of Interest:

Southwest LA Rice Tour
Wednesday, May 30, 2012

Rice Research Station South Farm Field Tour
Wednesday, June 13, 2012

Rice Research Station Annual Field Day
Thursday, June 28, 2012

Useful Rice Web Pages

The Internet and World Wide Web are becoming more important in providing information to rice growers on many different subjects including current production updates, marketing information, pest management, etc. Searching for this information can be daunting with massive numbers of websites found when searching, with most not having any pertinent information. Once a useful website is found, then comes the hassle of finding the information you want. A lot of frustration comes from this process. Following are several websites for rice producers and specialists with useful rice information that can be quickly found.

Several content-based webpages have been developed in the LSU AgCenter website (www.lsuagcenter.com) to help provide useful information on:

Rice diseases: www.lsuagcenter.com/en/crops_livestock/crops/rice/diseases

Rice insects: www.lsuagcenter.com/en/crops_livestock/crops/rice/insects

Rice production: www.lsuagcenter.com\rice

The Rice Research Station http://www.lsuagcenter.com/en/our_offices/research_stations/Rice/

Several international rice research institutes also have websites:

CGIAR: http://www.cgiar.org/impact/research/rice.html

International Rice Research Station: http://irri.org/default.asp

Several popular press publications that carry rice articles have websites including:

Rice Farming: http://www.ricefarming.com/home/index.html

Delta Farm Press: http://deltafarmpress.com/

MidAmerica Farmer Grower: http://www.mafg.net/

Most of the research stations and centers concentrating on rice have websites:

Texas: http://beaumont.tamu.edu/

California: http://www.plantsciences.ucdavis.edu/ricestation/

Mississippi: http://msucares.com/drec/rice/index.html

Arkansas: http://aaes.uark.edu/rice.html

Missouri: http://agebb.missouri.edu/rice/

USDA: http://www.ars.usda.gov/main/site_main.htm?modecode=62-25-05-00

There are several agricultural Web pages that have rice information on them:

Agfax: http://agfax.com/

Oryza: http://oryza.com/

Rice Online: http://www.riceonline.com/

THE HISTORY OF U.S. RICE PRODUCTION-PART 2

RICE MOVES INTO SOUTHWEST LOUISIANA

U.S rice production declined in the years following the Civil War. Production in the traditional region of South Carolina and Georgia was negatively affected by the end of slavery as well as the lack of available capital. In Louisiana, the already limited production along the Mississippi was hurt by eroding levees and flood devastation. In fact, U.S. rice production may have come to an end had it not been for a number of circumstances at the end of the nineteenth century. These included (1) the completion of the railroad system from New Orleans westward through south Louisiana and Texas, (2) the availability of cheap land and abundant water in the prairies of southwest Louisiana, and (3) the development of steam-powered farm implements.

The railroad was completed from New Orleans westward in about 1883. This facilitated the sale of the abundant prairie land in southwest Louisiana. Railroad agents came to the region from the grain-producing region in the American Midwest to develop and sell this land for agricultural production. The first prospective farmers came primarily from the Midwestern states of Iowa, Illinois and Kansas. Land could be purchased for as little as 12 cents per acre, and $14 down would initiate the sale of 160 acres. Grain farmers from the Midwest came in large numbers and brought with them their steam engines, steam tractors, mechanical harvesters, and knowledge and expertise in mechanized farming. They soon discovered that corn and wheat did not prosper in the coastal prairies but rice certainly did. Many farmers later came to the region directly from Europe, with a large portion from Germany.

The wheat twine binder was successfully adapted to rice harvesting by Maurice Brien in 1884. Railroad shipping records indicate that one twine binder was shipped to Louisiana in 1884, 200 in 1887, and more than 1,000 in 1890. Steam tractors and threshers became common in the region, and in 1888, William Deering and Company began to manufacture a harvester designed especially for rice. It became evident, however, that the capital improvements and technology required for rice production greatly exceeded those required for grain production in the Midwest.

Mr. Seaman A. Knapp left the presidency of Iowa State College to move to the region as a farm specialist. He promoted experimental farms, brought improved rice varieties and conducted a number of other activities that benefited the establishment and success of early rice production in the region. Mr. Knapp spent a great deal of his time educating producers on the newest technologies and varieties. He is given much credit for the establishment of the Cooperative Extension Service that now exists throughout the U.S. and is part of the LSU AgCenter in Louisiana.

It is estimated that by 1895, there were almost 300,000 acres in rice production in the U.S., most of which was in Louisiana. Rice production also spread rapidly into southeast Texas during this period. By 1903, Louisiana had more than 375,000 acres and Texas had more than 230,000 acres in production. Other important developments in Louisiana rice production during this period included establishment of large-scale canal and irrigation systems. Canal and land development companies built large canal systems that ran for many miles. These systems typically pumped water from bayous or rivers using large steam engine driven pumps. The water was delivered to adjacent fields along the length of the canals and offered rice farmers a dependable supply of fresh water. The canal company in turn received a share of the crop in exchange for the irrigation water.

During the early days of rice production in the region, most of the rice was shipped to the established milling industry in New Orleans. By the turn of the century, however, prairie rice farmers began building private and cooperative mills in the production area of southwest Louisiana. The first part of the 20th century also brought improved varieties. A number of new rice varieties were introduced from other countries, and several new varieties were introduced from Japan. Mr. Solomon Wright, a Midwesterner who relocated to Crowley, developed the Blue Rose variety that was the standard of the industry for many years.

Also in 1909, the Rice Experiment Station was established on a tract of land west of Crowley. The rice station came to be because of a cooperative endeavor between the LousianaAgricultural Experiment Station, the U.S. Department of Agriculture and local rice farmers. The station was originally established with the primary mission of introducing and later developing improved rice varieties. This has remained an important objective, and through the years, other important research areas were added to the mission of the current LSU AgCenter Rice Research Station.

The development of the rice industry was the foundation for the settlement and development of the coastal prairie region of Southwest Louisiana and remains an important economic engine for this region.

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The Rice Research Station Office at its original location west of Crowley.

Hybrid Rice Update

Hybrid rice research at the Rice Research Station was initiated in January 2009. Since then, research has been conducted on various aspects of hybrid rice development by working with introduced indica hybrid germplasm primarily from Guangxi, China (simplified as GX), which includes evaluation of GX cytoplasmic (CMS) male sterile A and S lines, screening of Louisiana/U.S. genotypes for use as restorer lines, seed production and yield trials of experimental hybrids, identification of new potential hybrids, and development of adapted hybrid lines.

In 2011, four experimental hybrids were tested in multi-location yield trials. These included 2-line long-grain Clearfield (CL) 10CT151 and non-CL10TC446, and 3-line medium-grain LAH10 and LAH20. In addition, LAH10 was also tested in the Uniform Regional Rice Nursery, Louisiana Commercial Advanced trials, and Date of Planting trials at various locations/states. All hybrids had yield potential (main and ratoon) superior to non-hybrid checks, while the medium-grain hybrid LAH10 had the highest yield among all hybrids. Both LAH10 and 10TC446 also showed good grain quality.

Small-scale seed production was continued in 2011 using the method modified from that used in China to minimize the labor involvement. More than 200 pounds of seed of the new long-grain experimental hybrid LAH12 were produced on a 1/8-acre area. Adequate seeds of another experimental long-grain hybrid 11TC401 were also produced. Both new hybrids, along with those tested in 2011, are included in 2012 hybrid advanced trials.

Plots of the cytoplasmic male sterile (CMS) line 08A (left) and its isogenic male fertile sister maintainer line 08B (right). The line 08A can only be multiplied by controlled pollination from line 08B.

Combine harvest of the seed production field of the long-grain experimental hybrid LAH12. Prior to harvest, male or pollen parent was removed from the seed field.

About 1,100 testcrosses between GX male sterile lines and Louisiana/U.S. genotypes have been made and 700 of them have been evaluated during the past three years for screening of potential restorer (R) and maintainer (B) lines, as well as for the identification of potential hybrids. We found that only 13 out of 220 tested U.S. genotypes were able to restore the fertility to GX CMS A lines. However, all 80 tested Louisiana/U.S. genotypes served as effective pollinators for the GX S male sterile line. A number of potential hybrids with better yield potential than LAH10 were identified and re-testcrossed for next year's yield trials.

Very good progress has been made in hybrid line development. Since September 2010, we have been able to advance two to four generations on selections out of the 20 or so original crosses between GX R lines and elite Louisiana lines. These were grown for testcrossing this summer. New crosses between elite Louisiana lines and additional R and B lines were made and advanced. By selection and advancement in both field and greenhouse, a large number of potential male sterile S lines have been developed and will be closely evaluated for their combining ability and outcrossing potential this summer. Through cooperation with Jim Oard and Herry Utomo, several promising molecular markers were identified and validated for future marker-assisted selection of major hybrid traits.

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Pest of the Quarter

Broadleaf Signalgrass

Broadleaf signalgrass (*Urochloa platyphylla*), previously classified as *Brachiaria platyphylla,* is believed to have originated on the savannas of eastern Africa. Some sources believe broadleaf signalgrass is native to the Unites States. Broadleaf signalgrass is a C4 plant, which means it has an efficient mechanism of fixing carbon to sugars. C4 plants tend to be more adaptable in tropical environments.

Broadleaf signalgrass is a summer annual often found as a problem weed in many crops. This plant can grow to a height of 2 to 4 feet. It has what is referred to as a decumbent growth habit, which means stems will grow horizontally along the ground from the base of the plant and then become erect. Broadleaf signalgrass has the potential to root at the nodes, which can allow the plant to be more adaptive to adverse conditions. Broadleaf signalgrass leaves are 1 to 6 inches long and less than 1 inch wide. The leaves are generally considered glabrous, meaning having no hair or pubescence; however, when broadleaf signalgrass first emerges, it can have pubescence on the underside of the leaf up to the four-leaf stage. The ligule is often described as hairy, but on close inspection, the ligule is a short membrane topped with a fringe of hairs. The seedhead is considered to be a raceme with 2 to 6 spikes or branches. Another key identifying characteristic is a crease or constriction at the tip of the leaf. This crease is caused by excess wax formation on the surface of the leaf.

Seedling Stage

Raceme Seedhead

Ligule displays short membrane topped with fringe of hairs

Broadleaf signalgrass is considered to be a common weed in corn, cotton, peanut, soybean and rice. Research in Arkansas in 1988 indicated that rice yield decreases 16 lb/A for every broadleaf signalgrass plant/yard^2 when allowed to compete the entire season. Broadleaf signal grass not only reduces rice yield but also rice leaf size, dry weight and rice height.

Broadleaf signalgrass is found throughout South and Central America and Africa. In the United States, it is found as far north as Illinois, south to Florida, west to Arizona and to the east coast from Maryland to Florida. It has become more of a problem in crops because of its tolerance to many herbicides and through weed shifts. This shift is probably due to removal of more competitive weeds by herbicides and cultural practices, which allows Mother Nature to take advantage of an opening.

Oftentimes, a rice weed control program is based primarily on the control of barnyardgrass, and in many cases, the same herbicides have activity on broadleaf signalgrass. Producers have the option to control this weed either preemergence or postemergence in rice. Herbicides with residual activity on broadleaf signalgrass are Command, Facet and pendimethalin. There are several herbicides that can also provide postemergence activity on broadleaf signalgrass, such as Ricestar HT, Clincher and propanil. Newpath is one of the best herbicides for control of broadleaf signalgrass. If a producer plants Clearfield rice and follows the recommendations for Newpath and/or Clearpath, control of broadleaf signalgrass will be achieved. Although, broadleaf signalgrass is competitive with rice, there are numerous options for controlling this troublesome weed.

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Development of Certification Standards for Coastal Restoration Species

Genetically improved coastal plant varieties with great adaptation to coastal environments can help improve the efficiency of coastal restoration and erosion control. Varietal certification is a key protection in the sale, tracked after distribution, and delivery of planting materials to the point of restoration. The certification program ensures a variety's genetic identity, purity, and performance characteristics.

The Louisiana Department of Agriculture and Forestry (LDAF) is the state agency charged with developing and implementing all plant certification standards. The LSU AgCenter Coastal Plant Breeding Program, the Natural Resources Conservation Service (NRCS), coastal restoration agencies, and coastal plant growers and nurseries have all provided input to the LDAF on the development of certification standards for three clonally released coastal plant species – smooth cordgrass, California bulrush, and sea oats. The LDAF will carry out the varietal certifications.

A successful certification program will depend on active collaborations of the certification agency, the coastal plant industry, restoration agencies issuing the plant restoration contracts, and plant developers (breeders). Realizing the critical relationship among these parties, concerns and ideas from each participant were part of considerations in developing the standards. Extensive meetings were held by the LDAF to address issues from each constituent. The process was rather lengthy and there were disagreements, but it was educational and productive.

In general, the certification standards developed follow typical requirements commonly applied to other crops, including definition of classes, production requirements, land requirements, grower inspections, LDAF inspections, and field standards. However, specific requirements were adopted to address specific needs and situations unique to coastal plants that are also a reflection of the current state of production technology and common practice in the industry. To ensure varietal purity, DNA fingerprint tests are included in the certification process.

The certification standards will provide quality assurance and consumer protection in obtaining coastal plant varieties as specified by the breeders to get maximum benefits in coastal restoration programs. The certification standards will provide a critical path to highly efficient coastal plant restoration efforts that will benefit all parties involved in coastal plant restoration programs. As the industry and the technology evolve, the standards will be adjusted to best suit the industry needs

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Smooth Cordgrass Breeder lines at the Rice Research Station.

California Bulrush Foundation Materials at the Burden Center.

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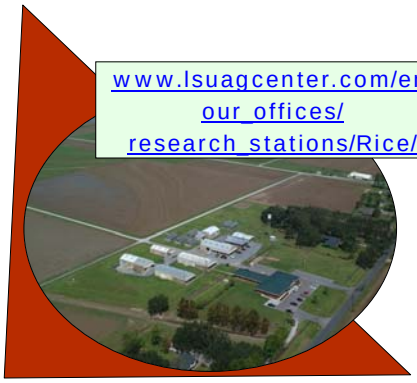

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The LSU AgCenter Rice Research Station is now on Facebook. The page will provide timely updates on research conducted at the station as well as other useful information. The page can be accessed at the link below. Simply go to the page and click on *LIKE*. Updates will then be posted to your Facebook homepage. If you are not currently a user of Facebook, signing up is easy and free.

http://www.facebook.com/#!/pages/LSU-AgCenter-Rice-Research-Station/212812622077680

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RICE RESEARCH STATION 1909-2009

Focus

Henry Plays Key Role in Variety Development

Blake Henry started working at the Rice Research Station in 1996 as a student worker assisting in entomology research. In 2000, he started full-time at the station, continuing in entomology before joining Steve Linscombe's variety development team.

In 2007, Henry started working with Xueyan Sha to develop specialty varieties where he currently works. His job requires him to be in the field and help grow a rice crop – from plowing, drilling seed, harvesting and threshing. But when another department on the station needs help, Henry drops what he's doing and lend a hand.

"I love being outdoors," Henry said. "I tried an inside job and I didn't like it."

Henry said his co-workers are good to work with.

"I enjoy working with the people at the station. I have great friendships here. I love working with Sha," Henry said. "He's real understanding and patient, and Sha's a great teacher."

Henry graduated from Crowley High School in 1995 and attended LSU-E. "I really didn't know what I wanted to do."

But, he said he found his niche working at the station.

Sha said his breeding program has benefitted tremendously from Henry's hard work and dedication. "He actually played a critical role in the development of three aromatic rice varieties. He helped me mill more than 1,000 pounds of rice for different sensory tests, which lead to the successful development of Jazzman, Jazzman-2, and Della-2," Sha said.

When Henry isn't at work, he's with his wife, Celeste, and their three children ages 2, 8, and 10. "Family is very important to me."

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Research partially funded by the Louisiana Rice Research Board