



**Dale Bumpers National Rice Research Center
USDA-ARS
Stuttgart, Arkansas**



SEPTEMBER and OCTOBER 2020

MONTHLY RESEARCH HIGHLIGHTS

For More Information: Dr. Anna McClung, Research Leader/Center Director
anna.mcclung@ars.usda.gov

- **Recent Scientific Publications**

This addresses USDA-ARS Research Goal: Plant and microbial genetic resource and information management

McClung, Anna M., Jeremy D. Edwards, Melissa H. Jia, Trevis D. Huggins, Harold E. Bockelman, M Liakat Ali, Georgia C. Eizenga (2020) Enhancing the searchability, breeding utility, and efficient management of germplasm accessions in the USDA–ARS rice collection. *Crop Science* 2020:1–21. <https://doi.org/10.1002/csc220256.20256>

Genebanks conserve worldwide crop genetic diversity in systematically assembled and maintained collections that are used by plant breeders and geneticists to improve the crop productivity, value, and sustainability. The USDA-ARS world rice collection contains over 19,000 varieties that have been collected over a century from around the world. Challenges faced in genebank management include providing sufficient and accurate trait information to facilitate searching the collection; controlling redundant accessions, seed mixtures, and mislabeled accessions; and identifying gaps in diversity. To help address these issues, we have employed genotyping the accessions using a set of 24 DNA markers. Trait-specific markers were used to validate grain aroma, bran color, amylose content, starch pasting properties, gelatinization temperature, resistance to rice blast disease, plant pubescence, and plant height. These markers are so effective they can replace more expensive and less robust methods for collecting trait data, like chemical analyses for cooking quality. In addition, we were able, for the first time, to classify accessions by species, subspecies, *Indica* or *Japonica*; and subpopulation, *aromatic*, *indica*, *aus*, *temperate japonica*, or *tropical japonica*. This is important to breeders that tend to work within only one gene pool for variety development. As a result of this study, these molecular markers will increase the value of the USDA world rice collection for breeding programs and providing new opportunities for gene discovery.

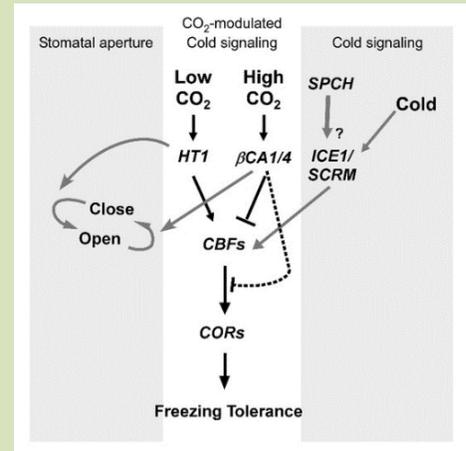


Aerial view of diversity within the rice germplasm collection at Stuttgart, AR. Photo by Javier Delao.

This addresses USDA-ARS Research Goal: Identify and characterize genetic and phenotypic variation to determine cold tolerance altered by rising atmospheric CO₂.

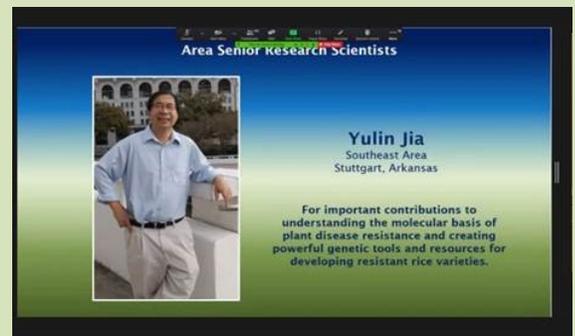
Barnaby, J.Y., Kim, J.Y., Mura, J.D., Fleisher, D.H., Tucker, M., Reddy, V.R. 2020. Varying atmospheric CO₂ mediates the cold-induced CBF-dependent signaling pathway and freezing tolerance in Arabidopsis. *International Journal of Molecular Sciences*. <https://doi.org/10.3390/ijms21207616>.

Stoma is a pore in a plant where there is an exchange of water vapor and other gases such as oxygen and carbon dioxide (CO₂) with the atmosphere. High levels of atmospheric CO₂ close stomata, and conversely low CO₂ levels open stomata. Although it is known that there is a relationship between the opening and closing of the stomatal aperture and cold tolerance/winter hardiness, the underlying mechanism is still largely unknown. The current study reports the effect of atmospheric CO₂ on the C-repeat Binding Factor (CBF), a master regulator of the cold-response pathway and freezing tolerance. This study demonstrated that CO₂ signaling in stomata and CBF-mediated cold signaling work coordinately in Arabidopsis to manage abiotic stress. These findings demonstrate the complex regulation of the plant's response to changing climatic conditions and will help in the development of crops that have enhanced freezing tolerance and productivity.



✓ Interactions with the Research Community

On September 15, Dr. Yulin Jia received an award as a Senior Scientist of the Year for the USDA-ARS Southeast Area, and attended a virtual meeting with other awardees to brainstorm how to increase workforce diversity to include underrepresented minorities and the conclusion of the discussions were presented to the ARS Advisory Council..



On October 14, the Tri-societies (American Society of Agronomy; Crop Science Society of America; Soil Science Society of America) featured the recent *Crop Science* publication entitled “Enhancing the Searchability, Breeding Utility and Efficient Management of Germplasm Accessions in the USDA-ARS Rice Collection” on the homepage of their respective society websites (see links below). Additionally, the Tri-societies Science Communications Manager sent a news release to science, agricultural and major media sites highlighting this web story. As a result of this promotion, on October 23, Dr. Georgia Eizenga was interviewed by Ms. Lela Nargi who is writing an article on plant germplasm collections for *The Counter*, a nonprofit newsroom investigating the forces shaping how and what America eats.



<https://www.crops.org/news/science-news/cataloguing-rice-collection-crop-improvement>

✓ **Rice Germplasm Distributed**

During the month of September, 428 rice genetic stocks were shipped to researchers in the United States.

During the month of October, 47 rice accessions from the Genetics Stocks *Oryza* (GSOR) collection were distributed to researchers in the United States, Italy and the United Kingdom.

• **Stakeholder Interactions**

Dr. Anna McClung was interviewed by Garden and Gun Magazine on Sept. 6th regarding her breeding efforts using the heirloom variety, Carolina Gold, to develop a new variety “Santee Gold” that will be ready for public release at the beginning of 2021. (pictured L to R: Luis Coral, Anna McClung, Trevis Huggins, Laduska Sells of the breeding program in a pure seed field of Santee Gold).



During September and October, Dr. McClung provided advice on rice varieties to be grown in Maryland, South Carolina, for research at the University of the District of Columbia and at the University of Arkansas, and colored bran varieties for specialty market development with a grower in Arkansas.

On October 1st, Dr. McClung was interviewed by a journalist from ScienceLine (New York University) regarding development of varieties that can be grown with less water.

• **Education and Outreach**

Adam Rice, Biological Science Technician, joined the Rice Germplasm project under the leadership of Dr. Trevis Huggins on June 22, 2020. Adam graduated from the University of Arkansas with a M.S. in Plant Breeding and Genetics. He is an avid fisherman and is glad to have the opportunity to visit various waterbodies in the central Arkansas area.



Maksud Hossain joined the Weed Physiology group in July as a Biological Science Technician and will be under the supervision of Dr. Dave Gealy. Originally from Bangladesh, where he received an M.S. degree in Agronomy, he later received an M.S. in Genetics and Plant Breeding from the University of Florida. More recently, he has worked on research projects at the Noble Research Institute in Oklahoma, and he came to DBNRRC directly from working with the sugarcane breeding program at the USDA Sugarcane Field Station in Canal Point, Florida.

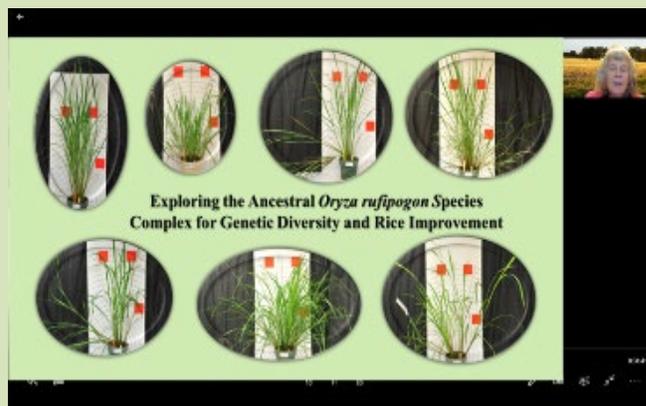
On September 1, Kristina Trahern joined DBNRRC. Kristina received a B.S. degree in Biology from Arizona State University and has worked over 5 years with US Forrest Service. She is now a Biological Science Technician with the Molecular Plant Pathology group under the leadership of Dr. Yulin Jia. She is supported through funding from a National Science Foundation grant in collaboration with Washington University at St Louis on a project titled “Characterization of genomic basis of weedy rice competitiveness”.



On Oct. 10 and Oct 24, Dr. Jinyoung Barnaby participated in the 2020 Korean-American Women in Science and Engineering (KWise) Virtual Conference as a KWise Washington D.C. Chapter president as well as the Florence Nightingale Day 2020 event as a committee member and as a judge for a video competition for middle and high school students, respectively. Florence Nightingale Day is an outreach event that is organized annually by the American Statistical Association and the Caucus of Women Statisticians to educate middle and high school students and their teachers on the opportunities for a career in statistics and data science.



On October 16, Dr. Georgia Eizenga presented a webinar entitled “Exploring the Ancestral *Oryza rufipogon* Species Complex for Genetic Diversity and Rice Improvement” as part of the Fall 2020 Newman Seminar and Lecture Series in Natural Resources Engineering provided by the Department of Agricultural Sciences at Clemson University. The seminar was well attended by graduate and undergraduate students, faculty members, USDA-ARS scientists and extension agents.



See the web version of all DBNRRC research highlights at:
<https://www.ars.usda.gov/southeast-area/stuttgart-ar/dale-bumpers-national-rice-research-center/docs/monthly-research-highlights/>