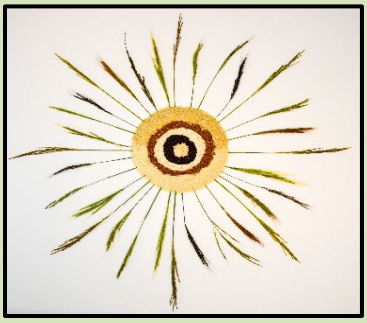
Dale Bumpers National Rice Research Center
USDA-ARS
Stuttgart, Arkansas

DECEMBER 2023



MONTHLY RESEARCH HIGHLIGHTS

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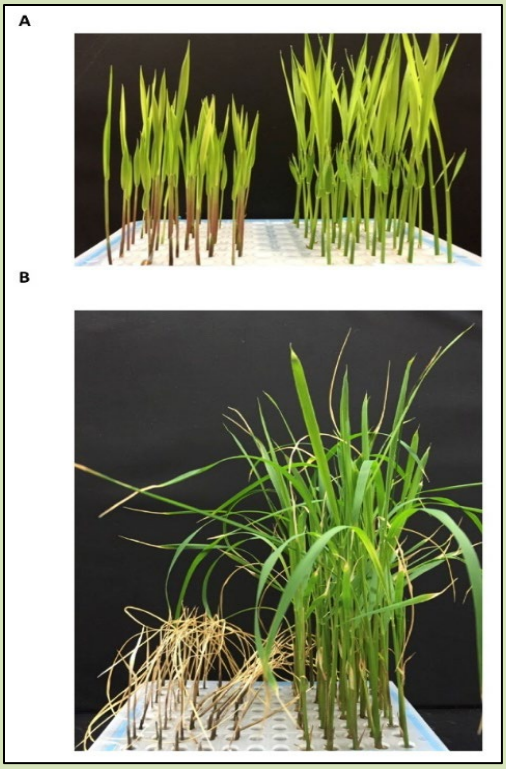
- **Recent Scientific Publications**

This addresses USDA-ARS Research Goal: Increasing knowledge of the molecular mechanisms underlying crop adaptation to temperature extremes.

Schläppi, M.R., Jessel, A.R., **Jackson, A.K.**, Phan, H., **Jia, M.H**., **Edwards, J.D.** and **Eizenga, G.C.** 2023. Navigating rice seedling cold resilience: QTL mapping in two inbred line populations and the search for genes. Front. Plant Sci. 14:1303651. http://doi: 10.3389/fpls.2023.1303651

Due to global climate change resulting in extreme temperature fluctuations, it becomes increasingly necessary to explore the natural genetic variation for chilling tolerance at the seedling stage in rice. Discovering new sources of seedling cold tolerance will facilitate the development of new climate resilient, cold tolerant rice varieties. Often rice seedlings struggle to survive when the seedlings experience cold temperatures because they lack chilling tolerance which limits how early rice can be planted in many rice growing regions of the world including the USA. An earlier study ascertained Krasnodarskij 3352 (GSOR311787), from the Krasnodar region of Western Russia, and WIR 911 (GSOR311685), from the Primorsky Krai region of Eastern Russia, were cold tolerant and classified as *temperate japonica*. This same study identified Carolino 164 (GSOR311654) from Chad, as cold susceptible and classified as *aus*. To discover genes associated with seedling stage cold tolerance, progeny from the crosses Krasnodarskij 3352 x Carolino 164 (see photo of parents), and WIR 911 x Carolino 164, were genotyped and evaluated for seedling stage cold tolerance using two different methods. Based on differences in the DNA and cold tolerance, 16 chromosome regions associated with seedling stage cold tolerance were discovered and these regions contained 25 potential genes for cold tolerance. Future studies will focus on determining which of these genes would be most effective for improving rice seedling cold tolerance and transferring the selected gene(s) into rice varieties adapted to the U.S. growing environment. Subsequently, these new varieties should be more resilient to climate change because they would withstand cold more effectively during their early growth stages thus, farmers could plant rice earlier in the growing season, resulting in superior grain quality because the rice would mature before the intense heat of late summer. Also, it offers the option of extending the growing season for a secondary (ratoon) harvest in the U.S. Mid-South due to planting earlier.



Phenotype of the cold sensitive rice variety, Carolino 164 from Chad with red stems (left) and the cold tolerant variety, Krasnodarskij 3352 from the Krasnodar region of Western Russia with green stems (right). (A) Two-week-old hydroponically grown rice seedlings. (B) Phenotype after one week of 10°C exposure and one week of warm temperature recovery growth.

- **Technology Transfer**

  ✓ **<u>Interactions with the Research Community</u>**

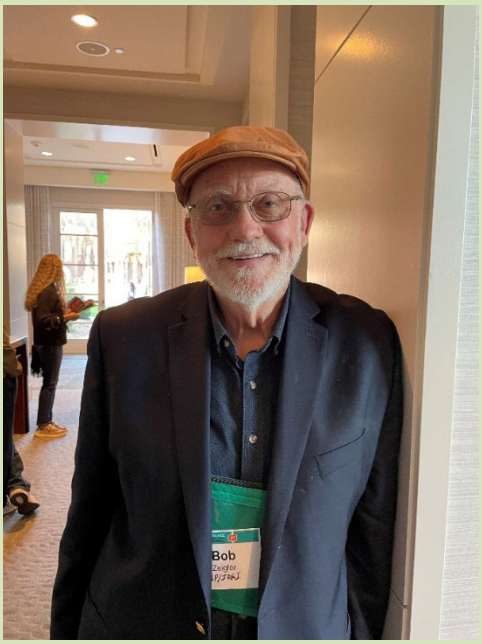
  On December 6, 2023, Dr. Shannon Pinson provided to Dr. David Robbins, MD, in the Medical School at Kansas University, and to Dr. Bart Dean, an anthropologist with the Center for Global and International Studies at Kansas University, information on how the glycemic index of a cooked rice sample can be reduced through post-harvest cooking and processing (e.g., parboiling) as well as genes, especially those that affect the starch structure and protein content of the rice endosperm.

- **Stakeholder Interactions**

  Dr. Georgia Eizenga provided three professional contacts and publication links describing recent genotyping of the wild *Oryza* species to Dr. Gregory Stull, Botanist & National Taxonomist with USDA-APHIS-PPQ on November 13, 2023. This information will be used to potentially develop molecular tools, such as barcoding, for identifying various *Oryza* species.

  December 6-8, 2023, Dr. Yulin Jia attended the rice outlook conference in Indian Wells, California. Rice farmers, millers, merchants, agri-businesses, government agencies, end-users, suppliers, academics, and other industry affiliates gathered to network, participated in

educational programming, quality symposium and plan for the coming crop year. Dr. Jia received feedback of what rice industry needs and discussed research activities of DB NRRC and staff planning to address needs of rice stakeholders during the conference.

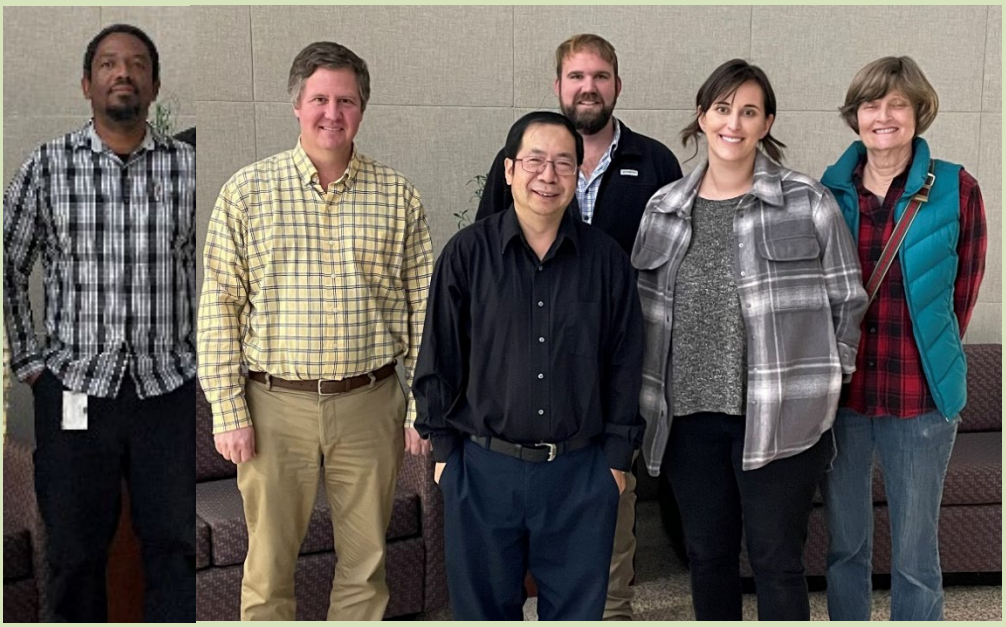


Retired former IRRI Director General Dr. Bob Zeigler at rice outlook conference.

On December 28, 2023, Drs. Yulin Jia and Shannon Pinson recommended a few premium rice varieties/germplasms for a rice grower in New Jersey to be grown using transplanting instead of direct seeding. If successful, this could offer the possibility of small scale rice production in the Northeast and with rice of superior quality.

USDA FAS Administrator Daniel Whitley addressed a foreign delegation at rice quality symposium.

On December 13, 2023, Drs. Yulin Jia, Trevis Huggins and Jeremy Edwards visited with Ms. Hallie Shoffner of Shoffner Farms located in Newport, Arkansas where they produce seed of ten DB NRRC varieties for farmers. She was accompanied by her mother, Wendy Shoffner, who is the President of the board of directors and Dustin Pickelmann, farm manager. The goal of the meeting was to discuss a partnership to develop a dwarf Carolina Gold rice variant for production. We discussed the aspects of the partnership which will be developed through a SEA CRADA. The selected lines will be evaluated at DB NRRC and at Shoffner Farms. The outcome of this project will be a variety that is shorter than Carolina Gold but with the same grain type, grain quality and sensory characteristics, and better yields. The variety will also possess disease resistance. Ms. Shoffner was also given a tour of the DB NRRC Genomic laboratory by Dr. Jermey Edwards and Ms. Melissa Jia. They shared information about our genotyping process and system using markers developed at DB NRRC.



- **Education and Outreach**

On December 15, 2023, Drs. Trevis Huggins and Jai Rohila provided 100 grams of two rice varieties to Nandini Rastogi, a high school student working on her science project with mentor Dr. Yajamana Ramu at Yard Sciences, NJ. She aims to determine the effects of abiotic stresses on rice at the molecular levels.

The Breeding and Genetics program provided 1 pound of Dellmati and Koshihikari to Mr. Brian Chadwell, a farmer in Kentucky. The varieties will be grown in the field in a non-flooded system.

The Stuttgart Employee Engagement, Diversity, Inclusion and Outreach committee hosted a Holiday team building event at Stuttgart National Aquaculture Research Center (SNARC) and conducted a food and treat bag drive for our local food bank. Over 40 people from both locations attended the event. DBNRRC employees Jackie Hughes, Dr. Trevis Huggins, and Melissa Jia helped plan the party and set up boxes for the food and treat bag drive at the

DBNRRC location. SNARC employees Heather Farmer, Raeann Braithwaite, Teresa Lazenby and Cindy Ledbetter helped plan the party, set up boxes at SNARC and decorated and ordered food for the party. DBNRRC employees Jessica Closson, Quynh Grunden, Jackie Hughes, Melissa Jia, and Tiffany Sookaserm helped prepare the treat bags and pack the food donated at DBNRRC for the food bank. The two locations donated more than 97 lbs. of food and more than 33 treat bags. DBNRRC employees, Dr. Jai Rohila and Tiffany Sookaserm helped deliver the items to the food bank along with Heather Farmer and Raeann Braithwaite from SNARC.

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/