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

MARCH 2024

MONTHLY RESEARCH HIGHLIGHTS

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- **Recent Scientific Publications**

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

Wang, D.R., Jamshidi, S., Han, R., **Edwards, J.D., McClung, A.M**., McCouch, S.R., 2024. Positive effects of public breeding on US rice yields under future climate scenarios. **Proceedings of the National Academy of Sciences** 121, e2309969121. https://doi.org/10.1073/pnas.2309969121

To support the production of food for a growing global population, agricultural systems must be able to adapt to a changing climate. One way to do this is to evaluate how weather has affected yields in the past and then predict how crops will respond in the future under forecasted climate scenarios. This study focuses on the Southern U.S. rice-growing area and uses information on genetic variation, crop productivity, and past weather data to model and predict rice
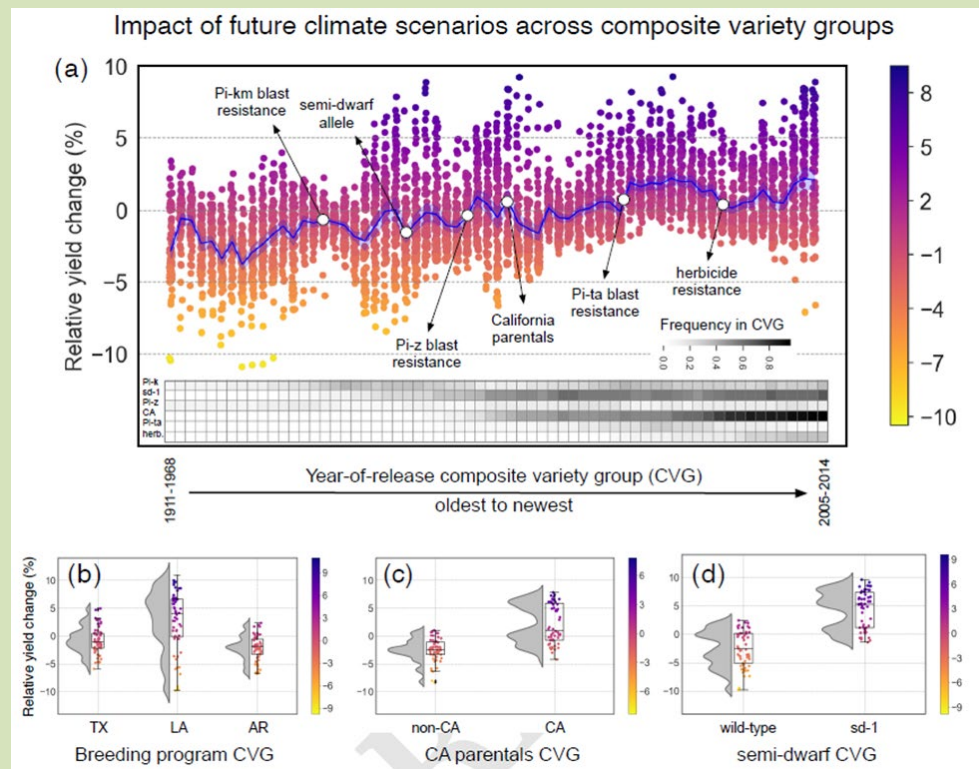
yields. Based on county-level data from 1970 to 2015 that includes yields, acreage by variety, and weather data, along with molecular marker information for the varieties grown in each year for each county, artificial intelligence and machine learning models were developed to predict historic yields. Results indicated that the models developed from this approach were highly correlated with the actual observed historic yields. These models were then used to predict yields under forecasted future climates. One significant discovery is that the more modern rice varieties developed through public breeding programs, which incorporate genetic material from diverse sources, exhibit greater resilience to predicted future climate conditions. This insight is particularly relevant for developing strategies to enhance crop resilience across various agricultural sectors.

- **Technology Transfer**

    ✓ **Interactions with the Research Community**

    On March 14, Dr. Yulin Jia met Dr. Chittaranjan Ray, Director of Nebraska Water Center to discuss several possibilities for collaborative research on water management for rice production.

    ✓ **Rice Germplasm Distributed**

    During the month of March, 6753 rice genetic stocks were shipped to researchers in Belgium and the United States.

- **Stakeholder Interactions**

    Dr. Yulin Jia has been working with OTT to transfer a few disease resistant rice germplasm to Dr. Ken Foster, Kennan Corporation, Davis, CA for rice variety improvement.

- **Education and Outreach**

    On March 15, 2024, Drs. **Yulin Jia** and **Georgia Eizenga**, DBNRRC scientists and Mr. John Mitchell, UA Pine Bluff graduate student, attended the 65th Annual Rural Life Conference hosted by the University of Arkansas at Pine Bluff (UAPB). The conference focuses on providing residents of rural communities in Arkansas with beneficial information that will contribute to the improvement of their communities. The group presented the exhibit entitled "Hidden Treasure! Genetic Discoveries in the USDA Collection of World Rice Varieties" describing rice varieties from around the world that have been the

Dr.Georgia Eizenga, Mr. John Michell and Dr. Yulin Jia at the DBNRRC exhibit.

source of useful traits (genes) for U.S. rice improvement. Videos describing the activities of the USDA-ARS National Plant Germplasm system were displayed as part of the exhibit. Also, Mr. Mitchell presented a poster on his master's research entitled "Boosting Drought Stress Tolerance in US Rice through Cutting-Edge Genomic Approach" which is a collaboration between Dr. Ponniah (UAPB) and DBNRRC scientists, Drs. Jai Rohila, Jeremy Edwards and Trevis Huggins. SEA outreach specialist, Ms. Daphney Cole-Smith, provided information about ARS and positions in ARS as part of the USDA-1890 liaison exhibit.

The DBNRRC welcomed 11 members from the Leadership of Arkansas County group in Stuttgart on March 26, 2024. The group engaged in various activities with DB staff including rice dehulling and milling with Ms. LaDuska Sells, learning about the importance and diversity of rice germplasm collections through panicle architecture, seed types, seed media germination and visited the cold room with Adam Rice and Jonathan Moser, hyperspectral phenotyping of rice plants with Dr. Trevis Huggins and John Mitchell, and DNA extraction with Aaron Jackson and Melissa Jia. They also participated in collecting evidence of rice disease with Dr. Yulin Jia, Aron Osakina, Rodrigo Pedrozo, and Yixiao Huang. They explored phenotypic and genotypic diversity of rice with Dr. Georgia Eizenga, Mrs. Quynh Grunden and Jessica Closson, and grain quality, market classes and starch digestion with Dr. Shannon Pinson. The group concluded their visit with rice tasting (Jackie Hughes and Heather Box) and discussion in the auditorium where they shared feedback on the just completed activities, and their favorite rice variety.

DNA extraction with Aaron Jackson and Melissa Jia

Hands on rice dehulling and milling with LaDuska Sells.

Hyperspectral phenotyping of rice plants with John Mitchell, UA PB graduate student.

Collecting evidence of rice disease with Aron Osakina and Rodrigo Pedrozo.

Jonathan Moser explaining the importance and diversity of rice germplasm collections through panicle architecture.

Leadership of Arkansas County and DBNRRC staff

On March 29, 2024, Melissa Jia judged **The Arkansas State Science Fair** at the University of Central Arkansas (UCA). This fair host's high school students who placed in the top 3 in their category at one of the 6 regional fairs in the State of Arkansas in more than 12 different categories. Ms. Jia judged the 18 students in the plant science category with two other judges from UCA. The judges picked first, second, third place winners, and students whose projects deserved honorable mention.

- **New Research Grants**

Arkansas Rice Research and Promotion Board (ARRPB): Developing Blast-Resistant, Water-Smart Rice Varieties Through Genomic Prediction and Marker-Assisted Selection; with Xueyan Sha (PI), **Jeremy Edwards**, Christian De Guzman, and **Yulin Jia**; $78,000, year 1 of 3. The goal of the project is to enhance Arkansas's rice cultivation by developing varieties resistant to blast disease, aligning with sustainable and water-efficient farming practices. This project represents a collaboration between the University of Arkansas (UA) rice breeding program and Dale Bumpers National Research Center (DB NRRC), integrating advanced genomic technologies with traditional breeding methods. The main objectives of this research are to (1) create new rice varieties with enhanced resistance to blast disease, suitable for water-efficient farming methods, (2) Integrate advanced molecular breeding and genomic selection techniques from DB NRRC into UA's rice breeding program, enhancing the efficiency and effectiveness of variety development, and (3) to develop rice varieties that are not only profitable for farmers but also contribute to environmental conservation efforts in Arkansas.

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/