



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



**MARCH 2023**

**MONTHLY RESEARCH HIGHLIGHTS**

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- **Recent Scientific Publications**

*This addresses USDA-ARS Research Goal: Well characterized core collections for trait discovery and increasing genetic diversity in crop plants.*

Ndjiondjop, M.N., Gouda, A.C., **Eizenga, G.C.**, Warburton, M.L., Kpeki, S.B., Wambugu, P.W., Gnikoua, K., Tia, D.D., Bachabi, F. 2023. Genetic variation and population structure of *Oryza sativa* accessions in the AfricaRice collection and development of the AfricaRice *O. sativa* core collection. *Crop Science* 63:724–739. <https://doi.org/10.1002/csc2.20898>

There are 14,480 cultivated rice (*Oryza sativa*) accessions conserved in the AfricaRice genebank located in the Ivory Coast. To explore the range of genetic variation and relationships between these accessions for rice improvement, a subset of 5,738 accessions, representing nearly 40% of the collection, was genotyped with 25,904 molecular markers. The genotyped accessions were from 73 countries and were traditionally grown in six different agro-ecologies including irrigated lowland, rainfed lowland, upland mangrove swamp, floating and hydromorphic ecologies. The genotyping showed 21.0% of the accessions were moderately distant and 78.2% were highly distant from each other. The accessions clustered into the two *O. sativa* subspecies, *Japonica* (787 accessions) and *Indica*, which further divided into *Indica* landraces (1,879 accessions), and *Indica* improved cultivars (3,027 accessions), and a fourth small group of accessions with mixed ancestry. Based on genetic diversity, the “AfricaRice *O. sativa* Core Collection” (AROSCC) was selected to represent 10% of the genotyped accessions utilizing the appropriate statistical tools. The AROSCC includes 600 *O. sativa* accessions and captures more than 95% of the genotypic variation in the entire collection. The AROSCC is an important resource to support pre-breeding and rice improvement programs around the world. It can be screened for important traits of interest, and the likelihood of finding these useful traits in one or more of the 600 accessions are nearly as high as if all 5,783 accessions were screened, thus saving considerable time and resources.



*Selected panicles of ten rice accessions, illustrating the diversity observed among the *Oryza sativa* accessions in the AfricaRice*

*This addresses USDA-ARS Research Goal: Enhanced knowledge of food (seed, fruit, tubers etc.) qualities and nutritional value at genetic, molecular, and physiological levels.*

**Shannon Pinson**, Jo Heuschele, Chris Isbell, Jifeng Li, Matther Vandal, and Aaron Smith. 2023. Foliar-applied sulfate and potassium does not reduce rice grain arsenic concentrations nor straighthead severity. *Crop Sci.* <https://doi.org/10.1002/csc2.20945>

Arsenic in rice poses a concern for some consumers and baby food producers, though US rice has been shown safe for general consumption. Arsenic is also toxic to plants, and is known to reduce rice yields by causing rice straighthead disorder. The amount of arsenic accumulated in rice plants and grains depends on both plant genetics and the production environment. By comparing eight rice varieties selected for having low grain arsenic concentrations with nine varieties having high grain arsenic, we determined that one method used by rice plants to minimize arsenic in grains is to accumulate it instead in flag leaves. Retaining arsenic in leaves during the grain filling period effectively prevents it from being transported to grains. Because sequestration of arsenic in leaf cells involves several sulfur containing compounds, we investigated if increasing plant sulfur through foliar fertilization could further reduce grain arsenic concentrations, or if it could decrease the severity of arsenic-induced straighthead disorder. We observed that plants sprayed with sulfur fertilizer produced grains with higher sulfur concentrations than did water-sprayed plants, showing that the sprayed sulfur did enter these plants in a plant-useable form. However, we did not see a reduction in grain concentrations of either total or inorganic arsenic, nor did we see a reduction in straighthead severity. Foliar application of sulfur fertilizer did not prove to be a useful method for limiting the accumulation of arsenic in US produced rice.



*Photo by Eric Grunden shows loss of yield from arsenic-induced straighthead disorder.*

- **Technology Transfer**

- ✓ **Interactions with the Research Community**

On March 16, 2023, Dr. Jeremy Edwards, Ms. Melissa Jia, and Mr. Aaron Jackson led a tour of the DB NRRC facilities for Dr. Peter McCornick, with the Water for Food Institute, University of Nebraska-Lincoln, accompanied by his wife Miriam McCornick, Dr. Christopher Henry (UA RREC), and leadership from the Winthrop Rockefeller Institute located at Petite Jean.

Winthrop Rockefeller Institute  
Attendees included: Janet Harris, Executive Director/CEO; Shawn Cathey, Chief Financial Officer; Carder Hawkins, Chief Strategy Officer; James Hopper, Director of Development; Austin DuVall, Communications and Content Manager; and Kimberly Bolin, Program Officer. Following the DB NRRC tour, the group, along with Dr. Yulin Jia, Dr. Jeremy Edwards, Dr. Jai Rohila, Ms. Melissa Jia, Mr. Aaron Jackson, and UA RREC faculty, scientists, and staff, met for a discussion on water issues related to rice production.



On March 20, 2023, Dr. Shannon Pinson provided information to Dr. Debasis Golui at North Dakota State University, Fargo, ND, regarding propagation of photoperiod-sensitive rice under greenhouse and hydroponic grown conditions.

On March 22, 2023, Dr. Shannon Pinson along with Dr. Michele Reba, ARS Delta Water Management Research, Jonesboro, AR provided information to Ms Kathryn Markham, a Public Affairs Specialist with the ARS Office of Communications, External Communications Branch, for an article in the USDA-ARS [\*Under the Microscope\*](#) online article series. Under the Microscope presents articles that review ARS research addressing complex issues with US consumer's interest. Drs. Pinson and Reba provided Ms. Markham information on how genes and production practices can reduce accumulation of heavy metal elements in rice grains.

Dr. Jai Rohila attended the 2023 annual meeting of the southern section of the American Society of Plant Biologists that was held from March 25-27, 2023, at Fayetteville, AR. Dr. Rohila presented an invited oral talk entitled " Towards Understanding Heat Stress Tolerance in Rice Using a Chromosomal Segment Substitution Library" with almost 80

researchers in attendance, and interacted with peer scientists, postdocs, and graduate/undergraduate students.



On March 31, 2023, Dr. Yulin Jia as a mentor attended 2022-2023 graduation and orientation for Career Development Program (CDP) of Federal Asian Pacific American Council (FAPAC <https://fapac.org/>). His mentee Dr. Jennifer Le, a scientist from U.S. Department of the Interior/Bureau of Ocean Energy Management (BOEM) received the best project award in 2022 class. The CDP is a six-month mentoring opportunity open to all federal, military, and District of Columbia employees with permanent career status at all levels. FAPAC is a nationally recognized organization that serves the interests and representation of Asian Pacific Americans in the Federal, State, County, City and District of Columbia governments. FAPAC also promotes partnerships with the public and private sectors in the community.



## ✓ Rice Germplasm Distributed

During the month of March, 15 rice genetic stocks were shipped to researchers in Canada, Spain, United Kingdom, and the United States.

The Breeding and Genetics program, under the direction of Dr. Anna McClung, consulted and provided rice cultivars for several stakeholders this month: on March 1<sup>st</sup>, to Bernard Singleton in Charlotte, NC who runs Nebedaye Farms as a means to educate the community on the basis of African food culture as it was adopted in the US; March 6<sup>th</sup>, short grain germplasm from the world collection for growers in PA and AR; on March 16<sup>th</sup>, a dozen varieties for testing for adaptation under upland conditions at the Stone Barns Center for Food and Agriculture in Tarrytown, NY.



*Bernard Singleton stands in a sea of Carolina gold rice at Nebedaye Farms. (Photo by Grant Baldwin, as published in Queen City Nerve)*

On March 16, 2023, Drs. Anna McClung and Yulin Jia consulted and provided a total of 18 rice cultivars/germplasm for testing in Georgia and Kentucky under upland conditions.

### • **Stakeholder Interactions**

On March 2, 2023, Dr. Anna McClung collaborated with Dr. Teresa De Leon to coordinate a culinary analysis with several chefs across the country of three arborio varieties recently developed at the California Rice Research Foundation in Biggs, CA.

On March 14, 2023, Dr. Anna McClung was interviewed by a journalist from Ambrook Research on the effects of drought in some parts of the country on rice production. This is an on-line magazine that addresses issues facing modern agriculture.

On March 14, 2023, Dr. Yulin Jia was invited to give a talk to the Stuttgart Rotary Club, an organization consisting of business professionals and community leaders in Stuttgart, Arkansas promoting integrity, goodwill, culture diversity and education. Dr. Jia presented

the history, mission, and recent accomplishments of Dale Bumpers National Rice Research Center (DB NRRC) to about 50 members of the club.



- **Education and Outreach**

On March 14, 2023, the Stuttgart Location Employee Engagement and Diversity Committee, which includes the Harry K. Dupree Stuttgart National Aquaculture Research Center (SNARC) and DBNRRC staff members hosted a Pi Day celebration in the DBNRRC Auditorium. DBNRRC employees Dr. Trevis Huggins, Ms. Jackie Hughes, Ms. Melissa Jia, Ms. Heather Box, Ms. Brenda Lawrence, and Ms. Tiffany Sookaserm assisted in preparation for the event and numerous employees of both centers provided a variety of pies in celebration of  $\pi$ .



Dr. Nisha Patwa and Ms. Melissa Jia judged at the 2023 Arkansas State Science Fair on March 31<sup>st</sup> at the University of Central Arkansas in Conway Arkansas. Dr. Patwa judged 8 posters in the Plant Science Category including two that will advance to the International Science and Engineering Fair (ISEF) in Dallas Texas on May 14<sup>th</sup>-19<sup>th</sup>. Ms. Jia judged the ISEF finalist category which included 13 posters from the top 2-5 winners from Regional Science Fairs in Arkansas that are already selected to attend ISEF, and then judged the top two posters from all 13 categories at the fair to select an additional 6 posters to attend ISEF and the top 4 winners of the state science fair.



Left to right: Ms. Melissa Jia and Dr. Nisha Patwa



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/>