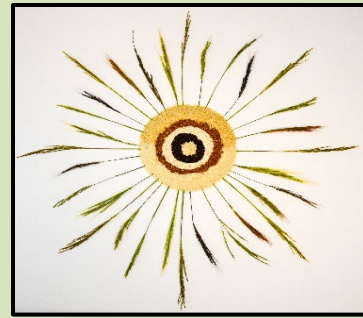




**Dale Bumpers National Rice Research Center
USDA-ARS
Stuttgart, Arkansas**



JULY 2022

MONTHLY RESEARCH HIGHLIGHTS

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- **Recent Scientific Publications**

This addresses USDA-ARS Research Goal: New uses for current crops.

Beaulieu, J.C., Grimm, C.C., Obando-Ulloa, J.M. and **McClung, A.M.** 2022. Volatiles recovered in novel, diverse and uncharacterized rice varieties. *Cereal Chemistry*.

<https://doi.org/10.1002/cche.10579>

The nutritional beverage market is a rapidly growing industry and some of the products use milled or brown rice as the core ingredient. However, sprouted grains are known to possess a wide variety of compounds that are associated with health beneficial properties, suggesting that sprouted rice may serve as a nutritionally enhanced ingredient for plant-based beverages. In a collaborative study between ARS researchers in Stuttgart, Arkansas and the Southern Regional Research Center in New Orleans, Louisiana, five diverse rice varieties were evaluated for 19 volatile compounds that may affect flavor to identify a rice variety that provides the best combination of sensory traits and nutritional compounds. A purple bran aromatic variety was identified as having the highest levels of favorable volatiles as well as being high in natural anti-oxidant compounds. This research demonstrates expanded opportunities for using rice as a flavorful and nutritional ingredient for new food and beverage products.



GCMS instrument used to detect rice volatiles

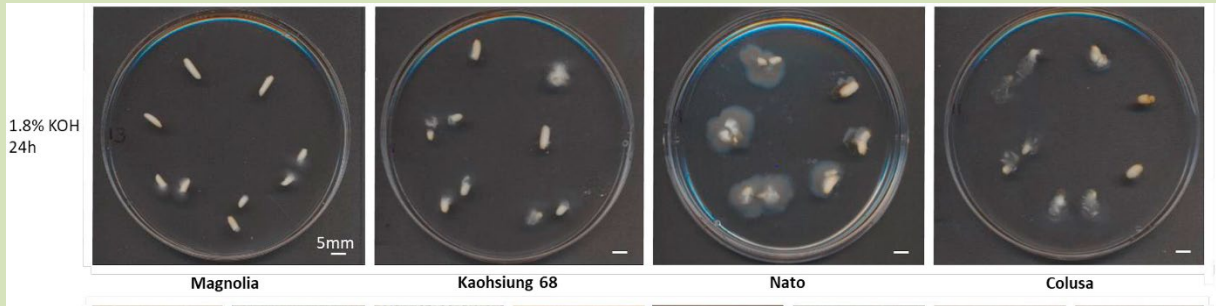
This addresses USDA-ARS Research Goal: New phenotyping approaches for quantitative trait analysis.

Armstrong, P.R., Maghirang, E.B., **Chen, M.H.**, **McClung, A.M.**, Yaptenco, K.F., Brabec, D. and Wu, T., Predicting Single Kernel and Bulk Milled Rice Alkali Spreading Value and Gelatinization Temperature Class Using NIR Spectroscopy. *Cereal Chemistry*. 2022

<https://doi.org/10.1002/cche.10587>

Rice cooking and processing quality is largely determined by the amount of starch and the temperature of its gelatinization when cooked. Most rice varieties developed in the USA have uniform cooking quality but imported rice or hybrid rice may have variable cooking properties. A SKNIR instrument was developed by ARS scientists at Manhattan, Kansas that can rapidly scan individual raw kernels of milled rice using near-infrared wavelengths. In a previous collaborative

study with researchers at DBNRRC, this method was shown to be able to predict the chalkiness of a single grain and, in the current study, shown that it can also predict the gelatinization temperature of rice when it is cooked. These results demonstrate that such instrumentation can be used to scan raw rice and determine its ultimate cooking properties. This technology may be used to rapidly segregate mixed samples of rice without the use of harsh chemical assays as a means to assure uniformity in cooking and processing quality which is important to the processing industry that produces parboiled, instantized, and canned rice.

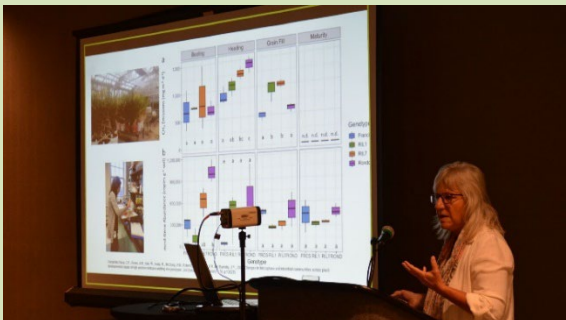


From Griebel, et al. 2019. Alkali spreading value test using potassium hydroxide as a predictor of gelatinization temperature.

- **Technology Transfer**

- ✓ **Interactions with the Research Community**

Dr. Anna McClung was an invited speaker at the 5th Global Research Alliance Paddy Rice Research America Sub-group meeting that was hosted by the ARS Delta Water Management Research Unit, in Jonesboro, AR on July 12-13. The event was attended in person and virtually by 50 participants from USA, Europe, India, and numerous countries in Central and South America. The purpose of the meeting was to discuss the latest research findings and the opportunities to reduce greenhouse gas emissions associated with sustainable rice production. Dr. McClung presented a talk “The Role of Rice Genotypes in Mitigation of Methane Emissions” which highlighted research findings from collaborative work conducted at DBNRRC, much of which was led by Dr. Jinyoung Barnaby, former Plant Physiologist with the unit. After the formal presentations, breakout groups discussed various approaches for future research. Dr. McClung led the discussion regarding biological mitigation efforts.



On July 15, Dr. Yulin Jia provided disease evaluation for rice farmers in southeast of New York. This was performed based on disease pictures in consultation with Dr. Yeshi Wamishe, an extension plant pathologist of University of Arkansas Rice Research and Extension Center.

On July 27, Dr. Shannon Pinson provided information to Jane Houlihan, Director of Research for the non-profit Healthy Babies Bright Futures (hbbf.org), regarding the accumulation of mineral elements in rice grains.

On July 27, Drs. Anna McClung and Shannon Pinson provided information to Pamela Starke-Reed, USDA ARS Deputy Administrator for Nutrition, Food Safety and Product Quality/New Uses, regarding factors that can reduce accumulation of toxic elements in rice grains.

Dr. Anna McClung, Research Geneticist with the Dale Bumpers National Rice Research Center in Stuttgart, Arkansas has been selected as a Fellow of the Crop Science Society of America. Dr. McClung received her B.S. and M.S. degrees from Texas A&M University and her Ph.D. from North Dakota State University. She is recognized as an authority on rice genetic resources and breeding for conventional and specialty rice markets. In team research, she led the development of genetic markers for grain quality and disease resistance traits. She has used novel germplasm and genes to develop new cultivars with superior parboiling and canning quality, enhanced nutritional quality, and broad-spectrum resistance to rice blast disease. She has authored 148 peer-reviewed publications and developed 24 cultivars that have been commercialized in the USA, Brazil, Italy, and Spain. Dr. McClung served as a Research Leader for 25 years, providing guidance on rice related issues to federal, state, industry representatives as well as researchers and growers. She will be presented with the award at the annual meeting in November 2022.



✓ **Rice Germplasm Distributed**

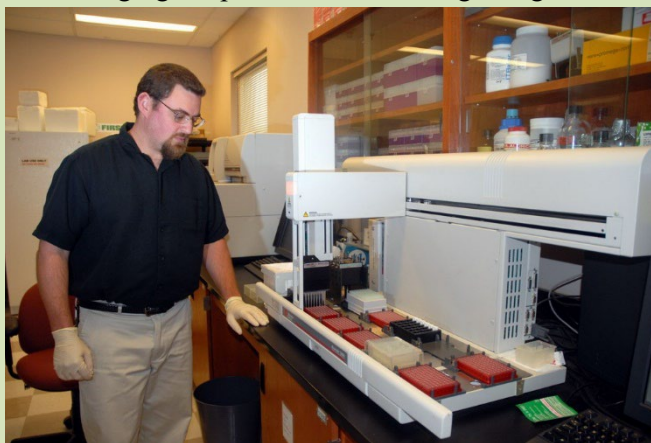
During the month of July, 22,994 rice genetic stocks were shipped to researchers in Italy, India, and the United States.

• **Education and Outreach**

On July 27, Dr. Shannon Pinson was job-shadowed by a young man who will be starting his High School career this fall at Stuttgart High School, interested in a future career in Genetics. Dr. Pinson demonstrated the daily use math, chemistry, engineering, and economics as well as biology in her career as a crop plant geneticist.



Aaron Jackson: With previous jobs ranging from managing a reptile store to working in a garden center for five years it's apparent that Aaron has always been fascinated by plants and animals. His love of nature and science was made evident by his bachelor's degree from Colorado State University - a triple major in biology, zoology, and botany. During his undergraduate and graduate work at CSU he served as a teaching assistant and lab instructor. Aaron enjoyed teaching and sharing his love of biology with others. He received a master's degree in Botany from CSU for genetically characterizing a cytokinin over-accumulating reversion



mutant in *Arabidopsis*. Aaron spent the next two years working as a research associate at CSU examining the genetics behind various biological control organisms and noxious weed species. During this time, he worked in conjunction with two labs and supervised a crew of seven grad students and laboratory technicians for field, greenhouse, and laboratory studies. In 2003 Aaron was hired by the USDA as a molecular genetics laboratory technician. At the time, the job opening for Aaron's supervisor was vacant, so he spent the first six months working on a rotational basis for all the labs in the building. This was a wonderful opportunity to experience and take part in what all the labs were working on and meet new people. Eventually Aaron's supervisor, Steven Brooks, was hired and Aaron worked in the molecular genetics lab for the next four years. During that time Aaron worked on numerous field, greenhouse and laboratory projects many of which examined the genetics and physiology between rice pathogens and rice. Some notable accomplishments were taking part in creating a method to isolate toxin produced by the sheath blight pathogen, screening plants for resistance to the toxin, and identifying a gene region in rice that provides high resistance to the toxin. Aaron also identified a mutation of the *Rc* gene in an elite cultivar of white rice that allows for the conversion of white rice back to red rice. This mutation allows for the heart healthy benefits of red rice to be expressed in a cultivated rice variety that already has desirable yield and cooking qualities. Aaron's work led to the patent application of Red Wells by the University of Arkansas and USDA scientists.

In 2008 Aaron began his work in the USDA Genomics Core facility as a category 3 support scientist for all the PI's at DBNRRRC and is currently working under Dr. Jeremy Edwards. Over the years Aaron has taken part in a large number of projects providing genomic data, analytical support and data interpretation. Aaron has been instrumental in maintaining the purity of breeding lines and identifying hundreds of genes/QTL associated with disease resistance, arsenic uptake, abiotic stress, chalkiness, yield, and grain quality traits. His work in the genomics core facility has resulted in 25 co-authored publications and contributed to many additional publications, posters and presentations for our center. In his free time Aaron served intermittently as a substitute teacher and eventually as an adjunct professor for one year at the local community college that was experiencing staffing shortages. He taught two biology night courses with accompanying labs and enjoyed the opportunity to teach again and share the importance of science and the role of the USDA with local students. Aaron enjoys participating in local USDA outreach and education events and believes in the importance of the USDA's mission in securing our nation's food supply.

Melissa Jia, currently a Plant Geneticist in the Genomics lab for Dr. Jeremy Edwards, joined Dale Bumpers National Rice Research Center in 2004.

Melissa grew up in Knoxville TN in the beautiful foothills of the Smokey Mountains. From an early age her father, an electrical engineer, instilled a love of science in Melissa. He was the first person in his family to obtain a BS degree, which he got from Vanderbilt University. He went on to work for NASA on the Redstone Rocket Project and his name is at the Smithsonian Museum in Washington DC. It was a true joy for Melissa when she first got to visit the museum on a high school band trip and see her dad's name represented for that critical work for the



US space program. Her dad went on to work for many years for the Tennessee Valley Authority building plants to provide affordable power to Tennessee residents. Melissa discovered a love of biology in high school, and really enjoyed her senior AP Biology class. Upon graduation she enrolled at Furman University where her advisor Dr. Joseph Pollard, a Botanist, taught her a love of plants. He along with Dr. Laura Thompson instilled a love of plant molecular biology in her heart. She moved to Purdue to pursue her MS under Dr. Sally Mackenzie in the agronomy department working on Cytoplasmic Male Sterility in Beans. There she learned the pleasure of working on agriculturally important species. Upon obtaining her MS she took a brief period off to have her daughter before returning to work at DuPont under Dr. Zhixiong Xue. There she was on the forefront of developing DNA microarray technology using yeast as a model system. Her work helped elucidate the yeast pathways important for response to the herbicide sulfometuron methyl and has been cited 148 times. After two years at DuPont, she moved to Stuttgart Arkansas where she took a little time off to have her second daughter. She was impressed with the beauty of rice fields which were new to her.

In 2004, she joined the Genomics team at Dale Bumper's National Rice Research Center as a Plant Geneticist. She oversaw all the molecular marker work for the scientists at DBNRRC. She has been involved in numerous QTL and association mapping projects and is responsible for overseeing the Marker Assisted Selection work on the Uniform Rice Regional Nursery and reporting the results to the Research Leader to report to the breeding community. This work helps breeders select rice with appropriate quality and disease resistance packages for their breeding needs. She also supervises the genotyping work on the rice portion of the US small grains collection. This work will further characterize the collection so stakeholders can better utilize those valuable resources. She is a coauthor on 49 peer reviewed journal publications, 3 book chapters, and her work has contributed to numerous other papers, abstracts, and proceedings. Melissa was proud to be a corecipient of the Distinguished Rice Research team award by the Rice Technical Working Group in 2020. Melissa feels deeply fulfilled to be able to help contribute to US rice agriculture. In her free time, Melissa enjoys her cat (the only cat ever known to eat salad) and her dog who now also eats salad. Melissa also loves to read and go for long walks near the rice fields with her dog and sometimes both the dog and cat.

Brenda Lawrence, currently a Biological Science Technician in the Genomics lab for Dr. Jeremy Edwards, joined Dale Bumpers National Rice Research Center in 2002.

Brenda grew up in Clarendon, AR. She loved living in rural Arkansas surrounded by woods with trees to climb and agricultural fields to play in. She loved to watch the farmers planting beans and rice. Brenda always had to know why things work so she asked the farmers to teach her about planting and harvesting which they were happy to do. After high school graduation, Brenda went to work in a factory making flannel shirts where she was rapidly promoted to a supervisory position.



In 1991 she married and left the factory to become a commercial fisherman. For the next three years she lived on a houseboat and harvested mussels and other aquatic life. She built and ran her own nets and trot lines. She loved to catch spoonbills and sturgeon for caviar production.

After three years of fishing, she moved back to Clarendon to raise a family. She started working at Delta Plastics and learned how to make polypipe and tubing. She was later transferred to work on the film lines. In 1999 she moved to Stuttgart Arkansas and started working at Producer's Rice Mill. She loved working in rice production.

In 2001 she met Marc Redus, who was a Plant Geneticist at Dale Bumper's National Rice Research Center. Right away Marc saw her potential and in 2002 she came to work in the Genomics Core Facility. From the beginning Brenda's meticulous research skills and thirst for knowledge helped the Core Facility thrive. Brenda quickly became an expert on high throughput robotics, DNA extraction, and setting up PCR reactions. Her work has contributed to numerous peer review publications for many scientists at the center. Brenda has trained numerous technicians, grad students and postdocs to perform high-throughput DNA extraction, PCR, and robotic operations. Currently her two favorite projects are "twins", rice seeds that germinate two or more seedlings and GRIN, the seed rejuvenation, phenotyping and genotyping of the rice portion of the US small grains collection. She loves twins because it has potential to produce rice plants that produce double the seed of a regular plant and GRIN because it involves keeping a large stock of rice seed available to make sure our stakeholders have the genetic diversity needed to keep US rice competitive. She loves working with her two team leaders, Aaron Jackson and Melissa Jia, and her supervisor Jeremy Edwards as they strive to make better rice for the US rice industry.

In her free time, she loves spending time with her 5 grandchildren. She loves to play laser tag with them and spoil them with candy.

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/>