



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



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MONTHLY RESEARCH HIGHLIGHTS

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- **Recent Scientific Publications**

Poulev, A., **Chen, M.-H.**, Cherravuru, S., Raskin, I., and Belanger, F.C. Variation in levels of the flavone triclin in bran from rice genotypes varying in pericarp color. *Journal of Cereal Science* 79, 226-232. 2018.

Tricin is a flavonoid compound that has recently been shown to have numerous health benefits including anticancer activity. It is found in many plant species including rice where it is located in rice hulls, leaves, bran and the germ (embryo). There are only a few reports of triclin levels in rice bran, mainly from brown bran rice varieties. This study evaluated the triclin content in brans of twenty rice varieties of light brown, brown, red, and purple colors. A wide range in triclin levels was observed with varieties with purple bran having higher levels. Various compounds with potential health benefits have been reported in purple bran rice. Tricin along with anthocyanins might be two critical bioactive compounds in purple rice bran that convey health benefits.



This addresses USDA-ARS Research Goal: Identification of new sources of novel phytochemicals important for human and plant health.

Pham, T., Savary, B.J., Teoh, K., **Chen, M.-H.**, McClung, A., Lee, S.-O. 2017. *In vitro* fermentation patterns of rice bran components by human gut microbiota. *Nutrients* 9, 1237. 2018. Doi:10.3390/nu9111237.

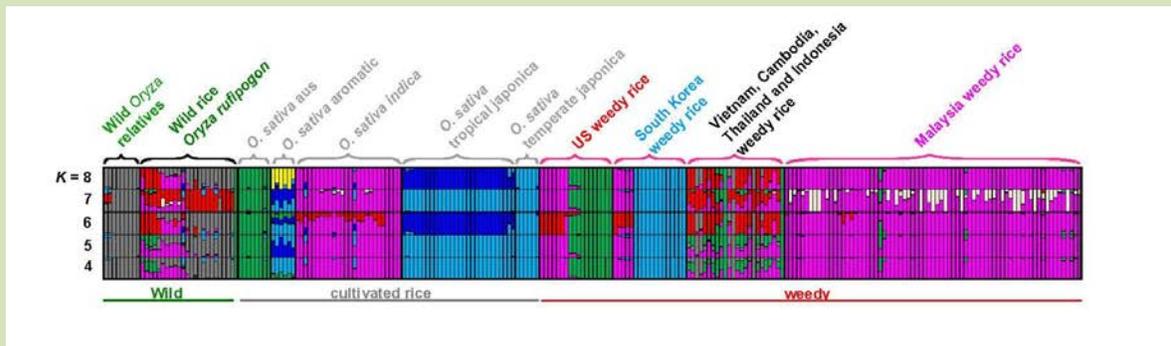
Whole grain rice bran is a rich source of bioactive components that have potential to promote gastrointestinal health. Among these components, feruloylated arabinoxylan oligosaccharides (FAXO), a soluble portion of non-digestible fiber after enzymatic hydrolysis, and red pigmented rice bran polyphenols (RBPP) were investigated for their prebiotic potential and the impact on human gut microbiota. Fresh fecal samples were collected from healthy adults with no signs or symptoms of bowel diseases or other health conditions. The samples received one of five treatments: no substrates (as a control), FOS (fructooligosaccharides) – known to have a positive impact on the gut as a pre-biotic, FAXO, RBPP, and a FAXO + RBPP mixture. After treatment, the samples were incubated at 37°C in an anaerobic chamber for a 24h-period and changes in fermentation compounds and microbiota were measured during this period. Results showed that treatment with FAXO significantly increased the

production of short chain fatty acids, the fermentation products of the colonic bacteria that are beneficial to the gut health, and was comparable to those of FOS. FAXO and RBPP had synergistic effects on increasing the abundance of bacteria that generate butyrate short chain fatty acid, a fatty acid with protective effects of colon cells against cancer. Results from this study suggested that FAXO and RBPP from rice bran can potentially promote colon health through a prebiotic function. This research was funded in part by a USDA-NIFA pilot grant.

This addresses USDA-ARS Research Goal: Identification of new sources of novel phytochemicals important for human and plant health.

Cynthia C. Vigueira, Xinshuai Qi, Beng-Kah Song, Lin-Feng Li, Ana L. Caicedo, **Yulin Jia**, and Kenneth M. Olsen. 2017. Call of the wild rice: *Oryza rufipogon* shapes weedy rice evolution in Southeast Asia. *Evolutionary Applications*. Special issue invited article. DOI:10.1111/eva.12581. Article made Open Access on 27 November, 2017.

A global problem in rice production is a common weed called weedy red rice which decreases yield and quality. This weed is very difficult to control because it is so similar to the cultivated crop and both belong to the same species, *Oryza sativa*. A wild species of rice, *Oryza rufipogon*, found throughout Southeast Asia, is believed to be the progenitor from which *O. sativa* evolved. In this study, genome-wide genetic markers were used to compare weedy rice found in regions outside the range of wild rice (North America, South Korea) with those from populations in Southeast Asia, where the wild rice populations are present. In Southeast Asia where these two populations co-exist, there was evidence of the transfer of genes from the wild rice populations into weedy red rice through inter-crossing that was not found in North America or South Korea. Some of the wild rice genes found in the weedy red rice were associated with invasive weedy traits like The study also found greater genetic diversity in the Southeast Asian weeds than in the North American and South Korean weeds. These findings suggest that in areas where these two species co-exists, the wild rice can serve as source of new genes that make weed control more challenging.



This addresses USDA-ARS Research Goal: Understanding the genetic architecture of complex traits

- **Technology Transfer**

- ✓ **Interactions with the Research Community**

November 2017. Dr. Jinyoung Barnaby of DBNRRC gave several presentations to the Beltsville Agricultural Research Center in MD. She introduced current issues facing the USA rice industry and research activities at DBNRRC including her research on greenhouse gas emissions from rice fields, grain quality, and metabolic responses to reduced soil water availability. Potential collaborative research projects between DBNRRC and the 1) Adaptive Cropping Systems Lab, 2) Sustainable Agricultural Systems Lab, and 3) Environmental Microbial and Food Safety Lab in MD were discussed.

On November 6th, Dr. Anna McClung gave a tour of the DBNRRC and overview of research being conducted at the center to Dr. Bonifacio Mostecado, Vice Dean of Agricultural Sciences Faculty at the Gabriel René Moreno Autonomous University in Santa Cruz, Bolivia.

On November 14-15, Dr. David Gealy hosted three scientists from the National Agriculture and Food Research Organization, Tohoku Agricultural Research Center in Japan who presented seminars and discussed rice and crop rotation issues of common interest in Japan and the southern USA.



On November 27-30, Drs. McClung and Chen visited ARS scientists at the Beltsville Human Nutrition Research Center in MD to discuss collaborative research and presented talks titled “From the Genome to the Field to the Plate – An Overview of Rice Research at the Dale Bumpers National Rice Research Center” and “Enhancing Nutritional Quality of Rice- An Integrated and Multifaceted Approach”, respectively.

On November 29th, Dr. Yulin Jia and his staff, Tracy Bianco, Heather Box, and Dr. Wenqi Li visited the Genomics and Bioinformatics Research Unit, Stoneville, MS and discussed technical details of DNA sequence analysis of rice genomics and host-pathogen interactions with Dr. Brian Scheffler’s lab.



- ✓ **Germplasm Exchanged**

During November, 854 rice accessions from the Genetics Stocks *Oryza* (GSOR) collection were distributed to researchers in the US, Hungary and India.

- **Stakeholder Interactions**

On November 3rd, Dr. Anna McClung gave an invited presentation to the Carolina Gold Rice Foundation in Charleston, SC. She presented an update on ARS collaborative research on *de novo* sequencing of Carolina Gold rice which will serve as a reference genome for USA cultivars. In addition, she talked about progress in utilizing the USDA world rice collection to develop a new specialty variety derived from Carolina Gold. An article regarding the presentation was published in the Charleston newspaper. http://www.postandcourier.com/blog/raskin_around/

On November 16th, Dr. Jeremy Edwards presented an invited webinar on “Gene editing technology and new opportunities for plant breeding”. He presented an overview of new gene editing techniques such as CRISPR/Cas9 and their potential impact on breeding and opportunities for scientific discovery. The webinar was hosted by Dr. Bobby Coats, with the University of Arkansas, Cooperative Extension Service. There were over 250 participants in the webinar which was streamed through several social media outlets. A video of the webinar can be seen at <https://youtu.be/RU4FaSkjeXk>.

- **Education and Outreach**

On November 1st about 45 pre-AP/AP Cabot High School science students and their teachers visited the Dale Bumpers National Rice Research Center. The group interacted with several of the scientists at the center. Dr. Shannon Pinson explained the chemistry and biology of arsenic uptake in rice; Dr. Georgia Eizenga and Ms. Quynh Grunden talked about the USDA world rice collection and variety improvement and demonstrated making genetic crossing; and Ms. Melissa Jia, Mr. Aaron Jackson and Dr. Trevis Huggins explained the use of molecular markers in rice improvement, and with assistance from Ms. Brenda Lawrence, provided a hands-on opportunity for the students to isolate DNA from bananas. The tour was highlighted in the Nov. 3rd edition of the local newspaper, The Stuttgart Daily Leader.



On November 4th, Drs. Ming Chen and Georgia Eizenga, and Ms. Lorie Bernhardt hosted 55 people at DBNRRC that participated in the “Rice Country Ramble” sponsored by “Preserve Arkansas”. This is a nonprofit organization whose mission is to build stronger communities by reconnecting Arkansans to their heritage and empowering people to save historic places. The guests were presented with a summary of the history of rice initially grown in South Carolina and later moving to Arkansas. Dr. Eizenga explained the utilization of the USDA world



rice collection in variety development and had examples of rice plants and seed from varieties from around the world. Dr. Chen described cooking quality of conventional and specialty rice varieties and their potential health benefits. The visitors participated in a rice tasting demonstration including Carolina Gold, the first rice grown in USA and Scarlett, a new red bran rice developed by DBNRRC, among others varieties.

On November 10th, Dr. Georgia Eizenga participated in the “Career Expo” for DeWitt High School seniors sponsored by Phillips Community College-Univ. Arkansas-DeWitt. She gave a short overview of employment opportunities in USDA-ARS, salaries and the education needed for various positions. Rice varieties from around the world, various rice products, and a hand-out and slide show of research activities at the Dale Bumpers National Rice Research Center were displayed.



On November 16th, Dr. David Gealy provided answers to questions and some published information to Walter G. O’Connell High School in Copiague, New York concerning the role of allelopathy in controlling weeds and C-13 isotope methods that can be used to measure weed-crop root interactions.

- **International Research Collaborations**
- **New Research Grants**