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

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MONTHLY RESEARCH HIGHLIGHTS

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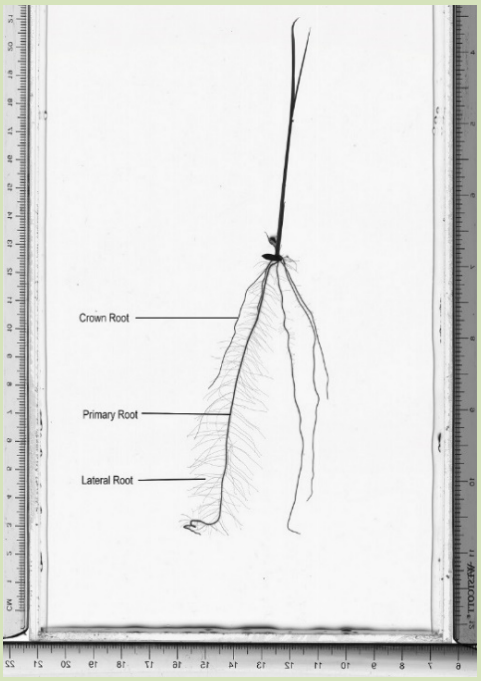
- **Recent Scientific Publications**

This addresses USDA-ARS Research Goal: New bioinformatic tools developed for data analysis and mining, and to manage high throughput phenotypic and genotypic data and knowledge

Sharma, S., Pinson, S.R.M., Gealy, D. R., Edwards, J.D. 2021. Genomic prediction and QTL mapping of root system architecture and above-ground agronomic traits in rice (*Oryza sativa* L.) with a multi-trait index and Bayesian networks. G3 Genes|Genomes|Genetics https://doi.org/10.1093/g3journal/jkab178

Roots are the means by which plants acquire the necessary water and nutrients for growth. A vigorous root system is essential for a high yielding crop variety. However, we know very little about how root structure or "architecture" contributes to above-ground shoot growth and grain yield. In this study, we used two gene mapping analysis methods to discover genetic marker associations with root structure traits predicted to impact overall plant growth and yield. We first identified genes using data on individual traits, then used a multi-trait, machine learning model (a Bayesian network) that considered trait-to-trait associations as it identified marker-trait associations. Genes identified using the network model explained how roots affect above-ground growth, while the genes identified using the individual traits were not only fewer in number, but also less informative of above-ground plant growth. In addition, we developed a multi-trait genomic selection model and validated its ability to identify progeny with improved root architecture. This research demonstrates a new approach that can be used to simultaneously select for numerous below-ground and above-ground traits using genomic information that may benefit rice cultivar development.



This addresses USDA-ARS Research Goal: Enhanced knowledge of food qualities and nutritional value at genetic and physiological levels

Siaw, M.O., Wang, Y.J., McClung, A.M. and Mauromoustakos, A., 2021. Effect of protein denaturation and lipid removal on rice physicochemical properties. *LWT*, p.112015.

Rice flour is growing in popularity as a food ingredient due to its hypoallergenicity and bland taste. Cooking properties of rice flour are predominantly governed by starch however, proteins and lipids also impact end-use properties of the grain. Glutelin and prolamin are two of the main proteins in rice and affect viscosity of the cooked starch. Lipids are highly concentrated in the bran, outer layer of brown rice. These compounds are known to vary among different rice cultivars. This study evaluated four rice cultivars and demonstrated that protein denaturation (PD) and lipid removal (LR) had some contrasting effects, with PD increasing gelatinization temperatures, while LR decreased gelatinization temperatures, whereas both PD and LR reduced pasting and swelling properties. In addition, the combined PD and LR treatments resulted in more significant increases in gelatinization temperatures and decreases in pasting, swelling power and water solubility properties than the individual treatments. These results demonstrate that heat treatment can be employed to produce brown rice flour with improved heat and shear stabilities for specific food product applications using brown rice as nutrient rich ingredient and some rice varieties may be more suitable than others.

- **Technology Transfer**

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

  On July 23, Dr. Yulin Jia provided information of genetic markers for blast resistance to a scientist in a US company for marker assisted breeding effort.

  ✓ **<u>Rice Germplasm Distributed</u>**

  During the month of July, 121 rice genetic stocks were shipped to researchers in the United States and Hong Kong from the Genetic Stocks Oryza (GSOR) collection.

Seed of the heirloom variety, Carolina Gold, was provided to Naturalis Biodiversity Center in Leiden, The Netherlands for comparison with other rice accessions from Suriname.

- **Stakeholder Interactions**

  On July 6, Dr. Shannon Pinson, Research Geneticist, provided information to a plant pathologist from USDA-APHIS Plant Germplasm Quarantine Program in Beltsville, MD on methods for pathogen-free tissue culture and how to find and dissect rice axillary meristems to assist APHIS in obtaining virus-free rice plants via tissue culture.

- **Education and Outreach**

  Dr. Yulin Jia, completed virtual Senior Executive Service training through the American University, Key Executive Leadership Program, sponsored by USDA-ARS.

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/