May 2017

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

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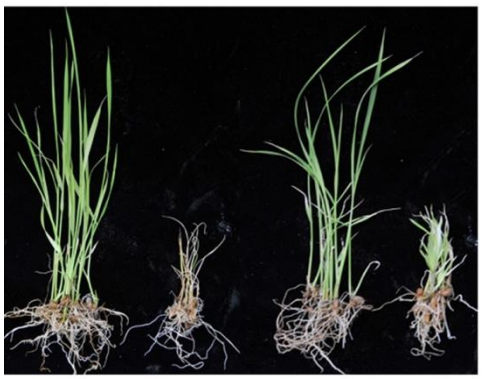
1. Recently Accepted Publications

ARS Anticipated Products: Plants tolerant to environmental changes or extremes.

Michael R. Schläppi, **Aaron K. Jackson**, **Georgia C. Eizenga**, Aiju Wang, Chengcal Chu, Yao Shi, Naoki Shimoyama, **Debbie L. Boykin**. 2017. Assessment of five chilling tolerance traits and GWAS mapping in rice using the USDA mini-core collection. Frontiers in Plant Science 8:957. doi.org/10.3389/fpls.2017.00957



Improved cold tolerance in rice is needed both at the germination and seedling stages. Cold tolerance at the germination stage allows rice to be planted directly into the fields early in the spring and tolerance at the seedling stage results in better survival when transplanting into cool water originating from mountain reservoirs or when flooding fields with cold water after the seedlings were at the four-leaf stage. Cold tolerance at the seedling stage also provides protection from unexpected cold temperatures that occur post germination. Using a set of over 200 rice varieties from around the world, five different assays were conducted as part of this study to mimic cold conditions at the germination stage or at the seedling stage. At germination, the two scenarios were cool temperatures either during germination or shortly after the seed had germinated. At the seedling stage, the three scenarios examined were cold temperatures occurring at transplanting, soon after transplanting, or after the seed had germinated and grown to the seedling stage. Based on the five assays and analyses with DNA markers, 27 chromosome regions were discovered that were linked to genes controlling cold tolerance at germination or the seedling stage, indicating both stages are controlled by several genes. This study lays the foundation for using the most tolerant varieties as parents in rice variety development programs and identifying key genetic markers linked to cold tolerance at the germination or seedling stage to incorporate cold tolerance into adapted rice varieties.

2. Technology Transfer

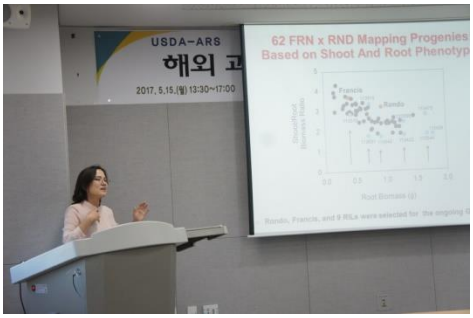
a. Formal Events:

To Non-research Stakeholders

Dr. Anna McClung gave an invited presentation at the Rice Market and Technology Convention, June 6-8, 2017, in Miami, FL. The meeting was hosted by the US Rice Producers Association which represents rice farmers in the southern USA. Attendance included ~400 industry representatives from Central and South America, a major export market for US rice. Dr. McClung's presentation was entitled "Rice research focused on production challenges and market opportunities".

To Research Community

During May 15-16, Drs. Anna McClung and Jinyoung Barnaby were invited to visit the Crop Breeding Research Division and the National Agrobiodiversity Center of the newly built National Institute of Crop Science (NICS), Rural Development Administration (RDA) in Jeollabuk-do, Republic of Korea. Their invited presentations included "Addressing the needs of the US rice industry- An overview of research at the USDA-ARS Dale Bumpers National Rice Research Center", "Mining the USDA-ARS rice germplasm collection for valuable traits and alleles"(McClung), and "Evaluation of genetic variation in rice to mitigate methane emissions" (Barnaby). Discussions were conducted with the RDA Director General, the NICS Director and senior scientists. Their comprehensive research program is similar in many ways with USDA-ARS program, although they have a strong emphasis on technology transfer and a close connection to county extension agents.



b. Informal Contacts

c. Germplasm Exchanged:

During May, 486 rice accessions from the Genetics Stocks *Oryza* (GSOR) collection were distributed to researchers in the US, Austria, Belgium and Canada.

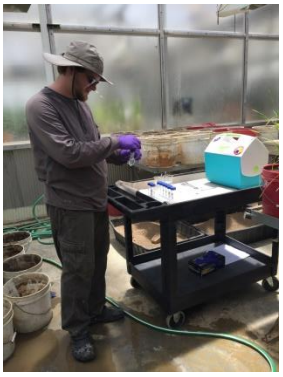
3. Education and Outreach

On May 12, 2017 three computer scientists, Drs. Joshua Xu, Jae Hyun Kim Tanmay Bera (ORISE Fellow) of National Center for Toxicological Research (NCTR), US-Food & Drug Administration (FDA), Jefferson, AR visited DB NRRC facility and gave a team presentation on pattern recognition to add phenotyping effort of genetic studies of rice. Dr. Yulin Jia led a tour and organized a round table discussion with DB NRRC scientists on potential collaborations. The following areas were explored as potential pilot projects: 1). Grain size

analysis of rice varieties and seeking their genetics correlation, 2). Analyzing chalk in rice grains with optical filters and imaging through UV, visible and NIR, 3). Mapping the distribution of microbiome in the root system of rice plants with the electron microscope (most probably SEM) to image the microbiome present in the root systems, 4). 3D electron microscopy images of fungal and bacterial infection, and 5). Image analysis of fungal and bacterial damage of plants and rice grain.

On May 26, 2017 Research Plant Pathologist Dr. Yulin Jia as chair and his university colleague were approved by the International Committee of International Congress of Plant Pathology (ICPP) to organize a special symposium titled "CRISPR/Cas9 Genome editing for plant pathology and disease management" as part of the program for the 2018 ICPP in conjunction with 2018 annual meeting of American Phytopathological Society, Boston, MA.

New Significant Research Collaborations



Dr. Jinyoung Barnaby is the recipient of a $10,000 mini-grant funded by the National Institute of Crop Science, Rural Development Administration of the Republic of Korea. This is an extension of another grant "Development of a screening methodology for assisting in rice cultivar selection for reduced methane emissions" from the same organization that is administered through the USDA/ARS Office of International Research Programs. The project is entitled "Determine genetic variation of root-soil-microbe interactions in methane emissions".