



April 2015
Highlights from the Dale Bumpers National Rice Research Center
Stuttgart, AR

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1. Recently accepted Publications

Gealy, DR, Burgos, NR, Yeater, KM, Jackson, AK. 2015. Outcrossing Potential between U.S. Blackhull Red Rice and Indica Rice Cultivars. *Weed Sci.* 63: (doi): <http://dx.doi.org/10.1614/WS-D-14-00150.1>

Weedy red rice is a major weed problem in rice production fields in the southern USA, which is made worse by outcrossing between red rice and cultivated rice that can form highly variable and difficult-to-control weedy biotypes. Indica rice, which has traditionally been grown in tropical regions of Asia, is now used in US breeding programs and on organic rice farms. However, its potential to outcross with US red rice plants is unknown. DNA marker analysis was used to show that a common black-hull red rice biotype outcrossed to four indica varieties at an average frequency of 0.0086%. However, red rice outcrossing to the US cultivated variety, Kaybonnet, was almost four times greater than for the indica varieties. This occurred primarily because Kaybonnet flowered at nearly the same time as the red rice, whereas indica varieties such as TeQing, flowered many days later. Interestingly, the seed production of weedy red rice was highest when it was grown adjacent to Kaybonnet, demonstrating that the indica varieties competed more aggressively against red rice. Although the red rice outcrossing frequency was less for indica varieties than for Kaybonnet in these experiments, we demonstrated that red rice plants that have overlapping flowering patterns with indica varieties could be a pollen source for outcrossing and the formation of damaging rice-red rice hybrid weed biotypes.

Chen, M.-H. and McClung, A.M. 2015. Effects of cultivars, organic cropping management and environment on antioxidants in whole grain rice. *Cereal Chemistry* <http://dx.doi.org/10.1094/CCHEM-11-14-0240-R>

Whole grain (brown) rice contains functional antioxidants such as phenolics, flavonoids, vitamin E homologues and gamma-oryzanol that have positive effects on human health. The objectives of this study were to quantify the variation in these antioxidants found in different cultivars grown in different years, and under conventional or organic cultural management. We found less variation due to cultural management method used as compared to choice of cultivar and growing environment. Although cultivars differed in concentrations of these antioxidants, no one cultivar contained the highest concentration of all antioxidants evaluated. Observing that cultivars differ in these compounds indicates that with traditional breeding, these antioxidant concentrations in whole grain rice can be increased further. This





study shows that rice cultivars can be chosen that will have high levels of specific antioxidant compounds whether grown under organic or conventional management systems.

Gealy, DR. 2015. Deep phosphorus fertiliser placement and reduced irrigation methods for rice (*Oryza sativa* L.) combine to knock-out competition from its nemesis, barnyard grass (*Echinochloa crus-galli* (L.) P.Beauv). *Plant Soil*. (DOI)10.1007/s11104-015-2478-5 (accepted 4/7/15)

Rice farmers are experiencing more and more roadblocks to production and profitability worldwide because of limitations in availability of abundant irrigation water, affordable fertilizers, and adequate weed control tools. This commentary paper reviewed recent discoveries by a research team from Sri Lanka and Australia, who demonstrated an interesting, and potentially more affordable and sustainable production approach for phosphorus-starved soils that saves water and improves weed control by placing phosphorus fertilizer deep in the soil where only the rice roots can reach. This production system dramatically increased the competitiveness of rice against barnyardgrass, one of the most devastating weeds of rice worldwide. It stunted the growth of barnyardgrass plants, but maintained the productivity of rice. This, and similar synergistic rice production systems have the potential to improve sustainability of rice production in this rapidly changing era of decreasing irrigation water availability, increasing fertility input costs, and increasing weed control challenges.

Liu, Y., Qi, X., Gealy, D.R., Olsen, K.M., Caicedo, A.L., and Jia, Y. 2015. QTLs Analysis for Resistance to Blast Disease in US Weedy Rice. *Mol. Plant- Microbe Interact*. <http://dx.doi.org/10.1094/MPMI-12-14-0386-R>

US weedy rice is well-adapted to the local conditions in the southern US rice fields. Rice blast disease is one of the most destructive diseases of cultivated rice and threatens rice production worldwide. However, information about blast resistance in US weedy rice is limited. We found that US weedy rice exhibits a broad resistance spectrum. Using genotyping by sequencing (GBS) methods, we identified 28 quantitative trait loci (QTLs) responsible for blast resistance in two US weedy rice ecotypes. Comparing with known resistance (R) genes close to these QTLs, we found that R genes at these resistance QTLs are novel suggesting that US weedy rice evolved novel mechanisms for adaptation and is a potential source of novel blast R genes for resistance breeding in the US.

2. New Significant research collaborations

International

Taiwan; 2 ARS scientists (McClung, Gealy) consulted with USDA-ARS-OIRP, Taiwanese Economic and Cultural Representation Office (TECRO), Taichung, Tainan, Kaoshung, and Hualien District Agricultural Research and Extension Stations, and Taiwan Agricultural Research Institute; regarding weedy rice genetics and control, and improvement of rice quality.





USA

3. New awarded grants

4. Technology Transfer

a. Formal Events:

To Non-research stakeholders

To Research Community

Anna McClung participated in the USDA NIFA's Climate Change Project Directors meeting that was held April 8-9, 2015 in Washington, DC and was a co-author on the presented poster "Characterization of genomic signatures for rice crop resilience in response to climate change in the US."

b. Informal Contacts:

Email correspondence with Intact Genomics, Inc., St. Louis, MO USA regarding how to germinate rice and grow rice in an incubator, and greenhouse.

Email correspondence with Dr. Muthusamy Manoharan, Director of Regulatory Science Center University of Arkansas at Pine Bluff to be a member of Institutional Biosafety Committee (IBC) of (UA PB).

2 Phone calls and 2 emails; to University cooperator and rice farmer regarding economics and productivity of organic/reduced-input rice systems.

Information to researchers at University of Delaware about germplasm for studying effects of various soil amendments on uptake of phosphorus, silica, and arsenic in rice plants and grain, and assisted them in obtaining 100 lbs. of rice hulls to include as a soil amendment treatment.

DNA marker results sent to a rice seed company that determined the source of red rice found in a seed production field.

Information to major rice processing company regarding specialty rice varieties.

Information to international investment firm looking to develop rice production expertise in West Africa.

Worked with a journalist associated with the Tri-Societies to develop an article on commercialization of pigmented bran rice cultivars which have high anti-oxidant activity.





Provided information to USDA Office of the Secretary regarding the issue of arsenic in rice.

New MTAs

Germplasm Exchanged:

679 GSOR accessions were sent to researchers in the U.S. and China.

Seed sent to researchers at Clemson Univ. (SC), Univ. Minnesota, and Univ. Arkansas-Pine Bluff (1890s).

Seed of various rice cultivars sent to organic growers in MO, PA, SC and MS.

5. Educational Outreach

April 17, Jia trained two graduate students from University of Arkansas, Pine Bluff on purifying and counting blast spores for disease evaluation at ARS.

April 23 2015 Jia supervised two graduate students on the evaluation of blast reactions of rice plants at University of Arkansas-Pine Bluff.

ARS researcher Rolfe Bryant, Dale Bumpers National Rice Research Center, Stuttgart, AR was invited by Drs. Jim Winter and Janet Lanza to give a seminar to the Biology Graduate, Arkansas-Louis Stokes Alliance for Minority Participation (ARK-LSAMP) and University Science Scholars Program (USSP) students at UALR on April 20. It was hosted with support from the LSAMP Scholars and University Science Scholars Program. He talked about research conducted at the DBNRRRC and jobs opportunities with USDA and ARS.

April 29 2015 Jia attended a MS thesis examination for a graduate student at UA Pine Bluff.

6. Awards/Honors

