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: develop technologies and practices producers can readily use to improve management of soil and water resources, reduce impact on air resources, efficiently use inputs, and contribute to ecosystems services.

Runkle, B.R.K., Seyfferth, A.L., Reid, M.C., Limmer, M.A., Moreno-García, B., Reavis, C.W., Peña, J., Reba, M.L., Adviento-Borbe, M.A.A., **Pinson, S.R.M**., and Isbell, C. Hypothesis and Theory: Co-implementing rice husk amendment and alternate wetting and drying irrigation for sustainable rice production. Frontiers in Agronomy, 22 October 2021. https://doi.org/10.3389/fagro.2021.741557

Rice is a staple food and primary source of calories and mineral nutrients for much of the world. However, rice can be a dietary source of toxic metal(loid)s like arsenic and cadmium, and its production in traditional flooded paddies requires significant water resources and can result in emission of the greenhouse gasses responsible for global warming. We therefore propose a modification to the rice production system that combines silicon management via incorporation of milled rice husks into the soil with growing rice under unflooded conditions for all or part of the growing season (alternate wetting and drying) to conserve water resources. Present research shows the promise of both strategies independently. This review paper presents how combining the two strategies could be expected to provide additional benefit. For example, reduced flooding periods and addition of silicon from rice husks have both been shown to independently decrease accumulation of arsenic in rice grains. Because silicon has also been shown to improve rice drought tolerance, combining the two strategies could allow the use of even longer dry periods during rice production, which could further decrease grain arsenic concentrations, water costs, and greenhouse gas emissions. Thus, these practices may be more effective together to counter the accumulation of toxic metal(loid)s, manage water usage and lower climate impacts either separately. The production system we propose would take advantage of rice husks which are an underutilized byproduct of milled rice. The wide availability of rice husks, with ~10% silicon content, and their physical proximity to commercial rice fields offer an opportunity for application to paddy soils as a silicon amendment. Rice husk application could, alongside alternate wetting and drying or furrow irrigation management, help resolve multiple sustainability challenges in rice production: (1) limit toxic metal(loid) accumulation in rice; (2) minimize greenhouse gas emissions from rice production; (3) reduce irrigation water use; (4) improve nutrient use efficiency; (5) utilize a waste product of rice processing; and (6) maintain plant-accessible soil Si levels. This review presents how such a shift in rice production practices could operate, identifies challenges, opportunities, and synergies to its implementation, and highlights remaining research issues. This review also suggests how farmers and millers would implement this practice together. This paper's purpose is to advocate for a changed rice production method for consideration by community stakeholders, including producers, millers, breeders, extension specialists, supply chain organizations, and consumers, while highlighting remaining research questions.

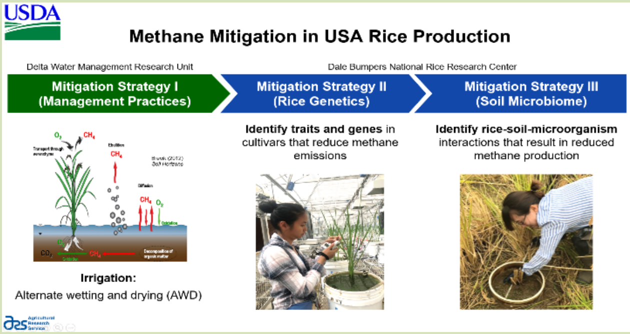
Moving rice husk waste at a rice mill by bulldozer.

- **Technology Transfer**

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

On October 6, 2021, Drs. Anna McClung and Ming-Hsuan Chen were interviewed by Brownfield AgNews Service about the recent announcement of the first export of long grain rice produced in the southern USA entering in the China market. The rice varieties that were included in the shipment were produced in Arkansas and were developed by USDA-ARS. They included aromatics and pigmented bran cultivars. Information was provided regarding the unique cooking, sensory, and health beneficial properties associated with the rice varieties which served as the basis of interest by the buyers in China.

On October 14, 2021, Drs. Anna McClung and Jinyoung Barnaby were invited by National Program Leader, Dr. Jack Okamuro, to participate in the USDA – Japan Ministry of Agriculture, Forestry and Fisheries (MAFF) meeting on greenhouse gas mitigation strategies for paddy rice and livestock production. Both organizations presented overviews of recent research



findings on these topics as a means to identify opportunities for future collaboration. Research by Dr. Barnaby on the importance of rice genetics in determining the soil microbial populations that produce methane was presented as one of potential directions for research collaboration.

On October 28, 2021, Drs. Yulin Jia and Alton Johnson, the Director of University of Arkansas Rice Research and Extension Center (UA RREC) discussed the updates of research accomplishments of ARS DB NRRC and UA RREC, and ideas to develop collaborative projects years ahead.

- ✓ **Rice Germplasm Distributed**

During the month of October, 420 rice genetic stocks were shipped to researchers in the United States from the Genetic Stocks *Oryza* (GSOR) collection.

- **Education and Outreach**

After 16 years as serving as the Research Leader/Center Director for the DBNRRC, Dr. Anna McClung has stepped down from her leadership position to focus more on research. During this time period, she has guided the consolidation of the ARS Rice Research Unit in Beaumont, TX with that in Stuttgart, AR and developed a unified research program from four previously separate projects. Four new scientists were hired under her leadership, expanding the scope of the research to include bioinformatics, physiology in response to climate stress, and metabolomics. Over her career she has participated in the creation and public release of 21 rice cultivars for conventional and specialty markets, 11 of which are currently in production.

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/