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

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MONTHLY RESEARCH HIGHLIGHTS

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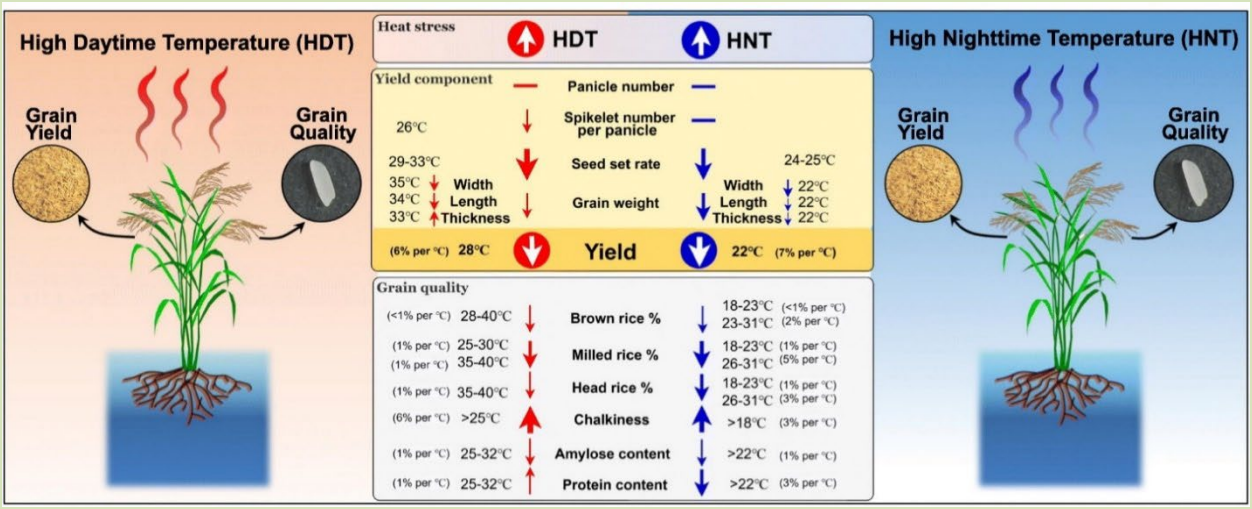
- **Recent Scientific Publications**

This addresses USDA-ARS Research Goal: Developing crop plants with enhanced tolerance to extreme temperatures.

Su, Q., **Rohila, J.S.,** Ranganathan, S., and Karthikeyan, R. 2023. Rice yield and quality in response to daytime and nighttime temperature increase – A meta-analysis perspective. Science of The Total Environment 898: 165256. https://doi.org/10.1016/j.scitotenv.2023.165256.
Recently, rice crop in the southern US is experiencing hotter ambient temperatures. The high day temperature (HDT) and high night temperature (HNT) affect overall rice well-being, fertility, grain-filling process, and thus eventually can lowers grain yield, grain quality, and profitability for rice growers. A lot of studies have been conducted as individual small experiments, but still a clear understanding for a relationship between rice yield and high daytime/nighttime temperatures was lacking. In this meta-analysis paper, daytime/nighttime temperatures were studied as one big data set by compiling data from 1105 experiments for HDT and 841 experiments for HNT from the collected peer-reviewed papers that were selected based on certain criterion such as daytime/nighttime temperatures, yield components and several rice quality traits. Interestingly, the study found that the ideal day/night temperature for rice is 28ºC/22 ºC. Higher nighttime temperature had higher impact on yield compared to the high daytime temperature, and the yield loss under heat stress was associated with impact on rice quality traits. We found that however, HDT and HNT, both had negative effects on grain yield, but grain yield showed a little more sensitivity to higher nighttime compared with daytime temperatures, decreasing rice yields by about 7% for every 1℃ increases in nighttime temperature with an assumption of 22 ℃ as the optimum night temperature. Also, the yield loss under heat stress was found associated with significant impacts on rice quality traits. One major outcome of this meta-analysis was the development of the following new working hypothesis about heat stress tolerance in rice. Based on the results, it was proposed that while the highest ambient temperature reading during day and night could be important, total heat degree hours (HDH) during day and night are critically important and their interaction must be considered in future experiments.



- **Technology Transfer**

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

Dr. Shannon Pinson, Research Geneticist with the Dale Bumpers National Rice Research Center in Stuttgart, Arkansas has received the prestigious honor of being designated a Fellow of the Crop Science Society of America. The CSSA names less than 0.3% of their members per year as Fellows in recognition of outstanding achievements and contributions to field crops research. This award is in recognition of the many contributions Dr. Pinson has made to the field of rice Molecular Genetics, including identification of more than 500 QTLs for a variety of rice traits including yield, disease resistance and grain milling and nutritional quality; the development of molecular gene-tags and enhanced germplasm that speed incorporation of newly discovered genes into improved rice cultivars; and the development of broadly useful gene mapping populations and trait evaluation techniques now used by rice researchers worldwide. Dr. Pinson will be presented with the award at the annual meeting in November 2023.

Dr. Anna M. McClung, recently retired Research Geneticist with the Dale Bumpers National Rice Research Center in Stuttgart, Arkansas was selected as the 2023 recipient of the Frank N. Meyer Medal for Plant Genetic Resources. Recipients of this medal are involved in exploration, evaluation, maintenance and/or research on preservation of plant genetic resources, and/or administrative support of a national or international plant genetic resource program. Dr. McClung has improved the management efficiency of the USDA Rice Germplasm Collection by revising field planting protocols, utilizing 23 trait linked and fingerprint markers to better characterize accessions and implementing a system for archiving duplicate accessions. She was the co-developer of three diversity panels and the *Tropical japonica* Core which is a unique genepool most relevant to US breeders. Also, she has been involved in the phenotypic characterization of these panels. Anna played a key role in developing the US Genetic Stocks-*Oryza* collection which currently distributes more than 15,000 accessions per year. Lastly, Dr. McClung identified novel traits in poorly adapted genetic resources and through breeding deployed these into the US varieties Scarlett which is high in antioxidants, Tiara with popcorn like anthocyanins, and Santee Gold with superior culinary properties. She will be presented with the award at the annual meeting in November 2023. To learn more about the Frank N. Meyer Medal check out: https://doi.org/10.1002/csan.21020

A collaborative research work of Dr. Jai Rohila and his colleagues at Oklahoma State University and the University of Pennsylvania, on novel epitranscriptomic mechanism for cold tolerance in plants that was published earlier (https://onlinelibrary.wiley.com/journal/1365313x) in The Plant Journal (TPJ), and highlighted in DB NRRC July 2022 Newsletter, is now selected as the outstanding original research paper published in TPJ for the calendar year 2022. The research is funded by the National Science Foundation.

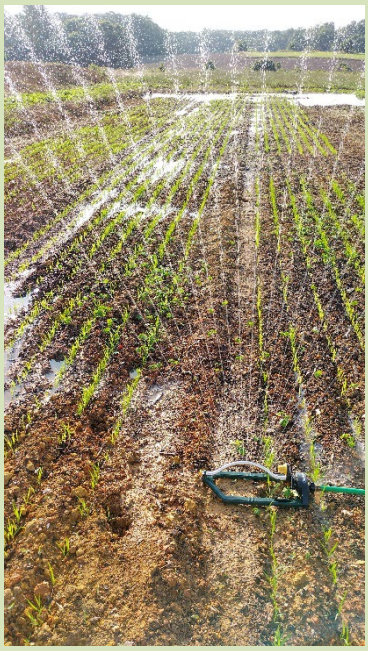
- ✓ **Rice Germplasm Distributed**

During the month of July, 308 rice genetic stocks were shipped to researchers in the United States.

Drs. Huggins and McClung sent seeds of rice varieties originating in West Africa and the Caribbean to the New York Botanical Garden earlier this year. The varieties were planted in the African American Garden: The Caribbean Experience display garden. The garden

was used in an outreach program focused on food crops and in the Juneteenth celebration. The garden will continue to be on display throughout the summer and will be documented through images. Toby Adams, Director of the Edible Academy, and Brooke Gibbard, Edible Academy Garden Coordinator, shared some images of the rice from the African American Garden: The Caribbean Experience Garden.

Recently, Dr. Trevis Huggins spoke with Mr. Bernard Singleton who runs Nebedaye Farms in Charlotte, NC. Earlier this year Dr. Anna McClung sent Mr. Singleton various rice varieties for him to grow and educate the community on African food culture in the US. Mr. Singleton shared images of the rice varieties in the production system that he practices and of the people he educates as they interact with the rice.



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/