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

OCTOBER 2019

MONTHLY RESEARCH HIGHLIGHTS

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- **Recent Scientific Publications**

Zhang, **Jia, Y.**, Wang, Y. and Sun, G. 2019. A Rapid Survey of Avirulence Genes in Field Isolates of *Magnaporthe oryzae*. **Plant Disease** October 16, 2019, https://doi.org/10.1094/PDIS-08-19-1688-RE

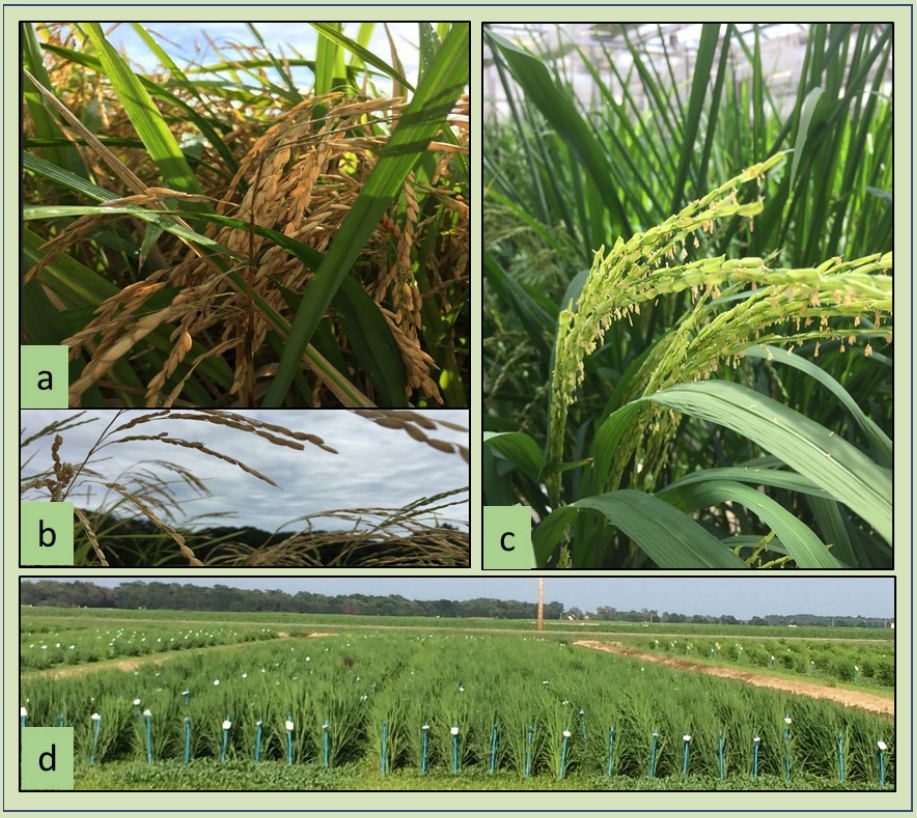
Rice blast is a lethal disease of rice worldwide. Major blast resistance (*R*) genes are effective only when the fungal pathogen *Magnaporthe oryzae* isolates contain the matched avirulence (*AVR*) genes. In this study, using DNA markers for five pathogen AVR genes, *AVR-Pik*, *AVR-Pizt*, *AVR-Pia*, *AVR-Pii* and *AVR-Pita1,* we investigated the presence of these genes in 258 blast isolates collected from southern US commercial rice fields from 1975-2009. Ten unique genetic fingerprints (haplotypes) were identified among the isolates. The results showed that 174 isolates of *M. oryzae* carried *AVR-Pita1*, 225 isolates carried *AVR-Pizt*, 44 isolates carried *AVR-Pik*, 3 isolates carried *AVR-Pia*, and 1 isolate carried *AVR-Pii*. After sequence analysis, we found genetic variants among 40 AVR-Pita1 and 11 AVR-Pik isolates suggesting that both of these pathogen genes are unstable and changing. In contrast, only one variant was found for the AVR-Pizt, AVR-Pia and AVR-Pii genes suggesting these are relatively stable. The presence of five AVR genes among the historic blast isolates suggests that their corresponding plant resistance genes *Pi-ta*, *Pi-k*, *Pi-zt*, *Pia,* and *Pii* can be deployed in rice cultivars and will be effective in limiting blast disease in the Southern U.S. This study demonstrates that monitoring *AVR* genes in pathogen populations is a means of assessing the effectiveness and stability of deployed blast *R* genes in commercial rice fields.

Rice blast disease on panicle, seeds and leaf

Jia, Yulin. 2019. Introductory Chapter: Protecting Rice Grains in the Post-Genomic Era: Are We There Yet?. Pages 1 -9 in: Protecting Rice Grains in the Post-Genomic Era, IntechOpen, DOI: 10.5772/intechopen.86390. Published on October 2, 2019.

Rice has been produced for thousands of years in a wide range of ecological and cultural systems around the globe becoming a primary food crop for more than 3.5 billion people. Recent advances in the study of rice genetics, genomics, pathology and interactions with the environment have resulted in a growing appreciation of how science may help in securing food production for the future. Selective breeding for rice that has improved stress tolerance, high-yield and nutritional merits is a major objective worldwide. However, the genetic diversity of cultivated rice has been significantly reduced in this process. Stable rice production is faced with the challenge of protection from harmful microorganisms, extremes in weather, and changing production practices. This book, with 12 chapters, aims to inform readers of the necessity of protecting rice by enabling friendly interactions between plants and microbes to meet the challenges of feeding a growing population. This book intends to provide an overview of the contemporary effort to safeguard the rice crop with recent advances in rice genetics and innate immunity to major biotic stresses.

Rice grown in greenhouses and fields in the Southern USA.



- **Technology Transfer**

  - ✓ **<u>To Non-Research Stakeholders</u>**

    On October 7th, Dr. Anna McClung provided information for a rice grower in Vermont about food safety testing.

    On October 22nd, the DBNRRC provided genetic information to a foundation seed company and to a specialty rice grower to identify the source of potential seed mixtures in their fields.

    Dr. Nazirhak Amen, Purple Mountain Organics in Takoma Park, Maryland, is growing several rice varieties developed by ARS for the local food market. He was interviewed on October 24th regarding his attempts at growing rice using reduced irrigation practices. This is being done commercially in the main rice growing region of the Mid-South also. https://www.yaleclimateconnections.org/2019/10/farmer-experiments-with-more-climate-friendly-rice-cultivation/

  - ✓ **<u>To Research Community</u>**

    Dr. Trevis Huggins has added five new rice descriptors associated with rice phenology and morphology to the Germplasm Resource Information Network (GRIN), a database associated with the USDA collection of global rice varieties. Dr. Huggins (pictured) is a newly hired Geneticist that is in charge of curation of the rice germplasm collection. The descriptors added include daylength (photoperiod sensitivity), apiculus color, awn color, seed shattering, and leaf pubescence. These new descriptors provide additional visual assessments for characterizing *Oryza* germplasm accessions which will be beneficial to the rice research community.

    On October 23rd to 25th, Drs. Georgia Eizenga (below pictured center) and Jeremy Edwards (pictured left) visited Marquette University in Milwaukee, WI, to discuss progress on the USDA-NIFA grant entitled “Mechanisms of Cold Stress Tolerance Responses in Rice” with P.I., Dr. Michael Schläppi, Dept. of Biological Sciences. As part of the visit, Dr. Edwards presented a seminar entitled “Designing Rice Varieties for High Yield Under Reduced Irrigation With the Introduction of New Genetic Diversity”, and Dr. Eizenga presented “SNP Markers for Rice Panicle and Grain Traits Developed from Marker-Trait Associations Identified in GWAS and Validated in Biparental Mapping” and included an introduction to U.S. rice production and research at the DBNRRC. As part of this visit, Drs. Eizenga and Edwards saw Wisconsin’s first and only

rice farm in the Mequon Nature Preserve which is growing a cultivar identified as part of this grant.

Dr. Jinyoung Barnaby was invited as a speaker at the III International Climate Change Forum held October 21 - 25, 2019 in Lima, Peru. The forum was limited to 200 scientists and specialists but 500 more participated through online streaming. Dr. Barnaby gave a talk entitled "Impacts of genotype x environment x management interactions on crop production and quality". The forum covered a broad range of topics including strategies and challenges facing climate change, trends and management of resources in climate change research, genetics and plant breeding to adapt to climate change, phenotyping, control of pests and diseases, data mining and crop modeling, silvopastoral systems, and carbon capture.

✓ **Informal Contacts**

On October 3rd, Dr. Anna McClung was interviewed by a reporter located in North Carolina about the importance of the heirloom variety, Carolina Gold, and the history of rice production in the USA.

✓ **Germplasm Exchanged:**

During the month of October, 213 rice accessions from the Genetics Stocks *Oryza* (GSOR) collection were distributed to researchers in the United States and Pakistan. Seed

of a starch mutant variety was provided to ARS researchers and seed of a specialty variety was provided to a grower for parboiling tests.

- **Education and Outreach**

On Oct 10th, Ms. Oyinlayo Ayankunbi (Left) and Ms. Karen Cunanan (Right) from Charles Herbert Flowers High School started their 1-yr research internship with Dr. Jinyoung Barnaby (in Beltsville, MD). They will be working on understanding the impact of genotype x environment x management (CO_2 and water management practices) interactions on rice production and grain quality.

On October 18th, Dr. Yulin Jia hosted Dr. Ely Oliveira-Garcia, Assistant Professor, from the Department of Plant Pathology and Crop Physiology, Louisiana State University Agriculture Research Center. Dr. Jia led a tour of research activities at DBNRRC and visited the University of Arkansas Rice Research and Extension Center with Dr. Yeshi Wamishe (UAR, Extension Pathologist) and discussed potential collaborations to battle rice diseases.

Yeshi Wamishe of University of Arkansas Rice Research and Extension Center (L), Ely Oliverira-Garcia (M) and Yulin Jia (R).