June 2017

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

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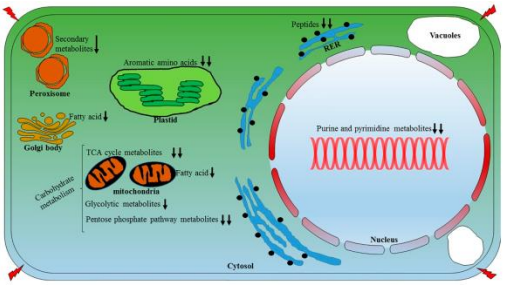
1. Recently Accepted Publications

Unraveling key metabolomic alterations in wheat embryos derived from freshly harvested and water-imbibed seeds of two wheat cultivars with contrasting dormancy status. 2017. Aayudh Das, Dea-Wook Kim, Pramod Khadka, Randeep Rakwal, and **Jai S Rohila**. Frontiers in Plant Science. doi: 10.3389/fpls.2017.01203 (prior research conducted by Dr. Rohila)

Untimely rains in fields during harvest season can cause pre-harvest sprouting (PHS), which deteriorates the yield and quality of the crop. Very little is known about metabolic changes in seed embryos that determines whether the seed will be dormant (PHS-tolerant) or non-dormant (PHS-susceptible). In this study, physiologically matured and freshly harvested wheat seeds of a PHS-tolerant and PHS-susceptible cultivars were water-imbibed, and the isolated embryos were subjected to high-throughput, global non-targeted metabolomic profiling. Results revealed that several key metabolic pathways and phytochemicals were differently regulated between dormant and non-dormant seeds. Cell membrane stability in response to water absorption was found to be a key factor for PHS-tolerance. Higher expressions of several secondary metabolites and phytochemicals with known antioxidant properties were also found to be responsible for PHS-tolerance. In conclusion, the results of this investigation revealed that a stable metabolic homeostasis after imbibition contributes toward dormant seeds that result in PHS-tolerant phenotype in wheat.

Metabolomic profiling of soybeans (*Glycine max* L.) reveals the importance of sugar and nitrogen metabolism under drought and heat stress. Aayudh Das, Paul J. Rushton**, Jai S. Rohila**. 2017. PLANTS. doi:10.3390/plants6020021 (prior research conducted by Dr. Rohila)

Soybean is an important crop that is continually threatened by abiotic stresses, especially drought and heat stress. At molecular levels, reduced yields due to drought and heat stress can be seen as a result of alterations in metabolic homeostasis of vegetative tissues. A study was conducted to compare leaf metabolite profiles under control conditions (28/24 °C), drought, and heat stress (43/35 °C). Analyses showed that in response to drought and heat stress, key



metabolites (carbohydrates, amino acids, lipids, cofactors, nucleotides, peptides and secondary metabolites) were differentially accumulated in soybean leaves. The metabolites for various cellular processes that regulate carbohydrate metabolism, amino acid metabolism, peptide metabolism, and purine and pyrimidine biosynthesis, were found to be affected by drought as well as heat stress. Metabolomic profiling demonstrated that in soybeans, keeping up with sugar and nitrogen metabolism is of prime significance, along with phytochemical metabolism under drought and heat stress conditions.

2. Technology Transfer

a. Formal Events:

To Non-research Stakeholders

To Research Community

b. Informal Contacts

c. Germplasm Exchanged:

During June, 548 rice accessions from the Genetics Stocks Oryza (GSOR) collection were distributed to researchers in the US, Canada and Vietnam.

3. Education and Outreach

Dr. Shannon Pinson organized a 5-day visit by three undergraduate students majoring in Biology at the University of Pine Bluff, an 1890 Institution. From June 5-9, 2017, students interacted with all 10 research projects at the Dale Bumpers National Rice Research Center, Stuttgart, AR, during which time they evaluated the rice for cooking quality, methane emissions, and photosynthetic rates, and learned about the importance and use of the USDA National Small Grains Collection as a source of novel crop genes. Visits for these three students were also arranged with the Harry K. Dupree Stuttgart National Aquaculture Research Center and the Federal Grain Inspection Service, also in Stuttgart, AR. These students were participating in an NSF-funded outreach program to inform minority students about careers in agricultural science.

New Significant Research Collaborations