

## Our Latest Research Results - September 2013

### **Association of candidate genes with drought tolerance traits in diverse perennial ryegrass accessions**

**Authors:** X. Yu, G. Bai, S. Liu, N. Luo, Y. Wang, D. Richmond, P. Pijut, S. Jackson, J. Yu, Y. Jiang

**Submitted to:** Journal of Experimental Botany  
Drought is a major environmental stress limiting growth of perennial grasses in temperate regions. We conducted association mapping to identify putative candidate genes associated drought tolerance using 192 perennial ryegrass accessions from 43 countries. Significant variations in leaf wilting, leaf water content, canopy and air temperature, and chlorophyll fluorescence were identified under well-watered and drought conditions. The 192 accessions can be classified into five groups based on genome-wide DNA markers. Analysis of a set of selected candidate genes involved in antioxidant metabolism, dehydration, water-movement across membranes, and signal transduction identified 346 single nucleotide polymorphisms across 192 accessions. Significant associations were identified between genes encoding late embryogenesis abundant group 3 protein (LpLEA3) and iron superoxide dismutase (LpFeSOD) and leaf water content, and between LpCyt Cu-ZnSOD encoding cytosolic copper-zinc superoxide dismutase and chlorophyll fluorescence under drought conditions. Four single nucleotide polymorphisms from the three genes resulted in amino acid substitutions in different genotypes. These results indicate that allelic variation in these genes may affect whole-plant response to drought stress in perennial ryegrass. Contact Guihua Bai, telephone 785-532-1124, email [Guihua.Bai@ars.usda.gov](mailto:Guihua.Bai@ars.usda.gov)

### **Wheat bran particle size influence on phytochemical extractability and antioxidant properties**

**Authors:** L.R. Brewer, J. Kubola, S. Siriamornpun, T.J. Herald, Y.-C. Shi

**Submitted to:** Food Chemistry  
Phytochemicals including carotenoids phenolic acids, flavonoids, and anthocyanins present in wheat bran offer health promoting benefits. Phytochemicals offer natural antioxidant benefits to help reduce diseases such as cancer. This research was designed to determine whether or not the particle size of the wheat bran after milling had any impact on the amount of these valuable health compounds extracted. The particle size of three different milled treatments (coarse, medium and fine

whole wheat bran) was measured and the health promoting compounds determined. The results indicated that smaller particle size improved the extraction of phytochemicals and increased the oxygen radical absorbance capacity.

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### **Biology and Management of Psocids Infesting Stored Products**

**Authors:** M.K. Nayak, P. Collins, J.E. Throne, and J.-J. Wang

**Submitted to:** Annual Review of Entomology  
Previously regarded as minor nuisance pests, psocids belonging to the genus *Liposcelis* are now a major problem for effective protection of stored-products worldwide. In this review we examine the apparent biological and operational reasons behind this phenomenon and why conventional pest management seems to be failing. We also investigate what is known about the biology, behavior, and population dynamics of major pest species to ascertain their strengths, and perhaps find weaknesses, as a basis for a rational pest management strategy. We outline the contribution of molecular techniques to clarifying species identification and understanding genetic diversity. We discuss progress in sampling and trapping, and our understanding of spatial distribution of these pests as a foundation for developing management strategies. Effectiveness of various chemical treatments and the availability and potential of non-chemical control methods are also critically examined. Finally, we outline research gaps and suggest future directions for research.

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### **Identification of a novel gene, H34, in wheat using recombinant inbred lines and single nucleotide polymorphism markers**

**Authors:** C. Li, M.S. Chen, S. Chao, J. Yu, G. Bai

**Submitted to:** Theoretical and Applied Genetics  
Hessian fly (HF) is an important pest of wheat worldwide. HF has many biotypes that are virulent to different wheat HF resistance genes, identifying new genes and stacking several resistance genes in a cultivar can improve resistance durability of the cultivar. In this study, we identified two genes from wheat cultivar 'Clark' for HF resistance to biotype GP, a predominant biotype in the Great Plains. The two genes were mapped on wheat chromosomes 6B and 1A. The QTL on 6B is a

novel wheat gene with resistance to HF, and thus designated *H34*. A significant interaction was detected between the two genes that enhanced the resistance of the two genes. The results indicated that different genes and their interactions contribute different degrees of resistance in a cultivar.

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### **Effect of Fusarium Head Blight (FHB) Resistance Gene *Fhb1* on Agronomic and End-use Quality Traits of Hard Red Winter Wheat**

**Authors:** A. Bakhsh, N. Mengistu, P.S. Baenziger, I. Dweikat, S.N. Wegulo, D. Rose, G. Bai, K.M. Eskridge

**Submitted to:** Crop Science

Fusarium head blight (FHB), also called wheat scab, is a devastating disease of wheat. *Fhb1*, a FHB resistance gene from Chinese line Sumai3, is the gene that has shown the largest and stable effect on FHB resistance. Transferring *Fhb1* into hard winter wheat can significantly improve FHB resistance. To determine if the *Fhb1* genes associated with any deleterious effects on agronomic or end use quality traits in winter wheat, 42 F3:7 entries from a three-way cross ('Alsen' / 'NE00403' // 'NE02584') with different alleles of *Fhb1* were evaluated for yield and quality traits in replicated trials at five locations in Nebraska. *Fhb1* lines were significantly more winter hardy, earlier, and higher in grain yield, but were lower in protein content as compared to *fhb1* lines. Contact Guihua Bai, telephone 785-532-1124, email [Guihua.Bai@ars.usda.gov](mailto:Guihua.Bai@ars.usda.gov)

### **Single Nucleotide Polymorphisms in HSP17.8 and Their Association with Agronomic Traits in Barley**

**Authors:** Y-S Xia, R-H Li, Z-X Ning, G-H Bai, KHM. Siddique, G-J Yan, M. Baum, RK. Varshney, P-G Guo

**Submitted to:** PLoS One

Large amount of small heat shock protein 17.8 (HSP17.8) is produced in plant cells in response to heat and other stress and may play an important role in plant tolerance to stress environments. However, the sequences of the gene in different genotypes may vary, which results in their different capability to adapt to various stress conditions. In this study, we evaluated the HSP17.8 gene across 210 barley accessions for single nucleotide polymorphisms (SNPs) using EcoTILLING technology. The barley collection was collected from 30 countries. We identified 11 SNPs with 10 from the coding region of HSP17.8. Five of the 10 SNPs were missense changes, which are predicted to alter the function of HSP17.8. The accessions from Middle East Asia showed the higher sequence variation in HSP17.8 than those from other regions, and wild barley (*H. spontaneum*) accessions exhibited greater sequence variation than the cultivated barley (*H. vulgare*). Four SNPs in HSP17.8 were found to be associated with

number of grains per spike, thousand kernel weight, plant height, flag leaf area or leaf color. The results suggest that sequence variation in HSP17.8 may contribute to drought tolerance in barley.

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### **Sorghum Flour Characterization and Evaluation in Gluten-free Flour Tortilla**

**Authors:** M. Winger, F. Aramouni, T. J. Herald

**Submitted to:** Journal of Food Quality

Tortilla sales represent a significant segment of the food industry. Sorghum is a grain that is drought resistant, heat tolerant and is safe for individuals with gluten intolerance. Few studies exist on the use of sorghum flour in the fast growing tortilla market. Four commercial sorghum hybrids were selected to determine their application in a wheat gluten free tortilla system. The research studied the physical grain traits of the sorghum kernel and respective flour properties. The research determined that difference existed among the sorghum hybrids as determined by the way the flour handled during processing and in the final tortilla quality. The researchers concluded that care must be taken in selecting sorghum hybrids for tortilla production.

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