GMPRC
GRAIN MARKETING AND PRODUCTION RESEARCH CENTER

RESEARCH Kernels

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Hot On The Trail Of Wheat Plant Defense Mechanisms. Fusarium head blight (FHB) or scab is a destructive disease of wheat caused by the fungus, *Fusarium graminearum*. When wheat plants are attacked by diseases such as this, normal defense mechanisms are activated. According to current theories, these defense mechanisms are based on the genetics of the plant and may vary in different varieties. In an attempt to learn more about these defense mechanisms, we studied the gene expression patterns of a FHB-resistant wheat cultivar, Ning 7840, and a FHB-susceptible cultivar, Clark, during a period of up to 72 hours after they were infected with *F. graminearum.* We identified 44 genes that were most likely involved in plant responses to this fungal infection. Defense responses in the resistant cultivar, Ning 7840, occurred from about 3 to 12 hours after infection. Three specific genes were highly expressed during this period and may play a significant role in the FHB resistance of this variety. Understanding this defense mechanism process will allow us to develop better disease and insect resistant crop varieties in the future. (Guihua Bai, telephone: 785-532-1124, email: guihua.bai@gmprc.ksu.edu)

FHB infected plant.

Grain Research May Also Help Protect Your House. Dampwood termites of the genus *Zootermopsis* are an abundant group of basal termites found in temperate forests of western North America. Three species are currently recognized and one of these species is subdivided into two subspecies. Reliable differentiation between species members requires hydrocarbon analysis of fresh specimens and requires long periods of time. We used the same near-infrared analytical techniques developed for single kernels of grain to identify the various species and subspecies with greater than 99% accuracy when coupled with neural network analysis. Access to this fast reliable and economical means of determining species and subspecies will benefit scientists studying these very destructive pests and it will help termite control companies optimize control strategies. (Floyd Dowell, telephone: 785-776-2753, email: floyd.dowell@gmprc.ksu.edu)

A New Method Developed To Help Find The Proverbial "Needles" In the Genomic Haystack. The genome of the modern wheat plant contains over 16 billion bases in the DNA structure. Each of these bases are symbolized by a letter (either G for guanine, C for cytosine, A for Adenine, or T for thymine). However, only about 10 to 20% of these bases are contained in genes that actually code for proteins in the wheat plant. With today's technology, it is not cost effective to determine the structural sequence of all of the bases in the entire wheat genome. However, we have developed a method using "Cot filtration" that allows us to concentrate our studies on the 10 to 20% of the DNA that is used for coding proteins in wheat. In a sense, we are able to ignore most of the genetic material that isn't being used by the plant. This allows for increased efficiency in sequencing and studying the genes that are important to the plant. (John Fellers, telephone: 785-532-2367, email: john.fellers@gmprc.ksu.edu)

Extrusion of Pre-Cooked Flours Improves The Quality of High-Fiber Baked Goods. Cereal products with high fiber can reduce calorie intake and provide health benefits linked to chronic disease. However, high fiber content tends to diminish the final product quality and consumer acceptability of cereal products like baked goods and pasta. In a collaborative research project with Dr. Sajid Alavi and Dr. Tom Herald of Kansas State University, pre-cooked flours were produced using a lab-scale twin-screw co-rotating extruder configured for low shear and low temperature. Swelling and pasting properties of the pre-cooked flours were characterized using rapid visco-analyzer standard methodology. The quality of cookies and tortillas were also characterized using approved methods from the American Association of Cereal Chemists.

Results showed that, while the pre-cooked flour had similar pasting and swelling properties when compared to commercially available flours, it had increased water absorption. Cookie diameters using the high fiber pre-cooked and extruded flours were comparable to those obtained with the commercial flour. The weight, diameter, height, and specific volumes of the tortillas were also comparable to those obtained with the commercial flour. These results suggest that extrusion technology can produce pre-cooked wheat flour containing high fiber with the same functionality as commercially available flour. (Scott Bean, telephone: 785-776-2725, email: scott.bean@gmprc.ksu.edu)

How Long Can You Store That Rice Without Having Insect Pest Problems? Rice is a major component of crop production areas in the south-central United States. After rice is harvested, it is dried, and typically stored as rough, unhulled kernels. During storage, it is vulnerable to attack by stored-grain insects which can result in substantial economic loss. Two major pest species are the lesser grain borer and the rice weevil. One integrated pest management strategy for stored grain including rough rice is the use of low-volume aeration with ambient air to lower the temperature within the grain mass. This reduction in grain temperature will slow population growth of insect pests. In cooperation with Texas A & M University, the University of Arkansas, and the University of Missouri, we have developed a web-based Post-Harvest Grain Management program for stored rice (http://beaumont.tamu.edu/RiceSSWeb). This program allows users to create different scenarios of bin and fan configurations and different initial conditions of pest infestations and to simulate changes in grain temperature and moisture content. Bin temperatures, insect populations, and grain damage are predicted from the simulations. Historical weather data are used to classify rice production in this region of the U.S. into different regions or zones for rice storage. The weather data are further used to predict durations required for cooling at different aeration airflow rates for each zone. Results show the potential for expanded use of aeration in pest management programs for stored rice. (Frank Arthur, telephone: 785-776-2783, email: frank.arthur@gmprc.ksu.edu)

Studying Grain Insect Pests That Hatch Inside Kernels Just Got Easier. The immature stages of the most serious insect pests that attack stored grain feed inside the kernels. This makes it very difficult to see and almost impossible to study them. We developed a method for following the development of these insects inside the kernels by weighing the kernels twice a day. Weight changes due to changing humidity, temperature, and barometric pressure were subtracted out using data from uninfected kernels. This method accurately indicates when the egg, larval, and pupal molts occur inside the kernel, but not when molts between individual larval stages occur. (James Throne, telephone: 785-776-2796, email: james.throne@gmprc.ksu.edu)

U.S. Department of Agriculture, Agricultural Research Service, Grain Marketing and Production Research Center, 1515 College Avenue, Manhattan, KS 66502. Phone: 800-627-0388.