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GRAIN MARKETING AND PRODUCTION RESEARCH CENTER

RESEARCH Kernels

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- **Further Evidence for the Existence of Three Types of Starch Granules in Wheat.** Although starch comprises up to 62% of the weight of the mature wheat kernel, little is known about how starch forms within the seed. We used transmission electron microscopy to follow starch formation in structures in the kernel called amyloplasts from the day of flowering through grain maturation. The synthesis of the large, Type A starch granules was observed during the first week after flowering. Synthesis of medium, Type B granules was observed to begin from 10 to 12 days after flowering and the synthesis of a fraction of tiny granules (diameter .25 micrometers or less), proposed as Type C, began from 17 to 21 days after flowering. The small size of Type C particles would produce a large area to volume ratio which may impact important properties such as water absorption, baking performance, etc.
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- **Development of an Objective (NIR) Test for Bread Staling.** Bread staling is one of the most common problems in bread storage. It affects bread texture properties such as firmness and taste. Bread gets firmer as the storage time increases. Bread firmness, as measured by a texture analyzer, has been commonly used to predict bread staling. However, this technique has many disadvantages. A trend always exists in a loaf with firmer slices in the center and its accuracy decreases when measuring samples made from different batches. This study investigated the potential of visible and NIR reflectance spectroscopy to detect bread staling. Results show that NIR analysis could predict bread staling more accurately and precisely than the texture analyzer.
(Floyd Dowell, telephone: 785-776-2753, email: fdowell@gmprc.ksu.edu)

- **Male and Female Red Flour Beetles Respond Differently to Pheromone Traps.** The red flour beetle is a major pest of food processing facilities and warehouses, but the pheromone lure used for the monitoring of this insect is widely perceived as not very effective. We are investigating how red flour beetle adults behave around pheromone traps by asking: over what range are insects attracted, what is the probability of capture, and how is insect response to traps influenced by the use of different combinations of attractant (pheromone, food oil, or pheromone + food oil combinations)? Results to date indicate that females are more likely to be captured in traps with the pheromone and food oil combination, but males are more likely to be captured in traps with

pheromone alone. However, even when looking at only the best attractant for a given sex, only 25% of individuals released 25 cm from the trap were captured. Further experiments will be performed to determine how mating status, starvation level, and air movement influence responsiveness to the traps. With this information we will be better able to implement and interpret monitoring programs.
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- **New Tool Developed for Plant DNA Analysis.** A high-throughput DNA extraction procedure was developed for wheat that can be applied without requiring greenhouse space or long growing periods. Seeds were germinated in 8-well tissue culture plates and 4-day-old seedling tissue was used to extract the DNA using sodium hydroxide methodology. Approximately 1 microgram of DNA was isolated per 10 milligrams of tissue at a cost of about $ 0.10. The DNA quality was found to be consistent with that obtained from either fresh or stored tissue extracts. This technique allows one person to extract nearly 1,000 stable DNA samples daily at a very low cost. (John Fellers, telephone: 785-532-2367, email: jpf@alfalfa.ksu.edu)

- **Update on the Area-Wide Integrated Pest Management (IPM) Project.** For the past 4 years, an area-wide IPM project for stored grain was developed and tested in 20 grain elevators in Kansas and Oklahoma. During this study, we have taken thousands of grain samples in concrete elevator silos. We found that there is little correlation between the need to fumigate because of the presence of large numbers of insects and whether or not the grain is actually fumigated. Fumigations tended to be based on past experience or were calendar-based. True integrated pest management requires insect sampling, risk benefit analysis and, often, the use of multiple control tactics. In the study, moving grain samples, probe trap, and vacuum probe samples were compared. We found that the best sampling method for estimating insect density without moving the grain was the vacuum sampler. In new grain, insect densities were highest in the top half of the grain mass and decreased with depth. Sampling the top 12 meters instead of the entire 30 meters greatly reduced sampling time.
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- **New Gene for Wheat Curl Mite Resistance is Mapped.** Wheat curl mite (WCM) is a serious pest of wheat in North America. It is the only vector known to transmit wheat streak mosaic virus which consistently reduces wheat yields. Genetic resistance to WCM has shown direct and indirect suppression of mites and wheat streak mosaic virus in the field. We mapped a new gene, designated Cmc4, in common wheat that provides resistance to six known strains of WCM. Our analysis showed that Cmc4 is located on chromosome 6D and is inherited as a single dominant gene. (Gina Brown-Guedira, phone: 785-532-7260, email: gbg@ksu.edu)

- **High Speed Sorter Detects Karnal Bunt and Wheat Color.** A high-speed optical sorter was used to remove kernels infected with Karnal bunt from 1800 g wheat samples in less than one minute per sample. When the sorter removed about 8% or more of the sample, the reject portion contained 100% of the bunted kernels. Concentrating the bunted kernels in a smaller sample size reduced sample inspection time and inspection errors. One high-speed sorter can process up to

8800 kg per hour. As a result, bunted kernels can easily be removed from large lots of grain. The sorter was also used to remove red wheat from hard white wheat stock. This is particularly advantageous for removing red wheat from early-generation white wheat breeder samples. Removing red seed from breeder samples reduces the amount of red wheat in subsequent generations and it also helps insure the purity of harvested wheat.
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