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RESEARCH Kernels

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- **Near Infrared (NIR) Attachment Detects Scab in Wheat.** Scab is caused by the mold Fusarium graminearum that affects wheat primarily in wet, cool years. This mold also produces vomitoxin. Using a Perten Instruments Single Kernel Characterization System with an NIR attachment, all kernels identified by the Federal Grain Inspection Service as scab-damaged were correctly classed by the system. In 3-4 minutes, the automated system could determine the number of scab-damaged kernels and the percent of scab-damage in the sample based on kernel weight. In addition, the automated system provides a technique for rapid estimation of vomitoxin and ergosterol levels in single wheat kernels. (Floyd Dowell, phone: 785-776-2753, email: fdowell@usgmrl.ksu.edu)

- **NIR Prediction of Insoluble Glutenin Content in Wheat Flour.** Insoluble glutenins are known to play an important role in bread baking and are directly related to dough strength. Flour from 100 Hard Winter Wheat samples grown in two different federal nurseries from 1993 to 1995 was analyzed for gliadin, soluble glutenin, and insoluble glutenin content using high performance liquid chromatography (HPLC). Values for insoluble glutenins predicted using NIR correlated with actual HPLC measured values with an $r^2 = 0.83$. These results indicate that NIR may be useful for glutenin measurements in plant breeding programs and where rapid screening of large numbers of flour samples is needed. (Okkyung Chung, phone: 785-776-2703, email: okchung@usgmrl.ksu.edu)

- **Patent Issued and Research Grant Received for Novel Biopesticide Used for Crop Protection.** Dr. Karl Kramer and others received a U.S. Patent (S/N 08/524,051) entitled RECOMBINANT CHITINASE AND USE THEREOF AS A BIOCIDE. Chitinase is an enzyme that degrades the polysaccharide, chitin, found in the guts and exoskeletons of insects and cell walls of fungi. Several crops are being genetically engineered to express a protein encoded by an insect chitinase gene incorporated into plants in order to provide resistance to insects and fungal diseases. Dr. Kramer and Dr. Muthukrishnam, a biochemist at Kansas State University, also received $190,000 from the USDA National Research Initiatives Competitive Grant Program to continue work on the improvement of this and other biopesticides. (Karl Kramer, phone: 785-776-

2711, email: kramer@usgmrl.ksu.edu)

- **Comparison between Mixograph Characteristics using Conventional and Computerized Analytical Methods.** Mixograms from 642 flour samples were analyzed for mixograph mix time and mixing tolerance using conventional methods involving human experts and for ten parameters using Mix-Smart software. Conventional mixograph mix times were most highly correlated with peak times (r=0.89) from the Mix-Smart software. Mixing tolerance was most highly correlated to the tail width at 6 minutes (r=0.81) from the software analysis. Prediction equations for mix time and tolerance were developed from software values using 221 samples for calibration and 117 samples for validation. Values of r^2 obtained for the validation sample set were 0.85 for mixograph mix time, 0.84 for bake mix time, and 0.72 for mixing tolerance indicating that computer software can correctly predict conventional mixograph values. (Okkyung Chung, phone: 785-776-2703, email: okchung@usgmrl.ksu.edu)

- **Effects of Extraction Methods on Lipid Functions in Reconstituted Flour.** Lipids from three representative wheat flours were extracted using four separate techniques. These techniques included normal Soxhlet extraction with petroleum ether, a new enhanced solvent extraction with petroleum ether, supercritical fluid extraction with carbon dioxide alone, and supercritical fluid extraction with carbon dioxide and ethanol. Defatted flours were mixed with lipid fractions to form reconstituted flours. Only reconstituted flours using Soxhlet extracted lipids showed fully restored properties of bake mix time, loaf volume, and crumb grain score when compared to control flours. Thus, while supercritical fluid extraction is a fast, convenient, safe method for measuring free lipid content in flours, it is not recommended for studying the roles of free lipids in baking quality. (Okkyung Chung, phone: 785-776-2703, email: okchung@usgmrl.ksu.edu)

- **How Parasitic Wasps Locate Insect Pests in Grain.** Female wasps (Cephalonomia tarsalis) were studied to determine how they locate the sawtoothed grain beetle larva in stored grain. Results clearly showed that the female wasps used their antennae to detect and follow chemical trails left by the larva. Vision played only a limited role in finding and recognizing the larva. Once the wasp located the larva, movement of the larvae triggered a stinging attack. The wasp did not recognize or attack larvae from other species of grain insect pests. Biological control of insect pests in stored grain using these very small parasitic wasps (adults are approximately 1/8" long) offers many advantages over using conventional insecticides. (Ralph Howard, phone: 785-776-2706, email: howard@usgmrl.ksu.edu)

- **Test of the Effectiveness of Encapsulated Cyfluthrin.** A new encapsulated form of the pesticide, cyfluthrin, was applied to Hard Red Wheat at levels of 0.5, 1.0, 2.0, and 4.0 parts per million (ppm) and treated samples were stored for eight months at 20, 25, 30, and 35 degrees C. Samples were assayed for insecticide effectiveness using rice weevils. Storage temperature had no effect on insecticide potency. Higher concentrations showed the expected increases in killing power which decreased with time. At 0.5 ppm, approximately 38% of the rice weevils survived exposure to grain which had been stored for two months. This value increased to approximately

70% survival after the treated grain had been stored for eight months. At 4.0 ppm, survival values ranged from less than 1% after 2 months of storage to approximately 10% survival after 8 months of storage. This insecticide is not currently registered for use on stored wheat. (Frank Arthur, phone: 785-776-2783, email: arthur@usgmrl.ksu.edu)

- **Natural Insect Resistance of Oats.** Twelve of the most common oat varieties grown in the U.S. including Brawn, Don, Dumont, Hytest, Jerry, Milton, Newdak, Otana, Paul, Riel, Robert, and Valley were tested for their resistance to the flat grain beetle, red flour beetle, and sawtoothed grain beetle. Both whole oats and crushed samples were tested. All crushed oats supported growth and reproduction of the insects. Some varieties of whole oats were almost totally resistant to the insects while others supported population levels comparable to those obtain on crushed oats. We are examining the chemical and physical characteristics of the resistant varieties to find out why they are resistant. (Jim Throne, phone 785-776-2796, email: throne@usgmrl.ksu.edu)

- **Effectiveness of Different Diatomaceous Earth Formulations as Insecticides.** Four diatomaceous earth formulations and one calcium carbonate formulation were evaluated in combination with high temperature as a control method for red flour beetles. At 34 degrees C (93 F), exposure to the dusts for 15 or 30 minutes did not increase mortality over untreated controls. At 50 degrees C (122 F), dust exposure increased mortality from 8 to 100% depending on the formulation. The calcium carbonate was not effective at either temperature. (Alan Dowdy, phone: 785-776-2719, email: dowdy@usgmrl.ksu.edu)

Mention of firm names or trade products does not constitute endorsement by the U. S. Department of Agriculture over others not mentioned.