



# RESEARCH Kernels

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- **Five-Year Area-Wide Integrated Pest Management Project Funded.** A 5-year Area-wide integrated pest management (IPM) project was recently funded by ARS to determine whether more uniform application of insect pest management across the marketing system reduces insect problems in stored wheat. The project is a collaboration of USDA-ARS-GMPCRC, Kansas State University, and Oklahoma State University and will involve elevator networks in Kansas and Oklahoma. The objective of the project is to implement a state-of-the-art stored-wheat IPM program that will reduce the frequency of pesticide use, the cost of pest management, and the risk of insect problems. (D. W. Hagstrum, phone: 785-776-2718, email: [hagstrum@usgmrl.ksu.edu](mailto:hagstrum@usgmrl.ksu.edu))
- **Novel Biopesticides for Insect and Fungal Pests are Being Programmed into Plants.** Tobacco plants have been genetically engineered to express novel insect control genes. Two specific examples of these genes code for chitinase and avidin. Chitinase is an enzyme that degrades structural components in the insect gut. Avidin is a protein that binds to the vitamin biotin and interferes with an insect's ability to produce energy from its food. Tobacco was used as a model system as a first step in developing these techniques in cereals because it is much easier to manipulate than wheat, corn, etc. The expression of these genes alone or in combination with other defense proteins confers resistance to insect and fungal pests. Similar work is now being done in the more genetically complex wheat, corn, rice and sorghum plants. (K. J. Kramer, phone: 785-776-2711, email: [kramer@usgmrl.ksu.edu](mailto:kramer@usgmrl.ksu.edu))
- **Heat Sterilization Plus Diatomaceous Earth for Insect Pest Management.** With the impending loss of methyl bromide as a structural fumigant for insect management in the food processing industry, many companies are reconsidering heat sterilization. To enhance insect mortality, diatomaceous earth (a powdery material containing broken shells from ancient sea microorganisms) may be applied in combination with high temperature to improve control. A synergistic effect of diatomaceous earth plus heat was observed; insects died faster and at lower temperatures. These results imply that the cost of heat treatment may be reduced and insect control effectively improved through the combined use of heat and diatomaceous earth. (A. K. Dowdy, phone: 785-776-2719, email: [dowdy@usgmrl.ksu.edu](mailto:dowdy@usgmrl.ksu.edu))

- **Resistance of Corn Hybrids to Maize Weevils.** We determined the resistance of 72 commercial corn hybrids to maize weevils. The numbers of weevils produced and developmental times varied greatly on the corn hybrids tested. Approximately half of the hybrids exhibited significant levels of resistance to weevils. This information will help us determine why these varieties are resistant which may lead to the development of additional control methods. It also can be used by corn growers to select hybrids for planting that will produce corn that is resistant to stored-grain insects. (J. E. Throne, phone: 785-776-2796, email: [throne@usgmrl.ksu.edu](mailto:throne@usgmrl.ksu.edu))
- **Wheat Protein Analysis Update.** Wheat proteins were separated by a two-dimension high resolution system. It involved reversed-phase high-performance liquid chromatography in the first dimension and free zone capillary electrophoresis in the second. Both techniques are automatable and provide digitized data for optimum data analysis. Results obtained will help us further define the role of specific proteins in wheat end-use quality. (G. L. Lookhart, phone: 785-776-2736, email: [george@usgmrl.ksu.edu](mailto:george@usgmrl.ksu.edu))
- **Baking Stability of Antioxidants.** In cooperation with Kansas State University, bread was fortified with three antioxidants: ascorbic acid, beta carotene, and tocopherol. Freshly baked pup loaves retained 76%, 67% and 96% of added antioxidants, respectively. (O. K. Chung, phone: 785-776-2703, email: [okchung@usgmrl.ksu.edu](mailto:okchung@usgmrl.ksu.edu))
- **Milling and Baking Results from 1998 HRW Samples.** In cooperation with Kansas State University, the milling and bread-baking qualities of 38 hard winter wheats commonly grown in Kansas during 1996 were evaluated and reported in a technical bulletin. Seven cultivars were scored as having "exceptional quality," sixteen were found to have "acceptable quality," and fifteen had "less desirable quality." (O. K. Chung, phone: 785-776-2703, email: [okchung@usgmrl.ksu.edu](mailto:okchung@usgmrl.ksu.edu))
- **Increased Funding for Wheat Genetics Research.** The Plant Science and Entomology Research Unit received an increase in base funding of \$500,000 for research on new and emerging pests of wheat. A molecular Plant Pathologist position was established to develop molecular markers to assist in breeding for Karnal Bunt resistance. The deadline for applications is May 6, 1998. In addition, an Entomologist will be hired to replace the retiring J. Hachet and to continue the Hessian fly program. (M. G. Eversmeyer, phone: 785-532-6168, email: [mge@rust.pp.ksu.edu](mailto:mge@rust.pp.ksu.edu))
- **Wheat Rust Prediction Models Have Been Developed.** Models were constructed to forecast the overwintering of wheat leaf rust using deviations for average temperature and moisture. When applied prior to planting in the fall, these models are about 70% accurate at predicting rust epidemics. Overwintering leaf rust provides the primary inoculum to start epidemics which may cause economic reductions in wheat yields. Yield losses are always greater than two percent when leaf rust has overwintered in a field or wheat production area. Work is continuing to test

and validate these models prior to their release. (M. G. Eversmeyer, phone: 785-532-6168, email: [mge@rust.pp.ksu.edu](mailto:mge@rust.pp.ksu.edu))

- **Alfalfa Pollen Dispersion Study.** Alfalfa pollen was shown to travel at least 1000 meters, and almost certainly is carried farther than that distance. This information is vital for making policy decisions regarding the regulation of patented genes in transgenic crop production. (D. Z. Skinner, phone: 785-532-7247, email: [dzs@rust.pp.ksu.edu](mailto:dzs@rust.pp.ksu.edu))
- **NIR Analysis Attachment for the Single Kernel Wheat Characterization Instrument.** A Perten Single Kernel Wheat Characterization System, Model 4100, was modified to accept an NIR analysis attachment. Preliminary studies with the modified instrument show that it can detect red versus white kernels with 99% accuracy compared to the bleach test; recognize diseased (bunted) kernels with 93% accuracy; measure single kernel protein relative to combustion Nitrogen analysis with a  $r^2$  value above 0.90; measure moisture relative to the air oven with a  $r^2$  value above 0.95; and detect the presence of the 3<sup>rd</sup> or 4<sup>th</sup> instar internal insect infestation with a 95% accuracy. Future studies will center on continued validation of these results as well as attempts to predict several milling and baking quality parameters. (F. E. Dowell, phone: 785-776-2753, email: [fdowell@usgmrl.ksu.edu](mailto:fdowell@usgmrl.ksu.edu))
- **Physical (flat plate crushing) Properties of Single Corn Kernels.** Two populations of corn kernels were prepared. One was dried at high temperature and the other at low temperature. Stein hardness values for the two populations were widely different. Means of single kernel crushing forces also were different for the two populations, but kernel to kernel variability was so large that this test would not be able to detect kernels of high temperature dried corn blended in with low temperature dried samples. (C. R. Martin, phone: 785-776-2730, email: [chaz@usgmrl.ksu.edu](mailto:chaz@usgmrl.ksu.edu))

**Kernels**

Grain