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Research Kernels

Our Latest Research Results - December 2010

Application of Binomial and Multinomial Sero–Surveillance of Rift Valley Fever in Wildlife in the Risk Areas of Kenya

Authors: Y.S. Binepal, W.M. Karithi, W.C. Wilson, L.O. Ateya, A.A. Oriko, S. Gacheru
Submitted to: Emerging Infectious Diseases
Rift Valley Fever (RVF) is a sub-Saharan African animal and human disease that occurs in periodic outbreaks causing economic impact and can lead to death of infected animals and to a lesser extent, humans. A virus causes the disease that is primarily associated with sheep, goats and cattle but has been show to infect wildlife as well. This study demonstrated an increase in exposure of wildlife to this virus prior to an outbreak in 2006-7 suggesting that wildlife are important in maintenance of the virus between outbreaks. Continued surveillance of wildlife may further support this suggestion and could lead to an early warning of the next disease outbreak.
Contact William Wilson, telephone 785-537-5570, email william.wilson@ars.usda.gov

Association Analysis Reveals Effects of Wheat Glutenin Alleles and Rye Translocations on Dough-Mixing Properties

Authors: S. Zheng, P.F. Byrne, G. Bai, X. Shan, S.D. Reid, S.D. Haley, B.W. Seabourn
Submitted to: Journal of Cereal Science
The glutenin loci of wheat (*Triticum aestivum* L.) are important determinants of bread-making quality, although the effects of alleles at those loci are incompletely understood. We applied an association analysis method to assess the effects of glutenin alleles and 1RS wheat–rye (*Secale cereale* L.) translocations on dough-mixing properties in 96 wheat cultivars and advanced lines grown at three Colorado locations while accounting for population structure and relatedness of individuals in the population. The results indicated that (1) in the majority of cases, controlling relatedness of individuals reduced the significance of associations between glutenin loci and mixograph traits; (2) the Glu-D1 and Glu-B3 loci and 1RS translocations had greater impacts on dough-mixing properties compared to other glutenin loci; (3) Glu-B1w, Glu-D1d, and Glu-B3b were consistently associated with greater (more favorable) mixograph peak time (MPT) than other alleles at the respective loci, whereas Glu-B1e, Glu-D1a, and Glu-B3c were associated with reduced MPT; (4) the 1BL.1RS translocation was associated with a decrease in mixograph properties. Our results indicate that taking multiple-level relatedness of individuals into account can improve the results of association analysis for wheat-quality traits.
Contact Brad Seabourn, telephone 785-776-2751, email brad.seabourn@ars.usda.gov

Response of *Tribolium castaneum* and *T. confusum* Adults to Black Shapes and its Potential to Improve Trap Capture

Authors: A.A. Semeao, J.F. Campbell, R.J. Whitworth, P. Sloderbeck
Submitted to: Journal of Stored Products Research
The red flour beetle (*Tribolium castaneum*) is a major pest of food processing and storage facilities, especially flour mills, and can be monitored using pheromone and food-baited traps, although attraction to traps is relatively low. Increasing beetle response to traps could improve the utility of these traps in monitoring programs. In laboratory experiments, the potential to increase beetle captures in traps by adding tall black shapes as an additional attractant was evaluated. Against a white background, beetles were more likely to visit black pillars than white pillars when presented with a choice. Beetle captures in pheromone and food-baited traps placed in front of tall and narrow black panels was shown to be greater than captures in traps in front of white panels in a series of experiments. A similar pattern of capture was also found for a closely related species, the confused flour beetle (*Tribolium confusum*). Our results suggest that captures of this important pest in monitoring traps could be increased by adding dark vertical shapes behind trap locations or placing traps near dark structures, although further evaluation in food facilities is needed to determine the extent of the benefit.
Contact James Campbell, telephone 785-776-2717, email james.campbell@ars.usda.gov

Probability Statistics to the Sampling Design Process of a Global Grain Tracing and Recall System

Authors: K.-M. Lee, P.R. Armstrong, A. Thomasson, R. Sui, M. Casada, T.J. Herrman
Submitted to: Food Control
Section 306 of the Bioterrorism Act of 2002 administered by the Food and Drug Administration requires grain to be traced one step forward and backward. For a commercial grain storage facility serving as the first collection point, tracing grain back to the farms of origin and forward to a terminal grain elevator or processor is an essential requirement. The EU General Food Traceability Regulation (EC/178/2002) requires labeling

and traceability for food and feed, including biotech grains and grain products, and identifying immediate suppliers or customers of the product. The use of small, coded, pill-sized tracers embedded in grain are proposed as one method for grain traceability. There is a trade-off though in a tracer system between tracer concentration and the amount of sampling required to obtain confident identification. As such, a statistical sampling process for traceability was designed and tested using a science-based sampling approach with the goal of accurately identifying grain in mixed lots. Sampling tests were conducted at predefined sampling points in a commercial-scale grain facility during simulated grain transportation and storage. Five lots of grain with different coded tracers were used. Conclusions of this study showed statistical predictions of grain mixing from sampling and known conditions were similar. Insignificant segregation of tracers in bin and truck operations was also observed. The sampling process was proven to be effective and provides assurance for accurately identifying grain origin.
Contact Paul Armstrong, telephone 785-776-2728, email paul.armstrong@ars.usda.gov

Development and Characterization of Food-Grade Tracers for the Global Grain Tracing and Recall System

Authors: K.-M. Lee, P.R. Armstrong, A. Thomasson, R. Sui, M. Casada, T.J. Herrman
Submitted to: Journal of Agricultural and Food Chemistry
Grain traceability is mandated by the Food and Drug Administration Bioterrorism Act of 2002. Achieving this in a commodity which is bulk handled and mixed with other sources of grain presents a significant challenge. Small pill-sized tracers, uniquely encoded and embedded in grain, are proposed as one method for grain traceability during handling and storage. To address the physical harshness of a grain handling environment, prototype tracers were manufactured and tested for physical strength properties. Tracer formulations and manufacturing processes were developed and used to produce tracers from food-grade starch, cellulose and sugar with different protective coatings. Components were chosen so that they would not be considered an adulterant to grain. Physical property tests were conducted on tracers to evaluate the relative strength of each formulation and the effect of moisture adsorption. In general all tracers were considered to have sufficient strength properties to withstand grain handling. Sugar based tracers were shown to be more susceptible to deterioration in humid environments and are considered less suitable than either the starch or cellulose based tracers. Protective coatings slowed moisture adsorption substantially and provided abrasion resistance. While still under development, this technology shows promise as a method to provide positive identification of grain.
Contact Paul Armstrong, telephone 785-776-2728, email paul.armstrong@ars.usda.gov

Rapid Mobilization of Membrane Lipids in Wheat Leaf-Sheathes During Incompatible Interactions with Hessian Fly

Authors: L. Zhu, X. Liu, H. Wang, C. Khajuria, J.C. Reese, J.R. Whitworth, R. Welti, M.S. Chen
Submitted to: Plant Journal
Host plant resistance is the most effective way to control Hessian fly (HF), an important pest of wheat. However, resistance in current wheat cultivars is short-lived, usually lasting for only 6-8 years. To develop more durable resistant wheat varieties, we need a better understanding of the resistance mechanisms at the molecular level. In this study, we discovered that there was rapid mobilization of membrane lipids in resistant plants following HF attack. The mobilized membrane lipids were likely converted into defense-related products such as polyunsaturated free fatty acids, oxylipins, and components of cuticle wax. Our results suggest that rapid mobilization of membrane lipids may constitute an important step in wheat defense against HF attack. This research provides a foundation for future research on the role of lipids in wheat resistance to HF, which may lead to practical application in resistant wheat breeding.
Contact Ming Shun Chen, telephone 785-532-4719, email ming-shun.chen@ars.usda.gov

USDA-ARS Center for Grain and Animal Health Research

1515 College Avenue
Manhattan, KS 66502

800-627-0388
ars.usda.gov/npa/cgahr