

Our Latest Research Results - June 2011

Occurrence and Yield Effects of Wheat Infected with Triticum Mosaic Virus

Authors: D.L. Seifers, J.T. Martin, J.P. Fellers

Submitted to: Plant Disease

Triticum mosaic virus (TriMV) was discovered recently and little is known about the virus' biology and potential to cause yield reductions. TriMV has been found all across the Great Plains and this study examined whether TriMV infection would re-occur at three specific locations in Kansas over a three year time period. The study also evaluated the effect on yield on numerous varieties. TriMV was inoculated at three Kansas locations in 2007 and over time could only be found in two locations in 2008, and one location in 2009 indicating that infection rates will be different from year to year. Yearly variation was not unique to TriMV as Wheat streak mosaic virus (WSMV) and High Plains virus also fluctuated from year to year. At one location in particular in 2009, 85% of the wheat 1.6 km from one site was infected with both TriMV and WSMV, even though only 3% was infected at this study site. Significant reductions in yield and bulk weight were found in Danby, RonL, and Jagalene, three wheat varieties grown on large acreages in Kansas. An experimental line KS96HW10-3 did not have any reductions and appears to have some resistance to TriMV. Overall, this study indicates that TriMV infection rates will tend to vary over time, but TriMV will cause significant yield reductions when infections rates are high in susceptible lines.

Contact John Fellers, telephone 785-532-2367, email john.fellers@ars.usda.gov

Protein and Quality Characterization of Complete and Partial Near Isogenic Lines of Waxy Wheat

Authors: R.S. Jonnala, F. MacRitchie, V.W. Smail, B.W. Seabourn, M. Tilley, D. Lafiandra, M. Urbano

Submitted to: Cereal Chemistry

Waxy wheats have found application in the production of modified starches, as blends in flour for superior noodle quality, and in enhanced bread making performance. Starch based properties such as pasting and gelatinization differ between waxy, partial waxy and non-waxy wheats. However, except for starch properties, there is limited information about the quality characteristics of partial waxy and complete waxy wheats. There is an obvious need to study waxy wheat protein composition and its effects on dough and end-use product quality. In this study, the effect of waxy and partial (single and double null) waxy proteins on flour quality and physical dough testing parameters using two sets of near isogenic lines developed in a durum wheat cultivar (Svevo) and a bread wheat line was evaluated. Results showed that loaf volume, which is an

important bread making quality, was highest with 100% waxy wheat flour and was not improved with 50% blending with commercial bread wheat flour. However, dark color and poor appearance with large gas cells in the internal crumb were observed with 100% waxy flour; this is unacceptable to consumers of traditional pan bread. In terms of protein composition, waxy wheats have relatively lower albumins/globulins than regular wheat. Dough strength parameters such as MDDT and Rmax were poorly correlated with UPP whereas loaf volume and extensibility were highly and positively correlated with FPP and PPP. Contact Brad Seabourn, telephone 785-776-2751, email brad.seabourn@ars.usda.gov

Evaluation of Sorghum Flour as Extender in Plywood Adhesives for Sprayline Coaters or Foam Extrusion

Authors: M.P. Hojillaevangelist, S. Bean

Submitted to: Industrial Crops and Products

In this research, we tested sorghum flour as a protein extender in plywood glues for sprayline coater or foam extrusion. The biorenewability of sorghum and competitive price of its byproducts make the adhesive attractive to plywood manufacturers as alternative glue. We first analyzed the solubility and foaming properties of sorghum flour protein to predict its behavior under the highly caustic conditions of plywood adhesive. We then substituted the sorghum flour for the extender in the industry sprayline glue mix (wheat flour) on a protein content basis and determined its mixing and bonding properties. The adhesive containing sorghum flour had mixing properties and appearance that were superior to those of the standard wheat flour-based plywood glue, but its viscosity and bond strength were markedly less. To resolve these problems, we doubled the amount of sorghum flour in the glue mix to increase its protein contribution. Both viscosity and adhesion strength of the modified sorghum-based plywood glue were significantly improved to acceptable levels. The modified sorghum flour-based plywood glue also produced substantial foam that remained stable up to 3 h. These results demonstrated that sorghum flour is a viable extender in plywood glues for sprayline coater or foam extrusion. The manufacture of this sorghum flour-based adhesive will expand the 2.4 million metric tons of sorghum that is allocated for combined food, seed, and industrial use (of which such industrial products account for a minimal amount), and thus will generate more income to U.S. sorghum growers.

Contact Scott Bean, telephone 785-776-2725, email scott.bean@ars.usda.gov

Effects of Transglutaminase on the Rheological and Noodle-making Characteristics of Oat Dough Containing Vital Wheat Gluten or Egg Albumin

Authors: F. Wang, W. Huang, Y. Kim, R. Liu, M. Tilley

Submitted to: Journal of Cereal Science

The use of oats (*Avena sativa* L.) in foods has received increased interest due to their nutritional value (e.g. high in soluble dietary fiber, proteins, unsaturated fatty acids, vitamins, minerals and other nutrients). A substantial amount of the dietary fiber of oats comes from β -glucan (mixed linkage (1-3)(1-4)- β -D-glucan), a cell wall polysaccharide that can reduce the concentration of serum cholesterol, attenuate blood glucose level, slow insulin response in the blood, and maintain the balance of intestinal flora. Furthermore, the FDA reports the positive role of soluble dietary fiber from oats in reducing the risk for coronary heart diseases. Utilization of oats in baked products is limited due to the inability of oat flour to form cohesive, viscoelastic dough, such as the gluten network of wheat dough. The addition of proteins from other food sources and/or enzymes to food ingredients is often used to improve the quality, texture, and storage stability of products. Addition of the enzyme transglutaminase (TGase) to dough systems results in an increase in the elasticity, water-holding capability, and other functional properties of end-products. In this study, oat dough containing 15% vital wheat gluten (VWG) and oat dough containing 15% egg albumin (EA) were used to produce oat noodles with or without gluten (gluten-free), respectively. TGase was added to examine the effects on the noodle-making characteristics and overall quality of the oat noodles. Adding 1.0% TGase to oat dough with or without the addition of VWG or EA improved the cooking quality, reduced the cooking loss, and enhanced the hardness and springiness of the noodles. This research has shown that it is possible to produce oat noodles both with and without gluten (gluten-free) and has provided an essential foundation for development of other oat products.

Contact Michael Tilley, telephone 785-776-2759, email michael.tilley@ars.usda.gov

Development of a Small-Scale Hybrid Sodium Dodecyl Sulfate-Solvent Retention Capacity-Sedimentation Method to Rapidly Predict Breadmaking Quality of Hard Winter Wheat Breeding Samples

Authors: B.W. Seabourn, Z.S. Xiao, M. Tilley, T.J. Herald, S. Park

Submitted to: Cereal Chemistry

Wheat gluten provides unique functional properties to bread dough in terms of end-use quality. Breeders and processors need tests that more rapidly and accurately evaluate wheat gluten quality. A small scale sedimentation method was developed to expedite the analysis time for predicting hard winter wheat protein quality. The method was developed by combining the sodium dodecyl-sulfate (SDS) sedimentation method (AACC 56-70) and solvent retention capacity (SRC) test method (AACC 56-11) to create a hybrid method that is both rapid and small scale. The new method was able to simultaneously test wheat samples in 66% less time

compared to the AACC method and HWWQL sedimentation methods. Furthermore, sample size was reduced from 6 g for the AACC method to 1 g for the hybrid SDS-SRC method. In addition, the SDS-SRC exhibited a higher correlation to loaf volume compared to the HWWQL method. Due to enhanced speed, accuracy, and simplicity, the Hybrid SRC-SDS sedimentation method may prove useful in breeding programs and other scenarios where rapid assessment of end-use quality determinations is required.

Contact Brad Seabourn, telephone 785-776-2751, email brad.seabourn@ars.usda.gov

Influence of Age, Mating Status, Sex, Quantity of Food, and Long-Term Food Deprivation on Red Flour Beetle (*Coleoptera: Tenebrionidae*) Flight Initiation

Authors: J. Perez-Mendoza, J.F. Campbell, J.E. Throne

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The red flour beetle is one of the major pests in stored grain and in grain processing facilities throughout the world. Traps are used to monitor their movement to aid in making pest management decisions, but we don't fully understand the factors that cause their movement. We found that older beetles were less likely to fly whether or not food was present, but more beetles flew when there was no food present than when provided with food. Both mated and virgin beetles were equally likely to fly when food was present, while mated beetles were more likely to fly than virgin beetles when there was no food present. More beetles flew when little or no food was present, but fewer beetles flew the longer they were starved. Our results suggest that *T. castaneum* uses flight as a mechanism to disperse to new environments during almost any part of their life span, unlike some other stored-product beetles that fly mostly when they are young. These results will help to develop better methods for interpreting trap catches from pest monitoring programs.

Contact James Throne, telephone 785-776-2796, email James.Throne@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

