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Center for Grain & Animal Health Research

Research Kernels

Our Latest Research Results - October 2011

Digestibility of Rice (*Oryza Sativa* L.) Flours and Starches Differing in Amylose Content

Authors: L-J Zhu, Q-Q Liu, J.D. Wilson, M-H Gu, Y-C Shi

Submitted to: Journal of Agricultural and Food Chemistry

Rice is second only to maize in world production and a primary staple in Asia. The objectives of this study were to determine the digestibility of rice starches with a wide range of amylose content, including a newly developed rice variety with greater than 50% amylose content. Amylose content was positively correlated with resistant starch and total dietary fiber content in rice flours containing from 1.7 to 55% amylose. Compared to low-amylose rice and waxy rice starches, the intermediate-amylose rice starch had a higher proportion of amylose as well as longer amylopectin chains. These chains have the ability to form more stable double helices and stronger crystallites reducing enzyme access. The newly developed high-amylose rice (55%) showed a predominantly B-type x-ray pattern, greater proportion of long amylopectin branch chains, a higher gelatinization temperature and semi-compound starch granules which may be attributed to it increased resistance to starch digestion. Determining factors affecting starch digestibility is critical with regard to creating unique functional and nutritional foods.

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Ethanol Production Performance of Ozone Treated Tannin Grain Sorghum Flour

Authors: S. Yan, X. Wu, J. Faubion, S. Bean, L. Cai, Y-C Shi, X.S. Sun, D. Wang

Submitted to: Cereal Chemistry

In 2009, more than 30% of the U.S. grain sorghum crop was used for ethanol production. Virtually all of the current commercial sorghum lines in the U.S. are tannin-free, and as such little research has been conducted on ethanol production from these sorghum types. Interest in tannin sorghum utilization has increased recently as health benefits associated with tannins have been discovered. Tannin grain sorghum lines also have some agronomic benefits relative to non-tannin sorghums. However, tannin sorghum and its use for ethanol production is not desirable largely because of the adverse effects of the tannins. We tested the effect of ozone on tannin sorghum lines to overcome these negative effects. Ozonation not only decreased measured tannin levels, but also affected properties of sorghum flour and starch. Fermentation efficiency is an important parameter in evaluating the performance of a material for ethanol production, and ethanol fermentation efficiency from ozone-treated sorghum increased over 10% compared to controls. This indicates that ozonation has great impact on ethanol yield and fermentation efficiency and is an effective way to increase ethanol yield and shorten the fermentation process without decreasing ethanol yield.

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Near-Infrared Imaging Spectroscopy as a Tool to Discriminate Two Cryptic Tetramorium Ant Species

Authors: J. Klarica, L. Bittner, J. Pallua, C. Pezzei, V. Huck-Pezzei, F.E. Dowell, J. Schied, G.K. Bonn, C. Huck, B. Schlick-Steiner, F.M. Steiner

Submitted to: Journal of Chemical Ecology

Correctly identifying insect species is essential for many ecological studies. Some species are very similar but are particularly difficult to discriminate and thus understudied ecologically. The chemical structure differs between species, and we used imaging near-infrared spectroscopy (NIRS) to detect this difference in ants (*Tetramorium caespitum* and *T. impurum*). NIRS is a rapid and non-destructive technique. We conclude that discrimination of *T. caespitum* and *T. impurum* using imaging NIRS is possible, promising that imaging NIRS could become a time- and cost-efficient tool for the reliable discrimination of similar species.

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The Effect of Preservation Methods on Predicting Mosquito Age by Near-Infrared Spectroscopy

Authors: F.E. Dowell, A.E.M. Noutcha, K. Michel

Submitted to: American Society of Tropical Medicine and Hygiene

Malaria affects about 300 million people per year, primarily in developing countries. Mosquitoes must be about 8 days old to transmit malaria, thus it is important to determine the age structure of mosquito populations in order to determine the effectiveness of disease control programs. Current age-grading techniques require tedious dissections or RNA extraction. We developed a rapid technique using near-infrared spectroscopy to determine the age of fresh mosquitoes, but the requirement for fresh insects limits applications of this

technique. Thus, in this study, we investigate whether age can be predicted from preserved insects. Results from this study show that age can be predicted from mosquitoes preserved with desiccants, ethanol, Carnoy, RNAlater, or refrigeration with confidence intervals less than 1.4 days. The best results were obtained from mosquitoes stored using desiccants, RNAlater, or refrigeration.
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Evaluating Residual Activity of Methoprene and Novaluron as Surface Treatments to Control *Tribolium castaneum* and *Tribolium confusum*

Authors: F.H. Arthur, E.A. Fontenot
Submitted to: Journal of Insect Science
Insect growth regulators are insecticides that inhibit insect development but do not kill adults, and historically these insecticides are evaluated by incorporation into the diet of an insect, which may not reflect how they would be exposed in actual field situations. We tested different methods to assess susceptibility of the red flour beetle and the confused flour beetle, two common pests of stored products. Exposing larvae directly on plywood, floor tile, and concrete treated with methoprene showed that the red flour beetle was the more susceptible of the two species, as determined by whether or not the larvae were able to reach the adult stage. Control was poorest on concrete. We then exposed larvae on concrete treated with a new insecticide, novaluron, and the confused flour beetle was again more difficult to kill than the red flour beetle. In our final test, we exposed adult confused flour beetles with flour on concrete treated with both insecticides, gave the adults the opportunity to lay eggs, and determined production of offspring. Novaluron provided better control than methoprene. Results show that evaluating an insect growth regulator by allowing flour beetle larvae to be exposed on a treated surface or by letting adult flour beetles lay eggs on a treated surface and examining progeny production would be effective methods for assessing susceptibility of different insect species.
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Movement of *Rhyzopertha dominica* in Response to Temperature Gradients in Stored Grain

Authors: P.W. Flinn, D.W. Hagstrum
Submitted to: Journal of Stored Products Research
The lesser grain borer is one of the most common and damaging insect pests of stored wheat in the USA. In the autumn, the periphery of the grain bulk cools faster than the center, and this allows grain insects to continue to reproduce in the center. Very little is known about the movement of the lesser grain borer in temperature gradients in stored grain. ARS researchers in Manhattan, Kansas, studied the movement and temperature preference of the lesser grain borer in wheat using two temperature gradients. Beetles preferred moderate temperatures but avoided the highest and lowest temperature regions. Compared to other stored grain beetles, such as the rusty grain beetle, the lesser grain borer appears to move more slowly through the grain into preferred temperature regions, which could affect the beetle's ability to overwinter in bins of stored grain because they may die from cold temperatures on the periphery of the bin before they have a chance to move toward warmer grain in the center of bins.
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Impact of *Rhyzopertha dominica* (F.) on Quality Parameters of Milled Rice

Authors: F.H. Arthur, G.O. Ondier, T.J. Siebenmorgen
Submitted to: Journal of Stored Products Research
The lesser grain borer is a major pest of stored rough rice, but there are only a few recent studies that have assessed susceptibility of different rice cultivars to this insect. In this test, adult lesser grain borers were allowed to feed and breed for one week on Francis and Wells cultivars rough rice, two common commercial cultivars, harvested in two different crop years at moderate and low moisture contents. Progeny production was consistently greater in Francis than in Wells, which resulted in reduced rice milling yield and reduced head rice yield in Francis cultivar rice. Techniques were also described that could be used to further assess susceptibility of different rice cultivars to the lesser grain borer.
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