

Our Latest Research Results - October 2013

Kafirins are Key Determinants of Bioethanol Conversion Efficiency in Sorghum

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Submitted to: Cereal Chemistry

Grain sorghum is a highly water and nutrient efficient cereal grain that has potential to an important feedstock for bio-fuels production. Starch content in grains is a key component of ethanol fermentation, but at least in sorghum, proteins also play a role in governing fermentation efficiency. To test the hypothesis that kafirin (prolamin) seed storage proteins specifically influence the efficiency of biofuel production in sorghum, ten diverse genetic lines with allelic variation in the β -, γ - and δ kafirins, including three β -kafirin null mutants, were tested for ethanol conversion and fermentation efficiency. Our selected lines showed wide variation in grain biochemical features such as total protein, starch and free amino acid (FAN) content. Starch content and protein digestibility were positively correlated to overall ethanol yield and an increased FAN content enhanced fermentation efficiency. Investigation of the impact of kafirin on ethanol production indicated that variation in the β -kafirin allele is correlated to grain digestibility and FAN, with subsequent negative effects on ethanol yield. A large seeded variety, carrying a novel γ -kafirin allele, was rich in FAN and exhibited excellent short term fermentation efficiency, but produced a low overall ethanol yield predominantly due to low starch content. RP-HPLC profiling of the alcohol-soluble kafirin protein fraction in the seed endosperm revealed a significant relationship between a specific protein peak and grain digestibility, providing further evidence for direct links between seed protein composition and end-uses such as digestibility and bioethanol production.

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Development of a Non-commercial Sugar-free Barbeque Sauce

Authors: F. Aramouni, T. J. Herald, M. Abu Ghoush
Submitted to: Emirates Journal of Food and Agriculture
There are limited barbecue sauces available in the diabetic and reduced calorie consumer market. A sugar-free barbecue sauce was formulated and evaluated for physical, chemical, microbial and sensory properties. Five formulations were evaluated with different levels of artificial sweeteners and thickeners including; sucralose, acesulfame-K, xanthan gum, and modified waxy maize

starch. The barbecue sauce was shelf-stable and no microbial growth noted. This study showed that a consumer acceptable sugar-free barbecue sauce with properties closely comparable to a sugar containing control formula is possible for the diabetic and reduced calorie market.

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Substitution Distribution in Octenylsuccinic Anhydride-modified Waxy Maize Starch

Authors: B. Yanjie, R. C. Kaufman, J. D. Wilson and Y. C. Shi

Submitted to: Carbohydrate Polymers

Substituted starch is of great industrial and academic interest due to its significant improvements in starch functional properties. Octenylsuccinic anhydride (OSA)-modified starch has been suggested to affect many physical and chemical properties of starch, including the starch gelatinization behavior as well as enhancing emulsifying properties and increasing hydrophobicity. This study utilized various starch degrading enzymes to study the position of octenylsuccinic anhydride (OS) substitutions on waxy corn amylopectin chains. Various chromatographic methodologies were utilized to evaluate these enzymatic hydrollysates and develop a model for these substituted OS starch chains. OS-S-L (degree of substitution of 0.018%) had OS groups located close to the branching points of the amylopectin, whereas the OS substitution in OS-S-H (degree of substitution of 0.092%) occurred near the non-reducing ends as well as the branching points. This study provides us with critical information regarding food and industrial uses of OSA-modified waxy starches.

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Efficacy of Dinotefuran (Alpine® spray and dust) on six species of stored product insects

Authors: F.H. Arthur, E.A. Fontenot

Submitted to: Journal of Stored Products Research

Alpine® is a new insecticide that is being used to control urban insect pests, and is available as a pressurized spray or as a dust combined with diatomaceous earth (DE). There is no information regarding effectiveness on stored product insects. ARS scientists in Manhattan, KS, conducted tests with both products to determine effectiveness on different stored product insects. The

dust formulation was much more effective than the spray on all adult insects tested, but larvae were easily killed by both products. Results show this new insecticide can potentially replace older insecticides used to control stored product insects in milling and processing facilities.

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Development and preliminary evaluation of an improved Rift Valley fever real-time RT-PCR assay

Authors: W.C. Wilson, M. Romito, D.C. Jasperson, H. Weingartl, Y.S. Binopal, M.R. Maluleke, D. Wallace, P. van Vuren Jansen

Submitted to: Journal of Virological Methods
Rift Valley fever in Africa has had devastating effects on livestock and human health. In addition, this disease is a food security issue for endemic African countries. There is growing concern for the potential introduction of RVF into non-endemic countries. This study describes the development of a new assay based on genome amplification that is more robust than previous assays due to multiple gene targets and includes an amplification control to detect inhibitors that could affect the assay. The assay also includes a differentiate infected from vaccinated animal (DIVA) compatible marker for some RVF vaccines, which is useful for RVF endemic countries but especially important in non-endemic countries.

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Evaluation of Lamb and Calf responses to Rift Valley fever MP-12 vaccination

Authors: W.C. Wilson, B. Bawa, B.S. Drolet, C.J. Leihy, B. Faburay, D.C. Jasperson, L.M. Reister, N.N. Gaudreault, J. Carlson, W. Ma

Submitted to: Veterinary Microbiology
An important viral disease of animals and humans in Africa and the Middle East is a mosquito-transmitted disease called Rift Valley fever. The disease is of concern to international agricultural and public health communities. The RVF MP-12 strain has been the most safety tested attenuated vaccine strain; thus it is being considered as a potential vaccine for the US national veterinary stockpile. Although a lot of research has been done with RVF MP-12, especially in small animal models, the developers of the vaccine have conducted a majority of the studies involving target livestock species. This study was designed to establish safety protocols for large animal research with virulent RVF viruses, establish a target host immune response baseline using RVF MP-12 strain and independently evaluate this strain as a potential US emergency response vaccine. No clinical or febrile response was observed in this study. There was no significant pathology in the lambs; however, some pathology was observed in the calves. Whether this pathology is due to the attenuated vaccine or another cause is not known. This study has provided confirmation of our biosafety procedures and provides

independent and baseline information on RVF attenuated vaccination in vaccine-age target species. Contact William Wilson, telephone 785-537-5570, email William.Wilson@ars.usda.gov

Impact of marker ascertainment bias on genomic selection accuracy and estimates of genetic diversity

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Submitted to: PLoS ONE

To use molecular DNA markers in a breeding program for prediction of traits and selection of superior lines or to understand the diversity in germplasm collections, it is important that the molecular markers are an accurate representation of the overall population under study. Marker bias can arise when molecular markers are discovered in one set of material and then applied to a different set of lines. Newly developed methods for genotyping that rely on DNA sequencing have the advantage of discovering polymorphisms at the same time they are assayed in the population. Using this 'genotyping-by-sequencing' approach, a set of 365 winter wheat breeding lines was evaluated. These lines were also genotyped using DArT (Diversity Array Technology) markers. This is a fixed array platform that has formed the basis of most of our knowledge about cereals genetic diversity and is used for genomic selection. It was found that the GBS markers gave higher prediction accuracy for genomic selection and that relative to DArT markers, the GBS markers captured more of the genetic diversity in the population. There are many more GBS markers than DArT markers so an equal number of markers from each set were compared. When using equal number of markers there was no difference in prediction accuracy between GBS and DArT suggesting that the increased accuracy is largely due to having more markers in the GBS dataset. We conclude that GBS markers are a usable platform for genomic selection and a preferable platform for assessing genetic diversity due to the simultaneous discovery and typing of DNA polymorphisms.

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