USDA Research Kernels

Our Latest Research Results – December 2014

Registration of 'TAM 305' hard red winter wheat

Authors: A.M.H. Ibrahim, J. Rudd, R. Devkota, J. Baker, R. Sutton, B. Simoneaux, G. Opeña, R. Herrington, L. Rooney, L. Dykes, J. Awika, L.R. Nelson, A. Fritz, R.L. Bowden, R.A. Graybosch, Y. Jin, B.W. Seabourn, X. Chen, J. Kolmer, P. St. Amand, G. Bai, R. Duncan
Submitted to: Journal of Plant Registrations
The hard red winter wheat (HRW) cultivar 'TAM 305' was developed and released by Texas A&M AgriLife Research in 2012. TAM 305 was derived from the cross TX97V3006/TX98V6239. TAM 305 was released for its leaf, stripe, and stem rust resistance and also because of its excellent grain yield in the Blacklands and South Texas. Comparisons to the HRW quality targets showed that TAM 305 has average milling yield, very good wheat and flour protein, minimal mixing time, excellent water absorption and loaf volume, but below average mixing tolerance. Authorized seed classes of TAM 305 are Breeder, Foundation, Registered, and Certified. TAM 305 has been submitted for U.S. Plant Variety Protection with the certification option.
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Wheat mill stream properties for discrete element method modeling

Authors: A. Patwa, R.P.K. Ambrose, H. Dogan, M. Casada
Submitted to: Transactions of the ASABE
Monitoring all variables during wheat milling would be very challenging, but models are an effective substitute for physically monitoring these variables. Models save time and reduce the effort required to control each variable independently; however, previous statistical models were limited and an accurate model of individual particle behavior during the milling process is needed. We measured the physical and mechanical properties of wheat mill streams (wheat kernels, break stream, and wheat flour) that are required as input parameters for a discrete element method (DEM) model for the wheat milling process and determined the effect of moisture content (from 12 to 16% wet basis) on these properties. Moisture content had a greater effect on physical properties (bulk, true, and tapped densities and particle size) of the mill streams than it did on the mechanical properties (Young's modulus, coefficients of static and rolling friction, and coefficient of restitution). These property values can now be incorporated into a DEM model of the milling process that will help flour millers to more easily and consistently produce high-quality flour.
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Genotyping-by-sequencing markers identified a major gene conferring resistance to Hessian fly in bread wheat

Authors: G. Li, Y. Wang, M. Chen, E. Edae, J. Poland, E. Akhunov, S. Chao, G. Bai, B. Carver, L. Yan
Submitted to: BMC Genomics
The Hessian fly *Mayetiola destructor* is one of the most destructive pests of wheat. The insect pest is mainly controlled by developing resistant cultivars. However, the resistance conferred by specific resistance genes is often short-lived, lasting for only 6-8 years. A better understanding of the mechanisms that lead to wheat resistance to Hessian fly is needed in order to improve durability of wheat resistance. In this study, we mapped one Hessian fly resistance gene in wheat to a small chromosome region by genotyping-by-sequencing. This work provides a basis for the eventual cloning of this resistance gene.
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A near-Infrared spectroscopy routine for unambiguous identification of cryptic ant species

Authors: M-C Kinzner, H.C. Wagner, A. Peskoller, K. Moder, F.E. Dowell, W. Arthofer, B.C. Schlick-Steiner, F.M. Steiner
Submitted to: Plos One
The identification of insect species is not always straightforward as similar species present a hurdle for traditional species discrimination. Fibre-optic near-infrared spectroscopy (NIRS) is a rapid and cheap method for a wide range of different applications, among them the identification of species. Despite its efficiency, NIRS has never been tested on a group of more than two species, and a working routine is still missing. Hence, we tested if specimens of the four morphologically highly similar, but genetically distinct ant species can be identified using NIRS. Furthermore, we evaluated which of three analysis tools was most efficient in species identification. Our NIRS identification routine with partial least squares regression was successful with up to 80% of identified specimens correctly classified. We emphasise that our classification routine using fibre-optic NIRS was a highly

efficient pre-screening identification method for similar ant species.

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Evaluation of the optimal preservation method of *Anopheles gambiae* s.s. and *Anopheles arabiensis* complex mosquitoes for species identification using near infra-red spectroscopy

Authors: V.S. Mayagaya, A.J. Ntamatungiro, S.J. Moore, R.A. Wirtz, F.E. Dowell, M.F. Maia
Submitted to: Parasites & Vectors

Determining age and species of preserved mosquitoes that transmit malaria is important to evaluate mosquito control methods. Near infra-red spectroscopy (NIRS) has been successfully used on fresh and RNA*later*® preserved mosquitoes to determine species and age. However, no cheaper or more convenient preservation methods have been tested. The aim of this study was to compare different preservation methods that are cheaper and more field-friendly over a long period of storage time. Mosquitoes of each species were placed in sample tubes and preserved using one of the following preservation methods: (i) refrigeration at 4ºC, (ii) freezing at -20ºC, (iii) drying over a silica-gel desiccant, (iv) inclusion in RNA*later*® at room temperature, and (v) inclusion in RNA*later*® at 4ºC. Mosquitoes were preserved for up to 50 weeks before they were scanned. Refrigeration at 4°C was the only preservation method that up to 32 weeks of storage did not result in predicted values that were significantly different than that obtained from fresh insects. However, refrigerated samples did not give meaningful results at 50 weeks. Desiccation over silica gel was the best preservation method when storing up to 50 weeks.

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Effects of flour and milling debris on efficacy of beta-cyfluthrin for control of *Tribolium castaneum* (Herbst), the red flour beetle

Authors: F.H. Arthur, L.A. Starkus, T. McKay
Submitted to: Journal of Economic Entomology

Contact insecticides are often used as part of pest management programs for stored product insects inside mills and processing facilities. However, there is little information available on how accumulated food material and milling debris on a treated surface will affect performance of insecticides that have been applied to that surface. We treated concrete test arenas with the contact insecticide Tempo® and then flour remained on the arenas for up to 8 weeks. The longer the flour was allowed to sit the more time it took for adult red flour beetles to be knocked down and incapacitated on the surface. In field tests, the presence of accumulated milling debris resulted in increased time required for 100% incapacitation on the surface. Results show that management of flour beetles can be improved with

increased cleaning and sanitation, and managers can use this information to increase effectiveness of insect management programs.

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Error analysis in the measurement of stored grain volume

Authors: A.P. Turner, M.D. Montross, J.J. Jackson, N.K. Koeninger, S.G. McNeill, M.E. Casada, J.M. Boac, R. Bhadra, R.G. Maghirang, S.A. Thompson
Submitted to: Transactions of the ASABE

Measurement of stored grain volume is important for crop insurance, financial statements, and as a good business practice for inventory control. The recent, rapid increase in bin sizes has caused greater difficulty in measuring bin volumes compared to smaller bins, particularly for accurately estimating bin surface profiles relative to standard cones. The effect of measurement errors caused by the uncertainty in measuring the bin diameter and grain height was evaluated and presented as a function of grain height to diameter ratio. With accurate measurements, the overall uncertainty in the volume measurement never exceeded 5% for small bins (<10 m in diameter) and decreased to less than 1% for large diameter bins (>10 m in diameter). A low-cost, portable bin surface mapping system was developed to accurately measure the grain surface using a laser distance meter, tablet PC, and ArcMap software. This system significantly lowered the coefficient of variation in farm bins to less than 6% and is suitable for large commercial bins.

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