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Research Kernels

Our Latest Research Results - February 2012

Measuring Cattle Feedlot Dust Using Laser Diffraction Analysis

Authors: H.B. Gonzales, R.G. Maghirang, J.D. Wilson, E.B. Razote, L. Guo
Submitted to: Transactions of the ASABE
Open beef cattle feed lots can emit considerable amounts of particulate matter. The combined effects of warm temperature, low humidity and high wind speed can promote rapid water evaporation from the pen surface, making particulates susceptible to air suspension. Emitted particles have human health and environmental effects such as vascular inflammation, atherosclerosis, an increased incidence of asthma and other respiratory problems. Rapid and accurate determination of particulate size distribution of this air borne dust is crucial in developing management policy for improved both human and livestock health in these large feed lots. These studies compares and contrasts laser diffraction analysis to a standard cascade impactor as well as determine meteorological factors and sampling period on dust particle size distribution. This study took place in a large commercial feedlot in Kansas over two years. The laser diffraction analysis and the cascade impactor did not differ significantly of the geometric mean diameter of the dust particles, consequently could be used interchangeably. Wind speed and period of sampling (day vs. night) significantly affected the measured geometric mean diameter of the particles, while increasing pen surface water content decreased large (<10µm) to small (<2.5 µm) fractions.
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Development of Equilibrium Moisture Relationships for Storage Moisture Monitoring of Corn

Authors: P.R. Armstrong, M. Casada, J. Lawrence
Submitted to: Applied Engineering in Agriculture
Multipoint measurement of grain moisture within a bin is feasible using relative humidity and temperature measurements to predict grain moisture and is currently offered as a commercial monitoring system. Traditionally, prediction of moisture by relative humidity and temperature measurements was done by generalized mathematical models which are less precise than models developed for a specific grain. Developing a model requires considerable time and effort. This work developed methods to reduce this effort and also outlined methods to improve moisture measurement accuracy. As a result it is feasible that moisture predictions can be tailored to a specific grain in storage with improved moisture accuracy thus facilitating better quality management of general storage of grain and for in-bin drying processes.
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Prediction of Kernel Density of Corn Using Single-Kernel Near Infrared Spectroscopy

Authors: P.R. Armstrong, J.G. Tallada
Submitted to: Computers and Electronics in Agriculture
Corn hardness is an important property for dry and wet-millers, food processors and corn breeders developing hybrids for specific markets. While several methods are used to measure hardness, kernel density provides one of the most repeatable methods to quantify hardness. Near infrared spectroscopy (NIRS) provides an attractive method to measure kernel density as it is non-destructive and can also measure other kernel attributes that may be related to processing the grain or hybrid development. Currently, some commercial NIRS instruments do measure density of bulk samples. Single-seed NIRS, however, may provide additional information and capabilities by measuring single kernels. This has potential applications for breeders or quality control personnel wishing to look at variability within samples and for sorting. This study found that NIRS could roughly determine density of corn samples by averaging single kernel values and that sorting individual samples into high and low density fractions was possible. The latter may be particularly useful for breeders wishing to increase hybrid kernel densities.
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Foraging On and Consumption of Two Species of Papaya Pest Mites, *Tetranychus kanzawai* and *Panonychus citri* (Acari: tetranychidae) By *Mallada basalis* (Neuroptera: Chrysopidae)

Authors: L.L. Cheng, J.R. Nechols, D.C. Margolies, J.F. Campbell, P.S. Yang, C.C. Chen, C.T. Lu
Submitted to: Environmental Entomology
Two species of mites are major pests of papaya in Taiwan, and both species can co-occur in screenhouses where papaya is grown. Current management of these pests relies on chemical pesticides, but resistance has developed to many of these pesticides and some alternative pesticides can be toxic to the papaya. The green lacewing is a predator that has been used

successfully as a biological control agent, but has not been evaluated for control of these mites. Rate of consumption by predators impacts their ability to suppress pest population growth and is influenced by time spent searching for prey, time spent handling prey after capture, and acceptability of the prey (ability of the predator to feed on the prey), so we determined these variables for different immature stages of the green lacewing using the two important mite pests of papaya. Green lacewings fed on all developmental stages of both mite species. Older immature stages of the green lacewing spent most of their time actively searching for mites and consumed 15 times the mite eggs and 17 times the mite adults of the younger lacewing developmental stage, which also spend approximately 40% of their time at rest. Green lacewings consumed more of one mite species than the other, primarily because it took longer to handle mites after encountering the mite. These results suggest that release of green lacewings within screenhouses where papaya is grown has potential as a management tool.
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The *Tribolium castaneum* Ortholog of *Sex combs reduced* Controls Dorsal Ridge Development

Authors: T.D. Shippy, C.D. Rogers, R.W. Beeman, S.J. Brown, R.E. Denell
Submitted to: Genetics
Development of the insect embryo is a complex process with many critical steps, disruption of any one of which would lead to the death of the embryo prior to egg-hatch. Although many or even most of the genes required for embryonic survival have been identified, the specific functions of regions within each gene are unknown. This knowledge would enable better design of gene knockout strategies for pest control that target specific regions of vital genes. In this work we identified subregions of the “Cephalothorax” gene required for development of the insect head, and showed that each subregion has a unique and essential effect during embryonic growth. This work refines our ability to design selective toxins for incorporation into resistant crop varieties.
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The Effects of Combined Thiamethoxam and Diatomaceous Earth on Mortality and Progeny Production of Four Pakistani Populations of *Rhyzopertha dominica* (Coleoptera: Bostrychidae) on Three Grain Commodities

Authors: W. Wakil, T. Riasat, M.U. Ghazanfar, J.C. Lord
Submitted to: Journal of Economic Entomology
The lesser grain borer is a major pest of stored grains, and insecticides are used for its control. But, new insecticides, or combinations of insecticides, are needed because the lesser grain borer has developed resistance to some of those that are currently used. Diatomaceous earth (DE) is a reduced-risk insecticide composed primarily of fossilized diatoms. Thiamethoxam is an insecticide with low mammalian toxicity that is a recent addition to the tools for control of stored-grain pests. We tested these materials separately and in combination for control of lesser grain borers in stored wheat, corn, and rice. Survival and progeny production were lower in wheat than in rice or corn. The insecticides generally were more effective when used in combination than individually. Lesser grain borers from four locations showed differences in susceptibility to the insecticides. This information will be useful to storage managers in selecting tools to combat lesser grain borers and delay resistance development.
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A Nuptially Transmitted Ichthyosporean Symbiont of *Tenebrio molitor*

Authors: J.C. Lord, K.L. Hartzer, S. Kambhampati
Submitted to: Journal of Eukaryotic Microbiology
The yellow mealworm is a pest of stored grain products, a commercial commodity used for bird and lizard food, and a research model insect. It harbors a unique microbe that has escaped previous detection in spite of intensive study of the insect. We discovered the microbe infecting mealworm nerve chords, fat body, and testes, and we determined that it is transmitted to females during mating with infected males in which spores are bundled into spermatophores (sperm transfer packages). Gene sequencing showed that the organism is not closely related to any known species, but belongs to a group of protists whose evolutionary position is near the animal-fungi divergence. This research will help to understand the biology of an important insect and to develop means to improve its production.
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