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Research Kernels

Our Latest Research Results - April 2013

Development of High-Density Genetic Maps for Barley and Wheat Using a Novel Two Enzyme Genotyping-By-Sequencing Approach

Authors: J.A. Poland, P.J. Brown, M.E. Sorrells, J.L. Jannink
Submitted to: PLoS One
The barley and wheat genomes are large and complex, a feature that has greatly hindered the development of molecular markers useful for marker-assisted selection in plant breeding programs. Further, new statistical approaches such as genomic selection can make predictions of expected performance for yield and other complex traits by using information from dense genome-wide molecular markers. In this study we have utilized next-generation sequencing capacity to generate tens of thousands of molecular markers in barley and wheat in an approach termed “Genotyping-by-sequencing”. These markers were developed at a relatively low per sample cost and represent a considerable advance in the tools available for wheat and barley breeding and genetics. Advancements in sequencing technology will continue to decrease the per sample costs for this approach while providing more and more marker data points, making the genotyping-by-sequencing method the molecular marker platform of choice in the future.
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MicroRNA Genes in the Gall Midge *Mayetiola destructor*

Authors: C. Khajuria, C.E. Williams, M.E.L. Bohssini, J.R. Whitworth, J.J. Stuart, M.S. Chen
Submitted to: Biomed Central (BMC) Genomics
Hessian fly is a destructive pest of wheat. The insect is mainly controlled through host plant resistance, but resistance genes in wheat are usually overcome within a few years by new fly biotypes. Alternative control measures are needed for effective management of the Hessian fly. Rapid advances in genomics and biotechnology bring new approaches for pest control. One of the promising new means for insect control is based on small, non-coding RNAs: small interfering RNAs (siRNAs) and microRNAs (miRNAs). Small RNAs can silence insect genes, resulting in the death of the insect. This study identified and characterized miRNAs and their genes systematically for the first time in Hessian fly. A large number of miRNA genes were identified. Some of miRNAs were found to be Hessian fly-specific and their expression was affected by host plant genotypes. The results provide a foundation for future research that may eventually lead to new ways for Hessian fly management.
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Inheritance and Genetic Mapping of Russian Wheat Aphid Resistance in Iranian Wheat Landrace Accession PI 626580

Authors: V.A. Valdez, P.F. Byrne, N.L.V. Lapitan, F.B. Peairs, A. Bernardo, G. Bai, S.D. Haley
Submitted to: Crop Science
Russian wheat aphid (RWA) is an insect pest that can cause significant damage in wheat and has had a major economic impact on winter wheat production in the western United States. Using resistant cultivars remains the most effective method for RWA control. Iranian wheat landrace accession PI 626580 has been identified to have a high level of resistance to RWA biotypes 1 (RWA1) and 2 (RWA2). In this study, we evaluated a RWA2 resistance segregation population derived from cross PI 626580 and ‘Yuma’ (a susceptible wheat cultivar). Genetic analysis of the segregation data suggested a single dominant gene, designated as Dn626580, controls the resistance. Three DNA markers were linked to the RWA resistance gene Dn626580 on the short arm of chromosome 7D. Dn626580 is a new resistance gene found in PI 626580 and could be used to develop cultivars with effective RWA resistance.
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The Effect of Nitrogen Fertilization and Cover Cropping Systems on Sorghum Grain Characteristics

Authors: R.C. Kaufman, J.D. Wilson, S. Bean, D.R. Presley, H. Blanco-Canqui, M.M. Mikha
Submitted to: Journal of Cereal Science
Sorghum is the 5th leading cereal grain produced worldwide. Due to sorghum’s tolerance to heat and drought conditions it is commonly grown under non-irrigated conditions in semi-arid parts of the United States, such as Kansas, Oklahoma, and Texas. The practice of no-till farming has become an increasingly popular cropping system, due to increased water and soil conservation. Recently, cover cropping has been added to the system to aid in weed prevention and also increase soil fertility. This study investigated different levels of nitrogen on a no-tilled soil with differing preceding cover crops (Sunn hemp and soybean) grown

on specific plots. The nitrogen fertilization and cover cropping systems appeared to enhance the soil by increasing both total soil nitrogen and soil organic carbon. Results also indicate cover crop systems provided an increase in the agronomic effect as well as overall sustainability of the production system without causing negative effects on end product quality. The treatments also increased the amount of protein in the grain without reducing digestibility, thus allowing for greater digestible protein yield. Since, cover cropping appears to provide both agronomic and end product quality benefits, increased utilization of this cropping system could be useful as another tool for the producer interested in sustainable agriculture.
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Do Spiders Feed On and Benefit From Fungal Growths

Author: R.S. Pfannenstiel
Submitted to: Florida Entomologist
A spider that is common in cotton, citrus and other crops in south Texas, was tested for consumption of fungi associated with pollen. Immature spiders have been observed to consume pollens as well as yeasts. During studies of pollen feeding, fungi would grow on the pollen and potentially was a source of food for the spiders in addition to the pollen. Here we compared survival of spiders exposed to fungi, water or corn pollen. No feeding on the fungi was observed. Survival of spiders exposed to the fungi was lower than those kept with water alone and much less than those provided corn pollen. This study suggests that these spiders do not feed on fungi associated with pollen or if they do feed, do not gain any benefit.
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Survival and Development of Two Spiders on Cotton, Corn and Portulaca Pollen

Author: R.S. Pfannenstiel
Submitted to: Annals of the Entomological Society of America
Two spiders, *Cheiracanthium inclusum* and *Hibana futilis*, were observed for feeding on pollen from the crops cotton and sweet corn as well as moss rose, a member of a genus that contains many weeds as well as ornamentals. Both spiders consumed all three pollens, which were pierced, crushed and macerated with the mouthparts while being extra-orally digested. Cotton pollen was the least valuable for both species providing resources for a small improvement in survival but no development. Feeding on Portulaca pollen improved spiderling survival more than cotton and also resulted in some spiderling developing to the 2nd and 3rd instars. Feeding on corn pollen resulted in the longer mean and peak survival times (52.6 and 103 days and 105.6 and 278 days for each of the spiders), the largest percentage of spiders molting one or more times (100 and 59.1% for *H. futilis* and *C. inclusum*, respectively) and the greatest number of total molts among spiders that molted (7). Pollen consumption is beneficial for these spiders and leads to improved survival and development.
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A History of Wind Erosion Prediction Models in the United States Department of Agriculture, Part 2

Authors: L.E. Wagner
Submitted to: Aeolian Research
This manuscript is a review of the history of modeling within the United States Department of Agriculture (USDA), beginning with the Wind Erosion Prediction System (WEPS). Development of WEPS was officially inaugurated in 1985 by USDA-Agricultural Research Service (USDA-ARS) scientists. It was in response to customer requests, especially from the USDA Soil Conservation Service (SCS), for improved wind erosion technology at the time. WEPS was conceived to address deficiencies in the then 20 year old, predominately empirical, Wind Erosion Equation (WEQ) widely used by SCS. It sparked an endeavor that relied on novel laboratory wind tunnel research as well as extensive field studies, to adequately uncover the physical relationships between surface properties and their influence on wind erosion. The result is that WEPS incorporates many process-based features and other capabilities not available in any other wind erosion simulation model today. The USDA Natural Resource Conservation Service (NRCS) has now recently implemented WEPS as a replacement for WEQ within their agency. However, the road to achieve that state was not easy and required years of close interaction between ARS and NRCS. The history of the development of WEPS, its unique features, and solutions to selected critical issues encountered by NRCS prior to implementation are presented and discussed.
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