GMPRC
Grain Marketing and Production Research Center

Research Kernels

Our Latest Research Results • September 2008

Residual efficacy of pyriproxyfen and hydroprene applied to wood, metal, and concrete for controlling stored-product insects

Pyriproxyfen is a new insect growth regulator that has been tested on insect pests of field crops but not on stored-product insects. We conducted a test by exposing older larvae of four beetle species and the Indianmeal moth on plywood, metal, and tile treated with hydroprene, which is also an insect growth regulator. Pyriproxyfen gave generally greater residual control, as determined by adult emergence of exposed larvae, than hydroprene on all surfaces, even though it was applied at much lower rates. Hydroprene was most persistent on metal compared to wood and concrete. The Indianmeal moth larvae were generally more tolerant to both insecticides than the beetle larvae, but there were variations in susceptibility among the different beetle species. However, the overall results showed that pyriproxyfen was effective and it could be used as a residual surface treatment in management programs for control of stored-product insects.

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Behavioral responses to patch boundaries: role of perceptual range and permeability

The ability of the red flour beetle, *Tribolium castaneum*, to find and colonize small patches of food is a major contributor to its pest status in food processing and storage facilities such as flour mills. Ability to use these small patches is influenced by both the distance from which animals perceive them (perceptual range) and how they interact with the edges of the patch. We examined perceptual range of female red flour beetles by manipulating distance to a flour patch, starvation level, and airflow and measuring the number of individuals successfully locating the patch. Beetles appeared to typically respond to the patch only when it was physically encountered and starvation of beetles and presence of air flow did not increase patch detection. Additionally, we investigated how patch characteristics influenced tendency of beetles to enter the patch and the time spent in patches with different amounts of resource and shelter. At the first encounter with a patch edge, patches with tall edges (high-resource) were less permeable to beetles than patches with low edges (low-resource), even though they contained more food. Upon subsequent encounters, beetles entered high-resource patches more frequently than low-resource patches and left less quickly. Beetles entered covered patches more quickly than uncovered patches, suggesting that shelter may take precedence over amount of food as a factor influencing initial permeability. Identifying behavioral rules of movement may ultimately lead to more accurate predictions of how beetles use the environment and how the landscape pattern can be manipulated to reduce its suitability for this pest.

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Inflow rates and interrupted flow effects on concentrated flow erosion and intake rate in two soils

Efficiency of surface irrigation is often low because of poor infiltration uniformity, resulting from relatively long periods of infiltration at the upstream end and short periods of infiltration at the downstream end of the field. Intermittent supply of water to furrows may reduce soil intake rate (IR) and furrow erosion due to development of negative pressure at the soil surface during flow interruption. However, the decrease in IR and furrow erosion caused by intermittent flow is highly variable among soils. We studied the effects of inflow rates and interrupted flow on intake rates and erosion in two soils (clay and silt loam) to determine the response of soil surfaces to intermittent supply of water to the furrows. We found that increase in inflow rates had no effect on cumulative intake in both soils exposed to continuous flow. However interrupted flow reduced IR in the clay and had a small effect in the silt loam. Soil erosion in continuous flow remarkably increased with the increase in inflow rates in the clay, but small increase in the silt loam. Interrupted flow reduced erosion in both soils with the effect being more pronounced in the clay soil. Flow interruption reduced soil loss due to its increase in the cohesion forces between surface soil particles and the bulk soil underneath. This work demonstrates that interrupted flow could be an

effective management tool for increasing water use efficiency and reducing erosion in furrow irrigation.
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Identification of the wheat curl mite as the vector of Triticum Mosaic Virus

Recently a new virus was isolated in Western Kansas that overcame plant resistance to Wheat Streak Mosaic virus (WSMV), but had similar symptoms. It was given the name Triticum mosaic virus (TriMV), due to its host range and the symptoms it caused. One of the key issues in the virus life cycle is how it is transmitted from plant to plant. TriMV has been found in several parts of Kansas and the work being reported describes how the vector was identified. Tests showed that only the wheat curl mite could transmit TriMV. Also found was that TriMV would transmit poorly when it was by itself, but if WSMV was present in the same plant with TriMV, both viruses would transmit well and infection levels would be high.
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Molecular cytogenetic characterization of alien introgressions with gene Fhb3 for resistance to Fusarium head blight disease of wheat

Fusarium head blight (FHB), or scab, can cause substantial yield and grain quality losses in wheat crops of the Great Plains. Losses in the 1990's alone exceeded $3 billion. Intensive resistance breeding efforts have resulted in a narrow genetic basis of FHB resistance, with most new wheat varieties sharing the same source of resistance. In order to broaden the basis of resistance, a new source of FHB resistance, named Fhb3, was identified from a wild relative of wheat, *Leymus racemosus*. This source is different from previously reported FHB resistance genes in wheat, providing a new source for wheat breeding programs. Fhb3 had a large effect in reducing disease severity in experimental wheat lines and may be rapidly deployed in wheat breeding programs.
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Virulence of Hessian Fly (Diptera: Cecidomyiidae) in the fertile crescent

The Hessian fly (*Mayetiola destructor*) is one of the most destructive insects of wheat world-wide. The insect is believed to originate from the Fertile Crescent in West Asia, and was brought to America during the American Revolution in the 1770s. The Hessian fly is most effectively controlled by deploying resistant wheat cultivars; however, virulent fly populations arise shortly after specific resistant cultivars are deployed. To share genetic resources, collaborative research has been launched between scientists at ICARDA and at USDA-ARS. This report shows distinct virulence differences between Hessian fly at ICARDA and Hessian fly in America to most known resistance genes. The goal is to reveal the mechanism of the differential virulence among different fly populations and to identify common pathways that confer resistance independent of Hessian fly populations.
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