Residual Efficacy of Aerosol Insecticides

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The use of aerosol insecticides to control insect pests in milling, processing, and warehouse facilities seems to be increasing in recent years. There are several possible reasons for this increase, including but not limited to costs relative to whole-plant treatments such as fumigations or heat, safety, and limited loss of production time. Recent research with tested commercial aerosol systems show effective distribution of the insecticide in large commercial sites and control of adults and larvae of the red flour beetle, *Tribolium castaneum*, and the confused flour beetle, *Tribolium confusum*. There are some variations in efficacy toward adults, depending on the position of the exposure arena and the presence of food material either during or after exposure.

One perceived limitation of aerosols is the lack of residual control, and therefore no different from fumigations in that regard. This perception is being tested through field trials conducted in commercial facilities. Concrete exposure arenas constructed in the bottom portion of a standard plastic Petri dish (9.5 in^2 or 62cm^2) are sent to commercial cooperators, who expose these arenas inside their facilities in positions on the floor that are open to the aerosol or obstructed by placing them underneath a pallet or piece of equipment. The exposed arenas are shipped to the Grain Marketing and Production Research Center (GMPRC) in Manhattan, Kansas, for testing

In the first test, eggs, 3 and 4-week old larvae and pupae of the red flour beetle, along with 300 mg of a flour food source, were exposed at 48 hours, and 1, 2, 3, and 4

weeks after the concrete arenas were exposed to a pyrethrin-methoprene aerosol at the label rate for both products. There was some residual control of pupae, with 62% adult emergence compared to 96% in untreated controls. However, adult emergence of exposed eggs, 3-week old larvae, and 4-week old larvae averaged about 20 to 30% (70% adult emergence of eggs in untreated controls, > 90% emergence of larvae) during the 4-week testing period, with no differences with respect to the weekly residual bioassays or exposure in open versus obstructed positions. The flour apparently absorbed residues from the treated surface, and the larvae came into contact with the residues from moving through the flour and feeding on the flour. Results from this test showed that the 4-week old larval stage was appropriate to use for residual bioassays, and subsequent tests were conducted with only this life stage.

A second trial with a cooperator is being conducted by exposing the concrete arenas to a pyrethrin-pyriproxyfen aerosol. Results show residual control of 4-week-old larvae of the red flour beetle for at least 1 month after the concrete arenas were exposed to the aerosol, with no difference with respect to position of the exposure arenas in open versus obstructed positions on the floor or approximately 12 feet (3.7m) off the ground. Tests will also be conducted with 4-week old larvae of the confused flour beetle.

A third field trial is being conducted in which the concrete arenas are being exposed to an aerosol application of dichlorvos. Results from all of these studies will provide data regarding the residual efficacy of some common commercial formulations that are being used in large-scale facilities to control stored-product beetles, particularly the red flour beetle and the confused flour beetle. The research is supported by a grant from the methyl bromide transitions (MBT) program.