SPATIAL PATTERN IN AEROSOL INSECTICIDE DEPOSITION IN A FLOUR MILL

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The use of aerosol insecticides as part of an Integrated Pest Management (IPM) program in food facilities has increased as the use of structural fumigation with methyl bromide has decreased. IPM programs that focus on reducing pest density and rate of pest population growth within facilities can reduce the need to fumigate. Fumigants are often effective because they are toxic in the gaseous phase and can penetrate into hidden areas in the structure of the building or inside equipment that can be important refugia for pest populations. Aerosol treatments involve applying pesticides as small droplets in a mist or fog that then settle onto surfaces. Therefore, aerosols have a limited ability to penetrate in hidden refugia where pest populations can occur. As droplets settle horizontal features in the landscape can block movement of droplets and reduce the amount of insecticide deposited in obstructed areas, and vertical surfaces may impact the flow of droplets from the point of release. Earlier studies have shown that insects exposed in the open are more likely to be affected than those in more covered positions. Within a food facility there are a variety of physical features that could impact aerosol deposition, resulting in refugia from exposure and thereby contributing to reduced efficacy.

Better understanding the patterns of deposition under real world conditions and the influence of physical landscape, environmental conditions, and insecticide application method such as temperature on this pattern could improve application and better predict the impact of treatments. In a recent study, three formulated insecticides were evaluated in a pilot scale flour mill located at Kansas State University. Experiments were conducted at two different temperatures, to evaluate if higher temperatures impacted the deposition pattern. Two experimental approaches were taken. First, the spatial pattern in deposition was determined using a dense grid of petri dishes containing adult confused flour beetles, *Tribolium confusum* du Val, placed on the floor. Mortality of the beetles was recorded and used as an indicator of insecticide dosage as a function of location. Contour maps of beetle mortality revealed differences in spatial pattern among the insecticides. Locations vulnerable to reduced insecticide deposition were also identified, along with potential features that might have impacted distribution. Second, boxes open at one end and of different heights were used to measure how far aerosols were able to drift under horizontal obstacles. Again, mortality of confused flour beetles in petri dishes was used as an indicator of insecticide dosage. These experiments revealed an impact of the gap size on dispersal under obstacles and also differences among the insecticides.

Data from these experiments provides critical information on how features in the landscape are likely to impact insecticide deposition and identifies locations potentially vulnerable to reduced efficacy. This information can be used to help guide how and where aerosols are applied and also where other management tactics need to be targeted in order to maximize treatment efficacy.