California Environmental Protection Agency
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DEPARTMENT OF PESTICIDE REGULATION
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EXECUTIVE SUMMARY
of Report EH 93-03 Entitled
"Assessment of Malathion and Malaoxon Concentrations and Persistence in, Water, Sand, Soil and Plant Matrices Under Controlled Exposure Conditions"

Environmental Monitoring and Pest Management Branch
Department of Pesticide Regulation

PURPOSE

The behavior of malathion and its breakdown products in the environment may be affected significantly by the Nu-Lure@ protein bait with which it is mixed, and as a result affect the health risk to people exposed during an aerial application. Little data have been collected on the persistence of malathion or malaoxon, a breakdown product, in bait on surfaces commonly associated with urban settings. Using a simulated aerial application of malathion/bait mixture, the objectives of this study were to determine the concentrations and persistence of malathion and malaoxon under controlled exposure and sampling conditions for various materials (e.g., sand, soil, and vegetation) commonly found in urban settings where aerial applications have traditionally occurred.

BACKGROUND

Aerial application of malathion/bait mixture has been used in recent Mediterranean Fruit Fly (Medfly) Eradication Programs conducted by the California Department of Food and Agriculture (CDFA) in 1981 and 1989-90. In response to public concerns over exposure to malathion from this method of application, the California Department of Health Services conducted exposure assessment studies and concluded that a subpopulation of potentially sensitive individuals exists. To more fully characterize this risk, additional information was required on the persistence of malathion in the environment and whether this persistence is affected by the presence of the protein bait. In order to gather additional information, simulated aerial spray application was made to the following media: soil, sand, water, tomato fruit and lettuce leaves.

STUDY METHODS

All experimental applications were carried out in the evening to duplicate conditions of the 1989-90 aerial applications, consistent with CDFA's standard protocol. The sprays were conducted in a polyethylene greenhouse at the University of California, Riverside. At the conclusion of the spray application, all samples were moved to four Teflon.-covered chambers. Samples of each media were divided equally among the chambers and held until sampling.

Sampling periods were as follows: 0 (immediately after the spray), 0.5 1, 2, 4, 10 and 21 days after the application. At each sampling time, four samples of each media were collected, one from each of the four chambers. For each media, the statistically best-fitting curve which showed the change in concentration over time was selected for the data. Predicted concentration values were then calculated for various times during the 21-day sampling interval.

RESULTS

Degradation of malathion in sand was very rapid: 12 hours after application, 16'percent of the original predicted concentration remained. Malaoxon concentrations were not detected in sand until approximately ten days after application. In contrast, decreases in malathion concentration on soil was much slower than on sand. Twelve hours after application, approximately 39'perceht malathion was predicted to remain. Malaoxon concentrations were not detected in soil until four days after application.

No consistent trends were evident in the degradation of malathion in water. Because of these inconsistencies, no statistical models' of the data were fit. Malaoxon did not appear in the water until the final'sampling interval (21 days after, application) and the values were extremely small.

Malathion concentrations declined more slowly on the surface of tomato fruit than on soil and sand. At 12 hours after application, about 90 percent of the malathion measured at 0 hour was predicted to remain and 50 percent predicted to remain four days after application. Internal concentrations of malathion in tomato fruit declined more rapidly: 72 percent was predicted to remain 12 hours after application. Malaoxon was not detected in tomato fruit until four days after application.

The decline of malathion concentration on lettuce leaves was extremely rapid compared to that on tomato fruit. Predicted malathion levels were 27 percent at 12 hours after application. Internal malathion concentrations on lettuce leaves were only 13 percent 12 hours after application, and declined to about 2 percent 2 ,days after 'application. Malaoxon was not detected at any time on lettuce leaves.

CONCLUSIONS

The rate of decrease in malathion concentration over time from a single spray application is affected by the type of material. Concentrations declined more slowly in, soil than in sand, possibly

because soil contains more organic matter which has been shown to slow pesticide degradation rates. The degradation of malathion in water did not show any identifiable trends. The degradation of malathion on tomato fruit surfaces was quite slow. This may be due to adsorption and limited ion exchange occurring on tomato fruit. Internal tomato fruit concentrations of malathion declined more rapidly. Degradation of malathion on lettuce, both on the leaf surface and internal, was rapid.

During the 21 days after application, malaoxon first occurred four days after application on soil and internal tomato fruit, and at ten days for sand. Levels on these materials increased. Malaoxon was not detected on the other materials.

The spray mixture applied in this study, though intended to simulate the spray mixture applied in the Aerial Spray Eradication Program in 1989-90, was different. The spray mixture used in this study was modified to include 15 percent distilled water and a final mixing ratio of approximately 10,000 parts bait+water to 1 part malathion as compared to the aerial spray mixing ratio of 4 parts bait to 1 part malathion. These modifications were required to achieve atomization of the mixture and the target deposition rate of the 1989-90 aerial application. However, the change in the ratio caused much more bait to be applied per volume of malathion which resulted in a slurry rather than discrete droplets. Further study is planned to determine the relative effect of bait/malathion mixing ratios on degradation rates.

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