

A Comparison of Residues Produced by Spraying and Fogging of Diazinon in Buildings^{1,2}

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Several different application techniques are used in applying insecticides inside structures. Surface spraying and space treatment are often used in controlling crawling and flying insects, respectively. There has been no differential comparison of the quantity and duration of residues occurring in structures sprayed and fogged with an insecticide. This experiment was conducted to compare quantitative residues of diazinon using crack and crevice spray and space fog applications.

METHODS

Vacant 2-story, 4-room apartments of the same size and floor plan and walls of concrete block faced with brick were used in the experiment. All windows and doors were closed to reduce air movement to a minimum. Apartments were locked and entered solely by the researchers. Aluminum pie plates (22.9 cm diam) were used to evaluate post application residues. They were located in the test structures as follows: kitchen - on a shelf inside an open wall cabinet, on the countertop, and on the floor in the center of the kitchen; and bedroom - suspended 168 cm from the floor in the center of the room, on the floor in the center of the room, and 15 cm out from the center of the outside wall. Three plates were positioned side by side, but not touching, at each site.

Diazinon (1% oil solution) prepared from diazinon (S 480g/l) and Ultrasene³, and Ultrasene alone were used in fogging and spraying. Diazinon does not have label registration for fogging

¹Contribution from the North Carolina State University Agricultural Experiment Station. Published with the approval of the Director of Research as paper no. 4181 of the Journal Series.

²Use of trade names in this publication does not imply endorsement of the products named or criticism of similar ones not mentioned.

³Ultrasene, distributed by Atlantic Richfield Company, 1112 South Boulevard, Charlotte, North Carolina 28201.

and should never be used in fog application. It was selected for the experiment because minute residues are readily detected and the apartments were vacant. Apartments were sprayed with the diazinon solution, sprayed with the Ultrasene, fogged with the diazinon solution, fogged with the Ultrasene, or left untreated. There were three replicates.

A 3.785 liter B & G compressed air sprayer and a Dyna-Fog '70B' were used for spraying and fogging, respectively.^{4,5} All cracks and crevices in the apartments were sprayed using the medium, pinpoint, spray stream produced by a multeejet nozzle.⁶ Pressure in the compressed air sprayer was maintained between 3.4 and 3.2 kg/cm² during spraying. The amount of diazinon solution applied per apartment was recorded. Other apartments were sprayed with the Ultrasene, following the same procedure employed in diazinon spraying. Fogs were applied at the standard rate of 3.785 liter/1400m³ recommended by the National Board of Fire Underwriters (1952). Known amounts of the diazinon solution were applied to each room of an apartment. Amounts were based on the volume of the apartment and rooms and the known rate of insecticide discharge from the Dyna-Fog.⁷ The "wetness" of the fog was adjusted so that the fog was dry 45.7 cm from the end of the nozzle (National Pest Control Association 1970). Other apartments were fogged with Ultrasene, following the same procedure employed in diazinon fogging, or left as checks.

Apartments were locked upon completion of fogging or spraying and not reentered for 0.2 days. One plate was selected randomly from each site in the kitchen and bedroom at each sampling interval (0.2, 1, and 4 days) after treatment of the apartments, placed in a plastic bag, and immediately removed to the laboratory for analysis. Apartments were closed and locked between plate removal periods.

Residues were removed from the plates and analyzed by flame photometric gas chromatography as described in a previous paper (WRIGHT and JACKSON 1971).

⁴B and G 3.785 liter compressed air sprayer, manufactured by B and G Equipment Company, Plumsteadville, Pa. 18949.

⁵Dyna-Fog '70B', manufactured by Curtis Dyna-Products Corporation, P. O. Box 297, Westfield, Indiana 46074.

⁶Multeejet nozzle, no. 1/8" T-5700, manufactured by Spraying Systems Co., Bellwood, Illinois 60104.

⁷The National Board of Fire Underwriters and the National Pest Control Association do not recommend the use of diazinon as a fog. The application rate and fog dryness are standards recommended for insecticidal fogs.

Aluminum pie plates for recovery studies were prepared by pipetting diazinon onto the plates. The solvent was evaporated and the plates were handled in the same manner as plates from the apartments. Recoveries with this technique averaged 95 percent. Amounts of diazinon as low as 0.35 μg could be detected.

A completely randomized analysis of variance was performed to determine significant insecticidal residues at the 5 percent level.⁸

RESULTS AND DISCUSSION

Technical diazinon sprayed in the 3 apartments was 7.0, 8.6, and 5.9 g, respectively. A constant 4.9 g of technical diazinon was applied per apartment fogged.

Plates in fogged apartments received significantly more diazinon than those in sprayed apartments after 0.2 and 1 day (Table 1). There was no detectable ($<0.35 \mu\text{g}$) diazinon residues on plates taken from apartments after 4 days and from Ultrasene sprayed and fogged and untreated plates. The actual amount of diazinon recovered per plate position showed greater variation in the sprayed than in the fogged apartments. This probably was due to space dispersion of the fog, whereas the spray was directed to selected surface areas. The cause of variations in the amounts of diazinon residues remaining on several saucers is unknown. Most likely such differences on exposed saucers were due to heavier deposits of an insecticide falling onto a dish (invisible) and remaining through the interval of aging.

Fogging residues were lowest on plates suspended from the ceiling and in cabinets. A possible explanation for lower residues on the suspended plates was that the Dyna-Fog outlet tube applied the fog below the plates, and the fog had to rise to the top surface of the plates, while those on the floor and counter received the fog as it settled. Plates in cabinets were sheltered from direct fog flow.

Diazinon residues recovered 0.2 days after spraying were greater on plates from the kitchen counter and the cabinet. The higher residues might be correlated to the fact that food preparation areas usually attract pests and are often sprayed more heavily than other areas of residences. The least diazinon residue was recovered from plates suspended from the ceiling, probably because they were positioned farthest from treated sites.

⁸Thanks are due to L. A. Nelson, Professor, Experimental Statistics, North Carolina State University, Raleigh, who made the statistical analysis.

TABLE 1

Amounts of diazinon in various apartment locations following spraying or fogging (3 replications).

Days after treating	Room	Location in room	Type of treatment ^{a, b}	
			Spray (μ g)	Fog (μ g)
0.2	Bedroom	Suspended	0.46 (<0.35-0.61) ^c	266.3 (19.5-686) ^c
		Floor at wall	0.92 (<0.35-1.40)	570.7 (299-901)
		Floor center	0.56 (<0.35-0.84)	560.7 (376-902)
	Kitchen	Floor center	0.63 (0.37-1.02)	422.3 (171-586)
		Counter top	1.59 (0.93-2.40)	322.9 (73.8-501)
		In cabinet	7.32 (1.66-18.4)	87.7 (8.89-190)
1	Bedroom	Suspended	<0.35 (<0.35-0.39)	4.83 (0.69-12.8)
		Floor at wall	0.36 (<0.35-0.51)	4.88 (1.30-10.2)
		Floor at center	<0.35 (<0.35)	46.4 (3.40-132)
	Kitchen	Floor center	<0.35 (<0.35-0.36)	28.0 (1.44-61.3)
		Counter top	<0.35 (<0.35)	1.93 (0.53-3.54)
		In cabinet	<0.35 (<0.35)	0.87 (0.37-1.51)

^a Less than 0.35 μ g of diazinon for all checks and after 4 days for all samples.

^b Significantly more diazinon on plates in fogged apartments.

^c The numbers in parentheses give the range of residue values.

Diazinon residues on plates in sprayed and fogged apartments dissipated rapidly; however, the initial residue was higher on plates in fogged apartments, and larger residues remained on the fogged plates after 1 day.

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