PERSISTENCE OF SEVIN AND DIAZINON RESIDUES ON FRUITS[1]

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Since Section B 15.002 of the Regulations under the Food and Drugs Act established official Canadian tolerances for pesticide residues (Morrell, 1957), the determination of such residues on fruits has become more important than heretofore. Diazinon [*O,O*-diethyl *O*-(2-isopropyl-4-methyl-6 - pyrimidinyl) phosphorothiate; Geigy Agricultural Chemicals New York, N.Y.] and Sevin (1-naphthyl N-methylcarbamate; Union Carbide Chemicals Company, White Plains, New York) are recommended for the control of several tree fruit pests in the Okanagan Valley of British Columbia (Anon., 1959). It is generally acknowledged that the type of formulation, or the addition of surfacants may markedly affect both the initial deposit of pesticides, and the persistence of the residue (Gunther and Blinn, 1955). This paper deals with the residues found on apples and cherries that had been sprayed with commercial formulations of Diazinon or Sevin.

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Methods and Materials

Duplicate single tree plots of young cherry trees were sprayed with a 25 per cent wettable powder formulation, or with a 25 per cent emulsifiable concentrate formulation, of Diazinon. Spray - concentration was one - half pound of actual Diazinon per 100 gallons of water; 30 gallons of spray liquid were applied to each tree with a hand spray gun.

In another experiment Diazinon was applied to two large plots of mature apple trees, and Sevin to five large plots. A standard air-blast concentrate sprayer moving at one mile per hour and applying 50 gallons of liquid per acre at a pressure of 300 pounds per square inch was used in this work. Details regarding spray formulations and application dates for this experiment are given in Table 1.

For assay of Diazinon residues, 50 cherries and 50 leaves were picked at random immediately after treatment, and one, four, eight and 14 days later. The samples of unwashed whole fruit were processed with n-hexane. A disc, one centimetre radius, was cut from

TABLE 1—Residues (Means of Five Determinations) of Sevin and Diazinon on Fruit of Three Varieties of Apple Trees after Several Applications of a Concentrate Spray.

Spray Dates	Materials	Amount per Acre per Spray	Residues Days after Last Spray, p.p.m.* 0	7	14	Harvest**
Golden Delicious						
May 23, June 6, 18						
August 3	Sevin 50% w.p.	6 lb.	6.1	4.2	2.7	1.4
Red Delicious						
May 24, June 6, 20						
August 9	Sevin 50% w.p.	6 lb.	6.2	3.4	2.8	0.7
Northern Spy						
May 24, June 6, 17	Sevin 50% w.p.	6 lb.	4.8	2.9	2.6	—
July 17, August 7	Sevin 50% w.p.	3 lb.	2.3	1.5	0.8	—
	Sevin 50% w.p.	6 lb.				
	Triton B-1956***	1 pt.	4.2	3.2	2.0	—
	Diazinon 25% w.p.	8 lb.	2.6	—	0.3	—
	Diazinon 25% w.p.	8 lb.				
	Triton B-1956	1 pt.	2.8	—	0.4	—

* Official Canadian tolerance: Diazinon, 0.75 p.p.m.; Sevin, 10 p.p.m.
** Golden Delicious, 29 days; Red Delicious, 41 days.
*** Rohm and Haas Co., Philadelphia, Pennsylvania.

each leaf in the 50-leaf sample and the 50 discs were processed as a single unit with n-hexane.

Apple samples for assay of Sevin residues were collected from all plots immediately after the final spray and seven and 14 days later. At harvest samples were taken from two plots. For the determination of Diazinon residues fruits were sampled immediately after the final spray and 14 days later. Samples of ten apples were picked at random from each of five selected trees in each plot; these were processed with chloroform to remove Sevin residues, or with n-hexane to remove Diazinon residues.

Aliquots of the stripping solutions were analyzed for Diazinon by a colorimetric method based on the hydrolysis of Diazinon to inorganic phosphate (Geigy Agricultural Chemicals, 1956) and for Sevin by a colorimetric method based on hydrolysis of Sevin to 1-naphthol (Miskus, R., University of California, Berkeley, unpublished results).

Results and Discussion

Immediately after spraying with six pounds of 50 per cent wettable powder per acre the residues of Sevin on apples (Table 1) were well below the tolerance of 10 parts per million. The maximum dosage recommended in the British Columbia spray calendar is 12 pounds of Sevin, 50 per cent wettable powder per acre, and the data indicate that, at this dosage, the last spray can be applied up to one week before harvest without exceeding the residue tolerance.

At the eight pound per acre dosage of Diazinon, 25 per cent wettable powder, the residue on apples was well below the tolerance of 0.75 part per million 14 days after the final spray (Table 1). The recommended dosage is 12 pounds per acre, and the data indicate that, at this dosage, the last spray can be applied up to two weeks before harvest.

The addition of a spreader-sticker, Triton B-1956, apparently had no effect on the initial deposit nor on the persistence of Sevin and Diazinon residues on apples.

TABLE 2—Residues (Means of Two Replicates) of Two Formulations of Diazinon on Fruit of Cherry Trees after One Application of a Dilute Spray.

Material	Amount per 100 Gal.	Residues, Days after Spraying, p.p.m.* 0	1	4	8	14**
Diazinon, 25% emulsifiable concentrate	2 lb.	5.8	4.6	2.4	0.7	0.3
Diazinon, 25% wettable powder	2 lb.	8.6	4.7	2.1	0.6	0.2

* Official Canadian tolerance, 0.75 p.p.m.
** Harvest.

Sevin is more persistent on apples than Diazinon. About 50 per cent of the initial deposit of Sevin remained on the fruit two weeks after the final spray in comparison with only about 15 per cent of the Diazinon. Since there is about a 50 per cent loss of Sevin in two weeks, a fairly reliable estimate of the residue at harvest can be made from a residue analysis before harvest.

The data from Diazinon residues on cherries (Table 2) indicate that the persistence is similar for the wettable powder and emulsifiable concentrate formulations, and that the residue is below tolerance eight days after spraying.

The analytical results for Diazinon on cherry fruit and foliage, and on apple foliage, immediately after spraying (Table 3) indicate that the residues on cherry foliage were much lower than on cherry fruit, or on apple foliage, when the spray was applied by a high-volume hand gun. Evidently there was greater "run-off" of spray liquid from the cherry foliage. It may be that, in low-volume concentrate spraying where there is no run-off, the initial residues on cherry and apple foliage would be similar.

TABLE 3—Average Residues of Two Formulations of Diazinon on Fruit and Foliage of Cherry Trees and on Foliage of Apple Trees Immediately after One Application of a Dilute Spray.

Materials	Amount per 100 Gal.	Residues, mmg. per sq. cm. Cherry* Fruit	Cherry* Foliage	Apple** Foliage
Diazinon, 25% emulsifiable concentrate	2 lb.	2.0	0.4	—
Diazinon, 25% wettable powder	2 lb.	3.5	0.7	2.9

* Means of two replicates.
** Mean of eight replicates.

Summary

Data are given showing the amount of Diazinon residues on cherries and apples, and Sevin residues on apples. Results indicate that Diazinon residues on cherries were similar for a wettable powder formation and an emulsifiable concentrate formulation. The addition of a surfactant to Diazinon and Sevin sprays on apples did not affect the magnitude of the initial residues nor the persistence of the spray residues. Sevin residues on apples were more persistent than Diazinon residues.

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RESISTANCE TO DDT IN THE CODLING MOTH IN BRITISH COLUMBIA[1]

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In 1934 Hough (5) determined that there was considerable variation in the ability of larvae of the codling moth, *Carpocapsa pomonella* L., from Colorado and from Virginia, to penetrate deposits of lead arsenate, and of several other codling moth insecticides. He attributed the variation to difference in vigour. Whatever the reason, from that time until the beginning of the DDT era in orchard pest control in 1946, evidence mounted that lead arsenate was gradually losing its effectiveness in many areas where the insect was a serious pest.

Particularly in arid, or semi-arid, areas such as the Okanagan Valley of British Columbia, DDT was a spectacular success; even indifferent application of the new insecticide proved adequate (6). Orchardists brought to the brink of ruin by the codling moth became successful again, and serious loss of fruit from codling moth injury became a thing of the past. But five or six years later there were hints of trouble. Extra applications of DDT were becoming common although weather conditions were not very favourable for the development of the insect. Spraying technique, however, had radically changed between 1949 and 1952 (7).

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