DETERMINATION OF RESIDUES OF DIMECRON, MALATHION AND ENDRIN ON RADISH PLANTS BY BIOLOGICAL METHOD

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The residues of dimecron, endrin and malathion, applied each in the concentrations of 0.25 and 0.5 per cent, on radish remained effective against *Lipaphis erisimi* (Klth.) for 10 and 11, 7 and 8, and 7 and 9 days with maximum quantities of residues being 25.6 and 112.9, 49.1 and 50.4, and 6.5 and 53.6 p.p.m. at 24 hours after application and minimum level of residue on the last day of effectiveness, being 0.6 and 0.7, 0.1 and 0.1, and 0.8 and 0.8 p.p.m. respectively in 1968. The respective values for 1969 regarding the persistence of residual effect, maximum amount of insecticide residues at 24 hours of application and minimum level of residues on the last day of effectiveness were 9 and 10, 10 and 12, and 5 and 6 days, 31.0 and 50.7, 45.0 and 68.5, and 39.1 and 50.4 p.p.m., and 0.9 and 1.0, 0.5 and 0.8, and 2.4 and 2.1 p.p.m. respectively.

INTRODUCTION

The use of pesticides in boosting up agricultural production in Pakistan has become almost inevitable. Consequently, millions of rupees are being spent on the import of these pesticides every year and still these are not sufficient to cover more than 20 per cent of the cropped area. The evaluation of pesticides for the control of different pests has received due attention, but the problem of pesticides residues on edible and forage crops has remained almost neglected. For information on this important aspect of chemical control, one has to depend on data obtained entirely under different climatic conditions.

Dimecron (Phosphamidon), endrin and malathion are commonly used against insect pests attacking radish but little work has been done to find out their residual persistence on this crop. Some information obtained in foreign countries, on this aspect of these chemicals is available in literature. Burnson *et al.* (1962) stated that different concentrations of EPN, parathion, methyl parathion and metacide did not always result in corresponding deposits, but the rate of loss of residue was about the same, irrespective of the amount of insecticide initially deposited.

Dogger and Bowery (1958) reported that 8.08 ppm. of malathion residue, observed five days after application on alfalfa green forage, dissipated to 0.76 ppm. by 10th day. Byrdy (1963) found 1.8 ppm. of malathion

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residue after five days of treatment, when this insecticide was applied at 0.05 per cent, using *Aedes aegypti* (L.) larvae as test insect. Miles *et al.* (1964) reported that residues of malathion, sprayed at 0.5 lb. per acre on forage crop, declined from 51 ppm. to trace amounts (0.25 ppm. or less) within a week after application. Yamauchi (1966) found that residues of malathion used at 0.05 and 0.025 per cent, were 1.4 ppm. on rice in autumn and 7.4 ppm. on cabbage in winter, six days after treatment in each case.

Brewerton (1963) detected 1 ppm dimecron residues in apple fruit, 12 days after application. The residues of dimecron, at usual rates of application, have been reported to fall below 1 ppm. within 10 days of application (Ciba, 1967).

Endrin when applied on foliage at usual rates of application persists for 10 to 20 days (Shell compilation-*Endrin Hand Book*, 1961). Mattic *et al.* (1963) observed 0.13 ppm. of endrin, applied at 0.25 and 0.5 lb. a.m. per acre on cabbage, using gas chromatographic technique, 21 days after the application.

The present investigation embodies relative information on the residual persistence of the three insecticides under study on radish crop by biological method.

MATERIAL AND METHOD

Residues of dimecron, endrin and malathion, applied on radish, each in the concentrations of 0.025 and 0.05 per cent, were determined by bioassay technique using mustard aphid, *Lipaphis erisimi* (Kltb.) as test insect.

A sample of 10 plants for each treatment in each experiment was earmarked at random and sprayed with insecticides in the above mentioned concentrations to the point of run off using a lady hand sprayer. A distance of 10 feet was maintained between two plots to avoid the drift of insecticides. There were in all seven treatments including a check and were repeated five times.

The leaves from each treatment were collected at random every day for the liberation of test insect and the first sample was taken twenty-four hours after spray. The samples were taken to the laboratory in cellophane bags for the liberation of insects on them. Fifteen freshly collected adult aphids were liberated in each jar containing treated leaves. Observations on mortality were recorded 24 hours after each liberation. Number of dead insects in each jar were counted and percentage mortality was recorded daily till no mortality occurred.

For preparing the standard curves, 1, 3, 5, 7, 10, 12, and 15 p.p.m. concentrations of each insecticide were prepared. The leaves of the same size

were dipped into the solutions, dried under fan and placed in the glass jars. Five repeats were made for each concentration. Control treatment was also maintained. The insects were then liberated in the manner as mentioned above and mortality data were recorded after 24 hours of liberation. The data were analysed using Probit Analysis Technique.

RESULTS

The results obtained from the trials carried out on radish crop during 1968 and 1969 are summarisd.

The standard experiments were carried out during March-April, 1968 in the laboratory with known concentrations to derive a standard equation for each insecticide. Following standard equations were derived from the data obtained from these experiments :

Dimecron	x	=	1.8298	+	1.7597 y
Endrin	x	=	3.2292	+	1.3721 y
Malathion	x	=	1.4391	+	2.0105 y

The data obtained from the field experiment were projected on the basis of above equations and the results are givn in Table 1. The maximum and minimum temperatures and relative humidity during the course of this experiment, ranged from 70.8 to 84.9 and 43.9 to 60.2; and 60 to 90 per cent and averaged 78.7 and 52.7°F and 74 per cent respectively.

The data given in Table 1 revealed that residues of dimecron, endrin and malathion, applied each in the concentrations of 0.025 and 0.05 per cent, on radish crop remained effective for 10 and 11, 7 and 8 and 7 and 9 days respectively. The maximum quantities of insecticide residues, determined at 24 hours after application were 25.6 and 112.3, 49.1 and 50.4, and 6.5 and 53.6 ppm. against 85.7 and 98.6, 97.2, and 97.3, and 53.5 and 97.3 per cent mortality and minimum (residue level on the last days of effectiveness) 0.6 and 0.7, 0.1 and 0.1, and 0.8 and 0.8 ppm. against 3.7 and 4.9, 4.3 and 5.1, and 4.3 and 4.0 per cent mortality in the rspective treatments. The rate of fall in the residue level of endrin was almost the same in the two concentrations and was greater in the first few days as compared to that in other insecticides. By the end of 3rd day, in 0.025 and 0.05 per cent concentrations, (Table III) 97.9 and 96.3 per cent endirin residues were lost as against 74.5 and 84.2, and 55.4 and 90.8 per cent loss of dimecron and malathion residues respectively.

The experiments carried out in 1968 were repeated in March, 1969. The following three equations were derived from the standard experiments carried

TABLE I. *Percentage mortality and quantity of residue of dimecron, endrin and malathion on radish crop during 1968.*

DAYS	Dimecron				Endrin				Malathion			
	0.05%		0.025%		0.05%		0.025%		0.05%		0.025%	
	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)
1	98.6	112.9	85.7	25.6	97.3	50.4	97.2	49.1	97.3	53.6	53.5	6.5
2	88.6	30.7	86.7	27.1	62.5	3.3	56.2	2.5	70.8	11.1	34.8	3.8
3	78.5	17.8	50.9	6.5	49.3	1.9	35.1	1.0	44.0	5.8	26.9	2.9
4	74.7	15.1	41.9	4.8	40.6	1.3	26.6	0.7	36.4	4.0	18.9	2.1
5	65.8	11.8	38.9	4.4	39.8	1.3	17.1	0.4	31.0	3.4	18.0	2.1
6	47.7	5.8	32.8	3.5	22.4	0.6	8.6	0.2	21.8	2.4	10.3	1.4
7	34.4	3.7	26.3	2.8	17.1	0.4	4.3	0.1	10.6	1.4	4.3	0.8
8	26.3	2.8	13.3	1.5	5.1	0.1	—	—	5.2	0.9	—	—
9	17.6	1.9	9.5	1.1	—	—	—	—	4.0	0.8	—	—
10	8.8	1.0	3.7	0.6	—	—	—	—	—	—	—	—
11	4.9	0.7	—	—	—	—	—	—	—	—	—	—

out in the laboratory for each insecticide :

Dimecron	x	=	1.4829	+	2.0068 y
Endrin	x	=	2.4844	+	1.6071 y
Malathion	x	=	0.1696	+	2.6002 y

The results of the field experiment were projected on the basis of above equations and are given in Table 2. The maximum and minimum temperatures and relative humidity during the course of this experiment, ranged from 84.8 to 95.8 and 55.3 to 66.7°F and 68 to 78 per cent and averaged 91.7 and 54.9°F and 71.7 per cent respectively.

The data given in Table 2 indicated that residues of dimecron, endrin and malathion, applied each at 0.025 and 0.05 per cent concentrations, remained effective for 9 and 10, 10 and 12, and 5 and 6 days with maximum quantities of insecticide residue at 24 hours after application being 31.0 and 50.7, 45.0 and 68.5, and 39.1 and 50.4 ppm. against 93.1 and 97.2, 97.2 and 98.6, and 97.2 and 98.6 per cent mortality, respectively. The minimum quantities of insecticides on the last day of residual effectiveness in the respective treatments were 0.9 and 1.0, 0.5 and 0.4, and 2.4 and 2.1 ppm. against 5.5 and 7.0, 8.0 and 5.4, and 11.0 and 8.2 per cent mortality. The rate of disappearance in the two concentrations in case of each insecticide was about the same (Table 3) and by the end of 3rd day 64.2 ad 66.5, 71.1 and 60.6, and 80.5 and 79.8 per cent residues were lost in the respective treatments.

DISCUSSION

The residual level of malathion, used in the concentrations of 0.025 and 0.05 per cent, was recorded to range between 0.8 and 2.4 ppm. after 5 to 9 days of application. A similar observation was recorded by Yamauchi (1966) who observed 1.4 ppm. of this insecticide on 6th day after application. Miles *et al.* (1964) detected 51 ppm of malathion residue 48 hours after application which dissipated to traces (0.25 ppm. or less) within a week. During the present study in case of 0.05 concentration, 53.6 and 50.4 ppm. of malathion residue dissipated to 0.8 and 2.1 ppm., 9 and 5 days after application in 1968 and 1969, respectively. Malathion residue dissipated below tolerance level within five days of treatment. This observation is in conformity with that of Dogger and Bowery (1958). Byrdy (1963) found 1.8 ppm. malathion residue on fifth day. During the present studies malathion dissipated nearly to this level within a week.

Mattick *et al.* (1963) detected 0.13 ppm. endrin after 21 days of application on cabbage, when used at 0.25 and 0.5 lb. a.m. per acre. In the present study the residual effectiveness persisted for 7 to 8 and 10 to 12 days in 1968

TABLE 2. *Percentage mortality and quantity of residue of dimecron, endrinand malathion on radish crop during* 1968.

DAYS	Dimecron				Endrin				Malathion			
	0.05%		0.025%		0.05%		0.025%		0.05%		0.025%	
	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)	%age kill	Residue (ppm.)
1	97.2	50.7	93.1	31.0	98.6	68.5	97.2	45.0	98.6	50.4	97.2	39.1
2	88.4	22.3	82.1	16.2	97.3	45.8	87.7	19.4	95.8	33.5	77.7	14.2
3	83.1	17.0	72.2	11.1	91.8	27.0	81.1	13.0	65.3	10.2	52.7	7.7
4	67.6	9.5	61.6	7.9	84.6	15.8	72.2	8.5	38.3	5.5	30.0	4.5
5	61.1	7.8	53.6	4.7	71.0	8.1	64.7	6.3	24.4	3.9	11.0	2.4
6	52.1	6.0	33.3	3.4	64.5	6.3	54.7	4.4	8.2	2.1	—	—
7	39.7	4.2	22.2	2.4	50.7	3.8	43.7	2.9	—	—	—	—
8	32.9	3.4	13.9	1.6	40.3	2.6	31.4	1.8	—	—	—	—
9	18.1	2.0	5.5	0.9	28.8	1.7	17.3	1.0	—	—	—	—
10	7.0	1.0	—	—	20.3	1.1	8.0	0.5	—	—	—	—
11	—	—	—	—	17.3	1.0	—	—	—	—	—	—
12	—	—	—	—	5.4	0.4	—	—	—	—	—	—

TABLE 3. *Rate of disappearance of dimecron, endrin and malathion on radish*

DAYS	Dimecron				Endrin				Malathion			
	1968		1969		1968		1969		1968		1969	
	0.05%	0.025%	0.05%	0.025%	0.05%	0.025%	0.05%	0.025%	0.05%	0.025%	0.05%	0.025%
1	72.8	—	56.0	47.7	93.4	94.8	33.2	57.0	79.4	42.3	33.6	63.9
2	84.2	74.5	66.5	64.2	96.3	97.9	60.6	71.1	90.8	55.4	79.8	80.5
3	86.6	81.1	81.2	74.4	97.4	98.6	76.9	81.0	92.6	67.2	89.0	88.4
4	89.5	82.9	84.6	84.8	97.5	99.2	88.2	86.0	93.8	68.3	92.3	93.8
5	94.9	86.2	88.2	88.9	98.9	99.6	90.7	90.3	95.5	78.7	95.8	—
6	96.7	89.2	91.7	92.4	99.2	99.8	94.5	93.5	97.4	87.3	—	—
7	97.6	94.3	93.3	94.8	99.8	—	96.2	95.9	98.3	—	—	—
8	98.3	95.3	96.1	97.1	—	—	97.6	97.9	98.5	—	—	—
9	99.1	95.5	98.0	—	—	—	98.4	98.9	—	—	—	—
10	99.4	97.6	—	—	—	—	98.6	—	—	—	—	—
11	—	—	—	—	—	—	99.5	—	—	—	—	—

and 1969 respectively. The variation in results might be due to vriation in crop, ecological condition and the technique used.

Residue of dimecron dissipated to 0.6 to 1.0 p.p.m. within 9 to 11 days. These results are in line with those reported in Ciba compilation (1967) ahd by Brewerton (1963).

In the present studies, the different concentration of insecticides used, did not result in corresponding deposits. This observation is in conformity with the findings of Brunson *et al.* (1962) who reported that different concentrations of insecticides tried by him did not result in corresponding deposits and the rate of loss of residues was about the same irrespective of the amount of insecticides initially deposited.

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