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Residues of Quinalphos and Phosalone in Tomato

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Quinalphos and phosalone sprayed at the rate of 0.250 and 0.437 kg a.i./ha, respectively, have been reported to give effective control of Heliothis armigera (Hubner), the major insect pest of tomato (SINGH et al. 1976). However, one of the important considerations in their use is that their residues should rapidly decline to toxicologically acceptable safe levels. Dissipation of quinalphos on tomato was earlier studied by HEENAN (1974) in New Zealand and MAES et al. (1974) in Switzerland. Since the dissipation of an insecticide varies with the crop variety, dosage applied, agroclimatic conditions, etc., the present studies were undertaken to determine the decline of quinalphos and phosalone residues on tomato under North Indian climatic conditions. The effect of the use of different types of containers, viz., glass beakers and polyethylene bags for collection of the samples, on the estimates of the residues of these insecticides was also investigated.

MATERIAL AND METHODS

Field experiment. Tomato (var. Punjab Tropic No. 216) was raised at the University Farm (Ludhiana) from seedlings transplanted in March 1978 according to locally recommended agronomic practices. Quinalphos 0.03 per cent aqueous emulsion prepared from Ekalux^{R} 25 EC and phosalone 0.06 per cent aqueous emulsion prepared from Zolone^{R} 35 EC were sprayed on the crop in May 1978 at the dosages of 0.250 and 0.437 kg a.i./ha, respectively. Control plants maintained similarly were sprayed with water alone. Means of maximum and minimum temperature during the experiment period were 42.4 and 22.8^{o}C, respectively.

Sampling. Three samples (0.5 kg each) of marketable-size tomato fruits were taken at random from the treated and control plants by clipping the fruits into glass beakers on 0,1,2, and 4 days after spray. Another set of samples was taken similarly in polyethylene bags. These were brought to the laboratory and cut into small pieces. Representative subsamples of 50 g were taken for analyses.

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Extraction and analysis. The method of LUKE et al. (1975) for the extraction of organophosphorus insecticides was followed with slight modifications. Sample was blended with 100 mL of acetone for 2 min in a Waring blender. The macerate was filtered under vacuum in a suction filter. The residual material was re-blended twice using 50 mL acetone each time. The filtrates were combined and concentrated to about 50 mL on a rotary vacuum evaporator. This was transferred to a separatory funnel along with 100 mL of water and partitioned thrice into 110, 60 and 60 mL of dichloromethane. The dichloromethane fraction was evaporated till almost free of solvent. Complete removal of dichloromethane was ensured by repeatedly adding acetone to the residue followed by evaporation under vacuum. The residue thus obtained was taken up in small volume of acetone and analysed using a gas chromatograph equipped with a thermionic (KCl-coated) detector. A 1 m x 3.2 mm OD glass column packed with 3% DC-200 on 80/100 mesh Gas Chrom Q was used. Inlet, column and detector temperatures were 210, 200 and 210°C, respectively; nitrogen carrier gas flow was 90 mL/min.

Retention times of quinalphos and phosalone were 2 and 9 min, respectively. Insecticide residues in samples were quantified by comparing with the peak heights of the standard materials chromatographed under parallel conditions. Recoveries of quinalphos from the untreated fruit homogenates fortified at 0.1, 0.25 and 1.0 ppm ranged from 78 to 94 per cent while that of phosalone ranged from 80 to 91 per cent. Residue data were not corrected for recovery. Minimum limit of estimation of quinalphos and phosalone residues was 0.01 and 0.1 ppm, respectively. It was, however, observed that the GC response of phosalone was adversely affected by the contamination of the column, which necessitated the frequent replacement of the packing material.

RESULTS AND DISCUSSION

Quinalphos spray resulted in the initial deposit of 1.8 ppm on tomato, which dissipated to the level of 1.2, 0.5 and 0.2 ppm in 1, 2 and 4 days, respectively (Table 1). The reduction in

TABLE 1
Quinalphos residues on tomato fruits

Days after spray	Mean residues (ppm) ± S.D.	
	Glass beakers	Polyethylene bags
0	1.8 ± 0.1	0.5 ± 0.04
1	1.2 ± 0.02	0.3 ± 0.04
2	0.5 ± 0.04	0.3 ± 0.02
4	0.2 ± 0.02	0.1 ± 0.002

quinalphos residues was 30, 72 and 88 per cent in 1, 2 and 4 days, respectively. According to HEENAN (1974), spraying of quinalphos at the rate of 850 g a.i./ha resulted in the initial deposit of 2.5 ppm on tomato, which dissipated to level below 0.4 ppm after

2 weeks. CHAWLA et al. (1979) observed fairly fast rate of degradation of quinalphos on cauliflower. A general maximum residue limit of 0.25 ppm has been tentatively proposed for quinalphos residues (Personal communication from M/s Sandoz India Limited). The results obtained, therefore, suggest that 3 days should elapse after spraying, before marketing tomato fruits.

Interestingly, samples of tomato collected in polyethylene bags showed significantly lower levels of quinalphos residues than those collected in glass beakers (Table 1). This indicates the loss of quinalphos residues from tomato fruits through their contact with polyethylene bags, probably by absorption. However, insignificant amount of quinalphos (0.005 ppm) was recovered from glass containers after the transference of the tomato samples. The use of glass containers is, therefore, considered appropriate for sampling.

The data on phosalone residues on tomato are presented in Table 2. Samples collected immediately after the spray showed the mean initial deposit of 1.7 ppm. The residues at the end of

TABLE 2
Phosalone residues on tomato fruits

Days after spray	Mean residues (ppm) ± S.D.	
	Glass beakers	Polyethylene bags
0	1.7 ± 0.2	1.1 ± 0.2
1	0.9 ± 0.2	0.8 ± 0.1
2	0.7 ± 0.03	0.6 ± 0.01
4	0.4 ± 0.1	0.3 ± 0.01

1, 2 and 4 days were 0.9, 0.7 and 0.4 ppm respectively. In case of phosalone also, samples collected in glass beakers showed consistently higher level than those collected in polyethylene bags. However, the effect of the type of container on the level of phosalone residues was not as pronounced as was observed in quinalphos. Phosalone residues in tomato reached below the prescribed maximum residue limit of 1 ppm (FAO/WHO 1973) in 1 day.

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