Residues of BHC and DDT in Egg Plant *(Solanum Melongena)*

by P. S. JAGLAN and S. L. CHOPRA
Department of Chemistry and Biochemistry
Punjab Agricultural University
Ludhiana, India

INTRODUCTION

In India most of the recommendations of doses of BHC and DDT against different insect pests on various crops are based on their efficacy without ascertaining the magnitude and extent of residues resulting from such applications. We were particularly concerned for possible residue problems for a number of years. This apprehension was further buttressed by the anxiety shown by the public in discussion of this subject.

Because there are no legal tolerances in India to control the pesticide residues in the crops and the crop products, farmers usually apply these toxicants in large amounts and at frequent intervals especially to cash crops such as vegetables. In addition, no interval is required between spray and harvest.

This study was therefore undertaken to establish residues of BHC and DDT in egg plant and to follow the rate of their disappearance during the period 1963-65. This study was conducted at the farm of Punjab Agriculture College, Ludhiana (India) on the plots where no pesticide was used previously and thus presented an ideal situation. This pioneering work which was of great practical interest, stimulated much impetus to establish the behavior of several pesticides on various crops under the leadership of Junior author.

MATERIALS AND METHODS

Field Methods

The seedlings of egg plant were raised in a pesticide free sand culture and were transplanted when 6"-8" high during August, 1964, in plots ten feet square keeping two feet from plant to plant and between rows. This study was conducted in a randomized block design with three replicates and using two concentrations of 0.1% and 0.2% usually recommended for both the pesticides. A buffer area of 5 feet was left around the plots and a hessian cloth was used to avoid pesticidal drift. Five sprays at each concentration were given with manual bucket spray. The first four sprays constituted 500 ml per plot. The volume of final spray was raised to one, one per plot as necessitated due to increased growth of plants in order to drench them completely to obtain a practical situation used by growers. Control plots were similarly sprayed but only tap water was used.

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Sampling

Two fruits were randomly plucked from each plot after 1, 3, 7, and 14 days of final spray and were cut into small pieces. Half of the sample was washed thoroughly with distilled water while the other half was processed as such. Composite samples were subsampled as described by Gunther and Blinn (1).

Extraction and Analysis

BHC was analyzed as per details of BHC panel method (2) at 565 mμ using acetone as the extraction solvent. DDT was analyzed by the method of Schechter, et al., (3) as per details of DDT panel method (4) at 596 mμ using benzene (thiophene free) as the extraction solvent. The analyses were conducted with SP 500 unicam quartz tube spectrophotometer using 1 cm cell width and 0.3 mm slit width.

Fortification

Fortification at 0.4, 2.0, and 4.0 ppm level at stripping stage was done to monitor recovery data for extraction efficiency. The extraction was done with acetone (aromatic free) and benzene (thiophene free) for BHC and DDT, respectively, using 2 ml/g of substrate.

RESULTS AND DISCUSSION

A standard curve of p,p'-DDT was linear between 10-80 μg/ml with a slope of 0.120 A/10 μg and an intercept of zero. Control samples processed according to the procedure showed an average of 0.06 ppm DDT with highest value of 0.1 ppm. Similarly, a standard curve of BHC (technical grade) was linear between 10-100 μg/ml with a slope of 0.068 A/10 μg and an intercept of zero. Control samples processed showed average of 0.01 ppm apparent BHC with highest value of 0.03 ppm.

Fortification of DDT at levels of 0.4, 2.0, and 4.0 ppm in control showed a recovery of 94-106%. BHC fortified as above showed recovery of 90-107.5%. Fortification at the stripping stage shows that recovery was good. This is illusory except in a few cases (5), and does not represent a true picture of extracting field residues especially in cases where the aged residues penetrate in the locales untouched by solvent.

The colorimetric method used is non-specific, but great reliance can be placed in the data due to availability of control samples and particularly from history of pesticide applications. Such methods will fail to reveal the identity of compounds, however, in samples with multiple residues.

The results of analysis of residues of BHC and DDT in egg plant at different intervals after spray are given in Table 1.

TABLE 1. - Recovery of BHC and DDT from egg-plant fruit

No. of days after spray	Replication	Unwashed BHC 0.1%	Unwashed BHC 0.2%	Unwashed DDT 0.1%	Unwashed DDT 0.2%	Washed BHC 0.1%	Washed BHC 0.2%	Washed DDT 0.1%	Washed DDT 0.2%
		Recovery (ppm)				Recovery (ppm)			
2 hrs	1	9.20	19.10	10.24	24.48	1.00	1.20	0.48	0.32
	2	6.40	14.10	8.96	12.96	1.30	1.60	0.32	1.52
	3	6.00	16.10	8.16	17.12	1.50	0.70	0.88	0.36
	Mean:	7.20	16.43	9.12	18.19	1.27	1.17	0.56	0.73
1 day	1	4.80	8.80	8.16	15.36	2.15	2.10	4.16	4.96
	2	4.60	10.20	7.36	11.68	1.30	1.60	3.92	4.56
	3	4.00	9.60	6.24	11.52	1.50	1.40	4.00	5.44
	Mean:	4.47	9.53	7.25	12.85	1.65	1.70	3.69	4.97
3 days	1	3.80	6.70	5.96	10.24	1.30	2.00	3.92	4.16
	2	2.10	5.50	4.00	8.96	1.90	2.40	3.04	4.00
	3.	2.90	5.80	5.12	10.08	1.80	2.30	2.52	3.12
	Mean:	2.93	6.00	5.03	9.76	1.73	2.23	3.16	3.76
7 days	1	2.70	5.10	3.84	5.44	1.60	-	2.32	2.26
	2	1.50	4.10	3.68	3.84	1.00	2.00	1.60	3.04
	3	2.00	3.20	3.28	6.24	1.00	1.40	1.92	2.32
	Mean:	2.07	4.13	3.60	5.19	1.20	1.70	1.95	2.54
14 days	1	0.70	1.00	1.60	2.32	0.90	1.20	1.04	1.60
	2	0.90	2.00	1.52	1.76	0.70	2.00	1.52	1.56
	3	0.50	1.50	1.92	2.40	0.70	1.25	2.00	1.52
	Mean:	0.70	1.50	1.68	2.16	0.77	1.48	1.52	1.56

The variation with replicates are not unexpected. On the other hand these reasonable variations suggest that sample size and sampling procedure was quite adequate and satisfactory.

The data shows that initially there are high amounts of residues from both pesticides and at both concentrations in the unwashed samples, well above the tolerances set forth in the United States of America. There is a great decrease of both pesticide residues at both concentrations for the first three days indicating typical degradation behavior as discussed by Gunther and Blinn (1). Residues tend to disappear at a slow rate after three days. The greater dissipation of BHC residues as compared to DDT is not unexpected since BHC has a high vapor pressure and may volatilize faster.

The possible reasons for the decrease in residues may be attributed to the environmental degradation by the action of sunlight, temperature, wind and humidity and the biochemical alteration to products which are undetected or give lower responses to the colored species formed by these methods at the wavelengths under discussion.

Additional factor of process of development and the growth of fruit itself appears more important in diluting the residues. Taschenberg and Avens (6) observed that reduction of 27.7% of residues due to growth alone. The bearing of new fruits after the last spray and their inclusion in a random sample is also likely which might have helped in reducing the residues.

The residues in washed samples show low residues initially, indicating the residues are extra surface and can be dislodged by washing with water. Although these compounds are soluble in water in the range of few ppb and ppm of DDT and BHC, respectively (Gunther, et al. (7)), use of large amounts of water is particularly effective. The higher residues after one and three days suggest that the chemicals have penetrated below the surface and may be solubilized in the wax and lipids and are no longer amenable to washing. The decrease of residues after seven days suggest biochemical transformations.

Further studies with the availability of modern instruments recently for segregating multiple residues coupled with confirmatory tests will make such preliminary studies more valuable in our laboratory.

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LITERATURE CITED

1. F. A. Gunther and R. C. Blinn. Analysis of Insecticide and Acaricides. Interscience Publ., Inc., New York (1955).

2. BHC Panel. The Determination of Small Amounts of BHC in Flour and Edible Oils. Analyst, 87; 220 (1962).

3. M. S. Schechter, S. B. Soloway, R. A. Hays, and H. L. Haller, Colorimetric Determination of DDT - Color Test for Related Compounds. Ind. Eng. Chem. Anal. Ed. 17, 704 (1945).

4. DDT Panel. Recommended Method of Analyses of Pesticide Residue in Food Stuffs. Analyst; 86, 600 (1960).

5. F. A. Gunther, Instrumentation in Pesticide Residue Determinations. Adv. Pest Control Res. 5; 191 (1962).

6. E. F. Taschenberg and A. W. Avens. DDT Residues on Grape as Effected by Growth and Weathering. J. Econ. Entomol. 53; 269 (1960).

7. F. A. Gunther, W. E. Westlake, and P. S. Jaglan, Reported Solubilities of 738 Pesticide Chemicals in Water. Residue Reviews 20; 1 (1968).