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NOTE

Insecticide Residues in Farmgate Vegetable samples in Punjab

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Ninety six farmgate vegetable samples namely cauliflower (23), brinjal (30), okra (12), cabbage (6) and tomato (25) when analysed for residues of insecticide last applied to the crop revealed that about 67% of the samples were contaminated and only 7% of these contained residues above respective MRLs Sixty nine vegetable samples were also analysed for the presence of DDT and HCH which are ubiquitously known to be present in the environment. Thirty five and 71% samples were contaminated with DDT and HCH respectively.

KEY WORDS : *Insecticides, monitoring, organochlorine, organophosphorus, residues, vegetable, farmgate*

The vegetable crops of cauliflower, cabbage, brinjal, okra and tomato are attacked by a number of insect pests during different stages of growth, causing considerable losses in terms of quality and quantity. Control of pests is, therefore, indispensable to safeguard vegetable production. Repeated application of insecticides is often made to protect the crop from severe pest attack. This may lead to undesirable residue problems. Therefore, monitoring of farmgate vegetable samples which is a part of the programme of All India Coordinated Research Project (AICRP) on Pesticide Residues was undertaken to estimate the level of pesticide residues in vegetable samples at the farmgate level primarily to establish the status of marketable vegetables in respect of the prescribed MRL[1]. Recently, several coordinating centres of the AICRP have reported their work on monitoring of farm gate vegetable samples from different regions of India[2]. The present study was undertaken during 1994-96 in farmgate vegetable samples from Punjab.

Materials and Methods

Samples : Ninety six vegetable samples were collected from farmers' fields during 1994-96 when these were ready for transportation to market. The detailed history of the insecticide(s) treatments and other relevant information was obtained from the farmers at the time of collection of samples. These were analysed for the insecticide last applied to the crop and 69 samples were additionally analysed for the presence of DDT and HCH residues. In case of brinjal, cauliflower and cabbage, four to six marketable heads and for tomato and okra approximately 1 kg of fruits were taken to represent the whole crop area.

Chemicals : The solvents were distilled in all glass apparatus before use. All other chemicals were of analytical grade and were used as such. The suitability of the reagents/solvents was checked by running reagent blanks alongwith samples during analysis.

Extraction, clean up and estimation

Extraction : Endosulfan, synthetic pyrethroids, DDT and HCH residues from various vegetables were extracted in acetonitrile and partitioned into n-hexane; organophosphorus insecticide residues were extracted in acetone and partitioned into dichloromethane.

Cleanup : Endosulfan and synthetic pyrethroid samples were cleaned up as per Singh *et al*[3] while DDT and HCH samples were cleaned up using concentrated sulphuric acid[4]. For organophosphorus insecticide residues, column chromatography was used[5] employing benzene as an eluant.

Estimation : The residues of insecticides in cleaned up extracts were quantified on Nucon 5700 gas chromatograph equipped with ^{63}Ni EC and NP detectors. The operating conditions are described in Table 1.

of endosulfan residues which were below their respective MRL values of 1.0 and 2.0mg kg^{-1}. Out of the 21 samples analysed for synthetic pyrethroids, 17 showed the presence of residues in the range of ND-0.081 mg kg^{-1} (Table 2). Vegetable samples analysed also showed the presence of DDT and HCH in the range of ND-0.29 and ND-0.10 mg kg^{-1}. However, none of the samples contained DDT residues exceeding MRL of 1.0 mg kg^{-1} (Table 3).

Residues of chlorpyriphos were found to be present in all the 5 vegetables but only one sample of cauliflower contained residues of 0.07 mg kg^{-1} which was above its MRL of 0.05 mg kg^{-1}. Residues of quinalphos were found in all the vegetables except cabbage. Two samples of tomato and one each of cauliflower and brinjal contained residues of 1.04, 0.93, 0.32 amd 0.33 mg kg^{-1}, respectively which

Table 1. GLC parameters used in the present study

Parameter	Endosulfan, DDT and HCH	Synthetic pyrethroids	Organophosphorus insecticides
Column	1.5% OV-17+1.95% OV-210	1.5% OV-17+1.95% OV-210	3% OV-101
Column temp (°C)	180	240	220
Detector temp (°C)	270	270	300
Inlet temp (°C)	220	260	240
Gas flow (ml min^{-1})			
Nitrogen	70-80	60	40
Air	--	--	80
Hydrogen	--	--	10
Recovery	95	90	95

Results and Discussion

The results obtained by analysing samples of different vegetables are discussed according to the nature of insecticides detected. (Tables 2 and 3)

One sample of cabbage and two samples of tomato contained 0.06, 0.01 and 0.48 mg kg^{-1} were above the MRL of 0.25 mg kg^{-1} for quinalphos on vegetables. One sample of cabbage contained 0.28 mg kg^{-1} of monocrotophos above the MRL of 0.2 mg kg^{-1}, while one sample of tomato contained 0.44 mg kg^{-1} of phosphamidon which was above its MRL of 0.1 mg kg^{-1}. Low levels of residues of methyl parathion, triazophos and malathion were

Table 2. Residue levels (mg kg^{-1}) of various insecticides detected in farmgate vegetable samples collected during 1994-96 (summarised data)

Commodity (no. of samples)	Insecticide last applied (no. of samples)	Frequency	Range of residues levels (mg kg^{-1})	MRL (mg kg^{-1})	No. of samples exceeding MRL
Cauliflower	Monocrotophos (1)	1	0.10	0.2	Nil
(23)	Methyl parathion (5)	4	ND-0.08	0.2	Nil
	Quinalphos (5)	1	ND-0.32	0.25	1
	Chlorpyriphos (4)	4	0.02-0.07	0.05	1
	Cypermethrin (4)	3	ND-0.07	1.0	Nil
	Fenvalerate (3)	2	ND-0.03	2.0	Nil
	Endosulfan (1)	0	ND	0.5	Nil
Brinjal	Monocrotophos (3)	0	ND	0.2	Nil
(30)	Methyl parathion (6)	5	ND-0.08	0.2*	Nil
	Quinalphos (3)	2	ND-0.33	0.25	1
	Triazophos (5)	4	ND-0.08	N.A	-
	Phosphamidon (1)	0	ND	0.1	Nil
	Chlorpyriphos (4)	3	ND-0.06	0.2	Nil
	Malathion (1)	0	ND	0.5	Nil
	Cypermethrin (3)	3	0.08	0.2	Nil
	Fenvalerate (2)	2	Tr.-0.01	1.0*	Nil
	Deltamethrin (1)	0	ND	0.2*	Nil
	Endosulfan (1)	0	ND	2.0	Nil
Okra	Methyl parathion (5)	1	ND-0.13	0.2*	Nil
(12)	Quinalphos (2)	1	ND-0.01	0.25	Nil
	Triazophos (1)	1	0.04	N.A.	-
	Chlorpyriphos (1)	1	0.02	0.2*	Nil
	Malathion (2)	1	ND-0.20	0.5*	Nil
	Fenvalerate (1)	0	ND	1.0	Nil
Cabbage	Monocrotophos (1)	1	0.28	0.2	1
(6)	Chlorpyriphos (2)	2	0.01-0.04	0.05	Nil
	Malathion (1)	1	0.59	8.0	Nil
	Endosulfan (2)	1	ND-0.06	1	Nil
Tomato	Monocrotophos (2)	0	ND	1.0	Nil
(25)	Methyl parathion (4)	4	0.04-0.14	0.2	Nil
	Quinalphos (5)	4	ND-1.04	0.25	2
	Phosphamidon (1)	1	0.44	0.1	1
	Chlorpyriphos (1)	1	0.03	0.5	Nil
	Malathion (1)	1	0.03	3.0	Nil
	Cypermethrin (5)	5	Tr.-0.02	0.5	Nil
	Fenvalerate (2)	2	0.02-0.03	1.0	Nil
	Endosulfan (4)	2	ND-0.48	2.0	Nil

For OP ND = <0.01 mg kg^{-1}, For synthetic pyrethroids Tr. = 0.001-0.009 mg kg^{-1},
N.A = not available, * MRL values compared with vegetable groups[7], - = not comparable

Table 3. Residue levels (mg kg^{-1}) of DDT and HCH detected in farmgate vegetable samples collected during 1994-96 (summarised data)

Commodity (no. of samples)	Insecticide detected	Frequency	Range of residue level (mg kg^{-1})	Mean residue (mg kg^{-1})	MRL	No. of samples exceeding MRL
Cauliflower	DDT	8	ND-0.29	0.03	1.0	Nil
(17)	HCH	13	ND-0.04	0.02		
Brinjal	DDT	7	ND-Tr	Tr	1.0	Nil
(20)	HCH	17	ND-0.10	0.02		
Okra	DDT	1	Tr	Tr	1.0	Nil
(8)	HCH	4	ND-0.08	0.01		
Cabbage	DDT	2	0.01-0.03	Tr.	1.0	Nil
(5)	HCH	5	Tr-0.10	0.02		Nil
Tomato	DDT	6	ND-0.02	Tr.	1.0	Nil
(25)	HCH	10	ND-0.01	Tr.		

Tr = 0.01 - 0.009 mg kg^{-1}, ND = <0.001 mg kg^{-1},
HCH and DDT = Σ HCH (all isomers of HCH: α-, β-, γ- and δ-),
all metabolites of DDT: *p,p'*- DDE, *o,p'*-DDT, *p,p'*-TDE and *p,p'*-DDT)

found in cauliflower, brinjal, okra and tomato (Table 2).

The present study of monitoring farmgate vegetable samples for insecticide residues during 1994-96, revealed that 67% of samples were contaminated with insecticides last sprayed and about 7% of these had residues above their respective MRL values. These studies are in consonance with the findings of Madan *et al*[6] on vegetable samples from Haryana. In about 2500 fruit and vegetable samples monitored for pesticide residues under AICRP on Pesticide Residues, majority of the samples revealed the presence of residues, however, the levels were generally below the prescribed MRLs[2]. As majority of the samples in the present study were found to contain residues less than MRLs of the insecticide last applied, the present pattern of insecticide use in the vegetable fields from the sampled areas does not seem to contribute towards excessive residues. However, the use of insecticides should be need based only and recommended insecticides should be applied as and when required. Further, to safeguard the consumers interest, proper waiting period must be observed by the producer before marketing vegetables.

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