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Monitoring of Pesticide Residues in Farmgate and Market Samples of Vegetables in a Semiarid, Irrigated Area

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Vegetables are important constituents of our daily diet. During their cultivation almost all vegetable crops are badly infested with a variety of insect pests, mainly, different kinds of borers, leaf catterpillars, jassids, aphids and moths. Unless controlled, these pests damage the vegetable production very badly. To obviate such menace of insect pests, farmers make frequent applications of different kinds of pesticides; most of the time with complete disregard to the recommended waiting periods between their harvest and last pesticide application. As a result, considerable amounts of harmful pesticide residues often remain in the harvested vegetables, which may ultimately reach the consumer and slowly cause health hazards. The problem is most serious in vegetables which are eaten raw, without cooking, like onion, tomato, cucumber and green chilli. Therefore, periodical monitoring of pesticide residues in farmgate and fresh market vegetable samples is very important to guide the vegetable growers on the judicial use of pesticides in area under study in the interest of public health.

Pesticide residue studies in vegetables have been reported from certain regions of the country (Madan et al. 1996; Dubey et al. 1999). In the present study an attempt has been made to report extensive monitoring of pesticide residues conducted during 1999-2000 in common vegetables grown around Jaipur (India) where the agro-climate is semiarid and all vegetables are cultivated under irrigated conditions, with frequent use of pesticides.

MATERIALS AND METHODS

162 samples of different vegetables viz. tomato, brinjal, cauliflower, cabbage, cucumber, chilli, bottlegourd, bittergourd, okra and onion

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were collected from farmer fields and fresh vegetable markets near Jaipur during 1999-2000. The samples were analysed for different pesticide residues by multi-residue methodology. 200g of the representative sample was chopped and ground to a fine paste. 10 g of the paste was mixed with 10-15 g of activated florisil to get a free flowing powder. This powder was packed in an extraction column containing about 1 cm layer of anhydrous sodium sulfate over a plug of cotton at the bottom. The column was first eluted with 50 ml of methylene chloride and acetone (9:1) for organochlorine pesticide comounds and then with ethyl acetate for organophosphate pesticides. The elute was concentrated to 0.5mL with a rotary vacuum evaporator. Methylene chloride was removed by adding 5mL of hexane and again evaporated. The process was repeated twice for complete removal of methylene chloride. The volume was made to 5mL with hexane for analyses.

The pesticide residues were determined with a GLC (Chemito 1000 model) equipped with ECD and NPD. The organochlorine pesticides were analysed in ECD using 1.5% OV-17 + 1.95% OV 210 column. The diameter of the column was 0.2mm and its length 1.80m. Temperature of the column was kept at 220°C and of detector at 300°C. For the estimation of pyrethroids, the temperatures kept were: oven, 270°C; injection port 270°C; and detector 300°C. The organophosphate pesticides were analysed in NPD again using the same column and temperatures as given for organochlorine, except that the temperature of the NPD was kept at 270°C. For the analysis of organophosphate pesticides like phosphamidon, methyldemeton and montocrotophos, 3% DEGS column was used. With this column the temperatures used were: oven 190°C, injection port 210°C and detector 250°C to avoid the column bleed. The flow rate of carrier gas nitrogen was kept at 60mL/min in all cases. The recovery limits of detection of the standards used were; organochlorine pesticides 0.001-0.01 μg/g, organophosphate pesticides 0.05-0.1 μg/g, and pyrethroid 0.05 μg/g. The purity of standards used was 99 to 100%.

RESULTS AND DISCUSSION

Analytical data pertaining to residues of different pesticides in 10 different vegetables determined during 1999-2000 are given in Table 1. These data showed that in green chilli, out of the 26 samples analysed, none showed pesticide residues above MRL. Earlier

monitoring work of 1994-96 reported by Singh et al. (1999) showed the presence of HCH, endosulfan, fenvalerate, phosphamedon, monocrotophos and carbafuran residues in chilli; with 20% of these samples containing above MRL residues. In brinjal, only two out of 18 samples showed monocrotophos residues above MRL. Parihar et al. (1997) found during 1994-96, in the same area, 13 brinjal samples with pesticide residues above MRL. In cabbage and cauliflower, pesticide residues in all samples were found below MRL. In variance with these results, Gupta et al. (1998) reported 100% of the cabbage and cauliflower samples analysed during 1994-96, contaminated with different pesticide residues, with 33-38% of the samples above MRL. In bottlegourd, pesticide residues were found below MRL. In comparison to it, earlier in 1994-96 Gupta et al. (1998) reported for the same area presence of residues of monocrotophos only in one sample as above MRL. In all other samples these residues were below MRL.

In bittergourd, 20 out of 24 samples analysed showed pesticide residues below MRL. Gupta et al. (1998) earlier reported monocrotophos residues in this crop above MRL.

In tomato, 20 samples were monitored for their pesticide residues. Of these, 13 (65%) samples were found to contain residues below MRL. The onion samples analysed (16) were found free of any insecticide residues. 50% of the cucumber samples analysed (12) were found to carry pesticide residues though only chlorpyriphos residues in two samples were found above MRL. In okra, no samples showed pesticide residues above MRL.

It was concluded from the monitoring of pesticide residue studies reported here that during 1999-2000, out of total of 162 farmgate and market samples of different, fresh vegetables, 91 samples were contamiated with different insecticide residues. Of these, the above MRL residues were detected only in four samples; two each of brinjal and cucumber.

Table 1. Monitoring of pesticide residues in farmgate and market samples of vegetables.

Sl. No.	Vegetable	Insecticide detected	Number of Samples		Range of residues mg kg^{-1}	MRL mg kg^{-1}
			Analysed	Contaminated (%)		
1.	Chilli	β HCH	26	18 (69%)	0.041-0.1	3.0
		γ HCH			0.01-0.03	3.0
		Endosulfan			0.04-0-08	2.0
		Monocrotophos			0.04-0.06	0.2
		Quinalphos			0.04-0.05	0.2
2.	Brinjal	Endosulfan	18	8 (44%)	0.03-0.06	2.0
		Monocrotophos			0.8-0.9	0.2
		Quinalphos			0.05-0.06	0.2
3.	Cabbage	γ HCH	12	4 (33%)	0.002-0.66	3.0
4.	Cauliflower	γ HCH	18	16 (89%)	0.028-0.28	3.0
		Endosulfan			0.005-1.2	2.0
		Dimethoate			0.8-0.9	2.0
5.	Bottlegourd	α endosulfan	12	4 (33%)	0.06-0.09	2.0
6.	Bittergourd	Endosulfan	24	20 (83%)	0.02-0.5	2.0
		Monocrotophos			0.05-0.1	0.2
		Quinalphos			0.02-0.07	0.2
		Chlorpyriphos			0.04-0.06	0.2
7.	Tomato	β HCH	20	13 (65%)	0.08-0.09	3.0
		γ HCH			0.02-0.03	3.0
		Endosulfan			0.007-0.3	2.0
		Monocrotophos			0.03-0.05	0.2
		Chlorpyriphos			0.01-0.015	0.2
8.	Onion	Nil	16	0 (%)	BDL	-
9.	Cucumber	Endosulfan	12	6 (50%)	0.02-0.8	2.0
		Chlorpyriphos			0.9-1.0	0.2
		Quinalphos			0.07-0.08	0.2
10.	Okra	Endosulfan	4	2 (50%)	0.05-0.06	2.0
		Chlorpyriphos			0.03-0.04	0.2

BDL = Below Detectable Limit : MRL = Maximum Residue Limit (Fixed by PFA, India)

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