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Dissipation of Fenvalerate Residues in Cauliflower

A. Gupta, B. Singh

AICRP on Pesticide Residues, Agricultural Research Station, Durgapura, Jaipur, India

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Fenvalerate is used as an insecticide worldwide because of its broad-spectrum activity. The compound is known to be environmentally stable and moderately toxic to warm blooded animals (Zweig and Sherma 1984). The major use of this insecticide is in vegetable crops, particularly for the control of those insect pests, which become resistant to repeat applications of conventional insecticides of organochlorine, organophosphate and carbamate groups. It is particularly true for cauliflower, a very important vegetable crop grown in India. It is heavily damaged by insect pests and the farmers make liberal application of insecticides to control them. This has frequently been found to leave high levels of toxic residues of insecticides in cauliflower curds for the consumer and in leaves used as fodder for cattle. Fenvalerate is now recommended for the control of wide spectrum of insect pests in cauliflower. However, only limited information is available on the dissipation of fenvalerate in this crop. Therefore, a supervised trial was conducted to study the residues of fenvalerate in cauliflower curds and leaves.

MATERIALS AND METHODS

Field experiment was conducted at ARS, Durgapura in winter season of 1992-93 to study the dissipation of fenvalerate in cauliflower. The crop was raised in the 4m x 5m plots following the recommended agronomic practices. The treatments comprised two levels of the insecticide, viz. recommended (0.75 g ai/ha) and double the recommended (150 g ai/ha) and an untreated control. The treatments were replicated three times in randomised block design of layout. The crop was sprayed with fenvalerate twice at interval of 15 days, starting

Correspondence to: A. Gupta, 5/290, SFS, Agarwal Farm, Jaipur—302020, India

at about 50% curd formation stage of the crop. Cauliflower curds and fodder leaves were collected at random from each plot on 0, 1, 3, 5, 7, 10 and 15 days after treatment. The samples were chopped and mixed. A sample of 50g was drawn by quartering technique (Zweig and Sherma 1972). This was extracted with 200ml of mixture of n-hexane: isopropanol (3:1) (Zweig and Sherma 1984), in high-speed blender for 1-3 minutes. It was then filtered. The filterate was taken in a 500ml separatory funnel and 200ml water was added to it. The mixture was shaken for 2 minutes and its lower aqueous layer was discarded. The upper n-hexane layer was washed twice with two additional 100ml volumes of water to completely remove isopropanol. The n-hexane layer was dried over anhydrous sodium sulphate, concentrated and purified over florisil (60-100 mesh) column. The column was eluted with 50ml of 5% ethyl acetate in hexane. The elute was concentrated to a known volume and analysed for fenvalerate residues by gas chromatograph Tracor 565 model equipped with electron capture detector using glass column packed with 1.5% OV 17 + 1.95% OV 210. The operation conditions were; temperatures (°C) column 270, injection port 270 and detector 300 and flow rate of nitrogen 60 ml min^{-1}. The minimum detectable limit of fenvalerate was 0.01mg kg^{-1}. The average recovery of fenvalerate was 88 to 92% at two fortification levels of 0.1 and 0.5 mg kg^{-1}. The fenvalerate isomers resolved to give two peaks but the peak area of the two were added to estimate total fenvalerate as suggested by Hill et al. (1982).

RESULT AND DISCUSSION

The analytical data pertaining to fenvalerate residues in cauliflower curd are given in Table 1. The average initial deposit of fenvalerate on cauliflower curd at 75 g ai/ha was found to be 1.28/mg kg^{-1} which registered a dissipation pattern of 45.74, 72.09, 94.57 and 98.45% in 1, 3, 5 and 7 days after the application of the insecticide, respectively. The half life and T_{tol} values were found to be 1.19 and 0.58 days respectively calculated by Hoskin's (1961) method.

At the higher dose of 150 g a i/ha, the average initial deposit of 2.25 mg kg^{-1} dissipated to 0.98, 0.56, 0.28, 0.06 and 0.018 mg kg^{-1} in 0, 1, 3, 5, 7 and 10 days after treatment, respectively. The residues fell below detectable limit in 15 days. At the higher dose, the half life and T_{tol} values were found to be 1.46 and 1.56 days, respectively (Table 1)

Table 1. Fenvalerate residues in cauliflower curd

Dose g a i ha	Sampling interval (days)	Residue Level (mg kg^{-1})			Average	S.D.±	Dissipation (%)	Half life days	T_{tol} (days)
		R_1	R_2	R_3					
75	0	1.29	1.32	1.26	1.28	0.039	-	1.19	0.58
	1	0.62	0.80	0.70	0.70	0.090	45.74		
	3	0.36	0.38	0.35	0.36	0.015	72.09		
	5	0.06	0.08	0.07	0.07	0.010	94.57		
	7	0.02	0.03	0.02	0.02	0.005	98.45		
	10	BDL	BDL	BDL	BDL	-	-		
Regression Equation = log y x 10^3 = (3.14646 – 0.2508823 x)									
150	0	2.25	2.20	2.30	2.25	0.050	-	1.46	1.56
	1	0.96	0.98	1.00	0.98	0.02	56.44		
	3	0.5	0.58	0.5	0.56	0.017	75.11		
	5	0.28	0.30	0.26	0.28	0.02	87.55		
	7	0.06	0.04	0.08	0.06	0.02	97.33		
	10	0.02	0.015	0.02	0.018	0.02	99.20		
	15	BDL	BDL	BDL	BDL	BDL	-		
Regression Equation = log y x 10^3 = (3.3229621 – 0.38356 x)									

T_{tol} = Time required to reach the tolerance limit ; BDL = Below detectable limit.

Table 2. Fenvalerate residues in cauliflower leaves

Dose g a i ha	Sampling interval (days)	Residue Level (mg kg^{-1})			Average	S.D.±	Dissipation (%)	Half life days	T_{tol} (days)
		R_1	R_2	R_3					
75	0	1.11	1.15	1.10	1.12	0.0265	-		
	1	0.50	0.55	0.50	0.52	0.0288	53.57	1.95	4.36
	3	0.33	0.36	0.34	0.34	0.0153	69.64		
	5	0.17	0.18	0.15	0.16	0.0153	85.71		
	7	0.09	0.08	0.07	0.08	0.0100	94.64		
	10	BDL	BDL	BDL	BDL	-	-		
Regression Equation = log y x 10^3 = (3.14646 – 0.2508823 x)									
150	0	2.35	2.30	2.45	2.36	0.0764	-		
	1	1.07	1.10	1.05	1.07	0.0251	54.66		
	3	0.51	0.55	0.60	0.55	0.0451	76.69		
	5	0.31	0.35	0.30	0.32	0.0265	86.14	1.22	5.36
	7	0.11	0.15	0.10	0.12	0.0265	94.91		
	10	0.04	0.05	0.04	0.04	0.0058	98.31		
	15	BDL	BDL	BDL	BDL	BDL	-		
Regression Equation = log y x 10^3 = (3.6167535 – 0.244685 x)									

T_{tol} = Time required to reach the tolerance limit ; BDL = Below detectable limit.

The average residues of fenvalerate on cauliflower leaves were 1.12 and 2.36 mg kg^{-1} at the lower and higher tried doses of the insecticide, respectively (Table 2). At dose of 75 g ai/ha, the residues fell below detectable limit in 10 days while at the higher dose of 150 g ai/ha it was found so in 15 days. The half-life values were found to be 1.95 and 1.22 days at the lower and higher doses of the insecticide, respectively. The corresponding T_{tol} values were found to be 4.36 and 5.36 days. (Table 2).

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