Bull. Environ. Contam. Toxicol. (1998) 60: 159-163

Bulletin of Environmental Contamination and Toxicology

Fenvalerate Residues in Green Pods, Pod Cover, and Grain of Pigeonpea (*Cajanus cajan* L.)

N. S. Parihar, A. Gupta*

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

Received: 23 July 1997/Accepted: 3 November 1997

Pigeon pea (*Cajanus cajan* L.) is the most important Kharif pulse crop grown in India. However. it is attacked severely in the fields by insects specially pod borer (*Heliothis armigera* Hub.). Several insecticides have been recommended for the control of these pests. Fenvalerate is one of the most common recommendation in this regard. The compound is known to be environmentally stable and moderately toxic to warm blooded animals (Zweig and Sherma 1984).

The use of pesticides results in the accumulationof their residues in crop. If these residues persist in the crop at the time of harvest they may be harmful to the consumer as well as to the environment. Hence, it is essential that any pesticide should be tested for its residual behaviour so that proper recommendation of its use can be made. Therefore, it was considered necessary to study the residual behaviour of fenvalerate in green pod, pod cover and mature grains of pigeonpea, to ensure its environmental safety to the pulse consumers under sub-tropical conditions of Rajasthan (India).

MATERIALS AND METHODS

The field experiment was conducted in Kharif 1994 at the Agricultural Research Station, Durgapura, Jaipur. Pigeonpea was raised in 4 m x 5 m plots. All the cultural practices were followed as the package of practices recommended by the Rajasthan Agricultural University. Two doses 75 and 150 g ai/ha of each formulation of fenvalerate (0.4% dust and 20% EC) were applied to the crop twice. The first application was done four wk after the germination of the crop and the second one at the pod formation stage. All the treatments alongwith the control were replicated thrice in a randomised block design. Green pod samples of pigeonpea were collected at 0, 1, 5, 0, 15 and 20 days. Pod cover and grain samples were collected at crop maturity. All the samples were analysed for fenvalerate residues by GLC method.

Present address: 5/290, SFS, Mansarovar, Jaipur 302020, Rajasthan, India
Correspondence to: A. Gupta

Fifty gram of finely choped green pod samples of pigeonpea were drawn by quartering technique (Zweig and Sherma 1972). The samples were homogenised with n-hexane and isopropanol (3:l) in tissue homogenizer. The extract was washed with water to remove the isopropanol (Zweig and Sherma 1984). The n-hexane extract was dried over anhydrous sodium sulphate, concentrated and chromatographed over acidic alumina. The column was eluted with a mixture of n-hexane : acetone (9:l). The eluent was concentrated to a known volume and then analysed using GLC.

The grain and pod cover samples were finely powdered and 35 g sub-sample was extracted with n-hexane : acetone (1:l) in a soxhlet for 6 hrs. The extract of pod cover and grain samples were also subjected to cleanup by column chromatography using acidic alumina.

The samples were analysed by gas liquid chromatography electron capture detector and 3% OV-17 column. The temperature of the detector was kept at 250°C, column at 200°C and injector port at 210°C. The carrier gas nitorgen flow rate was maintained at 45 ml/min. 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.

RESULTS AND DISCUSSION

The analytical data pertaining to fenvalerate (0.4% dust residues on pigeonpea green pods, pod cover and grain at crop maturity are given Table-l. The initial deposits of the insecticide were found to be 1.75 and 2.6 $mgkg^{-1}$ at 75 and 150 g ai/ha treatments, respectively. The residues dissipated to below detectable limit in 15 days at the lower dose and 20 days at the higher dose. The half life values were 2.05 and 2.24 days and waiting periods were 1 and 1.64 days for 75 and 150 g ai/ha doses, respectively. Grain and pod cover samples collected at crop maturity showed below detectable limit of fenvalerate residues.

The analytical data presented in Table-2 showed 3.5 $mgkg^{-1}$ residues of fenvalerate 20 EC at 75 g ai/ha on the day of application of the insecticide. The residues declined to 1.6, 0.5, 0.1 $mgkg^{-1}$ and BDL in 1, 5, 10 and 15 days, respectively. The grain at harvest did not show fenvalerate residues but pod cover showed 0.002 $mgkg^{-1}$ residues.

At the higher dose of 150 g ai/ha the initial deposit of 5.2 $mgkg^{-1}$ dissipated to below detectable limit in 20 days. The waiting periods were 3 and 3.85 days for

Table - 1

Residues of fenvalerate (0.4% dust) in green pods, pod cover and grains of pigeonpea.

Dosages g ai/ha	Sampling interval (days)	Part analysed	Residue level $mgkg^{-1}$ R-1	R-2	R-3	Average residue $mgkg^{-1}$	S.D. ±	Dissipation (%)
75	0	Green pods	1.80	1.73	1.72	1.75	0.0355	-
	1		0.78	0.84	0.78	0.80	0.0282	54.28
	5		0.22	0.28	0.25	0.25	0.02449	85.71
	10		0.04	0.07	0.04	0.05	0.01414	97.14
	15		BDL	BDL	BDL	BDL	-	100.00
At harvest		Grain	BDL	BDL	BDL	BDL	-	100.00
		Pod cover	BDL	BDL	BDL	BDL	-	100.00
Regression Equation = log y x 10^3 = 3.1471893 - 0.1466074 Xx								
RL_{50} 2.05 days; T_{tol} 1.0 days; MRL = 1.0 ppm								
150	0	Green pods	2.6	2.3	2.9	2.6	0.2449	-
	1		1.30	1.24	1.21	1.25	0.03741	51.92
	5		0.18	0.17	0.16	0.17	0.00816	93.46
	10		0.08	0.08	0.08	0.08	0.000	96.92
	15		0.02	0.03	0.02	0.02	0.000	99.23
At harvest		Grain	BDL	BDL	BDL	BDL	-	100.00
		Pod cover	BDL	BDL	BDL	BDL	-	100.00
Regression Equation = log y x 10^3 = 3.2198287 - 0.13395 Xx								
RL_{50} 2.24 days; T_{tol} 1.64 days; MRL = 1.0 ppm								

RL_{50} = Half life; T_{tol} = Time require to reach the tolerance limit;
MRL = Maximum Residue Limit.

Table - 2

Residues of fenvalerate (20% EC) in green pods, pod cover and grains of pigeonpea.

Dosages g ai/ha	Sampling interval (days)	Part analysed	Residue level $mgkg^{-1}$ R-1	R-2	R-3	Average residue $mgkg^{-1}$	S.D. ±	Dissipation (%)
75	0	Green pods	3.48	3.56	3.46	3.5	0.0432	-
	1		1.54	1.58	1.68	1.6	0.0588	54.28
	5		0.48	0.48	0.54	0.5	0.0282	85.71
	10		0.10	0.10	0.10	0.1	-	97.14
	15		BDL	BDL	BDL	BDL	-	100.00
	At harvest	Grain	BDL	BDL	BDL	BDL	-	100.00
		Pod cover	0.003	0.002	0.002	0.002	-	99.99
Regression Equation = log y x 10^3 = 3.4482191 - 0.1466074 Xx								
RL_{50} 2.05 days; T_{tol} 3.05 days; MRL = 1.0 ppm								
150	0	Green pods	5.3	5.4	4.9	5.2	0.2160	-
	1		2.2	2.6	2.7	2.5	0.2160	51.92
	5		0.32	0.38	0.32	0.34	0.0282	93.46
	10		0.22	0.18	0.23	0.21	0.0216	95.96
	15		0.02	0.02	0.02	0.02	-	99.60
	At harvest	Grain	BDL	BDL	BDL	BDL	-	100.00
		Pod cover	0.003	0.004	0.002	0.003	-	99.99
Regression Equation = log y x 10^3 = 3.5701739 - 0.1478135 Xx								
RL_{50} 2.03 days; T_{tol} 3.85 days; MRL = 1.0 ppm								

RL_{50} = Half life; T_{tol} = Time require to reach the tolerance limit;
MRL = Maximum Residue Limit.

the lower and higher doses, respectively. The grain at harvest was free from fenvalerate residues but the pod cover was contaminated with 0.003 $mgkg^{-1}$ of fenvalerate residues.

It was found from the analytical data that the dust formulation of fenvalerate left lighter residues than EC formulation, this may be attributed to the more penetration power of EC formulation. Moreover, the dust formulation did not persist either in grain or in pod cover at crop maturity but the EC formulation of fenvalerate persisted in pod cover.

From the above studies it was also found that fenvalerate was easily degradable and did not persist in crop for longer times hence, this insecticide did not create any environmental problem. After observing the waiting period the produce was safe for human consumption.

The minimum and maximum temperatures during the application of insecticide and last sampling varied from 10.7 to 17.2°C and 34.8 to 35.1°C and the rainfal was 1.6 mm.

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