

## Lindane and Fenvalerate Residues in Blackgram (*Vigna mungo*)

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Pulses form an important part of Indian diet as vegetarian sources of protein. Being leguminous crops these can be grown in low fertility soils. Blackgram (*Vigna mungo*) is such seed legume which is grown in India in about 2.5 million ha of land with a low productivity of hardly 400 kg/ha. One important reason of its such low productivity is its high susceptibility to a number of insect pests, especially to the blackgram pod borer and jassids. Lindane and fenvalerate are commonly used to control pod borer in blackgram at its pod formation stage (Agnihotri, NP 1999). The present experiment was undertaken to study the dissipation behaviour of the two insecticides in green pods, mature grains and pod cover of blackgram. Dissipation studies of lindane and fenvalerate were reported in other pulse crops viz. mungbean (Parihar and Gupta, 1997), pigeonpea (Parihar and Gupta, 1998), vegetable pea (Madan *et al.* 1998). However, dissipation studies of lindane and fenvalerate in blackgram are wanting. Therefore, the present study was undertaken to determine residues of lindane and fenvalerate in green pods of blackgram during its active growth stage and in mature grains and pod cover at harvest time.

### MATERIALS AND METHODS

Field experiment was laid out to study the dissipation behaviour of lindane and fenvalerate in green pods, mature grain and dry pod cover of blackgram. Two formulations of lindane (20 EC and 1.3% dust) and fenvalerate (0.4% dust) were included in the study. The dosages of the two insecticides tried were 400 and 800 g ai/ha of lindane and 75 and 150 g of fenvalerate. The treatments, along with one untreated control were replicated thrice. Black gram crop was raised in 4 m x 5 m plot adopting the recommended agricultural practices. The insecticides were applied to the crop twice, first at 4 weeks after its germination and second at its pod formation stage. The samples of green pods were drawn at 0, 1, 5 and 10 days after the application of the insecticide, while the grain and pod cover samples were taken at crop harvest. The samples thus collected were analyzed for lindane and fenvalerate residues with GLC.

Twenty five g of each representative sample of green pods of blackgram was extracted with acetone and n-hexane for lindane. The extract was purified with

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concentrated sulphuric acid treatment. The acid layer was removed and the solvent layer was washed with water several times till the washings were neutral to litmus. The solvent layer was then dried over anhydrous sodium sulphate. The solvent was removed by rotary vacuum evaporator and the residue was dissolved in n-hexane and the volume was made to 5 ml (Luke *et al.* 1975).

Fenvalerate residues were extracted from the green pods of blackgram by grinding twenty five g representative sample with hexane and isopropanol (3:1) in a warring blender, isopropanol was removed from the extract by washing the hexane layer several times with water. The hexane layer was dried over anhydrous sodium sulphate and was chromatographed over acidic alumina and the column was eluted with n-hexane. The eluted portion was evaporated to dryness and the residues were dissolved in n-hexane and the volume was made up to 5 ml with n-hexane (Zweig and Sherma 1984).

For the extraction of pesticide residues from mature grain and pod cover, twenty five g finely ground samples, each from lindane and fenvalerate treatment were extracted with n-hexane in Soxhlet apparatus for 8 hrs. The extract was purified over florisil for lindane and for fenvalerate the extract was chromatographed over acidic alumina. After removing the solvent the residues of lindane and fenvalerate were dissolved in n-hexane and the volume was made to 5 ml in each case.

The residues of lindane and fenvalerate were estimated by GLC (Nucon 5700) equipped with Ni<sup>63</sup> electron capture detector. The column used was a mixture of 1.5% OV 17 + 1.95% OV 210. The temperatures used for the estimation of lindane were, Oven 210°C, Injection port 230°C and Detector 300°C. For the estimation of fenvalerate residues the temperatures were, Oven 260°C, Injection port 270°C and Detector 300°C. The retention time of lindane was 2.30 min. and incase of fenvalerate retention time were 10.91 and 11.82 for fenvalerate-I and fenvalerate-II, respectively.

The methods of extraction, clean up and estimation of lindane and fenvalerate residues were validated by fortifying the control samples at 1 and 0.5 ppm. The recovery percentage of lindane and fenvalerate are given in Table 1.

**Table 1.** Recovery percentage of lindane and fenvalerate residues in green pods, mature grains and pod cover.

Fortification level	Insecticide	Green pod	Mature grain	Pod cover
0.5 ppm	Lindane	89	89	90
	Fenvalerate	87	88	88
1.0 ppm	Lindane	92	91	95
	Fenvalerate	89	90	89

**Table 2.** Residues of lindane (20 EC and 1.3% dust) in green pods and mature grains and pod cover of blackgram at crop harvest.

Sampling interval (days)	Plant part analyzed	Average residues of lindane (20 EC)				Average residues of lindane dust (1.3%)			
		400 g ai/ha mgkg <sup>-1</sup>	Dissipation (%)	800 g ai/ha mgkg <sup>-1</sup>	Dissipation (%)	400 g ai/ha mgkg <sup>-1</sup>	Dissipation (%)	800 g ai/ha mgkg <sup>-1</sup>	Dissipation (%)
0	Green pods	2.10	-	4.70	-	1.89	-	2.84	-
1		1.42	32.38	3.05	35.10	1.23	34.9	1.81	36.26
5		1.00	52.38	2.93	37.65	0.83	56.0	1.19	58.09
10		0.31	85.23	0.65	86.17	0.34	82.0	0.42	85.21
At harvest	Pod cover	0.003	99.85	0.006	99.87	0.002	99.89	0.005	99.82
	Mature grains	0.003	99.85	0.005	99.89	BDL	100	BDL	100
Log Yx10 <sup>3</sup> = 3.30-0.07xX		Log Yx10 <sup>3</sup> = 3.66-0.07xX				Log Yx10 <sup>3</sup> = 3.41-0.07xX			

**Table 3:** Residues of fenvalerate (0.4% dust) in green pods and mature grains and pod cover of blackgram at crop harvest.

Sampling interval (days)	Plant part analyzed	Average residues of fenvalerate (0.4%) 75 g ai/ha		Average residues of fenvalerate (0.4%) 150 g ai/ha	
		mgkg <sup>-1</sup>	Dissipation (%)	mgkg <sup>-1</sup>	Dissipation (%)
0	Green pods	2.10	-	2.90	-
1		1.27	39.52	1.80	37.93
5		0.70	66.60	0.80	72.41
10		0.24	88.57	0.28	90.34
At harvest	Pod cover	BDL	100	0.003	99.82
	Mature grains	BDL	100	BDL	100
Regression equation:		Log Yx10 <sup>3</sup> = 3.26 - 0.08xX		Log Yx10 <sup>3</sup> = 3.40x 0.09xX	
BDL = Below detection limit					

## RESULTS AND DISCUSSION

Analytical data pertaining to the lindane residues for EC and dust formulation in green pods, mature grains and pod cover of blackgram are presented in Table 2 which depicts that average initial deposit of 4.70 and 2.10 mgkg<sup>-1</sup> in green pods of blackgram dissipated to 0.65 and 0.31 mgkg<sup>-1</sup> in 10 days after its application at 800 and 400 g ai/ha doses, respectively. At crop maturity pod cover showed 0.003 mgkg<sup>-1</sup> residues of lindane at 400 g ai/ha dose whereas at 800 g ai/ha dose it showed 0.005 and 0.006 mgkg<sup>-1</sup> residues of lindane in grain and pod cover, respectively. Perusal of Table-2 revealed that initial deposit of 2.84 and 1.89 mgkg<sup>-1</sup> of lindane (dust 1.3%) dissipated to 0.34 and 0.42 mgkg<sup>-1</sup> in 10 days after its application at 400 and 800 g ai/ha doses, respectively. Mature grains at harvest did not carry any residues of lindane at 400 and 800 g ai/ha doses but pod cover showed 0.002 and 0.005 mgkg<sup>-1</sup> residues, respectively.

Analytical data of fenvalerate (dust 0.4%) residues in green pods, mature grains and pod cover of blackgram are presented in table 3, which depicts that average initial deposit of 2.9 and 2.1 mgkg<sup>-1</sup> in green pods of blackgram dissipated to 0.24 and 0.28 mgkg<sup>-1</sup> in 10 days after its application at 75 and 150 g ai/ha doses, respectively. At harvest, mature grains showed below detectable level of fenvalerate residues at both doses but at 150 g ai/ha dose pod cover showed 0.003 mgkg<sup>-1</sup> of fenvalerate residues whereas at 75 g ai/ha dose fenvalerate residues are at BDL.

The studies reveal that dust formulations leave higher initial deposit than EC formulation, that both lindane and fenvalerate were safe insecticides for the control of pod borer in blackgram since their residues did not persist in the grain and pod cover above tolerance level at harvest that green pods of blackgram treated with these insecticides could be consumed safely 10 days after the application of either insecticides.

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