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DISSIPATION OF LINDANE RESIDUES IN COWPEA

Cowpea is affected by a number of pests during the flowering stage for which regular use of insecticides at shoprt intervals is in vogue. Because of high persistence of beta and delta isomers in crop and environment, the use of HCH has been restricted and Lindane, 99% pure gamma isomer of HCH has been introduced as an alternative in most of the countries (Virs, 1983). Hence an experiment was undertaken to study the dissipation of lindane for which the maximum residue limit (MRL) prescribed was relatively higher.

A supervised field trial was laid out in RBD in plots of 10m2 at the Instructional Farm, Vellayani during July-September 1993 using the cowpea variety, C-152. Management practices were followed as per the recommendations of the Kerala Agricultural University (KAU, 1993). Lindae 0.05% (250 g ai ha-1) and 0.1% (500 g ai ha-1) were applied at the flowering stage and 25 days later at the pod formation stage. Pod samples were drawn randomly at 0, 1, 3, 5, 7, 10 and 15 days after the second spraying. Grain and pod cover were collected at the time of the first harvest. The samples were processed immediately after collection. Pod samples of zero and seven days after treatment were also subjected to decontamination processes viz., washing and washing followed by cooking for 20 min. The mean temperature during the first application of the chemical and last sampling ranged from 24.1 to 31.4 C and the percentage relative humidity from 84-96. The average sunshine was 7.4 hours and total rainfall was 17.78 mm.

Representative pod samples (50 g) were taken forestimation of residues. The samples were extracted with acetone (3 x 50 ml) by blending. The extracts were concentrated and 150 ml saturated NaCl was added and the pesticide was transferred to hexane (3 x 30 ml) by liquid partitioning. Concentrated sulphuric acid (25 ml) was added to it drop wise and the cleaned up hexane extract after washing with distilled water was passed through anhydrous sodium sulkphate and concentrated to known volume for estimation using gas chromatography. The dry grain samples (50 g) were subjected to soxhlet extraction with n-hexane for 8 h and partitioned with acetonitrile and dried over anhydrous sodium sulphate. The n-hexane extract was concentrated and cleaned up by sulphuric acid treatment as in the case of pod samples.

Table 1. Mean Residues of Lindane in Cowpea pods at different intervals after spraying

Sampling interval, days	Residues mg kg^{1}	
	0.05%	0.1%
0	1.37 + 0.108	2.49 + 0. 144
1	1.26 + 0.084	2.19 + 0.090
3	1.06 + 0.059	1.49 + 0.165
5	0.49 + 0.079	0.90 + 0.081
7	0.32 + 0.067	0.59 + 0.076
10	0.10 + 0.032	0.23 + 0.042
15	ND	0.08 + 0.005
Regression equation	y -1.24-0.09 t	y - 2.11- 0.165 t
RL50	2.63	2.92

A gas chromatograph Chemito Model 3865 equipped with electron capture detector and a 2 m x 2 mm glass column packed with 3% OV-17 on 100-200 mesh Gas Chrom Q was used. The temperature maintained or column, injector and detector was 200, 220 and 250° C respectively. The nitrogen flow rate was 80 ml min^{-1}. The sensitivity of the instrument was 0.05 μg and limit of detection was 0.005 μg g^{-1}. The retention time was 2.1 min. The recovery of lindane from the fortified

Table 2. Effect of decontamination process on the removal of lindane in cowpea

Treatment	Sampling interval, days	Residues (mg kg^{-1}) when observed as			Percentage removal by	
		Unprocessed	After washing	Washing + cooking	Washing	Washing + cooking
Lindane 0.05%	0	1.37 + 0.11	1.02 + 0.16	0.95 + 0.18	25.54	30.66
	7	0.32 + 0.67	0.17 + 0.03	0.13 + 0.02	46.88	59.38
Lindane 0.1%	0	2.49 + 0.14	1.61 + 0.19	1.52 + 0.35	35.36	38.96
	7	0.59 + 0.04	0.43 + 0.06	0.37 + 0.06	27.12	37.73

samples of cowpea pods and grains was 90 and 85 per cent respectively. The rate of dissipation of lindane residues was worked out by determining RL50 values and waiting period was calculated on the basis of maximum residue limit value of 3 ppm (FAO, 1991).

The residue data of lindane on the cowpea pods at different intervals after second application are given in Table 1. Initial deposit of lindane on green pods of cowpea after 2 h of spraying was 1.37 and 2.49 mg kg^{-1} for the doses of 0.05 and 0.1% respectively. The residues in the pods after 1,3,5,7 and 10 days after the second spray were 1.26, 1.06, 0.49, 0.32 and 0.10mg kg-1 respectively for the lower dose resulting 92.7% loss by 10th day. The corresponding values were 2.19, 1.49, 0.90, 0.59 and 0.23 mg kg^{-1} for the dose of 0.1% and the percentage loss on 10th day was 90.76. The reduction in the level of residues in the days following applications may be attributed to physical removal by the weathering agencies (Gunther and Blin, 1955) and dilution by growth (Ebeling, 1963). No detectable residues could be seen on 15th day in the lower dose while 0.08 mg kg^{-1} was detected in the higher dose. The residue half life (RL 50) values observed were 2.63 and 2.92 days in low and high dose respectively. These findings are in agreement with those of Mukherjee *et al.* (1989) who reported RL 50 of lindane in both pigeon pea and chickpea as 2 days. Although the initial deposit in both the treatments was within the MRL of 3 ppm, a waiting period of 3 days is suggested to avoid the risk involved due to the application of lindane. Beenakumari *et al.* (1996) observed similar dissipation pattern of lindane in cowpea. Following application of lindane at 0.05 and 0.1% on cowpea 26-79% dissipated within 5 days and 10-25% in the last 10 days. Effect of decontamination techniques on the reduction of lindane (Table 2) indicated that initial deposit (0 day) is reduced by 25.54 to 35.36% due to washing. Cooking the pods for 20 min was more effective in reducing the residues than simple washing alone and resulted in 30.96% removal. The decontamination processes make pods safer for consumption by reducing the residues in varying levels.

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