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Persistence and Dissipation of Different Isomers of Endosulfan in Jute Leaves

K. P. YADAV[1], VINOD KUMAR[2], BALRAM SINGH[3] AND PARAS NATH[4]

[1]*Department of Botany, RPM College, Madhepura 852113, Bihar, India*
[2]*Department of Agronomy, RAU, Pusa 848125, Bihar, India*
[3]*PG Department of Botany, BNMU, Madhepura 852113, Bihar, India*
[4]*KVK Raghopur, Supaul 852111, Bihar, India*
E-mail : vinod_pusa@ yahoo.com

Abstract

Field experiment was conducted to assess the residual status and dissipation pattern of different isomer of endosulfan, sprayed at 1 liter/ha on jute crop raised during *kharif* season of 2000. Jute leaves were randomly collected on 5, 10 and 15 days after spray to analyze the residual status and dissipation pattern by gas liquid chromatography. The data on residues showed that different isomer of endosulfan viz. α-endosulfan, β-endosulfan, endosulfan sulfate and over all total residues were found to be 0.85, 1.07, 1.50 and 3.42; 0.26, 0.38, 0.64 and 1.28; 0.11, 0.20, 0.43 and 0.74 mg/g, respectively on days 5, 10 and 15 after spray. Dissipation was found to be maximum on day 10 (69.4%) and day 15 (87.0%) for α-endosulfan followed by β-endosulfan (64.5% and 81.3%) and endosulfan sulfate (57.3% and 71.3%) on days 10 and 15, respectively. The residues on day 10 were less than the maximum residual limit (MRL) of 2.0 mg/kg shows that the Jute leaves is safer to use for human consumption.

Key words : Persistence, Dissipation, Jute, Endosulfan, Residue.

Jute is one of the most important cash crop grown during *kharif* season in North East Zone of Bihar. Jute fiber in mainly used for making gunny bags, ropes, some garment items etc. and its tender leaves is eaten as green vagetable having nutritional value for human beings. This crop is ravaged by over 12 insect pests during its growth period but jute stem weevil (*Apion corchori* M.), Bihar hairy caterpillar (*Diacrisia obliqua* W.), Jute semilooper (*Anomis sabulifera* G.) and mealy bug (*Ferrisia virgata* C.) are major insect pests of jute causing severe damage to apical tip, bud, tender leaves and fiber to the tune of 25 to 75% (Hameed and Singh 1998, Singh and Bhan 1999). To obviate the problem of insect pest, farmers are using indiscriminately higher dosages of insecticides especially endosulfan, monocrotophos, which lead to cropping up of resistance to insecticides in insects, environmental pollution, resurgence of secondary pest and persistence of residue in Jute fiber and tender leaves. Presently, no information is available especially in Kosi Zone of Bihar on residual status and dissipation pattern of different isomers of endosulfan in jute leaves. Therefore, the present study was carried out to investigate the dissipation pattern and to assess the residual status of different isomers of endosulfan in jute leaves.

Methods

The experiment was conducted at Research Farm of Rajendra Agricultural University, Irrigation Research Station, Madhepura during summer season, 2000 following recommended agronomic practices for raising good crop. The crop was sown in randomized block design (RBD) in 5 × 4 m^2 plot size with 60 × 30 cm (rows × plant) spacing in triplicate. The crop was sprayed with endosulfan at 1.0 liter/ha to runoff stage.

Sampling

Samples of jute leaves (approximately 500 g) were randomly collected from each plot at 5, 10 and 15 days after endosulfan spray and were stored in deep freezer (–20 C) till analysis. Estimation of residue of different isomers of endosulfan was done following standard

Table 1. Residues and dissipation of different isomer of endosulfan in jute leaves.

Insecticides	Average residues (mg/g) days after treatment			Percent dissipation days after treatment	
	5	10	15	10	15
Alpha-endosulfan	0.85	0.26	0.11	69.40	87.00
Beta-endosulfan	1.07	0.38	0.20	64.50	81.30
Endosulfan sulfate	1.50	0.64	0.43	57.30	71.30
Endosulfan	3.42	1.28	0.74	62.00	78.40

gas liquid chromatography method.

Extraction

Sample of jute leaves was chopped into small pieces and mixed thoroughly. A representative 50 g was extracted with 100 ml mixture of hexane : isopropyl alcohol (2 : 1, vol/vol) in a warring blender for 2 min. The extract was filtered under suction on a Buchner funnel. The process of blending was repeated twice with 75 ml of the solvent and the filtrates were combined. Extract was filtered through 2—3 cm layer of anhydrous sodium sulfate and subjected to liquid-liquid partitioning after diluting with hexane to wash the adhering material, and 150 ml distilled water and also 10 ml of saturated sodium chloride solution were added to it. Then the separatory funnel has shaken vigorously. The extract was partitioned twice with hexane and collected upper organic phase containing insecticide residue.

Clean Up

The hexane extract was concentrated to 45 ml under reduced pressure and 5 ml of acetone was added to it. Then 0.5 g of Darco G-60 was added and the flask was allowed to stand for 15 min with occasional shaking. The extract was filtered and the remaining contents were washed twice with 15 ml of hexane-acetone (9 : 1). The extract was concentrated and dissolved in a known volume of n-hexane for GLC analysis.

Recovery Experiments

The experiments on the recovery of endosulfan in jute leaves were conducted to know the efficiency of the analytical method used before analyzing the field samples. For carrying out the experiments, a 50 g representative sample of jute leaves collected from untreated plot was fortified in duplicate with 0.5 and 1.0 mg/kg of standard solution of endosulfan. Fortified samples were extracted, partitioned and cleaned up following the method described above.

Gas Liquid Chromatographic Analysis

The cleaned extracts were analyzed on gas liquid chromatographic (GLC) equipped with glass columns using electron capture detector (ECD). Operating conditions for endosulfan were as follows. Detector : EcO (63 Ni). Column : Glass column (1m) packed with 3% OV-101 on 80-100 mesh CHW. Temperature (C) : Column, 180, injector, 220 and detector 270. Carrier gas, N_2, flow rate 60 ml/min. Retention time (Rt) for alpha-endosulfan, beta-endosulfan and endosulfan sulfate were observed to be 3.99, 5.57 and 7.45 min, respectively; endosulfan isomers/metabolites were identified and quantified by comparison of the retention time and peak area of the sample chromatograph with those of standard run under the same operating condition.

Results and Discussion

The data on isomers of endosulfan in jute leaves are presented in Table 1.

Alpha-Endosulfan

The average deposit of alpha-endosulfan after 5 day of treatment was 0.85 mg g^{-1} (Table 1) which reached to a level of 0.26 mg/g after 10 day showing thereby 69.4% dissipation. After 15 days, the residue was 0.11 mg/g showing 87% dissipation.

Beta-Endosulfan

The deposits of 1.07 mg/g of beta-endosulan (Table 1) were observed on fifth day. The residue dissipated by 64.5% with average deposits of 0.38 mg/g on day 10 which further dissipated by 81.3% leaving residue 0.20 mg/g on fifteenth day.

Endosulfan Sulfate

Average residue of endosulfan sulfate recorded

to be 1.50 mg/g on fifth day (Table 1). Residues dissipated to an extent of 57.3% after tenth day showing residues of 0.64 mg/g. After fifteenth day 71.3% dissipation was recorded with average residue of 0.43 mg/g.

Endosulfan

Overall total residues of endosulfan (alpha and beta endosulfan and endosulfan sulfate) was observed to be 3.4 mg/g on jute leaves collected on day 5 of spraying. Residues dissipated to an extent of 62% after day 10 showing residues of 1.28 mg/g. Finally, on fifteenth day, the residues reached to a level of 0.74 mg/g showing 78.4% dissipation.

Table 1 shows that dissipation of α-endosulfan showing degradation of 69.4% at day 10 and 87.0% at day 15 and residues of β-endosulfan dissipated 64.5% on day 10 to 81.3% on day 15. While endosulfan sulfate dissipated 57.3% on day 10 and 71.3% on day 15. This showed that endosulfan sulfate and β-endosulfan were more persistent that α-endosulfan. On jute leaves, the degradation pattern of different isomers of endosulfan and its metabolite was found as α-endosulfan> β-endosulfan>endosulfan sulfate.

Overall total residues of different isomers of endosulfan again shows similar trends of dissipation with 62% degradation on day 10 with residual deposit of 1.28 mg/g and up to 78.4% dissipation on days 15 on jute leaves.

The residues on day 10 were less than the maximum residual limit (MRL) of 2.0 mg/kg as evident from data on jute leaves for different isomers of endosulfan. Similar results of endosulfan have been reported by Kumari et al. (1996) and Nag and Shah (2001) who determined residues of endosulfan on cowpea pods, sunflower and lucerne, respectively.

Conclusion

It may be concluded that the spray of endosulfan for controlling insect pest of jute is safer for consuming jute leaves as a vegetable because the residues of endosulfan is much less than MRL (2.0 g/kg) after day 10 of spray.

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