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DISSIPATION KINETICS OF RESIDUES OF FLUBENDIAMIDE 480 SC IN/ON TOMATO FRUITS AND SOIL

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ABSTRACT

Average initial deposits of flubendiamide 480 SC on tomato fruits was found to be 0.220 mg/kg following three applications of Flubendiamide 480 SC at 150 ml/ha at 15 days interval. More than 85 per cent of flubendiamide 480 SC residue dissipated just after 5 days of the last application. Residues of flubendiamide dissipated below detectable level (0.01 mg/kg) in 7 and 9 days. The half life value and the safe waiting period of flubendiamide 480 SC at 150 ml/ha were found to be 1.80 and 2.00 days. After 2 days the tomato fruits are safe for consumption from health point of view in respect of residue. Soil samples collected at harvest after last spray also did not reveal the presence of flubendiamide 480 SC at 150 ml/ha.

Key words: Flubendiamide, residues, tomato fruits, soil

INTRODUCTION

India is second largest producer of vegetables in the world next to China. Tomato is an important vegetable crop, which is cultivated throughout the year in the country. Tomato fruits are eaten raw, cooked or used to prepare soup, ketchup, pure, paste, powder etc. Tomato provides all the nutrient components like carbohydrates, proteins, fat, vitamins, minerals and water along with roughages which are the essential constituents of a balanced diet.

Flubendiamide belongs to a new chemical class, the phthalic acid diamide and is widely used against lepidopteran pests. Newer group of insecticides offer great scope as they maintain higher toxicity to insects at lower doses and are not persistent as conventional group of insecticides (Singh and Singh, 2000). Flubendiamide with unique chemical structures was reported to be effective against insect pests in many crops (Yadav *et al.*, 2003; Kuttalam *et al.*, 2008) It is also reported safe to natural enemies and environment (Ameta and Kumar, 2008).

In order to avoid the adverse consequences of traditional insecticides on non target organisms, environment pollution, health hazards and development of resistance, the present study was carried out to investigate the persistence and dissipation kinetics of flubendiamide residues in samples of tomato fruits and soil which helps to determine human safety.

MATERIALS AND METHODS

The reference standard of Flubendiamide 480 SC with 99.8 per cent purity was supplied by M/s Bayer Crop Science Limited, Mumbai. The stock solution of Flubendiamide 480 SC was prepared at 10000 ppm and 100 ppm in acetonitrile of HPLC grade and these were diluted to obtained desired concentrations.

Tomato var. Sangam was raised and transplanted during *kharif* 2009–10 at Horticultural Farm, RCA, Udaipur, in randomised block design (RBD). Three sprays of flubendiamide 480 SC at 150 ml/ha were given at 15 days intervals initiating first at flowering. Each treatment was replicated thrice and size of plot was 4.5×3.6 sq.m. In control plots, only water was sprayed.

The extraction and clean up of tomato and soil samples for residue of Flubendiamide 480 SC was carried out as per procedure reported by Battu *et al.* (2008).

About 1 kg of tomato fruits were taken from five randomly selected plants from each plot at 0, 1, 3, 5, 7 and 9 days interval after last spray. The soil samples were collected randomly from the plots at the time of harvesting of tomato crop. A representative 50 g sample of chopped and macerated tomato fruits were placed into 100 ml of acetonitrile in a flask for 24 hours. The extract was filtered into a 1 L separatory funnel along with rinsing of acetonitrile. The filterate in the separatory funnel was diluted with 600 ml of brine solution (almost saturated sodium chloride solution), and the content were partitioned

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three times into 100, 50 and 50 ml of chloroform. The chloroform fractions were combined and dried over anhydrous sodium sulfate.

Soil samples were dried, ground and sieved. A representative sample of 50 g was extracted as per the procedure mentioned for tomato samples.

The chloroform fractions of both the tomato and soil samples were treated with 500 mg of activated charcoal powder for about 2–3 hours at room temperature. The clear extract so obtained was filtered through WhatMan filter paper No. 1 and concentrated to near dryness, and the residues were dissolved in 20 ml of HPLC grade acetonitrile and again concentrated using the rotary vacuum evaporator at 30°C. The process was repeated to completely evaporate chloroform and the final volume was reconstituted to about 5–10 ml using HPLC grade acetonitrile. The cleared extract was used for further residue estimation.

The residues of flubendiamide 480 SC were estimated on HPLC by employing a Phenomenose Luna C_{18} column, a UV detector at 230 λ (wavelength), and an acetonitrile/water (60:40, V/V) mixture as mobile phase at 1 ml/minute.

Table 1. Recovery of flubendiamide 480 SC in/on tomato fruits and soil samples

Substrate	Level of fortification (mg/kg)	Recovery of flubendiamide 480 SC (%)	Mean ± SD
Tomato fruits		92.45	
	0.20	92.70	92.97±0.707
		93.78	
		87.40	
	0.10	88.65	88.00±0.626
		87.95	
		85.23	
	0.05	87.50	86.43±0.141
		86.56	
Soil		97.13	
	0.20	95.62	96.28±0.773
		96.09	
		91.00	
	0.10	90.15	90.38±0.539
		90.00	
		86.72	
	0.05	87.01	87.43±0.989
		88.56	

Mean ± SD of three replications

Under these operating conditions the retention times of 3.818 min. was recorded for flubendiamide 480 SC. Residues were estimated by comparison of peak area/peak height of the standards with that of the unknown or spiked samples run under identical conditions.

Tomato and soil samples were spiked with flubendiamide 480 SC at 0.20, 0.10 and 0.05 mg/kg levels of fortification and analysed as per the methodology described above. Per cent recovery of flubendiamide in tomato and soil ranged from 86 to 92 and 87 to 97 per cent, respectively (Table 1).

The safe waiting period and half life value (*i.e.* time for disappearance of pesticide to 50% of its initial concentration) was calculated using Hoskins (1961) formula.

RESULTS AND DISCUSSION

The data recorded for residues and dissipation of flubendiamide 480 SC at 150 ml/ha in tomato and soil have been presented in Table 2. Average initial deposits of flubendiamide 480 SC on tomato fruits was found to be 0.220 mg/kg following three applications of flubendiamide 480 SC at 150 ml/ha at 15 days interval. The dissipation rate of residues of flubendiamide 480 SC at 150 ml/ha was 31.36, 63.64 and 85.90 per cent at 1, 3 and 5 day time interval, respectively (Fig. 1). Residues of flubendiamide dissipated below detectable level (0.01 mg/kg) in 7 and 9 days. The half life value and the safe waiting period for flubendiamide 480 SC at 150 ml/ha were found to be 1.80, 2.0 days, respectively, which showed that after 2.0 days tomato fruits are safe for consumption from health point of view in respect of residue. Soil samples collected at harvest after last spray also did not reveal the presence of flubendiamide 480 SC at 150 ml/ha.

These results are compatible with the results of Kooner *et al.* (2010) who reported 0.08 and 0.16 mg/kg average initial deposits of flubendiamide 480 SC at 48 g a.i./ha and 96 g a.i./ha, respectively and the residue dissipated below detectable level of 0.01 mg/kg in 3 and 5 days at single and double dosages. While soil samples collected at 15 days after the last spraying did not reveal the presence of flubendiamide. Similarly, Sahoo *et al.* (2009) observed reisude of flubendiamide 480 SC on chilli and soil and they found the average initial deposits of 1.06 and 2.00 mg/kg at 60 and 120 g a.i./ha following two applications at 10 days interval, which more than 80% dissipated just after 3 days of the last spray. Gopal and Mishra (2008) proposed 0.2 mg/kg of MRL of flubendiamide on rice.

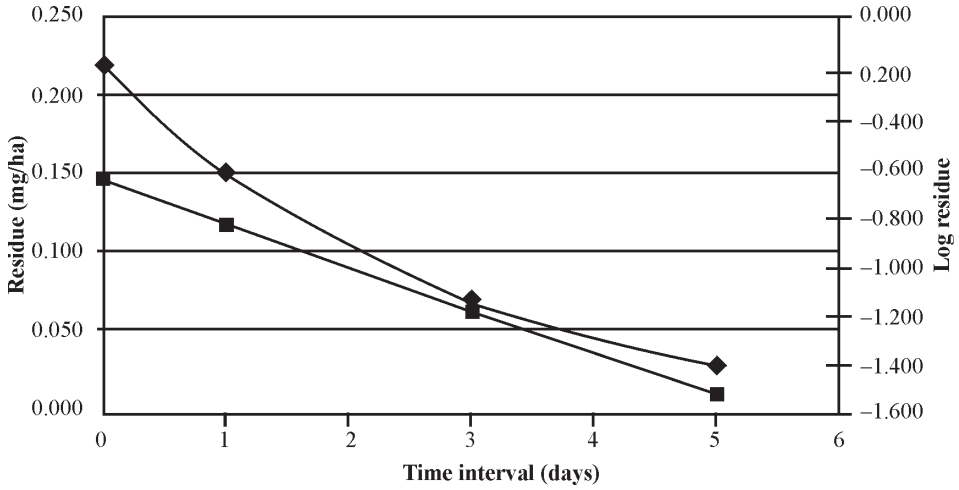

Fig. 1. Dissipation curve for residue of Flubendiamide 480 SC @ 150 min/on tomato fruits

Table 2. Residues (mg/kg) of Flubendiamide 480 SC at 150 ml/ha in/on tomato fruits and soil at different time intervals after the third application during 2009–10

Days after application	Flubendiamide 480 SC at 150 ml/ha (Mean ± SD)	Dissipation (%)
Before application	BDL ± 0.0	–
0	0.220 ± 0.0165	–
1	0.151 ± 0.0020	31.36
3	0.080 ± 0.0017	63.64
5	0.031 ± 0.0015	85.90
7	BDL ± 0.0	–
9	BDL ± 0.0	–
Soil samples at harvest	BDL ± 0.0	–
$T_{1/2}$ (days)	1.80	–
Total (days)	2	

BDL < 0.01 mg/kg (Below detectable level); $T_{1/2}$ (days) = Half life; Total (days) = Waiting period

REFERENCES

Ameta, O.P. and Kumar, A. 2008. Efficacy of flubendiamide against *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fab.) in chilli. *Pestology.* **32**:26–29.

Battu, R.S., Singh, B., Kooner, R., and Singh, B. 2008. Simple and efficient method for the estimation of residues of flubendiamide and its metabilite desiodo flubendiamide. *Journal of Agricultural Food Chemistry.* **56**:2299–2302.

Gopal, M. C. Mishra, C. 2008. Analytical method for estimation of a new insecticide flubendiamide and its safety evaluation for usage in rice crop. *Bulletin of Environment Contamination and Technology.* **81**:310–64.

Hoskins, W.M. 1961. Mathematical treatment of the rate of loss of pesticide residues. *Plant Protection Bulletin. FAO* **9**:163–168.

Kooner, R., Sahoo, S.K., Singh, B. and Battu, R.S., 2010. Dissipation kinetics of flubendiamide and thiocloprid on tomato (*Lycopersicon esculentum* Mill) and soil. *Quality Assurance and Safety of Crops and Foods.* **2**:36–40.

Kuttalam, S., Kumar, B.V., Kumaran, N. and Boomathi, N. 2008. Evaluation of bio–efficacy of flubendiamide 480 SC against fruit borer *Helicoverpa armigera* (Hub.) in tomato. *Pestology.* **32**:13–16.

Mishra, H.P. 2008. New promising insecticides for the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. *Pest Management in Horticultural Ecosystem.* **14**:71–74.

Sahoo, S.K., Sharma, R.K., Battu, R.S. and Singh, B. 2009. Dissipation kinetics of flubendiamide on chili and soil. *Bulletin of Environmental Contamination and Toxicology.* 83:384–387.

Singh, D.S. and Singh, J.P. 2000. Relative susceptibility of *Spilarctia obliqua* larvae against some pyrethroid and non pyrethroid insecticides. *Indian Journal of Entomology* **62**:289–294.

Yadav, J.L., Chauhan, R. and Yadav, P.R. 2003. Relative toxicity of four synthetic pyrethroids and endosulfan to *Helicoverpa armigera* (Hub.) from Hisar (India). *Indian Journal of Entomology.* **65**:115–1.