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RESEARCH ARTICLE

PERSISTENCE OF PROFENOPHOS AND BIFENTHRIN RESIDUES IN CABBAGE

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ABSTRACT

The experiment was conducted during Kharif 2012 with cabbage variety varun. Three sprays of Profenophos and bifenthrin were given at head formation stage. The dissipation pattern of Profenophos showed initial deposit of 2.75 mg kg^{-1} dissipating to below detectable residues in 15 days after third spray when profenophos was sprayed at head formation stage. The dissipation pattern of bifenthrin indicated the initial deposit of 1.21 mg kg^{-1} dissipated to below detectable level on 7 days after third spray of bifenthrin at head formation stage. The maximum residue limit for Profenphos and bifenthrin are 0.2 and 0.1 mg kg^{-1} respectively. The waiting period for safe harvest of cabbage heads after three sprays of profenophos and bifenthrin at head formation stage was four and one day respectively.

INTRODUCTION

Cabbage is the fourth most widely grown vegetable crop of our country. The average productivity of cabbage in India is about 15.68 tons per hectare in the world. In India, cabbage production is about 5.7 M tons from 0.27 M ha of area with average yield of 21.11 tonns/ha. In Andhra Pradesh, cabbage production is about 0.3883 M tons (0.68% of Indian cabbage production) from 0.00155 M ha (0.57% Indian cabbage cultivated area) with an average yield of 25 tons/ha. (CMIE, 2009). However insect pests are major limiting factor in productivity of these vegetables. In India, it is estimated that at least 52 percent loss in marketable yield due to diamond back moth attack alone and loss coud be more than 80 percent when attack is severe (Chellaiah and Srinivasan 1986). Use of Profenophos and bifenthrin would be profitable and most effective method of control of diamond back moth (Nathuram *et al*., 2001) Therefore dissipation of Profenophos and bifenthrin residues were studied in detail as these insecticides are used for controlling the diamondback moth.

MATERIALS AND METHODS

Field experiment was conducted during Kharif 2012 with cabbage variety varun. Replicating each treatment thrice in a randomized block design. Three sprays of Profenophos and bifenthrin were given. The first spray was initiated at head formation stage and subsequent sprays were given at ten days after first spray with knap sack sprayer. The representative cabbage samples of three heads were collected from each plot at 0 (2h), 1, 3, 5, 7, 10 and 15 days after three sprays.

Extraction and cleanup Profenophos, Bifenthrin

Cabbage samples were analyzed for Profenophos, Bifenthrin pesticide residues following the AOAC official method 2011 (QuEChERS). After validation of the method at the laboratory. The samples were homogenized with robot coupe blixer, and homogenized 15±0.1g sample was taken in 50ml centrifuge tube.then added with 30±0.1 ml acetonitrile. Sample is homogenized at 14000-15000 rpm for 2-3 min using Heidolph silent crusher and then added with 3±0.1g sodium chloride and mixed by shaking gently followed by centrifugation for 3 min at 2500-3000 rpm to separate the organic layer. The top organic layer of about 16 ml was taken into the 50 ml centrifuge tube and added with 9±0.1g anhydrous sodium sulphate to remove the moisture content. 8 ml of extract was taken in to 15 ml tube, containing 0.4±0.01gr PSA sorbent (for dispersive solid phase d-SPE cleanup) and 1.2±0.01gr anhydrous magnesium sulphate. The sample tube was vortexed for 30sec then followed by centrifugation for 5min at 2500-3000rpm. The extract of about 2ml was transferred into test tubes and evaporated to dryness using turbovap with nitrogen gas and reconstituted with 1ml n-Hexane for GC analysis with ECD detector.

Estimation of Profenophos and bifenthrin The residues of Profenophos and bifenthrin were determined using Varian 3800 Gas chromatograph equipped with electron capture

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detector and capillary column VF – 1 MS, 15m, 0.25 mm id 0.25 mm film thickness. The operating temperatures were detector 300 ^{o}C, injector 280 ^{o}C , column oven programmed at 70^{o}C for 1 min, increased @ 20^{o}C min^{-1} to 150 ^{o}C for 5 min, increased @2 ^{o}C min^{-1} to 240 ^{o}C for 15 min (total time 76 minutes). The carrier gas (nitrogen flow) was 1.0 ml min^{-1} and make up flow was 15 ml min^{-1}. The retention time for Profenophosand bifenthrin was 23.91 and 72.48 minutes repectively. The residue data was subjected to regression analysis and waiting periods (T_{tol}) and half life (RL_{50}) were calculated as suggested by Gunther and Blinn (1955) and Hoskins (1961).

RESULTS AND DISCUSSION

The recovery test was carried out at 0.1 and 0.01 mg kg^{-1} levels for fortification of Profenophos and bifenthrin on cabbage and soil. The percent recovery of Profenophos was 83.75 at 0.01 ppm and 86.12 at 0.1 ppm level of fortification in cabbage (Table 1) while in the it soil was 85.25 and 87.38 percent respectively at 0.01 and 0.1 ppm level of fortification.

Table 1. Percent recovery of Profenophosand bifenthrin in cabbage and soil

Fortification level mg kg^{-1}	Percent recovery of Profenophos		Percent recovery of bifenthrin	
	cabbage	Soil	cabbage	Soil
0.10	86.12	87.38	89.26	88.47
0.01	83.75	85.25	86.39	86.61

Table 2. Dissipation of Profenophos and bifenthrin residues in cabbage

Day after third spray	Profenophos		Bifenthrin	
	Residues (mg kg^{-1})	Dissipated (%)	Residues (mg kg^{-1})	Dissipated (%)
0	0.99	0	2.24	0
1	0.85	14.14	1.72	23.21
3	0.82	17.17	1.38	38.29
5	0.16	83.84	0.82	63.39
7	0.07	92.93	0.23	89.73
10	BDL	BDL	BDL	BDL
15	BDL	BDL	BDL	BDL
Soil	BDL	BDL	BDL	BDL
MRL(mg kg^{-1})				
Regression equation	Y=-0.141+1.031		Y=-0.311+2.126	
$T_{1/2}$ (days)	0.672		2.22	

* BDL: Below Detectable Level (0.01 mg kg^{-1})

The percent recovery of bifenthrin was 86.39 at 0.01 ppm and 89.26 at 0.1 ppm level of fortification in cabbage (Table 4) while in the soil it was 86.61 and 88.47 percent respectively at 0.01 and 0.1 ppm level of fortification. Profenophosand bifenthrin residues in cabbage and soil are presented in the Table 1. The initial deposit of Profenphos of 0.99 mg kg^{-1} dissipated to below detectable level by 10 days after third spray with corresponding dissipation of 14.14,17.17, 83.84, 92.93 and 97.00 percent at 1, 3, 5 and 7 days after third spray (Table 2 and Fig 1).The initial deposits obtained in the present study was in conformity with the studies conducted on tomato by Peter *et al.* (2001). Based on the first order kinetics, the haif life of profenophos was0.672 days. The maximum residue limits of Profenophos in cabbage was 0.5 mg kg^{-1} (Codex alimentarius1998). The waiting period for safe harvest of cabbage heads was 10 days after three sprays of application of profenophos @ 0.05% for safe consumption.

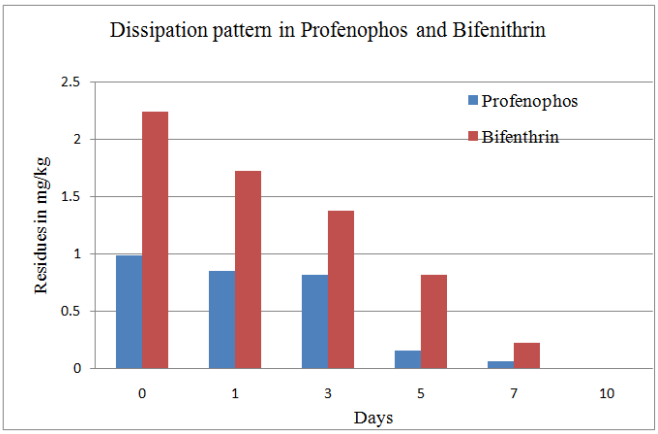

Fig-1: Dissipation pattern of Profenophos and bifenithrin in Cabbage

The initial deposit of bifenthrin was 2.24 mg kg^{-1} which dissipated to below detectable level on 10th day after third spray with corresponding dissipation of 23.21, 38.29 and 63.39 and 89.73 percent at 1,3,5 and 7 days afterlast spray respectively (Table 2 and Fig. 1). Based on the first order kinetics, the haif life of bifenthrin was2.22 days. The initial deposit of bifenthrin residues were below MRL of 0.2mg kg $^{-1}$ (Codex alimentarius1998). The waiting period for safe harvest of cabbage heads was 1.39 days after three sprays of application of bifenthrin @ 0.01% for safe consumption. Babu *et al.* (2001) reported that safe waiting period for cabbage heads was three after application of cypermethrin in cabbage. Singh *et al.* (2003) reported that beta cyfluthrin on cabbage dissipated to below detectable levels at 20 days after second spray when beta cyfluthrin sprayed at 25.0 g a.i per hectare while The variation of the results of the dissipation pattern of bifenthrin in cabbage may be due to variation in the chemical and dosage of the chemical.

Conclusion

The initial deposits of Profenophos and bifenthrin when sprayed thrice at 0.05% and 0.01% during head formation stage was0.99 and 2.24 mg kg^{-1} respectively. The waiting period for safe harvest of cabbage heads when sprayed Profenophos 0.05% and bifenthrin 0.01% thrice at head formation stage was 0.672 and 2.22 days, respectively.

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