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Dissipation Study of Quinalphos (25 EC) in/on Brinjal and Soil

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Abstract A field experiment was conducted at Agricultural Research Station, Durgapura, Jaipur during *kharif* 2008 to study the dissipation of Quinalphos (25 EC) in/on brinjal and soil, when sprayed at its recommended dose (375 g a.i. ha^{-1}) and double of the recommended dose (750 g a.i. ha^{-1}). The residue data revealed the magnitude of dissipation and persistence by calculating safety parameters like RL_{50} and T_{tol}. The initial deposit of Quinalphos in brinjal at 375 and 750 g a.i. ha^{-1} were recorded as 0.0866 and 0.1517 mg kg^{-1}, respectively which reached to below detectable level (0.01 mg kg^{-1}) in 7 and 10 days at recommended (375 g a.i. ha^{-1}) and double of the recommended dose (750 g a.i. ha^{-1}), respectively. The residues, however, had a half life value (RL_{50}) of 2 days for lower dose and 3 days for higher dose. Hence 6 and 9 days waiting period was suggested for recommended and double of the recommended dose, respectively. No residues were detected in soil in treated plots at both the treatment levels 30 days after the spray of insecticide to the crop.

Keywords Dissipation · Quinalphos · Brinjal · Waiting period

Brinjal (*Solanum melongena* L.) known as egg plant or anbergine is an important vegetable throughout the world, especially in South Asia. India is regarded to be the original habitat of brinjal, as wild species are available across the country. The total area under cultivation is 506.9 thousand hectares with annual production of 8,372 m tones (Indian Horticulture 2003). It is a rich source of vitamin B, calcium, phosphorus and iron. The crop is attacked by a number of insect pests from seedling to fruiting stage affecting its growth and productivity. However, Hill (1987) recorded as many as 40 insect pests of which five are major. Among these, the brinjal fruit and shoot borer (*L. arbanalis*) *Epilachna beetle, Henosepilachna viginitioctopunctata* are economically the most important pest of brinjal crop. In severe infestation, they cause up to 70%–90% yield loss (Banerjee and Basu 1955, Naresh et al. 1988). The attacked tender shoots dry up while flowers and developing fruits fall prematurely and damaged fruits become unfit for human consumption. The Quinalphos (25 EC) has been recommended to control these pests. The insecticides are being used indiscriminately as a result of which phytotoxic symptoms developed on the plant resulting in the reduction of the crop yield and also created environment pollution and health hazards in human being and animals. After the spray of the insecticides, when these fruits are brought to the market, the pesticides persist. Hence, in view of the possible residue problems posed by the pesticide to the consumer, the study was conducted to find out the safe waiting period for consumption of the brinjal fruit and influence of pesticides on the quality parameters of the soil.

Materials and Methods

The field experiment was conducted at Agricultural Research Station, Durgapura, Jaipur during *kharif* 2008. The soil of the experimental field was sandy loam with pH 8.1, EC 0.18 dSm^{-1}, organic carbon 2.1 g kg^{-1}, available N 178 kg ha^{-1}, P_2O_5 21.8 kg ha^{-1} and K_2O 193.4 kg ha^{-1}. The experiment consisted of three treatments viz.

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control (water spray), recommended dose of Quinalphos (375 g a.i. ha^{-1}) and double the recommended dose of Quinalphos (750 g a.i. ha^{-1}) with three replications. The spray was done as per the treatment at 100% fruiting stage. The samples were collected at 0th, 1st, 3rd, 5th, 7th, 10th, and 15th days after spray (Table 1).

100 g representative samples of brinjal from each replication was crushed and blended for 5 min in a blender with 150 mL acetonitrite and then extract was filtered through sintered funnel under vacuum along with rinsing of acetonitrile 100 mL aliquot from filtrate was transferred to stop graduated cylinders, 5 g NaCl was added and then shaken well. The organic layer was allowed to separate; 25 mL extract from upper layer was pipetted into 150 mL conical flask. Then it was evaporated to dryness by rotary vacuum evaporator and washing was given with Acetone : Hexane (1:9). Finally, 3 mL volume was prepared and used for injection in Gas Chromatograph.

20 g representative samples of soil from each replication was shaken with 150 mL Acetone : Hexane (1:9) solvent and was left for overnight. Then it was filtered over glass wool and 500 mg activated charcoal was added and kept for 2 h. Then extract was filtered evaporated on a rotary vacuum evaporator and final volume was prepared to 3 mL for injection in Gas Chromatograph.

The estimation of residues of Quinalphos was carried out by Gas Chromatograph (Shimadzu—2010) equipped with FTD/NPD Gas Chromatograph operating conditions were: Detector temperature 290, oven 260°C (-) 1 min. hold—7°C—290°C total programming 20 min. column fused silica capillary column BP-5 (25 m length), 0.25 mm I.D. Gas flow 1.5 mL/min., split ratio −5 Under these conditions retention time of Quinalphos was 10.555 min. To ensure the results and to check the reliability of the analytical technique, as well as variation arises due to handling procedures, percent recovery experiments were also conducted with brinjal and soil at 0.25, 0.5 and 1.0 ppm fortification levels, the recovery percent for respective fortification was 102.2%, 81.9% and 71.8% for Quinalphos in brinjal and 97.6%, 91.6% and 87.2% in soil. The half life (RL_{50}) and days required to reach tolerance level (T_{tol}) were worked out as per Hoskins (1961). Since MRL of the Quinalphos in brinjal is not available in the literature (Codex elemetarious/PFA). Hence, the waiting period of the Quinalphos in brinjal was calculated by considering LOQ as 0.01 ppm as MRL.

Results and Discussion

The residue data of Quinalphos (25 EC) on brinjal fruits show that average initial deposit of the pesticide were recorded as 0.0866 and 0.1517 mg kg^{-1} at an application of Quinalphos (25 EC) at 375 and 750 g a. i. ha^{-1} doses, respectively. On 5th day the residue deposit declined to

Table 1 Dissipation of Quinalphos (25 EC) in/on Brinjal and soil at 375 and 750 g a.i. ha^{-1} dose

Dosages g a.i. ha^{-1}	No. of days	Residues of Quinalphos (mg kg^{-1})				Dissipation (%)	RL_{50} (days)	T_{tol} (days)
		R_1	R_2	R_3	Average ± SD			
375	Control	N.D.	N.D.	N.D.	N.D.	–	1.78	5.64
	0	0.1028	0.1165	0.0406	0.0866 ± 0.0404	–		
	1	0.0623	0.0261	0.0757	0.0547 ± 0.0256	36.84		
	3	0.0180	0.0441	0.0202	0.0371 ± 0.0120	57.12		
	5	0.0113	0.0101	0.0118	0.0111 ± 0.0008	88.34		
	7	BDL	BDL	BDL	BDL	100.00		
	Soil (control)	N.D.	N.D.	N.D.	N.D.	100.00		
	Soil (treatment plot)	N.D.	N.D.	N.D.	N.D.	100.00		
	Regression equation	$\text{Log } y \times 10^3 = 1.902052 - 0.186855 \times X$						
750	Control	N.D.	N.D.	N.D.	N.D.	–	2.16	8.85
	0	0.1579	0.1370	0.1604	0.1517 ± 0.0128	–		
	1	0.1189	0.1041	0.1009	0.1079 ± 0.0096	28.87		
	3	0.0721	0.0843	0.0987	0.0850 ± 0.0133	43.16		
	5	0.0277	0.0215	0.0581	0.0357 ± 0.0195	76.47		
	7	0.0131	0.0122	0.0214	0.0155 ± 0.0050	89.78		
	10	BDL	BDL	BDL	BDL	100.00		
	Soil (control)	N.D.	N.D.	N.D.	N.D.	100.00		
	Soil (treatment Plot)	N.D.	N.D.	N.D.	N.D.	100.00		
	Regression equation	$\text{Log } y \times 10^3 = 2.218172 - 0.0137571 \times X$						

Table 2 Percent recovery of Quinalphos (25 EC) in Brinjal and Soil

Level of Fortification (μg)	Brinjal		Soil	
	μg recovered	Percent recovery	μg recovered	Percent recovery
0.25	0.254	101.6	0.247	98.8
0.25	0.257	102.8	0.241	96.4
0.25	0.251	100.4	0.243	97.2
	Average ± SD = 101.6 ± 0.9797		Average ± SD = 97.4 ± 0.9977	
0.5	0.394	78.8	0.419	83.8
0.5	0.425	85.0	0.497	99.4
0.5	0.431	86.2	0.472	94.4
	Average ± SD = 83.3 ± 3.242		Average ± SD = 92.5 ± 6.504	
1.0	0.718	71.8	0.853	85.3
1.0	0.719	71.9	0.892	89.2
1.0	0.821	82.1	0.902	90.2
	Average ± SD = 72.2 ± 4.832		Average ± SD = 88.2 ± 2.113	

0.011 mg kg^{-1} indicating a loss of 88.34% residue deposit in case Quinalphos (25 EC) application at 375 g a.i. ha^{-1}, while in case of Quinalphos (25 EC) application at 750 g a.i. ha^{-1} the residue deposit on 7th day declined to 0.0155 mg kg^{-1} indicating a loss of 89.78% residue deposit. Prem Chand et al. (1999) reported deposit from Acephate, malathion, Endosulfan and Deltamethrin 0.24 mg kg^{-1} on 7th day, 0.55 mg kg^{-1} on 5th day, 0.17 mg kg^{-1} on 7th day and 0.01 mg kg^{-1} on 7th day in tomato. The residues of Quinalphos at lower and higher doses dissipated to below detectable level of 0.01 mg kg^{-1} on 7th and 10th days, respectively, after the application of insecticide. Sen and Choudhary (1999) reported deltamethrin residue to be below detectable level after 10 days of treatment in brinjal. The residues of Quinalphos were not detected in control fruit and soil samples. Treated plot soil samples did not show the presence of Quinalphos residue 30 days after spray of insecticide (Table 2).

These results suggest that Quinalphos (25 EC) application at 750 g a.i. ha^{-1} persisted longer than Quinalphos application at 375 g a.i. ha^{-1} in brinjal and provided protection against insect pest for a longer period. However, a waiting period of 6 days for lower dose and 9 days for higher dose should be observed before the fruits are consumed when crop is sprayed with Quinalphos at 375 and 750 g a.i. ha^{-1}, respectively.

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