

Persistence of Propineb (Polymeric Zinc 1, 2-Propylene Bisdithiocarbamate) Fungicide in Onion and Cropped Soil

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Abstract To study the persistence of propineb in/on onion a field experiment was conducted during 2007 at Agricultural Research Station, Durgapura, Jaipur Propineb70WP @ 1,225 and 2,450 g a. i. ha⁻¹ dose was applied as foliar spray to the crop thrice at an interval of 10 days. After third spray, onion samples comprising of green leaves and immature bulb were collected at 0,1,3,5,7,10 and 15 days. The initial deposit was 2.32 and 4.89 ppm of propineb (on CS₂ basis) which persisted up to the 10 and 15 days at normal 1,225 g a.i. ha⁻¹ and higher 2,450 g a.i. ha⁻¹ dose of fungicide application. The half life values of propineb ranged from 3.27 to 4.60 days.

Keywords Persistence · Propineb · Half life · Initial deposit

Onion (*Allium cepa* L.) is the important vegetable, spice and medicinal crop grown all over the world. There is saying that when we have onion, it tears and when we don't have then also it tears. Hence, the crop has strong binding in the day-to-day human life. Onion is the maximum consumed vegetable in the world and its demand is increasing year after year. But our productivity is not increasing at the same rate and hence demand is not being met as per the standards of per capita demand. The major constraint is the low productivity and thereby low supply. The major reasons for this are the losses caused by various diseases. The crop suffers heavily due to the attack of various diseases both in the field as well as during storage.

Propineb (polymeric zinc 1, 2-propylene bisdithiocarbamate) is a newly introduced bisdithiocarbamate fungicide in the India subcontinent by M/s Bayer India Ltd. It is notable for its fast action and excellent residual activity (Weeren and Brennecke 1996). It is widely used as foliar application against blight disease of potato, tomato, paddy and onion as well as for protective control of apple scab, apple leaf spot, downy mildew in grapes, tobacco, onion and vegetables (Lee and Kim 1980; Nath and Sharma 1993; Weeren and Brennecke 1996; Tomlin 1997; Sarkar et al. 1998). It is non-phytotoxic and gives full coverage of treated leaves with good sticking property so that it is not easily washed off by rains (Tomlin 1997). The present study was therefore conducted to determine the persistence of propineb in green leaves onion bulbs, mature onion bulbs and soil. Very little information is available on the residual fate of propineb in potato and onion (Sarkar et al. 1998; Raj et al. 2008). The present experiment was therefore, conducted to know the persistence pattern of propineb in green leaves immature onion, mature onion bulb and soil.

Materials and Methods

To study the dissipation and persistence of propineb in/on onion, a field experiment was conducted in a randomized block design with three replications at Agricultural Research Station, Durgapura (Jaipur) during Rabi 2006-07 Nursery for onion saplings was raised in December 2006 using variety RO-1, onion saplings were transplanted in plots during January 2007 with R × R 15 cm and P × P 10 cm in a plot of 4 × 3 M² size. The climatic parameters during December 2006 to May 2007 were Average minimum temperature 13.6°C, Average maximum temperature

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27.9°C, Per cent relative humidity 67.8 (maximum) and 34.7 (Minimum), rainfall (mm) 45.2 and average relative humidity was 51.3%.

Application of fungicide and sample collection: first spray of propineb (zinc propylene-bis-dithiocarbamate) at 1,225 and 2,250 g a.i. ha⁻¹ dose was applied to crop by using a knapsack sprayer during second week of March 2007 and subsequent 2nd and 3rd spray were given at interval of 10 days. The spray volume was 500 L ha⁻¹. Onion green plant samples were collected randomly from each treatment replication after third foliar spray at an interval of 0 (2 h after spray), 1, 3, 5, 7, 10 and 15 days. At harvest, mature onion bulb and soil samples were collected for estimation of propineb residues in them by CS₂ evolution method as given by Kepple (1971). A representative 200 g sample was transferred into three neck distillation flask followed by 350 mL water, 30 mL hydrochloric acid and 30 mL stannous chloride solution with the help of a dropping funnel. The contents of the flask were heated to boil for 1 h, CS₂ evolved was trapped in ethanolic colour reagent containing cupric acetate and diethanol amine after elimination of acidic impurities by passing through sodium hydroxide impinger. After 1 h of boiling water suction was shut down and the colour reagent was transferred to a 25 mL volumetric flask with several rinsings using ethanol, diluted to the mark and mixed. The absorbance was measured at 435 nm on the UV–VIS Spectrophotometer against a blank solution prepared with 15 mL colour reagent and 10 mL ethanol. Standard curve was prepared with different amounts of CS₂ working standards containing 1.0, 2.0, 3.0, 4.0, 5.0, and 5.5 mL of carbondisulfide standard solution equivalent to 50.8, 101.6, 152.5, 203.3, 254.1 and 279.5 µg CS₂ respectively, transferred into 25 mL volumetric flasks, 15 mL of colour reagent was added to each of the volumetric flask, final volume was made with ethanol up to the mark and allowed to stand for

an hr after that absorbance was measured at 435 nm. Standard curve was prepared by plotting µg CS₂ on X (abscissa) axis and absorbance on Y axis (ordinate). The regression equation worked out was $Y = -0.0499 + 0.003x$ with $R^2 = 0.997$. The half life values were computed as per the method given by Hoskins (1961).

Results and Discussion

The method was validated by conducting recovery experiments, untreated onion bulbs (both green leaved and mature onion bulbs) and soil was fortified with propineb at 0.25, 0.50 and 1 µg g⁻¹ levels. Per cent recovery of propineb was obtained in soil varied between 94.80 and 95.60 where as in green leaves onion bulb it ranged between 89.60 and 95.40 and mature onion bulbs were 90.04–94.60 Table 1.

The application of propineb at 1,225 and 2,450 g a.i. ha⁻¹ resulted in initial deposits of 2.32 and 4.89 µg g⁻¹ (Table 2), which declined to 1.87 and 3.68 µg g⁻¹ CS₂ after 1 day of fungicide application at normal and higher dose, respectively. Corresponding dissipation percentage were 19.39 and 24.7, similar results have been reported by Raj et al. 2008. The residues were below MRL 0.50 ppm on 7.15 day of its application at lower dose (recommended dose) and 13.34 day of its application at higher dose (double of the recommended dose). Propineb residues declined to below limit of determination (0.2 µg g⁻¹ CS₂) on the 15 days at lower dose. Dissipation of the initial deposit of propineb could be attributed to the climatic conditions and its contact nature. At harvest of the crop, residues of propineb were not detected in mature bulb and soil at both treatments level. The maximum residue limit for dithiocarbamates is 0.50 µg g⁻¹ CS₂ for onion, hence produce onion with green leaves and mature bulb can be

Table 1 Results of method validation by recovery analysis of propineb (analytical grade) from test samples

Substrates	Amount of fortification (µg g ⁻¹)	Amount recovered (µg g ⁻¹)*	SD±	Recovery of Propineb (%)	Average recovery of Propineb (%)
Green leaves onion bulb	0.25	0.224	±0.014	89.60	91.00
	0.50	0.440	±0.026	88.00	
	1.00	0.954	±0.019	95.40	
Mature onion bulb	0.25	0.230	±0.032	92.00	92.21
	0.50	0.452	±0.047	90.04	
	1.00	0.946	±0.024	94.60	
Soil	0.25	0.237	±0.009	94.80	94.93
	0.50	0.472	±0.012	94.40	
	1.00	0.956	±0.015	95.60	

* Average of three replications (n=3)

SD ±Standard deviation

Table 2 Dissipation of propineb (70WP) at 1,225 g. a.i.ha⁻¹ (Normal dose) and 2,450 g. a.i.ha⁻¹ (Double dose) in onion green leaves, immature onion, mature bulb and soil

Dosages g a. i. ha ⁻¹	Sampling interval (days)	Part analysed	Residue level mgkg ⁻¹			Average residue mgkg ⁻¹	S.D. ±	Dissipation %
			R-1	R-2	R-3			
1,225	0	Onion green leaves & immature onion	2.36	2.31	2.28	2.32	0.030	–
	1		1.83	1.89	1.87	1.87	0.040	19.39
	3		1.09	1.12	1.11	1.11	0.015	52.15
	5		0.82	0.80	0.81	0.81	0.010	65.08
	7		0.57	0.60	0.56	0.58	0.020	75.00
	10		0.25	0.25	0.25	0.25	–	89.20
	15		BDL	BDL	BDL	–	–	100.00
		Mature bulb at harvest	BDL	BDL	BDL	–	–	100.00
		Soil at harvest	BDL	BDL	BDL	–	–	100.00
RL ₅₀ = 3.27 days T _{tol} = 7.15 days								
Regression equation = $\log y \times 10^3 = 3.3555 - 0.091821792 \times x$								
2,450	0	Onion green leaves & immature onion	4.78	4.93	4.96	4.89	0.055	–
	1		3.69	3.74	3.63	3.68	0.096	24.70
	3		2.41	2.39	2.34	2.38	0.036	51.30
	5		1.24	1.20	1.26	1.23	0.030	74.80
	7		1.07	1.03	1.02	1.04	0.026	78.70
	10		0.73	0.78	0.76	0.76	0.025	84.45
	15		0.51	0.50	0.49	0.50	0.106	89.77
		Mature bulb at harvest	BDL	BDL	BDL	–	–	100.00
		Soil at harvest	BDL	BDL	BDL	–	–	100.00
RL ₅₀ = 4.60 days T _{tol} = 13.34 days								
Regression equation = $\log y \times 10^3 = 3.571311 - 0.06539273 \times x$								

RL₅₀ Half life, T_{tol}. Time require to reach the tolerance limit, MRL Maximum residue limit 0.50 mg kg⁻¹

BDL Below determination limit, SD ±Standard deviation

consumed after 7.15 and 13.34 days at 1,225 and 2,450 g a. i. ha⁻¹ dosages respectively of fungicide application.

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