

PERSISTENCE OF PROPINEB RESIDUES IN PAPAYA

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ABSTRACT: Spray treatment of propineb (Antracol 70 WP) was given to papaya crop (variety Solo) three times at 15 days interval @ 2 and 4 g/litre during June–July, 2006 to study the persistence and residues. Initial residue deposit of 3.51 and 7.18 mg/kg of propineb was recovered from whole papaya fruit. Residues dissipated at faster rate and at harvest (30 days after the last spray) the residues were below the detectable level of 0.1 mg/kg. The residues of both the treatments dissipated at the half life of 4.5 days. Pre-harvest interval (PHI) or Waiting Period (WP) recommended were 1 and 4 days respectively for two doses. In the subsequent season of experiment September – October, 2006 with total rainfall of 95.8 mm. The initial deposits of propineb (0 day) were 3.55 and 7.73 mg/kg with half life of 6.7 and 5.9 days respectively for recommended and double the recommended doses. The suggested pre-harvest intervals were 1 and 8 days for recommended and double of the recommended dose, respectively.

Key Words: Papaya, propineb, persistence, residues, waiting period

INTRODUCTION

Papaya crop is affected by anthracnose caused by *Colletotrichum gloeosporioides* Penz. Sacc., which is carried from the field and develops during ripening. This is favored during wet weather conditions. Propineb gives good control of anthracnose disease of papaya. Propineb is a zinc propylenebisdithiocarbamate foliar-applied fungicide with long residual activity. It is used as a protective treatment on several crops for the control of various fungi including anthracnose. It is a newly introduced dithiocarbamate pesticide in India (Ahuja and Pande, 2004). Dithiocarbamates are widely-used chemicals that display high, broad-spectrum activity against fungal plant diseases (Tomlin, 1994). It is also

used to control of downy mildew, black rots, red fire disease, and grey mould on vines. Propineb also controls scab and brown rot on apples and pears (<http://www.yelori.com/products/Propineb.shtml>). Papaya crop is sprayed with fungicides close to harvest, which may leave harmful residues in fruits. Since there are no data available on the persistence of propineb on papaya, the present investigation was conducted to determine the dissipation pattern as well as the residue level of propineb on plants at two different Plots for two seasons in Bangalore climatic condition when applied @ 2.0 Kg/ha and 4.0 Kg/ha along with untreated control with the help of foot sprayer at the rate of 1000 L/ha.

MATERIALS AND METHOD

A field trial was conducted at Indian Institute of Horticultural Research, Bangalore (South India) in papaya crop (variety Solo) to study the persistence and residues of propineb (Antracol 70 WP). Spray application of propineb was given three times at 15 days intervals at the recommended and double the recommended dose of 2 and 4 g/litre. Liquid soap (<1ml) was used as adjuvant and the pH of the water was 7.3. The experiment was carried out during the month of June –July (rainy season) and the spray was given at the fruit growth stage which was 10 months after transplanting. Five papaya fruits free from PRSV (Papaya ring spot virus) were collected randomly from each treatment replication after the 3rd spray application. The analysis of papaya fruit was carried out at 0 (1 hr after application), 1, 3, 7, 10, 15, 20 and 30 days after the third spray. The rainfall during sampling time was 75.4 mm. The above experiment was repeated during the months of September – October to obtain information on the residue persistence of propineb on papaya during low rainfall period. The fruits were collected in the second season and it was carried out after the 3rd spray. The rainfall during sampling time was 29.8 mm. The analysis of papaya fruit sample was carried out at 0 (1 hr after application), 1, 3, 7, 10, 15, 20 and 30 days after the third spray. Analysis of papaya samples was carried out as per Keppel (1971). Residues of propineb were measured as CS₂ by Spectrophotometer at 435 nm.

Weather Conditions

The weather parameters for Season-I (June –July, 2006) were: temp. min. 19.9°C, max. 28.25°C; relative humidity 81.8%; rain fall 166.5 mm and for Season II (September – October, 2006) the climatic conditions were: temp. min. 19.45°C, max. 29.0°C; relative humidity 80.25%; rain fall 95.8 mm.

Residue analysis

The residue analysis of propineb was carried out by a standard method proposed by

Keppel (1971). In this method, residue of dithiocarbamates is estimated as the quantity of carbon disulphide (CS₂). The maximum residue limits (MRL) of dithiocarbamates are also fixed based on the CS₂ level by FAO/WHO (2000) and the MRL is 3ppm for papaya. A representative (50g) sample (whole papaya fruit) cut into small pieces was acid digested (30 mL hydrochloric acid) and the CS₂ gas evolved was trapped in ethanolic colour reagent (containing cupric acetate monohydrate and diethanolamine in 250 mL ethanol). The CS₂ on reaction with chromogenic reagent yielded a yellow coloured complex of cupric salt of N, N-bis (2 - hydroxy) dithiocarbamic acid which was measured immediately by spectrophotometer at 435 nm. The concentration of carbon disulphide was calculated from the standard curve prepared with known concentrations of CS₂ solutions. The level of residues in the samples was expressed as mg of carbon disulfide (CS₂) per kg fruits. The half-life and waiting periods were calculated on the basis of maximum residue limit of CS₂ per kg fruits.

RESULTS AND DISCUSSION

In the single recommended dose, initial residue deposit of 3.51 and 7.18 mg/kg of propineb (as CS₂) was recovered from whole papaya fruit. Residues dissipated very fast and at recommended dose of treatment no residues were recovered after 20 days. At double the recommended dose treatment residues remained upto 25 days but at a low level of 0.14 mg/kg. At harvest (30 days after the last spray) the residues had reached below the detectable level of 0.1 mg/kg (Table 1). The data generated were statistically analysed as per Hoskins (1961) on the presumption of first order rate of dissipation. The residues dissipated at the half life of 4.5 days from both the treatments. Based on the MRL value of 3.0 mg/kg (as CS₂) (Codex Alimentarius) the pre-harvest interval (PHI) or Waiting Period were calculated for recommended and double recommended dose of propineb treatment and found to be 1 and 4 days respectively (Table 2).

Table 1. Dissipation of propineb residues on papaya fruits

Days after Spray	First season			Second season		
	Propineb Residues Recovered* (mg/kg)			Propineb Residues Recovered* (mg/kg)		
	Untreated control	Propineb 70WP @ 2 g/L	Propineb 70WP @ 4g/L	Untreated control	Propineb 70WP @ 2 g/L	Propineb 70WP @ 4g/L
0 (1hr)	BDL	3.51	7.18	BDL	3.55	7.33
1	BDL	2.81	5.60	BDL	2.98	6.25
3	BDL	1.20	3.34	BDL	1.81	5.47
7	BDL	0.65	1.74	BDL	1.34	3.83
10	BDL	0.50	0.83	BDL	1.07	2.42
15	BDL	0.25	0.47	BDL	0.73	1.34
20	BDL	0.14	0.33	BDL	0.48	0.97
25	BDL	BDL	0.14	BDL	0.18	0.61
30	BDL	3.51	7.18	BDL	BDL	0.13

BDL = Below detectable limit of 0.1 mg/kg as CS₂ * Average of 3 replicates

Table 2. Rate of residue decay and safety constants of propineb in/on papaya

	First season		Second season	
	Recommended dose (2 g/L)	Double dose (4g/L)	Recommended dose (2 g/L)	Double dose(4g/L)
Regression equation	Y= 3.4184 - 0.06799X	Y= 3.7503 - 0.0665X	Y= 3.48437 - 0.04537X	Y= 3.8928 - 0.0513X
Correlation coefficient	-0.98	-0.99	-0.98	-0.98
Half-life (t_{1/2}) (days)	4.43	4.53	6.6	5.9
Pre harvest interval (days)	1	4	1	8

MRL = Maximum residue limit of 3 mg/kg as CS₂

In the second seasonal study, initial deposit of propineb (0 day) was 3.55 and 7.73 mg/kg. Residues persisted up to 25 days and at 30 days it reached below detectable limit in recommended dose and it persisted in double the recommended

dose, respectively (Table 1). The residues dissipated at the half life of 6.7 and 5.9 days. The suggested waiting period and pre-harvest intervals worked out were 1 and 8 days for recommended and double the recommended

dose, respectively (Table 2). Since a strong correlation co-efficient (0.98 - 0.99) was obtained between residue dissipation and time, dissipation followed the first order kinetics in both the seasons. The results were comparable with earlier works (Ahuja and Pande, 2005; Liesivuori and Savolainen, 1994). Wasim Aktar (2009) had reported in his study of persistence and dissipation of propineb and found that the residues of propineb were below the MRL after 3.36-6.81 days and 3.23-6.71 days for Location I and Location II, respectively.

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