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RESEARCH ARTICLE

Integrated Management of Papaya Ring Spot Virus (PRSV) In Papaya

Muthulakshmi P

Department of Plant Pathology, Tamil Nadu agricultural University, Coimbatore-641003,India

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ABSTRACT

Papaya Ring Spot Virus (PRSV) is one of the major obstacles for boosting papaya production in the country. There is no curative control measure available through conventional methods. Precautionary measures for PRSV incidence *viz.* rouging, cross protection, vector controls separately are not much effective. Hence an integrated management strategy involving raising of papaya seedlings under Nylon net (40-60 mesh) and spraying of acephate 1.5g/litre, 3 days before planting. Use of two rows of border crop viz. maize (sown 15 days before planting)+. Spraying of urea @ 10g/liter + zinc sulphate @1.5g + boron @ 1.0g per litre recorded reduced PRSV incidence of 42.7 % with maximum average yield of 49.68 kg/tree compared to control with maximum PRSV incidence of 95.6 % incidence with reduced yield of 23.76 kg/tree at 150 days after planting.

Keywords: *PRSV, Papaya, IDM, Micronutrients, Yield.*

INTRODUCTION

Papaya (*Carica papaya* L) belongs to the family Caricaceae is one of the most important fruit crops of the country. Papaya fruit is known for its high nutritive and medicinal value (Azad et.,al 2012). It is a richest source of vitamin A, B, C and proteolytic enzymes viz. papain, chymopapain etc. Beta carotene helps in prevention of cancer, diabetes, and heart diseases. It is also used in the pharmaceutical and cosmetic industries (Retuta.et.al 2012) .The papaya production industry is threatened by most serious disease i.e. papaya ring spot disease worldwide. It is caused by papaya ring spot virus (PRSV), it is a member of the genus potyvirus. Symptoms of PRSV are prominent mosaic pattern on the leaf lamina, wet-oily streaks on the petioles and on the tree trunk, and complete distortion of young leaves. The fruit exhibits bumps and the classic "ringspot". This leads to 50 percent or even more reduction in fruit production. PRSV has been recognized as a destructive disease in many tropical and subtropical areas viz. USA, South America, Africa , India(Tripathi,et.al., 2008) Thailand, Taiwan, China and the Philippines , Mexico , Australia , Japan , French Polynesia, and the Cook islands resulting in the decline in fruit production. This disease leads to 100 percent yield loss in papaya. This virus is transmitted by aphids in a non-persistent manner. It is a non-persistent virus. There is no known resistance to PRSV, although certain varieties are more symptomatic than others.

There are four main methods of control for PRSV, quarantine and geographic displacement, rouging and netting, cross protection, and genetic modification of the host plant. Because PRSV is a non-persistent virus and is consequently transmitted to healthy plants by aphids within a very short time period, insecticidal control is difficult and impractical. Hence the present study was conducted with integrated technologies including several methods to manage the virus and to get higher yield.

MATERIAL AND METHODS

The experiment was conducted for two consequent years at orchard, HC& RI, TNAU, Coimbatore using CO.8 papaya. Papaya seedlings were raised under nylon net (40-60mesh) insect proof net house and spraying of Acephate 1.5g per litre, 3 days before planting was carried out. Two rows of border crop viz. maize (Maize sown 15 days before planting) was taken up for all treatments in the main field. The experiment was conducted with five treatments with four replications in RBD design. For each replication 12 plants were maintained and planting was taken up with a spacing of 6mx6m. The regular cultural practices were followed as recommended in crop production manual of TNAU, Coimbatore. The treatment details are given below. The observation on disease incidence was recorded at 30 days interval along with yield and aphid population for all the treatments.

*Corresponding author's e-mail: muthupathology@gmail.com

Treatments

T_1 : Raising of papaya seedlings under Nylon net (40-60 mesh) and spraying of Acephate 1.5g/litre, 3 days before planting. Use of two rows of border crop viz. maize (sown 15 days before planting.

T2 T1+application of Neem oil 1% + acephate 1.5 g/litre at 15 days interval

T3 : T1+spraying of 1.5g Zinc sulphate at 30 days interval

T4 : T1+spraying of Boron @ 1.0g per litre at 30 days interval

T5 : T1+spraying of Urea @ 10g/liter + Zinc sulphate @1.5g + Boron @ 1.0g per litre

T6 : Control with equal number of plants

RESULTS AND DISCUSSION

The results revealed that the treatment T4 ie., T_1+ spraying of urea @ 10g/liter + zinc sulphate @1.5g + boron @ 1.0g per litre recorded reduced PRSV incidence of 40.7 % with maximum average yield of 40.2 kg/tree compared to control with maximum PRSV incidence of 93.6 % incidence with reduced yield of 26.9 kg/tree at 150 days after planting. The treatment T_2 (T_1 + application of neem oil 1% + acephate 1.5 g/l at 15 days interval) recorded 44.4 % PRSV incidence on par with T_5; with an average yield of 32.6 kg/tree. (Table 1)

Both the treatments T_3 (T_1+ spraying of 1.5g zinc sulphate at 30 days interval) and T_4 (T_1+ spraying of boron @ 1.0g/l at 30 days interval) though recorded 55.5 and 51.8 % incidence respectively an average yield of 37.2 and 38.9 was obtained

The pooled mean analysis of two-year data revealed that the treatment T4 ie., T1+spraying of urea @ 10g/liter + zinc sulphate @1.5g + boron @ 1.0g per litre recorded reduced PRSV incidence of 42.7 % with maximum average yield of 49.68 kg/tree compared to control with maximum PRSV incidence of 95.6 % incidence with reduced yield of 23.76 kg/tree at 150 days after planting. The treatment T2 (T1+application of neem oil 1% + acephate 1.5 g/l at 15 days interval) recorded 49.8 % PRSV incidence with an average yield of 35.18 kg/tree.

In the other treatments T3 (T1+spraying of 1.5g zinc sulphate at 30 days interval) and T4 (T1+spraying of boron @ 1.0g/l at 30 days interval) an average yield of 34.0 and 43.32 kg/tree was obtained respectively although 52.4 and 58.2 % incidence was prevalent in these respective treatments (Table 2).Similar findings were reported by several workers. (Chandrashekar et.al. 2015 and Sharma, et.al. 2010). Chalak et.al 2017 reported that PRSV is transmitted through the aphids. Aphid management at regular intervals should be started at nursery stage. It can be done by using systemic insecticides. These systemic insecticides *viz.* carbosulphan, imidacloprid, acetamiprid *etc.* should be used in low concentrations at nursery stage and at regular concentrations at field stage. This can be a effective way of PRSV control at its source. Netting can also be used to prevent insect vectors from spreading the virus. (Gonsalves and Garnsey, 1989). Premchand et al., 2021 observed that different combinations of insecticides and bio rationals differed in their effectiveness in delaying PRSV infection. A combination of insecticides i.e tolfenpyrad 15%EC @1 ml/lt, imidacloprid 17.8%SL @ 0.2 ml/lt, thiacloprid 21.7 SC @ 1 ml/lt and dinotefuran 20 % SG @ 0.5g/lt. sprayed along with micronutrients at every 30 days internals was the most effective treatment with less PRSV infection. Out of nine treatments complete protection could not be obtained in any of the treatment combinations probably due to the non-persistent nature of virus transmission by vectors.

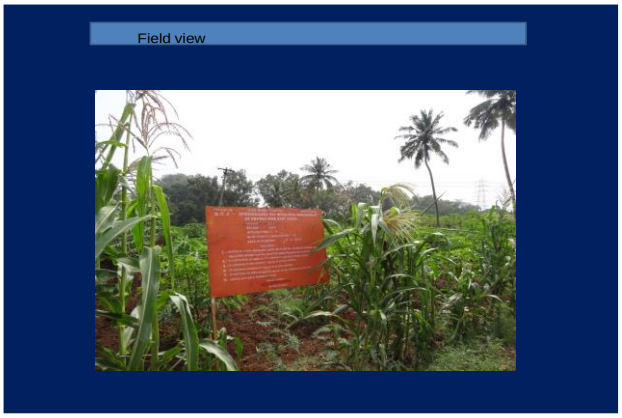

Fig.1- Field view of the Papaya Ring Spot Virus Management Trial

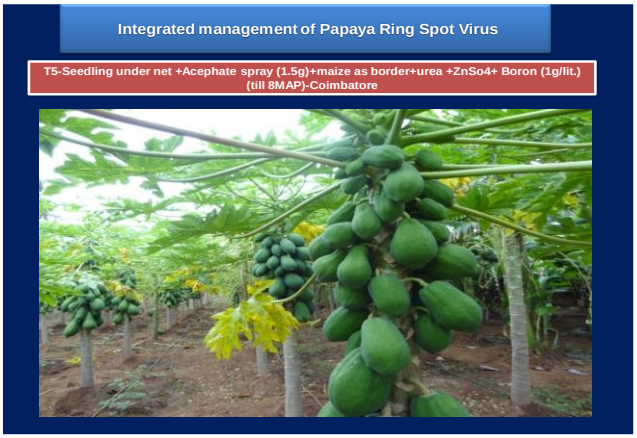

Fig.2.Management of Papaya Ring spot Virus-Best Treatment

Table 1. Integrated management of Papaya ring spot virus (I st Trial)

Trt	Disease incidence (%)			Aphid population (No./5 sq.cm)	Plant height at 1st flowering (cm)	Average Yield/tree (Kg)
	90 DAP	120DAP	150 DAP			
T_1	38.5	62.9	74.0	7.8	108	28.7
	(38.4)	(52.5)	(59.3)			
T_2	22.2	37.0	44.4	6.5	88.3	32.6
	(28.1)	(37.5)	(41.8)			
T_3	33.3	40.7	55.5	7.6	83.0	37.2
	(35.2)	(39.6)	(48.2)			
T_4	37.2	48.1	51.8	8.5	96.7	38.9
	(37.6)	(43.9)	(46.0)			
T_5	33.2	37.0	40.7	8.0	131.0	40.2
	(35.2)	(37.5)	(39.6)			
T_6	55.5	81.4	93.6	8.9	87.0	26.9
	(48.2)	(64.4)	(75.4)			
SEd	3.4	4.7	4.9	0.3	13.0	2.4
CD (5%)	7.5	10.5	11.0	0.7	30.3	5.5

*Mean of three replications. The numbers in the parenthesis are arcsine-transformed values

Table 2.Integrated management of Papaya ring spot virus-Coimbatore (II nd trial)

Treatments	Disease incidence (%)						Aphid population (No./5 sq.cm	Total No. of Marketable fruits	Total No. of un marketable fruits	Average Yield/tree (Kg)
	30 DAP	60 DAP	90 DAP	120DAP	150 DAP	180 DAP				
T1	12.8	24.3	32.6	42.4	58.3	72.8	8.8	30.0	7.56	24.86
T2	10.6	12.4	26.3	38.0	49.8	66.8	7.5	35.42	5.39	35.18
T3	11.3	16.2	36.8	42.7	52.4	70.0	7.6	40.25	6.59	34.00
T4	10.2	14.6	36.4	52.6	58.2	72.0	8.0	32.60	6.33	43.32
T5	9.8	12.8	22.4	32.5	42.7	60.2	7.0	41.60	4.21	49.68
T6	22.2	38.5	74.5	80.4	95.6	100.0	9.0	28.00	8.75	23.76
SEd	1.49	0.90	1.20	1.74	1.96	2.03	0.2	1.37	1.61	4.30
CD (5%)	3.17	1.12	2.50	3.70	4.18	4.33	0.5	3.42	3.20	8.70
CV %	16.50	7.59	6.14	5.33	5.25	4.67		22.44	12.60	25.15

*Mean of three replications

CONCLUSION

For the management of Papaya Ring Spot Virus , spraying of urea @ 10g/litre + zinc sulphate @1.5g + boron @ 1.0g per litre recorded reduced PRSV incidence of 42.7 % with maximum average yield of 49.68 kg/tree compared to control with maximum PRSV incidence of 95.6 % incidence with reduced yield of 23.76 kg/tree at 150 days after planting. The treatment T2 (T1+ application of neem oil 1% + acephate 1.5 g/l at 15 days interval) recorded 49.8 % PRSV incidence with an average yield of 35.18 kg/tree.

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