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Management of damping off disease of papaya seedlings in nursery

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Abstract

Papaya (*Carica papaya* L.) is an important fruit crop is being threatened by damping off disease of papaya seedlings in the nursery. A number of fungi *Pythium ultimum*, *Phytophthora parasitica*, *Fusarium solani* and *Rhizoctonia species* can cause damping off disease of papaya seedlings. The chemical control of these fungal pathogens is not effective throughout the growth of plants. Moreover, use of chemicals to control the disease is also criticized due to its detrimental effects on the environment and besides this, the pathogens became resistant to the common chemical fungicides used against them. Keeping all these things in the mind, a trial was formulated to find out the best alternative to control damping off disease of papaya seedlings. Six treatments, each in four replications were considered during the course of trial in summer 2016-17 and 2017-18 at farmers' field by Krishi Vigyan Kendra, Sheohar under DRPCA, Pusa. The efficacy of fungicides Carbendazim-50% wp, Copper oxychloride-50% wp, Mancozeb (64%) + Metalaxyl (8%) and *Trichoderma viride* either alone or in their different combinations was evaluated for the management of damping off disease of papaya seedlings in nursery stage. The results revealed that seed treatment with 0.1% solution of Carbendazim-50% wp for eight hours and basal drenching by Mancozeb (64%) + Metalaxyl (8%) @ 0.25% along with two times additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution gave maximum percentage of seed germination (98.50%) and reduced percentage of disease incidence upto 1.75% but found statistically similar with seed treatment with Carbendazim-50% wp @ 0.1% solution and basal soil treatment with *Trichoderma viride* @ 1% solution along with two additional soil drenching with Copper oxychloride 50% wp @ 0.3% solution. The similar trends were also observed in case of root length, seedling height, number of roots and number of leaves per plant. All the treatments were found significantly superior over the check in respect of seed germination, reduced disease incidence, root length, seedling height, number of roots and the number of leaves per plant of papaya seedlings in the nursery.

Keywords: Papaya, seedling, damping off, fungicide, *Trichoderma viride*

1. Introduction

Papaya is an important fruit crop in India, locally known as papeeta in hindi, pappaiya in Bengal and pappali in Tamil. It has become more popular due to its high palatability, productivity and fruiting ability throughout the year. It is regarded as highly remunerative and short duration crop along with multifarious uses viz., medicinal, nutritional and industrial input. Papaya raw fruits are consumed as vegetable and ripe as a fresh fruit in India. The optimum temperature for plant growth and development is 25 °C, light to medium alluvial soil with 6-7 pH. The well drained sandy loam soil along with adequate organic matter is most suitable for papaya cultivation⁽¹⁾. Papaya production is constrained by several biotic & abiotic factors and among the biotic factors, fungal diseases are the most significant constraints. Papaya seedlings are commonly affected by damping off disease in nursery beds. The base of the seedling gets infected and as a result, it topples down. Browning and shrivelling of the stem tissues took place & water soaked lesions appeared in the collar region which resulted in the weakening of tissues & finally the seedling collapsed. A number of fungi *Pythium ultimum*, *Phytophthora parasitica*, *Fusarium solani* & *Rhizoctonia species* can cause damping off disease of papaya seedlings. The chemical control of these fungal pathogens is not effective throughout the growth of plants and also not completely control the pathogens. Moreover, use of chemicals to control the disease is also criticized due to its detrimental effects on the environment and besides this the pathogens became resistant to the single common chemical fungicides used against them. Keeping all these things in the mind, a trial was formulated to find out the best alternative to control damping off disease of papaya

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seedlings. Six treatments each in four replications were considered during the course of trial in summer 2016-17 & 2017-18 at farmers' field by Krishi Vigyan Kendra, Sheohar under DRPCA, Pusa, Samastipur. The efficacy of fungicides Carbendazim-50% wp, Mancozeb (64%) + Metalaxyl (8%) and *Trichoderma viride* either alone or in their different combinations was evaluated for the management of damping off disease of papaya seedlings in the nursery. The data in respect of seed germination, disease incidence, number of roots, root length, seedling height & number of leaves were generated through investigation, will be useful for the management of damping off diseases for papaya growers.

2. Materials and methods

The experiment was conducted at farmers' field of Sri Sanjay Kumar Singh Madhopur Anant village under on farm trial by Krishi Vigyan Kendra, Sheohar, Bihar during the years 2016-17 and 2017-18. The soil of the experimental plot was sandy loam with alkaline pH of 7.3, low organic carbon, available nitrogen, zinc, boron and medium availability of phosphorous and potash. The experiment was conducted in open condition in polybag filled with sandy loam soil and vermicompost (4:1) mixture in a randomized block design. Six treatments including control were considered during the course of trial such as T1: Seed treatment with Carbendazim 50% wp @ 0.1% solution for eight hours + basal soil drenching with *Trichoderma viride* @ 1% followed by two additional soil drenching with Copper oxychloride @ 0.3% at the interval of 20 days, T2: Seed treatments with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution + basal and two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution at the interval of 20 days, T3: Seed treatment with Carbendazim 50% wp @ 0.1% solution and basal along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution at the interval of 20 days, T4: Seed treatment and one soil drenching with *Trichoderma viride* @ 1% solution along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% at the interval of 20 days, T5: Seed treatment with Copper oxychloride 50% wp @ 0.3% solution along with basal and two additional soil drenching with Copper oxychloride @ 0.3% at the interval of 20 days and T6: Control (without use of fungicide). The papaya seeds of cultivar Red lady-786 were treated with required quantity of different fungicides except control. Basal soil drenching with required quantity of different fungicides were done in all the polybags except control polybags. The seeds were sown in 250 polybags as per the treatments at nursery. The normal agronomical practices along with intercultural operations viz., irrigation and weeding were followed as per requirement during the nursery stage. Two additional drenching of polybag soil except the control with required concentration of different fungicides were also done at the interval of 20 days. The data on seed germination (%) and damping off disease incidence (%) were recorded at 45 days after sowing. The plant height was measured from the polybag top soil surface upto the highest leaf tip by straightening all leaves. The root length and number of roots were measured by destructive methods of uprooting the plants. The counting of number of the leaves was done at the end of the experiment. The collected data of both the years were analysed statistically for comparing the results.

3. Results and discussion

Damping off is an important disease which frequently occurs in the papaya nursery bed. Pathogens attack before or after seedling emergence, resulting in pre-emergence or post-emergence damping off respectively. It is more common under warm & moist conditions and seedling topples over after emergence due to infection in roots or in the collar region. Disintegration of tissue takes place in advanced stage, especially near soil level. Infected tissue becomes soft and water soaked constriction on the stem at the base is formed and hence seedling death may occur within few days. Pooled data revealed that among fungicidal seed treatment with Carbendazim 50% wp @ 0.1% solution for eight hours and basal along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solutions at the interval of 20 days proved best by having maximum seed germination of 98.50% and maximum disease management of 98.02%. The maximum seedling height (23.90cm), maximum root length (12.47cm), maximum number of roots (17.30) and maximum number of leaves per plant (11.25) were also observed with fungicidal treatment with Carbendazim 50% wp @ 0.1% solution and basal along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% at the interval of 20 days. This best proved treatment was significantly similar with seed treatment with Carbendazim 50% wp @ 0.1% solution and basal soil drenching with *Trichoderma viride* @ 1% solution along with two additional soil drenching with Copper oxychloride 50% wp @ 0.3% solution by having second highest of seed germination percentage (98.20%) reduction of disease incidence percentage (93.16%), seedling height (23.75cm), root length (12.20cm), number of roots (17.10) and number of leaves per plant (10.70). All the treatments were found significantly superior over the control in respect of the seed germination percentage, percent reduction in disease incidence, seedling height, root length, number of roots and the number of leaves per plant. The results of the present investigation showed that there was a significant increase in seed germination when the seeds were treated with Carbendazim, Mancozeb + Metalaxyl, Copper oxychloride and *Trichoderma viride*. The above said fungicides also provided the effective control of damping off disease of papaya seedling at nursery stage. The finding of this trial is supported by [5], who reported that fungicides Propamocarb, Furalaxyl and Metalaxyl + Mancozeb provided effective control of damping off disease of papaya seedling. Positive effect of seed treatment with Thiabendazole [2] and Benomyl and mixture of Iprodione + Benomyl [6] on germination and seedling emergence in papaya were reported [4] also reported for the support of finding of this trial that seed treatment with Carbendazim + Mancozeb, Copper oxychloride, Metalaxyl + Mancozeb significantly increased papaya seed germination and effectively controlled damping off disease of papaya seedling. The result of this trial also suggests that application of different fungicides can promote the plant growth of *Carica papaya* seedlings [3]. reported that the application of *Trichoderma species* in crops resulted in more vigorous plants of root system. More recently, when *Trichoderma species* was applied as growth promoter [1], reported a favourable effect in growth of pea plants as well as root length.



T1- Seed treatment with Carbendazim 50% wp @ 0.1% solution for eight hours + basal soil drenching with *Trichoderma viride* @ 1% followed by two additional soil drenching with Copper oxychloride @ 0.3% at the interval of 20 days.



T4- Seed treatment and one soil drenching with *Trichoderma viride* @ 1% solution along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% at the interval of 20 days.



T2- Seed treatments with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution + basal and two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution at the interval of 20 days.



T5- Seed treatment with Copper oxychloride 50% wp @ 0.3% solution along with basal and two additional soil drenching with Copper oxychloride @ 0.3% at the interval of 20 days.



T3- Seed treatment with Carbendazim 50% wp @ 0.1% solution and basal along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution at the interval of 20 days.



T6- Control (without use of fungicide)

Table 1: Treatments considered for the management of damping off disease of papaya seedling in nursery

Treatments	Details of treatments
T1	Seed treatment with Carbendazim 50% wp @ 0.1 solution + basal soil drenching with <i>Trichoderma viride</i> @ 0.5% followed by two additional soil drenching with Copper oxychloride @ 0.3% at the interval of 20 days
T2	Seed treatments with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution + basal and two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution at the interval of 20 days
T3	Seed treatment with Carbendazim 50% wp @ 0.1% solution and basal along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solution at the interval of 20 days
T4	Seed treatment and one soil drenching with <i>Trichoderma viride</i> @ 0.5% solution along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% at the interval of 20 days
T5	Seed treatment with Copper oxychloride 50% wp @ 0.3% solution along with basal and two additional soil drenching with Copper oxychloride @ 0.3% at the interval of 20 days
T6	Control (Without use of fungicide)

Table 2: Effect of fungicides on seed germination and disease management

Treatments	Seed germination (%)				Seedling damping off (%)			
	2016-17	2017-18	Pooled	Increased seed germination over the check (%)	2016-17	2017-18	Pooled	Disease management over the control
T1	98.00	98.40	98.20	32.56	5.80	6.30	6.05	93.16
T2	86.10	88.30	87.20	8.40	8.40	9.50	8.95	89.88
T3	98.25	98.75	98.50	32.77	2.15	1.35	1.75	98.02
T4	77.50	75.80	76.65	13.57	18.25	16.20	17.22	80.53
T5	87.50	89.80	88.65	25.30	11.40	12.50	11.95	86.49
T6	67.10	65.20	66.15	-	86.75	90.20	88.47	-
CD at 5% 5.27 4.01 4.92					4.21 5.09 5.86			

Table 3: Effect of fungicides on the growth parameters of papaya seedlings

Treatments	Seedling height			Root length			Number of roots			No. of leaves		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
T1	23.60	23.90	23.75	11.90	12.50	12.20	17.25	16.95	17.10	10.60	10.80	10.70
T2	22.00	21.80	21.91	11.80	11.40	11.60	16.70	16.35	16.52	10.30	10.15	10.22
T3	24.00	23.80	23.90	12.20	12.75	12.47	17.50	17.10	17.30	11.00	11.50	11.25
T4	21.75	20.90	21.32	10.70	11.10	10.90	15.45	15.90	15.67	9.70	9.65	9.67
T5	22.50	22.10	21.80	11.75	11.30	11.52	16.10	16.25	16.17	10.10	9.90	10.00
T6	11.30	11.70	11.50	7.10	7.60	7.35	6.90	7.15	7.02	6.4	6.80	6.60
CD at 5%	0.571	0.920	0.857	0.385	0.421	0.691	0.598	0.874	0.941	0.632	0.965	0.995

4. Conclusion

Seed treatment with Carbendazim 50% wp @ 0.1% solution for eight hours and basal along with two additional soil drenching with Mancozeb (64%) + Metalaxyl (8%) @ 0.25% solutions at the interval of 20 days proved best with maximum seed germination (98.50%), disease management (98.02%), seedling height (23.90 cm), root length (12.47 cm), number of root (17.30) and number of leaves per plant (11.25).

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