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Efficacy of application methods of biocontrol agents and fungicides on Fusarium wilt management in banana

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Abstract

The experiment was conducted at the Horticultural Research Station, Orissa University of Agriculture and Technology during 2013-14 in complete randomized block design. The treatments comprised of fungicides, biocontrol agents and neem cake used through sucker treatment, soil drenching and soil application methods. Sucker treatment and soil drenching with biocontrol agents *Trichoderma viride* and *Pseudomonas fluorescens* (T6) at 60 and 180 days after planting recorded highest plant height and highest number of total leaves while lowest plant height and lowest number of total leaves were recorded in control at full growth stage. Sucker treatment and soil drenching with biocontrol agents *Trichoderma viride* and *Pseudomonas fluorescens* recorded minimum percentage of yellow (30.30 %) and dead leaves (31.00 %) in a plant. Due to better control of disease incidence this treatment T6 also resulted in maximum bunch yield (20.87 t ha⁻¹) and highest number of fingers in a bunch (79.20). Apart from soil drenching soil application of the biocontrol agents *T. viride* and *P. fluorescens* was also effective in controlling the disease.

Keywords: Banana, fusarium wilt, biocontrol agents and fungicides

1 Introduction

Banana is the most widely consumed, exported fruit in the world and it is the staple food for for millions of people in the developing countries of tropics. Among the production constraints, Fusarium wilt caused by the fungus *Fusarium oxysporum* f.sp cubense (Foc) is the most devastating disease affecting commercial and subsistence of banana production throughout the banana producing areas of the world. It is a classic vascular wilt disease in which the fungus gains entry to the water conducting xylem vessels, then proliferates within the vessels causing water blockage. The typical symptoms include wilting and death of the leaves, followed by death of the whole plant. In India varieties susceptible to Fusarium wilt roughly occupy one fourth of the total area under the crop and yield losses may reach 90 per cent by the disease (Thangavelu *et al.*, 1999). The aim of the current study was to develop the suitable application methods of biocontrol agents and fungicides for effective management of fusarium wilt.

2 Materials and methods

The experiment was laid out in complete randomized block design with ten treatments replicated thrice. Each treatment in a replication comprised of Ten banana plants. Laboratory verified fusarium wilt infected one month old suckers of cv. Bantal were used as planting material. The different treatments comprised of fungicides, biocontrol agents and neem cake used through sucker treatment, soil drenching and soil application methods. Suckers were planted at 2.2 m x 2.2 m spacing.

2.1 Details of Treatments

	Sucker treatment with Carbendazim 50 WP 0.2% + Blitox 50 WP 0.3% + Bleaching powder 0.015% for 30 min.
T ₂	Sucker treatment with Captan 50 WP 0.3% + Vitavax power 75 WP 0.5% + Bleaching powder 0.015% for 30 min.
T ₃	Sucker treatment with Trichodermaviride + <i>Pseudomonas fluorescens</i> @20g/l for 30 min.
T ₄	T ₁ + Soil drenching with T ₁ chemicals at 30 DAP and 180 DAP
T ₅	T ₂ + Soil drenching with T ₂ chemicals at 30 DAP and 180 DAP
T ₆	T ₃ + Soil drenching with <i>Trichodermaviride</i> + <i>Pseudomonas fluorescens</i> at 30 DAP and 180 DAP
T ₇	T ₄ + soil drenching with T ₂ chemical alternatively at 30 DAP and 180 DAP
T ₈	Soil application with <i>Trichodermaviride</i> + <i>Pseudomonas fluorescens</i> at 30 DAP and 180 DAP
T ₉	Neem cake application @ 250 kg /ha at planting and 180 DAP
T ₁₀	Control

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3. Results and discussion

Effect of methods application of biocontrol agents and fungicides on growth, wilt incidence and yield of banana. The plant height was maximum for treatment T6 (146.40 cm, T₃+ Soil drenching with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) followed by T8 (143.83 cm) and T2 (141.17 cm) while, the least plant height was recorded for the treatment T10 (106.17 cm) followed by T1 (120.33 cm) and T5 (121.83 cm). Highest number of total leaves at 270 DAP was observed for banana plants with T6 treatment (11.47, T₃+ Soil drenching with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) followed by T8 (11.47, Soil application with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) and T2 (11.27) whereas, T10 treatment had lowest number of leaves at 270 DAP followed by treatment T9 (9.73). Minimum per cent of plants showing prominent symptoms (360DAP) for fusarium wilt was observed for T6 treatment (30.00%, T₃+ Soil drenching with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) followed by T8 (40.00%, Soil application with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP), T5 (40.00%), T4 (40.00%) and T2 (40.00%) whereas, maximum per cent of plants showing prominent symptoms (360 DAP) for fusarium wilt was observed in T10 treatment (100.00%). The least per cent of disease affected area of leaves in a plant (360 DAP) was in treatment T6 (30.30%, T₃+ Soil drenching with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) followed by T1 (31.00 %) and T8 (31.90%, Soil application with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) treatments while, T10 (44.10%) and T7 (40.90%) treatments. Per cent of dead leaves in a plant (360 DAP) was minimum for the treatment T6 (31.10%) followed by T8 (35.20%, Soil application with *Trichoderma viride* +

Pseudomonas fluorescens at 30 DAP and 180 DAP) and T3 (38.40%) whereas, the maximum per cent of dead leaves in a plant (360 DAP) was in treatment T10 (57.90%). Highest number of fingers in a bunch was observed in treatment T6 (79.20, T₃+ Soil drenching with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) followed by T8 (78.10, Soil application with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) and T2 (72.50). The lowest number of fingers in a bunch was observed in treatment T10 (58.10). Highest bunch yield was observed in T6 treatment (30.30%, T₃+ Soil drenching with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) with 20.87 t/ha followed by T8 treatment (Soil application with *Trichoderma viride* + *Pseudomonas fluorescens* at 30 DAP and 180 DAP) with 19.14 t/ha whereas the lowest yield was observed in T10 treatment with 8.15 t/ha.

Sucker treatment and soil drenching with biocontrol agents *Trichoderma viride* and *Pseudomonas fluorescens*(T6) at 60 and 180 DAP recorded highest plant height and highest number of total leaves while lowest plant height and lowest number of total leaves were recorded in control at full growth stage. Soil application treatment with the biocontrol agents was observed to be at par with sucker treatment and soil drenching with biocontrol agents at the final stage of observation. Such findings have also been confirmed by Thangavelu and Mustaffa (2010) [4] and Selvarajan *et al.* (2014) [2]. Lowest percentage of disease affected area in leaves and dead leaves in a plant were observed in sucker treatment and soil drenching with biocontrol agents. These results were in line with findings of Sivamani and Gnanamanikyam (1987) [3]. Highest number of fingers in a bunch and bunch yield were reported in sucker treatment and soil drenching with biocontrol agents. Similar findings were reported by Raghuchander *et al.* (1997) [1].

Table 1: Effect of methods application of biocontrol agents and fungicides on growth, wilt incidence and yield of banana

Treatment	Plant height (cm) at 270 DAP	Total leaves at 270 DAP	Per cent of plants showing prominent symptoms (360DAP)	Per cent of disease affected area of leaves in a plant (360 DAP)	Per cent of dead leaves in a plant (360 DAP)	No. of fingers bunch ⁻¹	Bunch Yield (t ha ⁻¹)
T ₁	120.33	10.00	53.33 (46.92)	31.00 (33.83)	49.60 (44.77)	68.10	11.29
T ₂	141.17	11.27	40.00 (38.85)	36.20 (36.99)	43.40 (41.78)	72.50	17.22
T ₃	137.93	10.47	46.67 (43.08)	37.10 (37.52)	38.40 (38.29)	69.80	15.66
T ₄	135.17	10.33	40.00 (39.23)	33.20 (35.18)	45.10 (42.19)	68.30	14.44
T ₅	121.83	10.53	40.00 (39.23)	33.30 (35.24)	44.60 (41.90)	68.60	15.13
T ₆	147.40	11.67	30.00 (32.30)	30.30 (33.34)	31.10 (33.89)	79.20	20.87
T ₇	133.50	10.20	46.67 (43.08)	40.90 (39.76)	46.40 (42.94)	70.70	14.67
T ₈	143.83	11.47	40.00 (39.23)	31.90 (34.39)	35.20 (36.39)	78.10	19.14
T ₉	129.17	9.73	73.33 (59.22)	36.20 (36.99)	43.60 (41.32)	69.30	15.92
T ₁₀	106.17	8.27	100.00 (90.00)	44.10 (41.50)	57.90 (49.54)	58.10	8.15
SEm±	6.540	0.562	3.662	1.72	2.59	2.70	1.051
C.D. 0.05	19.430	1.669	10.880	5.12	7.68	8.02	3.122

Note: Data in the parentheses indicate angular transformed values

4. Conclusions

The present study has revealed that sucker treatment and soil drenching with biocontrol agents *Trichoderma viride* and *Pseudomonas fluorescens* at 60 and 180 DAP was the effective application method for fusarium wilt management.

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