Open Access, Peer Reviewed, Referred Research Journal

Print & Online available on https://jbsd.in
ISSN: 2229-3469 (Print); ISSN: 2231-024X (Online)
Research Article

"Effect of Biocontrol Agent on different parts under field conditions catchment areas Penganga River Himayatnagar Nanded"

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Article Info

Received: 17-09-2025,
Revised: 12-12-2025,
Accepted: 20-12-2025

Keywords: Field, Turmeric, Rhizome, Pythium, Biological control.

Abstract

The efficacy of biocontrol agents recounded under the field of conditions against rhizome root of turmeric. The bacterial andfungal antagonists through rhizome dip and soil application (3rd and 5th month after planting) helps to reduce the incidence ofrhizome rot under the field conditions. Combined application of biocontrol agents are effective rather than the individual applicationof antagonists either through rhizome dip or soil application on 3rd and 5th month. The combined application of *Trichoderma viride* + *Pseudomonas fluorescens* rhizome dip + soil application (3rd + 5th MAP) T7 treatment recorded the least rhizome rootincidence and the highest yield. The control recorded the maximum rhizome rot incidence and least yield respectively. Plantheight, stem girth and number of leaves were found to be maximum recording in T7 (*Trichoderma viride* + *P. fluorescens* (rhizome dip + soil application on the 3rd + 5th MAP) whereas in the control treatment showed a severe reduction.

INTRODUCTION

India is recognised for the land of spices that produced the largest producer, consumer and exporter of turmeric in the world. *Curcuma longa* (turmeric) is a small rhizomatous perennial herb of Zingiberaceae (Ginger family) originating from southeastern Asia, most probably from India. These types of plants used to produce fleshy rhizomes of bright yellow to orange colorin its root system, that are the source of thecommercially available spice turmeric. In the form ofroot powder, turmeric is used for its flavouring propertiesas a spice, food preservative, antibiotic medicine and food-colouring agent.In India, turmeric is grown in 18 states of India mostly in the states of AndhraPradesh, Tamil Nadu, Karnataka, Orissa and West Bengalare the major turmeric- producing states in India. The Production of turmeric across India in financial year 2017,by state (in 1000 metric tons). Among the various turmeric diseases, Leaf Spot Turmeric rhizome root caused by Pythium sp. It is a major problem in all turmericgrowing areas of India (Ramarethinam and Rajagopal,1999). Rhizome root of turmeric incited by Pythiumaphanidermatum (Edson) Fitz, was firstly reported in SriLanka by Park (1934) and in India it was reported from Krishna district of Andhra Pradesh, Tiruchirappalli and Coimbatore of Tamil Nadu by Ramakrishnan and Sowmini (1954).

Water soaked spots in collar region, toppling down of infected tillers, rotting of roots and the affected rhizome becoming hollow with only fibrous tissues left behind. In has given up its cultivation owing to the frequent rhizome rot disease that destroyed the crops. In the light of certain constraints on management practices, biological control has been advocated as the most promising strategy (Mukhopadhyay et al., 1992). The fungal bioagents Trichodema spp, Gliocladium virens and fluorescent Pseudomonas have been reported to be effective against several plant pathogens (Mukhopadhyay, 2001). Several modes of action have been proposed to explain the biocontrol of plant pathogens by Trichoderma; these include production of antibiotics and cell wall degrading enzymes, competition for key nutrients, parasitism, stimulation of plant defense mechanisms and combination of these possibilities. Fluorescent Pseudomonads have revolutionized the field of biological control of soil borne plant pathogens. During the last 25 years, they have emerged as the largest potentially most promising group of plant growth promoting rhizobacteria involved in the biocontrol of plant disease (Osburn et al., 1983). Therefore the present studies were undertaken to investigate the effect of bio control agents against rhizome rot of turmeric under field conditions.

Materials and Methods

One field trial with the following treatments (plot size 5m×3m) were laid out with randomized block design at Himatnagear Naded . The variety popular among local farmers viz., Erode local was used. The observations on per cent incidence of rhizome rot were recorded at the time of harvest. In addition growth parameters like height, number of leaves and stem girth were recorded at bimonthly intervals. Each treatment was replicated thrice and the treatment details include,

Treatment schedule

T1 : T. viride rhizome treatment (10g/lit)
T2 : T. harzianum rhizome treatment (10g/lit) T3 : P. fluorescens rhizome dip (10g/lit)
T4 : Trichoderma viride + P. fluorescens rhizome dip + soil application (3rd + 5th MAP) T5 : COC (0.2%) rhizome dip + soil application (3rd + 5 MAP)

T6 : Control (inoculated)Isolation and identification of pathogen

Testing the efficacy of biocontrol agents against rhizome rot of turmeric under field condition

Table 1: Effect of biocontrol agents on the rhizome rot of turmeric under field condition

Tr. No	Treatments	Rhizome Incidence (%)	Yield (g/plant)
T1	T1 *T. viride* (rhizome dip)	23.35b	397.00b
T2	*T. harzianum* (rhizometreatment)	27.78d	358.00d
T3	*P. fluorescens* (rhizome dip)	30.08f	327.00f
T4	*richoderma viride* +P. fluorescens (rhizome dip+ soil application @ 3rd + 5th MAP)	19.89a	538.00a
T5	COC	35.98h	427.00h
T6	Control	69.38i	198i

Table 2: Effect of biocontrol agents on the height of turmeric plants under field condition

Tr.no	**Treatments**	**Plant Height 120 Days**	**Plant Height 180 Days**
T1	T1 T. viride (rhizome dip)	**35.30b**	**58.00b**
T2	T.harzianum (rhizometreatment)	**32.18d**	**52.90d**
T3	P. fluorescens (rhizome dip)	**28.60f**	**50.01f**
T4	Trichoderma viride +P. fluorescens (rhizome dip+ soil application @ 3rd + 5th MAP)	**36.99a**	**98.01a**
T5	COC	**29.08h**	**45.84h**
T6	Control	**25.01i**	**37.06i**

Table 3: Effect of biocontrol agents on the stem girth of turmeric plants under field condition

Tr.no	Treatments	**Stem Girth(cm) 120 days**	**Stem Girth (cm) 180 days**
T1	T1 T. viride (rhizome dip)	**6.99b**	**7.97b**
T2	T.harzianum (rhizome treatment)	**5.99d**	**6.87d**
T3	P. fluorescens (rhizome dip)	**5.01f**	**5.99f**
T4	Trichoderma viride +P. fluorescens (rhizome dip + soil application @ 3rd + 5th MAP)	**8.01a**	**9.13a**
T5	COC	**4.11h**	**4.83h**
T6	Control	**3.63i**	**3.81i**

*values in the column followed by same letters not differ significantly by DMRT (P=0.05).

Results and Discussion

Efficacy of biocontrol agents against rhizome rot of turmeric under field condition Rhizome rot

The efficacy of biocontrol agents were recorded under field conditions against rhizome rot of turmeric. The bacterial and fungal antagonists through rhizome dip and soil application (3rd and 5th month after planting) reduced the incidence of rhizome rot under field conditions. Combined application of biocontrol agents were effective rather than individual application of antagonists either through rhizome dip or soil application on 3rd and 5th month. T1 T. viride (rhizome dip) and recorded the rhizome rot incidence of (23.35% & 27.78%) and yield of (397g & 365g/plant) respectively. Fungal bio inoculants were found to be superior to bacterial bio agents individually. The combined application ofTrichoderma viride + P. fluorescens rhizome dip + soil application (3rd + 5th MAP) T7 treatment recorded the least rhizome rot incidence of 19.89 per cent and the highest yield of 538g/plant.

27.78%) and yield of (397g & 365g/plant) respectively. Fungal bio inoculants were found to be superior to bacterial bio agents individually. The combined application ofTrichoderma viride + P. fluorescens rhizome dip + soil application (3rd + 5th MAP) T7 treatment recorded the least rhizome rot incidence of 19.89 per cent and the highest yield of 538g/plant. The control recorded the maximum rhizome rot incidence (69.38) and least yield (198g/plant) respectively table 1. Prabhu karthikeyan et al., (2017) reported that the combined application of rhizome dip + soil drench of fp7 indicated was noteworthy in reducing disease incidence.

Table 4: Effects of biocontrol agents on the no. of leaves of turmeric plants under field condition

Tr.no	Treatments	**No. of leaves (cm) 120days**	**No. of leaves (cm) 180 days**
T1	T1 T. viride (rhizome dip)	**9.45b**	**10.43b**
T2	T.harzianum (rhizometreatment)	**7.99d**	**8.35d**
T3	P. fluorescens (rhizome dip)	**6.69f**	**7.01f**
T4	Trichoderma viride +P. fluorescens (rhizome dip+ soil application @ 3rd + 5th MAP)	**10.70a**	**12.71a**
T5	COC	**5.45h**	**5.70h**
T6	Control	**3.01i**	**4.44i**

in two field trials recorded the lower rhizome rot incidence of 10.18% and 13.29% in the trial I and trial II. Vinayarani et al., (2018) reported that the reduced severity in leaf blight and rhizome rot disease was recorded in four different treatments of endophytes viz., T. harzianum (Thar DOB -2), T. atroviride (Tatro DOB17), T. asperellum (Tasp DOB-19), T. harzianum (Thar DOB-31). Among the tested endophytes, T. harzianum 'Thar DOB-31' showed the lowest PDI of rhizome rot to 13.8% and PDI of leaf blight to 11.6%. The isolate also enhanced the plant length and fresh rhizome weight.

Efficacy of biocontrol agents promoting the growth parameters in Turmeric plants under field condition The growth parameters like Plant height, Stem girth and No. of leaves/clump showed significant increase. Plant height was significantly increased by the application of biocontrol agents. Plant height was found to be maximum recording 96.67cm on the 270th day of observation in T7 (Trichoderma viride + P.fluorescens (rhizome dip + soil

application on the 3rd + 5th MAP) whereas in the control showed a severe reduction showing 55.16 cm table 2.

Effect of biocontrol agents on the stem girth of turmeric plants under field condition The stem girth was significantly influenced by the application of biocontrol agents. Fungal bio inoculants were found to be superior to bacterial inoculant in all the days of observation. The maximum stem girth was recorded in T7 Trichoderma viride + P. fluorescens (rhizome dip + soil application on the 3rd + 5th MAP) recording stem girth of 7.97, 9.15 and 10.45cm on the 120, 180 and 270 days after planting. The second best results was T1 followed by T2 and T3. However in control the stem girth was only 3.57, 3.79 and 5.09cm on 120, 180 and 270 days after planting, which was significantly lower than the other treatments table 3.

Effects of biocontrol agents on the no. of leaves of turmeric plants under field condition Among the different treatments maximum no. of leaves were found on the plants treated with (Trichoderma viride + P. fluorescens rhizome dip + soil application on the 3rd + 5th MAP) with 15.35leaves on the 270th day, followed by Treatments T2 and T3 recording 9.97 and 8.52 no. of leaves respectively. The control showed a severe reduction (5.66 nos.) in the formation of leaves on the 270th day of observation. All the treatments were found to be superior when compared to control table 4. Different formulations using a variety of Trichoderma strains are available commercially for crop production worldwide (Harman, 2000) and its secondary metabolites affect plant metabolism and enhance growth (Vinale et al., 2012). Vinayarani et al., (2018) reported that the tested endophytes, T. harzianum 'Thar DOB-31' isolate also enhanced the plant height and fresh rhizome weight. Prabhu karthikeyan et al., (2017) reported that the combined application of rhizome dip + soil drench of fp7 enhanced plant length and increased the plant growth.

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