
Biological control of rhizome rot disease of turmeric

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Turmeric (*Curcuma longa* Linn.) an important rhizomatous spice crop being cultivated in India, since ancient times, is affected by some diseases of which rhizome rot disease caused by *Pythium* sp. is most important. The three biocontrol agents viz., *Trichoderma viride*, *Pseudomonas fluorescence* and *Bacillus subtilis* and Farm Yard Manure (FYM) were used in different combinations both as seed treatment and soil application to develop an effective biological control method against rhizome rot disease of turmeric. Combination of seed treatments with both *Trichoderma viride* and *Pseudomonas fluorescence* along with FYM showed highest disease reduction (63.65% less disease) as compared to check than other treatments. The soil application of *Trichoderma* and *Pseudomonas* along with FYM as well as combination of seed treatment and soil application with these two biocontrol agents also found to give very good result in terms of per cent reduction in rot over control. Regarding rhizome yield, combined seed and soil treatment with both *Trichoderma* and *Pseudomonas* along with FYM was the best, recording the highest rhizome yield. *Bacillus subtilis* had less pronounced effect on disease incidence and rhizome yield.

Key words : *Curcuma longa*, rhizome rot, biological control

INTRODUCTION

Turmeric (*Curcuma longa* Linn.) is a rhizomatous spice crop being cultivated in India since ancient times. India is the major producer and exporter of turmeric. The crop is valued for its medicinal properties, colouring pigment curcumin and spicy flavour. Orissa, Andhra Pradesh, Maharashtra, Tamil Nadu, Kerala, Assam, Bihar and West Bengal are the important states which grow turmeric and in northeastern states also on limited scale. Because of its high price and export value, it is cultivated in some areas more intensively in recent years. The crop is severely affected by some diseases, of which rhizome rot disease caused by *Pythium* sp. is most important. In India the disease is epidemic in Andhra Pradesh, Tamil Nadu, Kerala and Assam (Rao and Rao, 1988). As rhizome rot is an important disease of turmeric and absence of resistant cultivar and effective chemicals, an experiment has been carried out by using three biocontrol agents viz. *Trichoderma viride*, *Pseudomonas fluorescence* and *Bacillus subtilis*.

MATERIALS AND METHODS

A field experiment was conducted in Agricultural Farm, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal on effect of biocontrol agents on rhizome rot disease of turmeric by using *Trichoderma viride*, *Pseudomonas fluorescence* and *Bacillus subtilis* during the year 2001-2002. The three biocontrol agents and Farm Yard Manure (FYM) were used in different combinations with recommended NPK (120 : 60 : 60 kg/ha). The trial was laid out in Randomised Block Design (RBD) with three replications. Planting was done in raised beds of 3 m × 1 m size and usual agronomic practices were followed. The observations in respect of germination of rhizomes, disease incidence percentage and rhizome yield were recorded and analysed statistically. The disease incidence percentage was recorded twice, first at the appearance of above ground symptom and second one at 30 days interval, based on number of infected plant. The treatments followed in the experiment were as follows : T₁ = (Recommended NPK) Control ; T₂ =

NPK+FYM ; $T_3 = \text{NPK} + \text{Trichoderma viride} + \text{Pseudomonas fluorescence}$ as seed treatment ; $T_4 = \text{NPK} + \text{Trichoderma viride} + \text{Pseudomonas fluorescence}$ as soil application @ 12.5 kg/ha and 25.0 kg/ha as basal and top dressing, respectively ; $T_5 = T_2 + T_3$; $T_6 = T_3 + T_4$; $T_7 = T_2 + T_3 + T_4$; and $T_8 = T_2 + \text{Bacillus subtilis}$ (Biostat) @ 1 ml/L of water.

RESULTS AND DISCUSSION

It appears from Table 1 that among different biocontrol agents *Trichoderma viride* and *Pseu-*

lowed by T_6 and T_3 recording 9.00 kg and 8.83 kg/3m² plot respectively. Initially these three treatments (T_7 , T_6 and T_3) resulted in higher germination of rhizomes, protecting the rhizomes from the pathogen, which ultimately showed higher rhizome yield in comparison with other treatments. On the other hand *Bacillus subtilis* had less pronounced effect on germination percentage, disease incidence and rhizome yield.

A preliminary investigation on the management of rhizome rot of turmeric was also done by using

Table 1 : Effect of biocontrol agents on rhisome rot of turmeric

Treatments	Germination(%)	Disease incidence (%)		Per cent reduction in rot over control	Rhizome yield (kg/3 m ² plot)	Projected yield (ton/ha)
		1 st observation	2 nd observation			
T_1 (Recommended NPK) control	91.11	17.50	19.78	—	7.75	25.83
T_2 (NPK + FYM)	88.88	15.72	16.67	15.72	8.33	27.77
T_3 (NPK + <i>Trichoderma viride</i> + <i>Pseudomonas fluorescence</i> as seed treatment)	95.56	5.57	10.55	46.66	8.83	29.43
T_4 (NPK + <i>Trichoderma viride</i> as basal + <i>Pseudomonas fluorescence</i> as top dressing)	93.33	7.23	8.69	56.07	8.75	29.17
T_5 ($T_2 + T_3$)	93.33	5.62	7.19	63.65	8.80	29.33
T_6 ($T_2 + T_4$)	95.56	7.23	7.23	63.45	9.00	30.00
T_7 ($T_2 + T_3 + T_4$)	95.56	5.62	7.23	63.45	9.25	30.83
T_8 ($T_2 + \text{Bacillus subtilis}$)	91.11	15.58	17.50	11.53	8.20	27.33
Sem±		1.559	1.478		0.408	
CD(at 5% level)		4.72	4.48		1.24	

domonas fluorescence showed significant effect on germination of rhizome. The combined use of *Trichoderma viride* and *Pseudomonas fluorescence* as seed treatment along with FYM i.e., T_5 significantly reduced disease incidence by 63.65% as compared to check. The treatments T_6 and T_7 also showed higher per cent reduction in rot over control which was 63.45% for both the treatments. Better result obtained incase of T_5 , T_6 and T_7 in terms of per cent reduction of rot over control may be due to FYM which acted as a substrate for rapid growth of biocontrol agents in soil which in turn reduced the pathogen population and thereby reduced disease incidence. Regarding rhizome yield, the best treatment was T_7 i.e., seed and soil treatment with *Trichoderma* and *Pseudomonas* recording 9.25 kg/3 m² plot, with a projected yield of 30.83 ton/ha fol-

lowed by T_6 and T_3 recording 9.00 kg and 8.83 kg/3m² plot respectively. Initially these three treatments (T_7 , T_6 and T_3) resulted in higher germination of rhizomes, protecting the rhizomes from the pathogen, which ultimately showed higher rhizome yield in comparison with other treatments. On the other hand *Bacillus subtilis* had less pronounced effect on germination percentage, disease incidence and rhizome yield.

REFERENCES

- Anonymous, 2001. Annual report of AICRP on Spices, 2001, IISR, Calicut.
- Rao, P. S. and Rao, T. G. N. 1988. Diseases of turmeric in Andhra Pradesh, In : *Proceedings of National Seminar of chillies, ginger and turmeric*, Spice Board, Cochin, Kerala.

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