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## Effectiveness of *Trichoderma reesei* for management of anthracnose and survival of mango grafts

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DOI: <https://www.doi.org/10.33545/26631067.2025.v7.i5a.291>**Abstract**

Mango fruit is one of the most important cultivar in the konkan region. Several nurseries in the Konkan region of Maharashtra offer grafted mango plants. The mango disease such as anthracnose is destructive to mangoes grafts. The disease damages the leaf of infected mango grafts, leading to mortality of grafts. Mango anthracnose, caused by *Colletotrichum gloeosporioides* attacks on leaf portion of the mango grafts. Application of bio-control agent such as *Trichoderma* has huge potential in plant disease management. However the *Trichoderma* in talc or spore form did not significantly control the anthracnose of mango grafts under field conditions. However the graft survival is more in treatment having application of *Trichoderma* talc and spore formulation.

**Keywords:** Mango graft, leaf anthracnose, *Colletotrichum gloeosporioides*, graft survival, *Trichoderma* talc, spore form

**Introduction**

Mango is grown in almost all the parts of India and is one of the most important fruit crop of konkan region. There are so many nurseries in Konkan region which are involved in the production of mango grafts. Mango grafts can be affected by several diseases, including Anthracnose, Powdery mildew, Mango malformation, wilt and Root rot. Anthracnose, a fungal disease, can cause dark spots on leaves and fruits, particularly during wet conditions. However the mortality of the mango grafts may be due to the wilt, root rot and the anthracnose diseases. The mango disease such as anthracnose is destructive to mangoes grafts. The disease damages the leaf of infected mango grafts, leading to mortality of grafts. Mango anthracnose, caused by *Colletotrichum gloeosporioides* attacks on leaf portion of the mango grafts. Application of bio-control agent such as *Trichoderma* is effective in controlling the Anthracnose of mango (Mirwais Niazi *et al.* 2022) <sup>[2]</sup>. With this view the efforts have been made to manage the leaf anthracnose disease

**Materials and Methods**

The experiment has been conducted for the consecutive three years at Regional fruit Research station, Vengurla from 2021-22 to 2023-24. The details of the experiment are as follows.

Treatment Details	
Tr. No.	Treatments
T <sub>1</sub>	Potting mixture alone
T <sub>2</sub>	Potting mixture + <i>Beijerinckia</i> ( <i>Beijerinckia indica</i> ) 50 g
T <sub>3</sub>	Potting mixture + PSB ( <i>Burkholderia territorri</i> ) 50 g
T <sub>4</sub>	Potting mixture + Talc based <i>Trichoderma</i> ( <i>T. reesei</i> ) 50 g
T <sub>5</sub>	Potting mixture + <i>Beijerinckia</i> 50 g + PSB 50 g + Talc based <i>Trichoderma</i> ( <i>T. reesei</i> ) 50 g
T <sub>6</sub>	T <sub>2</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 6 times at 2 months interval @ 1 g/10 L
T <sub>7</sub>	T <sub>3</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 6 times at 2 months interval @ 1 g/10 L
T <sub>8</sub>	T <sub>4</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 6 times at 2 months interval @ 1 g/10 L
T <sub>9</sub>	T <sub>5</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 6 times at 2 months interval @ 1 g/10 L

The observations on anthracnose incidence were recorded using 0-5 rating scale as follows.

0 = No infection	1 = 1-20% infection	2 = 21-40% infection
3 = 41-60% infection	4 = 61-80% infection	5 = 81-100% infection.

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Percent Disease Intensity (PDI) was calculated by using the formula.

$$\text{PDI} = \frac{\text{Sum of all numerical ratings}}{\text{No. of flushes observed} \times \text{Maximum rating}} \times 100$$

**Table 1:** The month wise status of the Percent Disease Index (PDI) of anthracnose disease of mango grafts.(Pooled Mean)

Tr. No.	PDI															
	July				August				September				October			
	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean
T <sub>1</sub>	1.33 (6.56)	0.53 (4.17)	0.27 (2.98)	0.71 (4.83)	1.07 (5.74)	0.53 (4.17)	0.53 (4.17)	0.71 (4.83)	1.33 (6.55)	0.80 (5.13)	0.80 (5.13)	1.07 (0.00)	1.60 (7.27)	1.07 (5.74)	1.33 (6.55)	1.33 (6.55)
T <sub>2</sub>	0.80 (5.13)	0.27 (2.98)	0.27 (2.98)	0.45 (3.85)	1.60 (7.27)	0.27 (2.98)	0.27 (2.98)	0.71 (4.83)	1.60 (7.27)	0.53 (4.17)	0.53 (4.17)	0.89 (0.00)	1.87 (7.71)	0.80 (5.13)	0.80 (5.13)	1.16 (6.02)
T <sub>3</sub>	1.07 (5.74)	0.53 (4.17)	0.00 (0.00)	0.53 (4.17)	1.33 (6.55)	0.53 (4.17)	0.00 (0.00)	0.62 (4.52)	1.33 (6.55)	0.80 (5.13)	0.00 (0.00)	0.71 (0.00)	1.87 (7.71)	0.80 (5.13)	0.27 (2.98)	0.98 (5.71)
T <sub>4</sub>	1.07 (5.74)	0.53 (4.17)	0.27 (2.98)	0.62 (4.52)	0.80 (5.13)	0.53 (4.17)	0.27 (2.98)	0.53 (4.17)	0.80 (4.13)	0.80 (5.13)	0.53 (4.17)	0.71 (0.00)	1.07 (5.74)	1.07 (5.74)	0.53 (4.17)	0.89 (5.41)
T <sub>5</sub>	0.27 (2.98)	0.27 (2.98)	0.00 (0.00)	0.18 (2.43)	0.80 (5.13)	0.27 (2.98)	0.00 (0.00)	0.36 (3.44)	0.80 (5.13)	0.53 (4.17)	0.00 (0.00)	0.44 (0.00)	0.80 (5.13)	0.80 (5.13)	0.00 (0.00)	0.53 (4.17)
T <sub>6</sub>	1.07 (5.74)	0.00 (0.00)	0.00 (0.00)	0.36 (3.44)	1.07 (5.74)	0.00 (0.00)	0.00 (0.00)	0.36 (3.44)	1.33 (6.55)	0.00 (0.00)	0.27 (2.98)	0.53 (0.00)	1.60 (7.27)	0.27 (2.98)	0.27 (2.98)	0.71 (4.83)
T <sub>7</sub>	0.80 (5.13)	0.00 (0.00)	0.00 (0.00)	0.27 (2.98)	1.07 (5.74)	0.00 (0.00)	0.00 (0.00)	0.36 (3.44)	1.07 (5.74)	0.00 (0.00)	0.00 (0.00)	0.36 (0.00)	1.33 (6.55)	0.27 (2.98)	0.00 (0.00)	0.53 (4.17)
T <sub>8</sub>	0.53 (4.17)	0.00 (0.00)	0.00 (0.00)	0.27 (2.98)	0.53 (4.17)	0.27 (2.98)	0.00 (0.00)	0.27 (2.98)	0.80 (5.13)	0.53 (4.17)	0.00 (0.00)	0.44 (0.00)	1.07 (5.74)	0.80 (5.13)	0.00 (0.00)	0.62 (4.52)
T <sub>9</sub>	0.53 (4.17)	0.00 (0.00)	0.00 (0.00)	0.27 (2.98)	0.27 (2.98)	0.27 (2.98)	0.27 (2.98)	0.27 (2.98)	0.80 (5.13)	0.27 (2.98)	0.27 (2.98)	0.45 (0.00)	1.33 (6.55)	0.80 (5.13)	0.53 (4.17)	0.89 (5.41)
SE. +-	1.39	1.35	0.99	0.66	1.30	1.65	1.09	0.82	1.50	1.62	1.15	0.96	1.51	1.71	1.36	0.78
C.D. @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

**Table 2:** The month wise status of the Percent Disease Index (PDI) of anthracnose disease of mango grafts. (Pooled Mean)

Tr. No.	PDI															
	November				December				January				February			
	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean
T <sub>1</sub>	2.40 (8.91)	1.07 (5.74)	1.60 (7.27)	1.69 (7.27)	2.93 (9.81)	1.60 (7.27)	1.87 (7.65)	2.13 (8.33)	2.93 (9.81)	1.33 (6.55)	2.67 (9.28)	1.95 (7.92)	2.67 (9.28)	1.07 (5.74)	1.33 (6.56)	1.69 (7.27)
T <sub>2</sub>	2.40 (8.91)	0.80 (5.13)	1.07 (5.74)	1.42 (6.80)	2.67 (9.28)	1.07 (5.74)	1.33 (6.56)	1.69 (7.27)	2.40 (8.91)	1.07 (5.74)	1.87 (7.71)	1.51 (7.04)	1.87 (7.71)	1.07 (5.74)	1.07 (4.85)	1.34 (6.55)
T <sub>3</sub>	1.87 (7.71)	1.33 (6.55)	0.53 (4.17)	1.24 (6.29)	1.87 (7.71)	1.33 (6.55)	0.80 (4.13)	1.33 (6.55)	1.87 (7.71)	1.07 (5.74)	1.87 (7.71)	1.25 (6.29)	1.87 (7.71)	0.80 (5.13)	0.53 (3.42)	0.98 (5.71)
T <sub>4</sub>	1.07 (5.74)	1.33 (6.55)	0.80 (5.13)	1.07 (5.74)	2.13 (8.33)	1.60 (7.27)	1.07 (4.85)	1.60 (7.27)	1.60 (7.27)	1.33 (6.55)	1.33 (6.55)	1.33 (6.55)	1.33 (6.55)	1.07 (5.74)	0.80 (4.13)	1.07 (5.74)
T <sub>5</sub>	1.07 (5.74)	1.07 (4.85)	0.00 (0.00)	0.71 (4.83)	2.40 (8.91)	1.07 (5.74)	0.00 (0.00)	1.16 (6.02)	2.40 (8.91)	1.07 (4.85)	2.13 (8.33)	1.16 (6.02)	2.13 (8.33)	1.07 (5.74)	0.00 (0.00)	1.07 (5.74)
T <sub>6</sub>	1.60 (7.27)	0.53 (4.17)	0.53 (4.17)	0.53 (4.17)	1.87 (7.71)	0.80 (5.13)	0.53 (3.42)	1.07 (5.74)	1.87 (7.71)	0.80 (5.13)	1.60 (7.27)	0.98 (5.71)	1.60 (7.27)	0.80 (5.13)	0.27 (1.71)	0.89 (5.41)
T <sub>7</sub>	1.87 (7.27)	0.53 (4.17)	0.00 (0.00)	0.53 (4.17)	2.93 (9.81)	0.80 (5.13)	0.00 (0.00)	1.24 (6.89)	2.40 (8.91)	0.80 (5.13)	2.13 (8.33)	1.07 (5.74)	2.13 (8.33)	0.80 (5.13)	0.00 (0.00)	0.98 (5.71)
T <sub>8</sub>	1.07 (5.74)	0.80 (5.13)	0.27 (2.98)	0.53 (4.17)	1.07 (5.74)	1.07 (5.74)	0.27 (1.71)	0.80 (5.13)	1.87 (7.71)	1.07 (5.74)	1.07 (5.74)	1.07 (5.74)	1.07 (5.74)	0.80 (5.13)	0.00 (0.00)	0.62 (4.52)
T <sub>9</sub>	1.87 (7.71)	1.07 (5.74)	0.53 (4.17)	0.71 (4.83)	2.13 (8.33)	1.33 (6.55)	0.80 (5.13)	1.42 (6.80)	2.40 (8.91)	1.07 (5.74)	2.13 (8.33)	1.42 (6.80)	2.13 (8.33)	1.07 (5.74)	0.53 (3.42)	1.24 (6.29)
SE. +-	1.05	1.53	1.64	0.88	1.37	1.48	1.74	0.93	1.56	1.36	2.19	0.86	2.19	1.40	1.55	0.19
C.D. @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

**Table 3:** The month wise status of the Percent Disease Index (PDI) of anthracnose disease of mango grafts. (Pooled Mean)

Tr. No.	PDI															
	March				April				May				June			
	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean	21-22	22-23	23-24	Mean
T <sub>1</sub>	1.87 (7.71)	1.07 (5.74)	1.07 (4.85)	1.34 (6.55)	1.87 (7.71)	0.80 (5.13)	0.27 (1.71)	0.98 (5.71)	0.27 (2.98)	0.53 (4.17)	0.00 (0.00)	0.27 (2.98)	0.53 (4.17)	0.27 (2.98)	0.00 (0.00)	0.18 (2.43)
T <sub>2</sub>	1.33 (6.55)	0.80 (5.13)	0.80 (4.13)	0.98 (5.71)	0.53 (4.17)	0.80 (5.13)	0.27 (0.71)	0.53 (4.17)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>3</sub>	1.33 (6.55)	0.80 (5.13)	0.27 (1.71)	0.80 (5.13)	0.80 (5.13)	0.00 (0.00)	0.00 (0.00)	0.27 (2.98)	0.27 (2.98)	0.00 (0.00)	0.00 (0.00)	0.09 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>4</sub>	1.07 (5.74)	1.07 (5.74)	0.53 (3.42)	0.89 (5.41)	0.00 (0.00)	0.80 (5.13)	0.00 (0.00)	0.27 (2.98)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>5</sub>	1.87 (7.71)	0.80 (5.13)	0.00 (0.00)	0.89 (5.41)	0.80 (5.13)	0.53 (4.17)	0.00 (0.00)	0.44 (3.80)	0.00 (0.00)	0.27 (2.98)	0.00 (0.00)	0.00 (0.00)	0.27 (2.98)	0.27 (2.98)	0.00 (0.00)	0.18 (2.43)
T <sub>6</sub>	1.33 (6.55)	0.80 (5.13)	0.00 (0.00)	0.71 (4.83)	0.27 (2.98)	0.80 (5.13)	0.00 (0.00)	0.36 (3.44)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>7</sub>	1.60 (7.27)	0.53 (4.17)	0.00 (0.00)	0.71 (4.83)	0.27 (2.98)	0.00 (0.00)	0.00 (0.00)	0.09 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>8</sub>	0.80 (5.13)	0.80 (5.13)	0.00 (0.00)	0.53 (4.17)	0.00 (0.00)	0.27 (2.98)	0.00 (0.00)	0.09 (0.00)	0.00 (0.00)	0.27 (2.98)	0.00 (0.00)	0.09 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>9</sub>	1.33 (6.55)	0.80 (5.13)	0.27 (1.71)	0.80 (5.13)	0.53 (4.17)	0.53 (4.17)	0.00 (0.00)	0.35 (3.39)	0.27 (2.98)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
SE. +-	1.65	1.42	1.25	0.80	2.02	1.69	0.75	0.02	0.98	1.03	0.00	0.67	1.01	0.78	0.00	0.55
C.D. @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

**Table 4:** Effects of different bio-inoculants on growth parameters of the one year mango grafts. (Pooled Mean)

Tr. No.	Treatments	Grafts survival (%)			
		21-22	22-23	23-24	Pooled Mean
T <sub>1</sub>	Potting mixture alone	53.00	56.00	52.00	53.67
T <sub>2</sub>	Potting mixture + <i>Beijerinckia</i> 50 g	59.17	59.01	62.80	60.33
T <sub>3</sub>	Potting mixture + PSB 50 g	57.20	59.67	59.00	58.62
T <sub>4</sub>	Potting mixture + Talc based <i>Trichoderma</i> 50 g	55.07	57.00	54.00	55.36
T <sub>5</sub>	Potting mixture + <i>Beijerinckia</i> 50 g 50 g + PSB 50 g + Talc based <i>Trichoderma</i> 50 g	61.73	60.85	62.00	61.53
T <sub>6</sub>	T <sub>2</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1 g/10 L	58.67	58.67	60.67	59.33
T <sub>7</sub>	T <sub>3</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1 g/10 L	55.67	59.20	59.67	58.25
T <sub>8</sub>	T <sub>4</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1 g/10 L	57.67	58.00	50.00	55.22
T <sub>9</sub>	T <sub>5</sub> + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1 g/10 L	62.00	62.27	64.00	62.76
	SE. +-	0.84	0.95	0.79	1.26
	C.D. @ 5%	2.53	2.84	2.37	3.78

## Results and Discussion

The results of this experiment indicated that all the treatments shows non-significant effect on anthracnose of mango grafts. This shows that the treatment containing *Trichoderma* application in talc as well as spore form does not effective in controlling Anthracnose disease of mango. This may be due the very low incidence of anthracnose disease on mango grafts and also the non-effectiveness of *Trichoderma* in very hot condition. This has been supported by Mahfouz, M.M *et al.* 2020 <sup>[1]</sup> who stated that biocontrol agents are sometime ineffective in controlling the diseases due the adverse climatic conditions. However the survival percentage of mango grafts is higher in treatment containing *Trichoderma* application in both spore as well as in Talc form. This may be due to the better efficacy of *Trichoderma* in controlling wilt disease in plant (Renata A.S.B. 2020) <sup>[3]</sup>

## Conclusion

This shows that *Trichoderma* is not effective in managing the anthracnose disease of mango grafts but effective in increasing the survivability of the mango grafts.

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