

## Trichoderma: A Bio-Control Agent for the Management of Soil Born Diseases

Kadam R.V.<sup>1</sup>, Neetiraj Karotiya<sup>2</sup> and Kolhe P. S.<sup>2</sup>

Senior Technical Officer<sup>1</sup> and Technical Officer<sup>2</sup>, RCIPMC, Nagpur (M.S.)

### SUMMARY

Trichoderma strains have long been recognized as biological agents, for the control of plant disease and for their ability to increase root growth and development, crop productivity, resistance to abiotic stresses and uptake and use of nutrients. They produce or release a variety of compounds that induce localized or systemic resistance responses in plants. Trichoderma is a potent biocontrol agent and used extensively for soil born diseases. It has been used successfully against various pathogenic fungi belonging to various genera, viz. Fusarium, Phytophthora and Scelerotia etc. Trichoderma strains solubilize phosphates and micronutrients. The application of Trichoderma strains with plants such as grasses increases the number of deep roots, thereby increasing the plant's ability to resist drought. Trichoderma strains solubilize phosphates and micronutrients. The application of Trichoderma strains with plants such as grasses increases the number of deep roots, thereby increasing the plant's ability to resist drought. Introduction of endochitinase gene from Trichoderma into plants such as tobacco and potato plants have increased their resistance to fungal growth. Biocontrol mechanisms of Trichoderma antagonist microorganisms, such as Trichoderma, reduce growth, survival or infections caused by pathogens by different mechanisms like competition, antibiosis, mycoparasitism, hyphal interactions, and enzyme secretion.

### INTRODUCTION

*Trichoderma* spp., are free-living fungi that are common in soil and root ecosystems. They are highly interactive in root, soil and foliar environments. They produce or release a variety of compounds that induce localized or systemic resistance responses in plants. Trichoderma strains have long been recognized as biological agents, for the control of plant disease and for their ability to increase root growth and development, crop productivity, resistance to abiotic stresses and uptake and use of nutrients.

### Benefits of Trichoderma:

**1. Disease Control:** Trichoderma is a potent biocontrol agent and used extensively for soil born diseases. It has been used successfully against various pathogenic fungi belonging to various genera, viz. Fusarium, Phytophthora and Scelerotia etc.

**2. Plant Growth Promoter:** Trichoderma strains solubilize phosphates and micronutrients. The application of Trichoderma strains with plants such as grasses increases the number of deep roots, thereby increasing the plant's ability to resist drought.

**3. Biochemical Elicitors of Disease Resistance:** Trichoderma strains are known to induce resistance in plants. Three classes of compounds that are produced by Trichoderma and induce resistance in plants are now known. These compounds induce ethylene production, hypersensitive responses and other defence related reactions in plant cultivates.

**4. Transgenic Plants:** Introduction of endochitinase gene from Trichoderma into plants such as tobacco and potato plants have increased their resistance to fungal growth. Selected transgenic lines are highly tolerant to foliar pathogens such as *Alternaria alternata*, *A. solani* and *Botrytis* as well as to the soil-borne pathogen, *Rhizectonia* spp.

**5. Bioremediation:** Trichoderma strains play an important role in the bioremediation of soil that are contaminated with pesticides and herbicides. They have the ability to degrade a wide range of insecticides: organochlorines, organophosphates and carbonates.

### Disease Control

*Trichoderma* spp. are widely used to control various crop diseases effectively and some of them are given below.

Name of the Crop	Name of the Disease	Disease causing micro-organism
Elephant foot yam	Collar rot	<i>Sclerotium rolfsii</i>

Chilli, Tomato and Brinjal	Damping off	<i>Pythium aphanidermatum</i> , <i>Phytophthora</i> and <i>Fusarium oxysporum</i>
Ginger, Turmeric and Onion	Rhizome rot	<i>Pythium aphanidermatum</i> , <i>Phytophthora</i> and <i>Fusarium oxysporum</i>
Banana, Cotton, Tomato and Brinjal	Wilt	<i>Fusarium oxysporum</i>

### Methods of Application:

- Seed treatment: Mix 5-10 g of Trichoderma formulation per litre of cow dung slurry for treatment of 1 kg of seed before sowing, particularly for cereals, pulses and oilseeds.
- Nursery treatment: Drench nursery beds with @ 5 g Trichoderma formulation per litre of water before sowing.
- Cutting and seedling root dip: Mix 10g of Trichoderma formulation per litre of water and dip the cuttings and seedlings for 10 minutes before planting.
- Soil treatment: Mix 1 kg of Trichoderma formulation in 100 kg of farmyard manure and cover it for 7 days with polythene. Turn the mixture in every 3-4 days interval and then broadcast in the field.
- Trichoderma formulations: Important commercial formulations are available in the name of TRICHO-PEP V, Tricho Power, TRICHO etc. These formulations contain 2x10<sup>6</sup> cfu.



Pure culture of *Trichoderma viride*

### Biocontrol Mechanisms of Trichoderma:

Biocontrol mechanisms of Trichoderma antagonist microorganisms, such as Trichoderma, reduce growth, survival or infections caused by pathogens by different mechanisms like competition, antibiosis, mycoparasitism, hyphal interactions, and enzyme secretion.

#### Competition:

It is the phenomenon in which the pathogen and the introduced biocontrol agent (antagonist) compete for the availability of space and nutrients. During this process, the antagonist may suppress the growth of the pathogen population in the rhizosphere and thus reduce disease development. For example, *Trichoderma harzianum* reduces collar rot in elephant foot yam by 80-85%.

#### Antibiosis:

Trichoderma strains are known to produce antibiotics and toxins, which are volatile or nonvolatile in nature, and have a direct effect on other organisms. Examples of such chemicals are trichothecin and a sesquiterpene, Trichodermin that has antimicrobial effect on bacteria and fungi.

#### Mycoparasitism:

It is the phenomenon in which the antagonist fungi parasitize other fungi. The mechanism covers different stages of interactions. 1) First stage: Chemical stimulus of pathogenic fungi attracts the antagonist fungi and induces a chemotropic response of the antagonist. 2) Second stage: Recognition between the pathogen and the antagonist is due to the lectins. 3) Third stage: It is followed by the interactions between hyphae of the

pathogen and the antagonist. The antagonist (*Trichoderma*) hyphae either grow along the host hyphae or coil around it and secrete different lytic enzymes such as chitinase, glucanase and pectinase that are involved in the process of mycoparasitism. Examples of such interactions are *T. harzianum* acting against *Fusarium oxysporum*, *F. roseum*, *F. solani*, *Phytophthora colocaciae* and *Sclerotium rolfsii*.

## CONCLUSION

*Trichoderma* is a potent biocontrol agent and extensively used for soil born diseases. It has been used successfully against various pathogenic fungi belonging to various genera, viz. *Fusarium*, *Phytophthora* and *Scelerotia* etc.

## REFERENCES

- Agrios, G. N. 1997. Plant pathology, 4th ed. P. 635-646. Academic Press, San Diego CA., USA.
- Chet, I. 1987. *Trichoderma*--application, mode of action, and potential as a biocontrol agent of soilborne plant pathogenic fungi. Wiley & Sons, New York, N.Y.
- Elad, Y. 2000. Biological control of foliar pathogens by means of *Trichoderma harzianum* and potential modes of action. *Crop Prot.*19:709-714.
- Ghisalberti, E. L., and C. Y. Rowland. 1993. Antifungal metabolites from *Trichoderma harzianum*. *J. Nat. Prod.*56:1799-1804.
- Howell, C. R., L. E. Hanson, R. D. Stipanovic, and L. S. Puckhaber. 2000. Induction of terpenoid synthesis in cotton roots and control of *Rhizoctonia solani* by seed treatment with *Trichoderma virens*. *Phytopathology*, 90:248-252.
- Yedidia, I., N. Benhamou, and I. Chet. 1999. Induction of defence responses in cucumber plants (*Cucumis sativus* L.) by the biocontrol agent *Trichoderma harzianum*. *Appl. Environ. Microbiol.*65:1061-1070.