

## Trichoderma: A Green Gold

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### INTRODUCTION

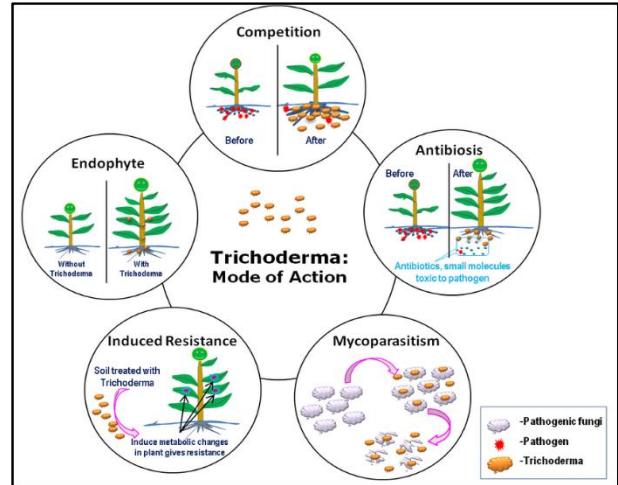
The genus *Trichoderma* is a diverse group of free-living fungi belonging to the family of *Hypocreaceae* commonly present in all soils. These ascomycetes fungi are opportunistic, avirulent, inhabiting root ecosystems and parasites on other groups of fungi. They reproduce by chlamydospores and ascospores. Proliferation is better in mesophilic environment (25-30° C) and a wide range of pH. Few important species of *Trichoderma* are *T. viride*, *T. harzianum*, *T. virens* and *T. hamatum*. *Trichoderma* is an effective biocontrol agent of plant-pathogenic fungi synthesizes secondary metabolites of medical importance and agent of bioremediation. Similarly, their ability to degrade lignocellulosic compounds to produce second-generation biofuels and other value-added products have been widely accepted.

The different species of this genus have long been known not only for the control of plant disease but also for their potential to amplify plant growth and evolution, elevated reproductive ability, the extent to modify the rhizosphere, capability to grow under unfavorable conditions, competence in the use of nutrients, strong aggressiveness against phytopathogenic fungi and efficacy in supporting plant growth and enhanced defense mechanisms. These properties have made *Trichoderma* an omnipresent genus able to grow in wider habitats and at high population densities. Apart from that, the interaction between plant and *Trichoderma* spp. successfully regulates root architecture, and increases the length of lateral and primary roots resulting in the effectiveness of nutrient uptake by the plant.

### 1. MODE OF ACTION

*Trichoderma* can work as biocontrol agents in various ways:

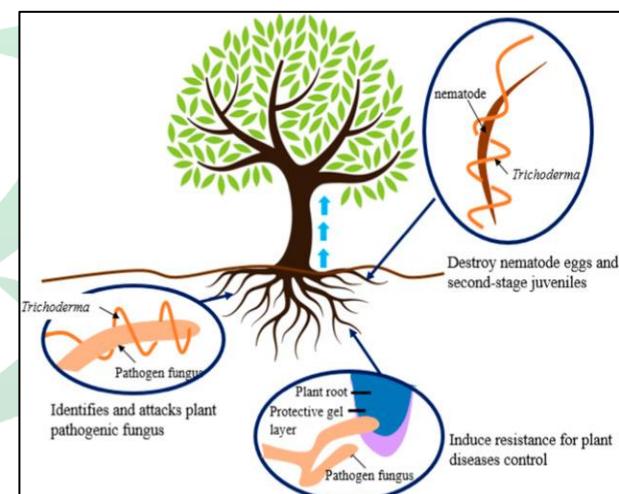
- It grows rapidly or uses its food source more efficiently than the pathogen, thereby crowding out the pathogen and taking over, known as nutrient competition.
- A biocontrol agent may excrete a compound that slows down or completely inhibits pathogens' growth in the surrounding area of such a compound called antibiosis.
- It may feed on or in a pathogenic species which is known as parasitism.
- It may promote a plant to produce a chemical that protects it from the pathogen, which is induced resistance.
- They can grow endophytically in other species and support plant growth.



### Disease Management in Trichoderma:

The prevention of infection or suppression of disease by *Trichoderma* is based on hyper parasitism, antibiosis, reduction of saprophytic ability, induced systemic resistance in the host plant, competition for nutrients and space.

Its hyper parasitism involves complementary action of antibiosis, nutrient competition, and cell wall degradation enzymes such as chitinases,  $\beta$ -1,3-glucanases, and proteases. Since chitin is the major component of most fungal cell walls, a primary role attributed to chitinases



Plant Disease Management by *Trichoderma* spp.

in the biocontrol activity of *Trichoderma*. *Trichoderma* spp. produce different volatile and non-volatile compounds that inhibit the growth of fungal plant pathogens. The mechanisms of antibiosis constitute a much more complex system leading to the phenomenon of biological control. Among these antibiotics, the production of gliotoxin, viridin, pyrones, peptaibols, and

others have been described extensively. The ability of *Trichoderma* to induce systemic resistance (ISR) has been demonstrated in crops.

### **Method of application of Trichoderma spp.**

- ✓ **Seed treatment:** Mix 6 - 10 g of Trichoderma powder per Kg of seed before sowing.
- ✓ **Nursery treatment:** Apply 10 - 25 g of Trichoderma powder per 100 m<sup>2</sup> of nursery bed. Application of neem cake and FYM before treatment increases the efficacy.
- ✓ **Cutting and seedling root dip:** Mix 10g of Trichoderma powder along with 100g of well rotten FYM per liter of water and dip the cuttings and seedlings for 10 minutes before planting.
- ✓ **Oil treatment:** Apply 5 Kg of Trichoderma powder per hectare after turning off the sun hemp or dhaincha into the soil for green manuring. Or Mix 1kg of Trichoderma the formulation in 100 kg of farmyard manure and cover it for 7 days with polythene. Sprinkle the heap with water intermittently. Turn the mixture in every 3-4 days intervals and then broadcast in the field.
- ✓ **Plant Treatment:** Drench the soil near the stem region with 10g of Trichoderma powder mixed in a liter of water.

### **Benefits of Trichoderma**

- ✓ **Disease Control:** Trichoderma is a potent biocontrol agent and is used extensively for soil-borne diseases. It has been used successfully against pathogenic fungi belonging to various genera, viz. Fusarium, Phytophthora, Sclerotinia, etc.
- ✓ **Plant Growth Promoter:** Trichoderma strains solubilize phosphates and micronutrients. The application of Trichoderma strains with plants increases the number of deep roots, thereby increasing the plant's ability to resist drought.
- ✓ **Biochemical Elicitors of Disease:** 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 defense-related reactions in plant cultivars.
- ✓ **Transgenic Plants:** The introduction of the endochitinase gene from Trichoderma into plants such as tobacco and potato plants has increased their resistance to fungal growth.

Selected transgenic lines are highly tolerant to foliar pathogens such as *Alternaria alternata*, *A. solani*, and *Botrytis cinerea* as well as to the soil-borne pathogen, *Rhizoctonia* spp.

- ✓ **Bioremediation:** Trichoderma strains play an important role in the bioremediation of soil that is contaminated with pesticides and herbicides. They can degrade a wide range of insecticides: organochlorines, organophosphates, and carbonates.

### Uses

Used in Damping-off caused by *Pythium* sp. *Phytophthora* sp., Root rot caused by *Pellicularis filamentosa*, Seedling blight caused by *Pythium*, Collar rot caused by *Pellicularia rolfsii*, Dry rot caused by *Macrophomina phaseoli*, Charcoal rot caused by *Macrophomina phaseoli*, Loose smut caused by *Ustilago segetum*, Karnal bunt diseases, Black scurf caused by *Rhizoctonia solani*, Foot rots of Pepper and betel vine and Capsule rot of several crops. Effective against silver leaf on plum, peach & nectarine, Dutch elm disease on elm's honey fungus (*Armillaria mellea*) on a range of tree species, Botrytis caused by *Botrytis cinerea*, Effective against rots on a wide range of crops, caused by *fusarium*, *Rhizoctonia*, and *Pythium*, and sclerotium forming pathogens such as *Sclerotinia* and *Sclerotium*.

### Recommended

Trichoderma is most useful for all types of Plants and Vegetables such as Cauliflower, Cotton, Tobacco, Soybean, Sugarcane, Sugar beet, Eggplant, Red gram, Bengal gram, Banana, Tomato, Chilies, Potato, Citrus, Onion, Groundnut, Peas, Sunflower, Brinjal, Coffee, Tea, Ginger, Turmeric, Pepper, Betel vine, Cardamom, etc.

### Compatibility

Trichoderma is compatible with Organic manure Trichoderma is compatible with biofertilizers like *Rhizobium*, *Azospirillum*, *Bacillus Subtilis*, and *Phosphobacteria*. *Trichoderma* can be applied to seeds treated with metalaxyl or thiram but not mercurials. It can be mixed with chemical fungicides as a tank mix.

**Precautions:**

- ✓ Don't use chemical fungicide after application of Trichoderma for 4-5 days.
- ✓ Don't use *Trichoderma* in dry soil. Moisture is an essential factor in its growth and survivability.
- ✓ Don't put the treated seeds in direct sun rays.
- ✓ Don't keep the treated FYM for a longer duration.

**Reference:**

Shah M. M. (2018). Introductory Chapter on *Trichoderma* spp. and its significance in agriculture.

Samuels GJ. (1996) A review of biology and systematics of the genus. Mycological Research.

Kumar Singh, R. (2010) *Trichoderma*: A bio-control agent