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Trichoderma: A beneficial fungus for agriculture and environment

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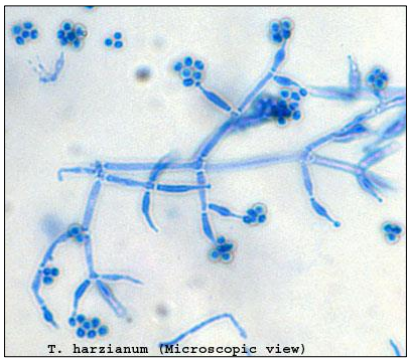
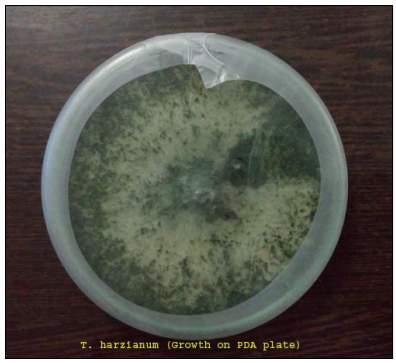
Abstract
Trichoderma is used as bio-agent and reported to be quite effective and eco-friendly. Potential species of *Trichoderma* have been used extensively as bio-control agents by the plant pathologists due to their high efficacy, broad-spectrum activity and ease in isolation and mass multiplication. The *Trichoderma* may suppress the growth of the pathogen population in the rhizosphere through competition and thus reduce disease development. It produces antibiotics and toxins such as trichothecin and a sesquiterpine, Trichodermin, which have a direct effect on other organisms and *Trichoderma* strains with plants, increases the number of deep roots, thereby increasing the plant's ability to resist drought. *Trichoderma* strains play an important role in the bioremediation of soil that are contaminated with pesticides and herbicides. It is most useful for all types of Plants and Vegetables. Don't use chemical fungicide after application of *Trichoderma* for 4-5days. It is compatible with Organic manures, biofertilizers like *Rhizobium, Azospirillum, Bacillus Subtilis* and *Phosphobacteria*. The decades of laboratory research has brought the usage of *Trichoderma* spp. From lab to land.

Keywords: *Trichoderma*, eco-friendly. bio-control, competition, bioremediation

Introduction
Trichoderma belongs to the division Ascomycota, class Sordariomycetes, order Hypocreales and the family is Hypocreaceae. It is characterized by fast-growing, hyaline colonies bearing repeatedly branched conidiophores in tufts with divergent, often irregularly bent, flask shaped phialides and conidiophores may end in sterile appendages with in phialides only borne on lateral branches in some spp. Conidia are hyaline or more usually green, smooth, walled or roughened. The genus *Trichoderma* classified as an imperfect fungus, in that it has no known sexual stage (Gams and Bisset, 1998). Rifai (1969) distinguished nine species and differentiated primarily by conidiophore branching patterns and conidium morphology based on microscopic characters; *T. aureoviride, T. hamatum, T. harzianum, T. koningii, T. longibrachiatum, T. piluliferum, T. polysporum, T. pseudokoningii* and *T. viride.*



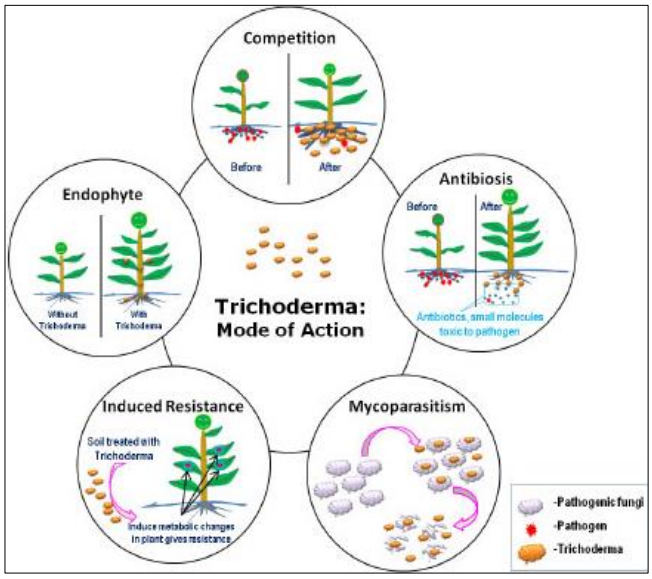


The abundance of *Trichoderma* in various soils, coupled with their ability to degrade various organic substrates in soil, metabolic versatility and their resistance to microbial inhibitors, suggests that they possess the ability to survive in many ecological niches depending on prevailing conditions and the strain involved. *Trichoderma* is used as bio-agent and reported to be quite effective and eco-friendly.
Potential species of *Trichoderma* have been used extensively as bio-control agents by the plant pathologists due to their high efficacy, broad-spectrum activity and ease in isolation and mass multiplication. Species of *Trichoderma* are common in soil, especially waterlogged soil, dung and decaying plant materials and familiar because of its antagonistic action and its involvement in food processing and biodegradation.

Weindling (1932), was first to demonstrate the potential use of *Trichoderma* as a biocontrol agent and suggested the parasitic activity of this fungal genus to pathogens such as soil borne plant pathogenic fungi e.g., *Rhizoctonia solani*. The fungus *Trichoderma* was described as early as 1794 by the mycologist Persoon. However, with the increasing interest in biological control and owing to environmental and economic concerns, Dennis and Webster (1971b) [2] described the antagonistic properties of *Trichoderma* in terms of antibiotic production and hyphal interactions in the control of *Sclerotium rolfsii.* Several *Trichoderma* species were formulated in a commercial production for the protection and growth enhancement of a number of crops in several countries.

Biocontrol mechanisms of *Trichoderma*

The *Trichoderma* may suppress the growth of the pathogen population in the rhizosphere through competition and thus reduce disease development. It produces antibiotics and toxins such as trichothecin and a sesquiterpine, Trichodermin, which have a direct effect on other organisms. 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 oxyporum, F. roseum, F. solani, Phytophthara colocaciae* and *Sclerotium rolfsii*.



In addition, Trichoderma Enhances yield along with quality of produce. Boost germination rate. Increase in shoot & Root length solubilizing various insoluble forms of Phosphates Augment Nitrogen fixing. Promote healthy growth in early stages of crop. Increase Dry matter Production substantially. Provide natural long term immunity to crops and soil.

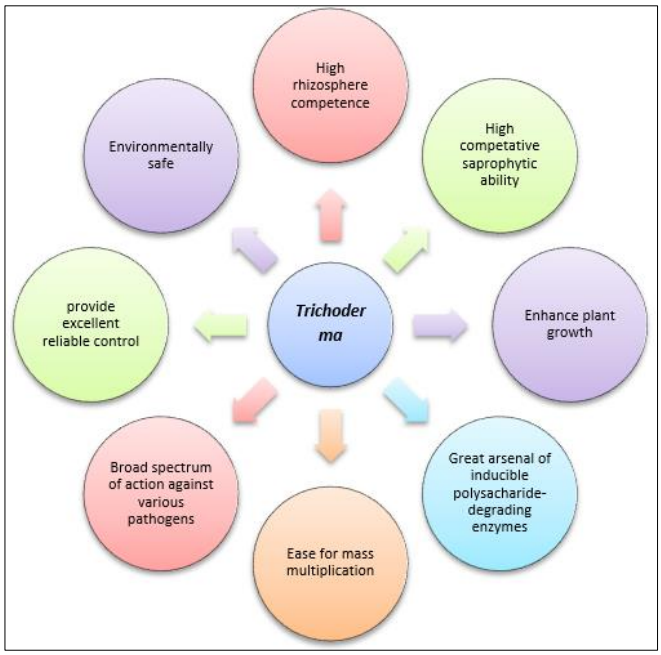
***Trichoderma* as bio-control agent for management soil Born diseases**

Trichoderma is a very effective biological mean for plant disease management especially the soil born. It is a free-living fungus which is common in soil and root ecosystems. It is highly interactive in root, soil and foliar environments. It reduces growth, survival or infections caused by pathogens by different mechanisms like competition, antibiosis, mycoparasitism, hyphal interactions, and enzyme secretion.

***Trichoderema* as a successful bio-control organism**

Trichoderma is the most widely used biocontrol agent. Among the various isolates of *Trichoderma, T. viride, T. harzianum, T. virens and T. hamatum* are used against the management of various diseases of crop plants.

It has many advantages as bio-control agent



Importance of *Trichoderma* in agriculture

- Disease Control: *Trichoderma* is a potent biocontrol agent and used extensively for soil Born diseases. It has been used successfully against pathogenic fungi belonging to various genera (*Fusarium, Phytopthara, Scelerotia* 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: Introduction of 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 cirerea* as well as to the soil-borne pathogen, *Rhizectonia* spp.
- 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.

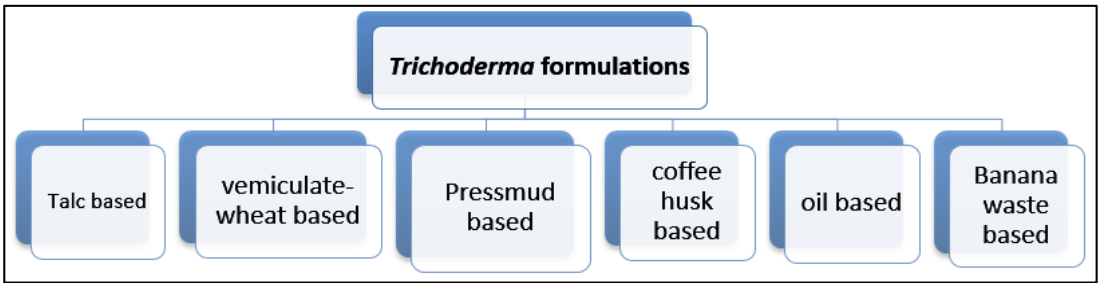
***Trichoderma*: Mass production and formulation**

Major research on biocontrol is centered with the use of spores of *Trichoderma* directly to seed. Technologies become viable only when the research findings are transferred from the lab to field. Though *Trichoderma* has a very good

potential in the management of diseases, it could not be used as spore suspension under field conditions. Thus, the culture of *Trichoderma* should be immobilized in certain carriers and should be prepared as formulations for easy application, storage, commercialization and field use.

Characteristics of an ideal formulation

- Should have increased shelf life.
- Should not be phytotoxic to the crop plants.
- Should tolerate adverse environmental conditions.
- Should be cost effective and should give reliable control of plant diseases.
- Should dissolve well in water.
- Carriers must be cheap and readily available for formulation development.



***Trichoderma* as potential and effective bio fungicide**

Trichoderma 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* & *Sclerotium.*

Recommended For

Trichoderma is most useful for all types of Plants and Vegetables such as cauliflower, cotton, tobacco, soybean, sugarcane, sugarbeet, eggplant, red gram, Bengal gram, banana, tomato, chillies, potato, citrus, onion, groundnut, peas, sunflower, brinjal, coffee, tea, ginger, turmeric, pepper, betel vine and cardamom etc.

Precautions while using as Bio fungicide

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

Trichoderma is compatible with Organic manures, biofertilizers like *Rhizobium*, *Azospirillum*, *Bacillus Subtilis* and *Phosphobacteria*. It can be applied to seeds treated with metalaxyl or thiram but not mercurials. The decades of laboratory research has brought the usage of *Trichoderma* spp. From lab to land. It has promoted the commercial application of *Trichoderma.* Future research should be directed towards exploiting the avenues of *Trichoderma* spp. in disease control.

References

1. Aneja KR. Experiments in microbiology plant pathology and biotechnology 4th edition New Age International Publisher, New Delhi India, 2003, 97-128.
2. Dennis C, Webster J. Antagonist properties of species group of Trichoderma. III hypal interaction. Transactions of the British Mycological Society. 1971; 57:363-369.
3. Doraiswamy S, Nakkeeran S, Chandrasekhar G. *Trichoderma viride*- Important in plant disease control. Microbial inoculants technology. 2003, 222-232.
4. Kumar A, Thakur M, Rani A. *Trichoderma*: Mass production, formulation, quality control, delivery and its scope in commercialization in India for the management of plant diseases. African Journal of Agricultural Research. 2014; 9(53):3838-3852.
5. Mukherjee M, Mukherjee PK, Howitz BA, Zachow C, Berg G, Zeilinger S. *Trichoderma*–Plant–Pathogen Interactions: Advances in Genetics of Biological Control. Indian journal of Microbiology. 2012; 52(4):522-529.
6. Nayyar BG, Akhund S, Akram A. Management of *Alternaria* and its mycotoxins in crops. Scholarly Journal of Agricultural Science. 2014; 4(7):432-437.
7. Rehman SU, Dar WA, Ganie SA, Bhat JA, Mir GH, Lawrence R, *et al*. Comparative efficacy of *Trichoderma viride* and *Trichoderma harzianum* against *Fusarium oxysporum* f sp. C*iceris* causing wilt of chickpea. African Journal of Microbiology Researc. 2013; 7(50):5731-5736.
8. Rehman SU, Dar WA, Ganie SA, Bhat JA, Mir GH, Lawrence R, *et al*. Comparative efficacy of *Trichoderma viride* and *Trichoderma harzianum* against *Fusarium oxysporum* f sp. *Ciceris* causing wilt of chickpea. African Journal of Microbiology Researc. 2013; 7(50):5731-5736.
9. Subash N, Sundaram MM, Sasikumar C, Unnamalai N. Mass cultivation of *Trichoderma harzianum* using agricultural waste as a substrate for the management of damping off disease and growth promotion in chilli plants (*Capsicum annuum* L.). International Journal of Pharmacy and Pharmaceutical Sciences. 2014; 38(2):113-1117.