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Trichoderma a Boon for Farmers

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Rinku Bhaskar[1], Rohit Kumar[1], Chheda Lal[2], Sarvesh Kumar[3]

[1]Ph. D Research Scholar, Department of Plant Pathology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.) 250110

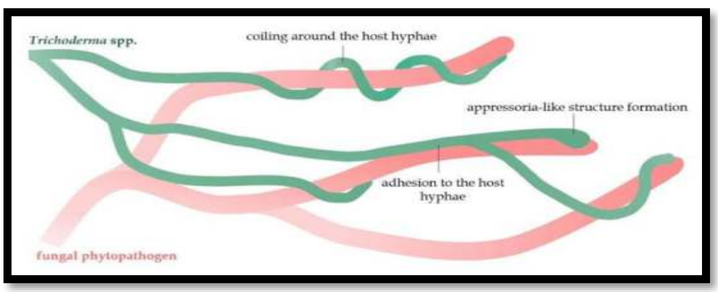
[2]Lecturer, Department of Agriculture, Impact College of Sciences and Technology, Rampur (U.P.) 244901

[3]M.Sc. Scholar, Department of Plant Pathology, Acharya Narendra Deva University of Agriculture & Technology, Ayodhya (U.P.) 224229

Why we use Trichoderma in agriculture?

Trichoderma is used in agriculture for several reasons:

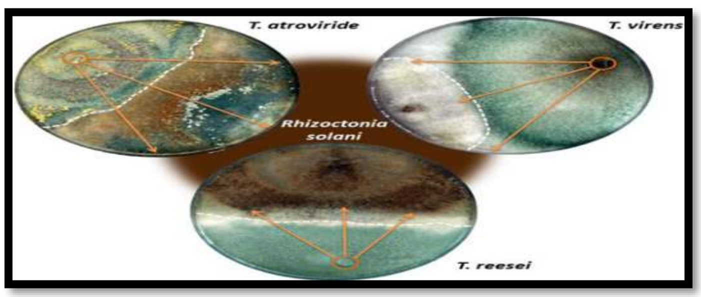
Biological Control: Trichoderma species are natural antagonists of various plant pathogens, such as fungi that cause root rot or damping-off diseases. When applied to the soil or plant roots, they can suppress the growth of these harmful pathogens, reducing the need for chemical pesticides.



Enhancing Nutrient Uptake: Trichoderma can promote plant growth by improving nutrient uptake. They produce enzymes that help solubilize essential nutrients like phosphorus and make them more available to plants.

Stress Resistance: Trichoderma can enhance a plant's resistance to environmental stressors, including drought and salinity. This can lead to better crop yields, especially in challenging growing conditions.

Biological Decomposition: Some Trichoderma species can break down organic matter, aiding in the decomposition of crop residues and other organic materials. This can improve soil health and nutrient cycling.



Root Growth: Trichoderma can stimulate root development and increase root branching, which can result in stronger and healthier plants with improved access to water and nutrients.

Sustainable Farming: The use of Trichoderma in agriculture aligns with sustainable farming practices as it reduces the reliance on chemical pesticides and fertilizers, thus promoting environmentally friendly and organic farming methods. Overall, Trichoderma plays a valuable role in promoting plant health and improving crop yields while reducing the environmental impact of agriculture.

How Trichoderma fungi work?

Trichoderma fungi work through various mechanisms to benefit plants and suppress plant pathogens. Here's how they function:

Antagonism: Trichoderma species are natural antagonists to many plant-pathogenic fungi. They produce antifungal compounds and enzymes that can directly inhibit the growth and development of these harmful pathogens.

Competition: Trichoderma competes with pathogenic fungi for space and nutrients in the rhizosphere (the area around plant roots). Their rapid growth and colonization of the root zone can crowd out pathogenic fungi, limiting their ability to establish and cause disease.

Induced Systemic Resistance (ISR): Trichoderma can trigger a plant's natural defense mechanisms. When in close proximity to plant roots, they can induce systemic resistance in the host plant. This means the plant becomes more resistant to various diseases and stressors, even those unrelated to the specific pathogen that Trichoderma is suppressing.

Production of Enzymes: Trichoderma fungi produce enzymes, such as cellulases and chitinases. These enzymes can degrade the cell walls of pathogenic fungi, making them more susceptible to attack by Trichoderma or other biocontrol agents.

Nutrient Solubilization: Trichoderma can solubilize essential nutrients like phosphorus and iron, making them more available to the plant. This enhances the plant's nutrient uptake and overall health. Enhanced Root Growth: Trichoderma can stimulate root growth and branching. Stronger and healthier root systems provide plants with better access to water and nutrients, which can improve their overall growth and resilience. In essence, Trichoderma fungi act as beneficial microorganisms in the rhizosphere, promoting plant health and suppressing plant diseases through a combination of direct and indirect mechanisms. This makes them a valuable tool in sustainable agriculture and biological pest and disease management.

Preparation procedure?

Preparing Trichoderma for use in agriculture is relatively straightforward and can be adapted for rural farmers. Here's a simple procedure:

Materials Needed

Trichoderma Culture: Obtain a Trichoderma culture from a reliable source, such as an agricultural extension office, research institution, or a trusted supplier.

Substrate: You'll need a suitable substrate for growing Trichoderma. Common options include rice, wheat, or maize grains. Choose a substrate that is readily available in your area.

Water: Clean, chlorine-free water is essential for the process.

Procedure

Sterilize Equipment: Thoroughly clean and sterilize all equipment that will come in contact with the Trichoderma culture. This includes containers, measuring utensils, and any tools you'll use.

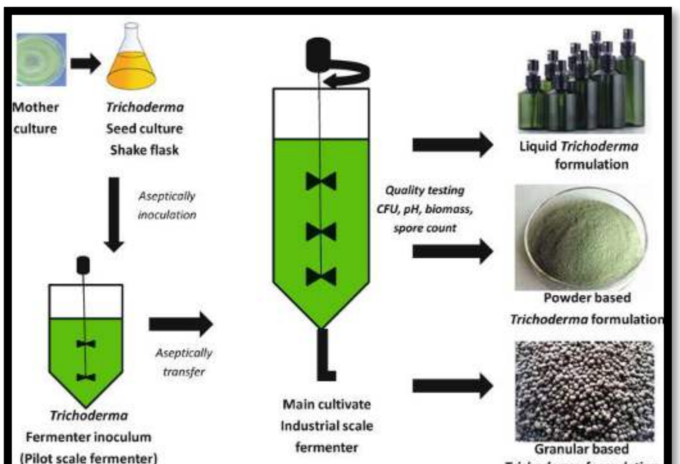
Prepare Substrate: Wash and rinse the chosen substrate (e.g., rice grains) to remove any impurities. Then, cook or steam the substrate until it's well-cooked but not mushy. Let it cool to room temperature.

Inoculate Substrate: Mix the cooled substrate with the Trichoderma culture. Use a clean, sterilized spoon or spatula. The amount of Trichoderma culture to use depends on the instructions provided with the culture but generally ranges from 1-5 % of the substrate weight.

Incubation: Transfer the substrate-Trichoderma mixture into clean, sterile containers. Seal the containers with lids or plastic wrap with small holes for air exchange. Place the containers in a dark, warm (25-30°C or 77-86°F), and well-ventilated area.

Monitor Growth: Check the containers regularly for Trichoderma growth. It should appear as white or greenish mold-like growth on the substrate. This can take 7-10 days or longer, depending on temperature and humidity.

Harvest: Once the Trichoderma has fully colonized the substrate, it's ready for use. The culture should have a pleasant, earthy smell.



Product development process of different formulation of *Trichoderma* sp. using submerged batch fermentation

Application:

To use the Trichoderma culture in your fields:

Dilution: Mix the Trichoderma culture with water to create a suspension. The recommended dilution rate depends on the specific application and the crops you are growing. Consult with local agricultural experts for guidance on the appropriate dilution ratio.

Application Method: You can apply the Trichoderma suspension as a soil drench, seed treatment, or foliar spray, depending on your crop and the specific disease or pest issue you are addressing. Remember to maintain cleanliness and sterility throughout the process to prevent contamination. Always follow local agricultural recommendations and consult with agricultural extension services or experts for specific guidance on Trichoderma use in your region and crop.

How Trichoderma controls plant pathogens?

Trichoderma controls plant pathogens through several mechanisms, making it an effective biocontrol agent: Competition for Resources: Trichoderma rapidly colonizes the rhizosphere (the area around plant roots) and competes with plant pathogens for space and nutrients. This competition can limit the establishment and growth of pathogenic fungi. Antagonism: Trichoderma produces secondary metabolites, such as antibiotics and enzymes that have antifungal properties. These compounds can directly inhibit the growth and development of pathogenic fungi by disrupting their cell walls or interfering with their metabolism. Mycoparasitism: Some Trichoderma species are mycoparasites, which means they can parasitize and kill other fungi, including plant pathogens. They do this by attaching to the pathogen's mycelium (the fungal equivalent of roots) and then penetrating and destroying the pathogen's cells.

Induced Systemic Resistance (ISR): Trichoderma can trigger a plant's own defense mechanisms. When it colonizes the root zone, it induces systemic resistance in the host plant. This means that the plant becomes more resistant to various diseases, even those unrelated to the specific pathogen that Trichoderma is suppressing.

Enzyme Production: Trichoderma produces enzymes, such as chitinases and cellulases; hat can break down the cell walls of pathogenic fungi. By degrading these walls, they make it easier for other biocontrol agents or the plant itself to attack and control the pathogen.

Nutrient Competition: Trichoderma can also outcompete pathogens for essential nutrients. By solubilizing nutrients like phosphorus and iron, Trichoderma makes them more available to the plant, which can boost the plant's overall health and competitiveness against pathogens.

Biofilm Formation: Trichoderma can form biofilms on plant roots, which can act as a protective barrier against pathogenic fungi. These biofilms can physically prevent pathogens from establishing themselves on the root surface. In summary, Trichoderma employs a combination of direct and indirect mechanisms to control plant pathogens. It competes for resources, produces antifungal compounds, parasitizes other fungi, induces plant defenses, and enhances nutrient availability, all of which contribute to its effectiveness as a biological control agent in agriculture.

How Trichoderma can be a blessing for farmers?

Trichoderma can be a blessing for farmers in several ways:

Natural Pest Control: Trichoderma acts as a natural biocontrol agent against various plant pathogens. It helps reduce the need for chemical pesticides, promoting environmentally friendly and sustainable farming improve the sustainability of farming practices underscores its importance as a blessing for farmers worldwide.

References

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