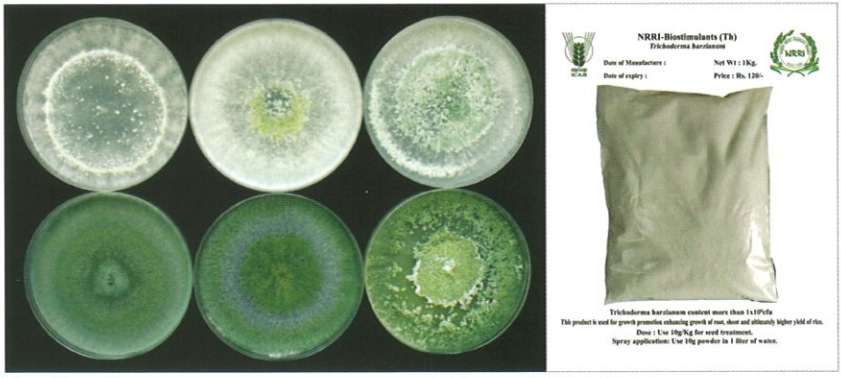
Tech NRRI-193

Low cost production technology of Trichoderma for sustainable rice disease management

Raghu S, Subhashree Jena, Basana Gowda G, Mathew S Baite, Prabhukarthikeyan SR and PC Rath



1. Introduction

Rice (*Oryza sativa* L) being an important food crop of the world, facing a number of diseases. Among them, Blast (*Magnoporthe oryzae*), Brown spot (*Helminthosporium oryzae*), Sheath blight (*Rhizoctonia solani*), False smut (*Ustiloginoidea virens*), Sheath rot (*Sarocladium oryzae*), bakanae (*Fusarium fujikuroi*), Bacterial leaf blight (*Xanthomonas oryzae* pv *oryzae*) are important. They almost cause significant yield losses. Use of chemical pesticides for management of disease is expensive, and has several negative impacts on human and animal life vis-à-vis a non-ecofriendly approach. Hence, use of biocontrol agents should be encouraged in larger scale. One such promising bipesticide/biocontrol agent is *Trichoderma,* and its species.

2. Biology of *Trichoderma*

Trichoderma is a genus of fungi belongs to Ascomycetes order of the class Hypocreales (*Hypocrea* spp.). They are present in nearly all the rhizosphere, phyllosphere, phylloclane and several other diverse habitats. They are the most easily cultivable fungi on artificial media. Antifungal ability of this beneficial fungus has been exploited since 1930s and being used as biological control agent for phyotopathogens and plant growth promoting agents. Biological control mechanisms of this fungus are competition, antibiosis and parasitism. Reports by various workers show that *Trichoderma* spp. is a powerful antagonist of parasitic soil fungi like *Pythium, Phytophthora, Sclerotinia, Sclerotium, Rhizoctonia, Fusarium, Verticillium* and *Gaeumannomyces,*and other foliar pathogens.

3. How *Trichoderma* help our rice crop?

Trichoderma species protect the rice crop from different diseases through their mechanism such as mycoparasitism, competition and antibiosis. They also improve plant growth promotion by enhanced plant root colonization, better uptake of water and nutrients in soil.

4. Species of *Trichoderma* for biological control and Plant Growth Promotion

1. *Trichoderma harzianum*
2. *Trichoderma virense*
3. *Trichoderma atroviridae*
4. *Trichoderma asperellum*
5. *Trichoderma longibrachiatum*
6. *Trichoderma citrinoviride*

5. Mass production and formulation of Trichoderma species

5. 1. Material Required

a. Rice/Wheat/Sorghum/Maize seeds

b. Mother Culture of *Trichoderma* (It may be procured from any recognized biocontrol laboratory of state agricultural universities, ICAR institutes or nearby central integrated pest management centers (CIPMCs)

c. Polythene bags (8" X 12")

d. Cotton

e. Rubber Bands/Thread

f. PVC pipe (1 ½ inch in length and 1 ½ - 2 cm in diameter): the pipe should have opening at both the ends or bamboo stem of same size can be used after removing internodes).

g. Pressure cooker (use 5-10 lit capacity)

h. Gas/Electric heater for sterilization and heating of the substrates.

i. Stone/Wooden surface.

j. Fresh water

k. Candle

l. Spoon (Preferably plastic)

5. 2. Preparation Method

1. Clean the grains of any one among Rice/Ragi/Sorghum/Wheat/maize, without any dirt/sand/ stone particles and wash them with running water two to three times.

2. Take 200 g of seeds and fill in polythene bags of 1kg.

3. Add same quantity of clean water (200 mL) to the grains. The mouth of the polythene bags should be inserted with PVC pipe/bamboo stem of above size such a way that, half of the tube should be inside the polythene and rest should cover the mouth of the tube.

4. Tie the mouth with rubber band and plug with clean cotton.

5. Place filled polythene bags in a pressure cooker and place two to three stones inside the cooker.

6. Switch on the pressure cooker after covering the lid and wait until three whistles.

7. Wait for pressure to remove and take out the covers and keep in clean surface.

8. Allow for cooling before inoculating the grains with *Trichoderma* spp.

5. 3. Inoculation with *Trichoderma* mother culture

1. Preferably select the corner side of a room, and make sure that, the surface is free from dust. Or surface sterilize with hot and clean water.

2. Place two to three candles in such a way that, there should be space for working and inoculation.

3. Switch on the candles and wait for 3-5 min, and in the mean time surface sterilize the hands with Dettol.

4. Remove the cotton plugs from each polythene and mix the grains uniformly.

5. Take the *Trichoderma* mother culture (either talc based or Plate culture) in a spoon and pour into the grains via pipe in front of the candle.

6. Immediately after inoculation, plug the polythene bags tightly and keep on a clean surface for 10-12 days under room temperature.

7. Entire grain mass will turn into green mass (sporulation) after 10-15 days indicating luxurious growth of *Trichoderma*.

8. Empty the grains into plastic trays and dry under shade for 2-4 days.

9. The dried /well colonized grains can be ground with the help of normal grinder to make into fine powder.

10. Sieve the powder through a normal mesh (50 mesh for coarse/80 mesh size for fine size) to get very fine powder.

5. 4. Formulation and field application

1. The Fine powder obtained after sieve can be mixed with talcum powder (10 g pure fine powder + 1 kg Talc)

2. Add 10% carboxy methyl cellulose (CMC) as a sticker.

3. The above formulation can be directly used for field application either as seed treatment, seedling root dip or foliar application.

5.5 Application Dose:

a. For Seed treatment: Use 10g Talc based formulation/kg of seeds.

b. For Seedling Dip: Mix 500 g in 50 lit water and dip the freshly uprooted rice seedlings from 30-60 min just before transplanting.

c. Foliar Application: Mix 150 g of talc based formulation in 16 lit knapsack sprayer along with a sticker material and mix well before spraying.

d. Soil Application: Mix 1kg of *Trichoderma* biomass multiplied on cereal grains with 100 kg of well decomposed compost of Farm Yard Manure (FYM) and allow for a month. This is sufficient to apply for 1 ha area.

5.6 . Precautions to be taken while using *Trichoderma* formulation.

1. Store the formulation with proper packaging in a cool and dry place.

2. Assure that, there should not be more than 20% moisture in the formulation.

3. Self life of the product is only for 4-6 months. So, make sure to use the product before expiry date.

4. Do not mix the *Trichoderma* with any fungicide like Carbendazim which is not compatible with it.

5. Spray the formulation preferably in early morning or evening hours.

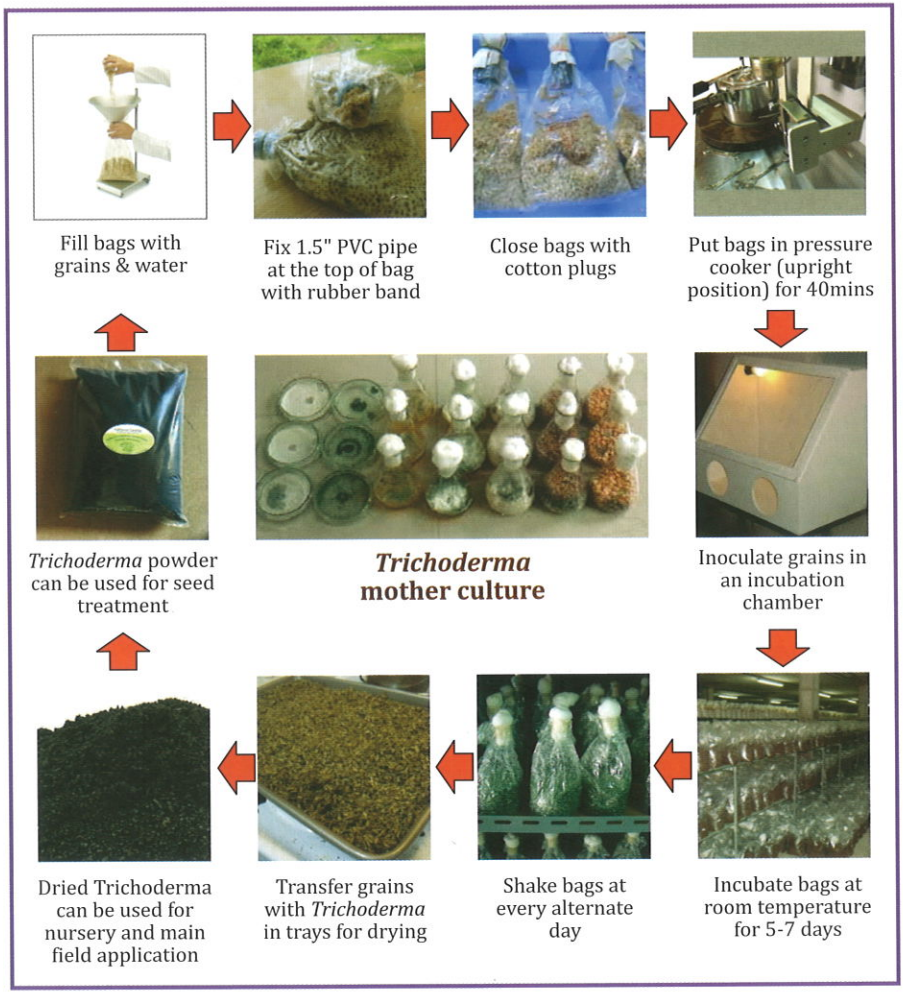


Fig. Detailed Steps in low cost production of *Trichoderma* spp.

Low cost production technology of Trichoderma for sustainable rice disease management

NRRI Technology Bulletin – 193, June 2022

Editing: MK Bag

Typeset at the ICAR-National Rice Research Institute, Cuttack (Odisha) 753 006, India and printed at Printech offset, BBSR. Published by The Director, for the National Rice Research Institute, Cuttack (Odisha) 753 006.