

Empowering Farmer's through Local Production and Mass Multiplication of Biocontrol Agent for Self Use and Income Generation

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Excessive dependence on synthetic agrochemicals has resulted in environmental degradation, contamination of natural resources, and the development of pesticide-resistant pests, emphasizing the need for sustainable crop protection strategies. *Trichoderma* spp. is a widely recognized biocontrol agent that effectively manages soil-borne plant pathogens while promoting sustainable agriculture. This study focused on the mass multiplication of *Trichoderma* using broken rice as a low-cost substrate and assessed its potential for farmer self-use and income generation. Broken rice is an economical and efficient substrate for producing quality *Trichoderma* inoculums. The study also identified key constraints to adoption, including limited technical knowledge, handling and storage challenges, inconsistent field performance, inadequate availability of quality bioagents, and weak market support. The findings suggest that strengthening farmer training, extension services, quality production practices, and market linkages can enhance the adoption of *Trichoderma*-based biocontrol technologies, thereby contributing to sustainable agriculture, reduced dependence on chemical pesticides, and improved rural livelihoods.



Keywords: *Trichoderma*, mass multiplication, Farmers, Biocontrol agents, Disease management.

Introduction

Agriculture is vital to rural livelihoods, especially in developing countries like India, but its sustainability is threatened by the excessive use of chemical pesticides, which has led to environmental pollution, declining soil fertility, and pesticide-resistant pests. Biological control has emerged as a sustainable alternative, with microbial agents such as *Trichoderma*, *Pseudomonas*, *Bacillus*, and *Beauveria* effectively managing plant diseases while promoting plant growth and soil health. Among these, *Trichoderma* is one of the most widely used and commercially important biocontrol agents due to its strong activity against soil-borne pathogens. Promoting the local production and mass multiplication of biocontrol agents at the farm or community level offers a practical solution by ensuring affordable, timely, and locally adapted bio-inputs. This approach not only reduces farmer's dependence on chemical pesticides and external suppliers but also creates opportunities for income generation, rural entrepreneurship, and knowledge sharing. Overall, empowering farmers to produce biocontrol agents supports sustainable agriculture, improves disease management, lowers production costs, and enhances rural livelihoods.

Mass Multiplication of *Trichoderma* Using Broken Rice

Materials Required- 1 kg clean broken rice, 2 L clean water, Two *Trichocap* capsules, sterile plastic containers with lids, Spirit for sterilization, Clean cloth or sieve.

Procedure

1. Boil 2 L of water, Add 1 kg broken rice and boil for 1.5–2 minutes.
2. Drain excess water using a clean cloth or sieve.
3. Allow the rice to cool until lukewarm.
4. Mix the powder from two *Trichocap* capsules thoroughly with the rice.
5. Sterilize plastic containers using spirit.
6. Fill the containers with inoculated rice up to approximately 1 cm depth and close the lids.
7. Incubate the containers separately in a clean, well-ventilated room at 25–30°C.
8. White fungal growth appears within 3 days and turns green after 7–8 days, indicating complete colonization. Grind the colonized substrate into fine powder.
9. Mix **100 g of *Trichoderma* powder per kilogram of well-decomposed farmyard manure (FYM) or vermicompost** before field application.



Benefits of *Trichoderma* in Agriculture

Work as biological control, Plant Growth Promotion, Improved nutrient availability, Improve soil Health, Induced Synthetic Resistance, and Reduced Chemical Pesticides Use, Cost-effective Technology, Compatibility with IPM, Increased crop Yield and Quality.

Challenges in Adoption of Biocontrol Agents

Despite their advantages, farmers face several challenges in adopting biocontrol technologies:

- Variable field performance influenced by environmental conditions.
- Requirement for proper storage and handling to maintain viability.
- Limited awareness and technical knowledge.
- Inadequate availability of quality bioagents.
- Compatibility issues with conventional pesticide-based farming.
- Regulatory requirements for production and commercialization.
- Need for careful management and timely application.

Scope for Farmer Empowerment and Income Generation

Local production of *Trichoderma* offers significant opportunities for sustainable agriculture and rural development by:

- Reducing expenditure on chemical fungicides.
- Ensuring timely availability of quality bioagents.
- Promoting village-level entrepreneurship.
- Generating additional household income through local sales.
- Strengthening farmer-to-farmer knowledge transfer.
- Supporting environmentally friendly crop production.

Application Methods of *Trichoderma*

Method	Recommended Dose	Purpose
Soil application	1–2 kg powder or 500–1000 ml liquid formulation mixed with 25–50 kg FYM and incubated for 2–3 weeks	Disease management and soil health improvement
Seed treatment	6–10 g powder or 5–10 ml liquid formulation per kg seed	Protection against seed- and soil-borne pathogens

Method	Recommended Dose	Purpose
Root/Seedling dip	20–25 g powder per litre of water for 20–30 min	Protection during transplanting
Soil drenching	1–2 kg formulation in 200 L water per acre or 8–10 g/L	Nursery and field disease management
Foliar spray	8–10 g powder or 3–5 ml liquid formulation per litre	Disease suppression at 10–12 day intervals
Seed biopriming	5–10 g/kg seed	Improved germination, disease resistance, and stress tolerance

Conclusion

Mass multiplication of *Trichoderma* using broken rice is a simple, economical, and farmer-friendly technology that enables local production of quality biocontrol agents. The approach reduces dependence on chemical pesticides, improves disease management, enhances soil health, and contributes to sustainable agricultural production. Furthermore, community-based production can generate supplementary income and encourage rural entrepreneurship. Strengthening technical training, quality control, and market support will further improve adoption and maximize the benefits of this technology for farmers.

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