

Application of trichoderma for fungal disease control in organic vegetable farming: A collaborative approach with farmers in Na Si Nuan, Maha Sarakham Province, Thailand

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Abstract - This paper presents a case study on the application of Trichoderma, a beneficial fungus, to control plant diseases caused by pathogenic fungi in organic vegetable farming. The study was conducted with the cooperation of vegetable farmers in Group 17, Na Si Nuan Sub-district, Kantharawichai District, Maha Sarakham Province, Thailand. The academic service was implemented by the Department of Agricultural Technology, Faculty of Technology, Maha Sarakham University. The paper details the process of identifying fungal disease issues, training farmers on the use of Trichoderma as a biological control agent, and the subsequent positive outcomes from its application. Through a participatory approach, farmers were trained on various methods of applying Trichoderma, which ultimately enhanced their crop health and contributed to the sustainability of organic farming practices.

Keywords: Trichoderma, fungal diseases, organic farming, agricultural technology, sustainable agriculture

1. Introduction

Agricultural productivity in developing countries, including Thailand, faces numerous challenges, especially in organic farming systems where chemical inputs are prohibited. One significant challenge is the prevalence of fungal diseases that severely affect crop health, particularly in vegetable production. These diseases are more pronounced during the rainy season, which exacerbates the situation for smallholder farmers (Waheed et al., 2023 and Zhou et al., 2024). This paper focuses on an academic service project carried out by the Department of Agricultural Technology, Maha Sarakham University, in collaboration with local vegetable farmers in Na Si Nuan, Thailand. (16°20'33"N 103°12'29"E) The project aimed to solve fungal disease problems in organic vegetable farms by introducing Trichoderma, a biocontrol agent, to prevent and manage fungal pathogens. The use of Trichoderma as a biocontrol agent in vegetable

production has gained significant attention due to its effectiveness against soil-borne pathogens. *Trichoderma* species not only inhibit the growth of harmful fungi but also enhance plant health through various mechanisms. This multifaceted approach positions *Trichoderma* as a sustainable alternative to chemical fungicides in agriculture. Mechanism of action, *Trichoderma* competes with pathogens for resources and space, effectively reducing their prevalence (Gaur et al., 2024). It produces cell wall-degrading enzymes like chitinases and β -1,3-glucanases, which degrade the cell walls of fungal pathogens (Oyesola et al., 2024). *Trichoderma* can trigger systemic acquired resistance (SAR) in plants, enhancing their defense against diseases (Gaur et al., 2024 and Oyesola et al., 2024). *Trichoderma* isolates showed up to 72.97% inhibition of *Fusarium oxysporum*, demonstrating significant potential in managing soil-borne diseases (Kumari et al., 2024).

2. Materials and methods

2.1 Problem identification and needs assessment

The first step in the project involved conducting a needs assessment and problem analysis with local farmers. Through participatory discussions and field observations, it was determined that fungal diseases were the primary obstacle to achieving high-quality organic vegetables. These diseases were particularly problematic during the rainy season when the humidity levels were conducive to fungal growth. Farmers expressed their concern over the lack of effective and affordable methods for disease management that were compatible with organic farming standards.



Figure 1. Assessment and problem analysis with local farmers.

Table 1. The results of the analysis are summarized in organic vegetable production.

Problem Area	Maximum Score	Actual Score	Percentage of Total Score (%)
Area (Land)	9	5	1.87%
Water Source	3	1	0.38%
Plant Nutrients	16	10	3.75%
Seeds	19	12	4.49%
Pests and Diseases	194	148	55.44%
Harvesting	0	0	0%
Washing and Cleaning	22	16	5.99%
Grading and Packing	4	2	0.75%
Total	267	194	100%

2.2 Methodology

The research team, in collaboration with the farmers, designed a hands-on training workshop aimed at equipping them with the necessary knowledge and skills to use *Trichoderma* as a biological agent to control fungal diseases. The project focused on four main applications of *Trichoderma*:

1. **Seed Treatment:** Farmers were trained to mix *Trichoderma* with vegetable seeds before planting to protect the seeds from fungal infection during the early stages of growth.
2. **Soil Treatment:** The application of *Trichoderma* to the soil was taught as a method of preventing soilborne fungal diseases.
3. **Foliar Spray:** A solution of *Trichoderma* was prepared and sprayed onto the leaves and stems of plants to prevent fungal diseases during the growing season.

2.3 Trichoderma production process

Farmers were shown how to produce their own fresh *Trichoderma* culture. The process begins by steaming rice until it becomes soft. The rice is then placed into a heat-resistant bag, where it is inoculated with *Trichoderma* spores (approximately the size of a green bean). The bags are sealed, shaken to distribute the spores evenly, and then punctured with small holes to allow for aeration. After three to four days of incubation, the culture is ready to use when the mycelium turns a dark green color. This method allows farmers to produce a sustainable and cost-effective source of *Trichoderma*.



Figure. 2 Trichoderma production process.

2.4 Application methods of trichoderma

Once the Trichoderma culture was ready, farmers were trained in several application methods:

1. **Seed Coating:** To prevent fungal infections during germination, Trichoderma was mixed with seeds. The recommended ratio is 1-2 tablespoons of Trichoderma per 1 kilogram of seeds.



Figure 3. Seedlings from seed mixing with Trichoderma.

2. Soil Application: Farmers were taught to apply Trichoderma directly onto the soil at a rate of 50-100 grams per square meter. And the use of fresh and dried azolla green manure to increase nutrients and organic matter in the soil by mixing it simultaneously with Trichoderma.



Figure 4. The use of Trichoderma in the preparation of vegetable soil.

3. Foliar Spray: For plants already in the field, Trichoderma was mixed with water (1 kg of Trichoderma per 100 liters of water) and sprayed onto the plants to prevent fungal infections on leaves and stems.



Figure 5. The use of Trichoderma for preventive spraying, pest control in vegetable plots.

3. Results and discussion

The intervention led to noticeable improvements in fungal disease management among the participating farmers. After undergoing the training, farmers reported a high level of satisfaction, with 90% of participants expressing satisfaction with the workshop and its outcomes. The application of Trichoderma successfully reduced the incidence of fungal diseases, particularly during the rainy season. Additionally, farmers observed improvements in soil fertility, which contributed to overall crop health and yield.

The results of this project suggest that the use of Trichoderma in organic farming systems offers a sustainable solution for managing fungal diseases without resorting to chemical fungicides. This practice not only supports the health of the crops but also ensures that the produce meets organic certification standards, which are increasingly demanded in both local and international markets.

4. Conclusion

This case study highlights the importance of academic service in addressing real-world agricultural challenges. By leveraging local knowledge and scientific expertise, the project successfully introduced a biocontrol solution that is both cost-effective and environmentally friendly. The positive outcomes of this initiative suggest that *Trichoderma* has great potential to be incorporated into the broader scope of organic farming in Thailand and other similar agricultural contexts. Future research could further explore the scalability of this solution across different regions and farming systems.

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