

# Comparative Efficacy of *Trichoderma viridae*, *Pseudomonas flourescens* And Mixture Of Bio Fertilizers Against Clubroot Of Broccoli Caused By *Plasmodiophora brassicae*

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## Introduction

- Clubroot (*Plasmodiophora brassicae*) is a serious soil borne disease of crucifers that can cause significant economic losses.
- P. brassicae* is a common soil protozoan (Niwa et al., 2008). It has a complex life cycle divided into two phases i.e. in the soil where it survives in the form of resting spores (Dixon 2009), and in the plants, mostly infecting the roots by causing hyperplasia and hypertrophy with the subsequent formation of galls and later interrupting the water and nutrient uptake leading to yield and quality losses.
- Dealing with the clubroot is a challenging task because thick walled resting spores remain viable even for 10-20 years. The spores are moved by tillage operations and they also move with water in water channels and across fields.
- The fungus gets in through the plant from the wounds on the fine hairs on the roots. Small to large spindle shaped swellings develops on the roots of the affected crop.
- The movement of infested soil to uninfested soil via transportation of seedlings, use of same tools and machinery etc results in the spread of the disease.
- Monocropping quickly increases the number of spores. Reducing the soil inoculums with crop rotation with non host species can help check the disease.

## Objective

This analysis aims to show that all bio control agents were able to reduce cube root and act as a promising factor for improved growth performance nutrition & yield of broccoli making bio control against a suitable substitute for chemical fertilizers and fungicides.

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## Methods

- Land preparation for experimental plot.
- Lime broadcasting @5ton per hectare evenly before 2 weeks of land preparation.
- Transplantation of seedlings and application of decomposed compost @ 200 g per plant in all treatments.
- Soon after transplantation, drenching the plants with their respective bio controls.
- Each treatments comprised 4 treatments in four replication:
  - Trichoderma viridae* (T1)
  - Pseudomonas flourescens* (T2)
  - Mixed treatment (T3=T1+T2)
  - Control
- Preparation of the solution.
  - Before the application to the crop, the prepared concentrate of bio control agents were taken to the field and further diluted @2 ml /lt of water.
  - The solution thus made was further treated with 5% sucrose solution and kept for 1 hour.
  - Finally, drenching in the roots of respective treatments @250 ml/lt of water for 4 times (Immediately after transplanting, 7 DAT,14 DAT and 25 days of 3<sup>rd</sup> application).
- (NOTE: 5% sucrose solution helped increased number of cells of bio control agents over time)
- Parameters monitored:
  - Plant height
  - Number of leaves
  - Disease incidence
  - Total crop yield
  - Root length
- Data analysis

## Results

### Plant height

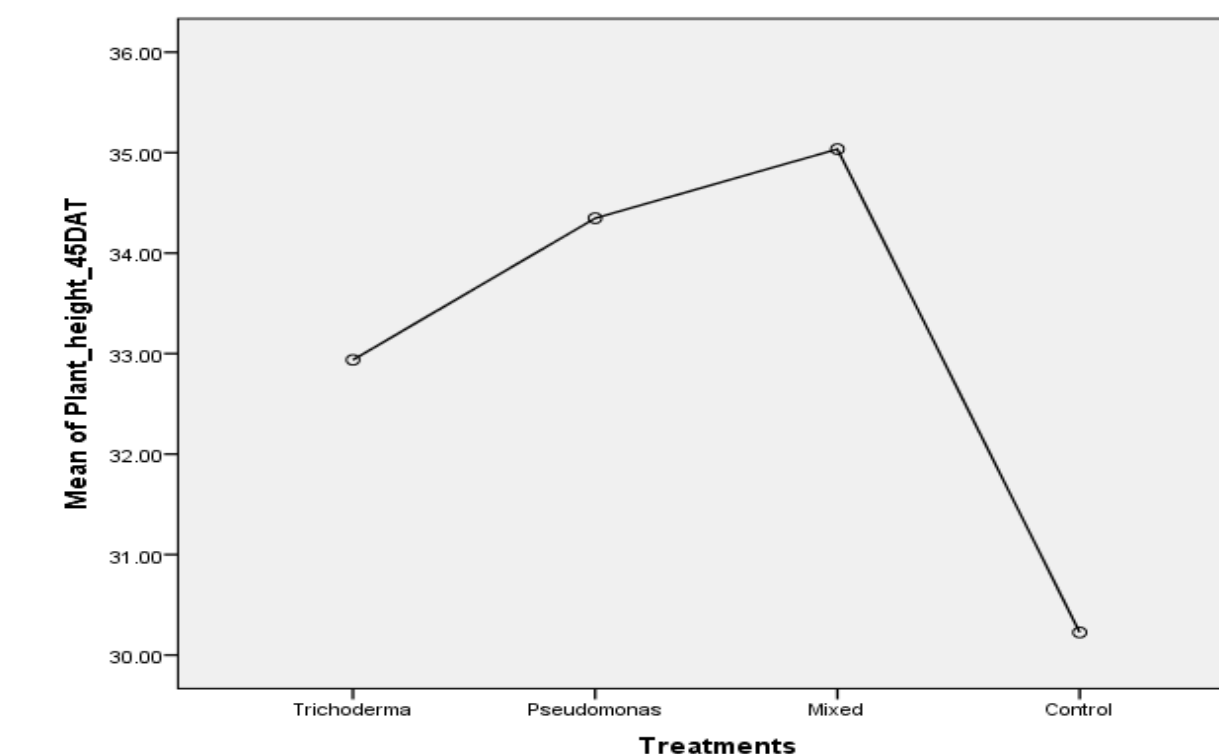


Figure 1: Graph showing the plant height of the plants in respective treatments at 45 DAT

### Number of leaves per plant

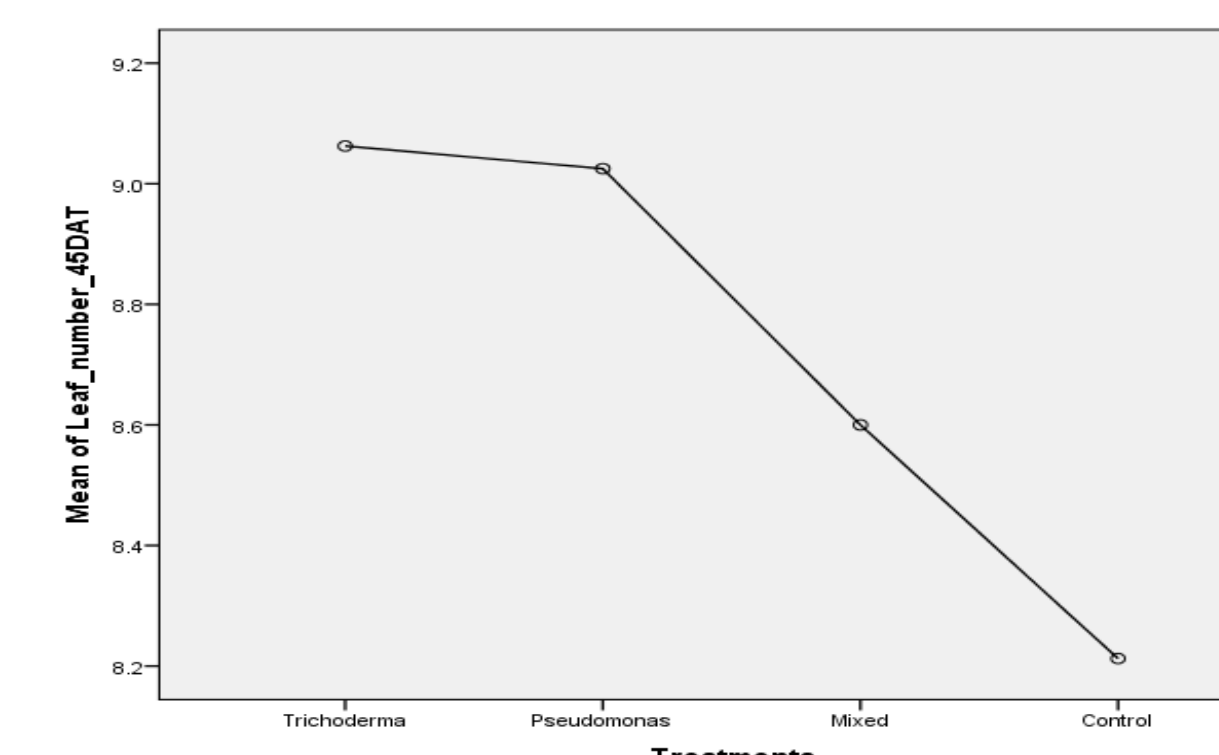


Figure 2: Graph showing the variation of number of leaf in respective treatments

### Root length (cm)

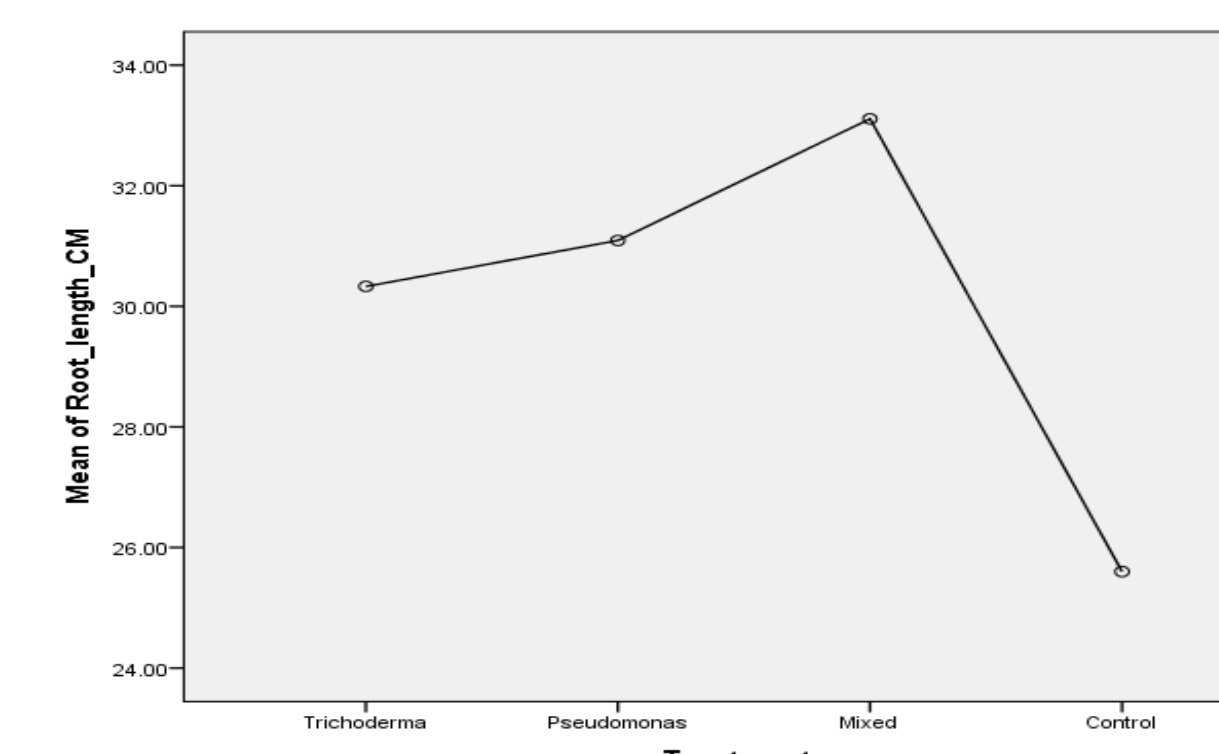


Figure 3 : Effect of different bio controls in the tap root length of Broccoli

### Disease Severity

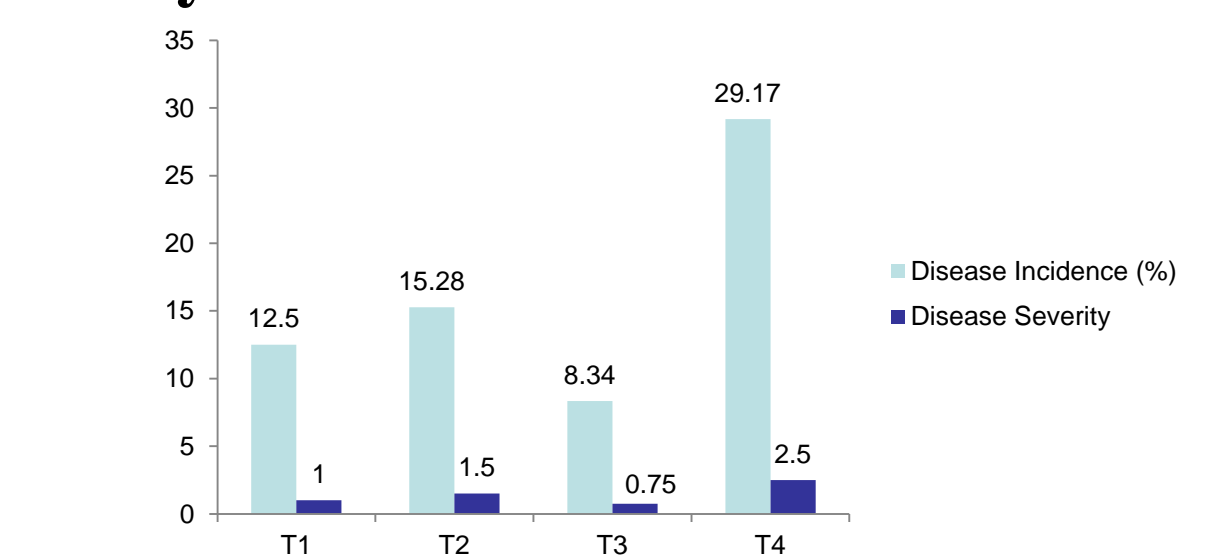


Figure 4: Disease Incidence and Severity in Respective Treatments

### Yield

Treatments	Disease Incidence (%)	Weight/headplant (Kg)
Trichoderma (T <sub>1</sub> )	12.5	1.07
Pseudomonas (T <sub>2</sub> )	15.28	0.99
Mixed (T <sub>3</sub> )	8.34	1.2
Control (Farmer's practice) (T <sub>4</sub> )	29.17	0.88
Mean	16.32	1.03
Standard Deviation	12.29	0.14
Standard Error	3.06	0.35

Table 1: Relation between Yield and Disease Incidence

## Conclusions

- Data obtained from the field shows that all biocontrol agents were able to reduce disease, showing great potential for clubroot management.
- The bio control agents proved to be a promising factor for improved growth performance, nutrition and yield of broccoli making biocontrol agents suitable substitute for chemical fertilizers and fungicides.
- The plant height was observed to be increased by the use of mixture of bio fertilizers and least plant height was observed in the control plot.
- The average no. of leaves was particularly higher in plots treated to *Trichoderma* followed by plot of *Pseudomonas* and least in control plot.
- The disease incidence in the control plot was remarkably higher i.e. 29.17% compared to the mixed plot i.e. 8.34%.
- The bio control agents can be effective for mobilizing the P in the rhizosphere which guarantees their use for the integrated management of diseases and P supply to plants. Similarly the yield of broccoli in the mixed plot was significantly higher than those in farmers practice.
- The experiment showed the negative correlation in between the disease severity and marketable yield of the crop. Combined use of bio control agents with well decomposed FYM has significant effect on control of soil borne pathogens. They are also ecologically safe and culturally more acceptable among the farmers.
- The overall research concluded that all bio control agents were able to reduce disease, showing their potential for club root management and increase in overall length, average plant height and average number of leaves of the plant.

## References

- Avis T.J., Gravel V., Antoun H., Tweddell R.S. (2008): Multifaceted beneficial effects of rhizosphere microorganisms on plant health and productivity. *Soil Biology and Biochemistry*, **40**: 1733–1740.
- Dixon, G. R. *Plasmodiophora brassicae* in its environment. *Journal of Plant Growth Regulation*, v. 28, n. 3, p. 212-228, 2009.
- Donald, C.; Porter, I. Integrated control of clubroot. *Journal of Plant Growth Regulation*, v. 28, n. 3, p. 289-303, 2009.
- Harman, G.E., Charles, R.H., Ada Viterbo, Chet, I. and Matteo, L. 2004. *Trichoderma* – opportunistic, avirulent plant symbionts. *Nature reviews Microbiology*, **2**: 43-56.
- Webster, M., and G. Dixon. 1991a. "Boron, pH and inoculum concentration influencing colonization by *Plasmodiophora brassicae*." *Mycological Research* **95** (1): 74–79.

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