Endophytic colonization of *Beauveria bassiana* for management of clubroot on cabbage

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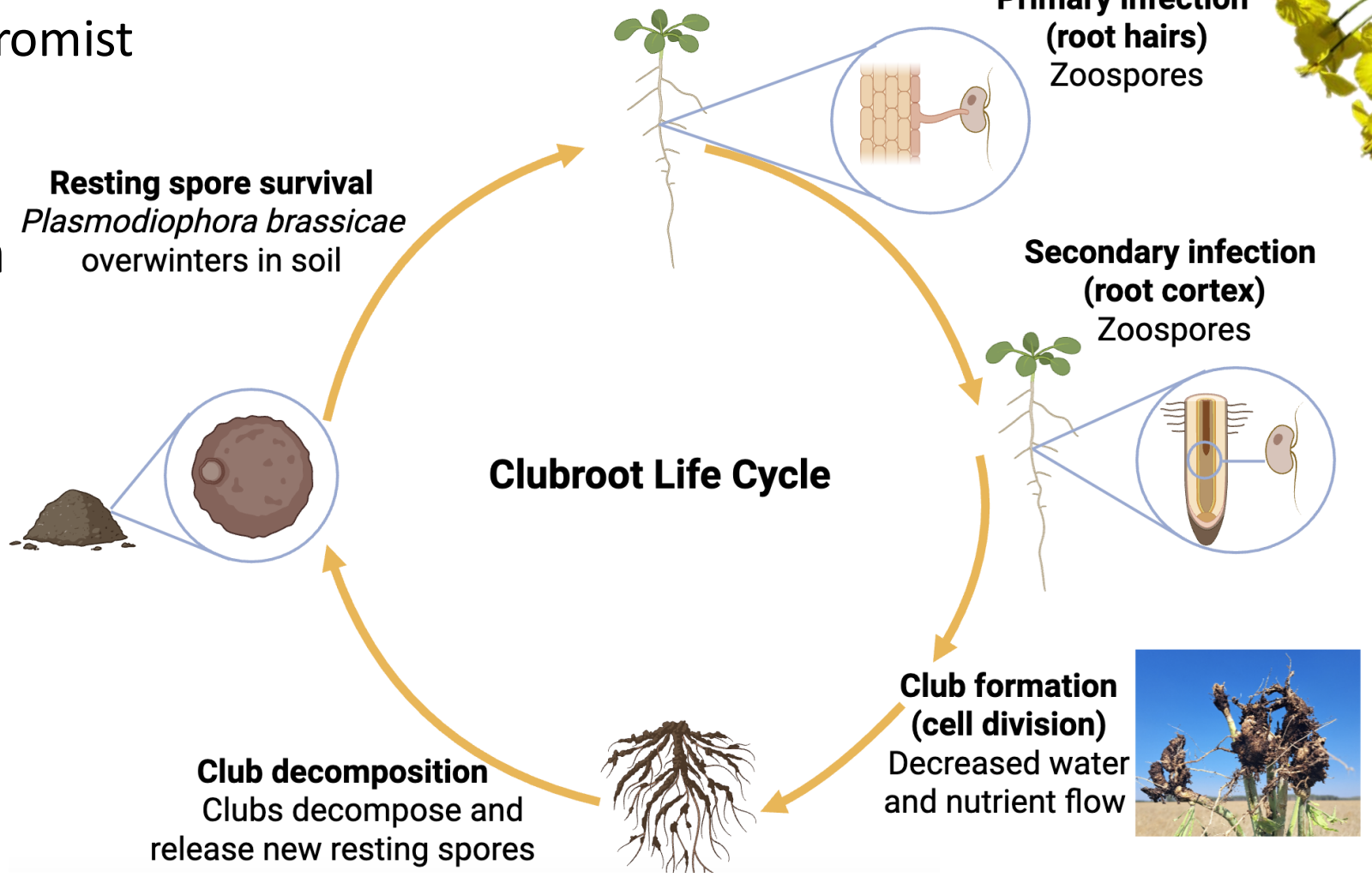
Clubroot in Canada

Plasmodiophora brassicae Wor.

Obligate biotrophic chromist

- A major threat to brassica crop production
  - Cabbage farm gate value $74 million
- Limited management strategies



Why *B. bassiana* and Clubroot?

Plant endophytic attributes:

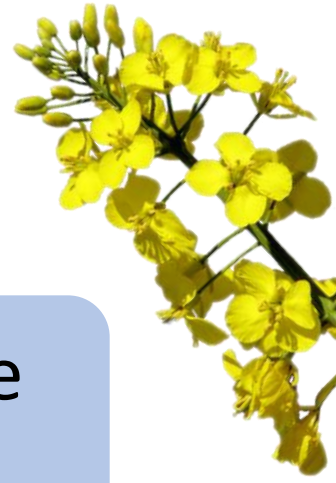
- Plant growth promotion
- Nutrient acquisition
- Stress tolerance
- **Disease suppression**

- Competition
- Antibiosis (ex. Beauvericin)
- Parasitism
- Induced Systemic Resistance

Why Cabbage?

Application of *B. bassiana* products, **BioCeres** and **BotaniGard**, to cabbage seedlings before transplanting will allow for colonization before exposure to *P. brassicae* in the field

Research Objectives



1) Evaluate the effect of *B. bassiana* on clubroot incidence and severity under controlled and field conditions.

1.b) Confirm that *B. bassiana* can colonize cabbage seedlings via soil drench.

2) Assess effects on plant growth and insect damage.

Methods
Growth Room

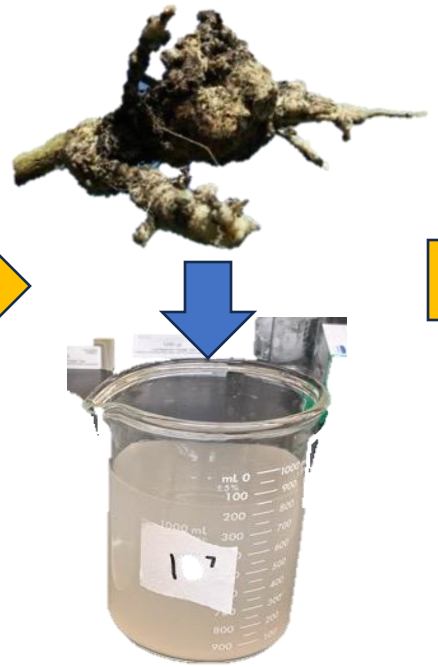
RCBD with 2 factors: *B. bassiana* and inoculum load

1) *B. bassiana* Appl.

Soil drench

4 weeks

2) Inoculum prep.



Spore suspension

1 x 10^5, 10^6, 10^7 spores / mL

@ 5 mL per plant

3) Transplant

6 weeks

4) Clubroot Assessment

DSI (0 – 3 scale)

Crete et al., 1963

Methods

Field

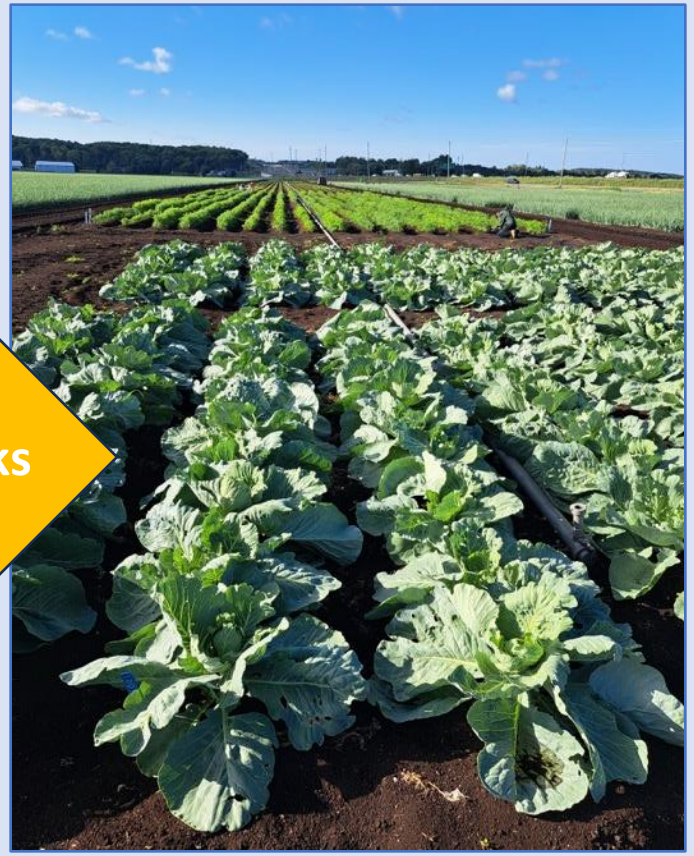
Ontario Crops Research Centre - Bradford

Soil drench @ 1st true leaf

4 weeks

Transplant to field in June

8 weeks



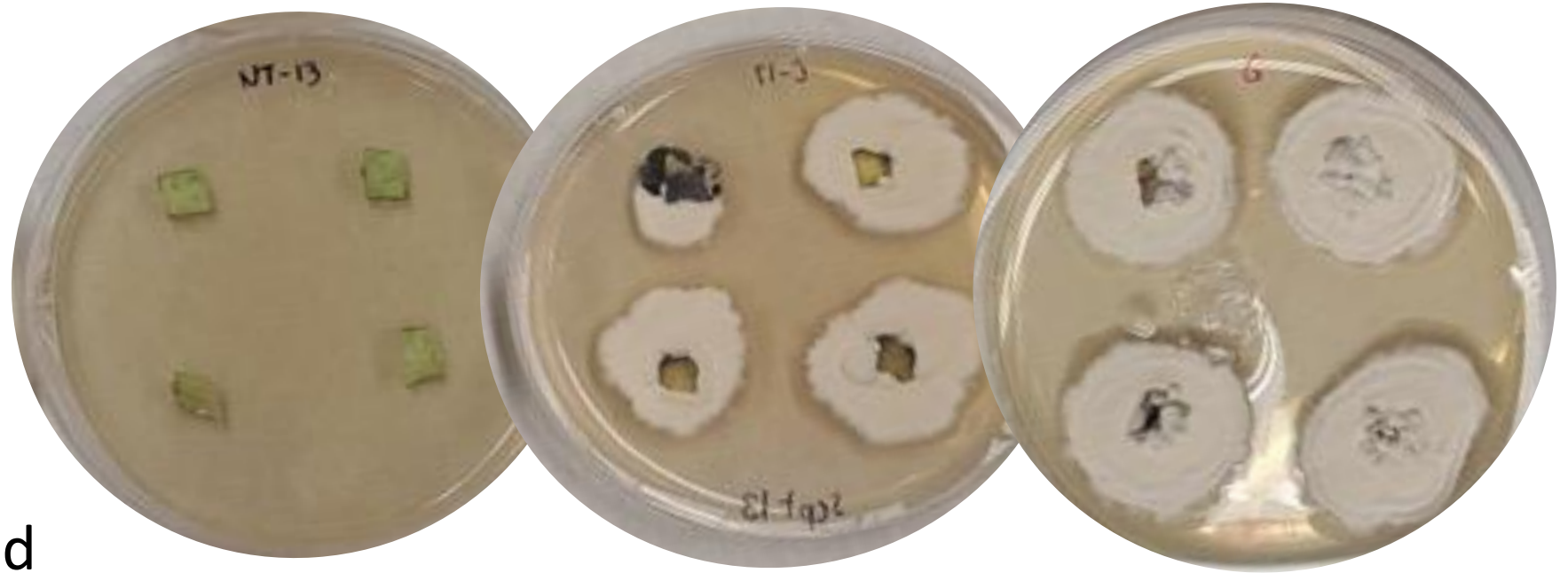
Assess after 8 weeks

* Soil naturally infested with *P. brassicae*

Methods

Endophyte colonization

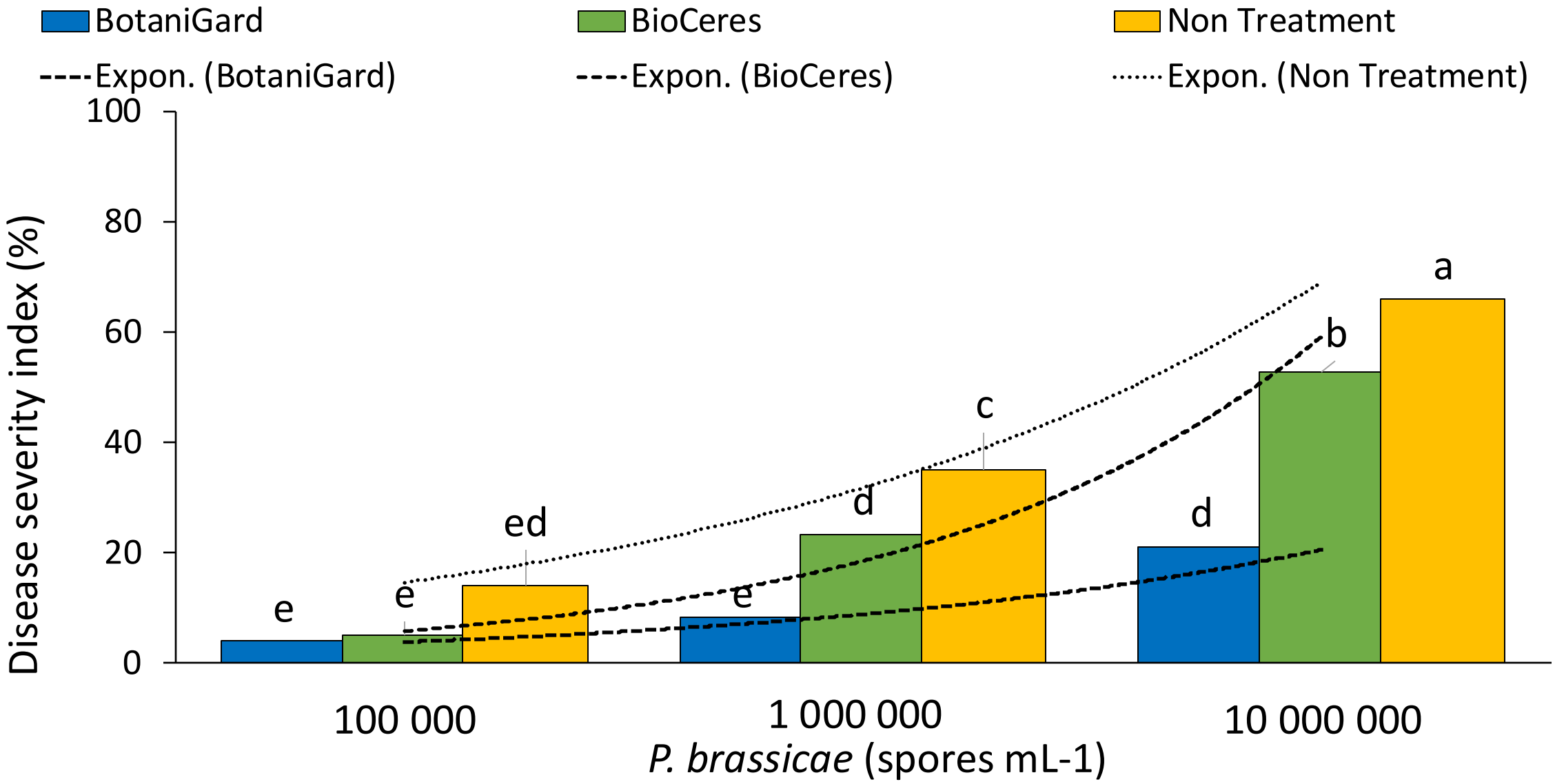
- 16 samples per experimental unit
- Surface sterilized
- Plated on PDA
- Colonization assessed after 14 days



(a) Non-Treatment (control) **(b) BioCeres** **(c) BotaniGard**

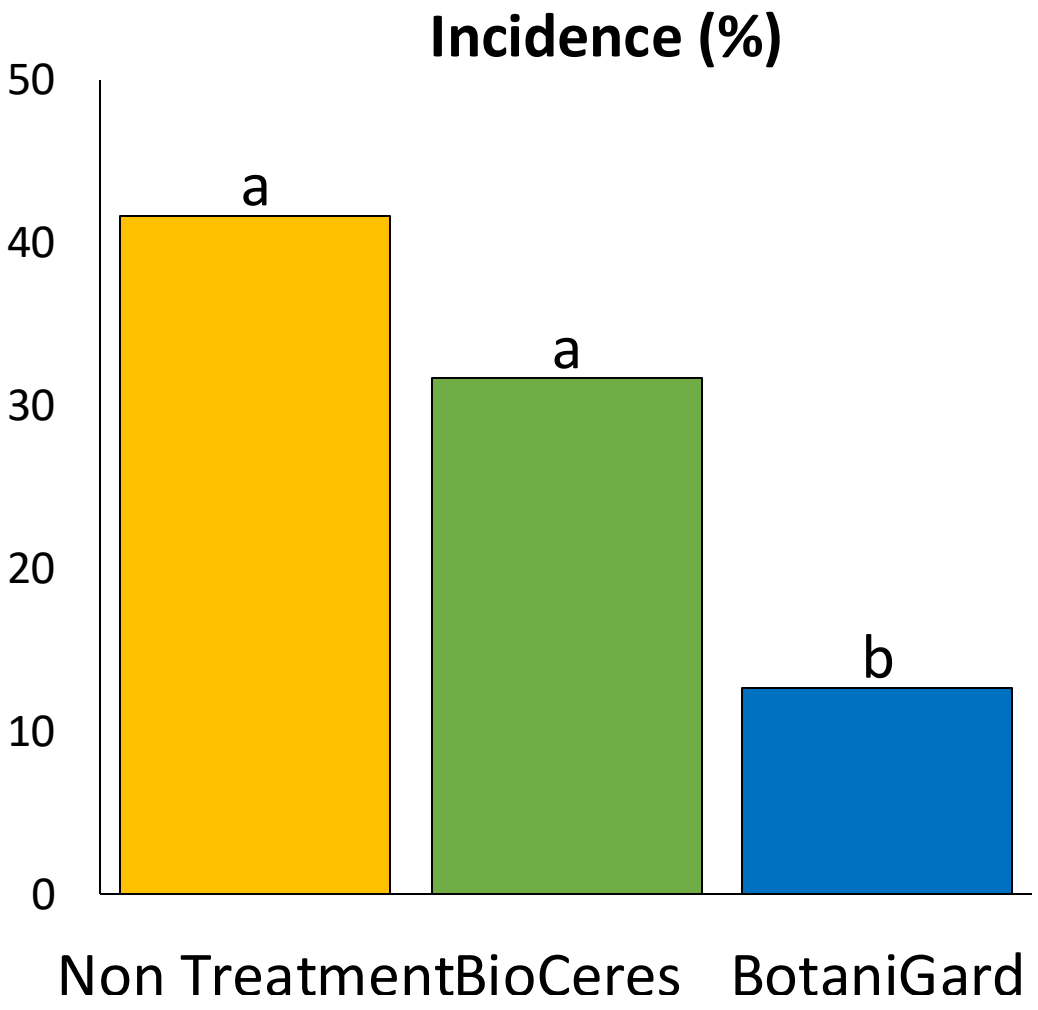
Results
Growth room study

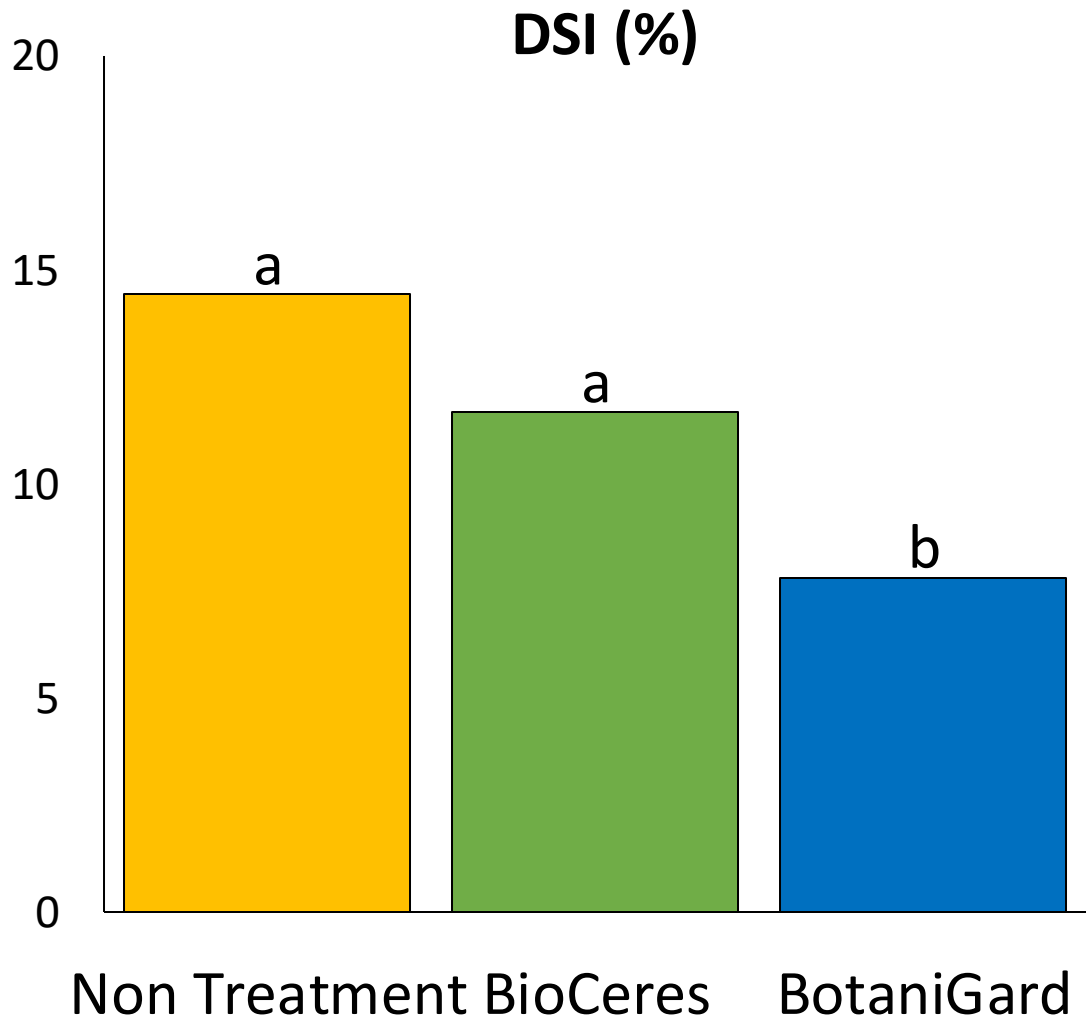
* 3 combined runs



Results

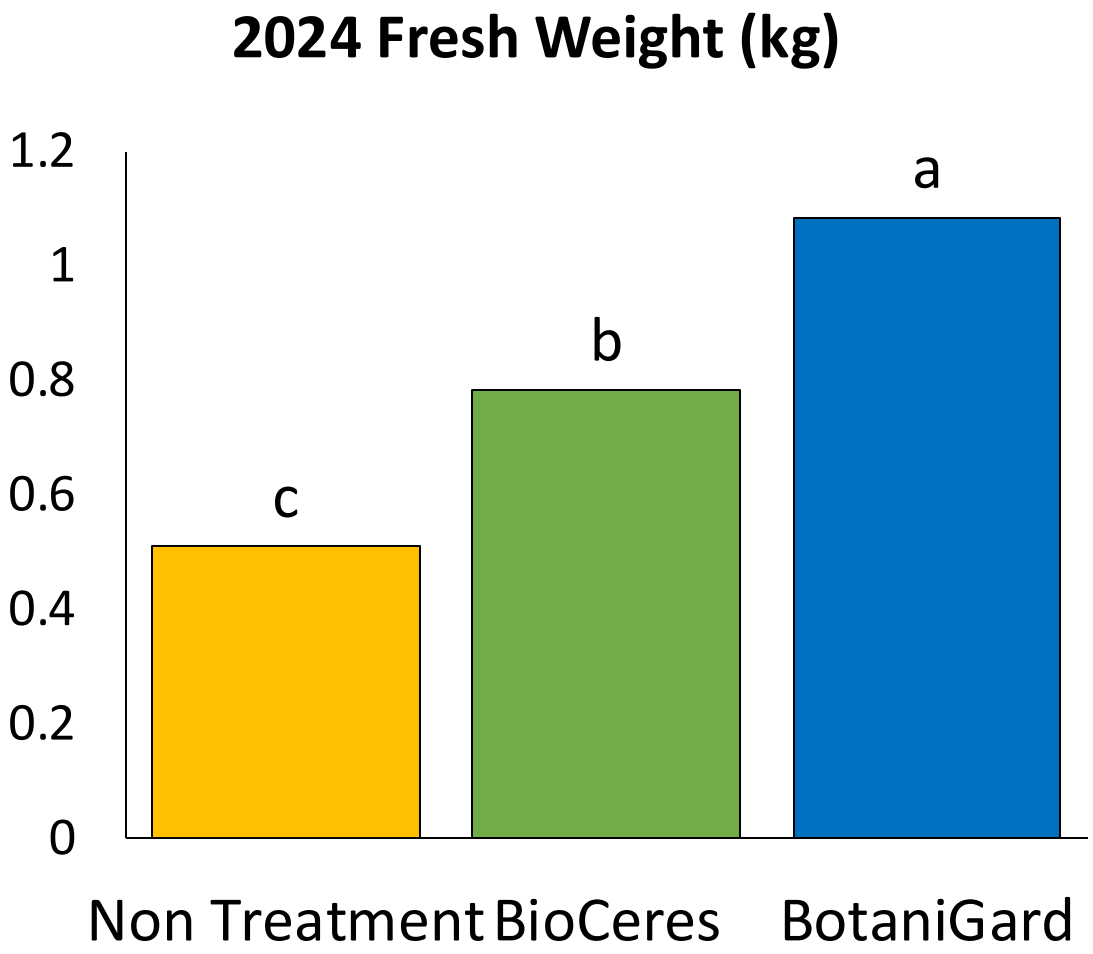
Clubroot 2025 field trial

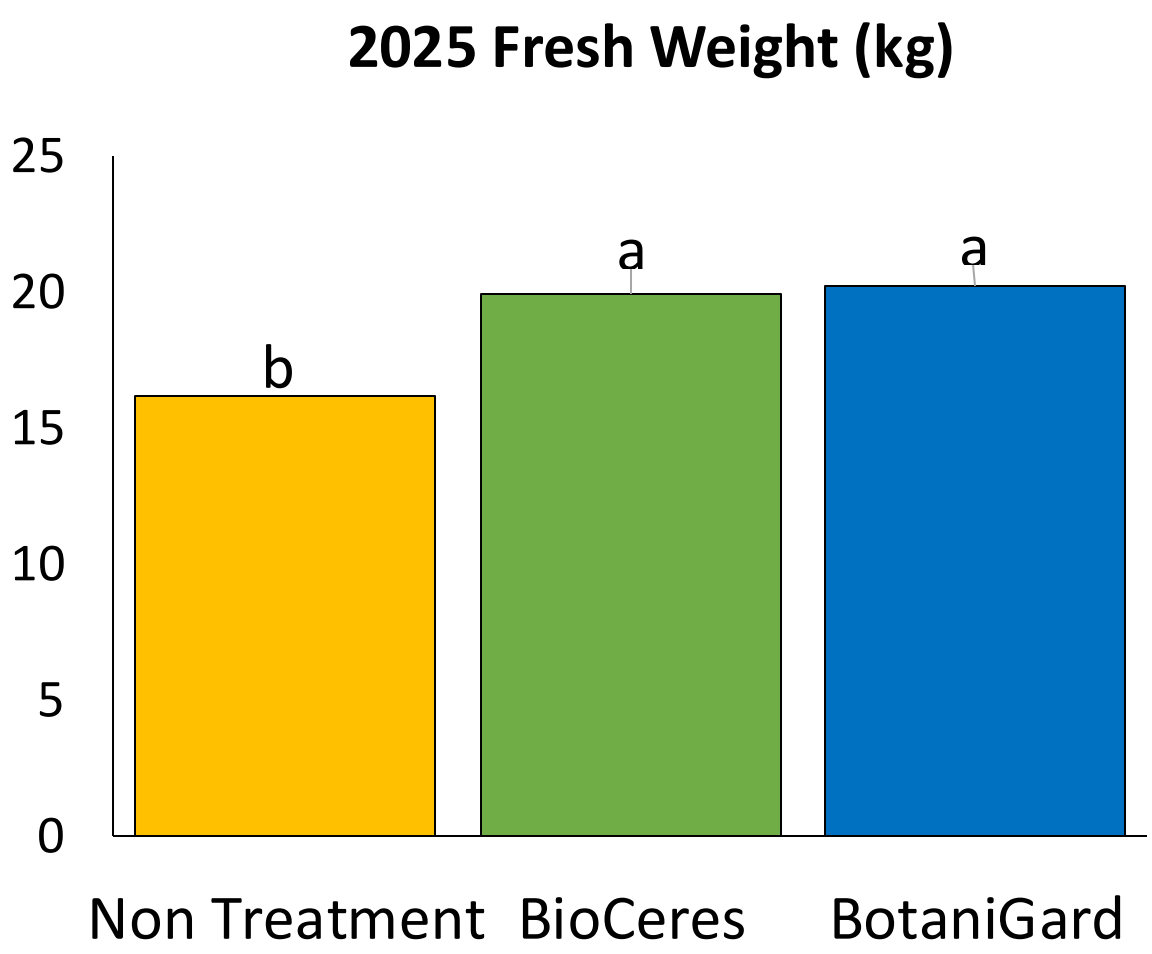




Results

Plant growth promotion





Results
Endophyte colonization

- Colonization rates were similar between runs in the growth room
- Colonization dropped to 0% at final assessment in the field

Treatment	Growth Room (%)		2024 field (%)		2025 field (%)	
	28 dpi	70 dpi	28 dpi	98 dpi	28 dpi	98 dpi
BioCeres	40	36	40	0	35	0
BotaniGard	70	67	62.5	0	65	0

Results
Insect damage

No significant differences among treatments for caterpillar presence or feeding damage on leaves

Larvae of imported cabbageworm

Chrysalid of imported cabbageworm

Adult butterfly of imported cabbageworm

Key Takeaways!

✅ **BotaniGard** reduced clubroot severity in both growth room studies and in the field (2025 only).

✅ *B. bassiana* improved plant growth with and without the presence of *P. brassicae* in the field.

❌ Did not reduce insect damage in the field.

Discussion

- Why did **BotaniGard** outperform **BioCeres**?
- Why did colonization drop to 0% at final assessment in the field?
- Will this work on other brassica vegetables?

Acknowledgements

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Questions?