

From nematode nightmare to yield triumph?

Evaluating biological agents' effect on lettuce cultivation in Costa Rica

Introduction

- Root-knot nematodes (*Meloidogyne spp.*) reduce yields in vegetable cultivation in the Cedros community garden in San José, Costa Rica.
- To enhance plant resistance and control nematodes, three different liquid biological agents have been applied for the past three years.

Nematobiol: a nematicide containing:

Paecilomyces lilacinus

Fungus which parasitizes nematode eggs



Fertibiol: a biofertilizer containing:

Bacillus subtilis, *Bacillus amyloliquefaciens*,
Pseudomonas fluorescens, *Atzotobacter chroococcum*

N-fixing and P-solubilizing bacteria



Trichobiol: a biofertilizer & biocontrol agent, containing:

Trichoderma asperellum, *Trichoderma asperelloides*,
Trichoderma guizhouense

Rhizospheric fungi boosting plant defense mechanisms



- Despite their continued use, the impact of these biological agents on vegetable yields in the community garden had not been investigated prior to this study.
- Research question:** Which of the three biological products (Nematobiol, Fertibiol, Trichobiol) results in a significantly increased lettuce fresh matter yield compared to the control?

Material and Methods

- Two consecutive pot trials with a randomized block design:
May 15 - June 13, 2024, and June 26 - August 7, 2024
- Pots filled with nematode infested soil (35 *Meloidogyne J₂* per 100g of soil) from the garden and mulched according to standard practice of the community garden.
- 4 blocks/repetitions á 4 pots
- 4 lettuces per pot

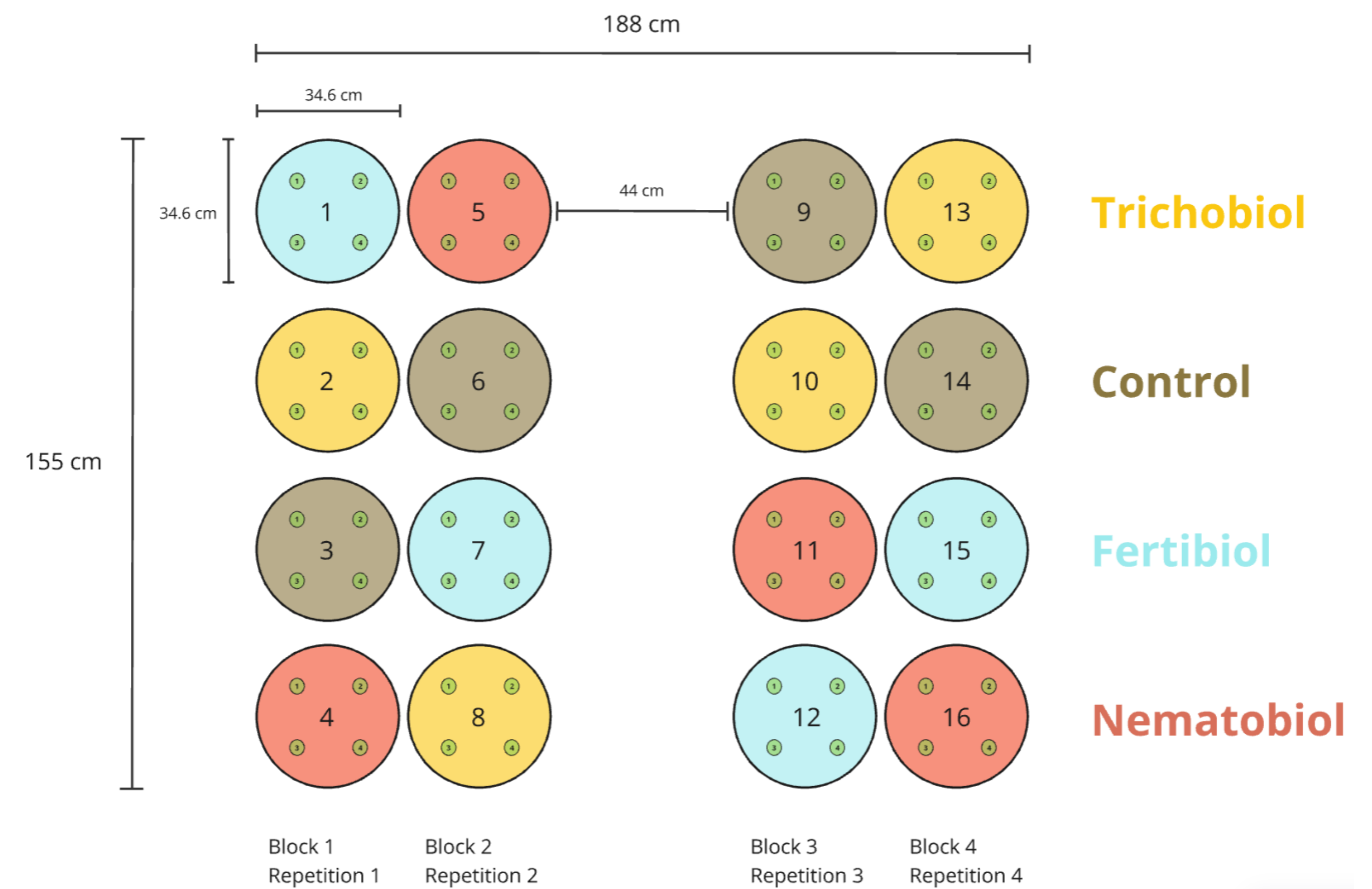


Fig.1: Trial plot design with 16 pots in 4 blocks/repetitions, each containing 4 treatments (blue = Fertibiol, red = Nematobiol, yellow = Trichobiol, brown = control) (created by the author)

- 1 application per week with 50 ml of biological product per liter of water
- Weighing fresh matter per pot after harvesting

Results Trial 1

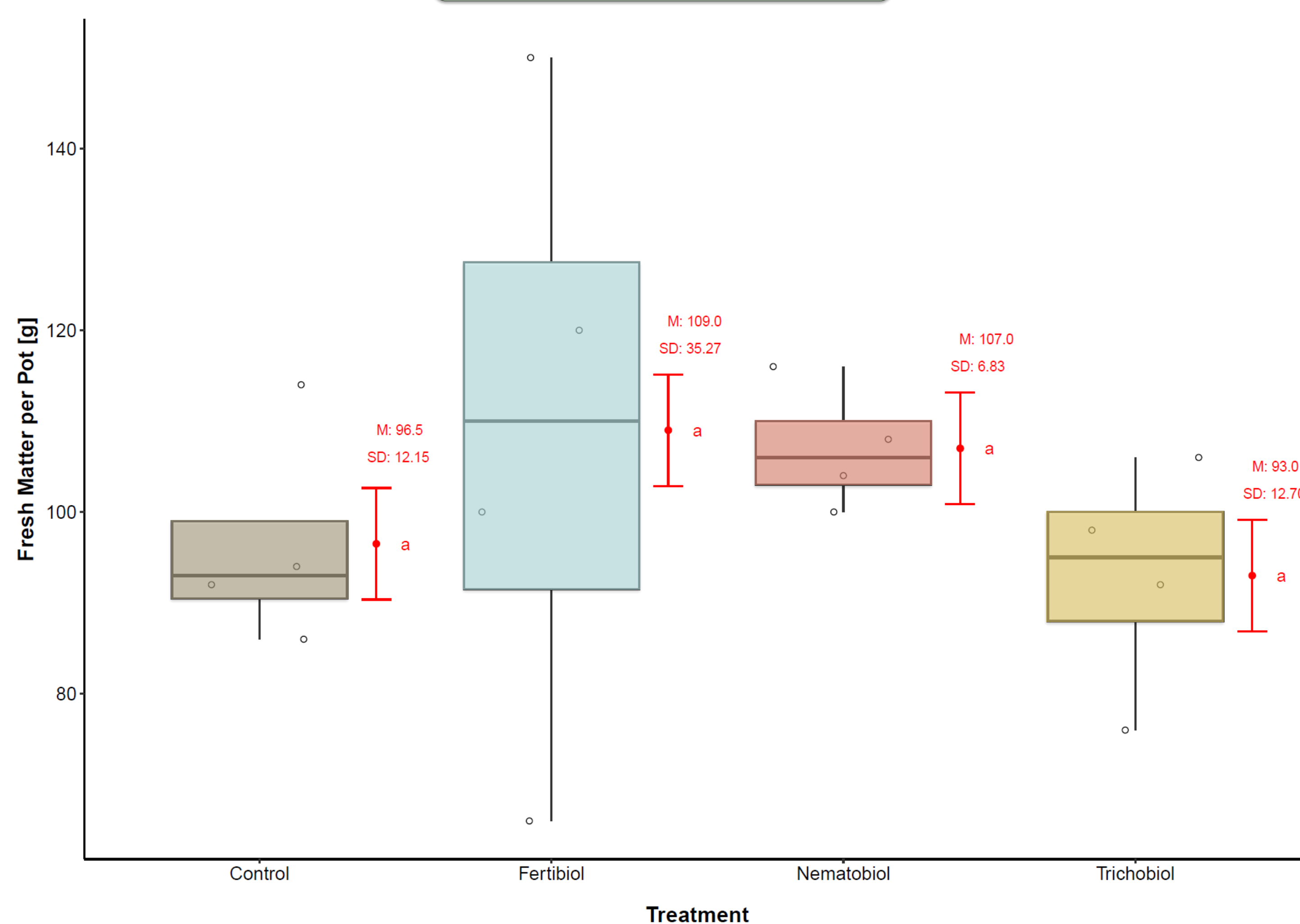


Fig. 2: Average fresh matter yield in grams per pot and treatment in the first trial, M = mean, SD = standard deviation (Graphic: Author's own, created in R)

- No significant differences in fresh-matter yield between the treatments and the control
- Trend toward higher yields in Fertibiol and Nematobiol treatments



Fig. 3-6: Condition of the lettuces and their roots when harvesting the plants from the first trial (Photos: Author's own)

Results Trial 2

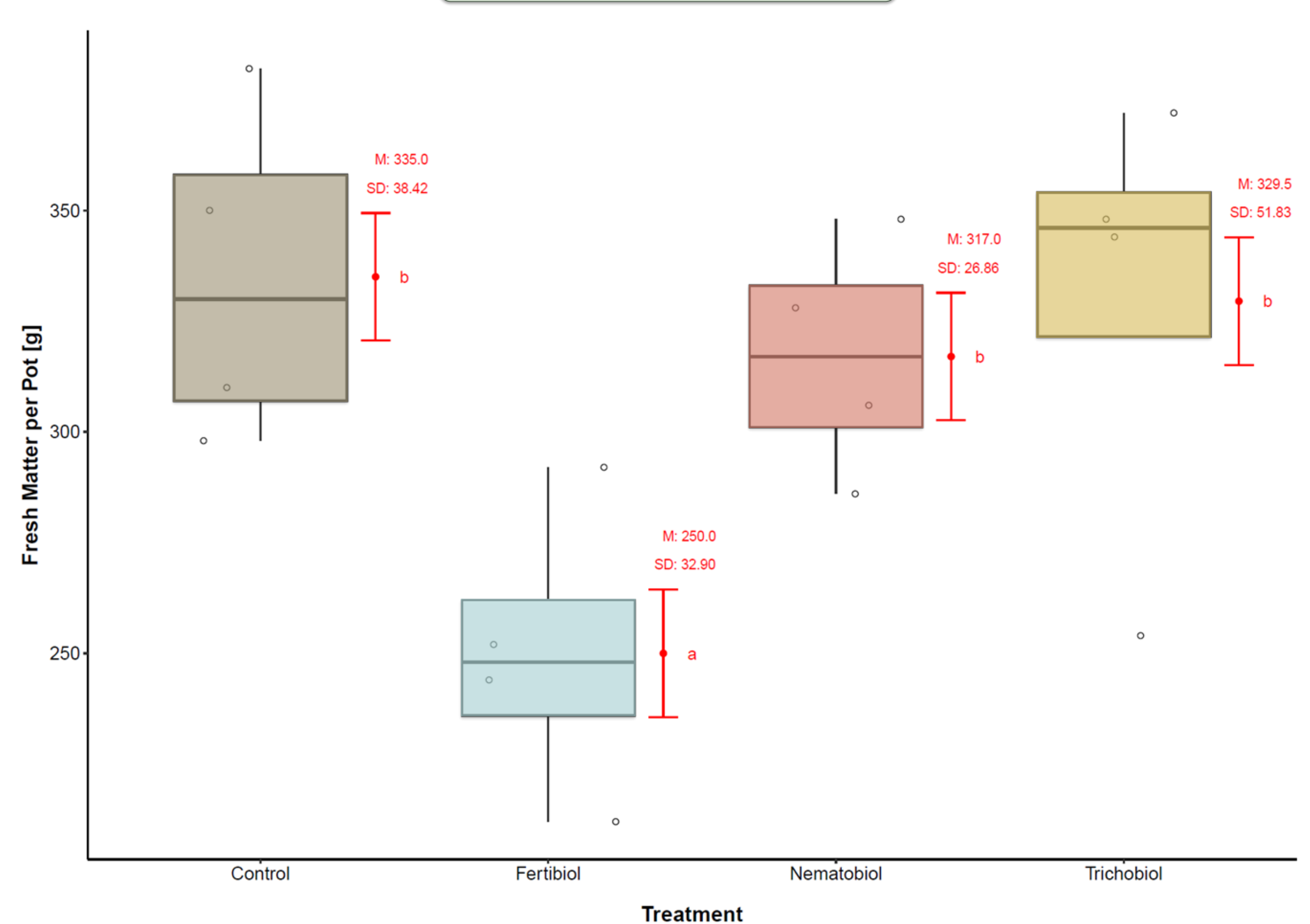


Fig. 8: Average fresh matter yield in grams per pot and treatment in the second trial, M = mean, SD = standard deviation (Graphic: Author's own, created in R)

- Fresh matter yield in Fertibiol significantly lower than in all other treatments
- No trend toward higher fresh matter yield in Nematobiol anymore



Fig. 9-12: Condition of the lettuces and their roots when harvesting the plants from the second trial (Photos: Author's own)

Conclusions

- Products had less effect on fresh matter yield of lettuce than expected
- Effect on fresh matter yield of Nematobiol and Fertibiol was bigger under disease pressure and high nematode infection
- Having root-knot nematodes in the soil does not automatically result in yield decrease
- Possibility of a negative effect on the plants by *Bacillus subtilis* in the Fertibiol treatment which needs further investigation