



Preliminary results on the control of Fusarium wilt on lettuce and tomato by insect frass

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INTRODUCTION

- Tomato is among the **most consumed** vegetables in the world. In Italy 507'256.7 tons were produced in 2023 (ISTAT)
- Lettuce is a **high value crop**

Both are cultivated in **intensive systems**, in open field or in greenhouse, on natural soil or growing media.

Fertilizers and **pesticides** are generally applied on both crops.

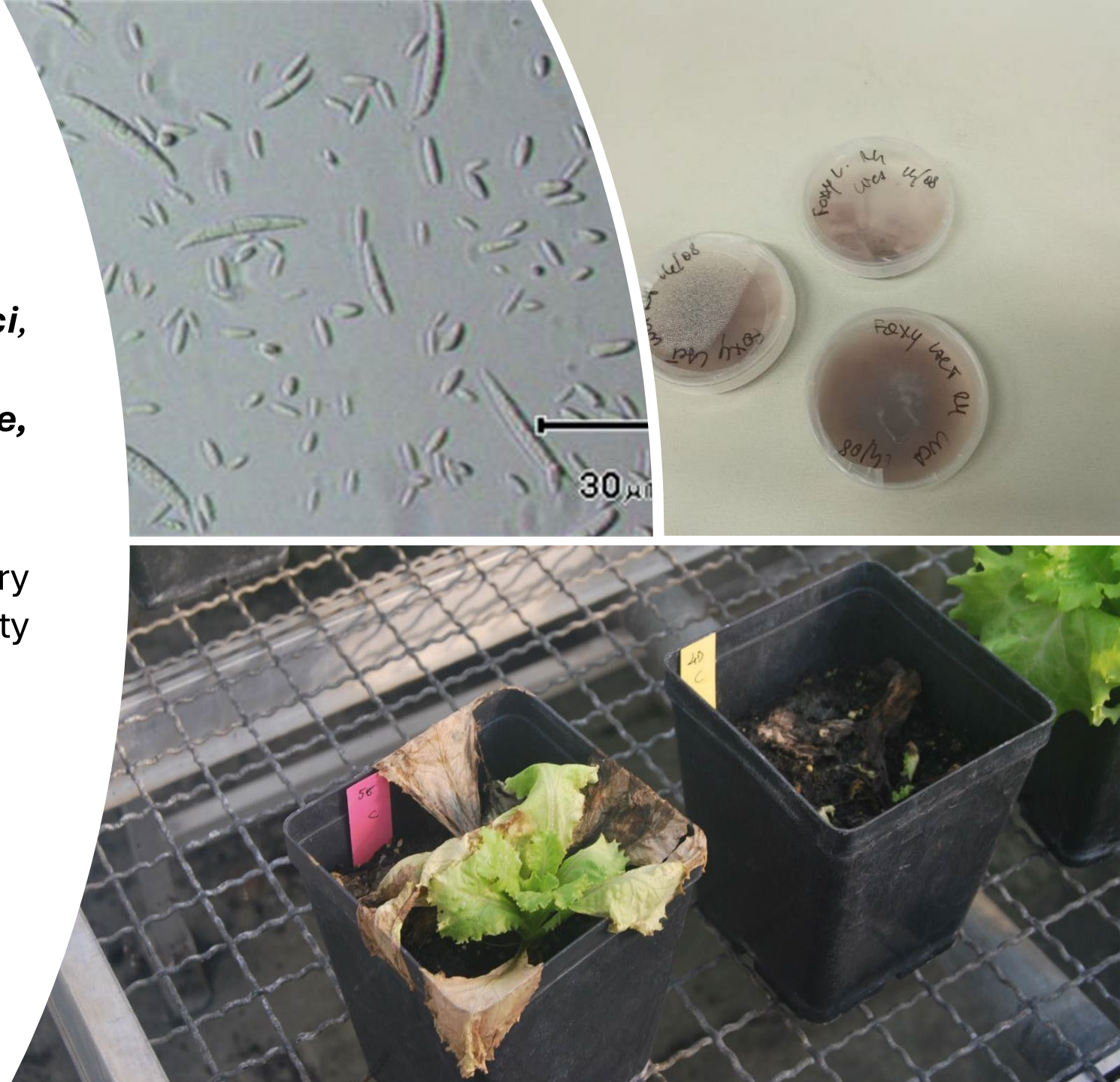


INTRODUCTION

Fusarium genus includes 50 species:

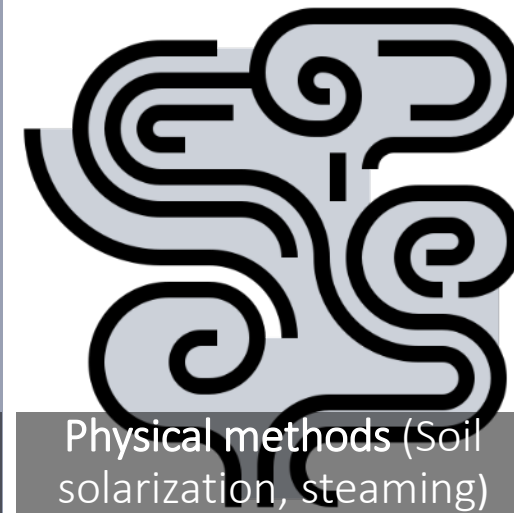
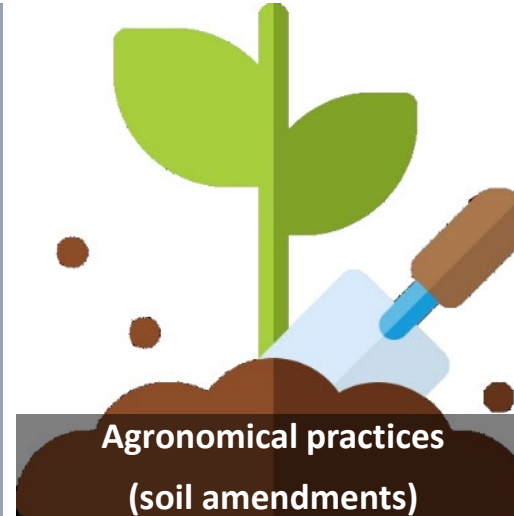
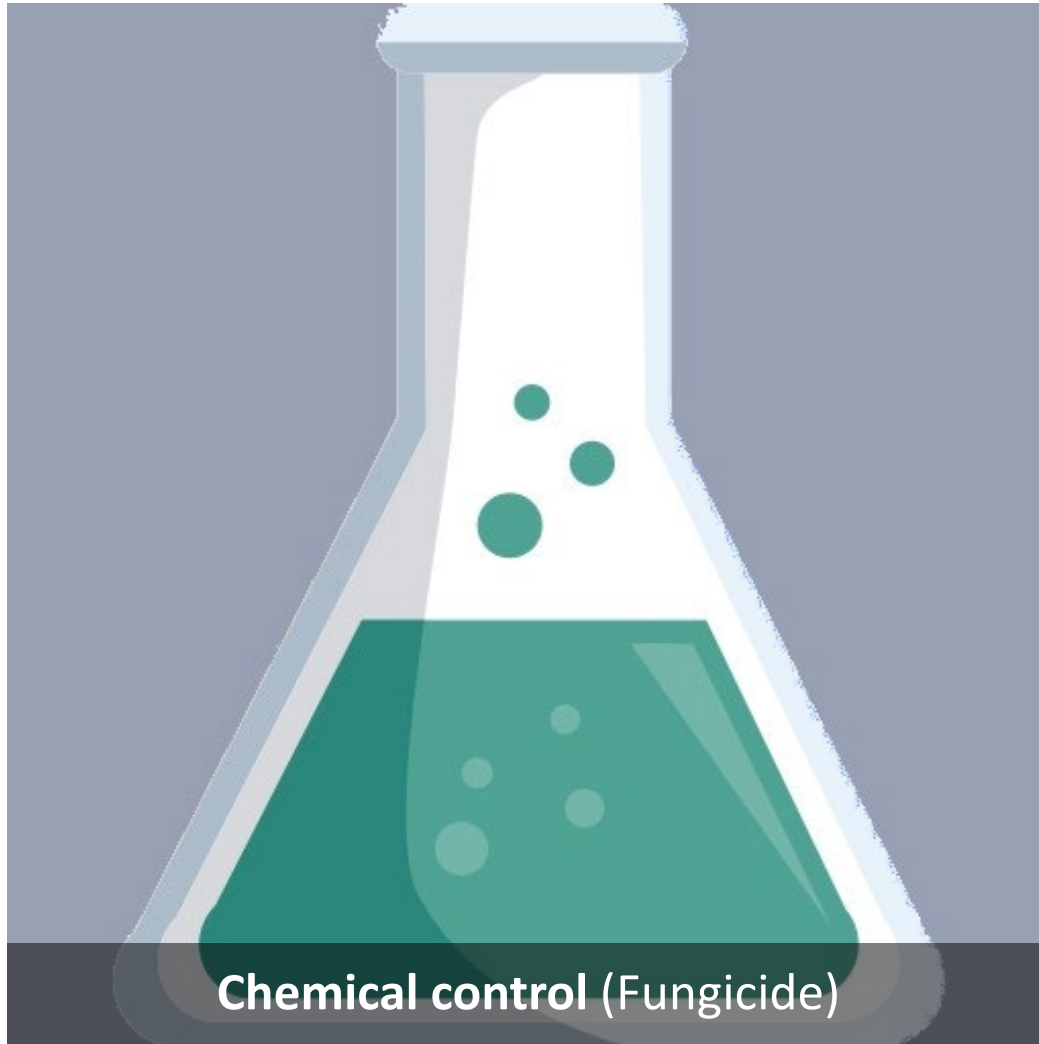
- *Fusarium oxysporum* f. sp. *lycopersici*, causing **Vascular wilt of tomato**
- *Fusarium oxysporum* f. sp. *lactucae*, causing **Fusarium wilt of lettuce**.

Symptoms: wilt of the plants, yellowing, dry leaves with consequently weight and quality reduction.



INTRODUCTION

Different approaches to control plant diseases:



INTRODUCTION

FRASS

Frass Hi is the by-product of rearing the insect *Hermetia illucens*, consisting of exuviae and droppings.

Frass Hi, as reported in various studies, is able to effectively control *Fusarium oxysporum* f. sp. *tracheiphilum* in vitro (Arabzadeh *et al.*, 2023) and on cowpea crop (Quilliam *et al.*, 2019).

This is probably due to the **elicitor activity** towards plants due to:

- the presence of **chitin** and **chitosan**;
- **amino acids, humic substances, phytohormones, and beneficial microbes** (Manan *et al.*, 2024).



OBJECTIVES

The objectives of this work are to evaluate the **efficacy** of **Frass Hi** in **controlling *Fusarium oxysporum*** on tomato and lettuce, and its **fertilizing effect** on these crops.



This aims to enhance the use in agriculture of natural substances obtained from sustainable production systems. These goals arise from the need to achieve the targets outlined in the European Green Deal:

- to reduce the use of chemical pesticides and mineral fertilizers by 50% by 2030;
- to improve organic farming by 25%.



MATERIALS AND METHODS

Insect frass was produced by Prof. Gasco research group at University of Torino. Insects *Hermetia illucens* were fed with **Gainsville diet**, composed by **50% wheat bran**, **30% alfalfa meal**, and **20% corn meal**.

N,P,K chemical composition: 2.01%; 1.94%; 3.65% (Arabzadeh et al., 2022).



Part of the frass was **heat-treated** according **EU REGULATION N. 142/2011**

Frass both thermally treated and untreated was applied to **substrate in nursery pots at different concentrations (v/v)%: 0% , 1%, 2%, 5%, 10%, 20%**

MATERIALS AND METHODS

After 4 weeks, plants were **transplated** in 2 liter pots, previously inoculated with *Fusarium oxysporum* f. sp. *lycopersici* or *Fusarium oxysporum* f. sp. *lactucae*.

An **untreated control** and a **chemical control** (*ENOVIT METIL*® *FL*, thiophanate-methyl, systemic fungicide, first application 0,14 ml/l, second application 0,5 ml/l) were also considered.

One tomato plant and 2 lettuce plants were transplanted in each pot. In total, 5 pots/treatment were considered.

After 4 weeks from transplanting the disease **incidence** and **severity** were analyzed.

The **disease incidence (DI)** (Chaudhary et al., 2003) corresponds to the percentage of diseased plants.

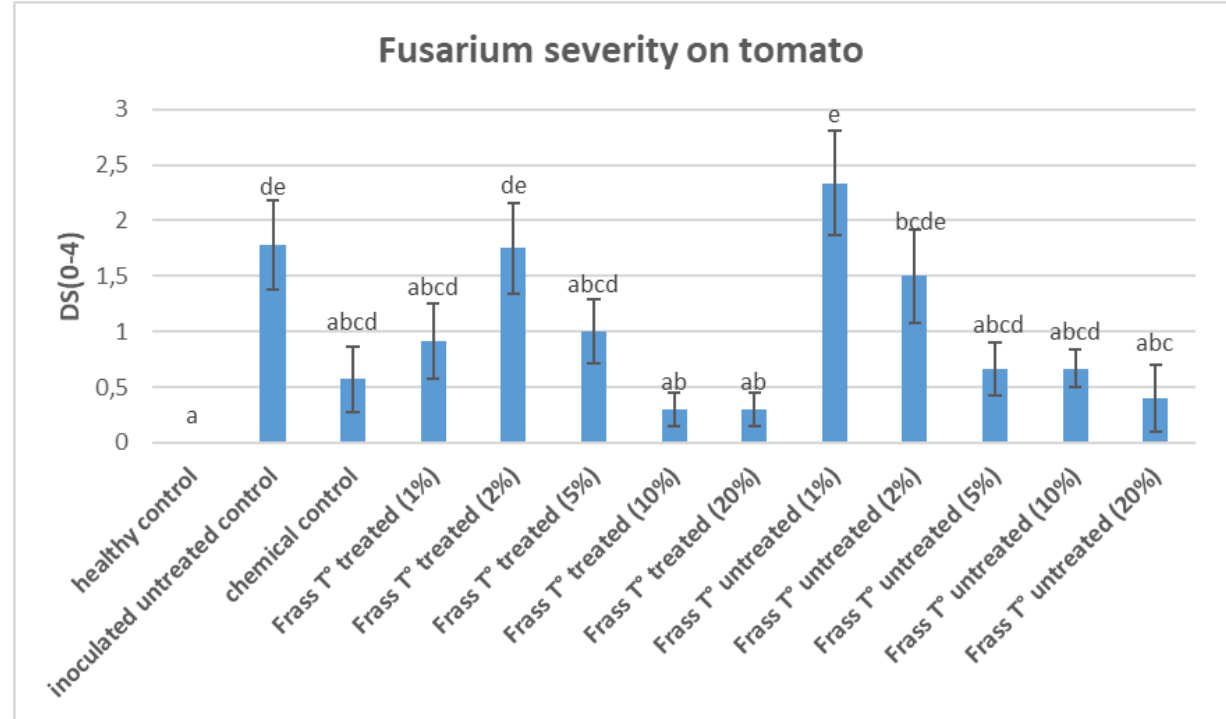
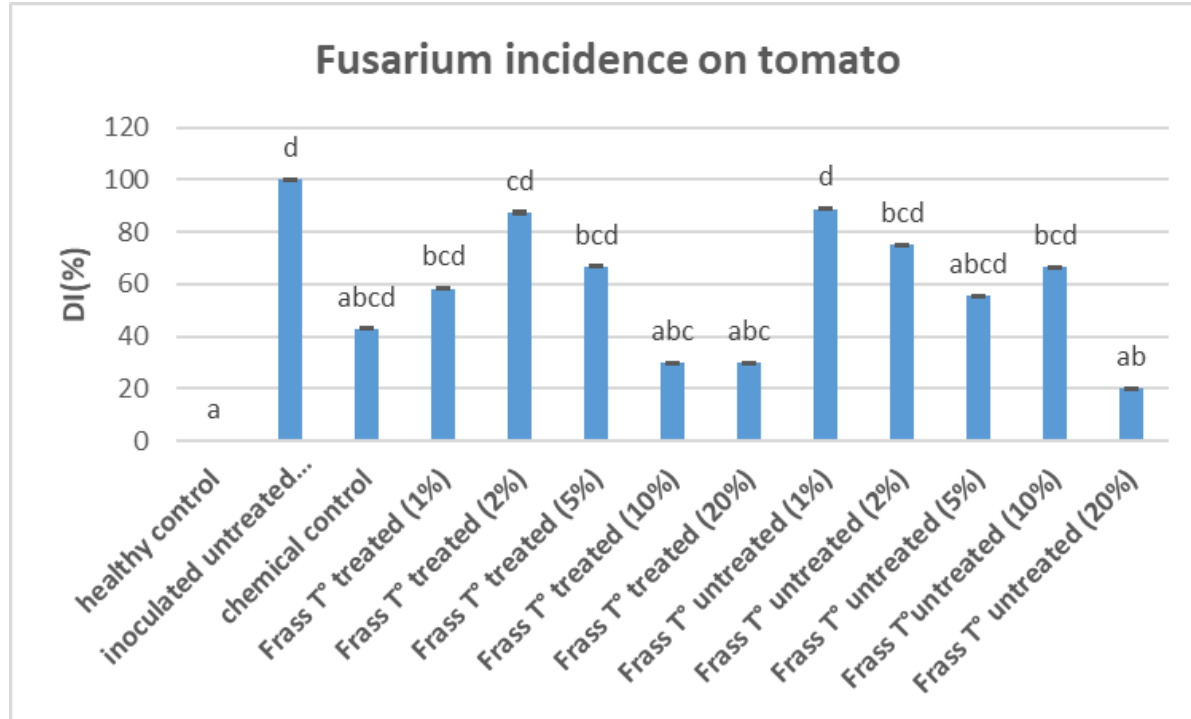
The **disease severity (DS)** was scouted evaluating the **browning of the vessels**, the presence of other symptoms as **chlorosis**, **growing reduction**, with a value range from 0 (healthy plant) to 4 (dead plant).

Above ground biomass of the plants **not inoculated** was also weighted at the end of the trials.



Results

Tomato

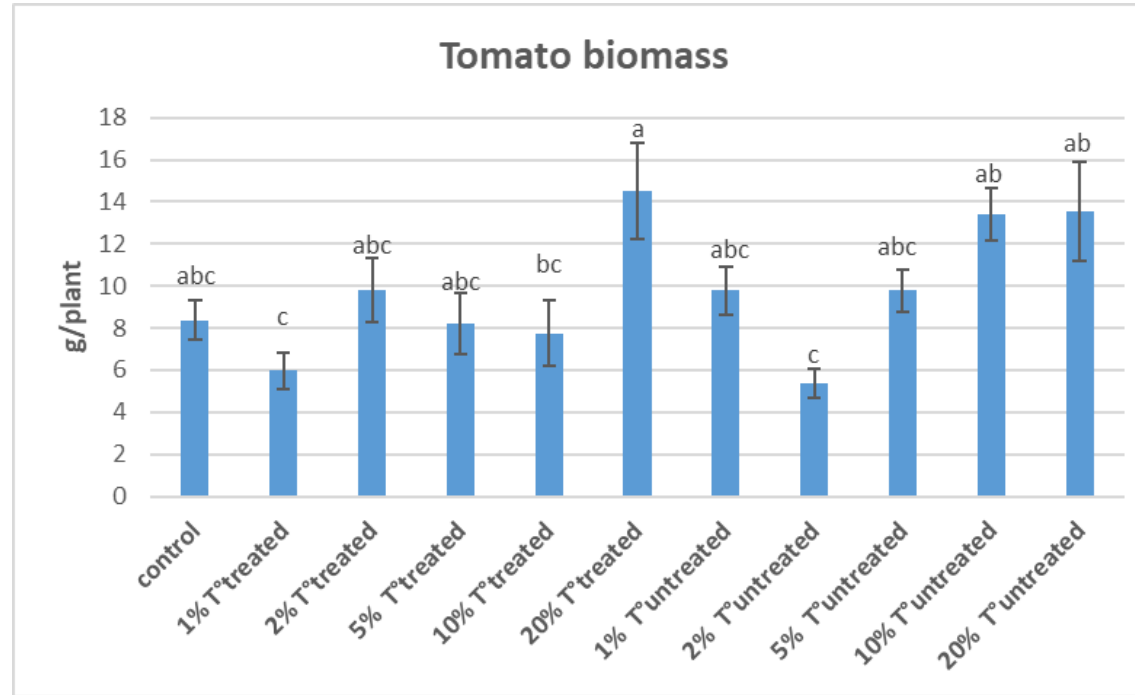


Tukey: different letters correspond to statistically different values, $P(f) < 0.05$

Disease incidence and severity were significantly reduced on tomato by heat treated frass applied at 10-20%, and by untreated frass at 20%.

Results

Tomato



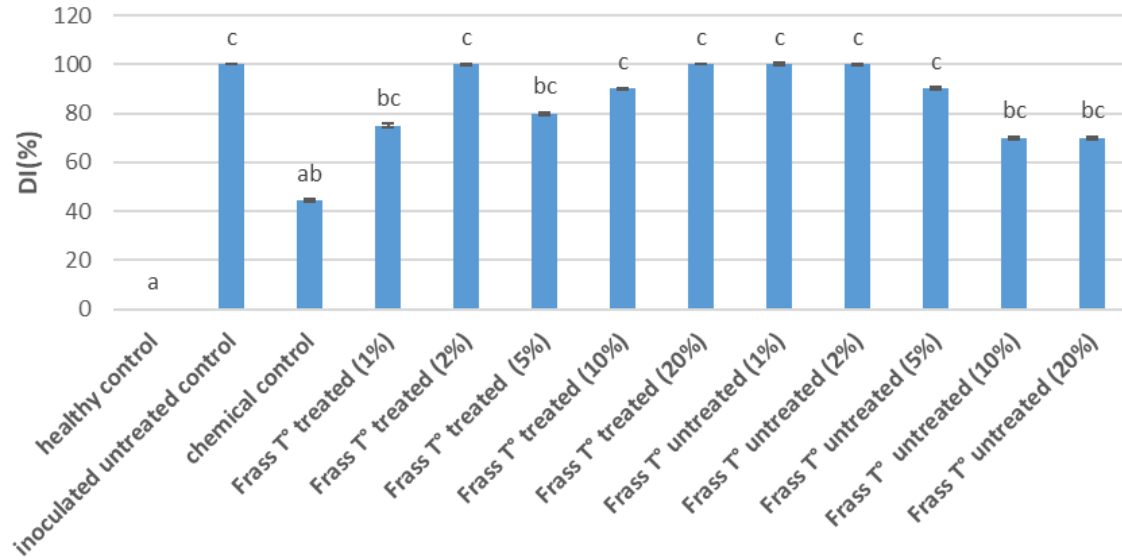
Tukey: different letters correspond to statistically different values, $P(f) < 0.05$

Tomato plants grown with 20% heat treated frass showed the highest fresh weight of above ground fresh biomass, although the differences were not significant compared to untreated control.

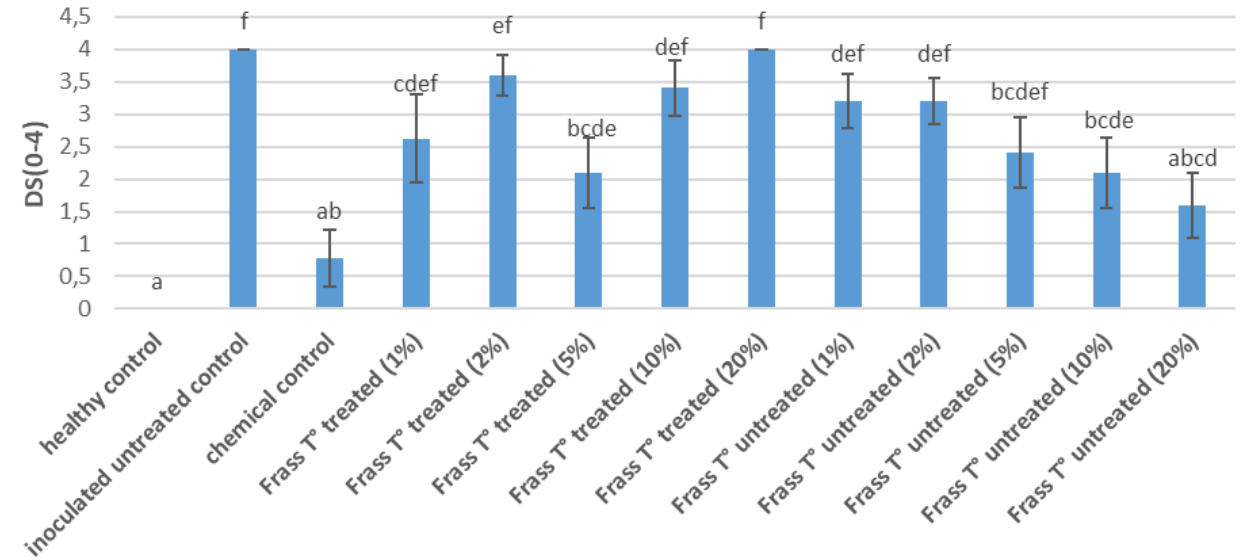
Results

Lettuce

Fusarium incidence on lettuce



Fusarium severity on lettuce



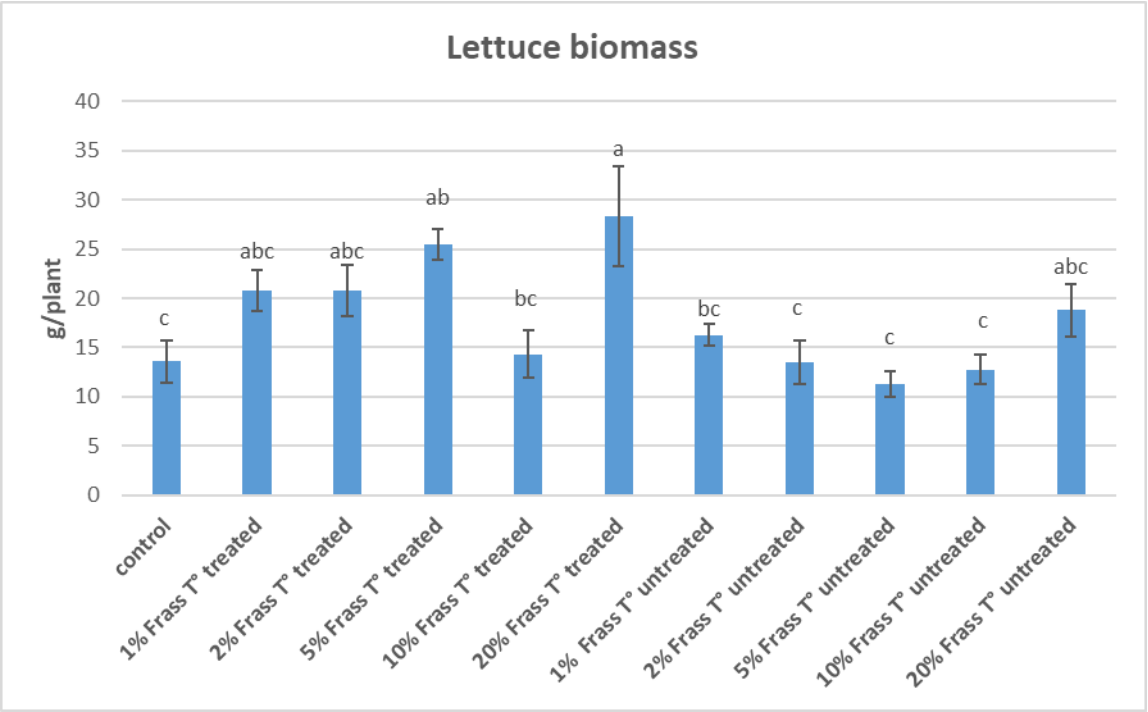
Tukey: different letters correspond to statistically different values, $P(f) < 0.05$

Disease incidence was not reduced by frass.

Disease severity was significantly reduced on lettuce by heat treated frass applied at 5%, and by untreated frass at 10-20%.

Results

Lettuce



Tukey: different letters correspond to statistically different values, $P(f) < 0.05$

Lettuce plants grown with 20% heat treated frass showed the highest fresh weight of above ground fresh biomass.



CONCLUSIONS

Although more trials are necessary to confirm the results, considering also the application of frass in potting soils, in conclusions:

- Thermally untreated frass applied at 20% v/v was effective on both tomato and lettuce to significantly reduce Fusarium wilts.
- The suppressive effect of heat-treated frass was more crop/pathogen dependent.

Is this due to the presence of microbial antagonists in untreated frass? Under investigation.

- Heat treated frass applied in nursery at 20% v/v led to higher above ground biomass of both tomato and lettuce plants.

The application at nursery stage stimulated an increase in plants development: is this effect due to any substance? Needs to be investigated.



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THANKS FOR YOUR ATTENTION

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