

The effect of biochar and compost on plant pathogens and the microbial community in soil

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Institute for Agricultural and Fisheries Research

Plant Sciences Unit

www.ilvo.vlaanderen.be

Agriculture and Fisheries Policy Area

Compost vs biochar

Compost	Biochar
Organic soil amendments: recycling organic waste	
<p>...by composting</p> <ul style="list-style-type: none">- with oxygen (aerobic decomposition)- phase 1: 50-70°C, phase 2 < 40°C- → full of microbes, but large effect of high temperature 	<p>....by pyrolysis</p> <ul style="list-style-type: none">- without oxygen- 200-600°C (thermal decomposition)- → 'sterile', habitat for microbes 

Compost vs biochar

Compost	Biochar
C-source	
Source of stable organic matter	Long term carbon storage in soil → global warming
Fertiliser	
"Slow release fertilizer"	Slow release or immobilisation
Effect on plant pathogens	
> 500 publications <ul style="list-style-type: none">- Reported levels of disease suppression = variable- The mechanisms involved not fully understood	< 10 publications <ul style="list-style-type: none">- Research group in Israel (Elad)- Induced resistance on strawberry and pepper – change in rhizosphere microbiology

Research on compost & biochar vs pest & diseases @ ILVO

- 2003-2004: Resistance to air-born diseases and pests induced by compost in substrate cultivation of strawberry
- 2010-2013: FOD  project: *Meloidogyne chitwoodi* = root knot nematode
- 2011-2015: PhD Negin Ebrahimi: The effects of soil amendments on survival and reproduction rate of *Globodera rostochiensis* and *G. pallida* = potato cyst nematode
- 2012-2016: EU project  : reducing mineral fertilizers and agro-chemicals by recycling treated organic waste as compost and biochar

Strawberry & air-born diseases & pests

- Treatments:
 - Peat + mineral fertilizer (F)
 - Peat + 30% compost 1/ compost 2 (M1/M2)
- Natural infections

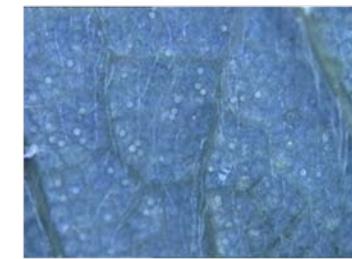
fruit rot (*B. cinerea*)



powdery mildow (*Sphaerotheca maculans* f. sp. *fragariae*)



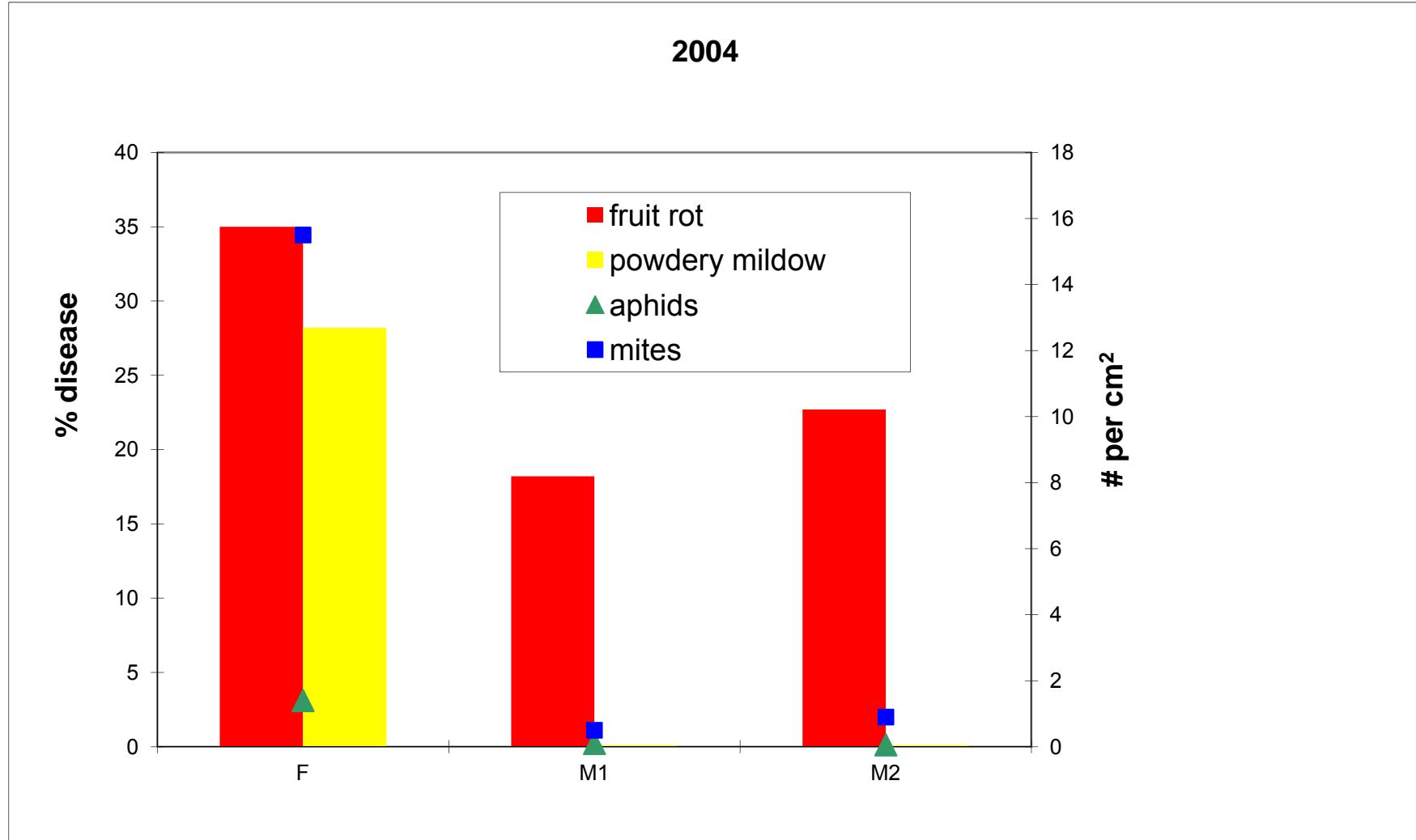
aphids (*Chaetosiphon ragefolii*)



mites (*Tetranychus urticae*)



Strawberry & diseases & pests

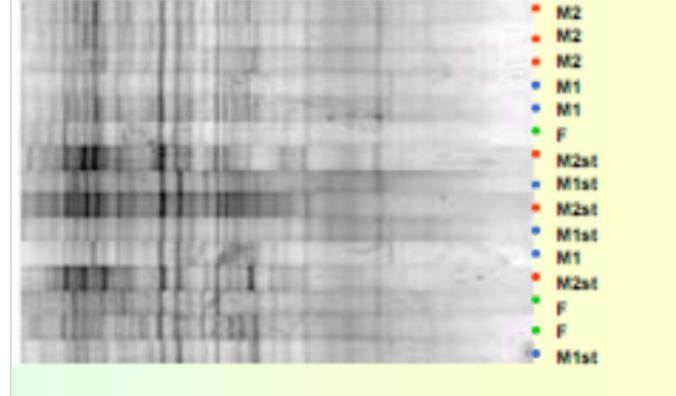


Strawberry & diseases & pests



- 4 days

No clustering



- ≈ 1 month

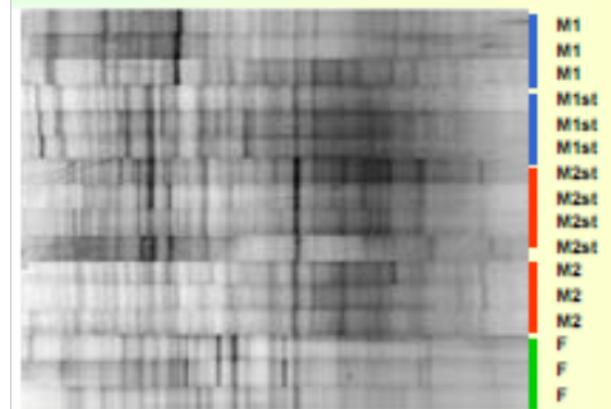
Clustering per object



St = pre-sterilized

- 3 months

Clustering per substrate type



Meloidogyne on bean and carrots

- Less problems with root knot nematodes in soils with high concentrations of organic material
- Treatments (30 ton/ha)
 - wood chip compost
 - wood chip compost 80% + biochar 20%
 - non-amended soil
 - inoculation with J2 (high Pi and low Pi)
- Why compost + biochar?

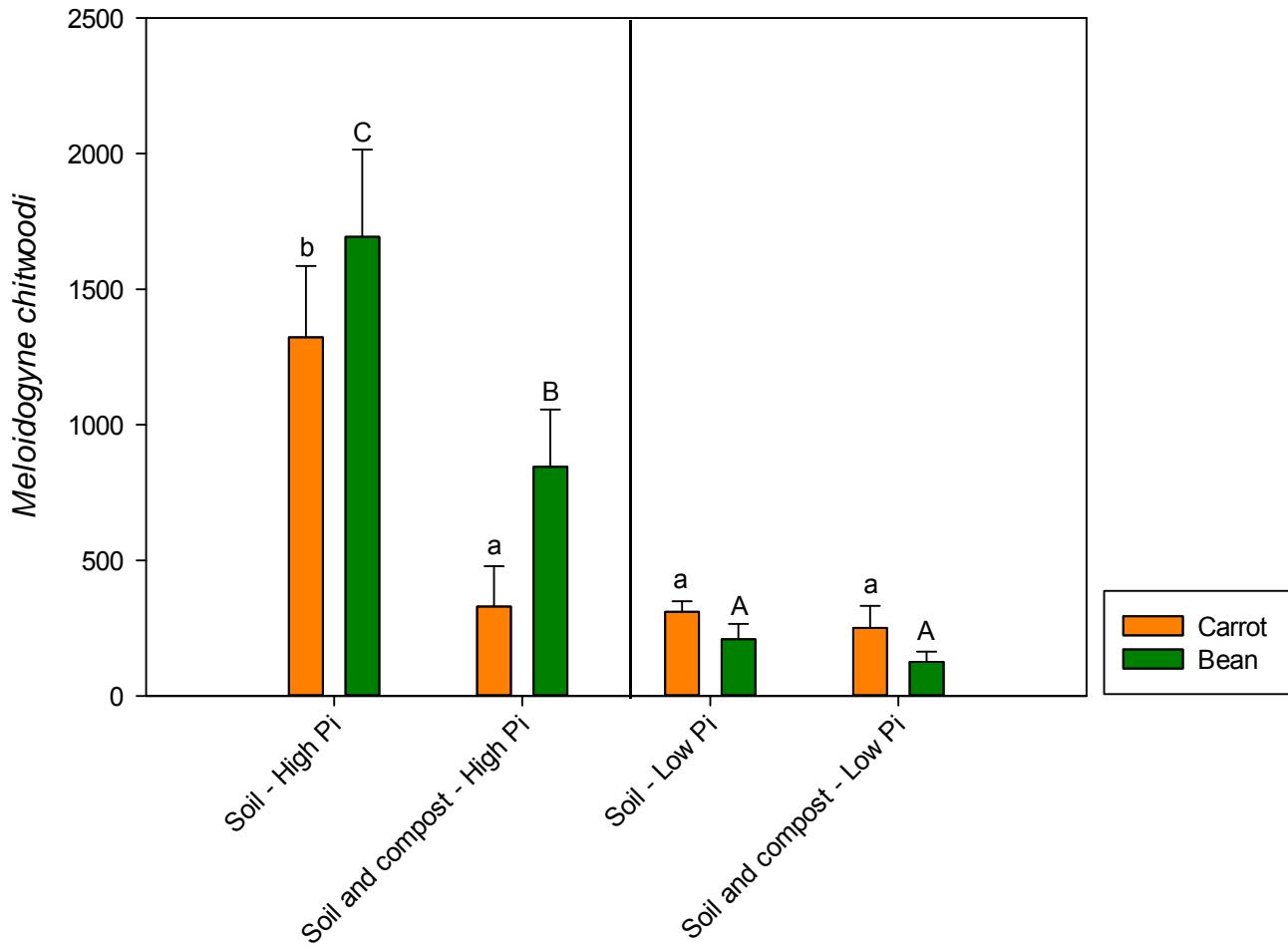


Courtesy W. Wesemael



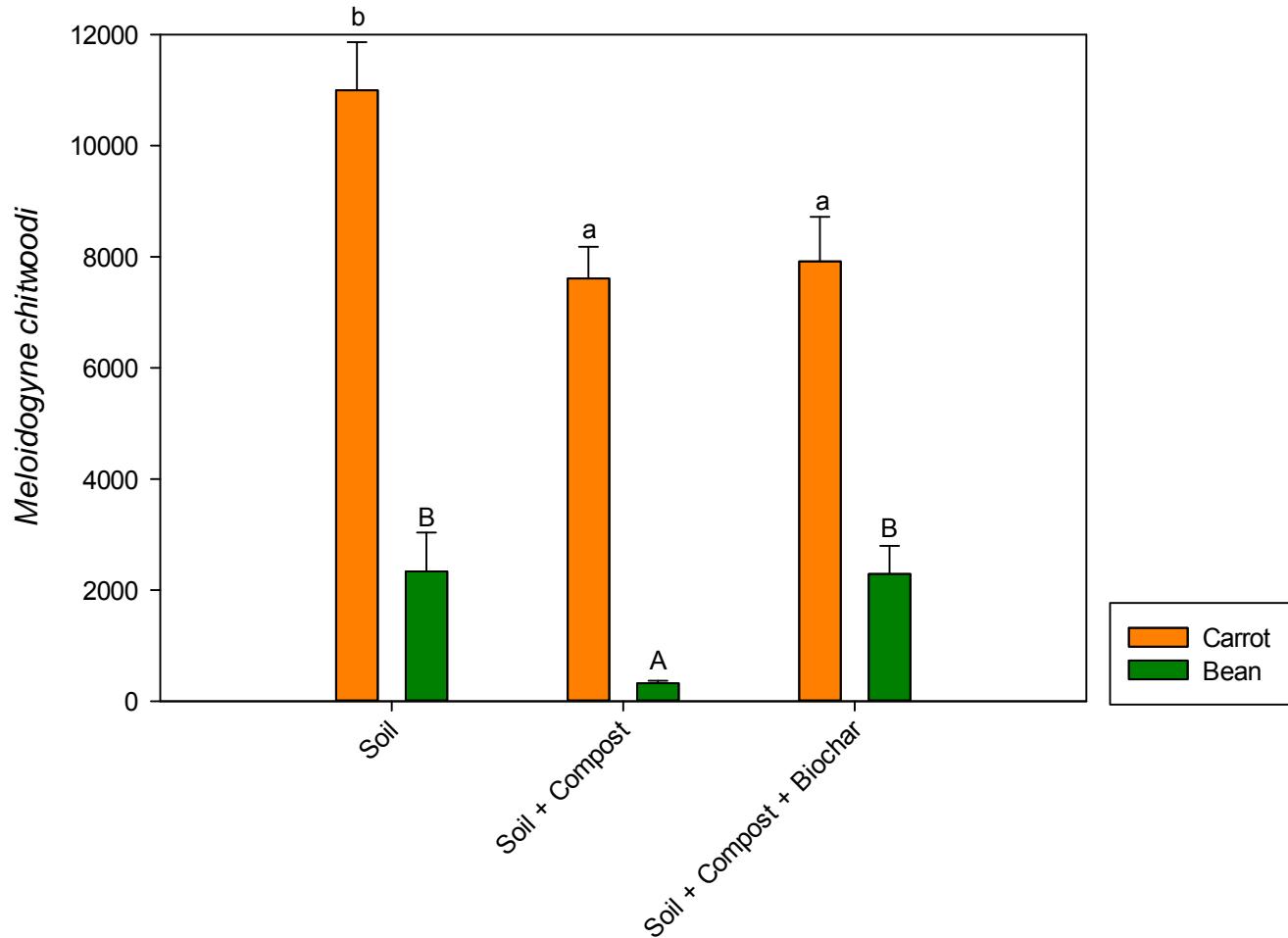
Courtesy W. Wesemael

Meloidogyne on bean and carrots



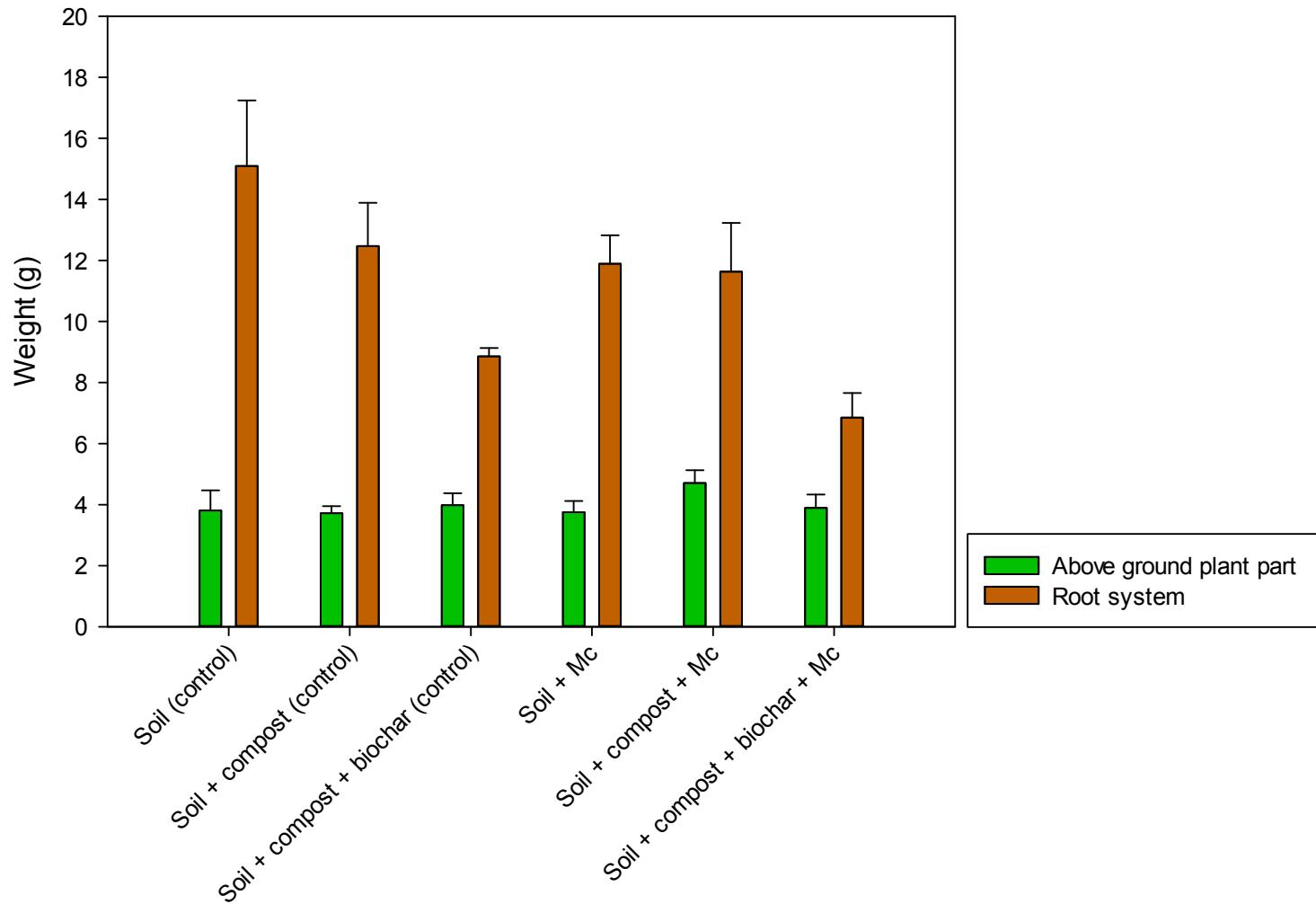
High Pi = 100 J2/100 cm³ soil
Low Pi = 10 J2/100 cm³ soil

Meloidogyne on bean & carrots



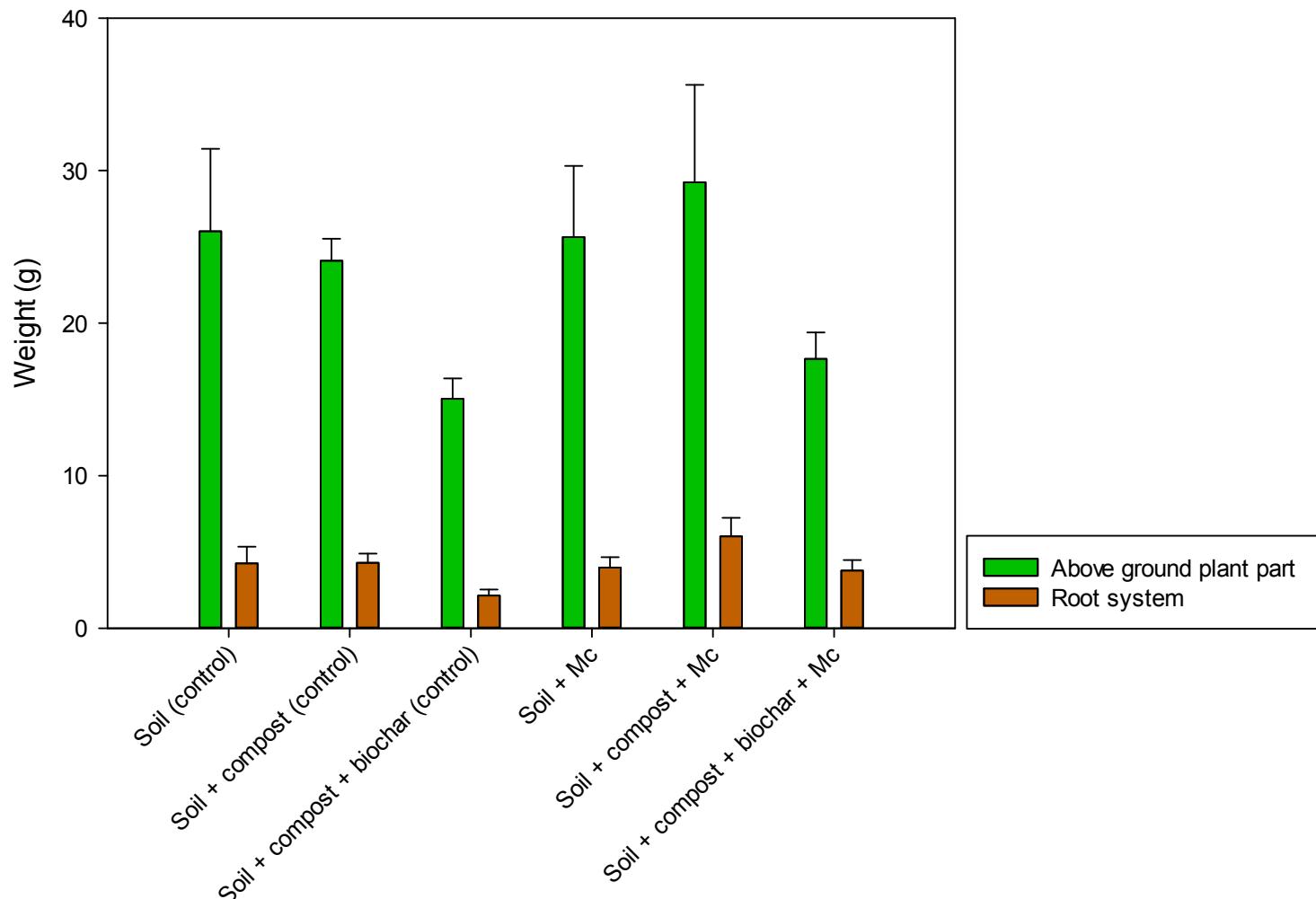
$$Pi = 40 \text{ J2}/100 \text{ cm}^3 \text{ soil}$$

Meloidoigne on carrots



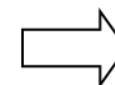
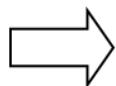
$P_i = 40 \text{ J}2/100 \text{ cm}^3 \text{ soil}$

Meloidogyne on bean



$$Pi = 40 \text{ J2}/100 \text{ cm}^3 \text{ soil}$$

Globodera on potato

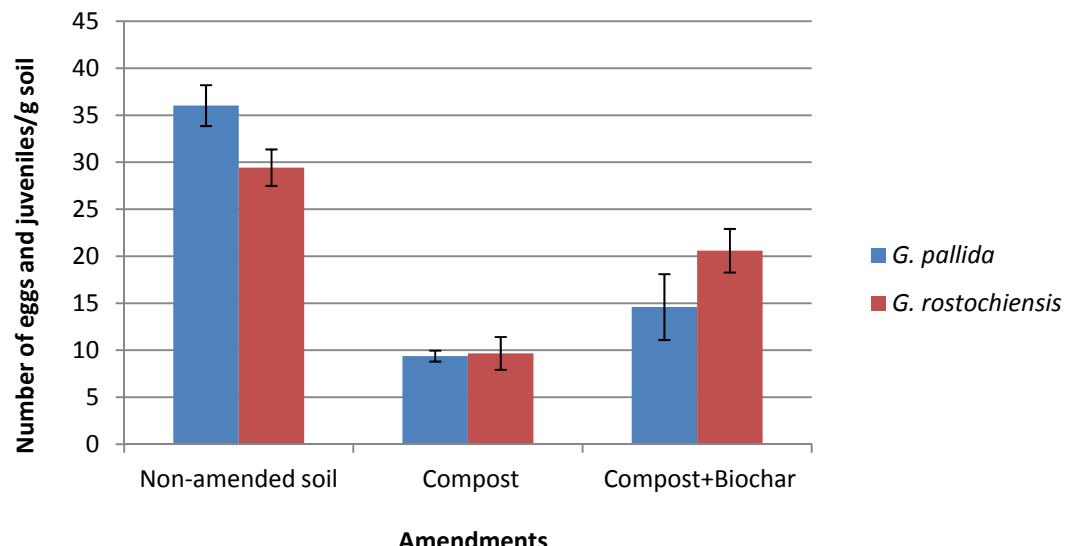
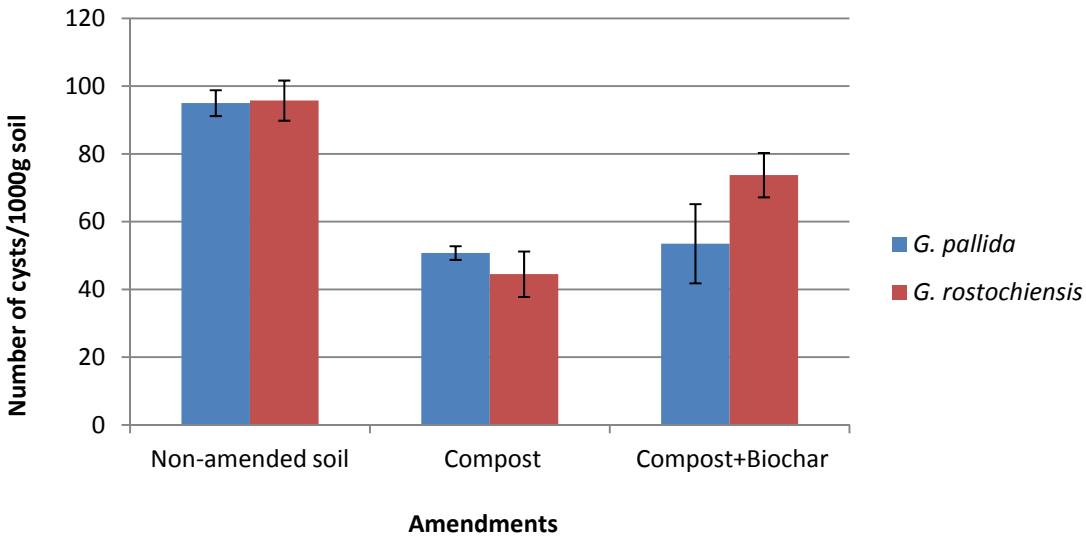


- Treatments (30 ton/ha)
 - wood chip compost (15g/L)
 - wood chip compost (12g/L) + biochar (3g/L)
 - non-amended soil
- Visual assessment and the trehalose test to determine the **viability** of eggs and juveniles after 8, 12 and 16 weeks
- Determination of the **reproduction rate** after 16 weeks

Reproduction of *Globodera* spp.

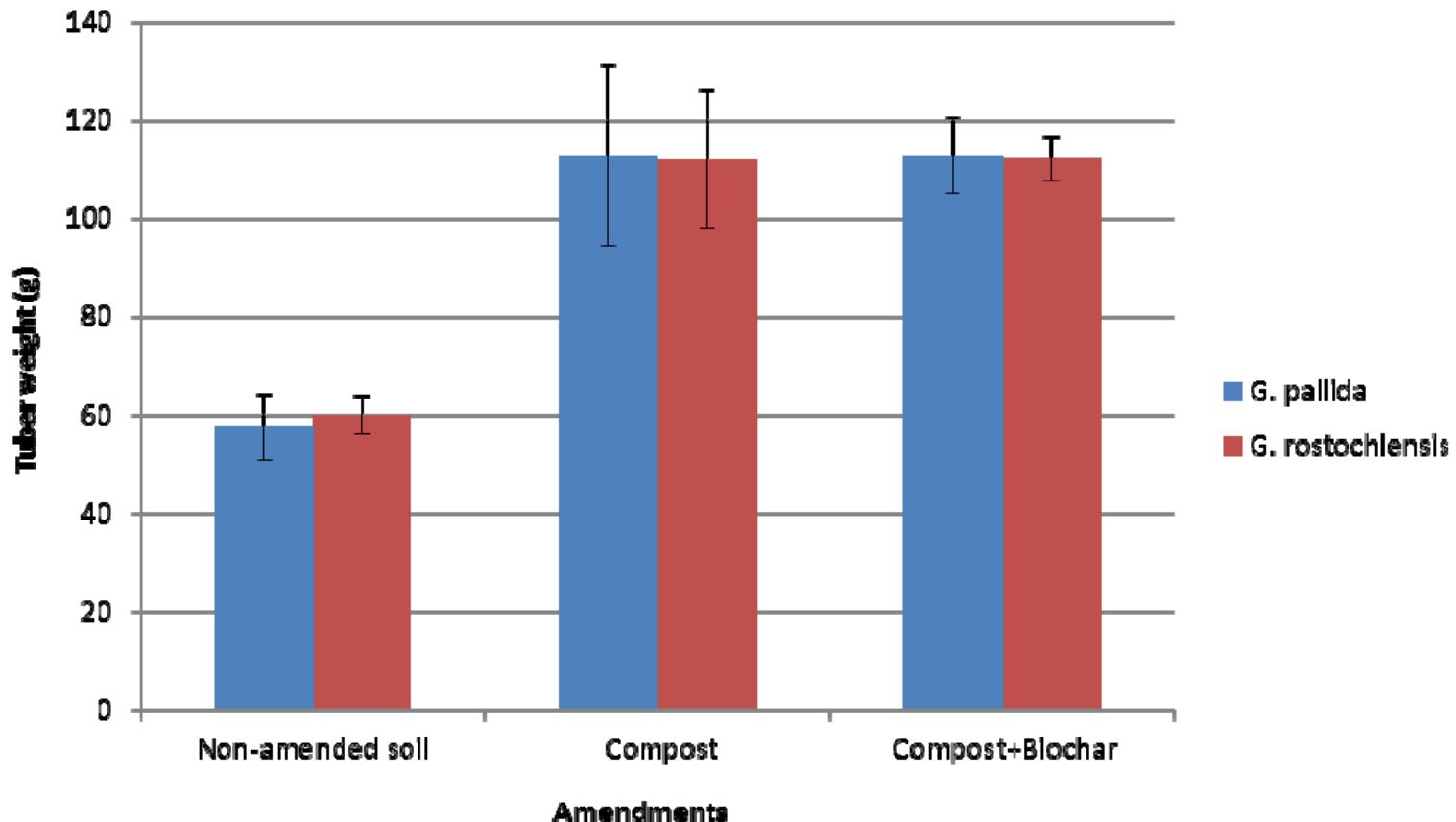


Courtesy W. Wesemael

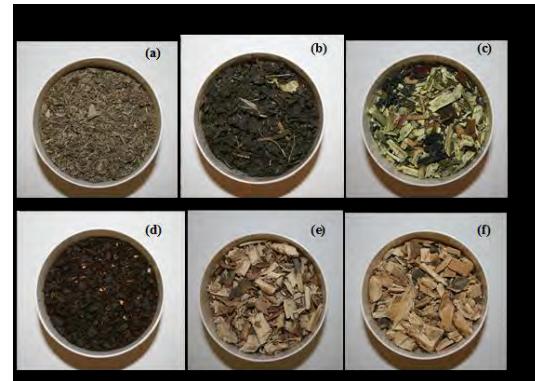


Pi = 3.6 eggs and J2/g soil

Potato tuber weight



- EU FP7 project: www.fertiplus.be
- Aim = to reduce mineral fertilizers (N,P use) & agrochemicals (pest control)
- How = by recycling organic waste by composting and pyrolysis



- Compost, biochar and biochar-blended compost

- ILVO-part: effect
 - 1. on soil plant pathogens of vegetables (bioassays)
 - *Meloidogyne*, *Pratylenchus* & *Globodera*
 - *Rhizoctonia solani*, *Sclerotinia sclerotiorum* & *Verticillium dahliae*
 - 2. on soil/rhizosphere microbiology
 - PLFA
 - DGGE
 - NGS
 - 3. On the physico-chemical properties of the soil
 - 4. correlation between 1-3?



Nematology

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