

## Biological soil disinfection '2.0'

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## Biological soil disinfection?

- Much research has been done on biological disinfection of soil.
  - Mostly applied in outside field crops
  - Grass
  - Other fresh organic materials
- Goal is to suppress persistent diseases in the soil
  - *Verticillium dahliae*
  - Nematode populations



## Biological soil disinfection (2)?



## Biological soil disinfection (3)?



## Biological soil disinfection (4)?

But.....:

- The effect of biological soil disinfection with grass in horticulture is not perfect.
- Grass has a changing mineral content during the year, which influences the disinfection effect and makes the method uncertain to its users.
- Large amount of grass are necessary. This makes the method labor intensive and unpractical in a greenhouse.



## Biological soil disinfection '2.0'

- Because of variable results and the previously mentioned arguments, alternatives for grass have been searched.
- Organic fermented material, waste product of food processing industry.
- Dry powder with a known content.



### Biological soil disinfection '2.0' (2)

- Material has to be cultivated (dug under) and covered with an airtight plastic.
- Anaerobic circumstances promote the anaerobic soil population.
- This group transfer the organic material in different toxic gasses and product which might kill soil organisms.



### Biological soil disinfection '2.0' (3)



### Experiment

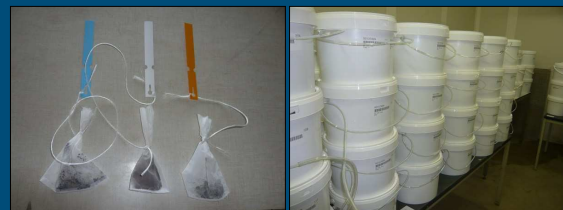
2009: cell experiment in cooperation with PPO-AGV, Lelystad

8 different fermented products have been tested (Tatchtec B.V.)

- 2 soil types: sandy clay and sand
- 3 dosage: 2, 4, and 6 raw proteins
- 3 times: 2, 4 and 8 weeks anaerobic circumstances



### Experiment



Buckets have been used to create anaerobic conditions. Buckets were placed in a climate chamber at 16°C. Pathogens *V. dahliae* and *P. penetrans* were in sacks with maze width of 50 micrometer



### Amazing results!

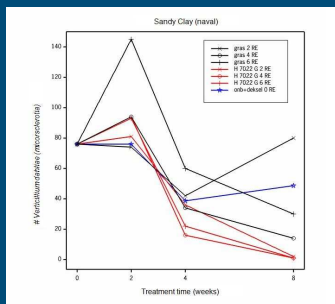
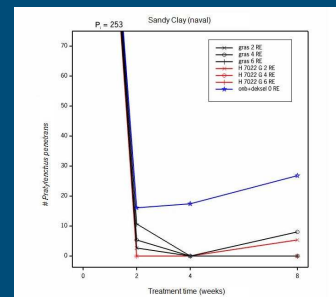
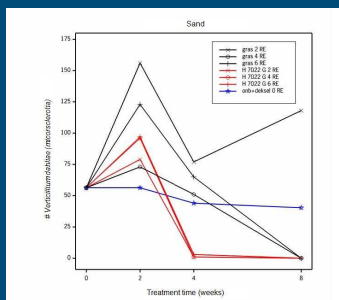
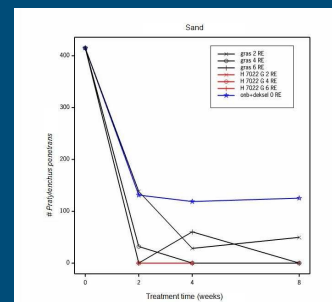
- In some cases up to 100% killing of *Verticillium dahliae* and *Pratylenchus penetrans*
- After 4 weeks (16°C depending on soil type and under lab conditions)
- Difference in effect per soil type
- Several products are promising, product H7022 is much better than all others.



### Amazing results! (2)

- A correlation between gasses and fatty acids and the killing of *Verticillium dahliae* microsclerotia and nematodes. Especially hydrogen sulfide (H<sub>2</sub>S) seems to have an effect on the survival of microsclerotia of *Verticillium dahliae*.



Sandy clay (naval)/H7022/*V. dahliae*Sandy clay (naval)/H7022/*P. penetrans*Sand/H7022/*V. dahliae*Sand/H7022/*P. penetrans*

## Conclusion.....

Very promising method under lab conditions:

- Result of this method is depending on soil type and probably also from other factors.
- This makes that further research is necessary to untie the mechanism behind this method to come to a practical and secure protocol for application in horticulture.

## Any applications in practice?

- Dutch biological growers are enthusiastic.
  - Monitoring of *Verticillium* and nematodes offers good results...but not always.
    - Nematode population builds up
    - Mineral content of the soil has changed because of the application, crops is vegetative, green and looks strong and healthy.
    - After about 3 months all extra minerals are gone
- Conventional growers are interested, some examples of application.
  - Time is money!
  - It is not easy to introduce the method in strict cultivation plan.

## Further research

### Further research must lead to....

- Shorten the anaerobic phase to speed up the process
- Insight in the effect on other organisms and weed
- Information on the long term effect against soil organisms.
- Information about the role of the different groups of (anaerobic) microorganisms.
  - Can we speed up the processes in the soil, to shorten the amount of time necessary for disinfection
  - To develop indicators for this method
  - The increase the certainty of the method

## Further research (2)

### With the goal....

- To develop an applicable protocol for biological soil disinfection in horticulture
- As an alternative and sustainable method for soil steaming

Thank you for your attention

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