

Long term effects of several soil treatments on soil health

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Introduction

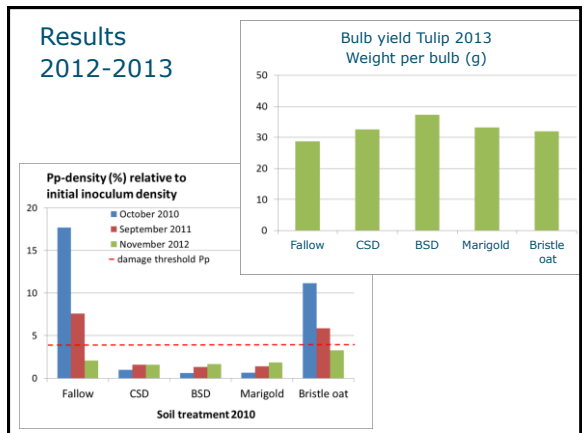
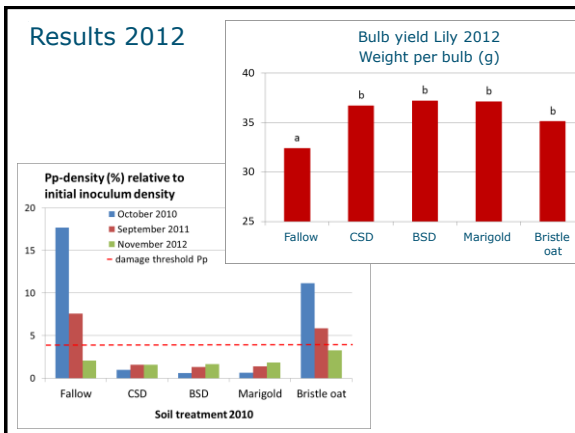
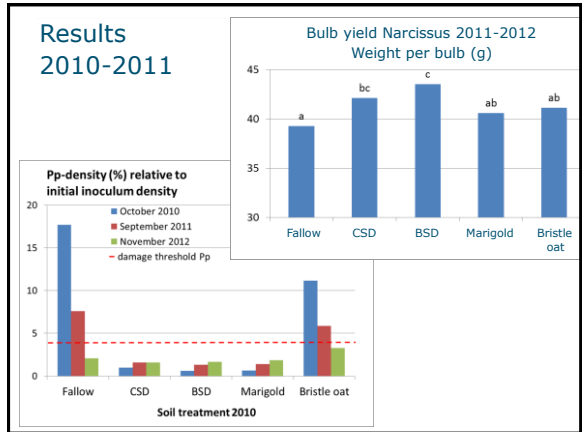
- Good results of several soil treatments against *Pratylenchus penetrans* (Pp) on glacial sand (field trial Vredepeel 2006-2014)
 - >> Efficacy and feasibility on dune sand?
- Glacial sand and dune sand differ in:
 - Physical-, chemical- and biological properties
 - Crop rotation, tillage practices, etc.
 - Damage threshold: Glacial sand ca. 100 Pp/100 ml
Dune sand ca. 10 Pp/100 ml

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Field trial on dune sand 2010-2013

- Natural infestation May 2010: 80-650 Pp/100 ml
- Soil treatments in July-September 2010:
 1. Untreated/fallow
 2. Chemical soil disinfestation (Metam sodium)
 3. Biological soil disinfestation (grass) + compost
 4. Marigold (*Tagetes patula*) + compost
 5. Bristle oat (*Avena strigosa*)
- Crop rotation:
 - 2010-2011 Narcissus
 - 2012 Lily
 - 2012-2013 Tulip

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2010-2013

Pp infestation declined below the damage threshold, even in untreated plots (fallow), despite cultivation of a series of host crops.

- Why?
- Natural disease suppression?



Growers' perspective

Are the soil treatments worth the investment?

Return on investment by:

- Increase of bulb yields:
 - Control of Pratylenchus (short term effect 2010-2012)
 - Fertilizing effect of incorporated organic residues
 - Control of other pathogens (not present in field plot)
- Effect on disease suppression against pathogens?
2013-2014: bioassays with *Pythium* en *Meloïdogyne hapla*



Bioassay disease suppression

Example: root knot nematode (*Meloïdogyne hapla*)



After 6 weeks:
root knot count

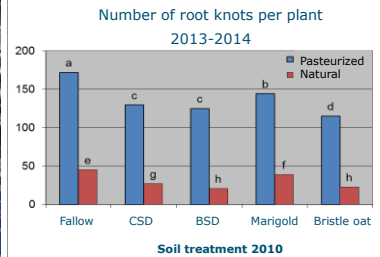


Few root knots >
good suppression

Add nematodes
Susceptible crop (Lettuce)



Disease suppression against *M. hapla*

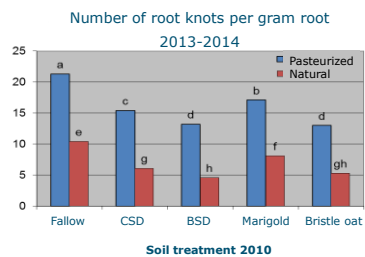


Significant suppression of *M. hapla* by:

- The natural soil microflora
- All soil treatments compared to fallow



Disease suppression against *M. hapla*

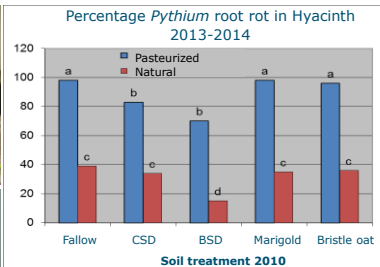
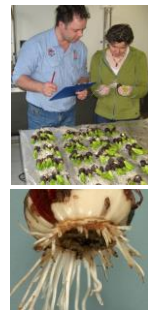


Significant suppression of *M. hapla* by:

- The natural soil microflora
- All soil treatments compared to fallow



Disease suppression against *Pythium*



Significant suppression of *Pythium* by:

- The natural soil microflora
- Biological soil disinfection



Financial calculations

Based on the results of this experiment, and using algorithms and assumptions from literature, we calculated:

- Treatment costs (€/ha)
- Bulb yields (ton/ha) and returns (€/ha)
- Potential effect of disease suppression on yields and returns

All calculations with reserve:

Results may vary between fields, years, crop/cultivars, bulb size, market values, etc.



Costs and returns over a period of 2 years

Cost-benefit analysis 2010-2012 (€/ha)

	Fallow	CSD	BSD + compost	Marigold+compost	Bristle oat
Treatment cost (€/ha)	510	1600	6400	2750	700
Returns of Narcissus (€/ha)	9918	10646	11000	10259	10396
Returns of Lily (€/ha)	41806	47355	48000	47871	45290
Total returns in 2 years (€/ha)	51214	56401	51300	55380	54986
Relative returns (%)	100%	110%	103%	108%	107%



Potential returns on disease suppression: *Meloidogyna hapla*

- Root knots hardly cause yield reduction in perennials
- Export market: zero tolerance for nematodes, the slightest infection = unsellable = no returns
- Disease suppression does not give 100% control; more or less disease suppression is not relevant
- Solution: 100% control by hot water treatment (1 h 45°C) of all plants for export market



Potential returns on disease suppression: *Pythium*

Potential reduction of returns per hectare of Hyacinth in case of *Pythium* infestation

Infested field area	Untreated (fallow)	Biological soil disinfestation + compost
10%	€ 1514 (3.4%)	€ 352 (0.8%)
50%	€ 7571 (17.4%)	€ 1760 (4.0%)

Returns of hyacinth under standard circumstances: €44.175 (100%)



Conclusions

Compared to untreated soil (fallow):

- CSD, BSD and Marigold reduced *Pratylenchus* numbers
- All treatments increased bulb yields (2 years)
- Returns on investments within 2 years for all treatments
- All treatments increased disease suppression against *M. hapla* (without direct financial benefits)
- BSD increased disease suppression against *Pythium*, potentially limiting reduction of returns by 3-13% in infested fields.



Thank you for your attention

Questions...?



Bristle oat

