



Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences



Swedish Farmers' Foundation
for Agricultural Research

Synergistic interaction between plant-feeding nematodes and the fungus *Rhizoctonia solani* in potato

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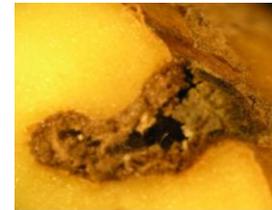
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Rhizoctonia solani



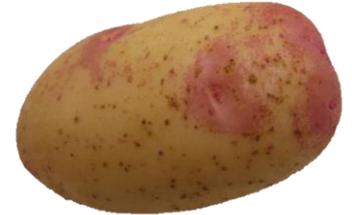
- Soil borne: harvest residues
 - survives many years but most active within 2-3 years
 - causes stem canker, black scurf *etc*
- Seed borne: black scurf, dry core, “elephant hide”
 - causes stem canker
- Sexual stage: ***Thanatephorus cucumeris***
 - basidiophores on the stems
 - wind spread basidiospores



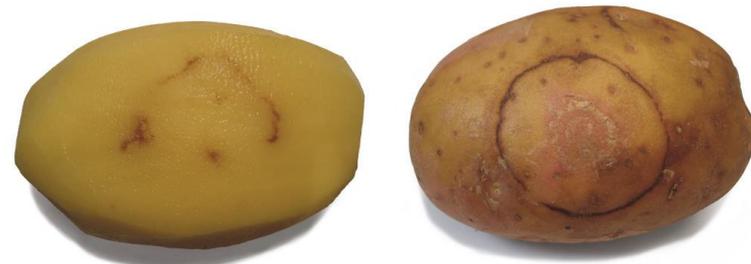
Free-living nematodes



- Root-lesion nematodes: *Pratylenchus* spp.
 - Endoparasite: go inside roots
 - Reduced growth and tuber size
 - Secondary infections



- Stubby root nematodes: *Trichodorus* spp and *Paratrichodorus* spp.
 - Ectoparasite: eat on root tips and causes stubby root branches with fine roots often in clusters
 - Tobacco rattle virus –spraing disease in tubers



(Synergistic) Interaction?

- Observations of high abundance of free-living nematodes in combination with severe stem canker and black scurf.
- Stubby root nematodes were more abundant at stands with severe stem canker
- The organisms take advantage of the other:
 - hyphae enter in nematode lesions
 - chemical changes that attracts the fungus and decrease the host defence
 - root pathogens may affect the host defence against nematodes



References: Klemmensen, 2006; Björsell 2015; Back *et al.* 2002;

Vrain, 1987; Advisors

Aim

To investigate if there is a correlation between stem canker on potato and free-living nematodes (root lesion nematodes and stubby root nematodes).



Project outline

1. Soil infestation and root lesion nematodes (*Pratylenchus penetrans*) and time of inoculation
2. Six potato cultivars with full nematode community
3. Fungicide treated seed tubers with root-lesion nematodes and full nematode community



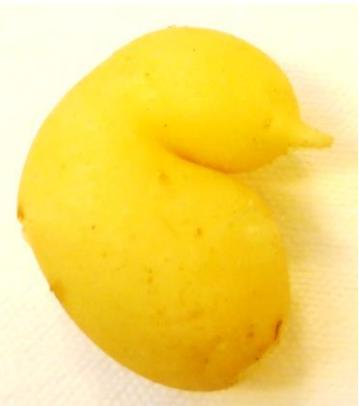
Experimental design

- Meristem propagated tubers of King Edward VII and cvs Erika, Fontane, Kuras, Perlo, Rosagold
- *Rhizoctonia solani* from Mid-Sweden
- Root lesion nematode *Pratylenchus penetrans* or full nematode community from Mid-Sweden,
 - includes plant-feeding and fungal-feeding nematodes
- Fungicide pencycuron (Monceren FS 250)
- Pot experiment: sterilised and washed sand, climate conditions as Swedish spring (+12°C)



1. Is timing involved in the interaction?

- Mini-tubers, cv King Edward VII
- *Rhizoctonia solani*
- *Pratylenchus penetrans*
- Added at planting, after 14 days and after 28 days.

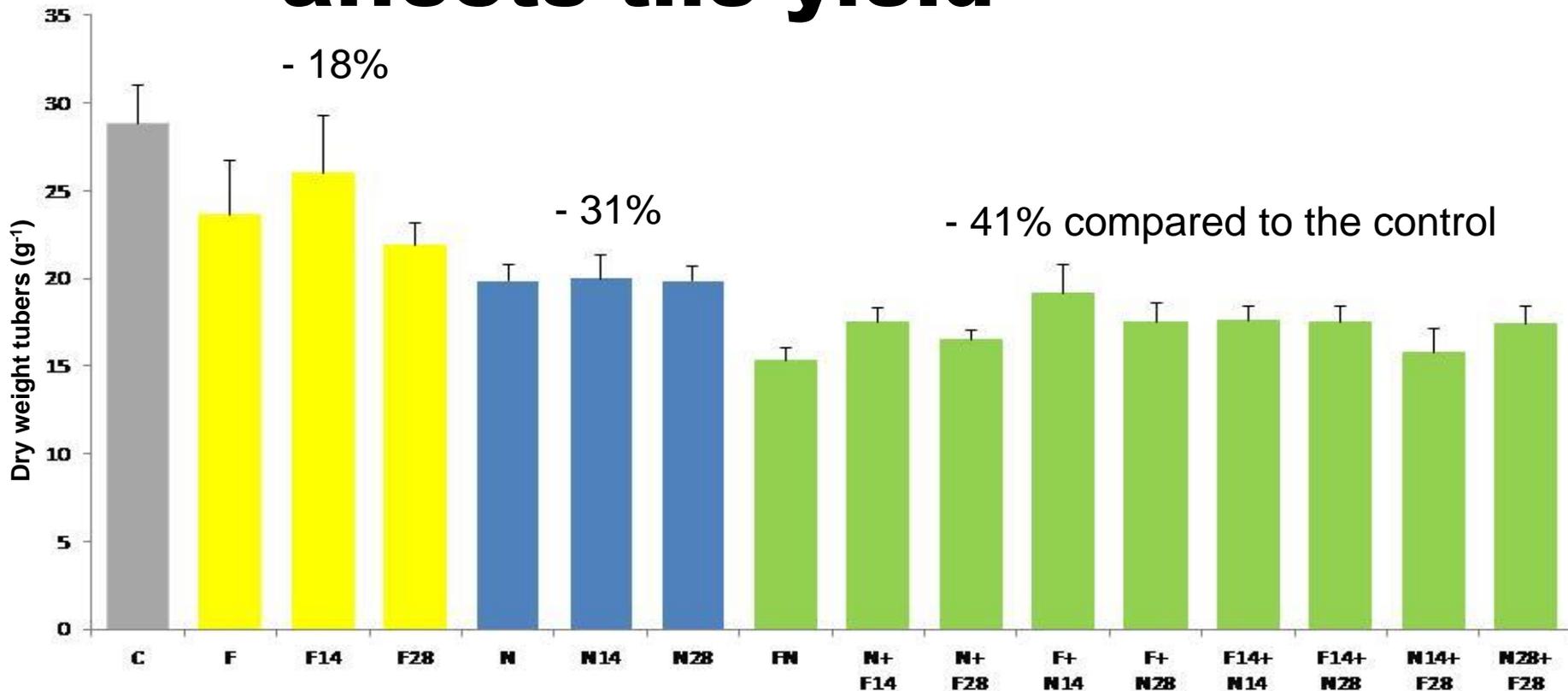


1. Is timing involved in the interaction?

- Results:
 - Time had effect on the number of damages:
 - 1/10 of nematode damages if added after 28 days
 - Black scurf increased if added after 28 days
 - Nematodes did not affect the number of fungal damages and vice versa
 - Root weight was reduced 25% by nematodes



1. Combination but not time affects the yield



C = control,

N14, F14: added 14 days after first inoculation

N28, F28: added 28 days after first inoculation

F = fungus,

N = nematodes, *Pratylenchus penetrans* (2 nem g⁻¹ sand).

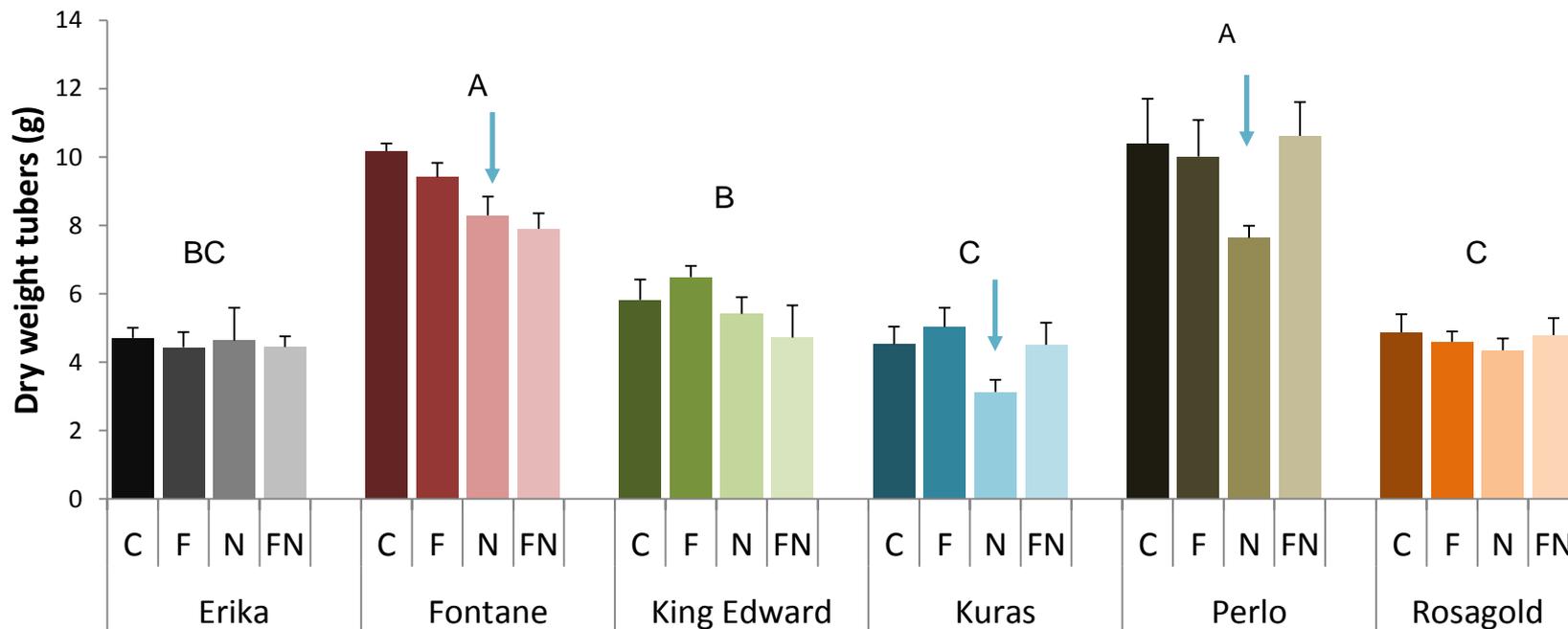
2. Cultivar differences

- Cvs. Erika, Fontane, King Edward VII, Kuras, Perlo and Rosagold.
- Full nematode community, incl. fungal-feeding nematodes.
- Cv. Perlo had higher likelihood of black scurf than the other cultivars.
- Number of tubers differed: cv. Erika had more but smaller tubers in the combination of fungus and nematodes



Photo: Nematode damage on stem

2. Tuber yield, cultivar differences



- Tuber yield was dependent on treatment and cultivar
 - Nematodes and fungus separately lowered the yield compared to the control, especially for cv. Fontane, cv. Kuras and cv. Perlo

C = control, F = fungus, N = full nematode community (2 pf nem g⁻¹ sand).

3. Can the nematodes affect fungicide seed treatment?

- Mini-tubers, cv King Edward VII
- Seed tubers inoculated with *Rhizoctonia solani*
- *Pratylenchus penetrans* or full nematode community added at planting



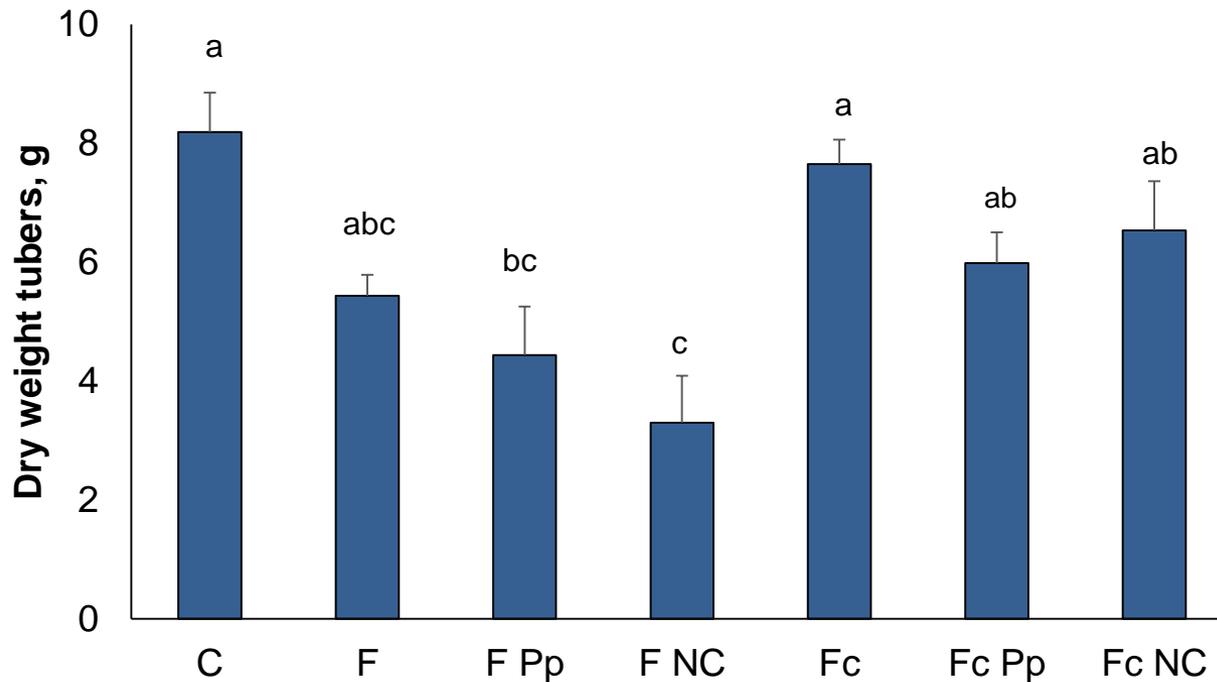
3. Can the nematodes affect fungicide seed treatment?

- Results:
 - Nematodes did not inhibit the efficacy of pencycuron (Monceren)
 - The probability of black scurf decreased in treatments with a full nematode community, which may be due to fungal-feeding nematodes.



3. Nematodes do not inhibit the fungicide effect

Tuber weight was affected by nematodes and fungus



C = control, F = fungus, Pp = *Pratylenchus penetrans* (2 nem g⁻¹ sand)
 NC = full nematode community, Fc = fungicide treated seed tubers

Take home message:

- *Rhizoctonia solani* + plant-feeding nematodes, esp. *Pratylenchus penetrans*, reduce tuber yield
- The time of inoculation affects the severity of the damages
- The cultivars behave differently
- The nematodes do not affect the fungicide seed treatment



Thank you for your attention!

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Damages on roots:



Sclerotia (fungus)



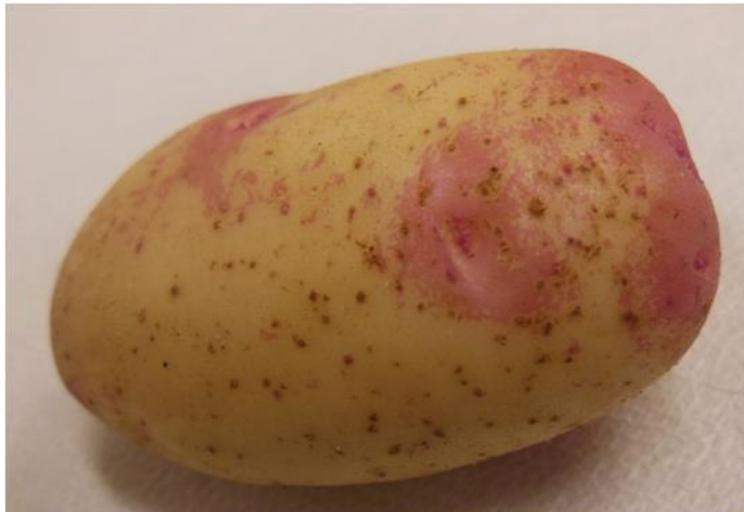
Brown lesions (mostly caused by nematodes)

Damages on tubers:

**Fungal
damages**



**Nematode
damages**



Damages on stems:



Stem canker



Wounds by nematodes



Stem canker

Thank You!



Thank You!
Tatties are the best!



- In the pot experiments we used pre-germinated mini-tubers that were planted in pots with sterilised sand and grown at conditions corresponding to Swedish spring. At harvest, the nematodes had produced gnawing symptoms on the entire submerged plant and the fungus had caused stem canker of varying severity on the stems, burned off stolons and produced sclerotia on the roots, stolons and on the majority of the tubers. The majority of the roots had brown discolouration of different degrees regardless of treatment.
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- The tuber yield decreased significantly for the cv. King Edward VII when both nematodes and fungus were present in the pots. However, our experiment with six different potato cultivars and a full nematode community showed that this synergistic effect was cultivar specific. The time of inoculation did not affect biomass growth but the stem canker got worse if the fungus was added at planting.
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