Epidemiology of *Spongospora* root infection

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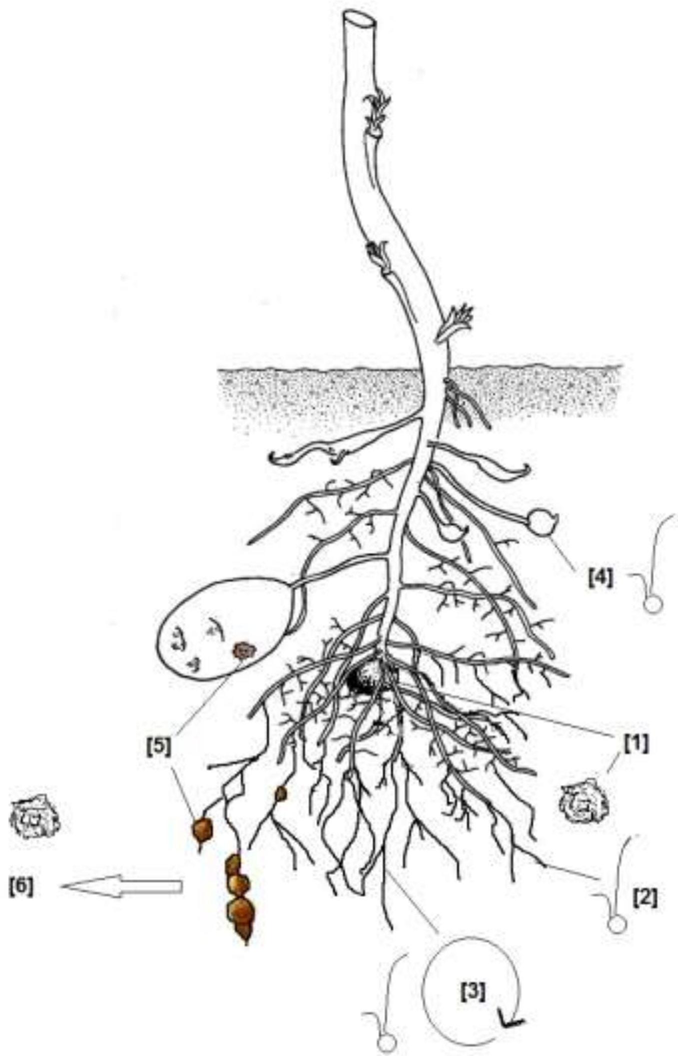
Outline

Merz (2008) quotes:

"…. we still lack basic knowledge on the etiology and epidemiology of the disease."

This lack of knowledge has severely limited the capacity to develop effective disease mitigation strategies

Outline



[1] Inoculum sources: sporosori containing zoospores in soil & seed tuber

[2] Released primary zoospores invade roots

[3] Polycyclic infection within root system with release of secondary zoospores

[4] Zoospores invade young tubers

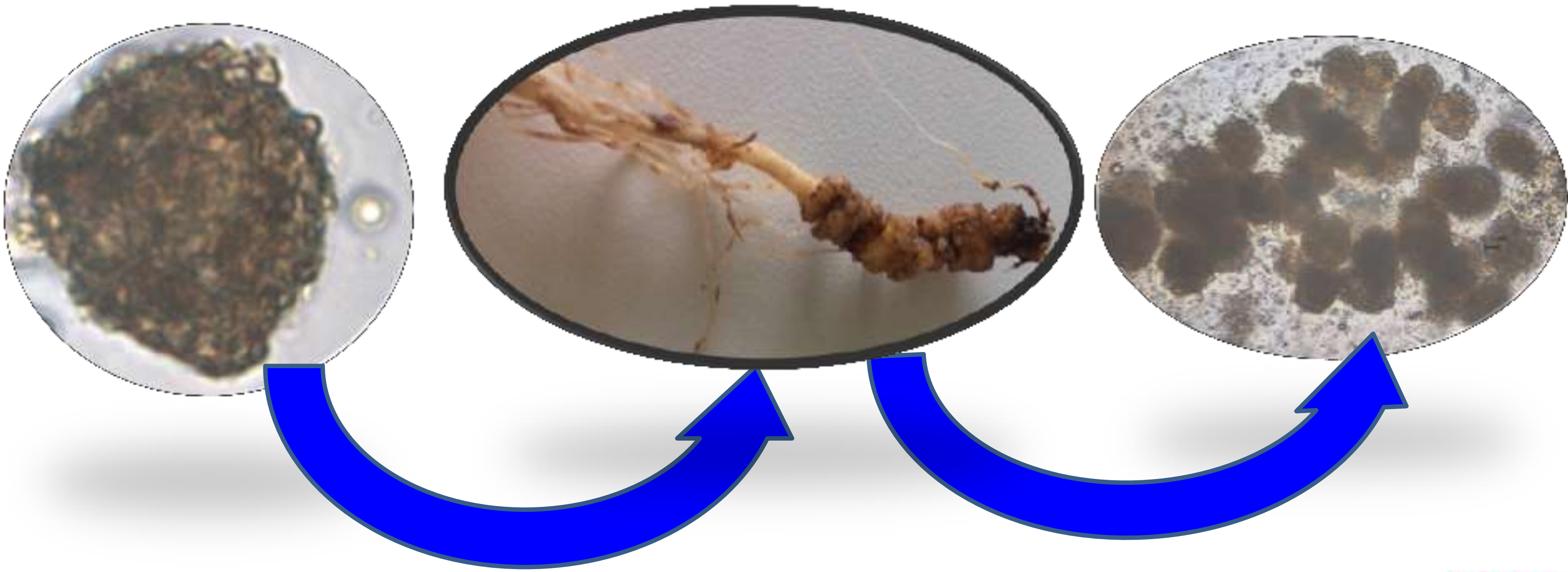
[5] Root galls & tuber lesions form

[6] Sporosori released into soil & retained on tuber

Outline

- Potato root infection by *Spongospora subterranea* f.sp. *subterranea* is of considerable significance

- Root infection is the primary source of inoculum build up in the soil



Outline

- Tasmanian soils have very high pathogen inoculum levels (often 10-25,000 pg/g)
- The major cultivar (Russet Burbank) grown is relatively susceptible to root infection AND has a relatively weak root system

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- Tasmanian soils have very high pathogen inoculum levels (often 10-25,000 pg/g)
- The major cultivar (Russet Burbank) grown is relatively susceptible to root infection AND has a relatively weak root system
- Tasmanian processors estimate yield losses of 10-20% regularly occur

Project aims

- To better understand the dynamics of disease progression in potato roots
- To examine the influence of delayed inoculation and root system maturity on disease progression
- To examine the effect available chemical treatments and seed health on suppression of disease progress

Experiments

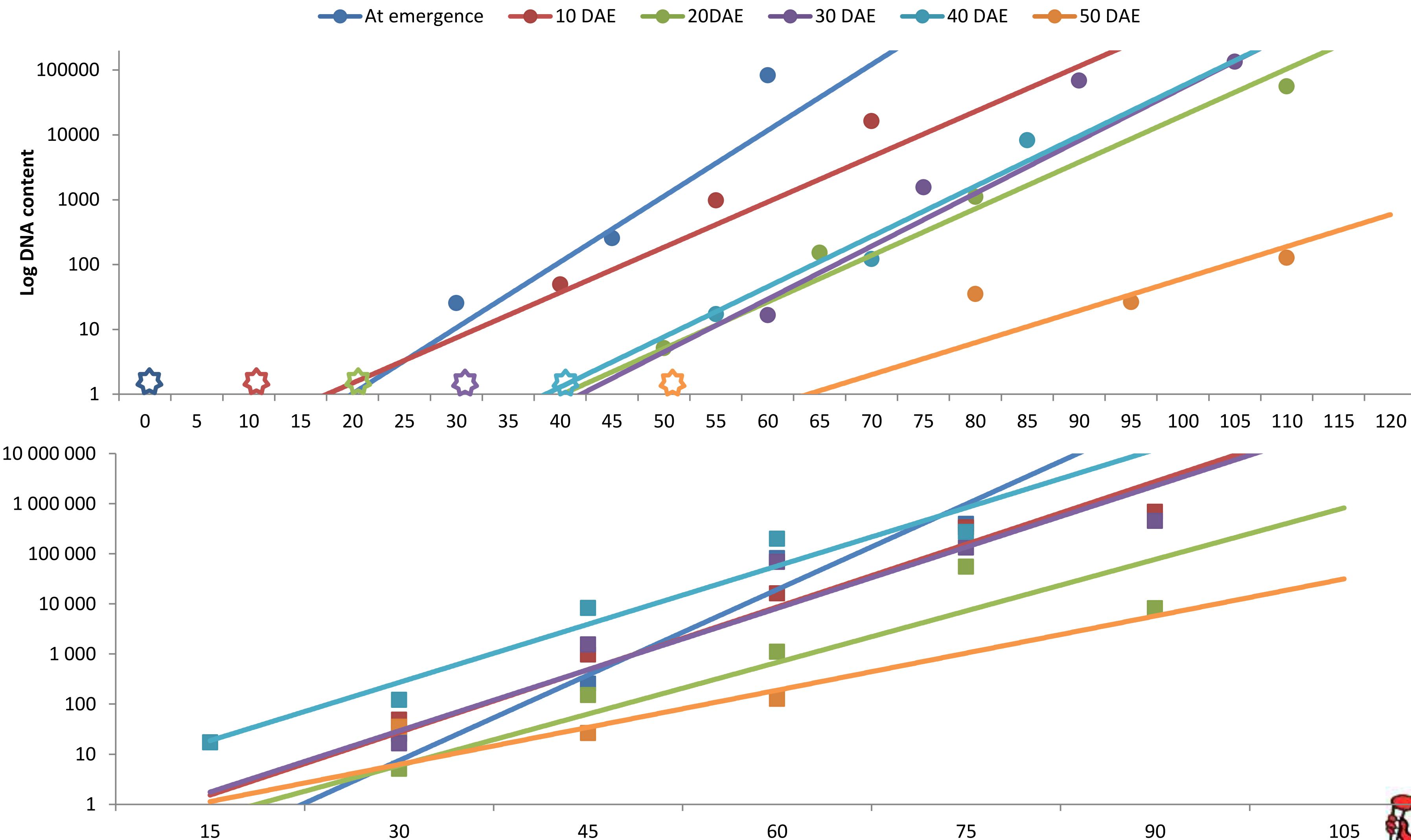
- A series of glasshouse and field trials were established assessing root infection dynamics
  - 4 x trials assessing the effect of delayed infection
  - 4 x trials assessing the effect of seed and soil treatments

Delayed inoculation

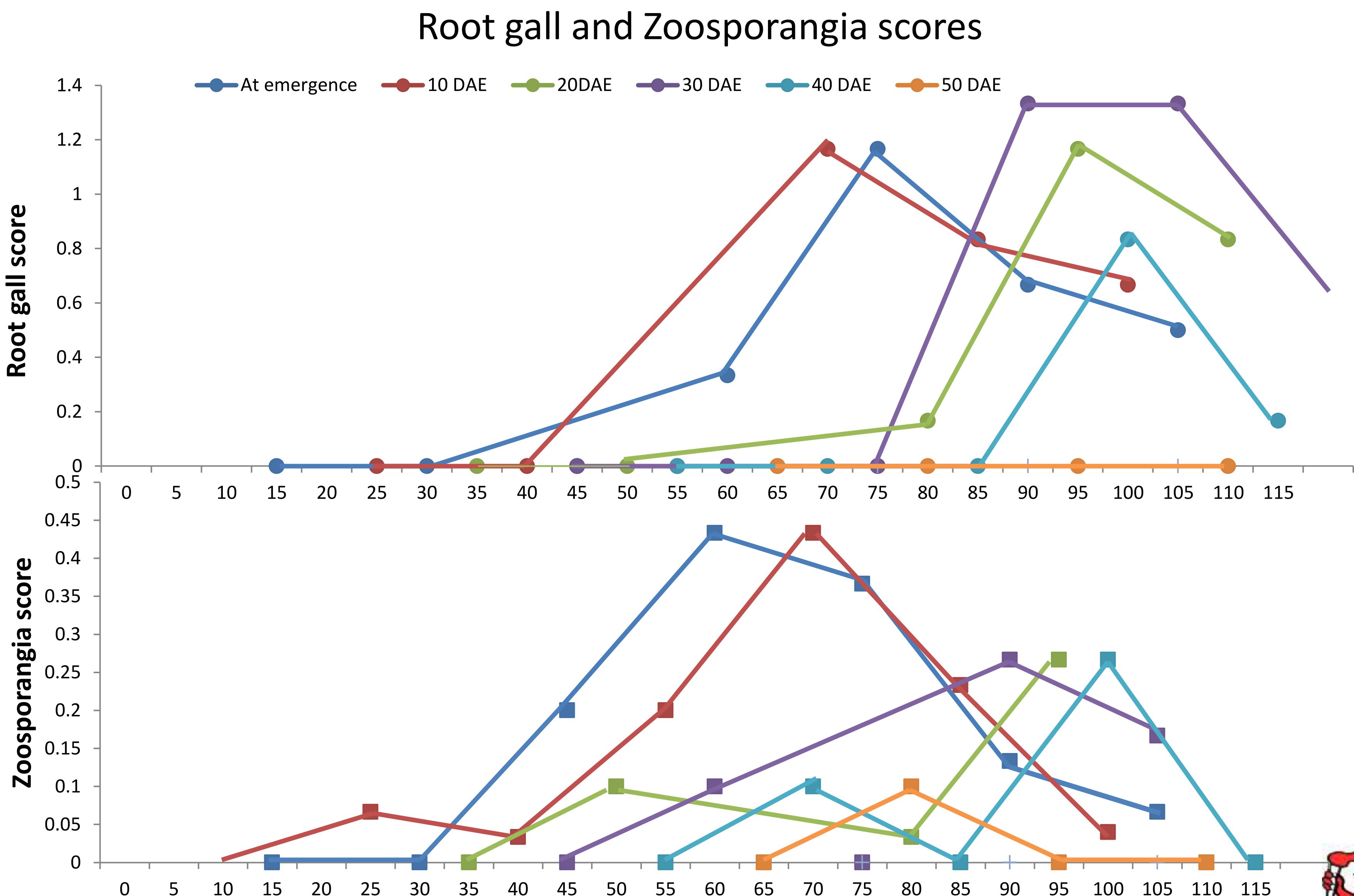
- Inoculum was added periodically during the plant growth cycle (at emergence, 10, 20, 30, 40 & 50 days after emergence)
- Plants were periodically harvested (every 15 days)
- Disease/pathogen assessments
  - Zoosporangia score
  - Root gall score
  - Tuber disease score
  - Pathogen quantification (qPCR)
- Plant growth assessments
  - Fresh weight

Delayed inoculation

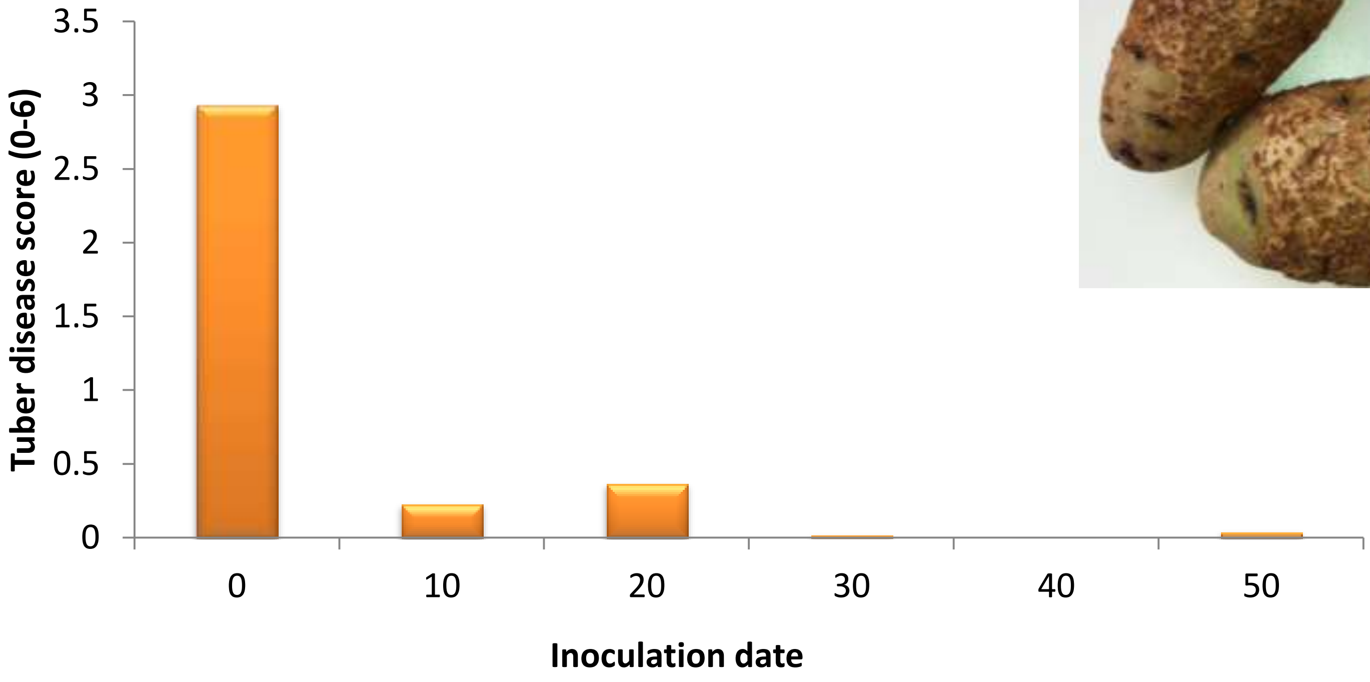
Content of pathogen (Log (mean Spongospora DNA +1)) in roots



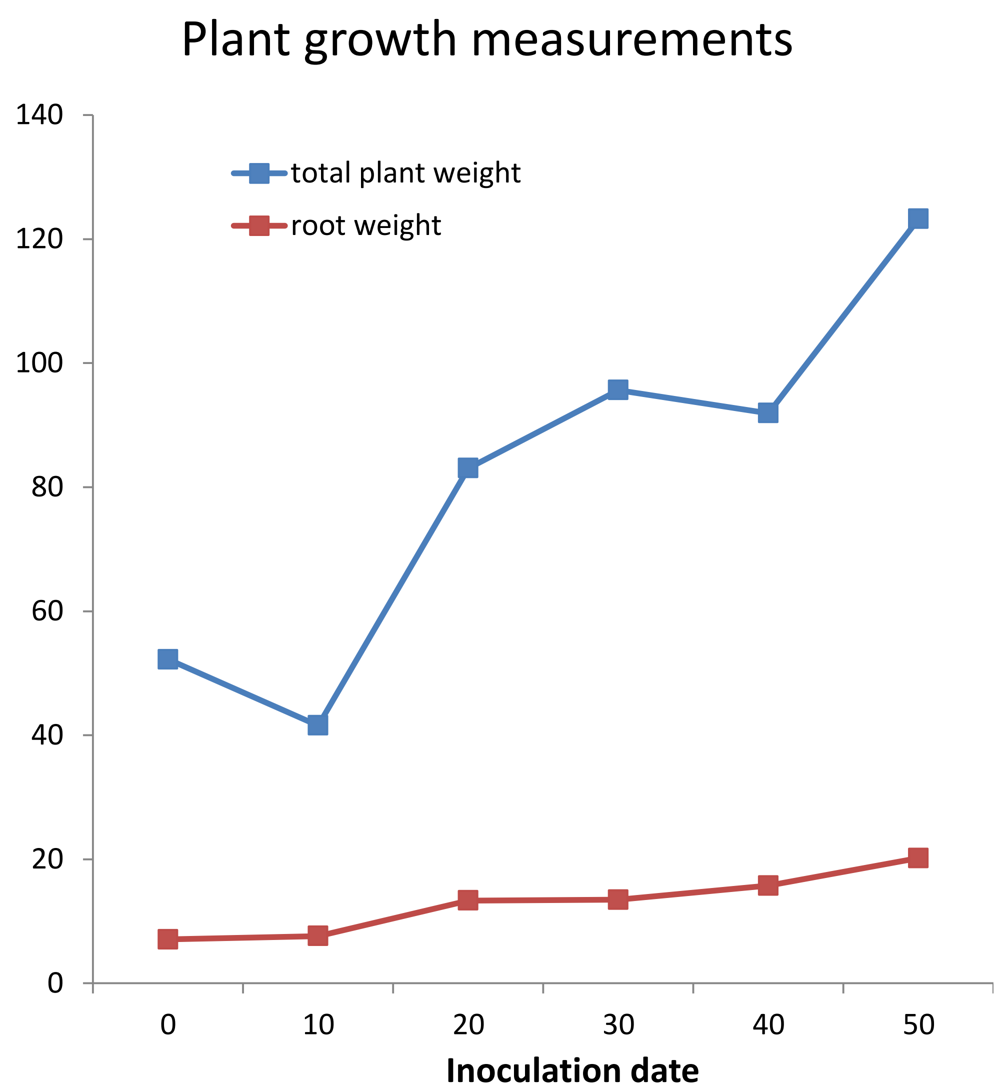
Delayed inoculation



Delayed inoculation



Delayed inoculation



Conclusions

- Root systems across a wide range of maturities are susceptible to invasion and follow an equivalent epidemic rate
- Delaying contact between roots and pathogen delays onset of root invasion
- Temporal disease level (AUDPC) is decreased
- This reduces the impact of root invasion on plant growth even if the level of pathogen in the roots at maturity is the same

Conclusions

- Delayed invasion may reduce the extent of zoosporangia formation (per root area)
- The amount of root galling may be similar but onset of galling is delayed
- Delayed invasion may also result in reduced tuber disease at harvest

Chemical treatments

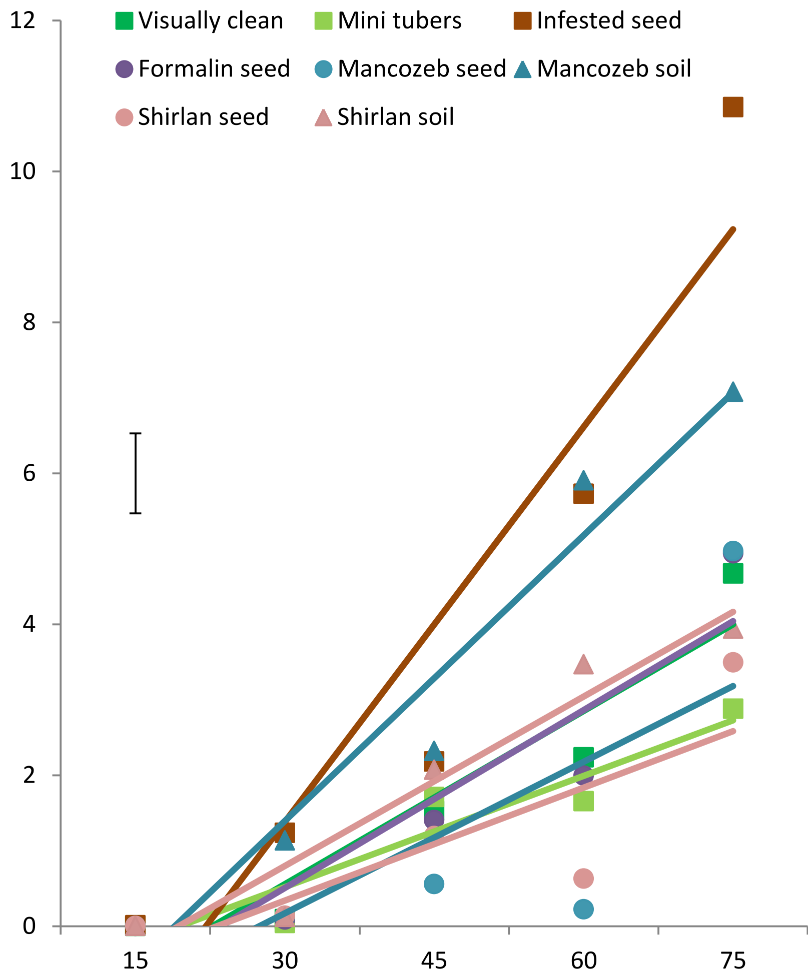
- Inoculum was incorporated prior to planting (or used natural field infection)
- Fungicides treatments applied to highly infested seed or to soil at planting
  - Mancozeb – in furrow spray
  - Mancozeb – seed treatment
  - Shirlan (Fluazinam) – in furrow spray
  - Shirlan (Fluazinam) – seed dip
  - Formalin seed dip
  - Visually clean seed
  - Mini-tubers

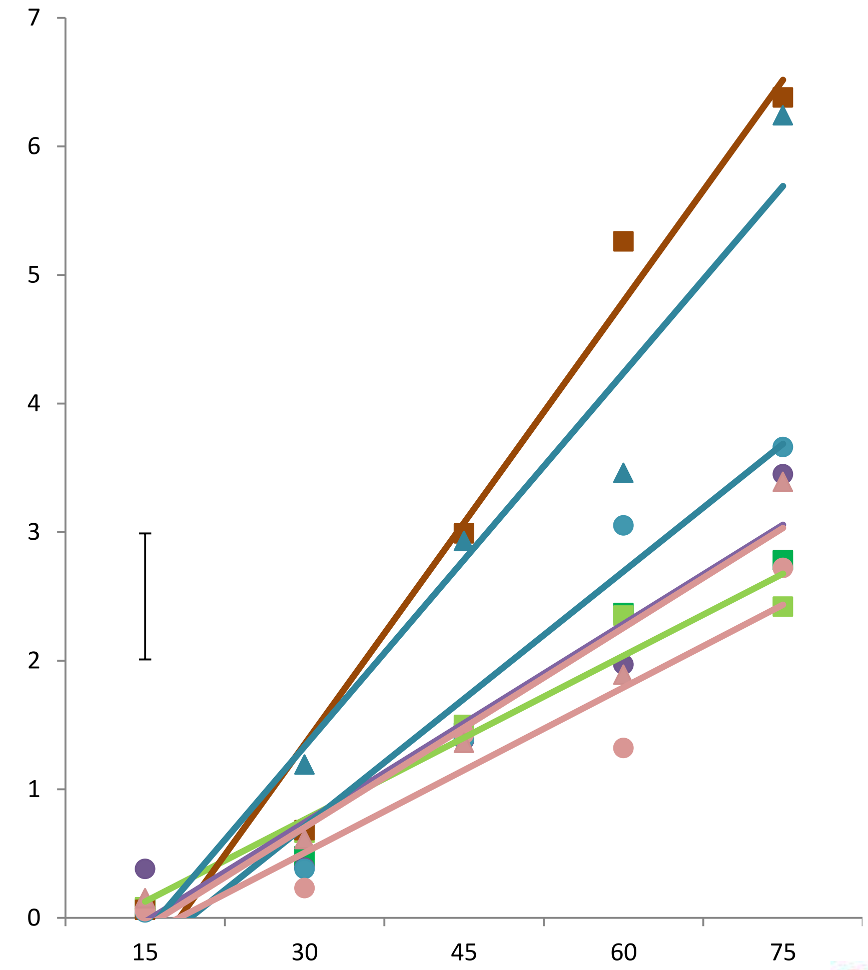
Chemical treatments

- Plants were periodically harvested (every 15 days)
- Disease/pathogen assessments (as before)
  - Zoosporangia score
  - Root gall score
  - Tuber disease score
  - Pathogen quantification (qPCR)

Chemical treatments

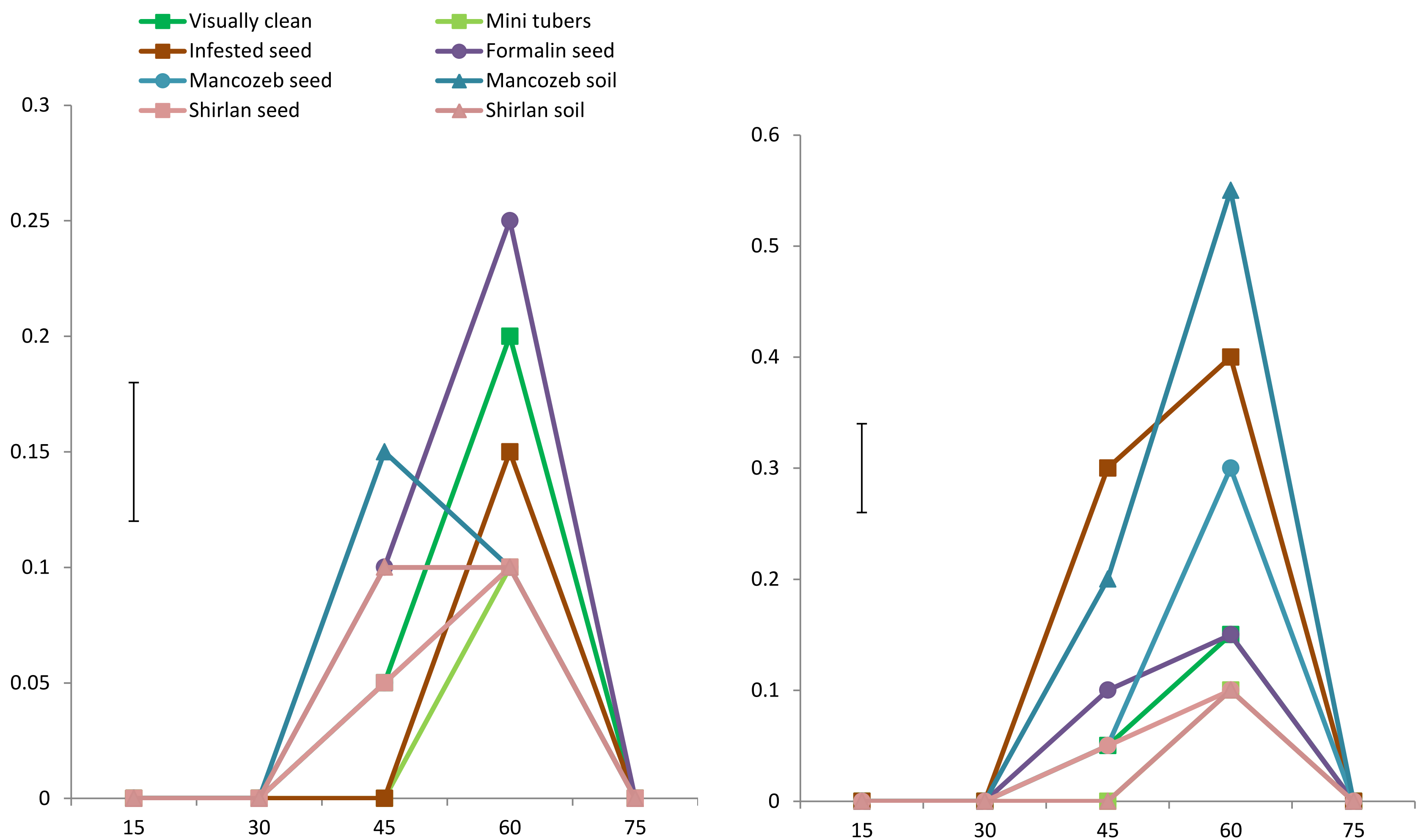
Content of pathogen (Log (mean Spongospora DNA +1)) in roots – field trials





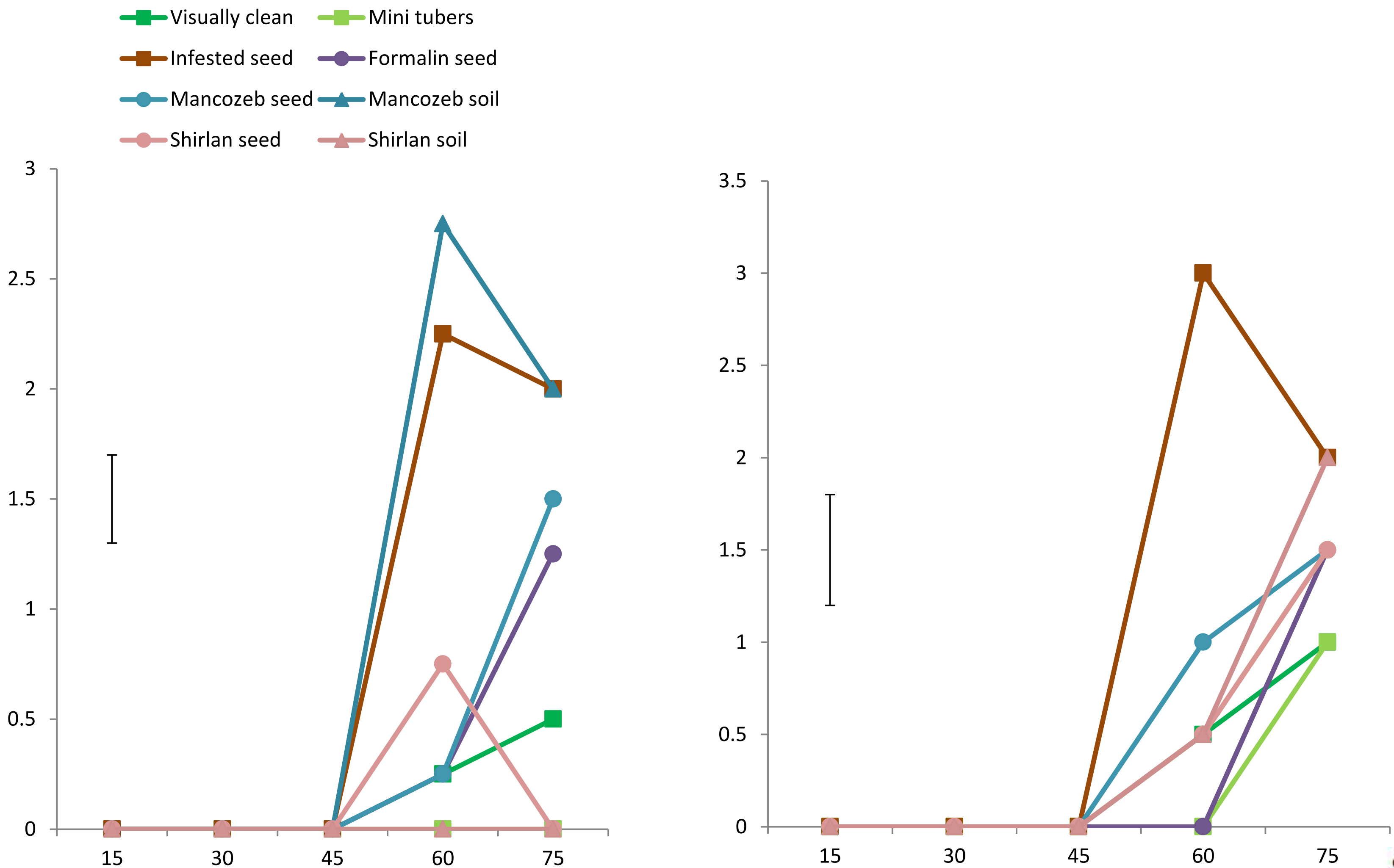
Chemical treatments

Zoosporangia scores – field trials 1&2



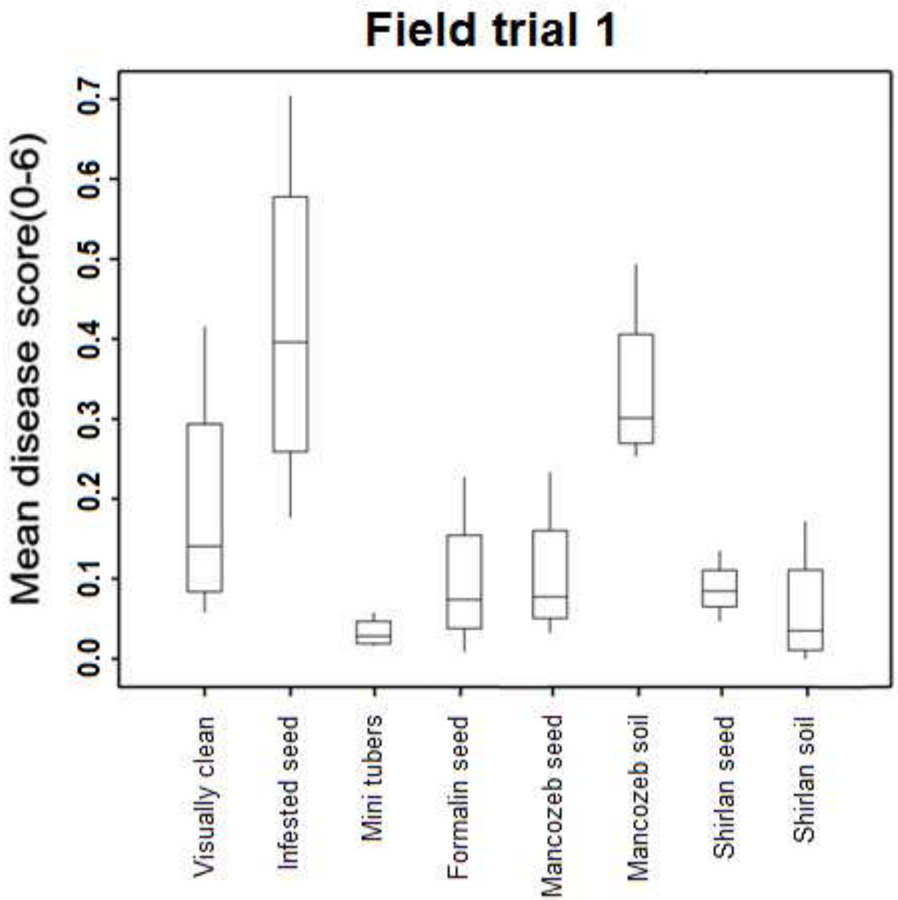
Chemical treatments

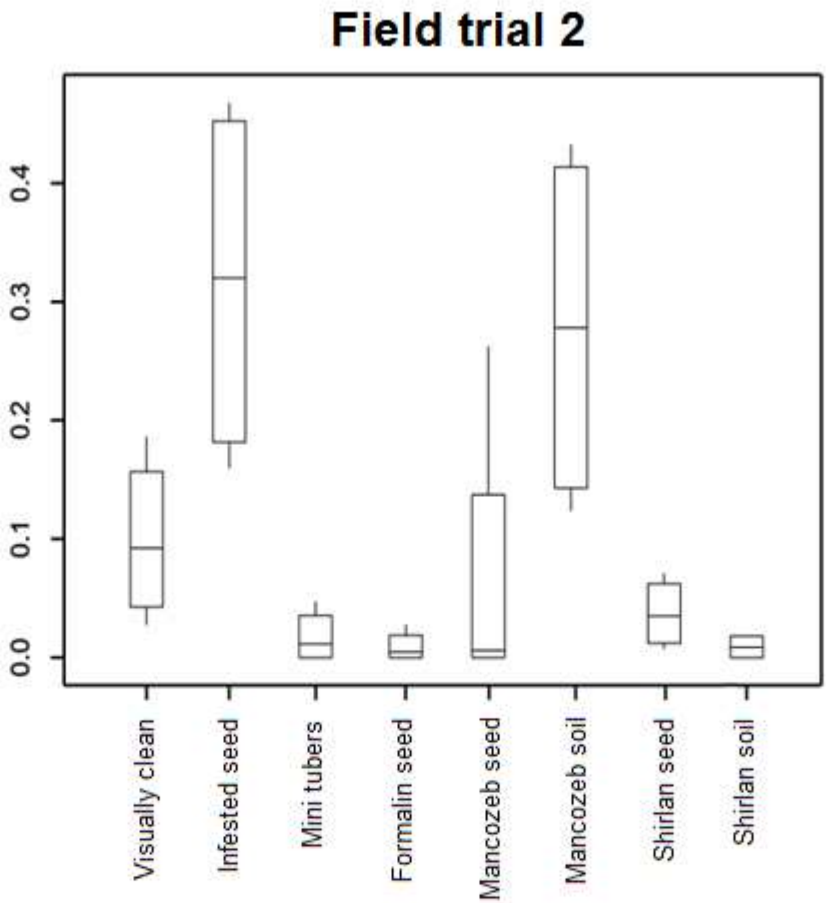
Root gall scores – field trials 1&2



Chemical treatments

Tuber disease scores at harvest – field trials 1&2





Conclusions

- Infested seed tubers can provide significant inoculum resulting in root and tuber disease

- Planting certified seed or high health mini-tubers is an important mitigations strategy for both root and tuber disease

Conclusions

- With infested seed - fungicide treatments (to seed and soil) can reduce root infection
- They slow the rate of epidemic rather than delaying infection
- Temporal disease level (AUDPC) is again decreased
- It can reduce zoosporangial content and galling of roots (although final levels in mature plants may be similar)
- And can reduce tuber disease on harvest

Conclusions

- Monitoring root infection dynamics can provide useful model system to measure impact of disease control treatments

http://www.appsnet.org/asds/

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