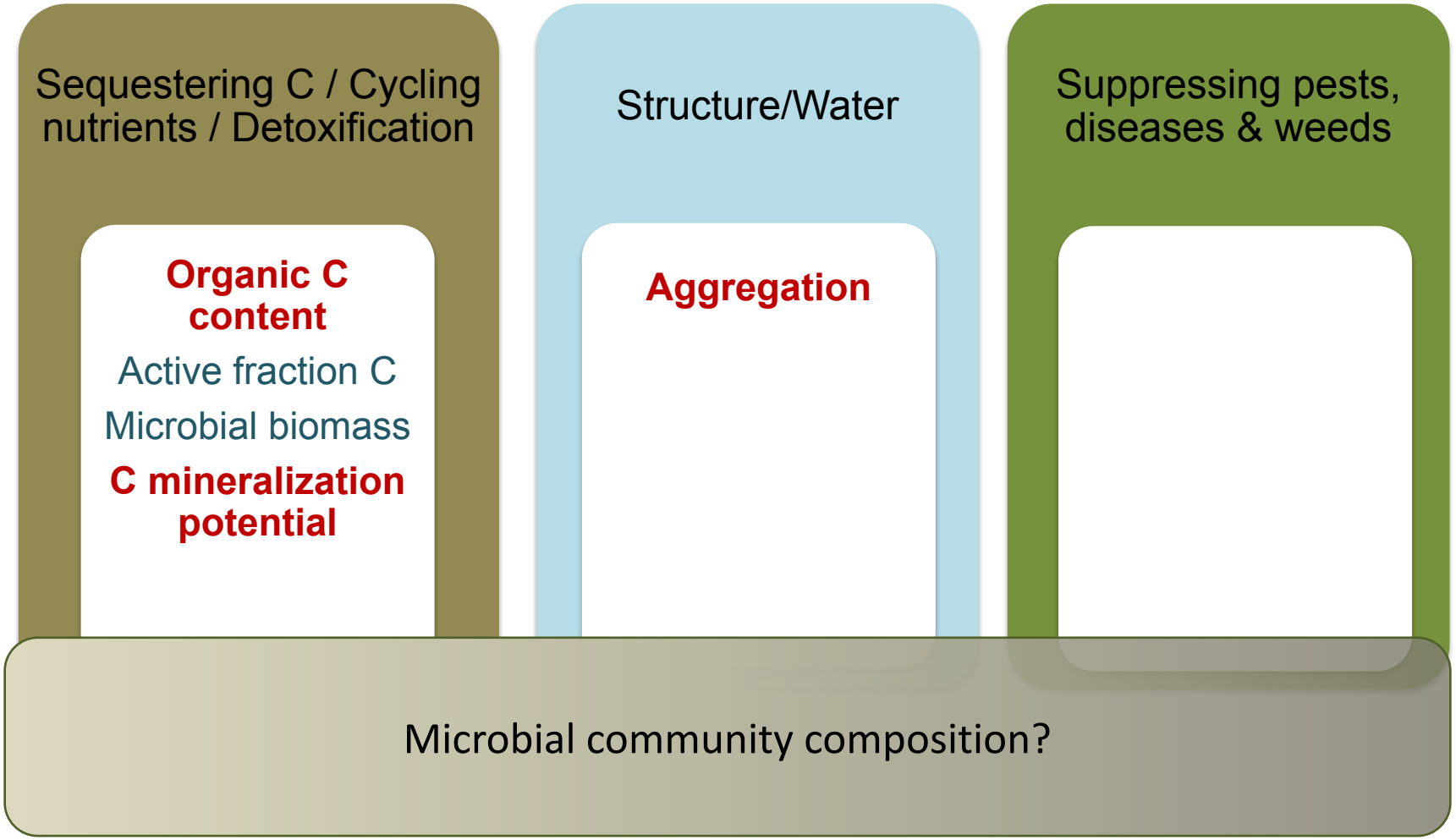
Prevalence of soil-borne pests and diseases in relation to soil health

Tom Forge
Agriculture & Agri-Food Canada
Summerland Research & Development Centre, British Columbia

ACARN Data Protocols Workshop
23 February, 2023

Assessing Ecological Functions of Soil

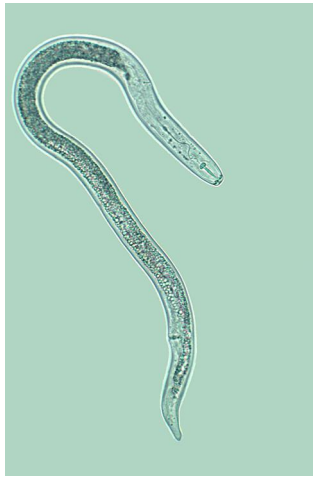


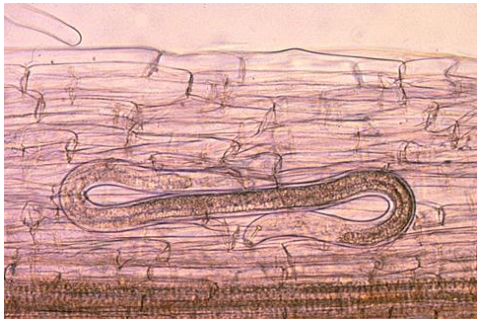
The connection between soil health and pest/disease suppression

- Some root pest/disease complexes have been *associated* with long-term cultivation and declines in soil organic matter
  - Due to monoculture or declining soil health?
- Soil-borne pest/pathogen populations are regulated by other soil organisms – antagonists
- Organic amendments can induce pest/disease suppressive soil

Example: Apple Replant Disease Complex

- Historically known as “sick soil” syndrome
  - (inverse of soil health?)
- Populations of nematodes and fungal pathogens build up in mature orchards
- Impacts of the pest/pathogen assemblages are most severe when replanting with juvenile trees
- Most perennial crops develop some sort of replant disease complex





Specific indicators

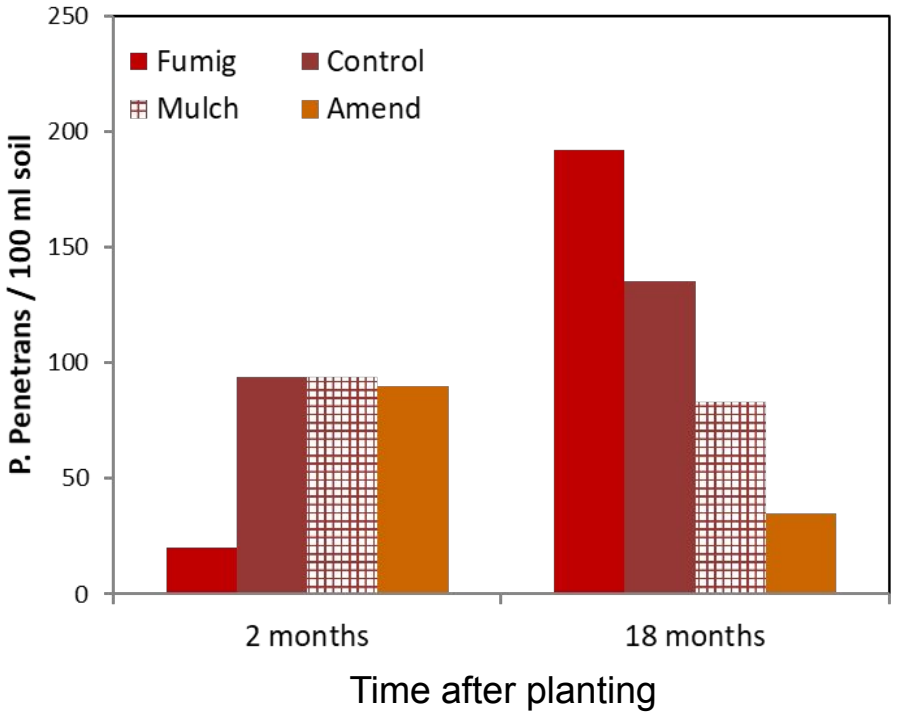
- Disease bioassay
- Lesion nematodes
- Specific pathogen quantification ?

General indicators

- total organic C
- Labile C (POX)
- Mineralizable C&N
- Aggregate stability

Illustration of the role of natural enemies:

-Re-establishment in fumigated soil



Data from Watson et al. 2017. Appl. Soil Ecol. 117-118: 212-220

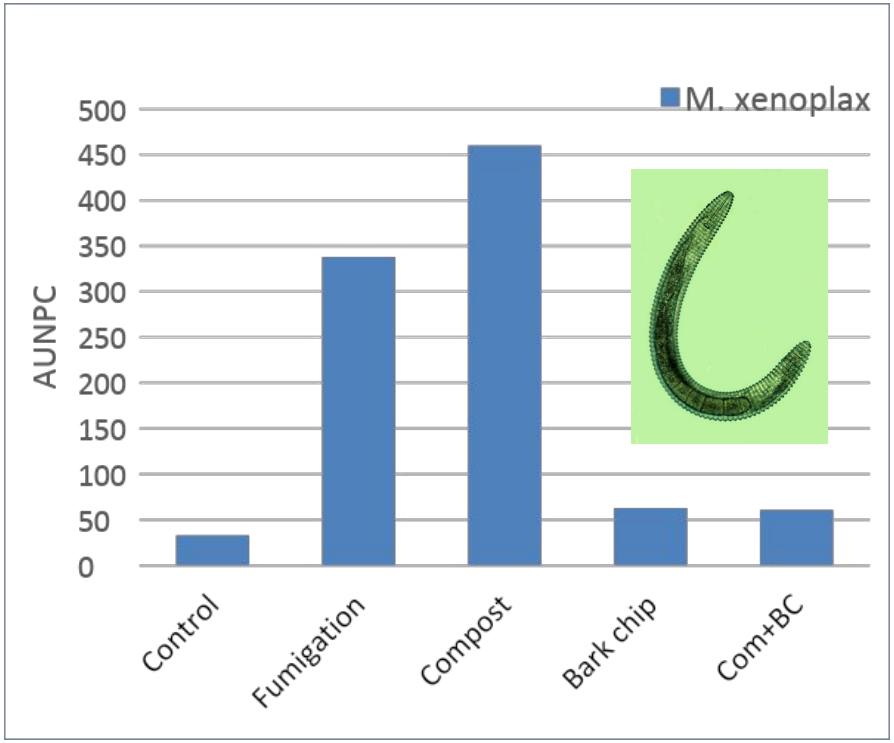
Soil health/organic matter management can lead to PPN suppression?

High C/N ratio mulches & amend's stimulate NTF and other antagonists

But…
can we assume soil health improvement leads to pest/disease suppression?

- Some amendments can increase pest populations in long-term
- Cover crops may or may not be alternate hosts
  - Depends on specific crop x pest/pathogen combinations
  - Devil is in the details
- BMPs intended to improve soil C/soil health can backfire wrt to pests/pathogens
  - "co-detriment?"

Mesocriconema xenoplax **parasitizing cherry - 9 years later…**



Proposed work

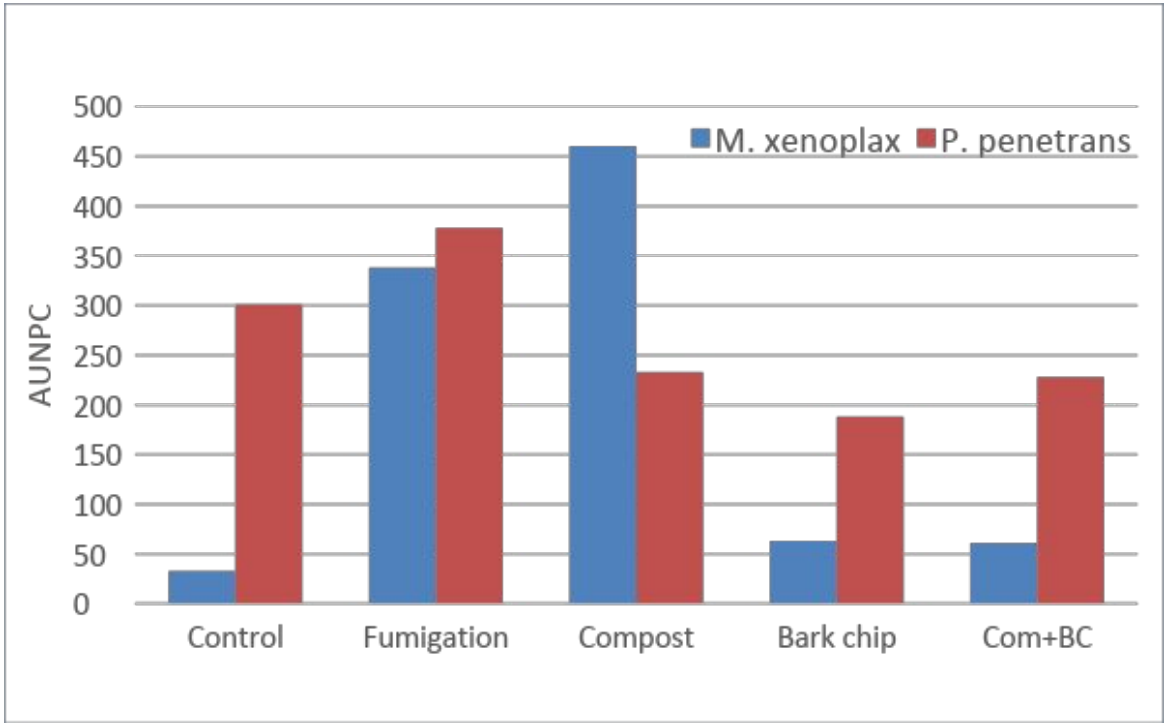
Year 1 (2023)

- Limited number of crops/sites (TBD)
  - Coordinate with soil micro analyses
- Characterize plant-parasitic nematode communities in first year (23/24)
  - Baseline for post-BMP analyses
  - General site characterization

Year 4 and…

- Re-sample:
  - Compare nematode communities in BMP and non-BMP fields/plots
  - Use bioassays to compare “net pathogenicity”
  - (Probe for specific pathogens?)
  - Interpret in relation to other SHI’s, microbial metagenomic data and… *crop health and vigour*

Sensible adoption of climate friendly BMPs… what it is all about!


500
450
400
350
300
250
200
150
100
50
0
AUNPC
M. xenoplax
P. penetrans
Control
Fumigation
Compost
Bark chip
Com+BC