Characterization of Soil Biology

Why--What is the question or problem you want to address?

Specific disease problem or microbial complex?

Damping-off of wheat by *Pythium* resulting in diminished stand

Apple replant disease incited by a consortium of microorganisms

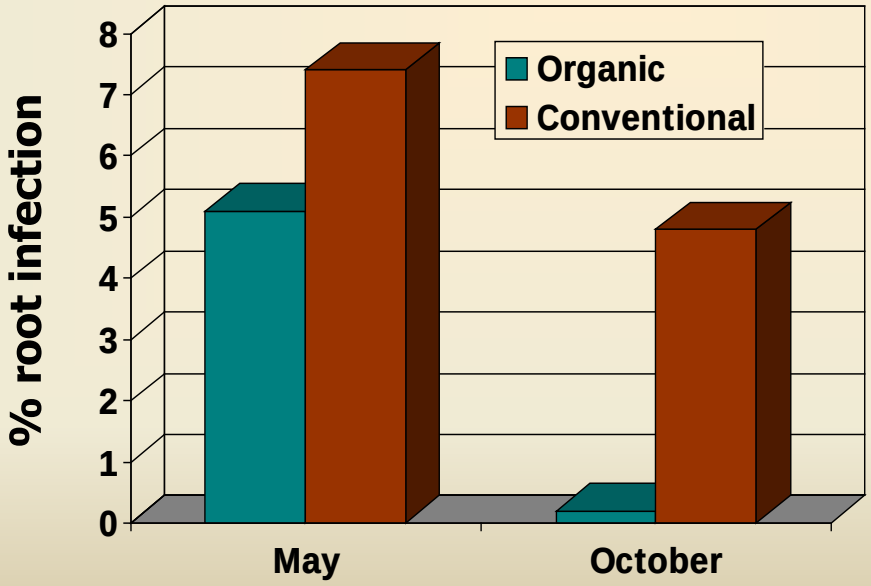
When?

Soil microbial populations vary throughout the year and the appropriate time to sample will vary in a similar fashion.

For example:

***Pythium* spp.---spring**

***Pratylenchus* spp.--fall**



Where?--

Plant row vs. aisle

Rhizosphere vs. Bulk soil

Relative Composition (%) of the Bacterial Community Recovered from 1-yr-old Apple Orchard

Genus	Bulk Soil	Rhizosphere
Agrobacterium		5
Arthrobacter		5
Bacillus	86	3
Burkholderia		42
Cellulomonas		2
Cytophaga		2
Flavobacterium		3
Micrococcus	2	
Phyllobacterium		2
Pseudomonas	7	22
Rhodococcus		2
Serratia	2	
Variovorax		11

What?--

General Community

Based on what parameters

Plant Pathogens

Bacteria, fungi, nematodes

Plant Beneficials

Mycorrhizae

Rhizobium

PGPR

Other Functional Groups

Characterization of Soil Biology: Molecular Methods

Analysis of Fatty Acids

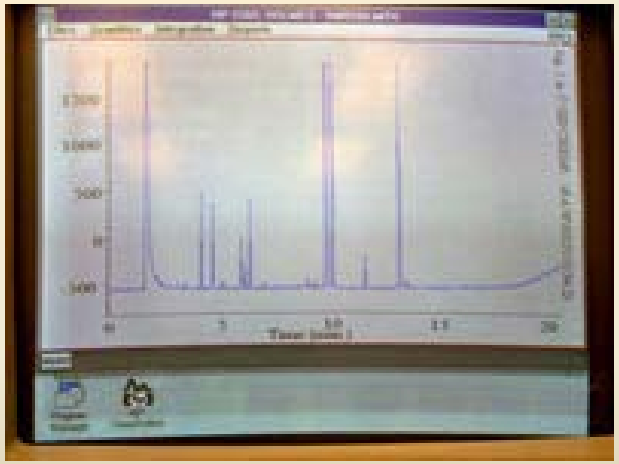
- GC-FAME
- PLFA

DNA-Based Methods

- Sequence Analysis-16S rRNA gene
- PCR
  - DGGE
  - RFLP
  - ETC

Analysis of Fatty Acids

Extraction from soil or micro-organism



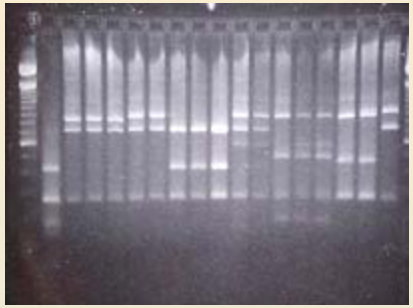
Speciation based on Comparison to library of profiles

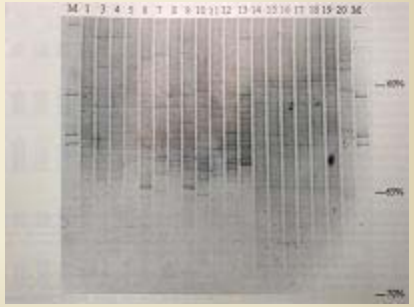
Examine for Indicator Fatty Acids

DNA-Based Methods

Amplification of rDNA (or other target)

Extract DNA from Environmental Sample





Sequence Analysis

RFLP Analysis

DGGE

Advantages:

VS.

-Methods are culture independent

Estimated that <1% of soil microbial community can be cultured using traditional methods

Many culturable bacteria are often present in soil in a viable but non-culturable state

-Shifts in community composition are more easily detected.

Advantages:

-Identification does not require specialized training in mycology, bacteriology, nematology, etc., etc.

Disadvantages:

-Identifications are only as good as the library
-Many non-culturable organisms are unknown both in ID as well as function
-Require specialized equipment
-PLFA methods have not consistently detected shifts even with dramatic changes in soil management over extended (years) periods.

Practical Application:

- Research Capacity
- Delimiting and Detecting Biological Markers
- Screening for the Presence of Known Pathogens
- Determining Mycorrhizal Colonization
- Monitoring Changes in Composition of Microflora
- ETC

16S rDNA Genotype Composition of Fluorescent *Pseudomonas* spp. Populations from Apple Grown in Wheat Cultivated WVC-A Soils

Genotype	Con.	'Eltan'	'Hill81'	'Madsen'	'Penawawa'	'Lewjain'
1	19	18	19	19	14	10
2	0	0	0	1	5	1
5	0	1	0	0	0	0
9	2	0	2	0	5	9
10	2	2	3	0	0	0
11	1	0	0	0	0	1
13	1	1	0	1	2	1
14	1	0	0	0	0	0
15	0	0	0	2	0	0
17	1	1	0	0	0	2
18	0	0	1	1	1	1
20	0	1	0	0	0	0
21	0	1	0	0	0	0
23	0	0	1	0	0	1
27	0	0	0	0	0	0
29	0	2	4	0	1	1
30	0	0	0	0	0	2
33	0	1	0	0	0	1
34	0	2	0	2	0	0
% inhibitory strains	13 %	10 %	10 %	15 %	40 %	43 %