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Linking Soil Microbes to High Quality, Stable Organic Matter

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About Us



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Ward Laboratories, Inc. is committed to the continued enhancement of analytical result excellence and service through the dynamics of its quality assurance system, the integrity of its people, and the professionals engaged in the agricultural analytical testing we provide.



Our Services

- Soil Analysis
- Feed/NIR Testing
- Water Testing
- Soil Health/Biotesting
- Proper Soil Sampling
- Plant & Tissue Testing





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Celebrating
40 years
1983-2023

Happy
85th Birthday
Ray



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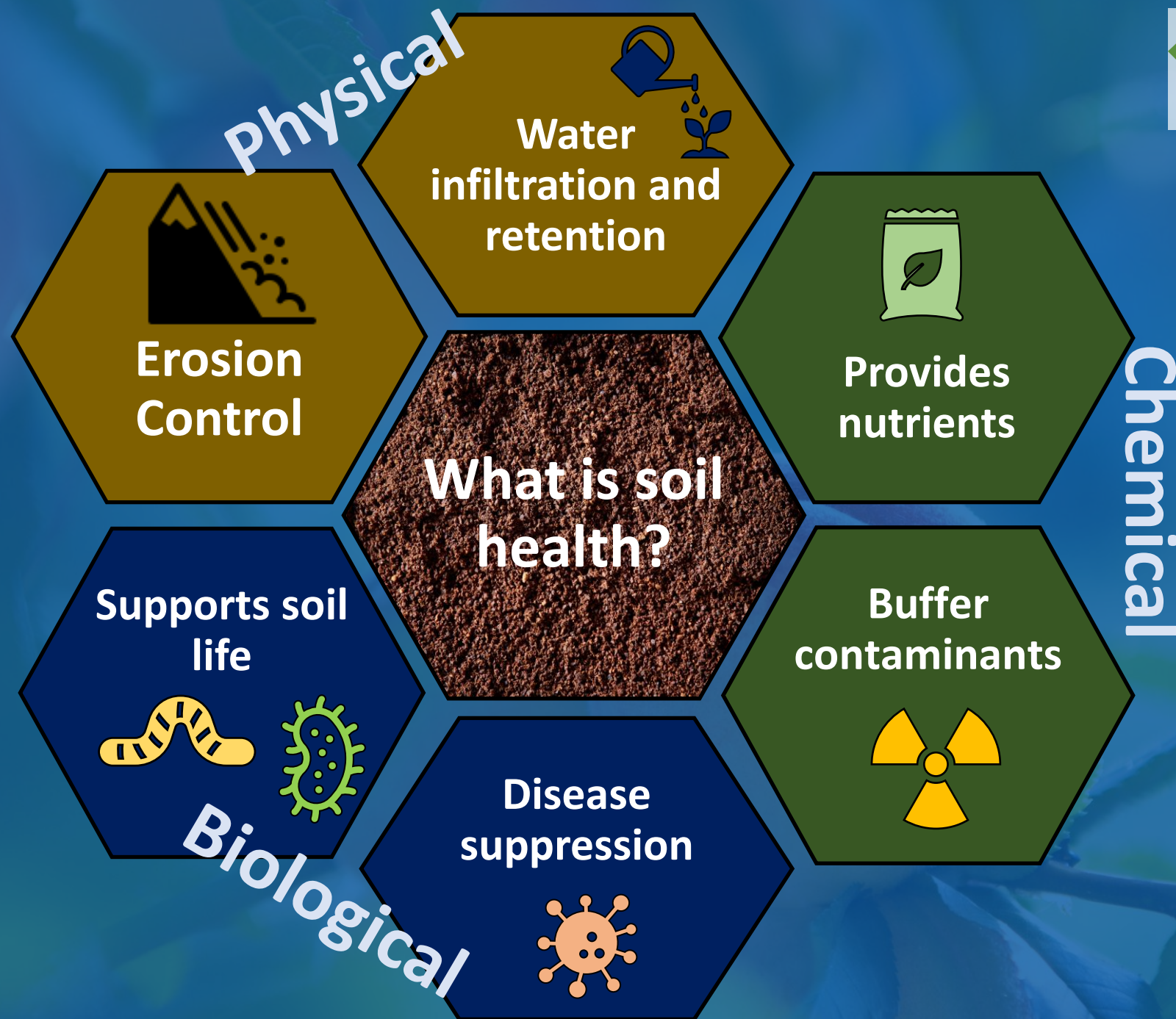
Microbes and Soil Health

Active and Stable Carbon

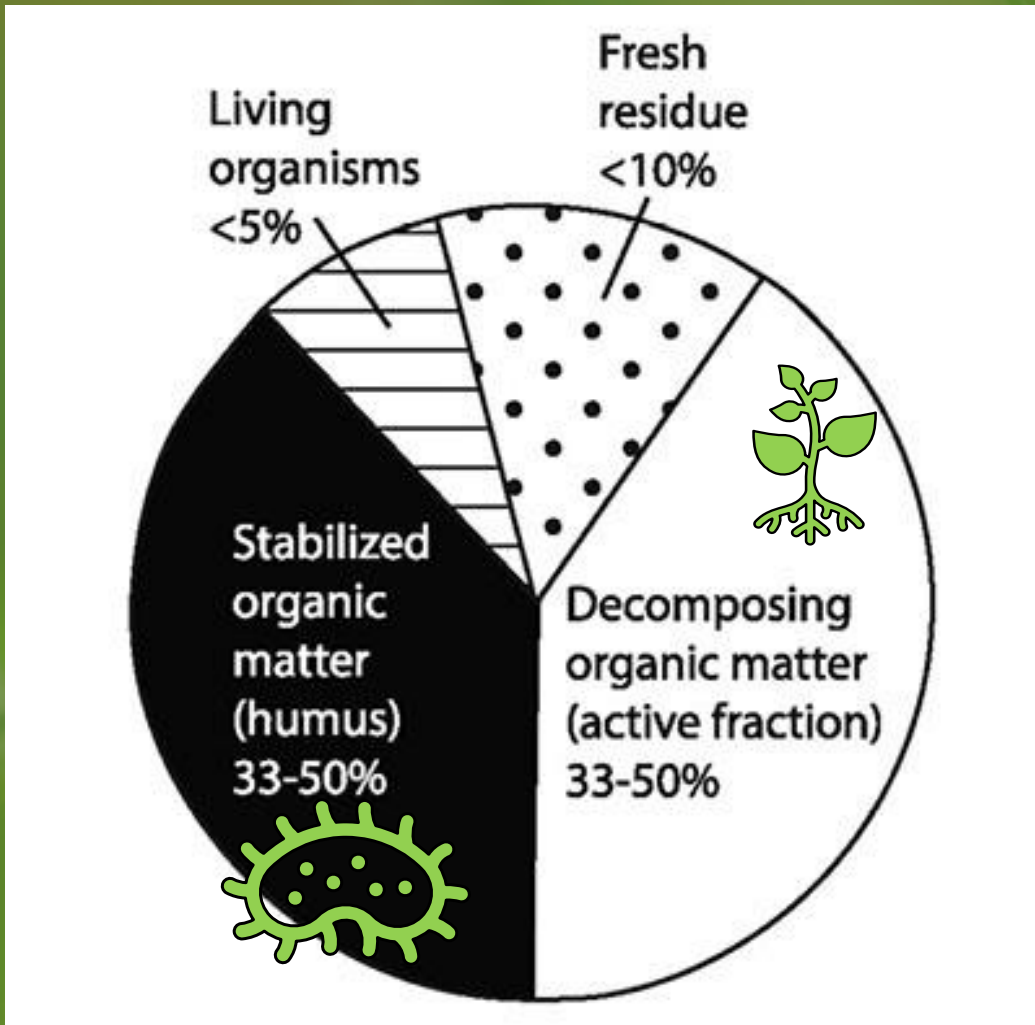
Microbes in Soil and Rhizosphere

Active Carbon and Protein





Organic matter (OM) composition



OM Carbon Composition:

~58% organic carbon

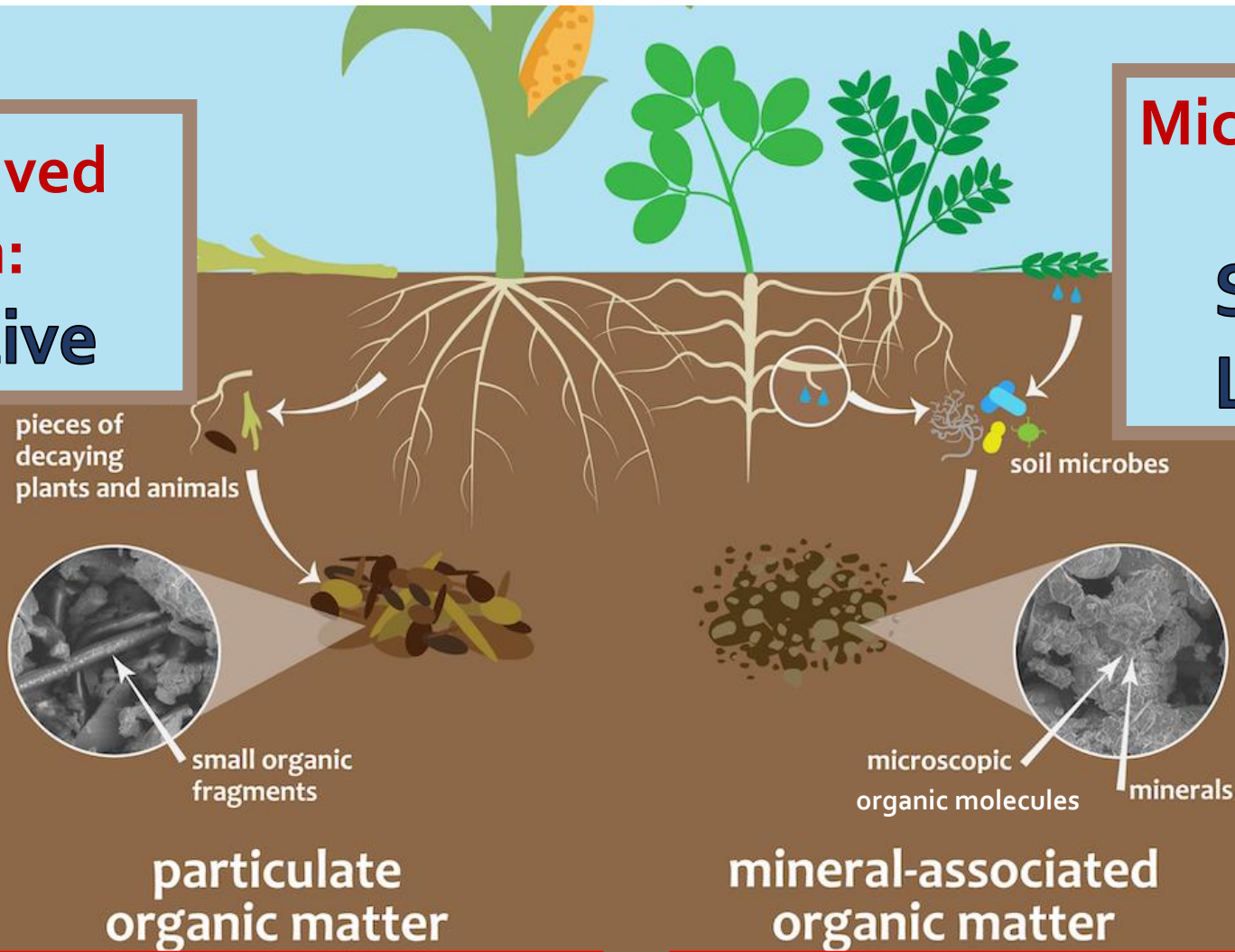
80% of that carbon:
dead microbes or
microbial byproducts


2% from living microbes
(Liang and Ballser, 2011)

Quality OM and Long-term Carbon Storage

**Plant-derived
Carbon:
Very Active**

**Microbial-derived
Carbon:
Stable and
Long-term**




POM


MAOM

lifetime
= 1-50
years



carbon
nitrogen

lifetime
= 10-1000
years



carbon
nitrogen



Everything above that is the particulate organic matter.

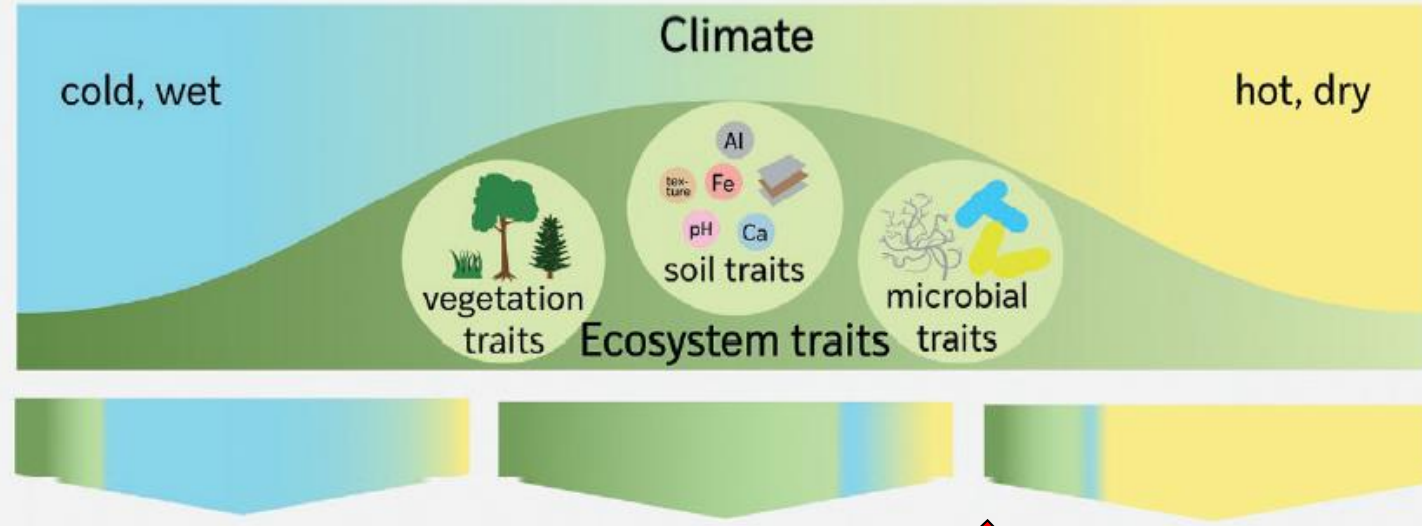
Scroll for details



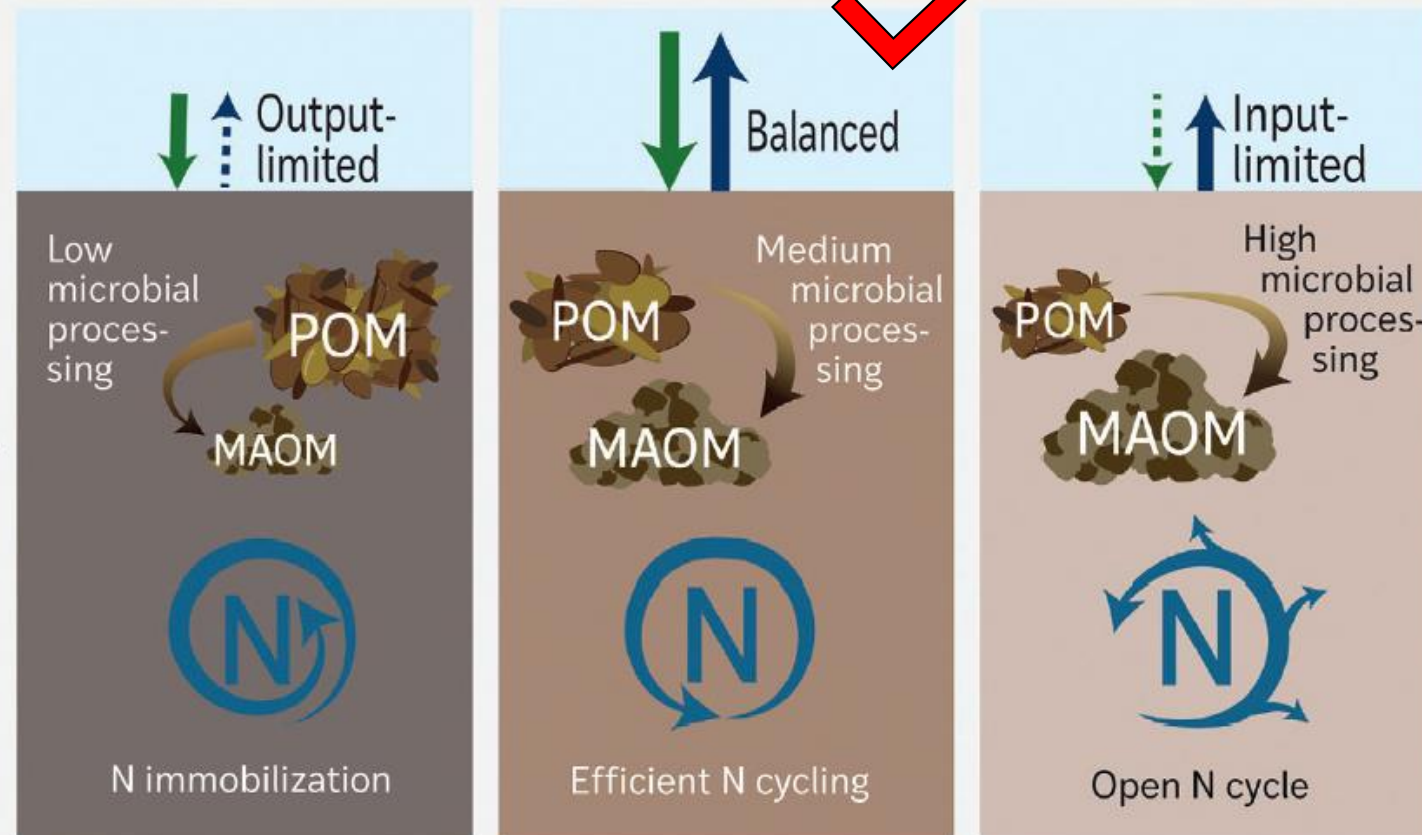
Everything that falls through the sieve is the mineral associated organic matter.

Scroll for details

Controls



Topsoil



Calculating your Organic Carbon stocks from a soil core:



The minimum data needed:

Bulk density and OM%, but a direct carbon test is required by most protocols

- $OM\% \times 58\% = \text{Organic Carbon (OC) \%}$
- $OC\% \times \text{Bulk density (g/cm}^3\text{)} \times \text{depth} = \%OC \text{ per cm}^3 \text{ per depth}$

If you know the % POM or MAOM, you can calculate your long-term carbon stores

Microbial Active Pools and Function Indicators in Orchards:



- Respiration: 24-hour C-mineralization
- Root-Fungal association: Replant Disease
- Active carbon: Permanganate Oxidizable-C (POX-C)
- Soil Protein: Autoclaved Citrate Extractable (ACE)
- Nematodes

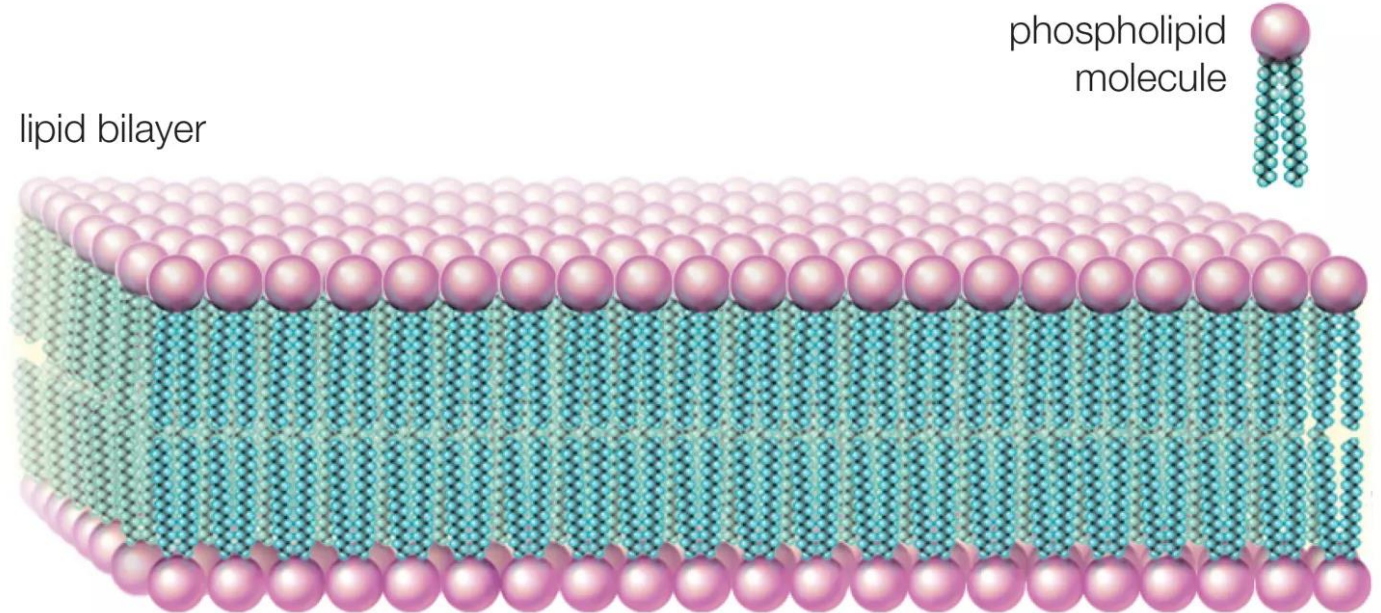
WSU Extension. "Soil Health in Orchards"

Microbes in Bulk Soil:

PLFA (Phospholipid Fatty Acid) analyses

Quantifies microbes from the most important groupings of the Soil Food Web:

- Total Microbial Biomass
- Bacteria (gram+/-)
- Fungi
- Rhizobia
- Protozoa



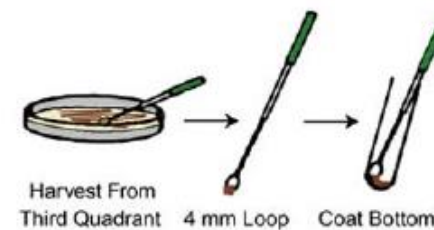


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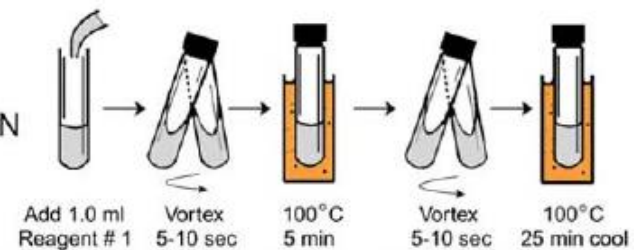
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Lipid Extraction Process: 1 to 2 day process

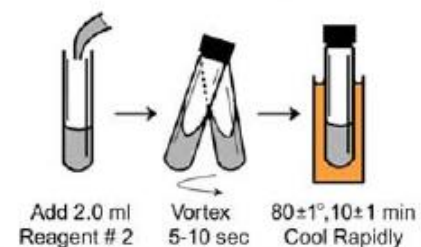
HARVESTING



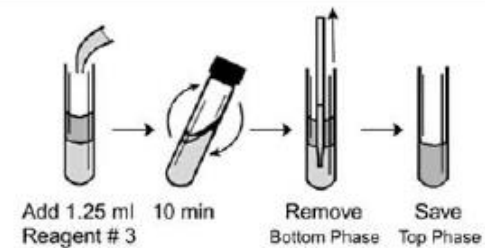
SAPONIFICATION



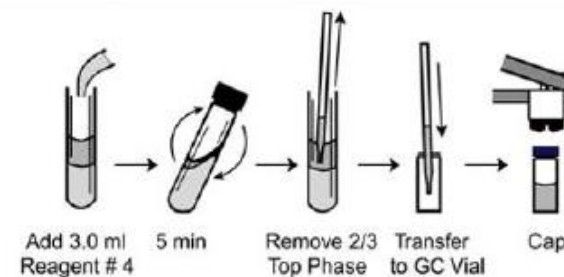
METHYLATION



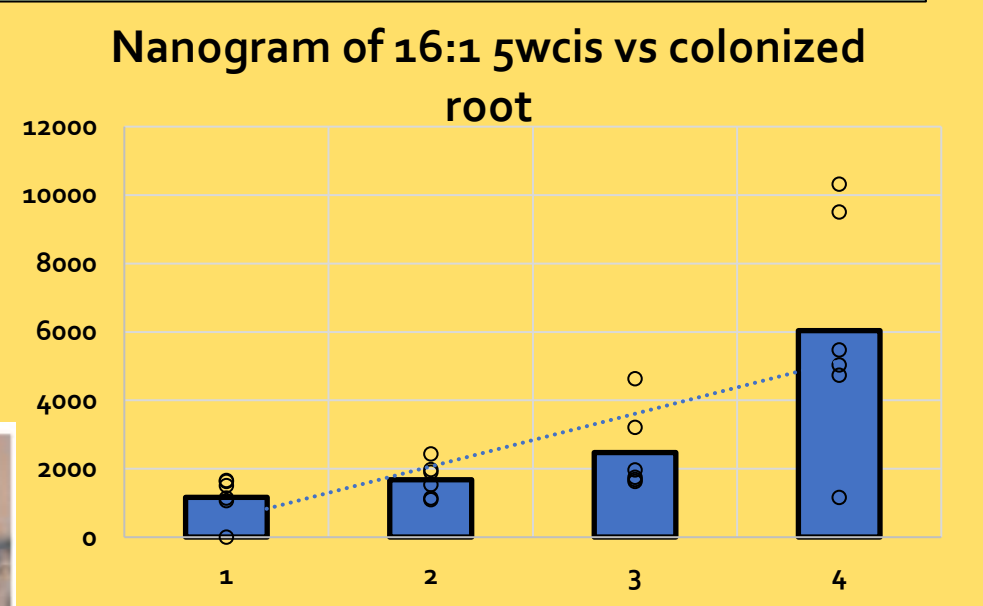
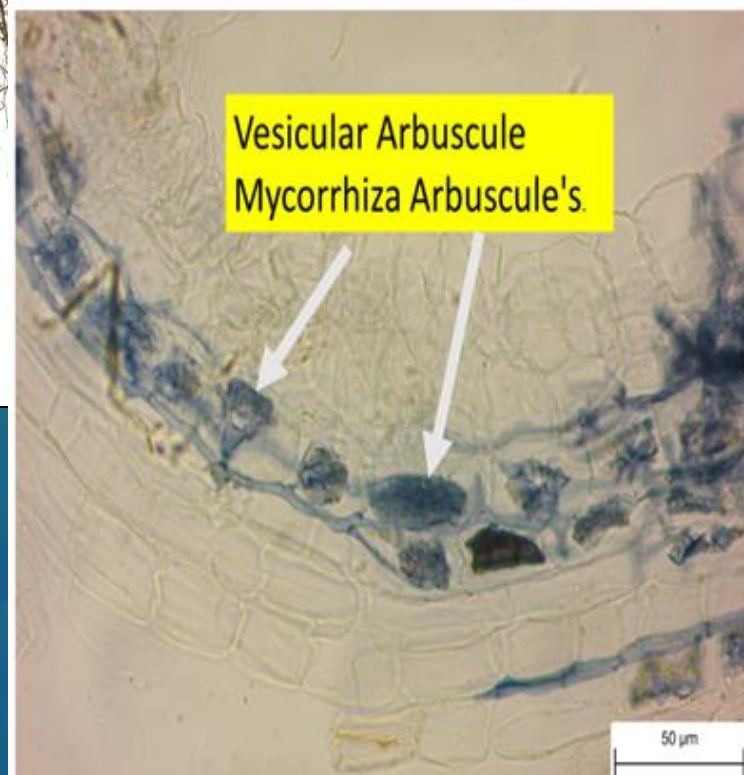
EXTRACTION



WASH



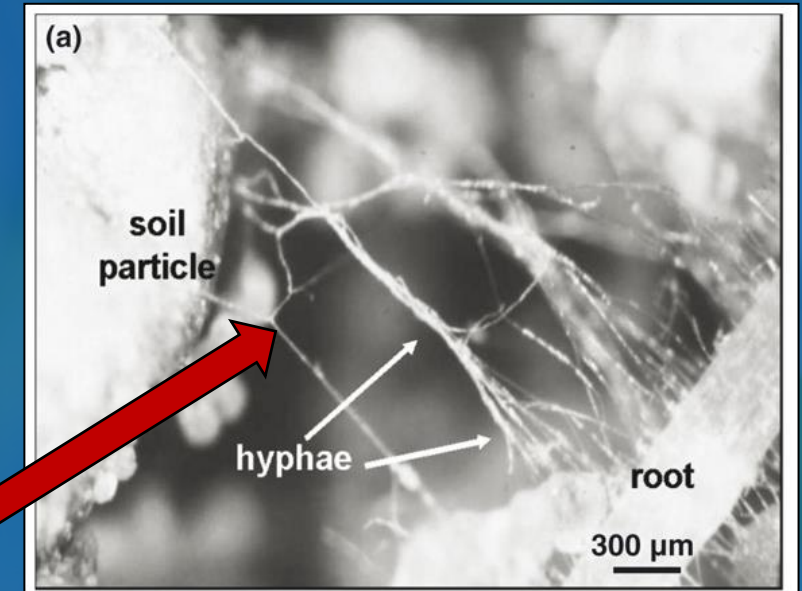
Combating Replant Disease with Mycorrhizae: Neutral Lipid Fatty Acid Analysis (NLFA)



*Correlation between
NLFA and % colonization
determined from root
staining*

Neutral Lipid Fatty Acid (NLFA) analysis

- quantifies root-colonized fungal colonies *that bring non-available nutrients to roots*

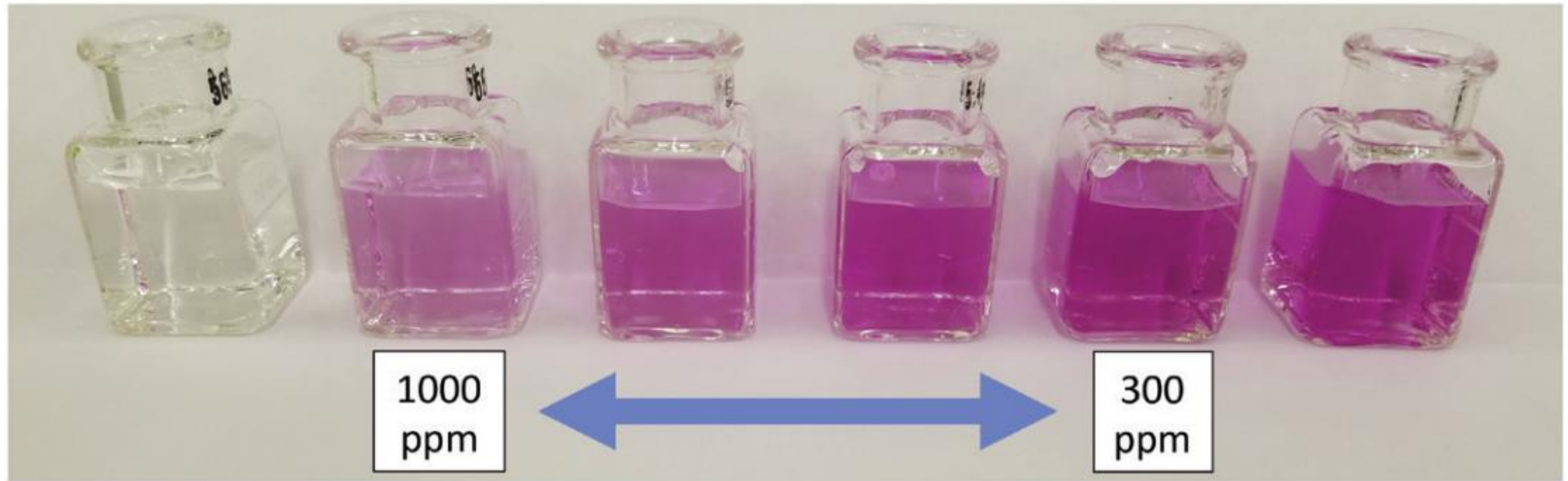


Lambert et al., 2008

Total Mineral Content (lbs/acre)

Total Nutrient Digest (Ward Lab) from 68 farms across several states	Element	P	K	Ca	Mg	S	Zn	Fe	Mn	Cu	B	Mo
Average Value		878	3735	8617	4418	431	90	22060	974	21	26	1
Median Value		825	3599	5333	4443	375	85	22037	665	21	9	1
Highest		2404	9354	70676	9956	1703	235	39559	5268	46	137	3.5
Lowest		281	666	1076	647	51	10	1889	47	2	2	1

POXC (Active Carbon) Testing



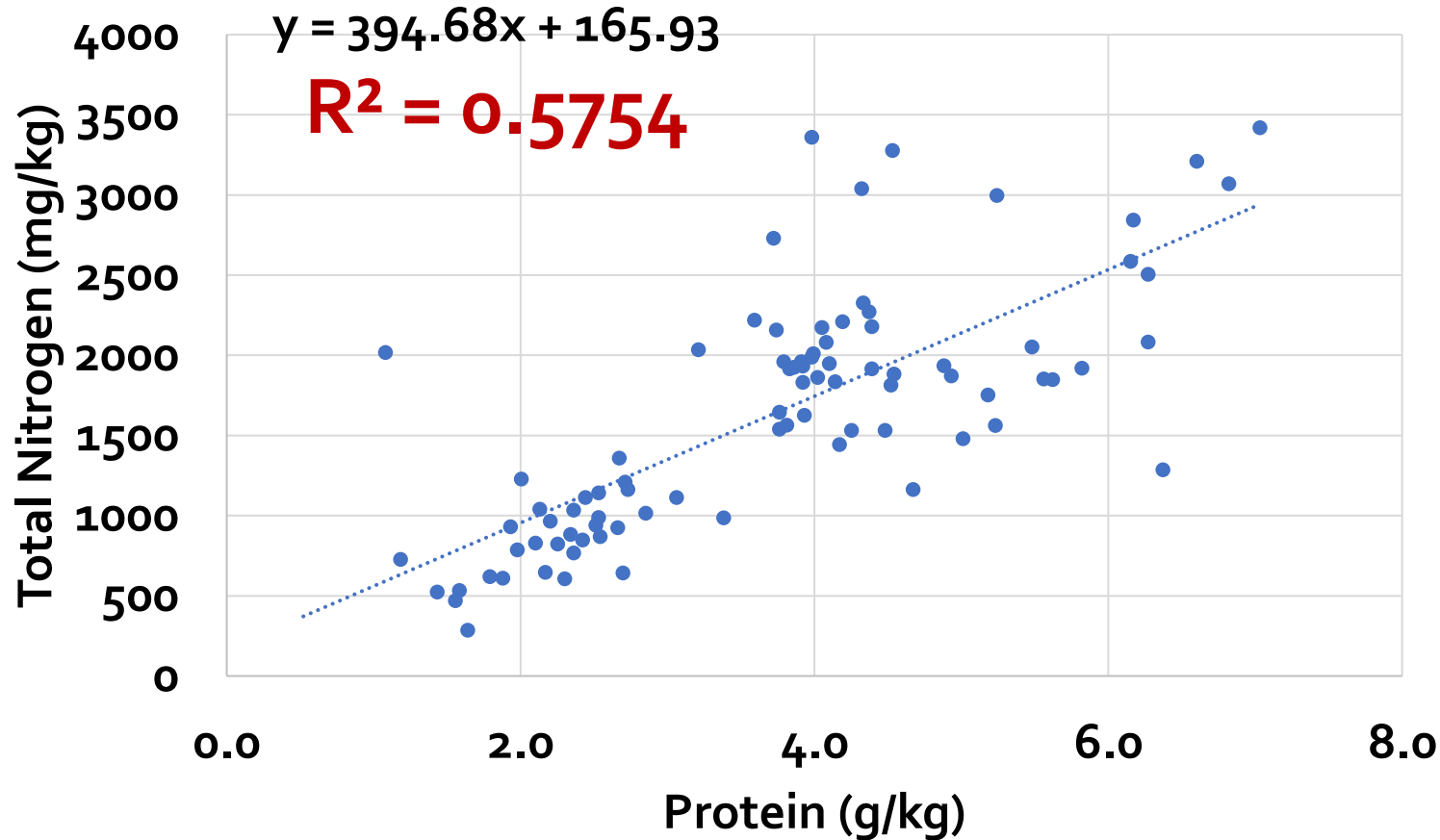
Permanganate Oxidizable Carbon (POXC) mg/kg of soil

Autoclaved Citrate Extractable Protein: Active Nitrogen Pool



- Corresponds with Soil Total Nitrogen

ACE Protein vs Total Nitrogen





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*Thank you!
Questions?*

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Contact



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