Science of the Giants Part 2: Organic Matters!





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Competitive grower since 2000 (PB 1422lbs)

B.S. Biotechnology (plant science emphasis)

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Goals for this presentation:

Organic Matter-

-What is it?

-Why is it important?

-What can you do about it?



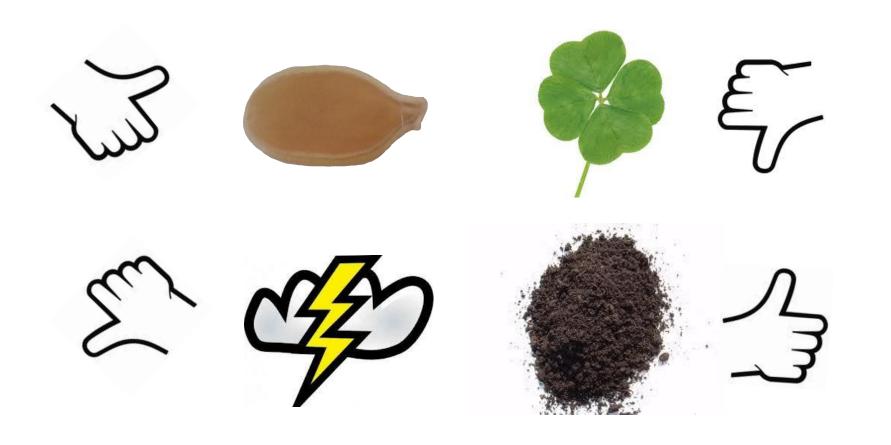




"All you need is good seed, good soil, good weather, and good luck!"

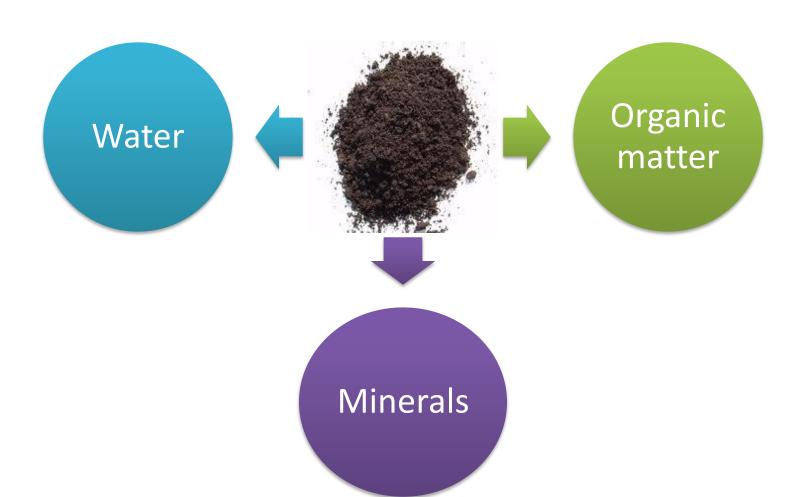
Quote by Gordon Thompson, from "How to Grow World Class Giant Pumpkins"

Which of these variables do you have the greatest control over?





Why should we care about organic matter?



Ai r

Compaction

"...organic matter positively influences or modifies the effect of essentially all soil properties"

Nutrients

Water

ANALYTE	UNITS	RESULTS	LOW	MEDIUM	ОРТІМИМ	V. HIGH
Organic Matter	%	6.5				

Organic Matter (OM) is many things to many people



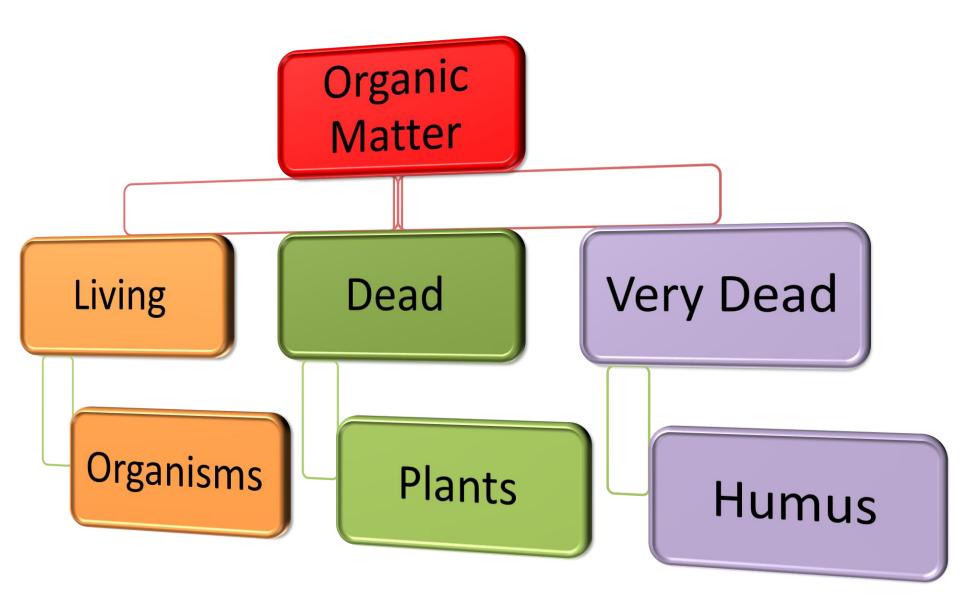


"Organic matter is that fraction of the soil composed of anything that once lived."

-USDA, 1996

"...organic matter (has) been described as the *living*, the *dead*, and the *very dead*"

-Building Soils For Better Crops, 2009



Living OM represents 15% of total OM

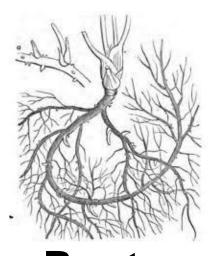


Bacteria

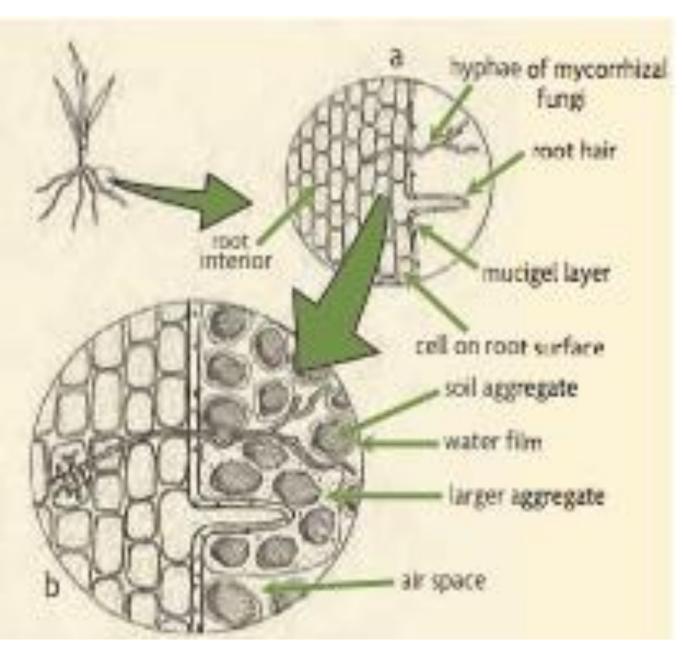


Fungi





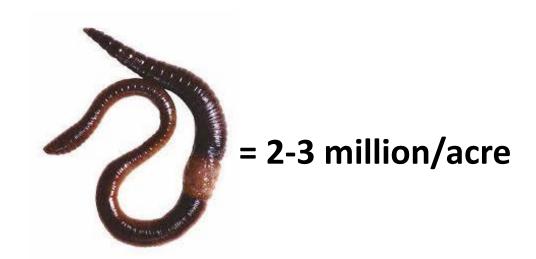
Roots



Living OM feeds roots

Building Soils For Better Crops, 2009

"It may be doubted whether there are many other animals which have played so important a part in the history of the world as these lowly organised creatures" - Charles Darwin



"Worms are the intestines of the Earth" -Aristotle

THE SOIL FOOD WEB ARTHROPODS ARTHROPODS **Predators** Shredders NEMATODES BIRDS Root-feeders NEMATODES Fungal & Bacterial-feeders LANTS FUNGI hoots & Mycorrhizal fungi roots Saprophytic fungi EARTHWORMS NEMATODES **Predators** ANIMALS ORGANIC MATTER Waste, residue and metabolites from plants, animals and microbes **PROTOZOA** Amoebae Flageilates BACTERIA and Ciliates

FIRST TROPHIC LEVEL:

Photosynthesizers

SECOND TROPHIC LEVEL:

Decomposers Mutualists Pathogens, Parasites, Root-feeders

THIRD TROPHIC LEVEL:

Shredders Predators Grazers

FORTH TROPHIC LEVEL:

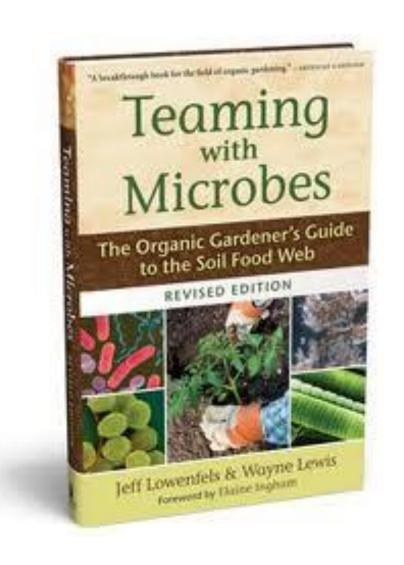
Higher level predators

FIFTH & HIGHER TROPHIC LEVELS:

Higher level predators

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Read Me



Living OM helps breaks down dead OM and provides nutrients & defense to plant roots



Dead OM is the food source of living OM



Dead Microorganisms

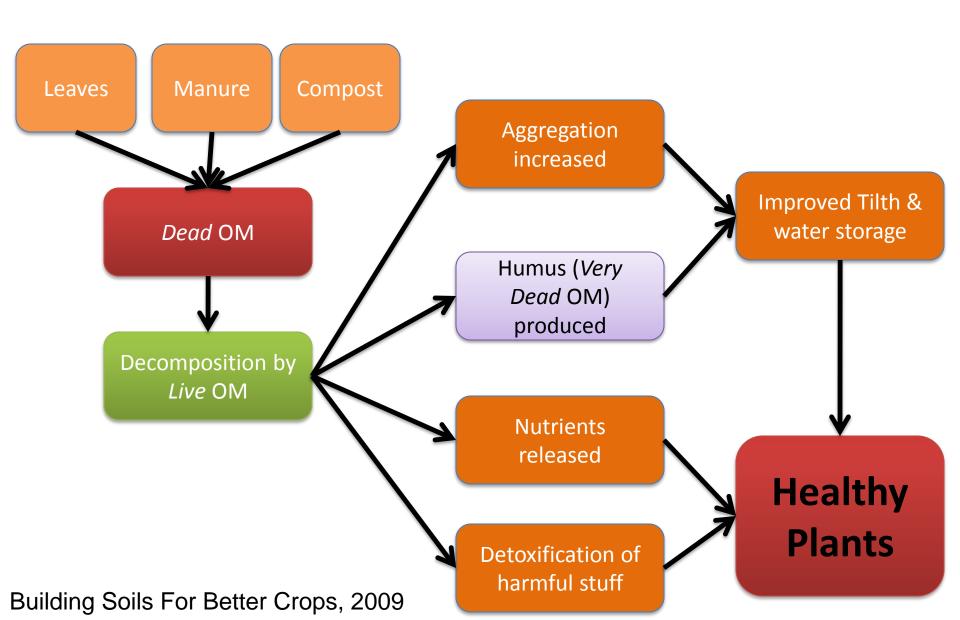






Dead Raccoons

Dead OM makes healthy plants



Dead OM is food for living OM and gives structure to the soil

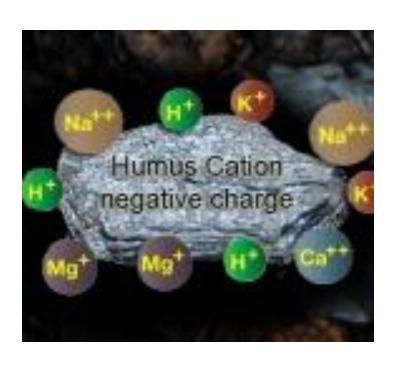


Very Dead OM (Humus) makes up 40-60% of total OM; it is old, stable, and gives soil a dark color

Very Dead OM holds onto essential nutrients, storing them for release & reduces leaching

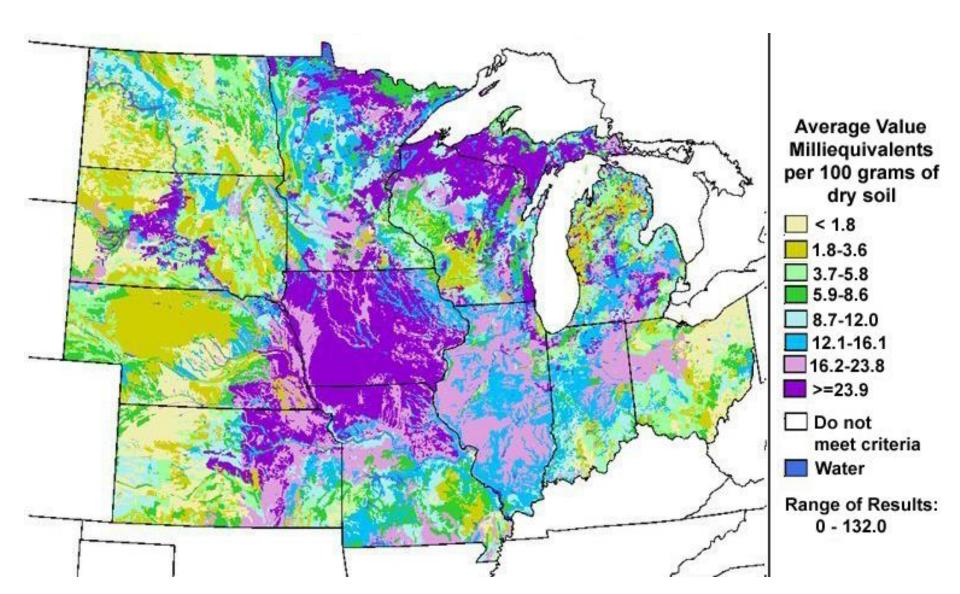


Cation Exchange Capacity (CEC) is a measures the soil's ability to store nutrients



Soil Texture	CEC
Sandy (light color)	3-5
Sandy (dark color)	10-20
Loams	10-15
Silt Loams	15-25
Clay/Clay Loam	20-50
Organic Soils	50-100

Soil CEC Map: purple> 23.9meq



Optimizing CEC is a critical factor for improving soil fertility

"The experts" recommend a CEC between 2025meq/100g

Chambers' Soil Study found average CEC = 16meq/100g for 1200lb-1800lb fruit (n=167) Increasing *very dead OM* is the most effective way to boost "CEC" and therefore the soil's ability to store nutrients (but it's a long slow process)

Humic and Fulvic acid



Sources of dead OM (humus) include:



Compost...aka...Black Gold

Humic Acid has the highest CEC of any soil amendment...



 $= \sim 200-500 \text{ meq}/100g$

...but it takes a boatload to make a difference in CEC levels



78 fifty lb bags of 70% granular Humic acid would be necessary to raise CEC from 10 to 20 in 3000 sq ft of garden space

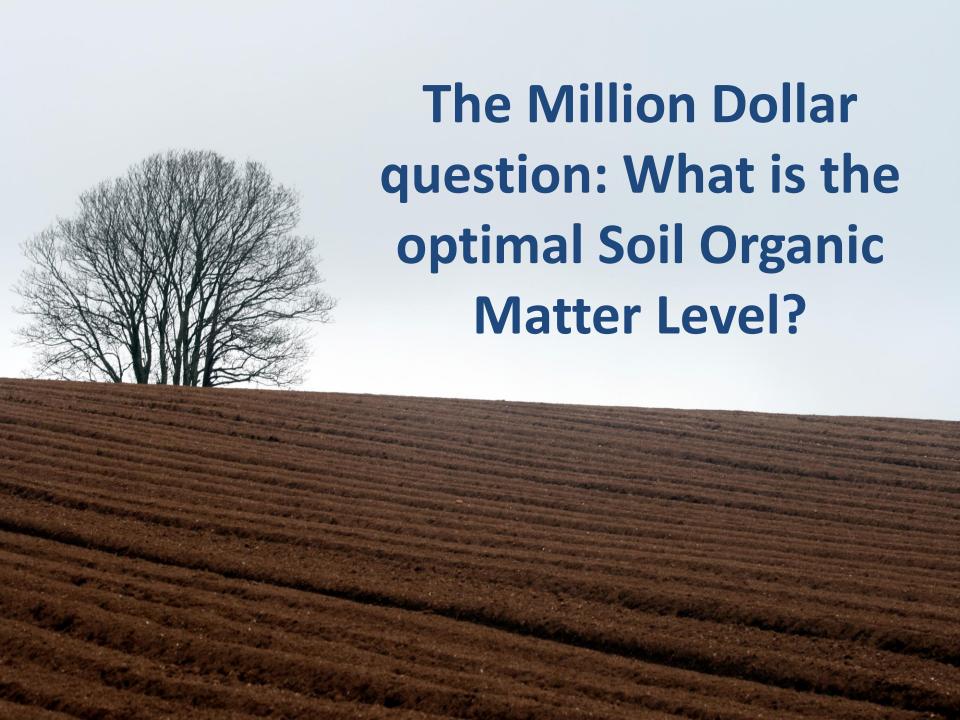
= ~\$1950 @ \$25/bag





"...soil organic matter is the very foundation for healthy and productive soils"

-Building Soils For Better Crops, 2009





ANALYTE	UNITS	RESULTS	LOW	MEDIUM	OPTIMUM	V. HIGH
Organic Matter	%	8.5				

Lab Poll: What do the major soil labs say about optimal OM?

Organic Matter %

3.9

4.4

2.7

2.1

% Organic Matter

1.75

Low

Expert Poll: What do the "experts" say about optimal OM?











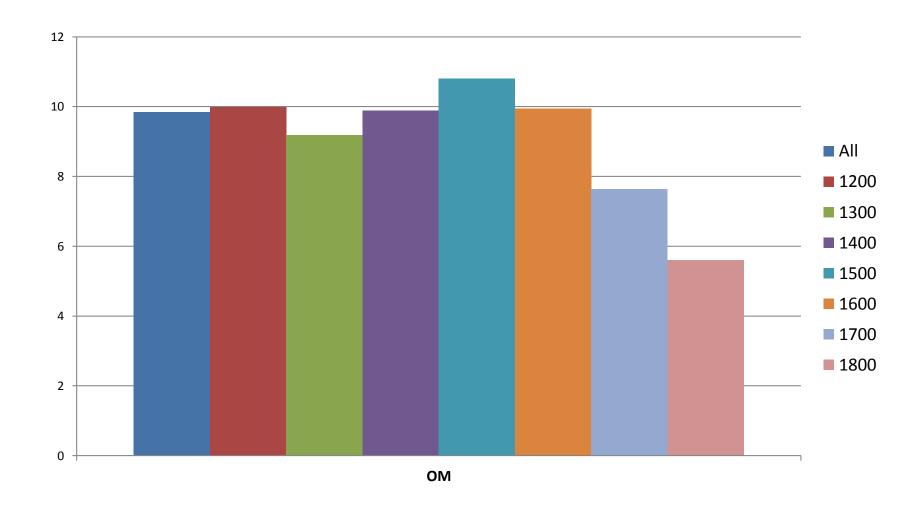


Expert Poll: What do the "experts" say about optimal OM?

Soil type	Optimum % organic matter		
Sandy soils	2–4 +		
Sandy loam soils	3–4 +		
Loam soils	4–5 +		
Clay loam soils	4–5 +		
Clay soils	4–6 +		

Source: The Canada-Ontario Environmental Farm Plan Program workbook, 3rd ed. 2004.

Don Chambers "Soil Study on AGPs" found average OM = 9.84%



Phosphorous Levels

Drainage

"ideal" OM% is dependent on many factors, therefore hard to standardize

Soil Type (sand vs clay)

Nitrogen Levels

Excessive OM can be detrimental

High/excessive Phosphorous

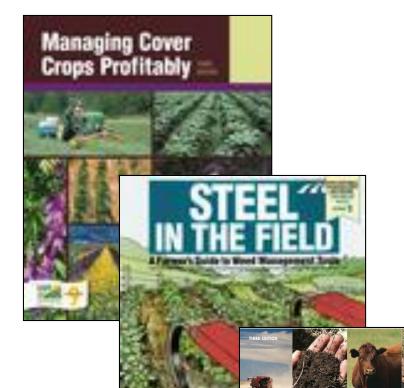
Excessive/deficient Nitrogen

Excessive water retention (wet feet)

Disrupt Calcium availability

Why is soil OM so important?

- Soil nutrition
 - Nutrients decomposing from dead organic matter
 - Addition of nitrogen by microbes
 - Storage of nutrients on humus
- Beneficial effects of soil organisms
- Soil tilth (less vulnerability to compaction)
- Protection of soil against rapid changes in acidity
- Stimulation of root development
- Darkening of the Soil (increases temp in spring)
- Protection against harmful chemicals



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