La matière organique du sol est un indicateur universel de la santé du sol, mais quelle est sa valeur pour la fertilité du sol?

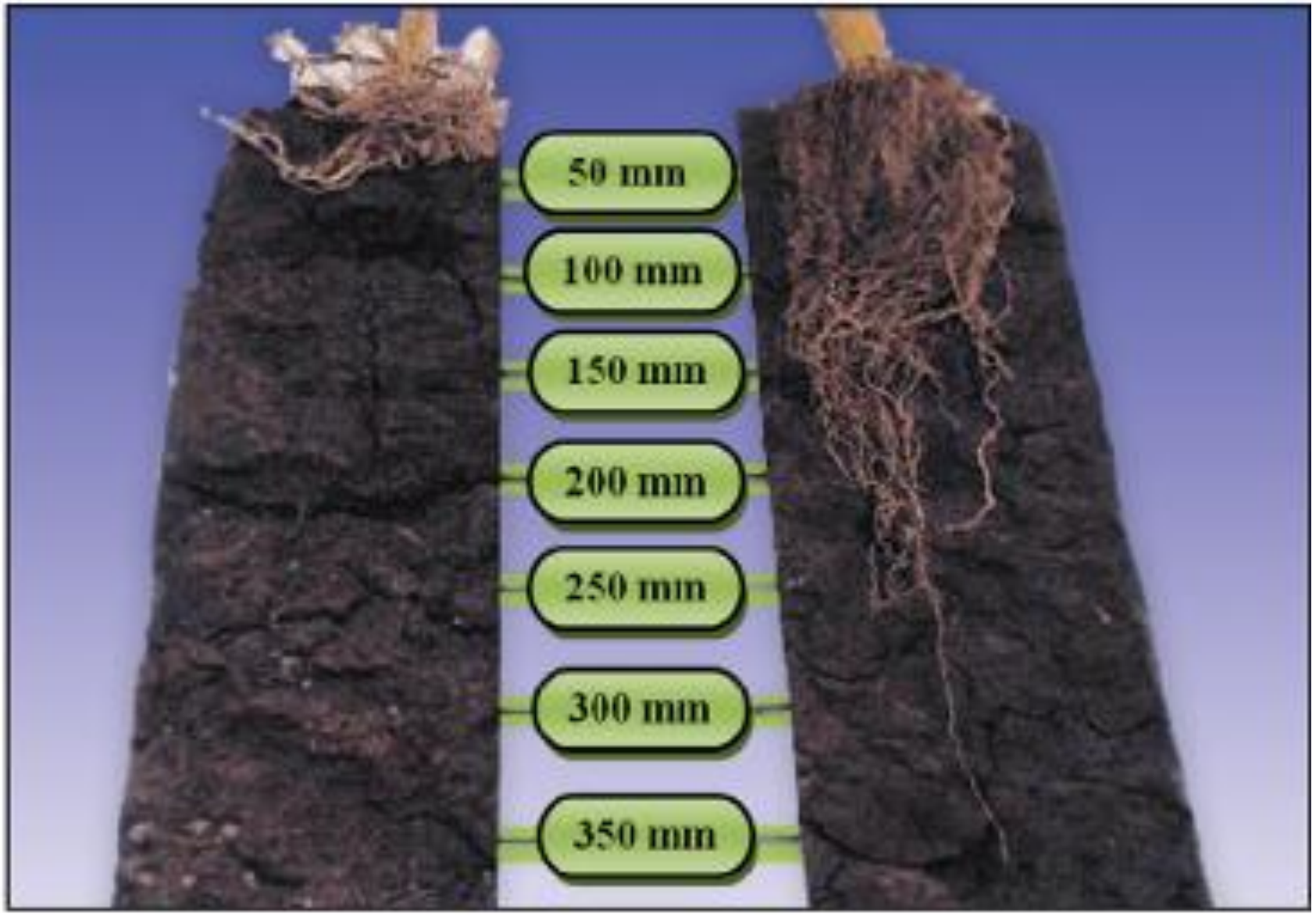
Prof. Joann K. Whalen

Dept. Natural Resource Sciences, McGill University

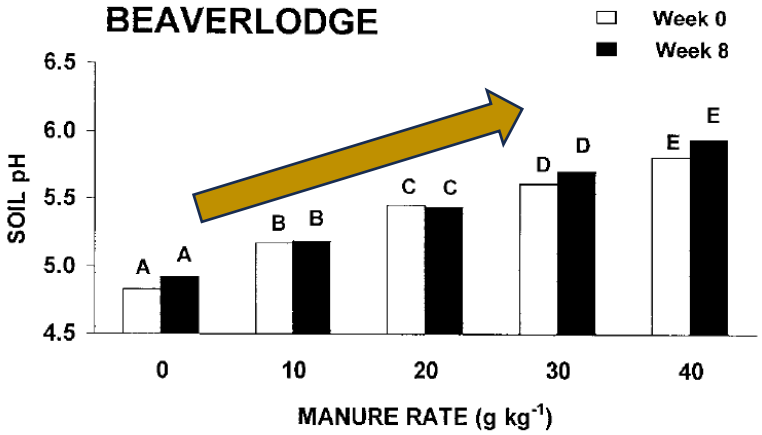
Soil organic matter, an indicator of soil health

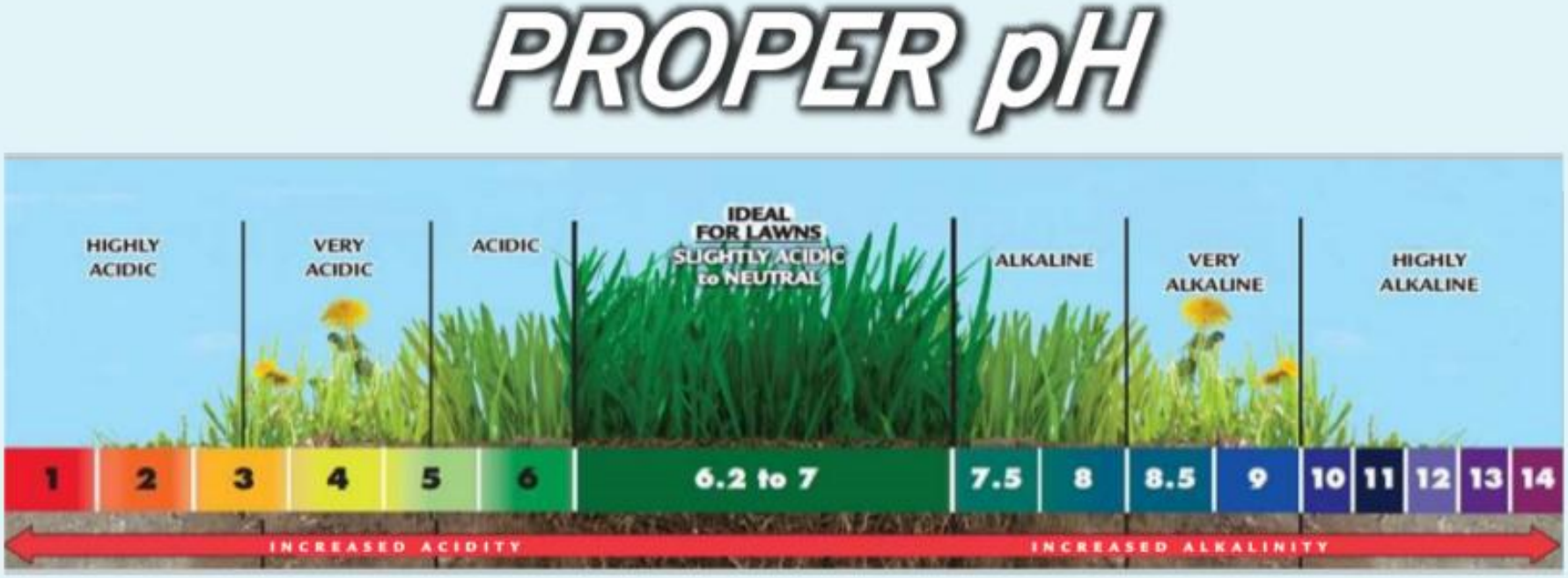
Soil organic matter: moist and warm

Soil organic matter creates porous structure

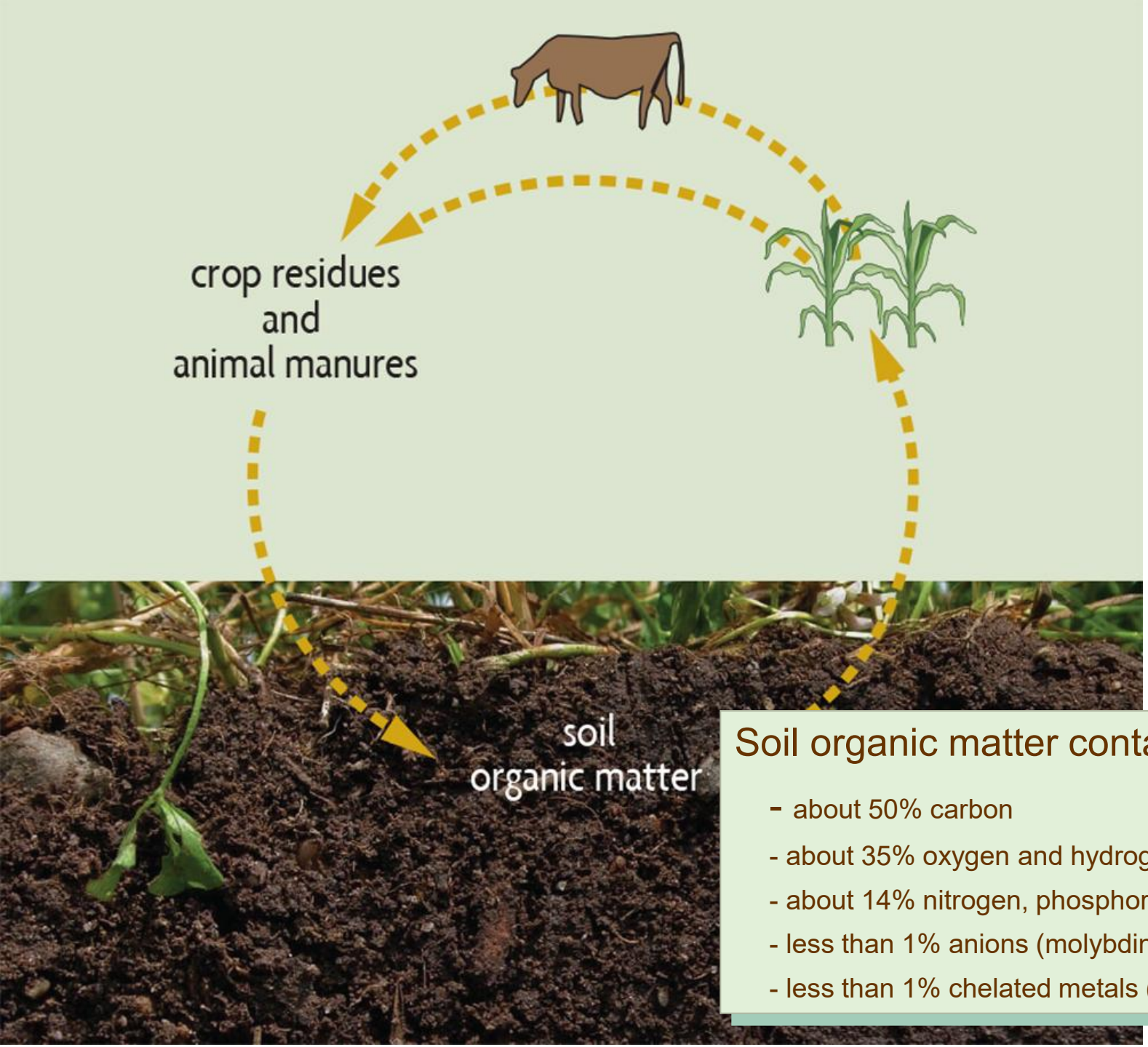


Soil organic matter buffers soil pH





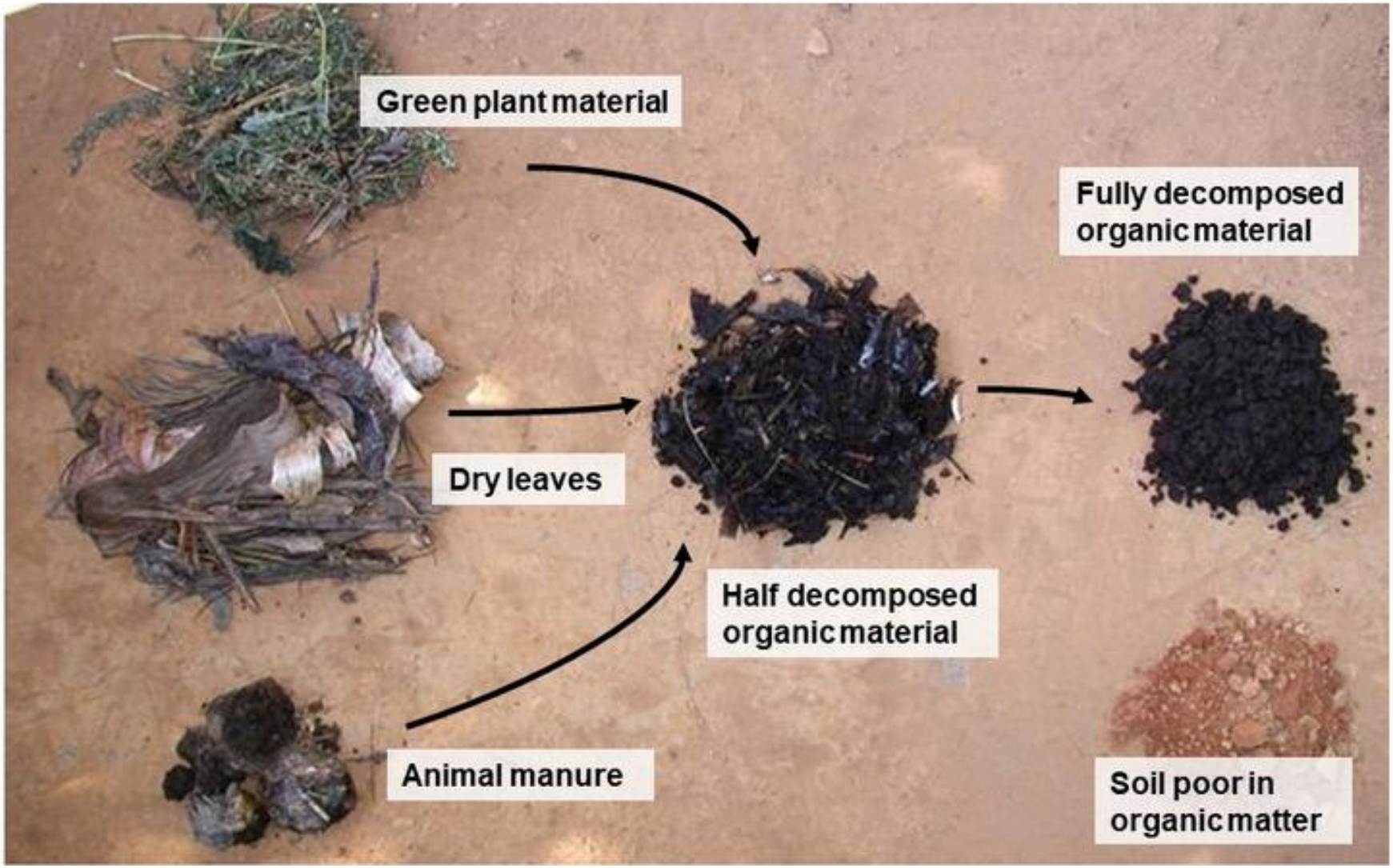
Soil organic matter contains nutrients



Soil organic matter contains:

- about 50% carbon
- about 35% oxygen and hydrogen
- about 14% nitrogen, phosphorus and sulfur
- less than 1% anions (molybdinum, boron)
- less than 1% chelated metals (e.g., Cu, Zn, Ni)

The formation of soil organic matter



Soil organic matter makes roots grow better

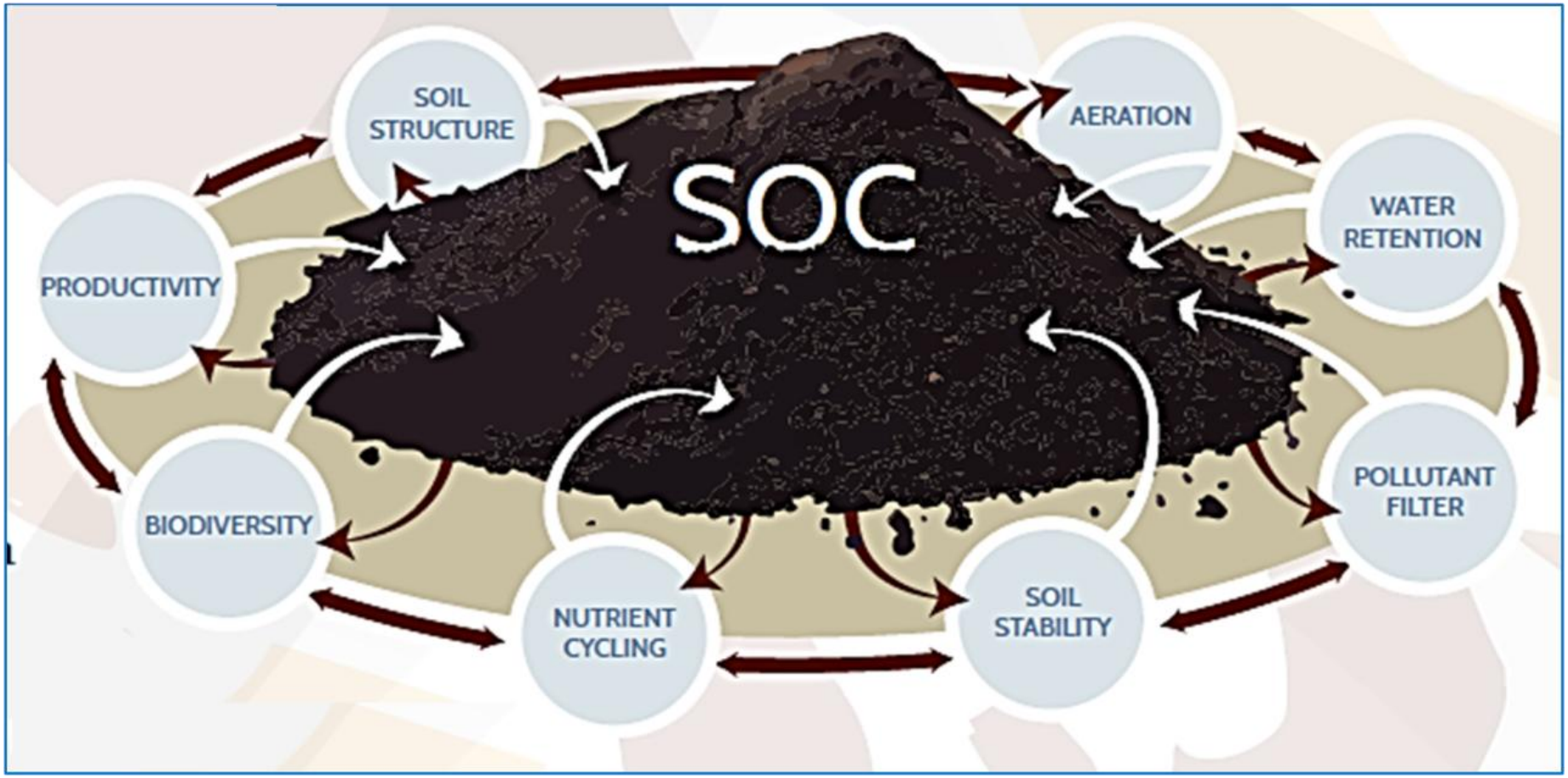
Fibrous root system (Gramineae)

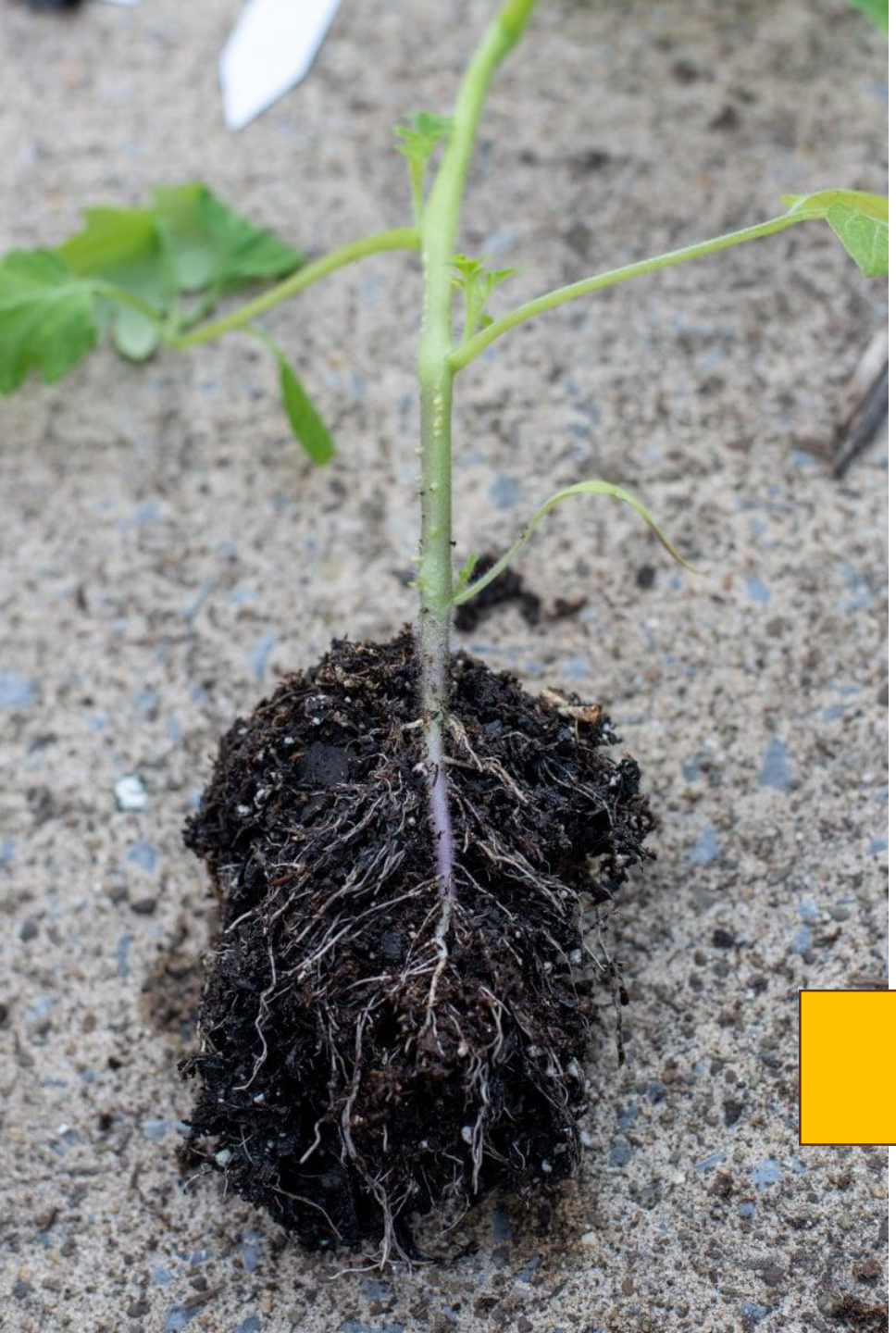
Legume-rhizobia

Soil organic matter increases biological activity

5% of soil organic matter = living organisms

Soil organic matter is an indicator of soil health because it supports multiple soil functions





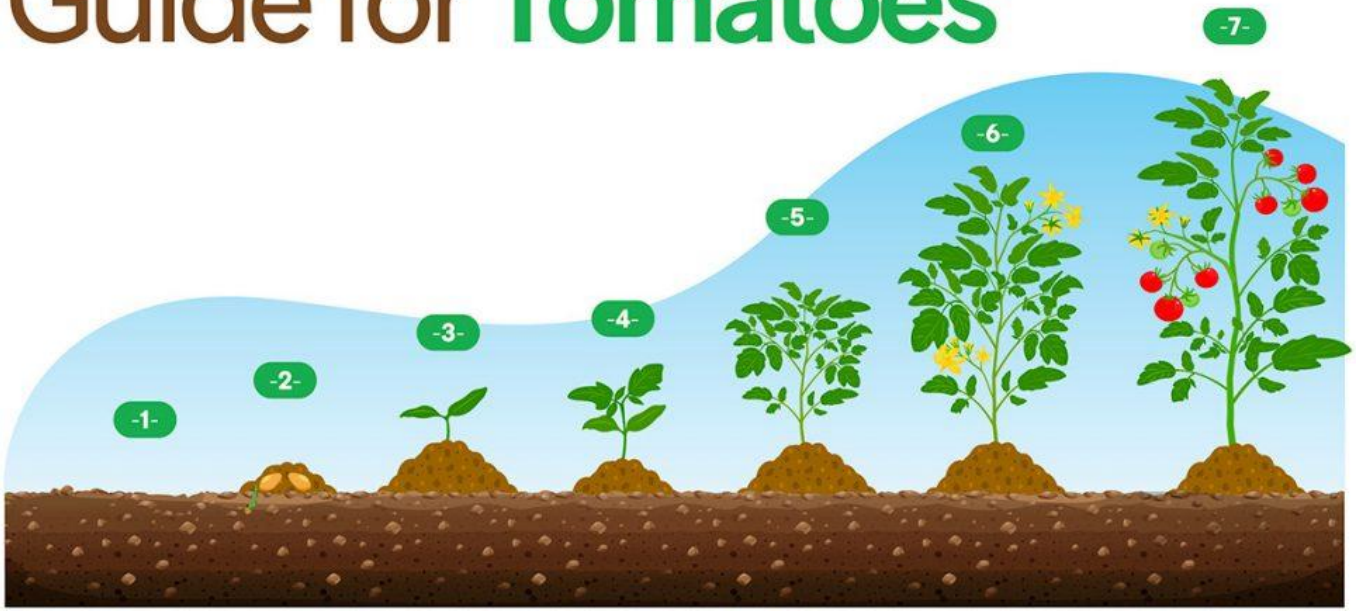
Well-structured soil

Rich in organic matter

Abundant biological activity

Crop Nutrition Guide for Tomatoes

CROPNUTS
grow more, with less



	1	2	3	4	5	6
CROP GROWTH STAGE	Pre -planting	Seedling & Transplanting	Vegetative Growth	Flowering & Fruit Setting	Fruit Development & Ripening	Regular Monitoring & Adjustments
FERTILIZATION GUIDE	Soil Testing	Starter Fertilizer	Topdressing Fertilizer	Leaf Testing	Foliar Fertilizer where applicable	

With a well-planned soil testing, leaf testing, and fertilizer program, tomatoes growers can optimize crop nutrition, boost yields, and achieve thriving tomatoes fields.

Grow more with less

#fertilizer #agriculture #cropnutrition #soilhealth #sustainability #plantnutrition #foodsecurity #savesoil #soilscience

Tomatos Fertilizer Program

SEEDLING

- CALCIMAG 25-25-25 + TE

OP/ECK + 27 Loosing

L'ARIT DIKP
25-DIKP

VEGETATIVE

FLOWERING & FRUIT SET

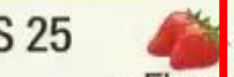
- UGARIT 25-25-25 + TE

AIKIP

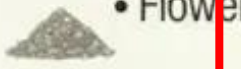
• 35ing

UGARIT DKP

- UGARIT K-T-S 25
- UGARIT DKP
- 6'T-S DKP



• Flowering



Strawbrerry

- PREMT
- 2-224-SF
- 5LOMP
- 66 NEP
- 65ling Coneptrern

UGARIT STRAWBERRY

FRUIT DEVELOPMENT &
& RIPENING

- SUPER DKP
- 656-0Kg

PROWTH STAGE
GRONCIANG

LEGENID

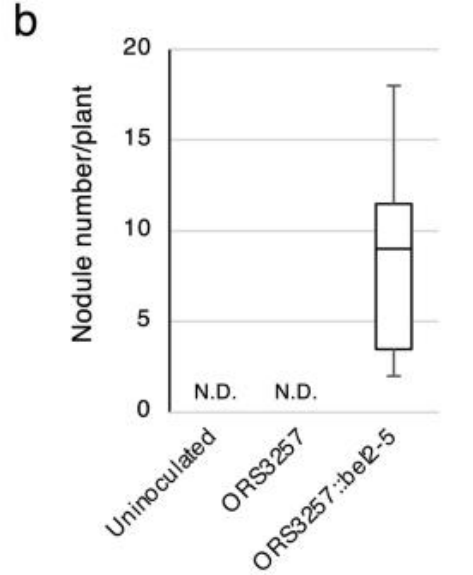
Does soil health reduce your fertilizer costs?

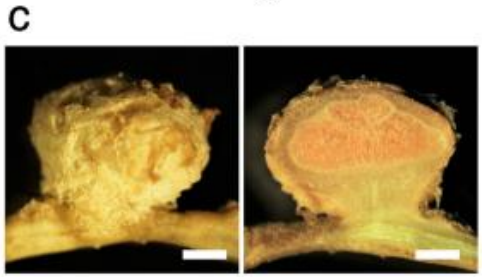
5% of soil organic matter = living organisms

??% of soil fertility depends on soil organisms?

Symbiotic soil biota – mycorrhiza and rhizobia

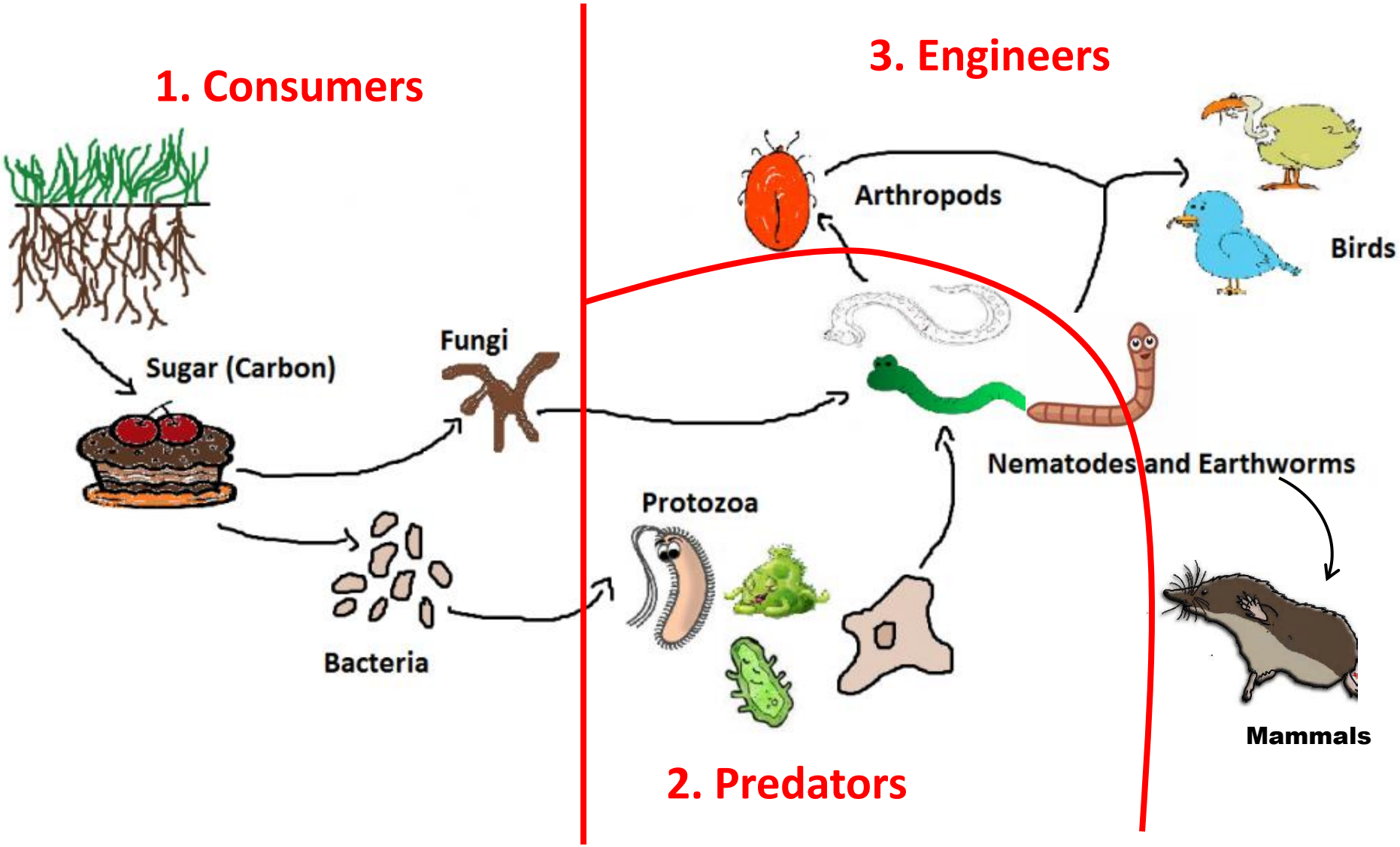
Letters in Applied Microbiology 70, 79--86



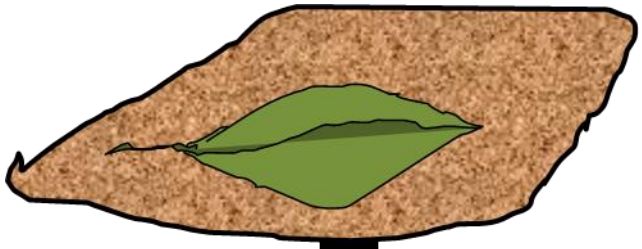


Scientific Reports volume 11, Article number: 2034 (2021)

Soil fertility involves soil microorganisms and biota in the soil food web

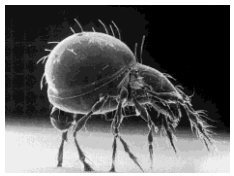


DECOMPOSITION & MINERALIZATION



Fragmentation (mechanical, biological)

Further fragmentation (biological)



Extracellular enzymes of microbial origin

COMPLEX POLYMERS
Cellulose, Phospholipids, Protein

IN SOIL SOLUTION

NH_4^+, HPO_4^{2-}, SO_4^{2-}

Extracellular enzymes of microbial origin

MONOMERIC UNITS
Sugars, Fatty Acids, Amino acids

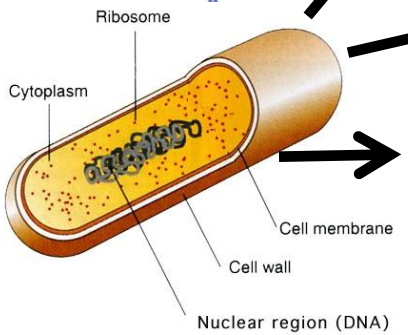
IN SOIL SOLUTION
NH_4^+, HPO_4^{2-}, SO_4^{2-}

Soluble
NO_3^-, K^+, Ca^{2+}

CO_2

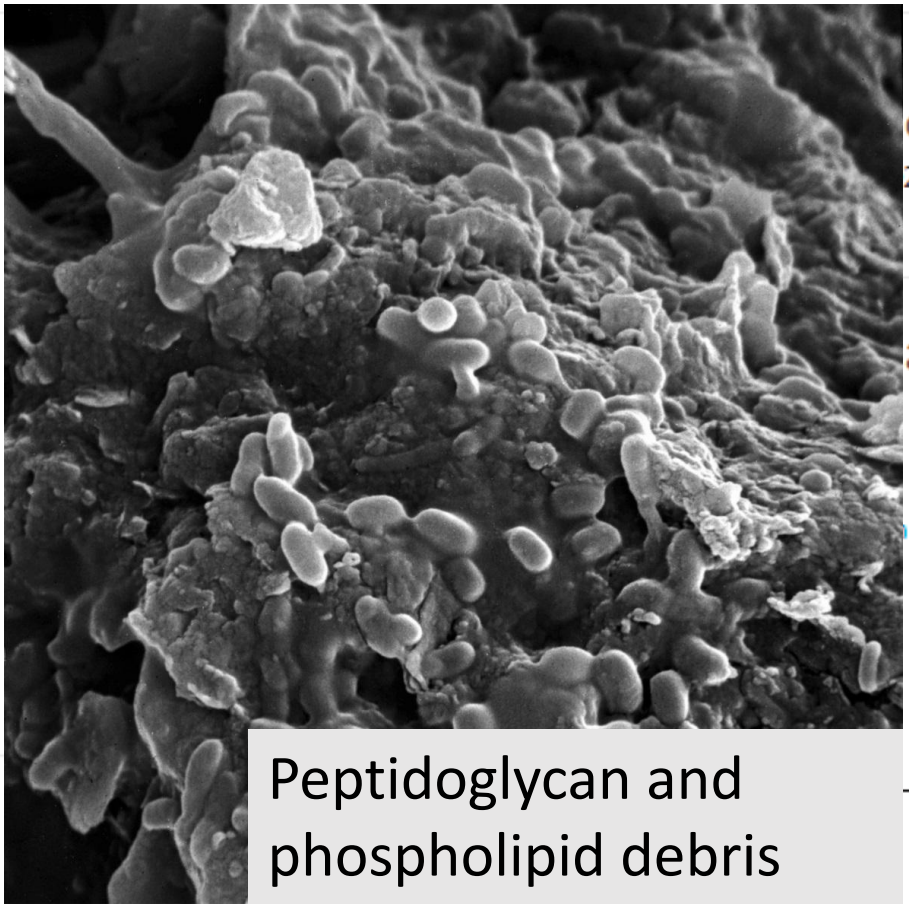
NO_3^-

Other products

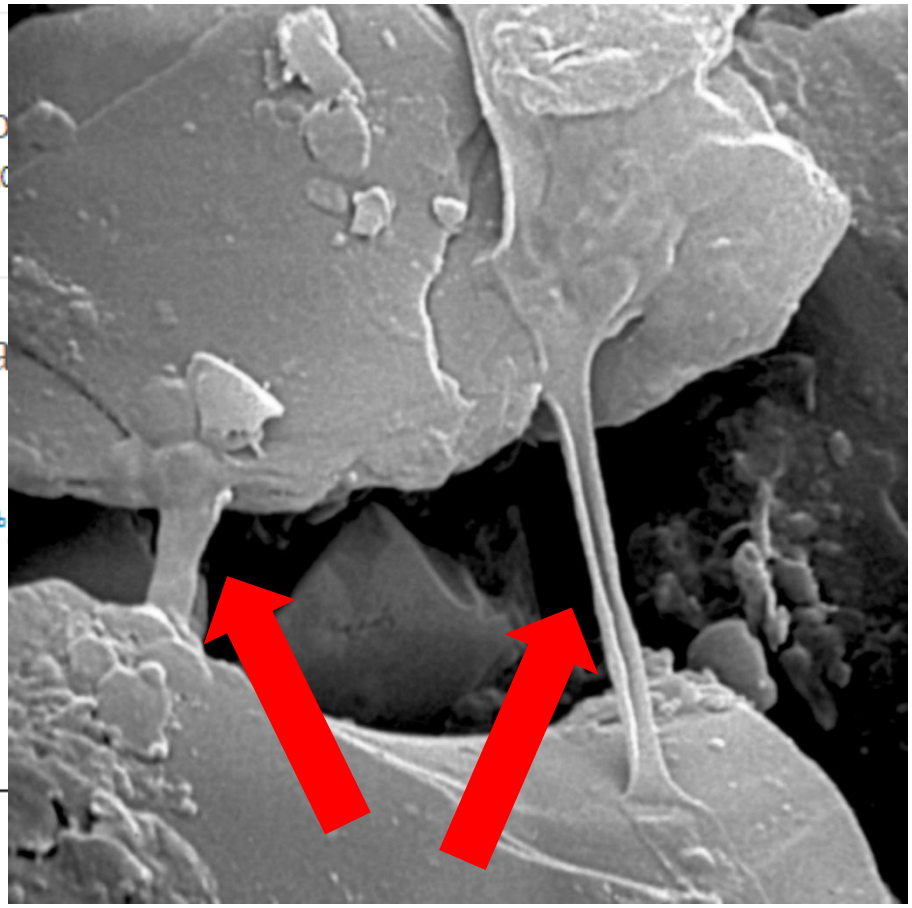


What are the microbes' "other products"?

Download PDF

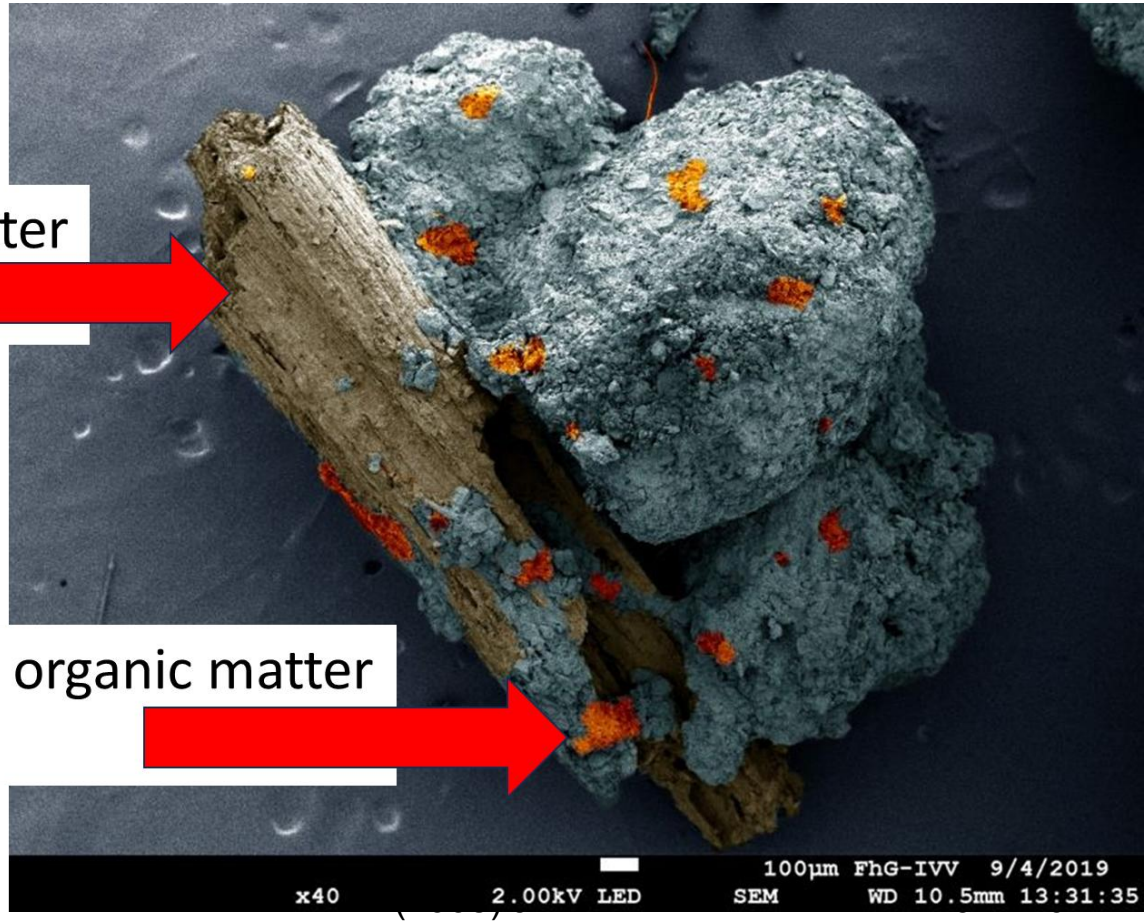


Peptidoglycan and phospholipid debris



Extracellular polysaccharides produced by soil bacteria

Microbial byproducts are part of soil organic matter



Decomposition and mineralization: nature-based processes

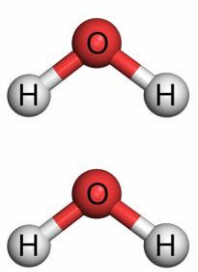
Soil Organic Matter containing ~50% Carbon

Fragmented plant residues + sticky dead microbes

+

Soluble

NH_4^+, HPO_4^{2-}, SO_4^{2-} and minerals



How much of the “soil nutrient supply” is transferred to plants via 1. consumers?

lactic acid

citric acid

Microbial death due to 2. Predators releases nutrients into soil

…. + viruses, bacterial predators, eDNA from plants and soil wetting-drying

3. Engineers accelerate decomposition and mineralization

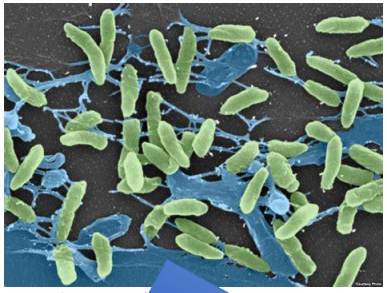
Engineers collect, eat and mix plant residues with microorganisms.

Decomposition supplies ~50% of crop N needs

Organic residue
-plant
-animal
-excreta
-soil organic matter

SLOW

Microbial community



Fragmentation
Bioturbation
Aeration

FAST

Indirect N flux

Crop N

NH_4^+
NO_3^-

Earthworm

Direct N flux

-mucus, urine
-dead tissue

Soil health is the foundation of soil fertility

Soil health is the basis for resilient crop systems

CLD

MRC Jardins-de-Napierville

Thank you!
Questions?

NSERC CRSNG

Fonds de recherche sur la nature et les technologies Québec

Centre SÈVE
RECHERCHE EN SCIENCES DU VÉGÉTAL

RQRAD

Ministère de l'Agriculture, des Pêcheries et de l'Alimentation Québec

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