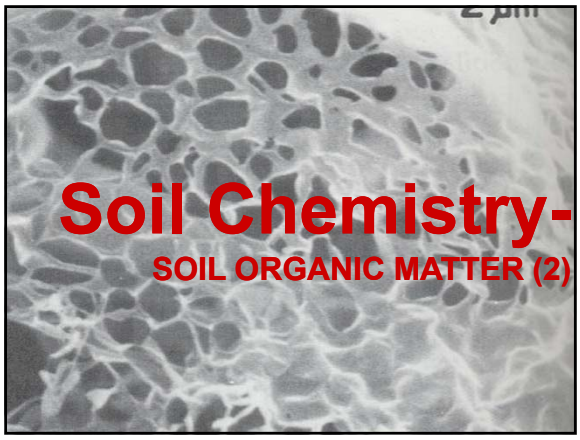


Soil Chemistry-

SOIL ORGANIC MATTER (2)

Lecture outline

A. Mineralization and immobilization

B. Significance of C/N ratio

C. Significance of SOM

B. Mineralization and immobilization

After residues are added to a soil the following takes place:

- C-compounds are oxidized and CO_2, H_2O, *E* are produced

$$R-(C,4H)+2O_2 \xrightarrow[oxidation]{Enzymatic} CO_2\uparrow + 2H_2O + E\uparrow$$

+ Nutrients (N, S, P) are released and/or immobilized

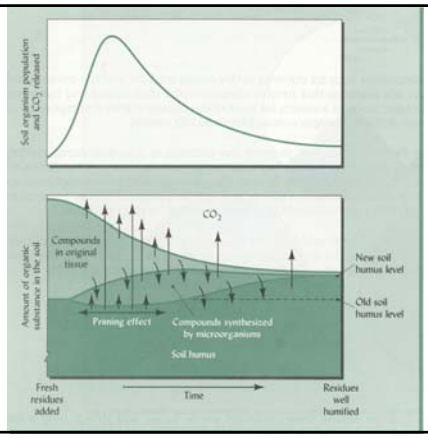
+ Resistant (humic substances) are formed

Mineralization - overall process of conversion of an organic form of an element to an inorganic state as a result of microbial decomposition

$$organic\ compound \xrightarrow{Mineralization} inorganic\ nutrient\ form$$

Immobilization - conversion of an element from the inorganic to organic form in microbial tissues, thus rendering the element unavailable to plants

$$inorganic\ nutrient\ form \xrightarrow{immobilization} organic\ nutrient\ form$$



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Time needed for organic matter decomposition depends on:

- Soil conditions (aeration, temperature, pH, water content)
- Quality of added residues as a food source for soil organisms (C/N ratio)

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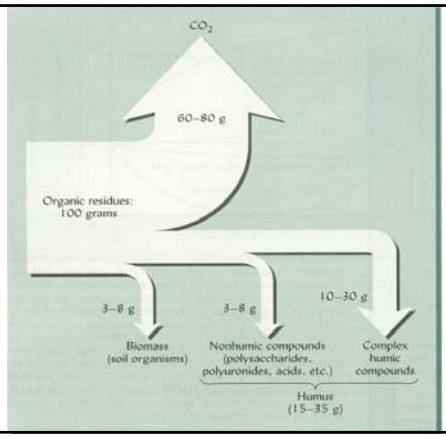

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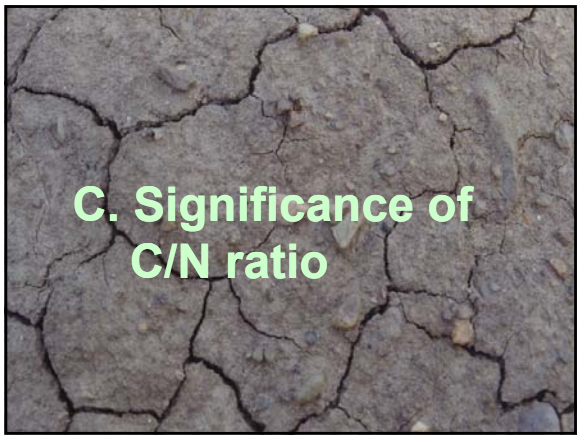

Typical C and N contents and C/N ratios

Organic material	%C	%N	C/N
Spruce sawdust	50	0.05	600
Hardwood sawdust	46	0.1	400
Wheat straw	38	0.5	80
Papermill sludge	54	0.9	61
Corn stover	40	0.7	57
Mature alfalfa hay	40	1.8	25
Finished household compost	30	2.0	15
Hairy vetch cover crop	40	3.5	11

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The C/N ratio in organic residues is important for 2 reasons:

- Intense competition among microbes and higher plants for available N occurs when residues having a **high** C/N ratio (e.g. 50/1) are added to soils
- C/N ratio indicates rate of residue's decay and rate at which N is made available to plants

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Soil bacteria (attached to a plant root hair) contemplates food quality

Practical consequence of microbial requirement for C and N

- C/N ratio > 25/1 leads to N deficiency for higher plants
- Decay of organic matter can be delayed if there is not enough N to support microbial growth

SOM effects of soil physical properties

- Dark soil color
- Increases aggregation
- Increases water retention
- Reduces plasticity and stickiness of clay soils; improves aeration and drainage

SOM effects of soil chemical properties

- Increases CEC
- Improves buffering capacity
- Provides nutrients (N, S, P)
- Chelating agent which can improve nutrient availability (Fe, Zn, Cu, Mn)

Biological effects of SOM

- Provides food for heterotrophic soil organisms
- Quality of SOM affects decomposition rate and organic matter accumulation in soils