

**Lecture outline**

- A. Mineralization and immobilization
- B. Significance of C/N ratio
- C. Significance of SOM

2



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

- C-compounds are oxidized and CO<sub>2</sub>, H<sub>2</sub>O, E are produced

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

- + Nutrients (N, S, P) are released and/or immobilized
- + Resistant (humic substances) are formed

4

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

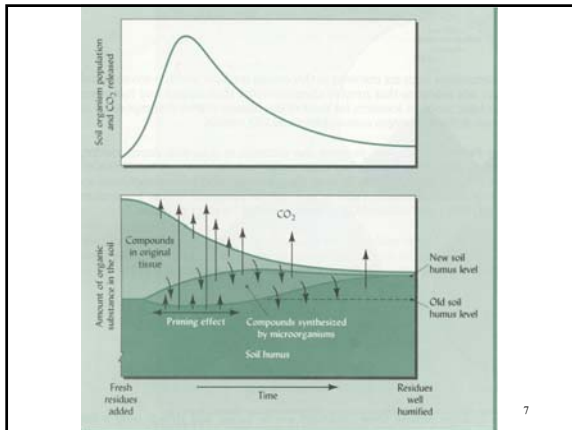
$$\text{organic compound} \xrightarrow{\text{Mineralization}} \text{inorganic nutrient form}$$

5

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

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

6

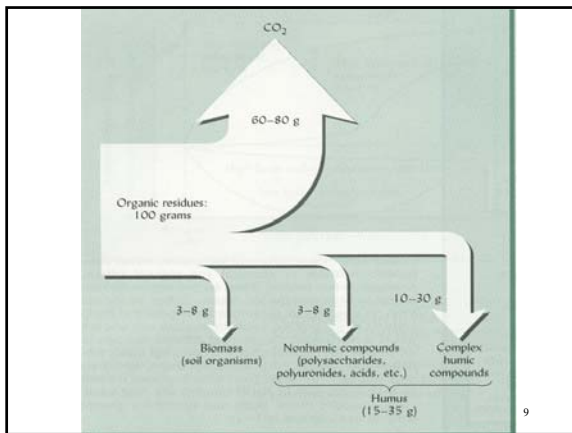


7

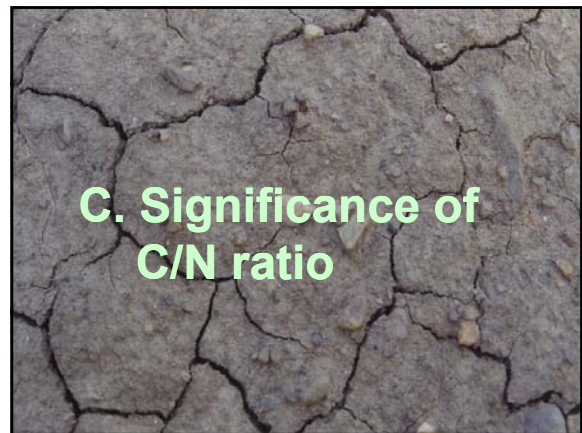
## Time needed for organic matter decomposition depends on:

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

8



9



## C. Significance of C/N ratio

### 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

11

### 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

12

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



13

### 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

14



### SOM effects of physical properties

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

16

### SOM effects of chemical properties

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

17

### Biological effects of SOM

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

18