

Compost Effects on Soil Quality

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Application of composted waste

A nation that destroys its soil destroys itself – F.D. Roosevelt

- Chemical and physical nature of compost
- Effects on soil physical, chemical and biological properties
- Effects on plants



The Nature of Compost

- Is complex!
- Source of stable, humus-like organic matter



Mature compost properties

Property	Value	Comments
pH	6.0 – 8.4	In acidic soil, alkaline compost can raise pH
Soluble salts	0 – 10 mmhos/cm	Excess salts can be phytotoxic
Nutrient content (N+P ₂ O ₅ +K ₂ O)	2 – 5 %	Additional fertilizer may be needed if < 2%
Organic matter	30 – 70%	Varies widely; affects application rate
Moisture content	40 – 50%	Higher moisture = increased handling and transportation costs
C:N ratio	< 12:1	N immobilization may occur at > 25:1

Effects on soil physical properties

- Improved soil structure
- Greater water-holding capacity

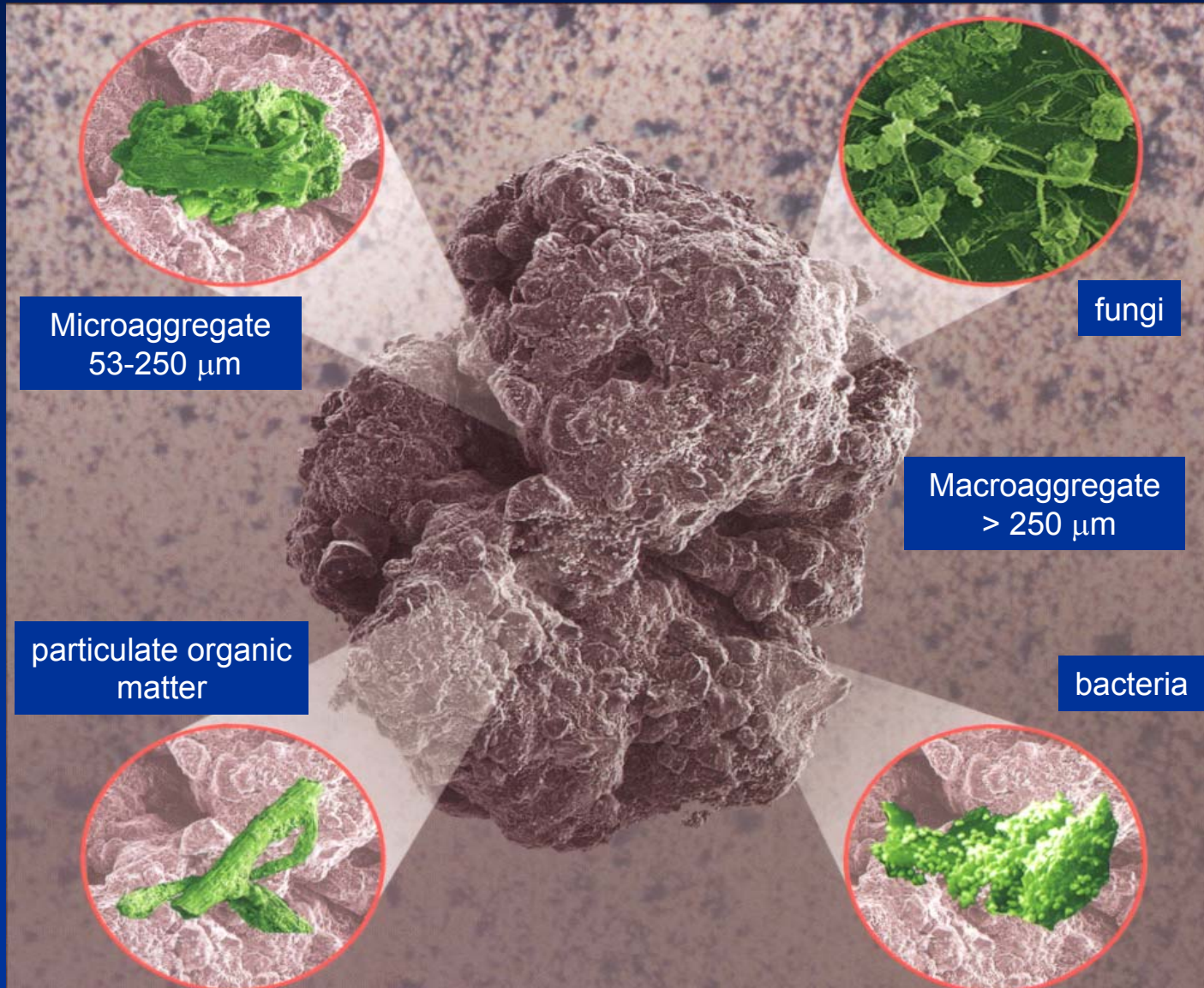


Soil structure

- Increased soil porosity
- Reduced soil bulk density
- Increased gas exchange and water permeability
- Greater water-holding capacity



Improved aggregation





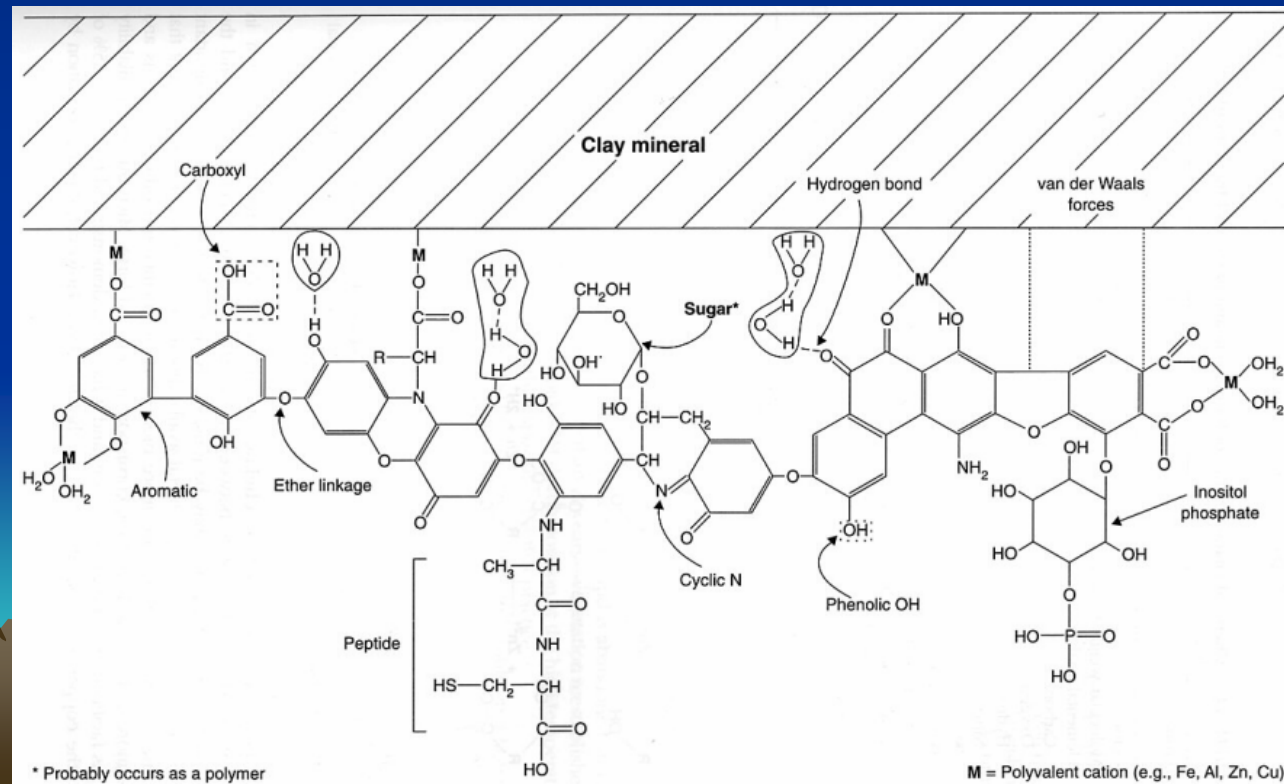
Improved root zone environment

Reduced wind and water erosion



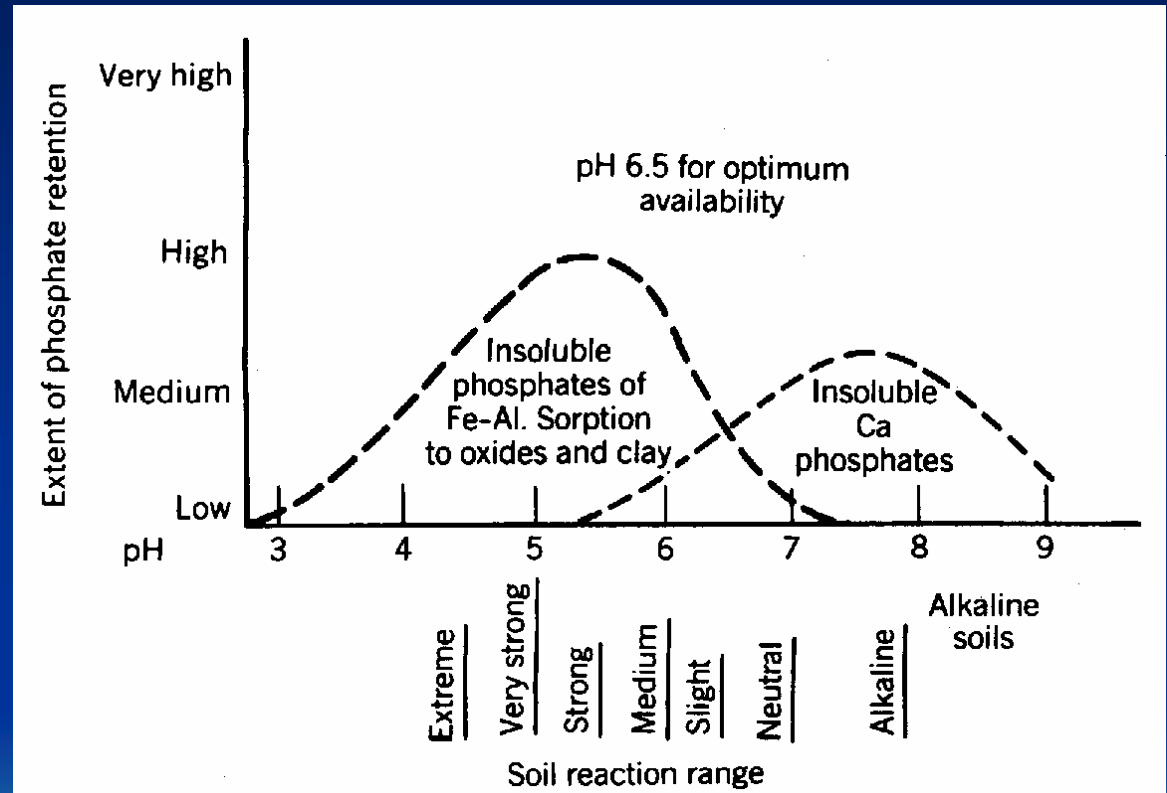
Effects on soil chemical properties

- Modifies and stabilizes soil pH
- Increases cation exchange capacity (CEC)
- Provides nutrients

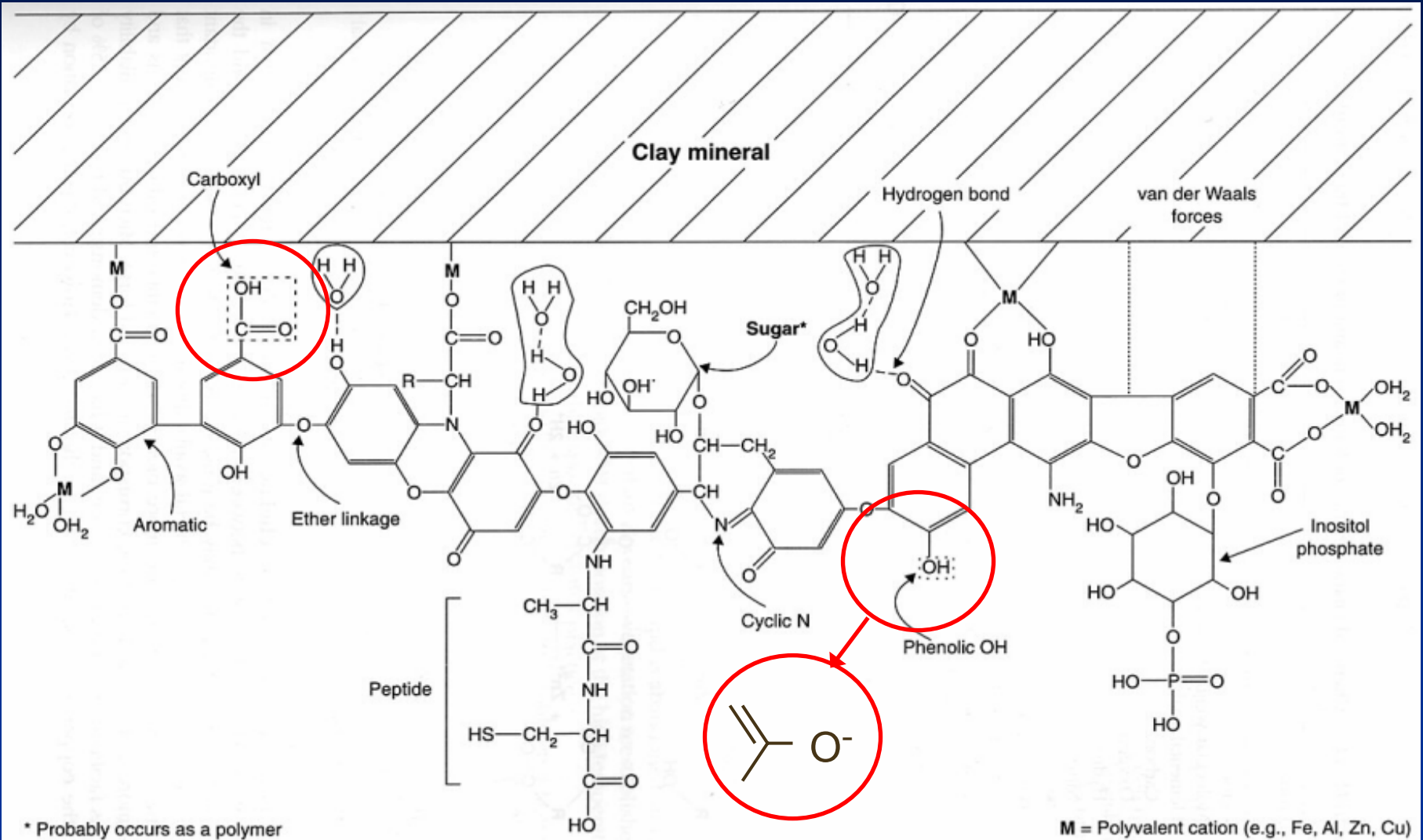


Soil pH

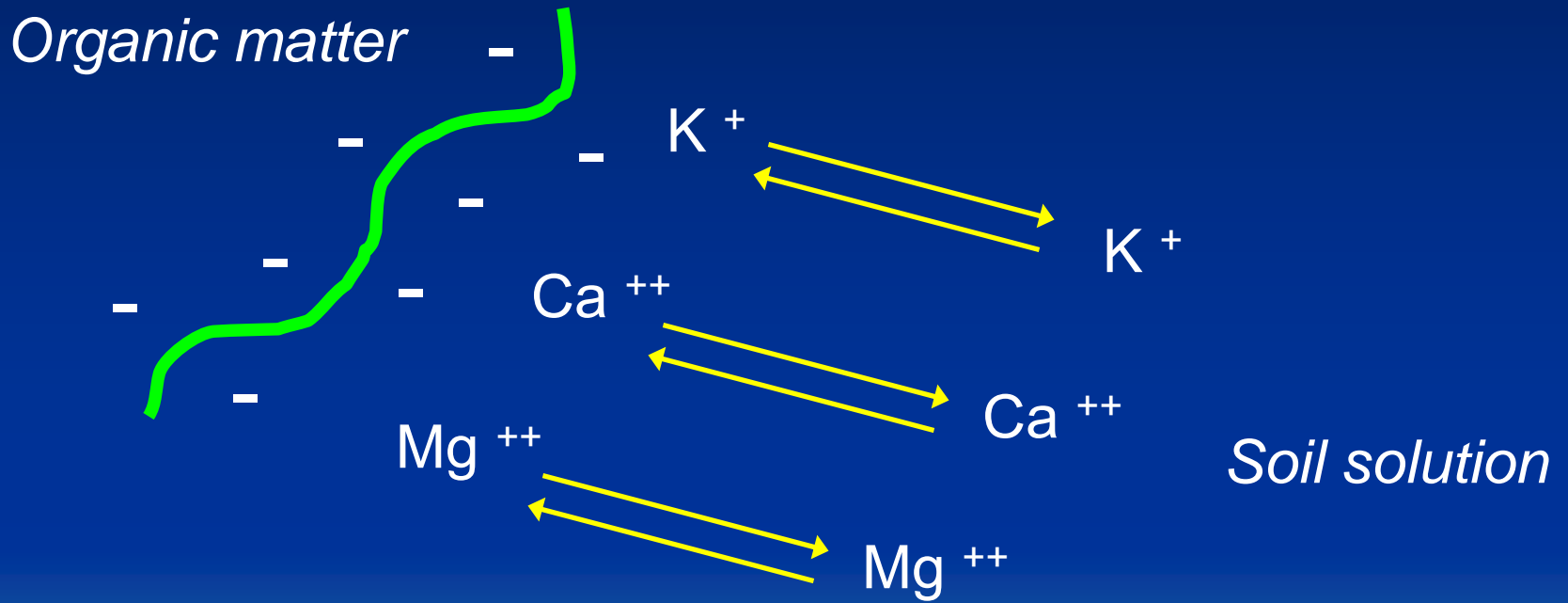
- Depending on its pH, compost may raise or decrease soil pH
- Organic matter has the ability to buffer pH change



Increases cation exchange capacity



Increases cation exchange capacity



Provides nutrients

- Source of N, P, K and micronutrients
- Organic nutrients are mineralized over time



Organic N

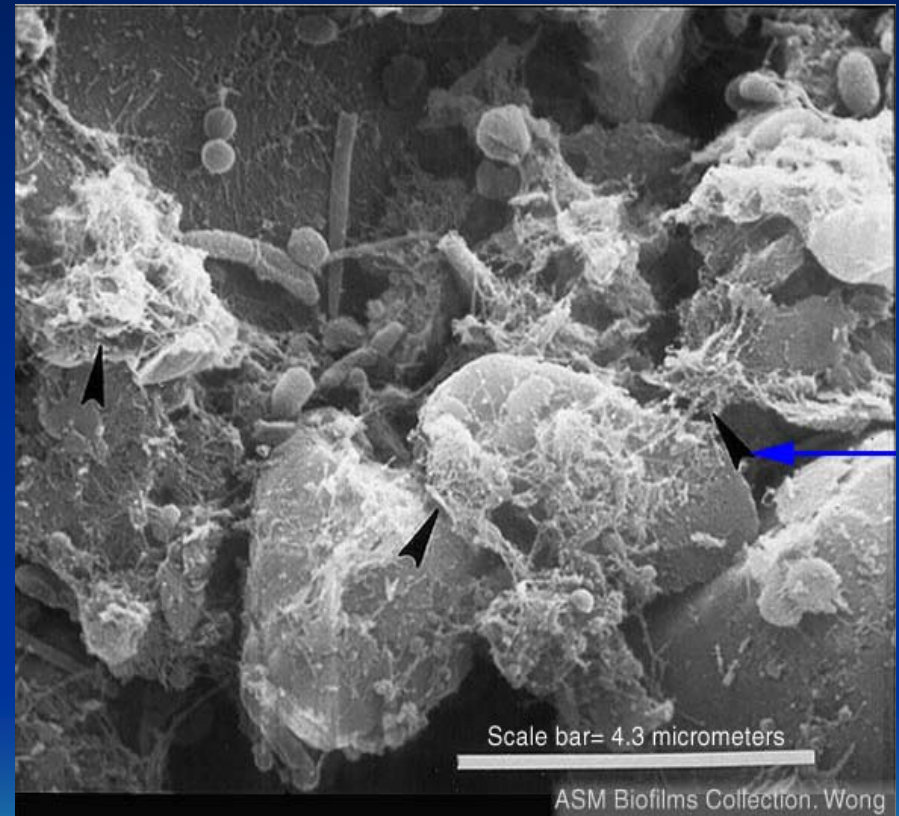
NH_4^+

NO_3^-



Effects on soil biology

- Stimulates microbial growth and activity
- May change species composition in soil
- Promotes earthworms
- May suppress plant diseases



Microbial properties with the potential to respond to compost

Microbial Biomass

C and N

Total biomass

bacteria

fungi

Biomass/total soil organic C

Soil respiration

Respiration/biomass

Enzyme activity

dehydrogenase

phosphatase

urease

arylsulfatase

N mineralization potential

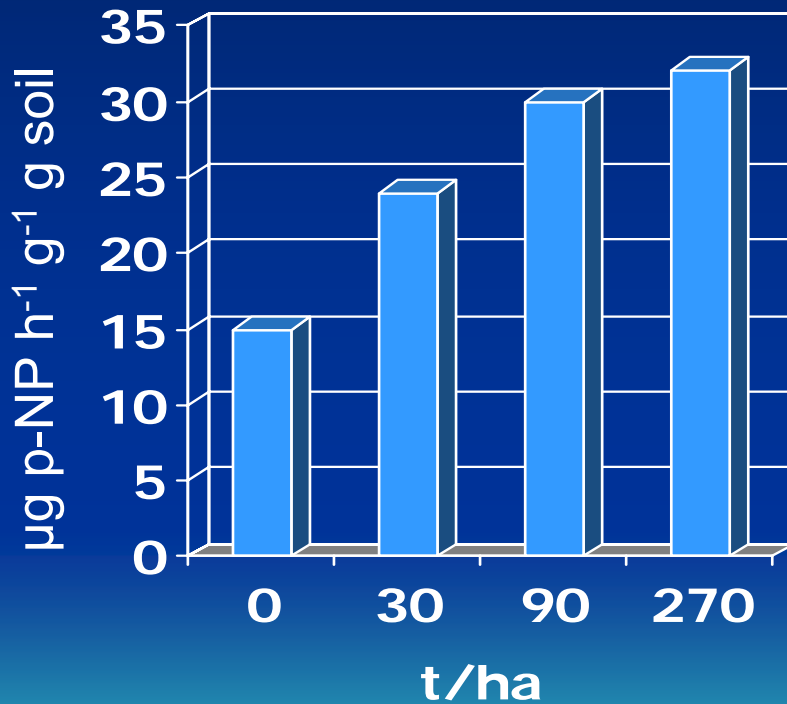
Nitrification potential

Microbial diversity

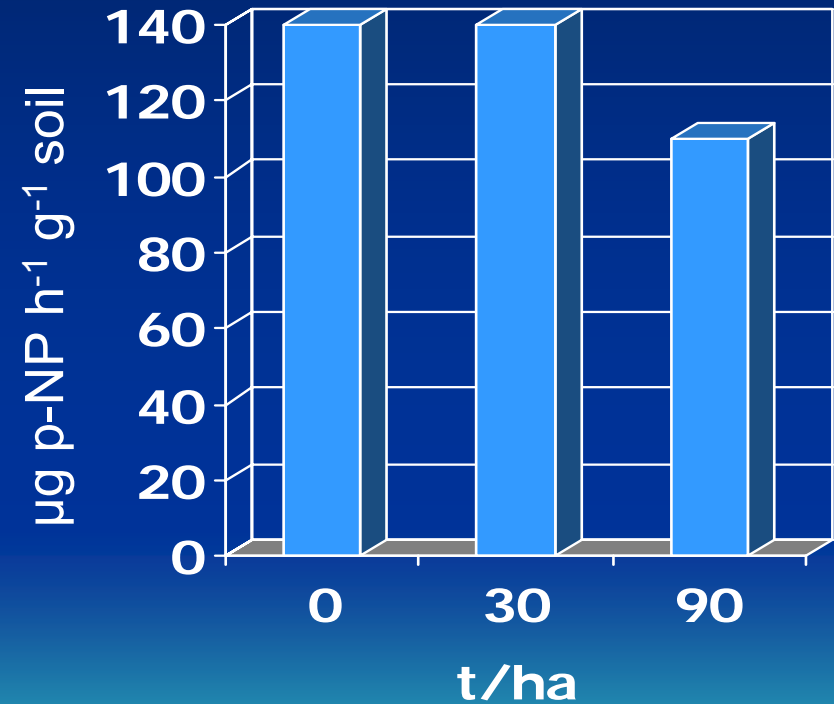


Example: Microbial Enzyme Activity 8 months after compost addition to soil

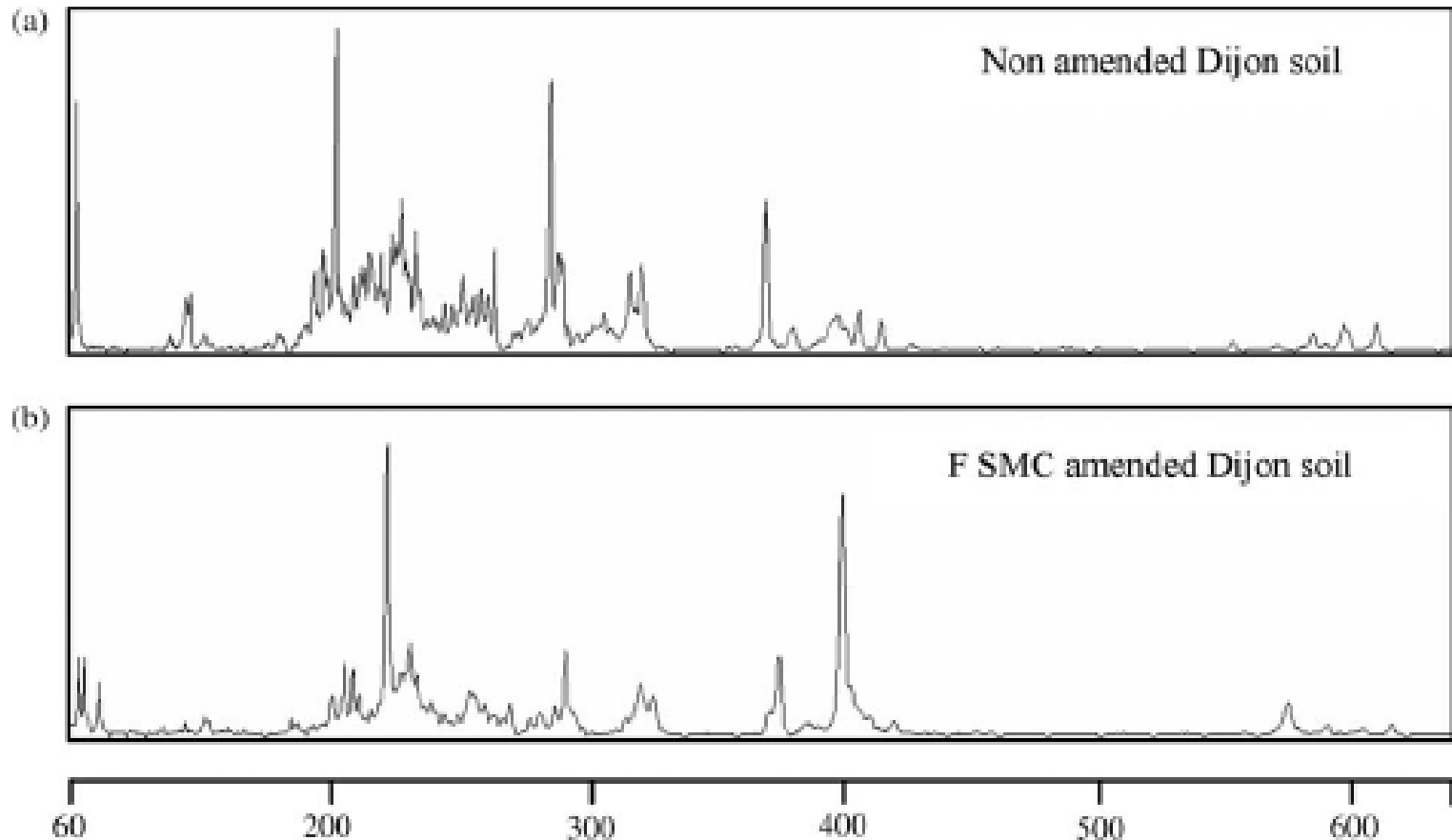
Arylsulfatase



Phosphatase



Example: effects on bacterial community structure



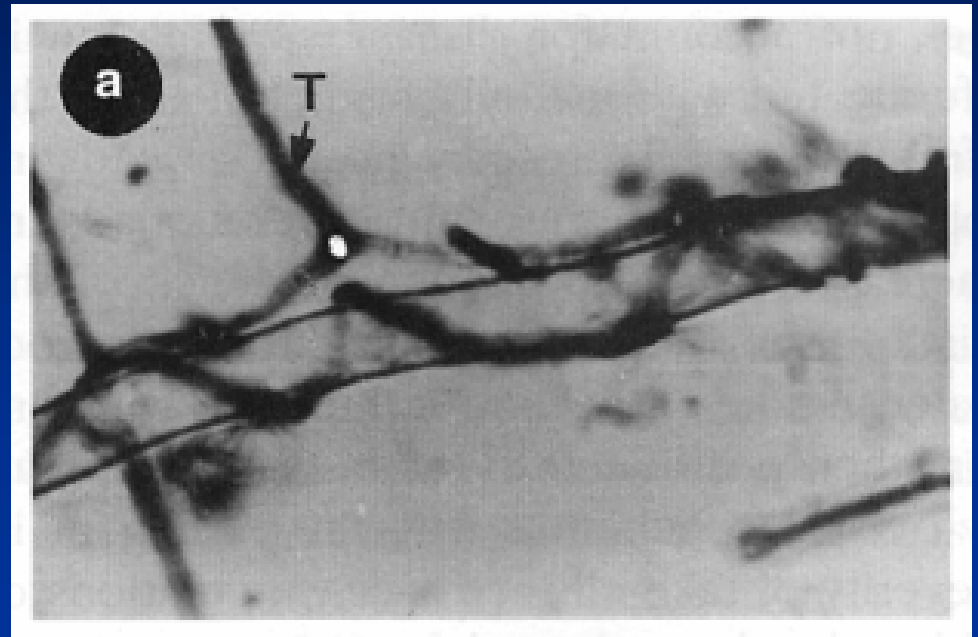
Implications for plants?

- Greater microbial biomass and activities can
 - increase availability of nutrients to plants
 - promote formation and stabilization of soil aggregates and better soil structure



Implications for plants?

- Possible link between microbial community composition and suppressiveness of soils to plant disease



Phytophthora being colonized by *Trichoderma*

Plant Disease Triangle

