Soil Fertility

Soil Biology

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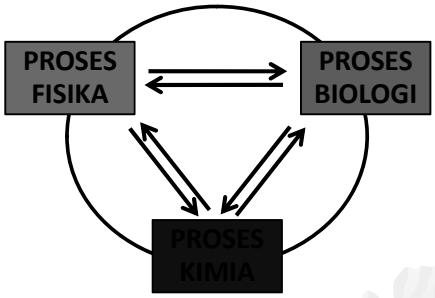
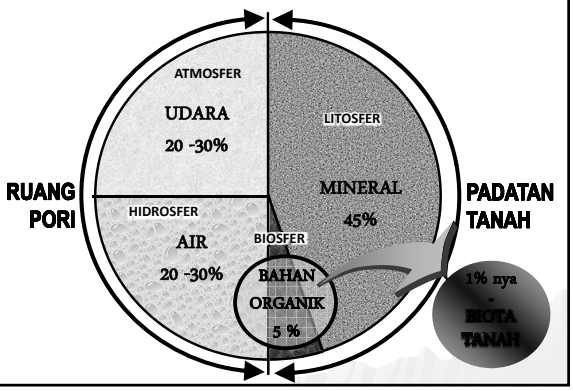
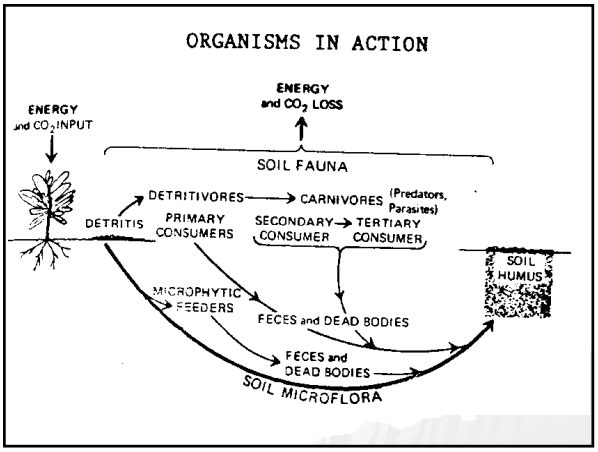
PROSES-PROSES DALAM TANAH AKAN SALING TERKAIT







In 1 teaspoon of soil there are…

Bacteria	100 million to 1 billion
Fungi	6-9 ft fungal strands put end to end
Protozoa	Several thousand flagellates & amoeba One to several hundred ciliates
Nematodes	10 to 20 bacterial feeders and a few fungal feeders
Arthropods	Up to 100
Earthworms	5 or more

Travis & Gugino - PSU

Soil Organisms

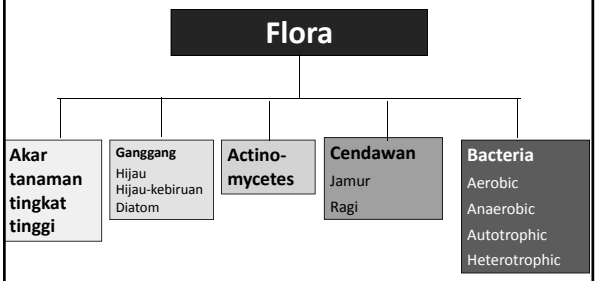
Fungsinya

1. Mendekomposisi sisa tumbuhan dan hewan
2. Melepaskan hara dan unsur anorganik yang dibuthkan tanaman dan menyebabkan pelindian mineral
3. Sintesis senyawa organik
4. Formasi humus untuk meningkatkan KPK dan struktur
5. Fiksasi Nitrogen

Soil Organisms Cont.

Jenis

1. **Tumbuhan**
2. Hewan



Soil Organisms Cont.

Tumbuhan (bacteria, actinomycetes, fungi, algae)

1. Bacteria

1. Very small single celled organisms
2. Multiply by elongation and dividing into 2 parts
3. Millions or even billions per gram of soil

I. Classification of Bacteria (Heterotropic)

A. Heterotropic memperoleh karbon dan energi dari variasi senyawa organik

1. Nitrogen fixing mendapatkan nitrogen dalam bentuk gas dari atmosfer atau dari Ammonia atau Nitrat

a. Non Symbiotic - those that are free living

1) *Anaerobic organisms - those not needing free oxygen for respiration*

Clostridium

–More common in forest soils

–Optimum Reaction pH 6.9 - 7.3

–no fixation below pH 5.0

2) Aerobic- need free oxygen

Azotobacter

–More common in agriculture soils

–Very sensitive to acidity

–pH below 5.5 to 6.0 no fixation

b. Symbiotic - live on host plant to mutual advantage

Rhizobium

- Find on nudules

- Nitrogen from the air

c. Aerobic Bacteria- requiring combined Nitrogen

Bacillus mycoides

- Cause denitrification

d. Anaerobic Bacteria - which require combined Nitrogen

- Nitrates ---------- Nitrites, ammonia

- Sulfates ---------- Sulfites, sulfides

Classification of Bacteria (Autotrophic)

B. Autotrophic- derive their carbon primarily from CO_2 of the atmosphere and their energy from the oxidation of inorganic compound or simple compounds of carbon

Cont.

1. Bacteria using nitrogen compounds as an energy source

a. Nitrosomes

- oxidize ammonium Nitrite

- $NH_4^+ \rightarrow NO_2^-$

Cont.

b. Nitrobacter

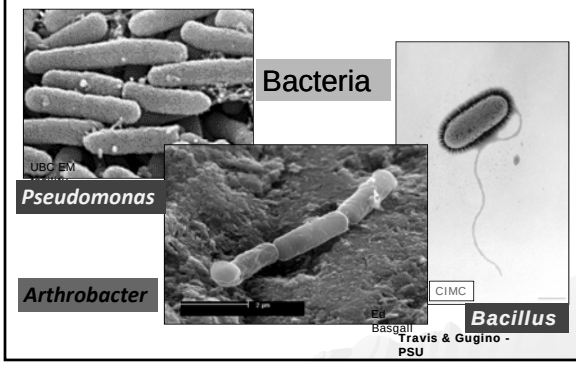
- *Oxidize Nitrite to Nitrate*
- $NO_2^- \rightarrow NO_3^-$
- *little or no activity below a pH of 6.0*
- *little or no activity below a temp of 65°F*

2. *Bacteria using sulfur or sulfur compounds as energy sources.*

a. Thiobacillus

$S + O_2 + H_2O \rightarrow H_2SO_4$

SOIL MICROORGANISM



II. Actinomycetes

Unicellular micro-organisms

Transitional between the bacteria and fungi

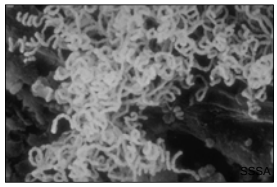
Effect of soil pH

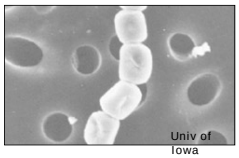
a. Sensitive to acid soil- no activity below pH 5.0, optimum activity between 6.0 - 7.5

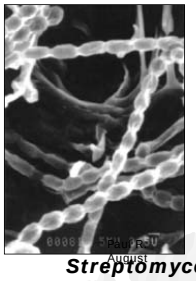
Heterotropic Feeders- breaks down organic matter and humus liberating nutrients, especially nitrogen

form NH_3

Actinomycetes

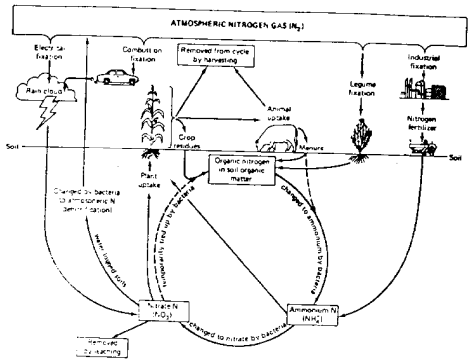






Streptomyce

Nitrogen Cycle



III. Fungi

Heterotropic organisms

Fungi will tolerate a wide pH range

- *abundant in acid soils where bacteria and actinomycetes offer only limited competition*

Activities of Fungi

- *Decompose organic residues*

Fungi Cont.

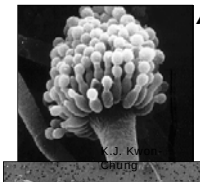
<u>Micorrhiza</u>- fungus roots

more common in forest soils

fungal roots form a mat around the absorbing root while others penetrate the root cells

- *<u>Symbiotic relationship</u>- help with nutrient absorption by increasing absorptive surface*
- *Pine seedlings will not grow well without them*

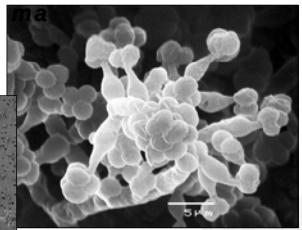
Microorganisms

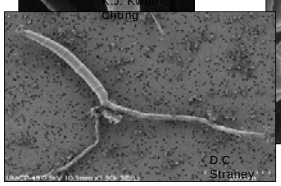


Aspergillus

Fungi

Trichoderma





Fusarium

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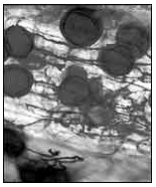
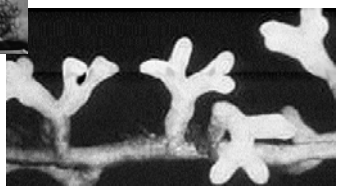
Mycorrhizae





IV. Algae

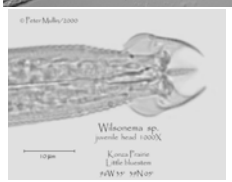
minute plants which are photosynthetic

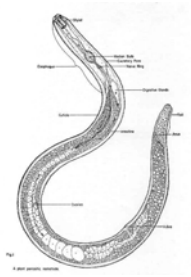
found in surface soils but in low amounts

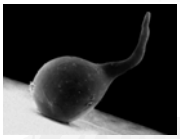
Blue green types are important in wet soil

- *–fix nitrogen in rice paddies*
- *–give off oxygen to the water*

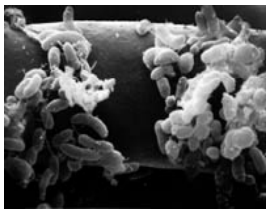
Nematodes





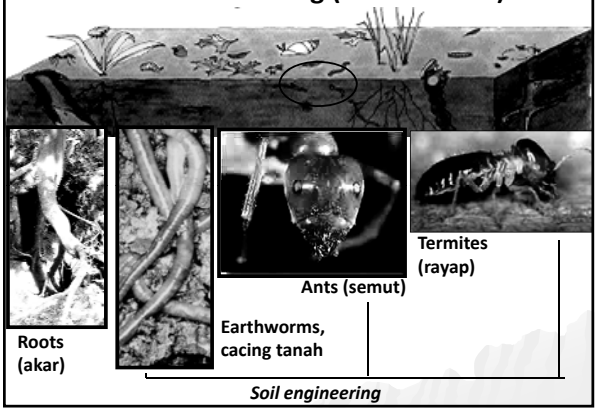


Many beneficial effects from activities of microorganisms



- *Microorganisms produce:*
  - *Plant growth hormones*
  - *Stimulate plant growth hormones*
  - *Compete with disease organisms*

Natural Soil Mixing (Bioturbation)



Mengapa disebut dengan Ecosystem engineers?

Dapat memperbaiki habitat organisma lain

- meredistribusikan bahan organik di dalam profil tanah
- membatu formasi struktur tanah → berpengaruh langsung terhadap pertumbuhan tanaman.

Contoh:

•Grup Anesik (spesies yang hidup di permukaan tanah)

•Grup endogeik (spesies yang hidup dan makan di dalam tanah).

Fungsi Cacing tanah

1. Dekomposer
2. Meningkatkan jumlah pori makro tanah ~ memperbaiki infiltrasi tanah
3. Bioturbasi

Karakteristik Cacing menurut Fungsinya

Karakteristik	Epigeic	Anesic	Endogeic
Lubang	Tidak ada	Terbuka permanen ke permukaan tanah	Ektensif dalam
Cast	Tidak ada	Di permukaan tanah berdekatan dengan pori tanah	Di dlm liang atau pori-pori tanah
Pigmentasi	Tinggi tkt. samarannya	Sedang, hanya di bag. belakang	Tidak berpigmen
Makanan	• Dekomposisi BO di permukaan tanah • Tidak makan tanah	Makan BO di permukaan dibawa masuk dlm tanah	Mencernak tanah, BO & akar mati

Lingkungan tanah sehat…. Biota sehat