Principles of Soil Science

Lecture -7-

Protecting soil: crop rotation and contour farming

- **Crop rotation** = growing different crops from one year to the next
  - Returns nutrients to soil
  - Prevents erosion, reduces pests
  - Wheat or corn and soybeans

(a) Crop rotation

- **Contour farming** = plowing perpendicular across a hill
  - Prevents rills and gullies

(b) Contour farming

Protecting soil: terracing and intercropping

- **Terracing** = level platforms cut into steep hillsides
  - This "staircase" contains water

(c) Terracing

- **Intercropping** = planting different crops in alternating bands
  - Increases ground cover
  - Replenishes soil
  - Decreases pests and disease

(d) Intercropping

Protecting soil: shelterbelts and reduced tillage

- **Shelterbelts** (*windbreaks*) = rows of trees planted along edges of fields
  - Slows the wind
  - Can be combined with intercropping

(e) Shelterbelts

- **Conservation tillage** = reduces the amount of tilling
  - Leaves at least 30% of crop residues in the field
  - **No-till farming** disturbs the soil even less

(f) No-till farming

Plant cover reduces erosion

- Plants anchor soil
  - Move livestock to prevent overgrazing
  - Cut fewer trees in an area
  - Plant vegetation along riverbanks and roadsides
- China's huge tree-planting program slows erosion
  - But the monocultures are not ecologically functioning forests

What is soil microbiology?

- Soil microbiology is the branch of soil science with soil inhabiting microorganisms, their functions and activities.
- Soil organisms can be classified to:

1) **Heterotrophic** : that rely on organic compounds for energy.

2) **Autotrophic**: that obtain their energy from photosynthesis.

Common population of some soil microorganisms

Organism	number /gram of soil
• Bacteria	10^8 -10^9
• Actinomycetes	10^7 -10^8
• Fungi	10^5 - 10^6
• Algae	10^4 -10^5
• Protozoa	10^4 -10^5
• Nematoda	10 -10^2

Abundance of soil Organisms

Organisms	Number / gram soil	Biomass (lbs/acre)
Earthworm	_____	100- 1500
Mites	1-10	5- 150
Algae	Upto 100 000	20- 200
Fungi	Upto 1 million	1000- 15000
Actinomycetes	Upto 100 million	400- 5000
Bacteria	Upto 1 billion	400- 5000

Bacteria

- **Most numerous in soil.**
- **Most diverse metabolism.**
- **Can aerobic or an aerobic.**
- **Optimal growth at pH 6-8.**

Some important Bacteria

- **Nitrogen Fixing Bacteria:** The plant supplies simple carbon compounds to the bacteria convert Nitrogen (N20 from air into a form the host can use.
- **Nitrifying Bacteria** : change ammonium (NH4) to Nitrite (NO2) then into Nitrate (NO3) . A preferred form of nitrogen for grasses and most row crops.
- **Denitrifying Bacteria**: Convert Nitrate to Nitrogen (N2) or nitrous oxide (N2O) as gas, an aerobic.

Earthworm

- Mix fresh organic matter into the soil.
- Brings organic matter into contact with soil microorganisms

Actinomycetes

- A large group of bacteria that grows as hyphae like fungi .
- Transitional group between bacteria and fungi.
- Active in degrading more resistance organic compounds.
- Optimal growth at alkaline PH.

Two important products

1) Produce antibiotics (Streptomycine) is produced by an actinomycetes.

2) Produce geosmin responsible for the characteristically (earthy) smell of freshly turned healthy soil.

Nagative impact : potato scape (streptomyces scabies)

Fungi

- Dominate the soil biomass.
- Obligate aerobes
- Can survive desiccations.
- Dominate in Acid soils.
- **Negative impact**:

1) Apple replant disease.

2) Powder mildew in coated by a fungus.

Beneficials: Penicillium.

Sample No.	Sand %	Silt %	Clay %	Textural name
1	100	80	20	--------
2	0	80	20	--------
3	40	40	20	--------
4	02	98	0	--------