SOIL

- The word soil is derived from Latin word **solum** meaning the substratum in which the plant grows.
- It is the loose superficial layer of the earth's crust.
- Study of soil is known as **Edaphology** or **Pedology** or **Soil Science**.
- It takes approximately **500 – 1000 years** for the formation of **1 inch** of soil.
- Formation of soil from the parent rock is known as **Pedogenesis**.
- Disintegration of parent rock into fine particles is known as **Weathering.**
- It is mechanical or chemical or biological.

SOIL PROFILE:

- It is cross section of soil as seen in a trench. It has three regions or horizons.

A. Horizon

- It is also known as **topsoil.** It is the uppermost layer of the soil.
- It is dark coloured and rich in humus.
- Its thickness varies from few centimeters to one meter.
- It is rich in microorganisms.
- Major portion of the root system is spread in this region.

B. Horizon

- It is present below A – horizon. It is also known as **sub–soil**.
- It is light in colour and has coarse mineral matter and clay.
- It acts as **water reservoir.**
- Taproots may reach up to this region.
- A and B horizons together called as **Solum** or **true soil.**

C. Horizon

- It is present below B – horizon and also known as **regolith zone.**
- It consists of **parent rock** or **mother earth**.
- Microbes are absent and very rarely the taproot system of the plant reaches this zone.

Components of Soil

- Soil consists of 5 components known as Mineral matter, Soil organic matter or humus, Soil water, Soil atmosphere and Biological systems.

1. Mineral Matter

- The weathering of rocks forms it. It is in the form particles known as soil particles.
- On the basis of size, **International Society of Soil Science** classified soil particles into 'Gravel with more than 2 mm diameter, Coarse sand with 0.2 – 2 mm diameter, Fine sand – 0.02 to 0.2 mm, Silt – 0.002 to 0.02 mm and Clay with less than 0.002 mm in diameter.
- It consists of **Quartz, Silica, Feldspars, Mica, Calcite, Magnesite, Dolomite, Iron oxide, Clay and Kaolin.**
- **Soil structure** has aggregations of Sand, Silt and Clay in defined proportions.
- Naturally formed soil aggregations are called as **Peds** and artificially formed ones as **Clods.**
- Peds are in various shapes and structures and play an important role in the structure and aeration of soil.
- On the basis of relative distribution of Sand, Silt and Clay particles, soils are classified into the following types.

Sandy soils

- These soils mainly consist of sand particles.
- Such soils are loose, dry and poor in nutrients.
- They have **more** pore space and **poor** water holding capacity.
- They are not suited for plant growth.

Clayey soils

- These are mainly made of clay particles with colloidal dimensions.
- They have high water **holding capacity** but poor aeration.
- These soils swell when moist and shrink and crack when dry and damage the roots.
- Clay particles are negatively charged and hold the exchangeable cations on their surface and prevent their leaching by rainwater.
- These are good source of mineral nutrition for plants.

Loamy soils

- In these soils sand, silt and clay are distributed in almost equal proportions.
- It has **optimum** pore space and water holding capacity.
- It is rich in minerals and **plants** grow luxuriantly in these soils.

- These soils are further divided into sandy loams with more sand, silty loams with more silt and clayey loams with more clay.

2. Soil Organic matter or Humus

- Soil also consists of organic substances derived from dead remains of animals and plants and products of various metabolic activities.
- Formation of humus is known as **humification**. It is formed from the decomposition of dead bodies of plants and animals and their excreta by saprophytic microorganisms such as **bacteria, fungi** and **protozoans.**
- Freshly fallen organic matter present on the surface of the soil is called as **Litter**.
- Partially decomposed litter present beneath the litter is known as **Duff**.
- The decomposed litter in the form of amorphous and dark coloured substance is known as **Humus**.
- Humus is chemically decomposed to form minerals and the process is known as **mineralisation**. This process makes the soil fertile.

Characters of Humus

- It is dark coloured, amorphous, light in weight mixed with other soil components.
- It has **more** water holding capacity than clay
- It is intimately associated with clay and forms **soil colloidal complex** with clay.
- It gives crumbly structure to the soil and improves the aeration and water holding capacity of soil.

Significance of Humus

- It makes the soil fertile.
- It provides nutrients to the plants and microorganisms.
- It increases the availability of minerals to the plants in dissolved state.
- It has higher water holding capacity.
- It improves aeration of soil and makes suitable for plant growth.

Soil Water

- It is reservoir of water for plants.
- Garden soil has about 25% of water per unit volume.
- The water source for soil is rain.
- Soil water exists in the following forms.

1. Run – away water

- It is the water that flows between the soil particles during or after heavy rain or irrigation.
- Plants cannot absorb it.

2. Gravitational water

- This is amount of soil water that percolates down and ultimately reaches the water table.
- Since the root system of most of the plants cannot reach the water table, plants can't absorb it.

3. Hygroscopic water.

- It is the thin film of water present around the soil particles due to strong intermolecular attraction.
- Though it is available, plants can't absorb it because the forces developed in the plant are not sufficient to draw this water.

4. Capillary water

- The amount of soil water present in between the non-colloidal soil particles is called as Capillary water.
- It is the only form of soil water absorbed by the plants.

Soil Water constants

- The amount of water retained by soil after it is thoroughly drained with water is called as **Field capacity**. It is the upper limit of Soil water constant.
- The amount of soil water at which the plants growing show permanent wilting is called as **Permanent Wilting Percentage**. It is the lower limit of soil water constant.
- **Water supplying capacity** is the amount of water supplied by the soil to plant for absorption. It is obtained by subtracting Permanent wilting percentage from Field capacity.
- The total amount of water present in the soil is called as **Hollard**. The amount of soil water that can be absorbed by plant is called as **Chresard**. The amount of soil water that cannot be absorbed by plant is called as **Echard**.

4. Soil atmosphere (Soil air)

- The space left in the soil after occupation of solid matter (Soil particles and soil organisms) is known as **Pore space**.
- It is occupied by soil moisture and soil air.

- Soil air has all the gases present in the atmosphere. The distribution of these gases is dependent on the texture of the soil.
- It has high amount of CO_2 (0.5%) and low O_2 when compared with the atmosphere.
- The amount of O_2 is less in wet conditions of soil. This is the reason for developing aerenchyma in hydrophytes and respiratory roots in Mangroves such as ***Avicennia*** and ***Rhizophora***.

5. Soil organisms (Biological systems)

- Bacteria, Fungi, Actinomycetes, Blue-green algae, protozoans, rotifers, nematodes, earthworms, molluscs, arthropods etc. form the biological system of the soil complex.
- Soil environment around the root system of the plant is called as **Rhizosphere**. It is rich in Soil organisms.
- Bacteria such as *Rhizobia, Azotobacter,* and *Clostridium* fix atmospheric nitrogen into ammonia and enrich the soil with nitrogen substances to increase soil fertility.
- Some fungi and bacteria secrete growth hormones like **IAA**, which enhance the growth of plants.
- Saprophytic microorganisms decompose the dead bodies of plants and animals and convert them into humus. It is further converted to minerals. In this way the substances are recycled.
- Nematodes, some bacteria and fungi cause diseases in plants and responsible for decrease in the yield of the crops.