Physical Properties of soil

It **depends upon the amount, size, shape, arrangement, and mineral composition** of soil particles. It also depends on the organic matter content and pore spaces.

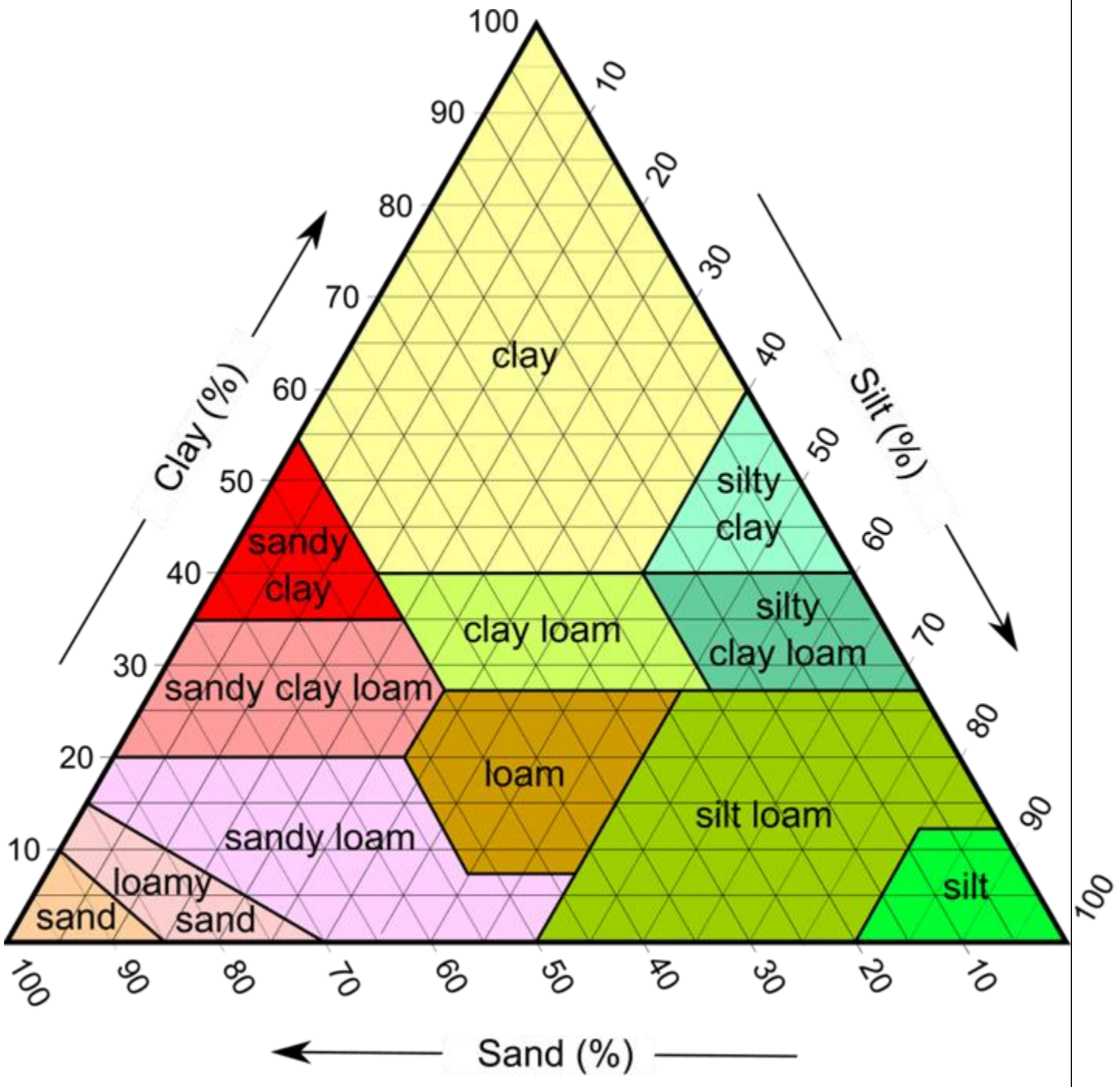
Soil Texture:

Soil texture defines the proportion in which the soil separates to make the mineral component of the soil. These separates can be classified as **sand, clay, and silt.** Sand and silt are of no importance to the soil as they don't contribute to the soil's ability to restore water or nutrients. **Clay is an active part of soil texture as clay has a small size and it has a large amount of surface area per unit mass and it helps in storing ions and water.**

The **soil texture refers to the coarseness/fineness of the mineral matter in the soil. It is determined by the proportion of the sand, silt, and clay particles**. **The equal proportion of all three of them is known as loam**. Soil texture affects the water holding capacity, nutrient retention, nutrient fixation, drainage, compressibility, and aeration of the soil.

- **Clay**: Particle Size – diameters **less than 0.002** millimeter
- **Silt**: Particle Size – diameters between 0.002 millimeters to 0.05 millimeters.
- **Sand**: Particle Size – diameters between 0.05 and 2 millimeters.

Rocks larger than 2 millimeters are regarded as pebbles, gravel, or rock fragments *and technically are not soil particles.*



Loamy Soil: Loamy soil is the one in which none of the three (sand/silt/clay) dominates the other two. In particular, **loamy soil has about 40% sand, 40%silt, and 20% clay**.

Soil Structure:

It is the **arrangement of soil particles into certain patterns** like- plate like structure, block like structure, prism-like structure, etc.

Soil structure describes the way the sand, silt, and clay particles are clumped together. Organic matter (decaying plants and animals) and soil organisms like earthworms and bacteria influence soil structure.

Clays, organic matter, and materials excreted by soil organisms bind the soil particles together to form aggregates. **Soil structure is important for plant growth, regulating the movement of air and water, influencing root development, and affecting nutrient availability.**

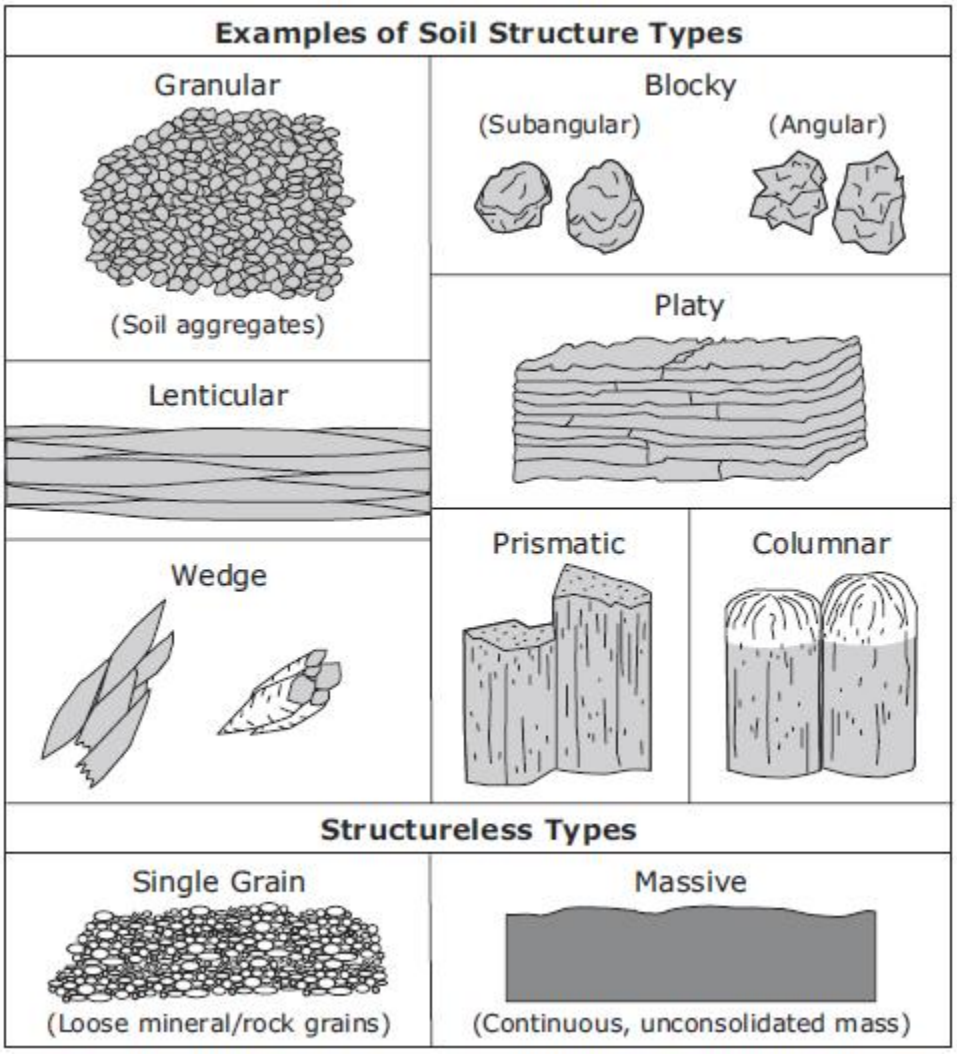
Good quality soils are friable (crumbly) and have fine aggregates so the soil breaks up easily if you squeeze it. Poor soil structure has coarse, very firm clods or no structure at all.

Some structural characteristics of soil:

- **Permeability** – The ease with which liquids/gases can pass through rocks or a layer of soil is called permeability. It depends on the size, shape, and

packing of particles. It is usually greatest in sandy soils and poor in clayey soils.

- **Porosity** – The volume of water which can be held within the soil is called its porosity. It is expressed as a ratio of the volume of voids (pores) to the total volume of the material.



There are 5 basic types of structural units:

1. **Platy**: Plate-like aggregates that form parallel to the horizons like pages in a book.

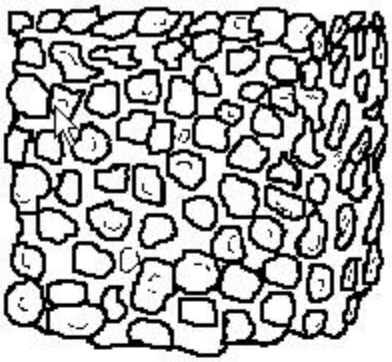
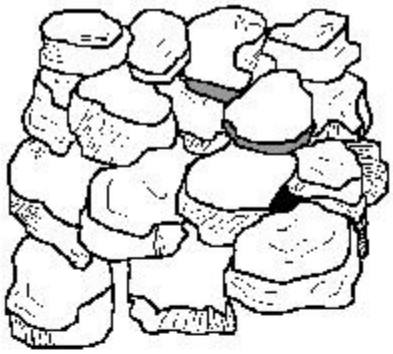
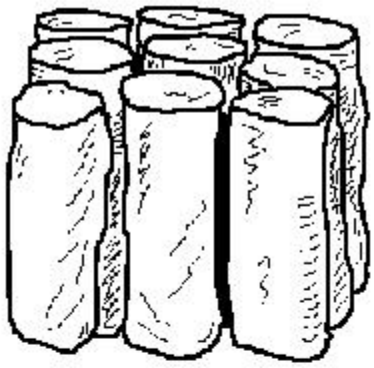
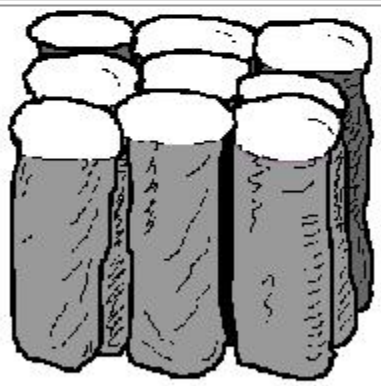
- This type of structure may reduce air, water, and root movement.
- a common structure in an E horizon and usually not seen in other horizons.

2. **Blocky**: Two types–angular blocky and subangular blocky

- These types of structures are commonly seen in the B horizon.
- Angular is cube-like with sharp corners while subangular blocky has rounded corners.

3. **Prismatic**: Vertical axis is longer than the horizontal axis. If the top is flat, it is referred to as prismatic.If the top is rounded, it is called columnar.
4. **Granular**: Peds are round and porous, spheroidal. This is usually the structure of A horizons.
5. **Structureless**: No observable aggregation or structural units.

- Single grain-sand
- Massive-solid mass without aggregates

		
Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.	**Blocky**: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.	**Prismatic**: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.
		
Columnar: Vertical columns of soil that have a salt "cap" at the top. Found in soils of arid climates.	**Platy**: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.	**Single Grained**: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.

Soil Colour:

Basically soil color (brown, yellow, red) depends on oxidized or **ferric iron** compounds. **Darker the color of the soil, the more organic content it contains.** The higher the organic content, the higher soil temperature as they absorb more heat due to the darker color.

Soils rich in humus tend to be dark because decomposed organic matter is black or brown. Soils with **high humus content are usually very fertile**, so dark brown or black soils are often referred to as 'rich'.

Red or yellow soils typically indicate the presence of iron.

Soil colour is described by the parameters called hue, value and chroma. Hue represents the dominant wave length or colour of the light; value refers to the lightness of the colour; chroma, relative purity or strength of the colour.

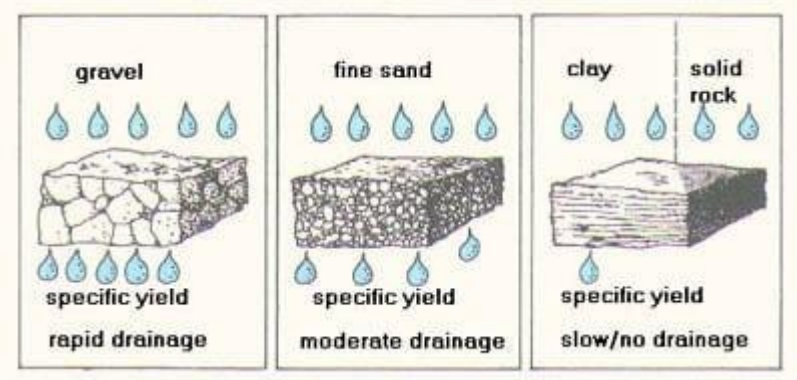
The colour of the soil in terms of the above parameters could be quickly determined by comparison of the sample with a standard set of colour chips mounted in **a note-book called MUNSELL SOIL COLOUR CHARTS**.

In these charts, the right-hand top corner represents the Hue; the vertical axis, the value; and the horizontal axis, the chroma.

Soil permeability:

Soil permeability is a broad term used to define the ability of the soil for transmitting water. It is important to understand the water dynamics and the water balance of the soil and it must be known for accurate management of irrigation. It is determined partly by texture, with sandy soils having high permeability as compared to clay soils and it can be altered by soil management.

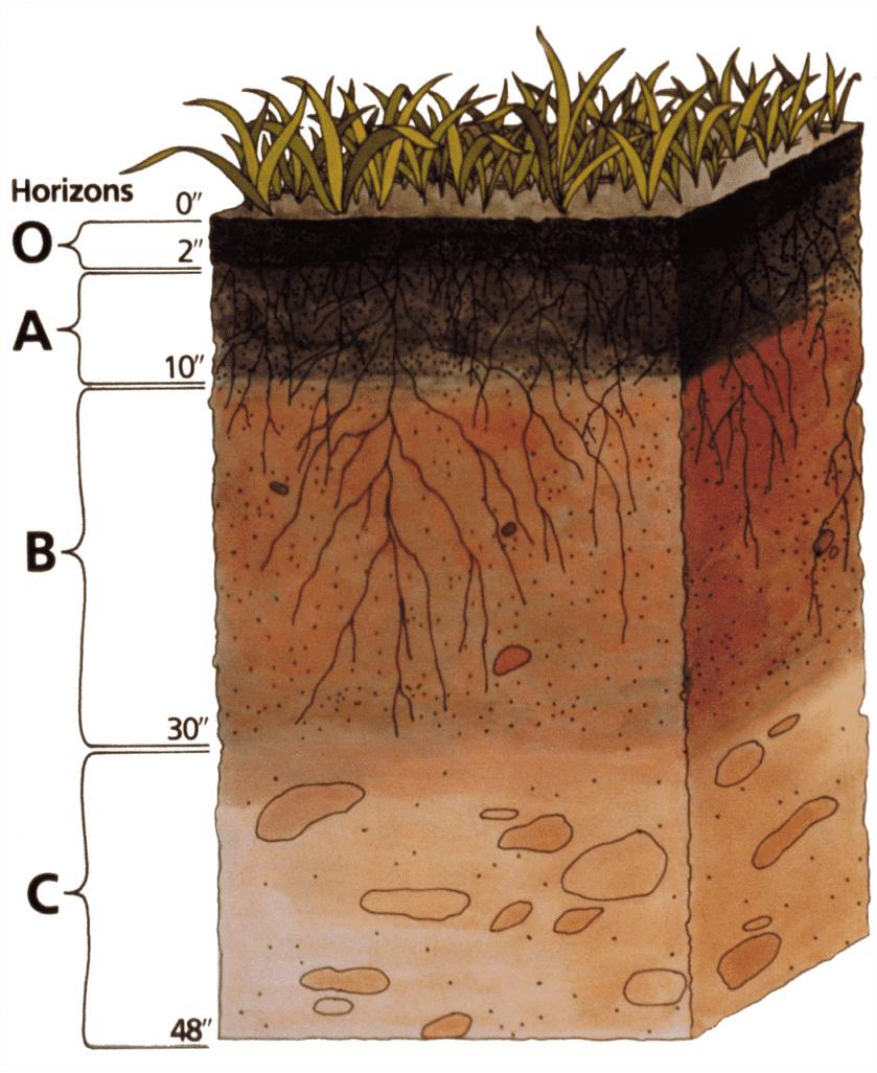
- **Most porous rocks are permeable with the exception of clay in which pore spaces are so small that they are often sealed with groundwater held by surface tension.** Another exception – **granite is non-porous but permeable**. It is a crystalline rock and hence non-porous. Its individual crystals absorb little or no water but the rock may have numerous joints/ cracks through which the water can pass rendering it permeable.
- **A soil with high organic content also tends to have high porosity.**



Soil Horizon:

1. The soil is divided vertically into different horizons from top to bottom namely:

- **A-Horizon:** This is the **uppermost layer of soil and also called topsoil.** This layer is rich in humus and minerals and holds most of the water as compared to other layers. This layer consists of sand, silt, and clay. It is also home to many living organisms like snakes, earthworms, etc.
- **B-Horizon**: This is the **second layer from the top and is a little rich in humus and it supports moisture**. This layer consists of silt, clay, weathered rocks, and some nutrients. Minerals are more in this layer as compared to the top layer.
- **C-Horizon**: **This layer consists of small pieces of rocks broken down due to weathering.**
- **BedRock: This layer is the last layer and consists of layers of solid unweathered rock.**


Horizons
O
A
B
C
0″
2″
10″
30″
48″