

7th Standard- Science

Soil Class

Soil is one of the most important natural resources. It is the uppermost layer of earth's crust which is blackish-brown in colour. Major functions of the soil are:

- It supports plant growth by holding the roots firmly and supplying water and nutrients to the plants.
- It acts as a natural habitat for many organisms like an earthworm, fungi, bacteria, ants, etc.
- It is also essential for agriculture which provides us with food, clothing and shelter for all.
- It supplies water and nutrients to plants.

Therefore, we can say that soil is an inseparable part of our life.

Soil Teeming with Life

Soil contains air, water and countless living organisms like fungi, bacteria, insects (like ants and beetles), earthworms, rodents, moles and plant roots. Some organisms are too small that they cannot be seen by naked eyes (e.g. fungi and bacteria). An important soil organism is an earthworm, it is visible only in the rainy season. It increases the fertility of soil.

An analysis of different soil samples is summarised in the table given below:

Soil Source	Plants	Animals	Any other observations
Garden soil	Grasses and roots	Ants, earthworms, termites and beetles	Concrete
Soil from roadside	Dry roots	Ants and termites	Concrete, plastic bags and glass particles
Soil from the area where construction is going on	No plants	Ants	Gravels, plastic articles, polythene bags, sand, etc
Soil from agricultural land	Grass roots and plant roots	Earthworms, millipedes, centipedes, fungi and bacteria	Concretes, glass materials and manure (cow dung)
Soil from river side	Dry grasses, hays and humus	Milipedes, centipedes, and lichens	Glass particles, concrete, plastic articles, and polythene bags

Therefore, we see that different soils from different sites have various plants, animals and waste materials in them.

Soil Pollution

Sometimes people throw polythene bags and plastic articles in the soil. They pollute the soil and also kill the useful organisms living in the soil. Some other substances like chemicals and pesticides also pollute the soil.

To prevent the soil pollution, the use of polythene bags must be banned, and the waste products and chemicals must be treated before they are released into the soil. The use of pesticides in the agricultural field must also be minimised in order to prevent soil pollution.

Soil Profile

Soil is formed by breaking down of rocks by the action of wind, water or climate by the process called weathering. During this process, the rocks are worn away to form small particles by long exposure to the elements of weather.

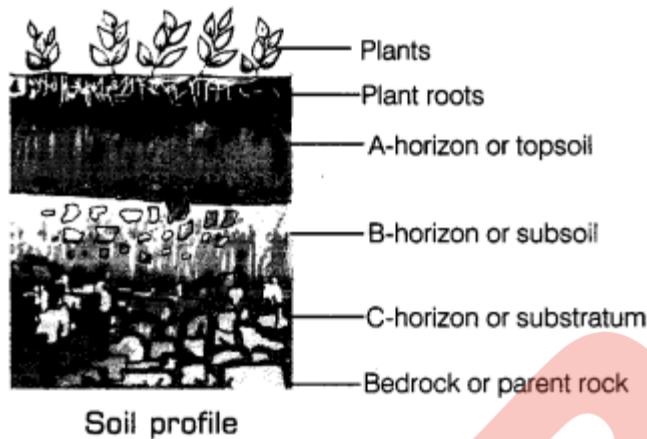
Weathering is a very slow process as it takes thousands of years for a huge rock to turn into fine particles. The nature of the soil depends upon the rocks from which it has been formed and types of vegetation that grow on it.

The soil profile is a vertical section through different layers of the soil.

Soil profile consists of different layers of soil which are called horizon. Each horizon differs in texture, colour, depth and chemical composition. Different horizons of the soil are discussed further.

1. A-Horizon or Topsoil

It is the uppermost layer of soil and is usually dark in colour because of the presence of minerals and humus in it. It provides the nutrients in plants since the roots of most plants are confined to this layer. Humus is the dark brown coloured layer which consists of dead, rotting remains of plants and animals.



Humus helps in making the topsoil porous. This layer is generally soft and retains more water in it. This layer provides shelter for many living organisms like earthworm, rodents, moles and beetles.

2. B-Horizon or Subsoil

This layer of soil lies just below the topsoil. It is made up of slightly bigger rock particles than that of the topsoil. It does not have much humus and is lighter in colour than topsoil. It is somewhat harder and more compact than the topsoil. This layer is less fertile than topsoil and contains few living organisms. The subsoil is rich in minerals and iron oxides.

3. C-Horizon or Substratum

The layer of soil which lies just below the subsoil is called C-horizon.

. It consists of small pieces of broken rocks with cracks and crevices, formed by the weathering of bedrock or parent rock.

4. Bedrock or Parent Rock

Below the C-horizon unweathered solid rock is found which is called as bedrock. It is non-porous and can produce the soil over a long period of time.

Rainwater gets collected over it to form the water table.

This layer is hard enough and is difficult to dig with a spade.

Soil Types

The weathering of rocks produces small particles of various materials, these include sand and clay. The relative amount of sand and clay depends upon the rock from which the particles were formed. The rock particles present in soil are of different sizes and chemical compositions. On the basis of sizes, the rock particles present in soil can be divided mainly into four major groups:

(i) Clay, These are formed by the smallest rock particles. These are so small that we cannot see a single clay particle and it feels smooth.

(ii) Silt These are made up of somewhat bigger rock particle than clay. It is not so smooth as clay. Silts are found deposited at river beds. Floods deposit the silt from rivers in the field.

(iii) Sand, These are made up of larger particles enough than that of silt and can be easily seen. These are coarse to touch due to their larger size.

(iv) Gravel These are the largest sized rock particles that are present in the soil. These are the tiny stones that are present in topsoil in very small quantity.

The soil in different geographical areas contains different proportions of sand, clay and silt in them. It also contains a small amount of hummus in them. Depending upon its composition, soil can be classified as sandy soil, clayey soil and loamy soil. The size of the particles in the soil influences its properties.

(i) Sandy soil These contain mainly sand. These are quite large particles. There are large spaces between them which are filled with air. Water can drain quickly through these spaces. The sandy soil tends to be light, well aerated and rather dry. Since it is aerated, can be ploughed easily and cannot retain water, so it is not good for plants. Since it is light, it can be easily blown away if left bare. It does not possess humus, thus it is less fertile. It can be made fertile by adding manure in them which increases its water-holding capacity. This soil is not sticky and therefore, these cannot be used to make pots, bricks, toys and statues.

(ii) Clayey soil' Clay particles are smaller and packed tightly so that it leaves a little space for air. Water drains very slowly through clayey soil. These also contain very little humus. It is heavier than sandy soil. Clayey soil is more fertile than sandy soil.

The fertility of clayey soil can be improved by adding some sand and humus to it. Clayey soil is very sticky and can be used to make pots, bricks, toys, statues, etc.

(iii) Loamy soil It is a mixture of sand, clay and silt with a small amount of humus in it. Therefore, it is very fertile and the best topsoil for growing plants. It has water holding capacity and excess water can also be drained out through it easily. It is a smooth, partially gritty and sticky soil.

Properties of Soil

Soil possesses various properties like:

- It contains air.
- It can hold water or moisture.
- It can absorb or soak water
- It allows water to pass down through it.

Percolation Rate of Water in Soil

Soil is porous, i.e. it has tiny pores in it. When water is poured over it, then some water gets absorbed in the soil and rest passes down the soil. The process of passing down water slowly through the soil is called percolation of water. Percolation rate is the amount of water (in mL) that is percolated through the soil in unit time, i.e. in minutes. The percolation rate differs in different soil types.

The rate of percolation can be calculated by using the following formula:

Percolation rate (mL/min) = Amount of water (mL) / Percolation time (min)

For example, if water in bottle 'A' percolates in 20 min, in 'B', it percolates in 15 min in bottle. While in bottle 'C', it percolates in 25 min, then the percolation rate (mL/min) will be calculated as follows:

For bottle 'A', Rate of percolation = $\frac{200\text{mL}}{20\text{min}} = 10 \text{ mL/min}$

For bottle 'B' Rate of percolation = $\frac{200\text{mL}}{15\text{min}} = 13 \text{ mL/min}$

For bottle 'C', Rate of percolation = $\frac{200\text{mL}}{25\text{min}} = 8 \text{ mL/min}$

Percolation rate is highest in sandy soil because it is very loose. On the other hand, clayey soil is very compact and therefore has the lowest rate of percolation. The rainwater moves or reaches to well faster and in a greater amount from sandy soil.

Since clayey soil can retain water in them. These are the best soil to grow paddy because paddy requires standing water in fields. The kutchha (unpaved) road due to percolation of water becomes dry after rain while pakka road does not.

Moisture in Soil

The soil contains some water in it which is called soil moisture.

Usually, 'moisture is present as a thin film around the soil particles. This moisture is absorbed by the roots of plants. Thus, the moisture content of the soil is very important for the growth of crops.

Absorption of Water by Soil

Soil contains moisture in it but it can still absorb or soak a lot of water. But soil has the limit to absorb water in it. The ability or capacity of the soil to absorb a limit of water is called absorption percentage. It can be calculated as follows:

Percentage of water

absorbed = $\frac{\text{Amount of water absorbed (in mL)}}{\text{Amount of Soil (g)}} \times 100$

Different types of soil can absorb water to a different extent, i.e. some absorb more water while other absorbs less water. When we talk about the percentage of water absorbed by the soil, it means the mass of water absorbed by 100 g of soil.

Water Retention

The ability of soil to hold water is called water retention. The space between soil particles is called pores provide the passage for gases and moisture within the soil.

The ability of soil to retain water is strongly related to the particle size. Water molecules hold more lightly to the fine particles of the clayey soil than the coarser particle of sandy soil.

When we perform this activity with different soil samples, we will see that.

- Sandy soil will absorb less water and allows more water to percolate.
- A clayey soil will absorb more water but allow less water to percolate.
- Sandy soil will absorb less water than clayey soil because of the large spaces between the soil particles. The area where, there is a lot of clay in the soil, stagnant water collects above the soil whenever it rains.

Soil and Crops

Different types of soil are found in different parts of India. Soil is mainly affected by wind, rainfall, temperature, light and humidity. Some climatic factors also affect the soil profile and bring changes in the soil structure.

The plants that grow on the surface of the earth are called vegetation. It includes green grass, herbs, shrubs, bushes, crop plants and trees.

Types of Soil	Crop Grown
Clayey Soil	Wheat, Gram and Paddy
Loamy Soil	Lentil, Tomatoes, Corn and Oats
Sandy-loam Soil	Potatoes, Cotton and Cereal Rye

Vegetation is mostly in the fertile topsoil of the earth and covers the soil like a green sheet spread on the surface of the earth.

The component of soil along with various climatic factors determine the type of vegetation in a particular region.

- Clayey and loamy soils are both suitable for growing cereals like wheat and gram. Such soils are good at retaining water.
- For paddy, soils rich in clay and organic matter and having a good capacity to retain water are ideal.
- For lentils (masoor) and other pulses, loamy soils which drain water easily, are required.
- For cotton, sandy-loam or loam, which drain water easily and can hold plenty of air, are more suitable.

- Crops such as wheat are grown in the fine clayey soils because they are rich in humus and are very fertile.

A Case Study

John, Rashida and Radha went to Leeladhar Dada and Santosh Malviya of Sohagpur in Madhya Pradesh. Leeladhar Dada was preparing the soil to make items like surahi, matki, kalla (earthen frying pan), etc. John asked him the complete procedure of making such items. A summary of conversation they all had with Leeladhar Dada is given below:

- Leeladhar and other porters, bring the black soil from a piece of barren land.
- Dry soil is then placed in a large tank and would be cleaned of pebbles, etc. After removing these things the soil is then soaked for around 8 hours. This soil would be kneaded after mixing burnt horse dung.
- This kneaded soil is then placed on the wheel and appropriate shape is given. The final shape of the material is given with hands. These are kept for drying for three days. These items are baked at high temperature after drying in air and then coloured.

Soil Erosion

The removal of land surface by water wind or ice is known as erosion. The topsoil is very fertile and in the absence of it, the plants cannot grow. In the absence of plants, the soil becomes loose. As the plant roots bind to the soil. Soil erosion is mainly caused by the large scale cutting of forest trees and plants. This process of cutting down of trees is called deforestation.

Erosion of soil is more severe in the areas of little or no surface vegetation like the desert or barren land. Therefore, cutting of trees and deforestation must be prevented. The effects of soil erosion are, famines, flood desertification and damage or spoilage of environment.

