ACTA SCIENTIFIC AGRICULTURE (ISSN: 2581-365X)

Volume 2 Issue 12 December 2018

E-Book

The Soil

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Received: October 23, 2018; **Published:** November 09, 2018

Soil is the upper layer of the earth in which plants grow. The soils support us all-plants grow. The soils support us all-plants, animals and people either directly or from other life that comes from the soil. From the time man began to think, the soil has been recognized as the mother of all-plants, animals and man. The soil is covering on the soiled crust of the earth's land mass.

The soil is developing as a result of chemical, biological and physical actions and reactions within the earth's crust knowledge of rocks and earth's crust is essential in understanding (1) the origin of different soil (2) causes of variations in properties of different soils. There are two basic concepts of soil. The first Pedology, considers soils as a natural entity, a biochemically weathered and synthesized product of nature. Certain aspects, such as the origin of the soil, its classification and its description are involved in pedology. Pedology consider soil as the natural body a biochemically weathered and synthesized product. We study the origin, classification and description. The second edaphology conceives of the soil as a natural habitat for plant. Edaphology is the study of the soil from the stand point of higher plants. It considers the various properties of soils as they relate to plants growth and production.

Soil developmentat

Soils are composed of the unconsolidated organic and mineral materials on earth's surface in which physical, chemical and biological differentiation in to horizontal layer has taken place. Soil development include (1) brake down of rock to soil (2) the changes in to the soil profile brought about by natural processes of leaching translocation of colloids, accumulation of organic materials and weathering. In the other words, the changes that produce A and B horizons are referred to as soil development. The decomposition of plant and animal residues represent a very essential series of reactions in soil development.

Definition and components of soil

Soil is the more or less loose and crumbly part of the outer earth crust. Crust in which by means of their root's plants may or do find foot hold and nourishment as well as all other conditions essential to their growth.

Hilgard

Soil may be defined as "A dynamic natural body on the surface of the earth in which plants grow, compound of mineral and organic materials and living forms".

Buckman and Brady

"Soil is an upper most weathered layer of the soil earth crusts. It consists of rocks that have been reduced to small fragments and have been more or less changed chemically together with the remains of plants and animals that live on it and in it".

Raman

"Soil are applied solely to those superficial or nearly superficial horizons of rocks. That has been more or less modified naturally by the interaction of water, air and various kinds of organism. Either living or dead, this being reflected in certain manner in composition, structure and colour of such formations. where this condition is absent there are no natural soils, but either artificial mixtures or rocks".

Dakuchaev

"Soil is natural body developed by neutral forces acting on natural material. It is usually differentiated in to horizons from mineral and organic constituents of variable depth which differ from the parent material below the morphology, physical properties and constituents, chemical properties and composition and biological characteristics".

Joffe and Marbut

Components of soil

The soil consists 4 major components By volume, the air-dry soil contains given in table 1.

Components	% in soil
Mineral matter	45%
Organic matter	5%
Soil air	25%
Soil water	25%

Table 1

Figure 1

Many microorganisms like insects, rodents and worms like in soil in large amount and also like the microorganism like bacteria, fungi and algae live in soil in large amount.

Mineral matter

The size and composition of mineral matter is soils variable due to nature of parent rock form which it has been derived. Mineral matter is compost of small rock fragments and minerals of various kinds. In general, primary minerals are present in coarser fraction more than 2 mm (> 2mm) of the soil. Quartz and some other primary minerals (Anarthite, albite, orthoclase etc.) have persisted with little change in composition from the original soil.

Secondary minerals are dominant in the finer fraction less than 2 mm (< 2 mm) of the soil.

Silicate clay, apatite, dolomite and some other secondary minerals are prominent in the fine materials, especially in clay.

Organic matter in soils

The residue of plants animals, vegetation and microorganism are found on upper layer of the soil.

The organic matter content in a soil is very small and varies from only about 3 to 5 per cent by weight in a top soil.

Organic residues are continually being broken down as a result of microbial activity in soil and due to constant change, it must be replenished to maintain soil productivity. Organic manure is a store house of nutrients in the soil and also influences soil properties and consequently on plant growth.

Organic matter functions as granulator mineral particles. It is responsible for the loose, easily managed condition of productive soils and also improves the physical condition of soils, increase the water holding capacity. It is major source of plant nutrients like nitrogen, phosphorus and Sulphur etc. and It is the main sources of energy for soil microorganism.

Important functions of organic matter

It makes the physical condition of soil and improves the soil fertility. Organic matters help to binds soil particles and provide aggregation suitable for maintenance of soil aeration and also maintain infiltration and permeability. Organic matter increase water holding capacity and buffering capacity of soil and help in growth of organism in soil. Organic matter decreases water erosion, wind erosion and alkalinity of soil.

Soil water

Soil water plays a very significant role in soil plant growth relationship. Each water molecule contains two H_2 atom and one O_2 atom. It is a universal solvent and held within the soil pores. Soil solution is an important medium for supply of nutrients to plant. The movement and retention of water in the soil in primarily influenced by the characteristics of the soil viz. texture, structure, nature of inorganic and organic colloids.

Plants absorbed some water through leaf stomata (openings) but most of the water used by plants is absorbed by the roots from the soil for optimum water use. it is vital to know how water moves in to and through the soil, how the soil stores water, how the plants

absorb it. How nutrients are lost from the soil by percolation and how to mauser soil water contains and losses.

Soil also serves as the regulated reservoir for water. Because it receives precipitation and irrigation water. A representative cultivated loam soil contains approximately 50% solid particles (sand silt clay and organic matter) 25% air and the rest 25% water only half of this water is available to plants because the mechanics of water stores in the soil.

Soil air

Soil air is a continuation of atmospheric air unlike the other components. It is constant state of motion from the soil pores in to the atmosphere and from the atmosphere in to the pore space. This constant movement or circulation of air in the soil mass resulting in the renewal of its components gases is known as soil erosion.

"Soil aeration is defined as the exchange of O_2 and CO_2 between soil pore spaces and aerial atmosphere". Soil air occupies pores not filled with water. Hence content of air is determined by water content of the soil. After a heavy rain the soil pores may be filled with water. After sometimes when water moves downward pores are filled with air. Thus, the relative amounts of air and water in the pore space fluctuate continuously.

Surface Soil

The upper most loose layer of the earth consisting of organic matter and soil organisms suitable for plant growth. The depth of surface soil is 0-15 cm and it is most fertile.

Sub soil

The layer down below the soil is called sub soil. which is compact and less fertile. It is generally poor in nutrient status and organic matter and hence it is less fertile than that of surface soil. Subsoil is the layer of soil under the topsoil on the surface of the ground. Like topsoil it is composed of a variable mixture of small particles such as sand, silt and/or clay, but it lacks the organic matter and humus content of topsoil. Below the subsoil is the substratum, which can be residual bedrock, sediments, or aeolian deposits. As it is lacking in dark humus, subsoil is usually paler in colour than the overlying topsoil. It may contain the deeper roots of some plants, such as trees, but a majority of plant roots lie within the surface topsoil.

Comparative deference between the Surface Soil and Sub Soil

Figure 2

Branches of soil science

There is an intimate plant and soil relationship, any discussion on soils would be incomplete without including these relationships. Soil science deals with soil as a natural body and a medium for crop growth. Different aspects of soil science may be studied under fallowing major disciplines for soil science.

1. Soil genesis
2. Soil survey
3. Soil taxonomy

Soil genesis

It deals with the mode of origin of the soil. The mode by which soil originates, with particular reference to processes of soil-form-

ing factors responsible for the development of true soil from unconsolidated parent material. Also known as pedogenesis soil formation. Pedogenesis is the process of soil formation as regulated by the effects of place, environment, and history. Biogeochemical processes act to both create and destroy order (anisotropy) within soils. These alterations lead to the development of layers, termed soil horizons, distinguished by differences in color, structure, texture, and chemistry. These features occur in patterns of soil type distribution, forming in response to differences in soil forming factors.

Soil survey

Systematic examination, description, classification and mapping of soil of an area is called soil survey. Soil surveys are conducted for preparing a scientific inventory of different soils.

Soil taxonomy

The grouping of soils based on their properties and characteristics. It called soil taxonomy.

Soil physics

Soil physics is the study of soil physical properties and processes. It is applied to management and prediction under natural and managed ecosystems. Soil physics deals with the dynamics of physical soil components and their phases as solid, liquids, and gases. It draws on the principles of physics, physical chemistry, engineering, and meteorology. It is especially important in this day and age because most farmers require an understanding of agro ecosystems. Soil physics applies these principles to address practical problems of agriculture, ecology, and engineering.

Soil chemistry

The study of chemical basis of soil formation and soil fertility is soil chemistry. It includes the role and function of individual elements and their compounds in the genesis of soils and their properties.

Soil microbiology

The branch of science dealing with micro-organisms and their activities in soil is known as soil microbiology.

Soil Technology

It deals with the management of problem soils, i.e. saline, saline sodic, sodic and eroded soil.

Soil Fertility

The study of nutrient status of soil with respect to the amount and availability of nutrient to plants. Soil fertility is defined as the ability of soil to supply nutrients for plant growth.

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