Aeration - Can Improve the Physical properties of soil

Texture

Soil texture refers to the relative amounts of inorganic particles i.e. Sand, Silt and Clay. Sand grains are large and coarse, clay particles are very fine and smooth, and silt particles intermediate.

Structure

The way in which soil particles are grouped or bound together to form lumps or aggregates is known as soil structure. There are two main types of soil structure, (10) single grained and (2) compound structure. Soil structure can be modified by adopting various soil management practices including aeration, tillage, crop rotation, irrigation, drainage etc.

Density

The density of soil can be expressed in two ways.

1.The density of solid (particle density), particles of the soil and
2.The density of the whole (Bulk density) soil that is inclusive of pore space.

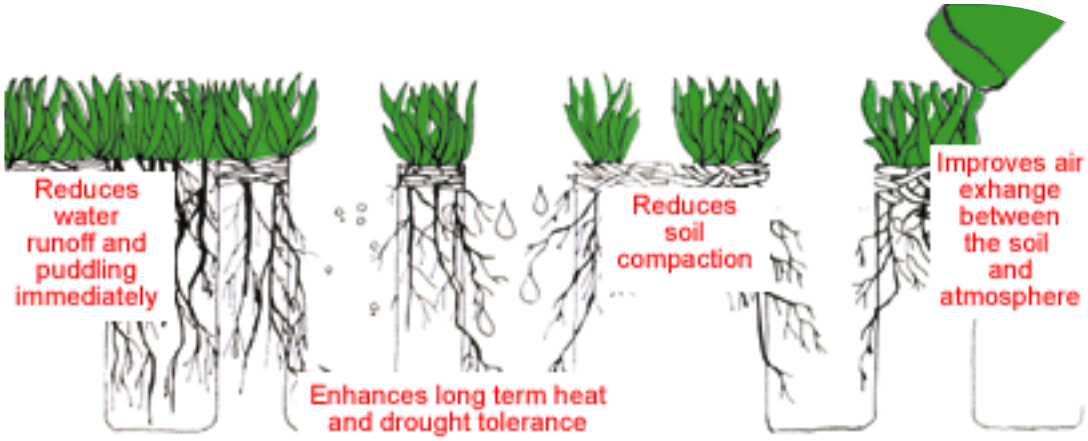
Generally soils with low bulk density have better physical condition than those with higher bulk densities. Texture and structure of a soil, its total pore space and organic matter content are all related to bulk densities. Soil density can be modified with aeration.

Porosity

Between the soil particles there are empty spaces which are occupied by air and water and are termed as pore spaces. Pore spaces between the aggregates of soil particles are macro pores and those between the individual particles of the aggregates are micro pores. Sandy soils have a higher percentage of macro pores. Typically, sandy soils never become water logged and allow water to percolate downward more rapidly than clay soils. Typically, moisture content in sandy soils is relatively low when compared to clay soils.
Clay soils contain a higher percentage micro pores when compared to sandy soils. Clay soils are more susceptible to water logging which can adversely affect root respiration and microbial activity. A proper balance between the macro and micro pores can be maintain by timely aeration.

Colour

Soil color is helpful in determining soil properties. A dark brown or black colored soil indicates its high organic matter content and fertility. A red or yellowish soil shows good aeration and proper drainage. A white color, resulting from the accumulation of salts of alkali indicates deterioration of soil fertility and its unsuitability for normal growth of many crops



Biological properties of soil

A variety of organisms inhabit the soil. They decompose organic matter, fix atmospheric nitrogen, cause denitrification etc. Specific groups of organisms are responsible for specific activities in the soil. Such activities may be beneficial or harmful to the crop or its yield potential.

Soil temperature and plant growth

Soil micro-organisms show maximum growth and activity at optimum soil temperature range. All crops practically slow down their growth below the temperature of about 90C and above the temperature of about 500 C. The biological processes for nutrient transformations and nutrient availability are controlled by soil temperature and soil moisture. Soil temperature has a profound influence on seed germination, root and shoot growth, and nutrient uptake and crop growth. Seeds do not germinate below or above a certain range of temperature but Micro-organisms functioning in the soil are very active while a certain range of temperature, which is about 270 to 320C.

It is necessary to know whether the soil temperature is helpful to the activities of plants and micro-organisms and the temperature could be suitably controlled and modified. The various factors that control the soil temperature are soil moisture, soil colour, slope of the land, vegetative cover and general soil tilth. Aeration can be used to control soil temperature, regulate soil moisture, improve drainage, stimulate microbial activity and improve overall soil tilth.

Bacteria

Bacteria are generally confined to the 20 to 30 cm. layer and work best when there is (1) good aeration, a neutral reaction, soil moisture content at about half of the soil's water holding capacity and temperature between 250 c and 380 c.

Fungi

These organisms produce microscopic threads called mycelia and are found in the organic matter of plant roots. Fungi help in breaking down the somewhat resistant parts of the organic matter like cellulose, lignin, gums etc. A large part of slowly decomposing soil humus is made up of the dead remains of fungi.

Actinomycetes

They can grow in deeper layers even under dry conditions. Their main function lies in decomposing the resistant parts of organic matter like cellulose.

Algae

They are microscopic or very minute sized plants having chlorophyll and are usually found on the surface of wet soils. They help in adding organic matter to soil, improving the soil aeration and fixing atmospheric nitrogen.

Texture and other soil properties and plant growth

Many of the important soil properties are related to texture. Clayey soils show high water holding capacity, high plasticity, and stickiness and swelling whereas sandy soils are conspicuous by the absence of these properties. The most important way in which soil texture affects plant growth is water and with it the nutrient supply. The available water holding capacity of soil is related to soil texture. Timely aeration can improve Soil texture improved water holding capacity.

Soil structure and plant growth

Soil structure influences plant growth rather indirectly. The pores are the controlling factors governing water, air and temperature in soil, which in turn, govern plant growth. One of the best e.g. of the effect of soil structure on plant growth is the emergence of seedlings in the seedbed. The seedlings are very sensitive to soil physical condition so that there should not be any hindrance to the emergence of tender seedlings and there should be optimum soil water and soil aeration. The soil in the seedbed should have a crumb structure so that the roots of the seedling can penetrate it easily. The hard compact layer impedes root growth.

Soil water

Water is essential for plant growth. Soil is capable of being a storehouse of water and becoming the main source of water for land plants. Soil water plays a significant role in several natural processes- evaporation, infiltration and drainage of water, diffusion of gases, conduction of heat, and movement of salts and nutrients are all dependent upon the amount of water present in soil. Plants meet their water requirement from water stored in soil. Soil moisture can be improved with aeration.

Soil Aeration and plant growth

Oxygen is required by microbe and plants for respiration. Oxygen taken up and carbon dioxide evolved are stoichiometric. Under anaerobic conditions, gaseous carbon compounds other than carbon dioxide are evolved. Root elongation is particularly sensitive to aeration. Oxygen deficiency disturbs metabolic processes in plants, resulting in the accumulation of toxic substances in plants and low uptake of nutrients.

Soil compaction

Soil compaction is the process of increasing dry bulk density of soil and reducing pore space by expulsion of air through applied pressure on a soil body. Soil compaction is a limiting factor in seed germination, water transmission and aeration. Timely aeration and the incorporation of biologicals can prevent soil compaction.