ADVANCED

Soil can be defined as a thin layer of the earth's crust which serves as a natural medium for the growth of plants. Soil, though considered as a non-living thing, acts as a for various living organisms from small worms and insects, to reptiles, etc. Thus, the soil is an environment of its own. For a healthy ecosystem, healthy soil is important.

The physical properties of any kind of soil largely determines the manner in which it can be used. Properties like water holding capacity, permeability to water, aeration, plasticity and nutrient supply ability, are influenced by the size, proportion, arrangement and mineral composition of the soil particles. The major soil groups are as follows:

Black Soil

These soils vary in depth from shallow to deep. They are highly argillaceous, very fine grained and dark, containing a high proportion of calcium and magnesium carbonates. But they are poor in phosphorus, nitrogen and organic matter.

Alluvail Soil

This type of soil differs in constituency from drifting sand to loam and from fine silt to stiff clay. This is also the most important soil group contributing, in a major extent, to agricultural wealth.

Red Soil

This is the most predominant type of soil found in Tamilnadu. These soils are rather shallow, very open in texture, having a pH ranging from 6.6 to 8.0 and are generally poor in nitrogen, phosphorus and humus.

Laterite

These soils are specially well developed on the summits. Though poor in lime, magnesium and nitrogen they are rich in plant nutrients.

Clay

Since the soil particles are very fine grained and fine textured, the quality of retaining water is more and hence the water infiltration capacity is low.

Sand

This is found in coastal and river bed areas. These soils are very permeable and drain well, but are less water retentive.

Problems arising due to soil loss

- Deforestation
- Leaching
- Erosion

Deforestation leads to loss of top soil, soil erosion, nutrient leaching. It takes 2,000 years for the top soil to develop. Due to deforestation, on open, bare land, soil gets dissipated or carried away by monsoon rains and deposited in rivers, tanks and ponds, thus leading to silt formation, thereby reducing their water holding capacity. The exposed poor soil in agricultural lands makes it unfit for cultivation.

Soil erosion occurs due to wind and rain. Prolonged soil erosion may lead to formation of gullies and may lead to land slides.

Acidic Soils

In humid regions where rainfall is high, the continued leaching of soils results in the replacement of calcium, magnesium, potassium and sodium ions by hydrogen ions, leading to the formation of acidic soils. Lime application neutralises to some extent the acidity in the soil.

Crops like millets, oats, peas and soyabeans, can tolerate moderate acidity and trees like Derris indica, Gliricidia and Tamarind can be grown in this soil.

Saline Soils

In India around 7 million hectares of land are saline in nature. This soil contains toxic concentrations of soluble salt in the root zone. Because of the white encrustation due to salts, the saline soil is also called white alkali. The salinity may increase due to a rise in the water table, water-logging in the root zone and sea coast irrigation. Excess soluble salts like chlorine, sulphate, sodium and calcium will be present. Tree species like Azadirachta indica, Prospis julliflora, Terminilia arjuna and Albizia lebbeck can be grown in these soils. While planting, ridge-trench method, sub-surface planting and planting in furrow irrigation channels would help to reduce the toxicity of salts.

Alkaline or Sodic Soils

These soils do not contain any neutral salts. Because of high alkalinity resulting from sodium carbonate, the surface soil appears discoloured and black. Such soils have a very low infiltration rate. If the soil texture is heavy, gypsum can be added. Silt and rice husk can also be added to improve the texture. Trees like neem, Albizia lebbeck, Derris indica, Subabul, Prosopis and terminilia arjuna can be planted.

Soil Management

There are around 16 micro and macro nutrients needed for the healthy growth of a plant. During each harvest, the soil's fertility will keep progressively reducing. To protect the fertility of the soil, it has to be tested each time after harvesting. A careless application of fertilizers will only further deplete the soil fertility. It is also not advisable to apply micro and macro nutrients simultaneously into the soil. Mixed cropping would help to balance the nutrients in the soil.

Although the problems of soil management vary according to the soils and their situations and the climatic conditions, there are fundamental factors which govern the choice of soil management practices. The productive capacity of the soil should be improved and maintained by providing adequate organic manure and plant nutrients.

Soil Test

For maximum production and rational soil management, a knowledge of the soil fertility status and the physical properties is essential. Soil testing is one of the methods of determining the fertility status of the soils, so that recommendation in regard to deficient nutrients or soil amendments can be made.

How to collect samples

Remove all leaf litter and debris from the top soil and using a soil tube, an auger, a spade or a pick-axe, dig the soil in a V shape up to a depth of 10 cm and collect the sample. Dry the sample. The soil should be removed from the centre of the land but manure filled or compost areas have to be avoided.

Given below are 16 micro and macro nutrients essential for plant growth.

Nitrogen	for leaves, stem growth, seed development
Phosphorous	for roots to spread and absorb water
Potassium	for protection from disease, pest resistance, and compensating evapotranspiration
Iron	for preparing chlorophyll and for energy development and transfer
Zinc	growth stimulator
Manganese	for absorption of CO2 and for transfer of nitrogen
Copper	for preparation of primary protein
Boron	in cell formation and division
Molybdenum	to absorb nitrogen and to resist excess micro-nutrients
Sulphur	for chlorophyll and root development
Calcium	in cell development and for transfer of food
Magnesium	for protein preparation - as an enzyme catalyst

Other nutrients such as carbon, hydrogen, oxygen and chlorine too play vital roles in plant growth.

SOIL POLLUTION

Land is a very valuable but limited resource, as the population increases rapidly. Many highly urbanised cities are faced with acute space problems, as in calcutta or bombay. Besides the limited availability of land, 175 million hectares of land are becoming less productive every year. India loses 20 tons of topsoil per hectare in a year due to floods, rainfall and deforestation. 20 % to 50 % of lands under irrigation can go out of cultivation at this rate because of water logging and salinity.

The scenario of desertification is compounded by pollution which includes

- Indiscriminate discharge of industrial effluents on land and into water bodies
- An increase in the use of fertilisers for agriculture
- Open defecation by animals and human beings
- Accumulation of solid waste; this is a major problem in developed countries like india where the garbage and refuse products are not degraded
- Radioactive substances from nuclear plants which are released into the soil

MAJOR SOIL POLLUTANTS AND THEIR EFFECT ON HUMAN HEALTH

METAL	SOURCE	EFFECTS
Arsenic	Occurs naturally	chronic poisoning leads to loss of appetite and weight, diarrhoea, alternating with constipation, gastro intestinal disturbances, peripheral neuritis, conjunctivitis and sometimes skin cancer.
Cadmium	mining, metallurgy chemical industry and electroplating	lead to chronic poisoning and affects the proximal tubules of the kidney, causing formation of kidney stones.
Lead	lead smelters storage battery	lead poisoning can lead to severe mental retardation or death.
Mercury	industrial wastes	methylmercury compounds are much more toxic than other forms of mercury, causes neurological problems and damages renal glomeruli and tubules.
Cyanides	waste from heat tratement of metals, dismantling of electroplating shops, etc.	rapid death may follow due to exposure to cyanide as a rusult of inhibition of cellular respiration.