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Soil of India

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Introduction

The soil of India is a complex and diverse resource that plays a crucial role in sustaining the country's agricultural productivity and supporting various ecosystems. It is a result of intricate interactions between geological processes, climate, vegetation, and human activities over thousands of years. India's vast territory and varied topography give rise to a wide range of soil types, each with distinct characteristics and capabilities. India boasts an incredible diversity of soils, classified into various types based on factors such as color, texture, structure, composition, and depth. Some of the major soil types in India include Alluvial, Black, Red, Laterite, Arid, Desert, and Mountain soils. The soil of India is the foundation of its agricultural sector, which employs a significant portion of the population and contributes significantly to the economy. Understanding the soil's characteristics and fertility is crucial for sustainable agriculture and proper land-use planning. Different crops require specific soil types, and appropriate agricultural practices are essential to maximize productivity and conserve soil health. Moreover, Indian soils also support various ecosystems, influencing the distribution of flora and fauna across the country. They play a role in regulating water flow, groundwater recharge, and flood mitigation. Soil conservation and sustainable land management practices are vital to prevent erosion, degradation, and desertification.

Definition of soil

Soil is a natural body composed of mineral and organic constituents, having a definite genesis and a distinct nature of its own.(V.V. Dokuchaev. 1900)

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Soil may be defined as "A dynamic natural body on the surface of the earth in which plants grow, composed of mineral and organic materials and living form."(Buckman & Brady 1969).

- **Soil texture:** depends on the proportion of sand, silt or clay it contains. For example, a soil described as a silt loam contains mainly silt but also will contain some sand and clay in smaller proportions.
- **Soil Profile:** Vertical section of the matured soil shows several layers, with distinct characteristic physical and chemical properties, which are known as horizons or soil horizons. Each horizon has a specific thickness, structure, colour, texture, porosity, etc. The soil profile can be broadly divided into five horizons. From the surface to downwards, these may be named as O-horizon, A-horizon, B-horizon, C-horizon and R-horizon. The A and B zones together form the true soil or Solum.

Types of soil in India

The Indian council for agricultural research (ICAR) has divided Indian Soil into 8 major groups they are

- Alluvial soils
- Black soils
- Red soils
- Laterite and Lateritic soils
- Desert (Arid) soils
- Mountain soils
- Salt Affected soils
- Peat & Marshy soils

Alluvial soils

Alluvium is fine particles of rock materials carried in suspension and later deposited by the river in its bed and bank. The soils which is composed of alluvium is called alluvial soil. These soils are important and extensive in India contributing greatly to the development of agriculture in the country where in they are confined largely to the flood plains of Satluj-Ganga and Brahmaputra from Punjab to Assam, the valleys and plains of river Narmada, Tapti, Mahanadi, Godhavari, Krishna and Cauvery covering about 15 lakh sq km or about

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45.6 per cent of the total land area of the country, these soils contribute the largest share of our agricultural wealth and support the bulk of India's population.

Being one of the most important and fertile soils of India they support growth of wide variety of crops such as Rice, wheat, sugarcane, cotton, jute, potato and vegetables, but they are deficient in nitrogen, phosphorous and Humus.

Brief about alluvial soil

- Mostly available soil in India (about 43%) which covers an area of 143 sq.km.
- Widespread in northern plains and river valleys. Humus, lime and organic matters are present. It is depositional soil. Sand content decreases from west to east of the country. Colour light grey to ash grey. Texture sandy to silty loam or clay
- New alluvium is termed as Khadar and old alluvium is termed as Bhangar.

Black soils

Black soil are so called because of their black colouration and derived from the Basalt rock under semi-arid conditions. It is also known as "Regur" or black cotton soil as it is best suited for cotton cultivation. In India black soil are largely found over deccan trap region namely the states of Maharshtra, Madhya Pradesh, parts of Andhra Pradesh, Northern part of Karnataka, Gujarath, parts of Tamil Nadu and Rajasthan. Black soil occupies 24.12% (74 Mha)of the total soil cover of the country with chief crops grown on it such as cotton, sugar cane, ground-nuts, millets, maize, pulses, sunflower, wheat and chillies.

Brief about black soil

- They are rich in Iron, line, calcium, magnesium, Carbonate and alumina, poor phosphorous, nitrogen and organic content.
- Crops grow- under rainfed condition Cotton, sorghum, millet, soybean, pigeon pea, etc. Under irrigated condition such as sugarcane, wheat, citrus plantation.
- Regur means cotton – best soil for cotton cultivation.
- Most of the Deccan is occupied by Black soil. Mature soil and high water retaining capacity. Swells and will become sticky when wet and shrink when dried. It has self-ploughing characteristic. Colour deep black to light black. Clayey Texture

Red soils

These are generally reddish to brownish in color obtained from weathering of granites, gneisses, and crystalline rocks and grade. These soils are ideal for cultivation of

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Ragi, Ground-nuts, millets, Tobacco and potato. They are rich in Iron, containing small amount of Humus as they about retain moisture and are slightly acidic with poor quantity of phosphorous, nitrogen and organic contents. from poor, thin and light colored soils on the uplands to that of fertile deep dark color soils of plains and valley. Red soils in India occupying 29.08% of the total soil cover of India extending extensively over parts of Tamil Nadu, Southern Karnataka, South-East Maharashtra, parts of Madhya Pradesh, Goa, Kerala, Orissa, Bihar, West Bengal, Uttar Pradesh, Eastern Parts of Rajasthan, Assam, Manipur, Tripura, Meghalaya and Nagaland

Brief about of red soils

- Seen mainly in low rainfall area. Also known as Omnibus group. Porous, friable structure and absence of lime, kankar (impure calcium carbonate). Colour is red because of Ferric oxide. The lower layer is reddish yellow or yellow. The texture is Sandy to clay and loamy.
- Crop grow in these soils can be profitably used for a variety of agriculture, horticulture and plantation crops. Such as millets, rice, groundnut, maize, soybean, pigeon pea, green gram, jute, tea, cashew, cocoa, mango, etc.

Laterite and Lateritic soils

Laterite is a formation that is only found in tropical countries like India with alternative wet and dry climatic conditions. The heavy rainfall conditions and high temperature makes the soil rich in oxides of Iron and Aluminum depleting in completely from Silica. The remnants of such oxides are known as laterites which are characterized by compact to vesicular structure occupying 4.30% (25 Mha) of India's soil cover. They are mainly found on the summits of Western Ghats and Eastern Ghats along with Vindhyas and Satpura's found in States of Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Assam and Tamil Nadu. Since they are very poor in calcium and magnesium and are well drained and porous. They are useful for both rice cultivation as well as plantation crops like cashew, rubber, tea and coffee.

Brief about Laterite and Lateritic soils

- Name from Latin word 'Later' which means Brick. It is soft when wet and so hard when dried. It found in areas of high temperature and high rainfall formed as a result of high leaching. Lime and silica will be leached away from the soil.

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- ❖ Organic matters of the soil will be removed fast by the bacteria as it is high temperature and humus will be taken quickly by the trees and other plants. Thus, humus content is low. Colour red colour due to iron oxide
- ❖ Crops grow-lower topographic positions are used for growing, rice, banana, coconut, arecanut and higher topographic positions for cocoa, cashew, tea, coffee etc. Shifting agriculture are mainly practised in this area, but the shifting cycle should be of 20 year or more.

Desert soils

The arid and the desert soil are found in semi-arid and arid conditional regions of India, namely the western Rajasthan, the Southern Haryana, and South-West Punjab. These are area lying between Indus River and the aravali-hill covering an area of about 29 million Hectares i.e., 1.42 lakh Sq Km. These soils contain soluble salts whose concentration is just below the toxic level as they are poor in nitrogen, Humus, and quite rich in phosphates and nitrates, there by not suitable for many crops except for few that to grown with the help of irrigation.

Brief about Desert soils

- ❖ Seen under Arid and Semi-Arid conditions. Deposited mainly by wind activities. Lack of moisture and Humus. It has high salt content.
- ❖ Kankar or Impure Calcium carbonate content is high which restricts the infiltration of water. The soil texture issandy with red to brown colour
- ❖ Growing a crop (millet or pulse) during monsoon period.

Forest and hill soils

Soils which are found all along the slopes of mountains and hills are termed as mountain soils. They are found from decomposition of organic matter from the forest. The characteristics of these soils differ from region to region depending on climates, vegetation and topography which contribute to the development of soil profile. They are dark brown in color with clayey silt to loamy texture and slightly acidic to moderate acidic in nature as they are rich in humus. Being the most fertile soil, they are useful for the growth of plantation crops such as tea, coffee, spices and tropical fruits. In India they are largely seen in Jammu & Kashmir, Himachal Pradesh, Manipur, Western Ghats in Karnataka, Kerala and Tamil Nadu covering a total area of 2.85 lakh Sq Km (75 Mha).

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Brief about forest and hill soils

- Soils formed under acidic conditions in the presence of acid humus and low base status.
- Podzolic soils-The soils, found under coniferous vegetation in the presence of acid humus and low base status.
- This soil pH is 4.5 to 6.0. These soils are dificient in Phosphorus since it get precipitated as iron phosphate and aluminium phosphate.
- Crop grow- The soil has great potential for growing agriculture crops such as rice, maize and fruit plants, such as apple, almond, pear, apricot, etc.

Salt Affected Soils

These soils are seen in Saline, aerid and Semi-aerid parts of Rajasthan, Punjab, Uttar Pradesh, Haryana, Gujarat and Maharashtra. These soils are infertile and uncultivable generally grading in texture from sandy to loamy sand with deficiency in nitrogen and highly pervious there by having low water retain capacity. They are estimated (Centar Soil Salinity Research Insititute CSSRI, Karnal) to occupy 7 million hectares in India of which 50% is in Indo-Gangetic alluvial plain 30% among black cotton soils and the rest 20% in aerid and coastal regions, are saline.

Crops grow: The rise in ground water causes salinization of soils and the farmers are obliged to switch over to growing rice and eucalyptus in areas which till recently were used for raising cotton and citrus plantation. Despite much limitation, the sodic soils, once ameliorated by applying gypsum, are used successfully for growing rice, followed by wheat.

The main objectives of reclamation

- Improve soil health for better crop production
- Bring abandoned farms back to cultivation
- Increase the crop yield per unit of land area
- Improve food security within national boundaries
- Enhance water and fertilizer use efficiencies
- Optimize cost of crop production per unit area, and
- Improve the livelihood of the farmers

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Peaty &Marshy soils

The peaty soils, developed under humid climatic environment, occupy a limited area in localized pockets of Kerala and NE region as a result of a large accumulation of organic matter. This soil, in addition, may contain some soluble salt in Kerala. Such saline peat soils are termed as Kari in Kerala state.

Brief about Peaty &Marshy soils

- These soils are dark to almost black in colour with abundent (20-40%) organic matter content. Soils are fine in soil texture. Accumulation of ferrous and aluminium sulphates, iron pyrite, especially in the-tidal swamp areas.
- When drained, the pyrite (Fe S_2) is oxidised and suphuric acid is formed, result significant drop in pH value <4.0.
- The clay contain are Kaolinite type of mineral.
- The iron and aluminium toxicities and associated phosphate deficiency contribute to limiting crop production on these soils.
- Crop grow-Rice and Pineapple.

Conclusion

In conclusion, the soil of India is a diverse and critical natural resource that underpins the country's agricultural productivity and ecological balance. Its complex composition and wide variety of soil types are a result of geological, climatic, and biological processes that have shaped the landscape over millennia. The richness and fertility of Indian soils, particularly the alluvial soils in the Indo-Gangetic plains and the black soils in the Deccan Plateau, have facilitated agricultural development and sustained the livelihoods of millions of farmers. These soils have been the backbone of India's agricultural sector, supporting the cultivation of a wide range of crops and contributing significantly to the country's food security.