



Popular Article



Cherish the soil for future generation through sustainable use

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Introduction

The soil, a fundamental component of our planet's ecosystem, serves as the cradle for life, supporting the growth of crops that nourish us and providing a habitat for countless organisms. To spread awareness about importance of soil, every year on December 5 will be celebrated as "World Soil Day". According to the United Nations (UN), the theme for World Soil Day 2023 is "Soil and water: a source of life". As we stand at the crossroads of unprecedented challenges, including climate change, population growth, and resource depletion, embracing sustainable practices becomes paramount. The concept of cherishing the soil extends beyond mere conservation; it encapsulates a profound commitment to cultivating harmony between human activities and the natural world. Sustainable use of soil involves adopting practices that maintain or enhance soil health while meeting the needs of the present without compromising the ability of future generations to meet their own needs. As custodians of the planet, we have the responsibility to be stewards of the soil, embracing innovative technologies and sustainable practices that nurture rather than exploit. By doing so, we can pave the way for a future where fertile soils sustain abundant harvests, resilient ecosystems thrive and the legacy we leave for generations to come is one of thoughtful custodianship and enduring sustainability.

Importance of Soil

Soil is a crucial component of the Earth's ecosystem, playing a fundamental role in supporting life and various ecological processes such as,

- Nutrient cycling: Soil acts as a reservoir for essential nutrients such as nitrogen, phosphorus, potassium, sulphur and other micronutrients. These nutrients are vital for plant growth and in turn support the entire food chain.

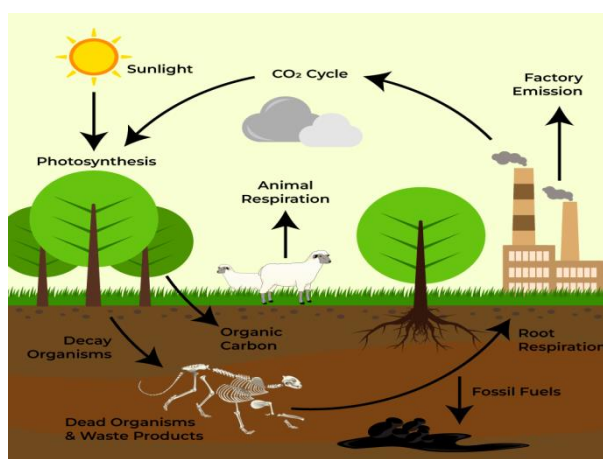


Fig. 1. Nutrient cycling

- Water filtration: Soil plays a crucial role in water filtration and purification. As water moves through the soil, impurities and contaminants are filtered out and the water is gradually purified before reaching groundwater reserves.
- Decomposition of waste: Soil microorganisms such as bacteria, fungi and actinomycetes play a vital role in breaking down organic matter, contributing to the decomposition of dead plants, animals and other organic materials. This process recycles nutrients back into the ecosystem.

- Biodiversity support: Soil is a habitat for a vast array of microorganisms, insects, worms and other soil dwelling organisms. This biodiversity is essential for nutrient cycling, decomposition of organic matter and the overall health of ecosystems.
- Carbon storage: Soil serves as a significant reservoir for storing carbon in the form of organic matter. Proper soil management practices such as conservation tillage, crop rotation and diversification, cover cropping and addition of organic matter can contribute to carbon sequestration, helping mitigate climate change by reducing the concentration of carbon dioxide in the atmosphere.
- Medicinal resources: Soil is a source of various minerals and microorganisms that have medicinal properties. Many pharmaceutical products such as penicillin, which is produced by a fungus, along with streptomycin, chloramphenicol and tetracycline, are produced by soil bacteria, ushered in the antibiotic age.

Status of soil health in India

Soil health in India has been a concern due to various factors, including intensive agricultural practices, improper land management, excessive use of chemical fertilizers and pesticides, water erosion, and depletion of organic matter. Indian soils are known for having high potassium content but low levels of phosphorus and nitrogen. According 2019–20 Soil Health Survey conducted by Government of India, 44% of the country’s soil lacks organic carbon, 55% phosphorus and 42% nitrogen. Farmers frequently employ a lot of chemical fertilizers due to low nutritional content of their land. After China, India is the world’s second-largest producer and consumer of fertilizers. In India, the levels of nitrogen pollution in soil and groundwater reached highest ever before. According to the National Academy of Agricultural Sciences (NAAS), India loses almost 9 million tonnes of nutrients and crop productivity annually due to soil erosion, which occurs at a rate of 15.35 tonnes per hectare. Furthermore, the nation’s vast area of fertile soil is impacted due to non-agriculture use.

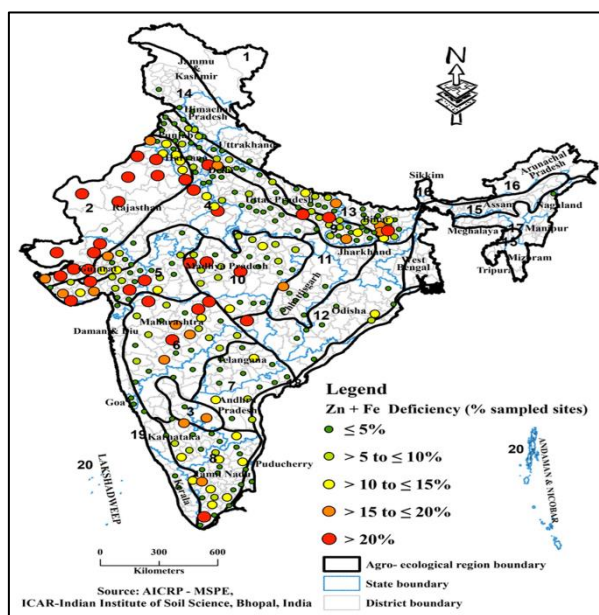


Fig. 2. Micronutrients deficiency in agricultural soils of India (Source: Shukla et al., 2021)

In this regard, the government has taken a few measures to prevent pollution and to maintain soil health. The national soil health card scheme is strongly in place to aware the farmers to health of the soil. It advises to the farmers for soil testing before crop cultivation and add fertilizes as per the requirement. Government and other private players are also suggesting farmers to smart and remote sensing based farming, even robotics, to help farmers. Bhoochetana, a mission to increase crop productivity, enhance farmer’s income and improve nutrition and livelihoods in the target regions. It was successfully scaled up in Karnataka and other states in the country. In some states, NGOs and other public institutions are also working to provide the knowledge about sustainable use of soil to the farmers.

Reasons for soil degradation

Soil degradation refers to the decline in soil quality, fertility and overall health. There are several reasons for soil degradation and often it is a result of the interaction of multiple factors such as,

- Soil erosion: It occurs when the topsoil is washed or blown away. This can happen due to wind, water (rainfall, rivers and oceans) or human activities like deforestation and improper land management.
- Deforestation: Removing trees and vegetation from an area can lead to increased soil erosion. Tree roots help bind the soil and their removal can make the soil more vulnerable to erosion.
- Overgrazing: Excessive grazing by livestock can lead to the removal of vegetation cover, making the soil more susceptible to erosion. This is a common issue in areas with extensive livestock farming.
- Agricultural practices: Certain agricultural practices, such as monoculture, excessive use of chemical fertilizers and pesticides and improper irrigation, can degrade soil quality over time. These practices may lead to nutrient imbalances, soil compaction, and loss of organic matter.
- Industrial activities: Some industrial activities contribute to soil degradation through the release of pollutants and contaminants. Improper disposal of industrial wastes such as heavy metals (chromium, cadmium, arsenic and nickel) and polycyclic aromatic hydrocarbons can introduce harmful chemicals into the soil.
- Climate change: Increased temperatures, altered precipitation patterns and extreme weather events can contribute to soil erosion, desertification and changes in soil moisture levels.
- Land pollution: The improper disposal of solid waste, including plastics and hazardous materials can contaminate the soil and degrade its quality.
- Unscientific land use: Improper land use planning, such as building on slopes or in flood-prone areas, can exacerbate soil erosion and degradation.

Sustainable practices for good soil health

Maintaining good soil health is crucial for successful and sustainable agriculture. Several methods can be adapted to maintain the soil health for longer time without compromising the crop yield.

- Soil testing to understand its nutrient levels and pH is most important before sowing the crop. Use fertilizers judiciously and based on soil nutrient analysis. Avoid over-reliance on synthetic fertilizers, as excessive use can harm soil health.
- Rotate crops to prevent the build-up of pests and diseases specific to certain plants. Different crops have varying nutrient needs and rotation helps balance soil fertility.
- Plant cover crops that protect the soil from erosion, add organic matter and enhance nutrient cycling.
- Add sufficient amount of organic matter, such as compost and well-rotted manure, this helps to improve soil structure, water retention and nutrient content.
- Practice no tillage or minimal tillage farming to reduce soil erosion and preserve soil structure. Disturbing the soil less helps maintain the natural habitat for beneficial microorganisms.
- Crop waste after the harvest has a lot of beneficial effect on soil health. Leave crop residues on the field after harvest, it prevents soil erosion, adds organic matter and provides habitat for beneficial organisms.
- Apply mulch to the soil surface to reduce evaporation, suppress weeds and regulate soil temperature. Organic mulches also break down over time, adding organic matter to the soil.

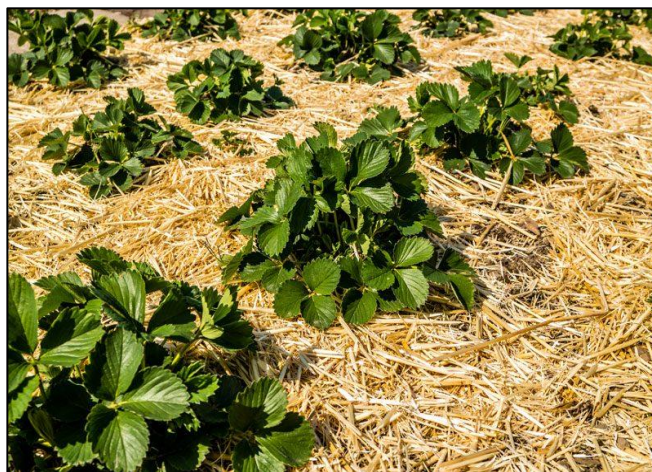


Fig. 3. Organic mulching to maintain soil health (Source: LS)

- Water is the most critical resource for agriculture. Implement efficient irrigation practices to prevent waterlogging and soil erosion. Proper water management helps maintain soil structure and health.
- Incorporate soil with biochar. Biochar is a type of charcoal produced from organic matter and, when added to the soil, can improve water retention and nutrient availability.
- Implement integrated pest management (IPM) strategies to control pests without resorting to excessive use of chemical pesticides, which can negatively impact soil health.
- Engage with local agricultural communities and educational resources to stay updated on the latest sustainable farming practices and soil health management techniques. By incorporating these practices, soil health can be cherished and enhanced, leading to improved agricultural productivity and long-term sustainability.

Conclusion

As stewards of the Earth, it is our responsibility to adopt and promote sustainable soil practices, ensuring that we leave a legacy of fertile and resilient land for the generations to come. Through education, advocacy and concerted global efforts, we can foster a deeper connection between humanity and the soil, fostering a harmonious coexistence that supports both current and future generations. By cherishing the soil, we invest in the well-being of our planet and lay the groundwork for a sustainable and prosperous future.