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# APPROACHES FOR ENHANCING SOIL FERTILITY TO SUPPORT AGRICULTURE

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The basis of the food chain is healthy soil. Given that human existence depends on the generosity of the soil, healthy soil is the most important resource for humanity. The foundation of agriculture's natural resource base, soil health ensures sustained output. Now a days soil health is diminishing, eroding and significantly influencing the productive potential of the ecosystem. The most significant threat to food security is likely soil loss from sealing caused by industrialisation, urbanization and transportation, but other serious forms of soil degradation include erosion from wind and water, compaction, nutrient mining, salinisation, flooding, loss of organic matter, and desertification. With its extremely slow creation and regeneration processes and possibly high deterioration rates, soil is a vital non-renewable resource.

## Reasons for soil deterioration:

- **Reduced organic matter content in the soil:**

The amount of organic matter in the soil is determined by the breakdown of litter and the introduction of organic matter. It has to do with the soil's physical and chemical characteristics, temperature, aeration, bioturbation, water leaching, and humus stability. In addition to being a primary factor in determining a soil's ability to withstand erosion and its underlying fertility, organic matter is essential to the maintenance of several important soil processes (Lal, 2002). Organic matter in the soil is also impacted by land use and management techniques. Through repeated crop harvesting and insufficient attempts to replace nutrients and maintain soil quality, farming systems have a tendency to deplete the soil of organic matter and mine it for nutrients. Cereal monoculture results in a decrease in soil organic matter. The supply and removal of nutrients and organic matter cannot be kept in balance without properly chosen, diverse cropping systems or well-managed mixed crop–livestock systems (Alexandra and Benites, 2005).

- **Mining nutrients from the soil**:

Global fertilizer demand has increased dramatically, especially since high-yielding varieties were introduced. Mining nutrients from the soil may be one of the biggest risks to food production. Nutrient mining has been estimated in terms of its amount and scope using nutrient balances that take into account the system's inputs and outputs. The loss of soil fertility resulting from uneven and ineffective fertilizer application has become a significant obstacle to increasing

crop yields and farmer earnings, as well as a significant environmental risk.

- **Effects of Human activity on soil:**

We expect the soil to serve a variety of purposes, which leads to the majority of risks to land and soil. We frequently create an unstable system where the soil becomes more fragile and less robust by gradually increasing the demands on it from various services. (Lal, 2007).

- **Industrialization and urbanization-related soil sealing:**

Modern life's infrastructure, such as roads, houses, and other land developments, has been established as a result of urbanization and industrialization. This results in land sealing, which prevents the soil from carrying out a variety of tasks, such as absorbing precipitation for general infiltration and filtering. The physical, chemical, and biological qualities of soil are deteriorated by ongoing cropping and insufficient nutrient supply, which is then lost by gaseous emissions, erosion, leaching, and harvesting materials. This contributes to an acceleration of global warming.

## Methods to raise the fertility of the soil

The ability of the soil to meet the physical, chemical, and biological requirements for plant development that yields productivity is known as soil fertility.

- **Agricultural sustainability:**

Adopting land management approaches like conservation tillage, which includes no-till cropping techniques, organic farming, permanent grassland, cover crops, mulching, and manuring with green legumes, farmyard manure, and compost can help reverse losses of soil

organic matter.




- **Organic farming practices:**

Crop rotations, which include plants with varying rooting depths and a variety of leguminous fertility-building crops, are one of the primary strategies that organic farmers may use to maintain and increase soil fertility (Watson et al., 2002). Furthermore, since they are valuable sources of nutrients for crop growth and ways to improve the general quality of the soil, organic wastes like animal manures, various by-products, and composted residues can be used as supplements to promote soil fertility (Davies and Lennartsson, 2005). In order to preserve and enhance soil fertility, sustainable methods that supply organic amendments may be a helpful tool for maintaining or increasing the amount of organic matter in agricultural soils.

- **Enhancing the level of organic matter in the soil:**

Because soil organic matter improves the physical, chemical, and biological aspects of soils, it sustains soil fertility over the long term, which is vital for sustainable agricultural production (Sequi, 1989). The amount of organic matter in a mixture is determined by the pace at which both newly introduced and pre-existing organic matter mineralizes and by the input of plant, animal, and microbiological wastes. The primary agents responsible for the breakdown of organic matter are heterotrophic bacteria. This process results in the release and cycling of plant nutrients, particularly nitrogen (N), sulfur, and phosphorus. It is influenced by temperature, moisture, and surrounding soil conditions.

- **Increased use of compost:**

The best method of increasing soil fertility is to add a wide variety of organic materials. First and foremost, manure needs to be added in order to provide nitrogen, which is essential for healthy soil. The additional advantage of compost is that it aids in the breakdown of clay particles, improving water drainage. Furthermore, in sandy loam, it increases soil fertility by binding the grains together to retain less moisture. The soil application of co composted manure has several advantages over fresh manure, such as reduced numbers of viable weed seeds, reduced volume and particle size, which facilitates land distribution, a better balanced nutrient composition, stabilized organic matter and a slower release of nutrients.

- **Mixed cropping:**

Planting diverse crops in the same field to stop soil erosion and manage the development of soil-borne plant diseases is a little-known method of increasing soil fertility. Using deeply rooted plants will organically increase soil fertility.

- **Using cover crops or mulching:**

By adding organic matter to the soil through cover crops, which enhance soil structure and encourage a healthy, rich soil, soil fertility can be further increased. Mulch is a soil layer that improves soil fertility by preventing erosion, controlling weed growth, and retaining water. Mulch can be created from plant debris. A thick layer of mulch could retain too much moisture and lead to plant disease.

Common agricultural practices that have deteriorated soils, poisoned water supplies, and contaminated the atmosphere include deep tillage, luxurious irrigation, and the overuse of agrochemicals. Concern over interconnected environmental issues including soil erosion, desertification, and degradation, as well as the acceleration of greenhouse effects and climate change, is growing.

- **An integrated strategy to manage soil fertility:**

An integrated soil fertility management strategy that maximizes crop production while minimizing the depletion of soil nutrient reserves and the physical and chemical deterioration of soil properties that can result in land degradation, including soil erosion, is necessary to advance food security and environmental sustainability in farming systems. In addition to knowing how to modify these techniques for local conditions, these soil fertility management techniques include crop rotation with legumes, the use of enhanced germplasm, fertilizers, and organic inputs. Enhancing crop productivity and optimizing the agronomic use of nutrients are the two main goals of integrated soil fertility management. Grain legumes are one way to do this; they improve soil fertility by fixing nitrogen biologically.

Because the rotation of cover crops and green manures increases soil microbial population and activity, it can also improve plant nutrient uptake efficiency. Typically, cover crops are planted in the winter to protect the soil from wind and precipitation, which over time lowers the amount of organic matter in the soil.

- **Enhancing soil fertility through agroforestry:**

Diverse tree species and other agroforestry system techniques can serve as alternate methods of preserving agricultural productivity and improving soil fertility, with significant real-world implications for the sustainability of tropical agriculture.

- **Microbes and fertility of the soil:**

Soil Microorganisms actively participate in the nitrogen cycles of different ecosystems and play a significant role in the breakdown of organic matter.

## Conclusion:

Soil is a vital non-renewable resource that requires careful maintenance to prevent degradation due to its extremely sluggish creation and regeneration processes and potentially fast degradation rates. The methods covered in this article, including agroforestry, the integrated approach to preserving soil fertility, and the appropriate use of microorganisms, offer a lot of options for stopping soil degradation and preserving soil fertility, both of which are necessary for sustainable agriculture.

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