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Soil Organic Matter-The Soul of Soil

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INTRODUCTION

The smallest element of soil is called organic matter. Despite being a little portion of the total soil,it is the soul of a healthy and productive soil. The components of soil organic matter (SOM) include plant litter, all degraded material from decomposing plant and animal material and living plants and animals. SOM introduces energy and nourishment into the soil. SOM improves soilfertility,soil resistance, builds diversity, stores carbon from the atmosphere, buffers chemical behaviour, stabilises soil structure, erosion susceptibility, boosts water retention,stores and delivers nutrients.A healthy and high-quality soil depends on the amount of organic matter in the soil.As opposed to deeper in the soil, the majority of the organic matter in the soil is found close to the soil's surface. The stable portion of soil organic matter known as humus is generated when plant and animal tissue break down. It is the end result of the decomposition process.Erosion, spontaneous decomposition, crop cultivation and harvesting can all contribute to the steady depletion of SOM in soils. However, with appropriate management, you may preserve and even raise the amount of organic matter now present in your soil.The potential of soil to provide regulatory ecosystem services is one of the many positive effects that SOM has on the physical and chemical properties of soil.Soil function and quality are thought to be significantly impacted by the presence of SOC.

Components of Soil Organic Matter:

The portion of soil known as organic matter contains, by weight, around 5% of living things, 10% of agricultural residues, 33-50% of decomposing organic matter and 33-50% of stable organic matter (humus). Soil organic carbon and soil organic matter are sometimes used synonymously. This is because the bulk of organic matter is composed of carbon. According to researchers, carbon accounts for around 58% of soil organic matter (Howard and Howard, 1990). Nutrients like as H, O, N and P make up the remaining bulk.

Organic matter and soil function:

The many kinds of organic matter (OM) have a significant effect on the physical, biological and chemical characteristics of soil. OM functions as a slow-release nutrient pool and a long-term sink for carbon. It enhances soil aggregation, water holding capacity, nutrient cycling and ion exchange capacity (nutrient storage)andit supplies nutrients and energy to the microbial organisms and plants.High organic matter soils are often more drought- and extreme rainfall-resistant and require less agricultural inputs.Soil tilth improves with an increase in organic matter because the soil becomes less compact and has a greater capacity for water storage and air circulation.In addition to being porous, well-tilted soil allows roots to more readily flow through it in search of nutrients, waterand oxygen.

How can we enhance soil organic matter?

1. Mulch substrates such as wood shavings, bark, hay, straw and leaves will gradually decompose into organic matter, help conserve water and inhibit the growth of weeds.
2. Cover crops, often known as green manure, are crops that are produced to feed soil organisms and eventually, soil organic matter.
3. The main sources of organic matter added to the soil for thousands of years have been animal bedding (straw, wood shavings) and manure.
4. Rotating crops: Growing a varied range of crops with spring and autumn seeding dates provides soil

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covering throughout the year, balancing SOM levels.

5. Perennial crops: Crop rotations frequently make use of perennial crops. For increasing the amount of organic matter in the soil, combinations of clover, lucerne and clover are ideal crops.

6.Soil additives, manures, composts, and organic fertilisers:Carbon application via compost and other organic materials is another way to boost SOM.A relatively novel approach to increase SOM is the application of biochar, frequently combined with compost or manures.

Organic Matter in Soil: Influential Factors:

1. Climate: Warmer soils often have less organic matter than colder soils because organic matter degrades more quickly at higher temperatures.
2. Soil texture: Organic matter is often higher in fine-textured than in coarse-textured soils.
3. Soil hydrology (drainage): The more damp a soil is, the less oxygen is available for organic matter to decompose, resulting in accumulation.
4. Land use (tillage):A faster rate of organic matter decomposition is a result of tillage, which increases the average temperature of the soil and adds oxygen to it. Erosion removes humus and topsoil, which also results in the loss of organic materials.When compared to native vegetation, cropping generally replenishes the soil with less organic matter.
5. Vegetation:An excellent source of soil organic matter is the roots. Deep roots that decompose deeply in the soil are developed by grasslands.Forest soils, on the other hand, predominantly get their organic matter from the breakdown of surface litter.Compared to roots, crops generate greater biomass above ground. Land management strategies determine the amount of organic matter applied to cropland.
6. Tilling and Cropping: Compared to virgin soils, the farmed areas have significantly less organic matter and nitrogen.Compared to traditional tillage, contemporary conservation tillage techniques aid in maintaining high amounts of organic matter.
7.Plant nutrition, residuals, and rotations: Increased soil organic matter is the outcome of rotating cereal crops with legumes.

What variables influence soil organic matter levels?

Temperature: The activity of soil microorganisms that decompose organic matter isinfluenced by soil temperature.

Oxygen: Being aerobic, the majority of soil microorganisms need water and oxygen to breathe. Microbial respiration is greatly slowed down in wet or compacted soil, which consequently limits the amount of organic matter that breaks down in the soil.

Rainfall: Plant development and the subsequent addition of plant biomass to the soil aredetermined by soil moisture, which is influenced by irrigation.Rainfall modifies soil microbial activity, which in turn affects soil moisture content.In damp soil, organic matter breaks down more quickly than in dry soil.

Soil reaction or pH:The majority of the breakdown of organic matter is carried out by bacteria, which is significantly decreased in acidic soil.

APPLICATIONS OF ORGANIC MATTER:

1. The granular texture of soil created by organic matter preserves the soil's beneficial aeration and permeability properties.
2. Because of improved infiltration brought about by the addition of organic matter, the soil's capacity to hold water is increased and problems like erosion, surface runoff are decreased.
3. In addition to providing nutrients necessary for plant growth, organic matter also acts as a storehouse for hormones and antibiotics, providing bacteria with nutrition.

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4. In addition to providing food for ants, rodents, and earthworms, fresh organic matter increases the availability of soil P in acidic soils.
5. Decomposing organic matter releases organic acids that contribute to lowering soil alkalinity.
6.Humus serves as a repository for the interchangeable and accessible cations.
7. SOM functions as a buffering agent, preventing abrupt changes in pH and soil response.
8. It has a nutritional role by providing N and P for plant growth.
9. The functions of microflora and microfaunae are significantly influenced by their biological role.
10.Good soil structure is encouraged by the physical and physico-chemical function of SOM, which enhances tilt, aeration, and moisture retention while boosting the soils' ability for buffering and exchange.
11.Energy reserve for metabolism: The metabolic energy provided by OM propels the biological processes in soil.
12.Resilience of ecological systems: An ecosystem's capacity to rebound from imposed anthropogenic disturbances can be strengthened by the accumulation of sizable pools of SOM and related nutrients.
13. Cation exchange capacity: The organic matter in soil has a high charge, which improves cation retention.
14.Metal chelation:Stable complexes with metals and trace elements improve phosphorus availability, decrease soil micronutrient losses, increase the solubility of soil minerals, and lower the potential toxicity of metals.
15.Xenobiotic interactions:Pesticides' biodegradability, activity, and persistence in soil can all be changed by organic matter.
16. Among the various purposes of organic matter, soil conditioning and providing plant nutrients are the two most crucial roles.

Soil Organic Matter Management:

1. Making use of farming systems with variable rotations that include perennial legumes high-residue crops, as well as continuous no-till systems, cover crops
2. Reducing or eliminating tillage, which raises the risk of erosion and speeds up the breakdown of organic matter by microbial activity.
3. Reducing erosion, which aids in preserving SOM's composition.
4. Aggregation of the soil: Aggregation of the soil enhances soil structure and is facilitated by organic substances.
5. Soil carbon sequestration: Stabilised soil organic matter sequesters atmospheric carbon. The amount of CO2 released into the environment is reduced with continuing adoption of SOM-enhancing management measures.
6. Use sophisticated crop nutrition and conduct soil tests.

Predicting the amount of organic matter required to produce SOM:

When the amount of organic matter added—from crop residue, roots, manure, or other organic material—equals the rate of decomposition, the situation is said to be in a steady state. The content of SOM will decrease if the rate of decomposition is greater than the amount of organic matter added.On the other hand, the content of SOM will rise if the amount of organic matter introduced exceeds the rate of decomposition.

Conclusion:

SOM has a major impact on plant health and soil quality.SOM aids with nutrient provision, moisture absorption and retention in the soil, and erosion control. There are numerous ways to improve SOM, such as adding compost, green manures, and cover crops, as well as mulch materials.For any gardening endeavour, the inclusion of organic matter is a beneficial and worthwhile investment with extremely noticeable results. Organic matter in the soil has become the foundation of healthy soil.In addition to promoting biological

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activity and acting as a source and sink of nutrients, it also controls the chemical behaviour of the soil and improves its physical environment.This performs multiple soil functions and is impacted by management approaches, making it a significant indication of soil health that merits special attention.

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