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Organic Matter: The Heart of the Soil

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SUMMARY

Soil organic matter is any material produced originally by living organisms (plant and animals) that is returned to the soil and goes through the decomposition process. At any given time, it consists of a range of materials from the intact original tissues of plants and animals to the substantially decomposed mixture of materials known as humus. This article on organic matter, and importance of soil organic matter in relation to soil health and plant nutrition.

INTRODUCTION

Soil organic matter (SOM) is the component of soil which consists of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by soil organism that are so well decomposed that it is impossible to tell what they were begin with. SOM acts as major source of soil carbon. Although it may typically vary, SOMs is estimated to contain 58% carbon. The organic matter content of agricultural topsoil is usually in the range of 1-6% and it takes at least 10 pounds of organic material to decomposed to 1 pound of organic matter, so it takes at least 2000,000 pounds (100 tons) of organic materials applied or returned to the soil to add 1 per cent stable organic matter under favourable conditions.

Pools of soil organic matter:

- Living pool (4%)
- It includes microbial cells, plant roots and flora and fauna in the soil.
- Dead pool (96-98%)
- Depending on time required to decompose carbon in a particular pool, it is divided into three parts – i) Active pool – it includes recently added plants and animal residues which takes few days to few years for decompositions. This pool provides food for microorganism and makes possible various roles of SOM.
- Slow pool- it consists of detritus (dead tissues), partially broken-down cells and tissues which decomposes gradually and takes few years to few decades for decomposition.
- Passive pool (very dead) - this pool of SOM is recalcitrant for resistant to decay *i.e.*, hummus and takes few hundreds to few thousands of years for decomposition.

Why is SOM so important?

Plant nutrition

SOM contains all of the essential plant nutrients required for the crop growth. It acts as a storehouse of these nutrients. But these nutrients exist as parts of larger organic molecules and is made available to plants by a process called mineralization i.e., conversion of organic form of nutrient to inorganic form which is then easily available to plants.

Cation exchange capacity (CEC)

Humus, which is an important component of SOM, is negatively charged and therefore it has an ability to hold on to cations and makes it available to the plants as and when required. This prevents these positively charged ions to be leached away. Also soils which have higher CEC requires less applications of fertilizers as compared to low CEC soils.

Chelating agent-

Chelating agents are organic molecules that can encapsulate or trap certain metal ions like Ca, Mg, Fe, Co, Mn, Cu, and Zn increasing its solubility and availability to plants. These chelating agents can from several

bonds with a single metal ion. Organic substances are natural chelating agents either applied or produced by plants or microorganism. Thus, nutrients are made available to the plants by chelation process mediated by SOM. Chelation may be particularly important for region with basic soils. Nutrient availability is often decreased under basic soil conditions, causing plant micronutrient deficiencies.

Soil physical properties –

Organic substances sever as binding agent for cohesion of clay particles by hydrogen bonding or coordinate bond with polyvalent cations. Organic matter plays an important role in formation of aggregates of high stability by forming a coating on clay particles. In the absence of organic coating clay is easily dispersed through slaking action of water. Also, during the decomposition of organic substances in soil, different polysaccharides are released which enhances soil aggregation. Studies on both undisturbed and agricultural soils shows that as organic matter increases, soil tend to be less compact and have more space for air passage and water storage. Thus, also increases the water holding capacity of soil. soil aggregate stability and less degree of surface crusting have positive impact on plant growth. If SOM is less, then soil becomes hard, compact and cloddy. However, SOM increase soil aeration, water holding capacity and soil aggregation.

Buffering capacity-

Buffering capacity of the soil is important because it helps to stabilize the soil pH. Since the availability of nutrients is largely affected by the soil pH therefore, changes in pH can affect plants in a variety of ways. In general, clay soils have higher buffer capacity than sandy soils, and a higher organic matter content in soil tends to increase buffering capacity. Soil organic matter offers many negatively charged sites to bind H^+ ions in an acidic soil, or from which to release H^+ ions in a basic soil, in both case pushing soil solution towards neutral.

Biological benefits-

Organic substances in soil provides food for the bacteria, fungus, actinomycetes and earthworm in the soil which enhance microbial biodiversity and soil enzymatic activity which improves pore space and helps to increase infiltration and reduces runoff. Soil organism are essential for keeping plants well supplied with nutrients because they break down organic matter. Some bacteria fix nitrogen gas from the atmosphere and makes it available to plants. Some organism helps in mineralization process. A soil which is continuously supplied with different types of fresh plant residues has more diverse group of organisms than soil depleted of organic matter.

Preventing soil erosion-

Data used in the universal soil loss equation indicate that increasing soil organic matter from 1to 3 percent can reduce erosion 20to 33 per cent because of increased water infiltration and stable soil aggregate formation caused by organic matter.

Prevents pesticide leaching-

Adsorption of pesticides and other organic compounds occurs in SOM. This prevents or reduces leaching of these chemicals into groundwater and allows time for detoxification by microbes.

CONCLUSION

From the above discussion, it can be concluded that soil organic matter has emerged as the mainstay of soil health. It acts as a nutrient sink and source, determines chemicals behaviour of soil, enhances soil physical environment and promotes biological activity. This can be considered as an important indicator of soil health and deserves special attention because it imparts several soil functions and is affected by management practices.

REFERENCES

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