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Soil Organic Carbon Dynamics – As Affected By Different Management Practices

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The soil organic matter (SOM) is considered as the most complex and least understood component of soil, because it is comprised of plant, microbial, and animal bodies in various stages of disintegration and a mixture of heterogeneous organic substances closely associated with the inorganic constituents. The SOM is a vital indicator of soil quality and, therefore, maintaining SOM quality and quantity is important for safeguarding long-term soil fertility .It has beneficial effects on soil physical (soil structural stabilization), chemical (buffering and changes in soil pH), and biological properties (substrate and supply of nutrients for microbes), and thus it influences the productive capacity of the soil .The total carbon in the soil consists of the inorganic carbon as carbonate minerals plus the soil organic matter. Carbon comprises up to 10% of the soil mass, except in waterlogged soils such as Histosols that contain up to 30% carbon .The surface horizons of most soils contain <3 percent Carbon. Most of the carbon that resides in soil is in the organic form, except arid soils and some soils formed from carbonate parent materials.

Maintenance and improvement of SOM quality and quantity are the most essential criteria for sustainable soil management. There are several pools and fractions of SOM with varying degrees of decomposition and stability, and these fractions may be useful in the study of short-term as well as long-term influences of land use and management on SOC dynamics. Total organic carbon (TOC) is comprised of both labile and non-labile forms of SOC and has different degrees of sensitivity to various land use changes and management practices.

When considering global climate change, land use has become a key factor that is directly related to food security, water and soil quality, and other life support issues.

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Recently, the influence of land use change and management practices on SOC dynamics has gained scientific attention, because alteration in land cover, land use, and management practices can have a significant impact on global carbon pools and fluxes. Land use change could cause changes in soil quality and land productivity over time and space by altering the structure and functioning of ecosystems and biogeochemical cycles .For example, cultivation of natural lands (forest, grassland) decreases the SOC level. Conversely, conversion of natural lands to cropland increases the SOC level in semi-arid and arid regions. The conversion of fallow lands to cropland, horticultural land, or agro forestry land could increase the log-term build-up of SOC and fractions due to greater organic matter inputs through aboveground and belowground biomass to the soil.

Continuous and intensive tillage practices along with traditional management practices have resulted in loss of SOC and, thus, degradation in soil physical, chemical, and biological characteristics. We cannot keep soil rich with fertilizer and a tractor. In contrast, conservation agriculture along with suitable residue management has been reported to increase SOC and fractions with an increase in soil quality and a reduction in the risk of soil degradation. Conservation management practices, such as no-tillage, residue incorporation, manure application, use of cover crops, and integrated nutrient management practices, increase the SOC storage and improve the sustainability of agro-ecosystems through soil aggregation and protection of SOC from microbial attack. However, application of organic manures and residues in soil will help to sequester carbon and improve organic content in soil. Cover crops are also recommended in rotation cycles to increase soil carbon sequestration.

We can say that identification of suitable land use and management practices is of upmost importance for sustainable agriculture. One should go for tree based agro forestry for building organic content in soil through litter fall which keeps on adding total carbon content in soil. *In-situ* residue management serves as a viable option for carbon sequestration as higher carbon sustainability and management indices have been reported in different studies. Significant increase in the microbial counts (16.1-43.1%) have been observed in soils containing higher carbon stocks. After years of work, the United Nations is clearly recognizing today that a massive part of the solution is tree-based agriculture.In order to

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conserve our environment, our first and foremost priority should be to conserve carbon content in soil so that each form of life can dwell sustainably and regenerate itself.