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Soil Organic Matter

P. P. Mahendran[1*] and M. Yuvaraj[2]

[1]Dept. of Crop Management, Agriculture College and Research Institute, Kudumiyanmalai, Tamil Nadu Agricultural University, Tamil Nadu (622 104), India

[2]Dept. of Soil Science and Agricultural Chemistry, Agricultural College and Research Institute, Vazhavachanur, Tamil Nadu Agricultural University, Tamil Nadu (606 753), India

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Corresponding Author
P. P. Mahendran
e-mail: ppmahendran@gmail.com

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Abstract

Soil organic matter is the fraction of the soil that consists of plant or animal tissue in various stages of breakdown (decomposition). Most of our productive agricultural soils have between 3 and 6% organic matter. Soil organic matter contributes to soil productivity in many different ways. In this fact sheet, we describe the various components of organic matter and the different roles organic matter plays in soil productivity. We also discuss field management practices that will help preserve or increase soil organic matter levels over time. The living microbial biomass includes the microorganisms responsible for decomposition (breakdown) of both plant residues and active soil organic matter or detritus. Humus is the stable fraction of the soil organic matter that is formed from decomposed plant and animal tissue. It is the final product of decomposition. The first two types of organic matter contribute to soil fertility because the breakdown of these fractions results in the release of plant nutrients such as nitrogen, phosphorus, potassium, etc.

Introduction

Soil organic matter (SOM) is consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms and substances synthesized by soil organisms. Soil organic matter exerts numerous positive effects on soil physical, chemical and biological properties. Particularly, the presence of Soil organic matter is regarded as being critical for soil functions and soil quality. The benefits of SOM result from a number of complex, interactive, edaphic factors; a non-exhaustive list of these benefits to soil function includes improvement of soil structure, aggregation, water retention, soil biodiversity, absorption and retention of pollutants, buffering capacity, and the cycling and storage of plant nutrients. SOM increases soil fertility by providing cation exchange sites and being a reserve of plant nutrients, especially nitrogen (N), phosphorus (P), and sulphur (S), along with micronutrients, which the mineralization of soil organic matter slowly releases. As such, the amount of soil organic matter and soil fertility are significantly correlated.

Composition of Soil Organic Matter

- Components of organic residues undergoing decomposition.
- Metabolic products of micro-organisms utilizing organic residues as a source of energy.
- Products of secondary synthesis in the form of bacterial plasma Humic substances.

The first three categories consist of various non-specific substances (such as proteins, decomposition products of proteins, carbohydrates, organic acids, fats, resins, waxes, etc.) and constitute 10-15% of soil organic matter. Humic

E-mail: bioticapublications@gmail.com

substances constitute 85-90%.

Proximate Constituents of Organic

- Carbohydrates and related compounds [mono- and disaccharides, celluloses, hemicelluloses, pectins, pentosans, mannans, polyuronides, uronic acids, organic acids, alcohols, hydrocarbons, aromatics] Proteins and their derivatives (amino acids, amides, amino sugars, nucleoproteins, purine and pyrimidine bases)
- Lignins and their derivatives
- Fats and related substances
- Tannins and their derivatives
- Resins and terpenes

Sources of Soil Organic Matter

The primary source of organic matter contained in soil is vegetation. In forest as well as agricultural fields, dead plants are transformed by different kinds of living organisms. This process involves several steps, the first being mostly mechanical, and becoming more chemical as it progresses. The small living beings that work on that decomposition chain are themselves part of the soil organic matter and form a food web of organisms.

There are also other animals that consume living vegetal material, whose residues are passed to the soil. The products from the living organisms' metabolism are the secondary sources of soil organic matter that also includes the dead corpses of these organisms. Some animals, like earthworms, ants and centipedes contribute to both vertical and horizontal translocation of organic material.

Composition of Plant Residues

The water content of most plant residues is in the range of 60% to 90%. The dry matter consists of complex organic material composed mainly of carbon, oxygen and hydrogen. Although these three elements make up about 92% of the dry weight of the organic material in soils, there are other elements that are of great importance for the nutrition of plants. They include nitrogen, sulphur, phosphorus, potassium, calcium, magnesium and a range of micronutrients.

Figure 1: Composition of Plant Residues

Organic Compounds Found in Plant Residues Include-

- Carbohydrates are made up of carbon, hydrogen and oxygen, and range in complexity from rather simple sugars to the big molecules of cellulose.
- Fats consist of glycerids of fatty acids, like butyric, stearic, oleic acids. They are also made up of carbon, oxygen and hydrogen atoms.
- Lignins are complex compounds that form the older parts of wood, and consist also mainly of carbon, oxygen and hydrogen. They are resistant to decomposition.
- Proteins contain nitrogen in addition to carbon, hydrogen and oxygen, and also small amounts of sulphur, iron, and phosphorus.
- Charcoal is elemental carbon derived from incomplete combustion of organic matter. Charcoal is resistant to decomposition.

Importance of Soil Organic Matter in Soil

- Imparts dark colour to soils.
- Supplies polysaccharides for binding soil particles for formation of aggregates (genesis of good soil structure).
- Increases infiltration rate of water and provides better drainage. Increases water holding capacity.
- Reduces plasticity, cohesion, stickiness etc in clay soils. Reduces bulk density, there by influence porosity favourably.
- Through granulation, reduces wind erosion losses.
- Provides mulching (raw organic matter) and lowers soil temperature during summer.
- Reduces alkalinity in soils by releasing organic acids and CO_2.
- Acts as a buffering agent and reduces the likelihood damage from acids and alkalis.
- With its solubilizing effect increases the availability of nutrients.
- Acts as a store house for nutrients. Organic matter is the source of 90-95% of nitrogen in unfertilized soils. Also supplies available 'P', 'S' and micro nutrients like Fe, Mn, Cu and Zn etc.
- Adsorbs temporarily the heavy metal pollutants and cleans the contaminated waters.
- Serves as a source of energy for macro and microorganisms in soils and helps in performing various beneficial functions in soils (N - fixation, mineralization etc.).
- Acts as a chelate and increases the availability of micro nutrients.
- Various organic substances like vitamins, antibiotics and growth promoting substances namely auxins are produced

by different microorganisms during decomposition of organic matter. Also some fungi-toxins are produced to control diseases.

Carbon:Nitrogen Ratio

• Both mineralization and immobilization are accomplished by microbes under the influence of temperature, moisture and pH.

• Significance of C:N ratio in Soil Carbon-to-nitrogen ratio is a ratio of the mass of carbon to the mass of nitrogen in a substance. It can, amongst other things, be used in analysing sediments and compost. A useful application for C:N ratios is as a proxy for paleo climate research, having different uses whether the sediment cores are terrestrial-based or marine-based. Carbon-to-nitrogen ratios are an indicator for nitrogen limitation of plants and other organisms and can identify whether molecules found in the sediment under study come from land-based or algal plants. Further, they can distinguish between different land-based plants, depending on the type of photosynthesis they undergo. Therefore, the C:N ratio serves as a tool for understanding the sources of sedimentary organic matter, which can lead to information about the ecology, climate, and ocean circulation at different times in Earth's history.

Conclusion

The most important issues that are faced are related to the effects of land-use change, global warming, pollution and invasive species on the soil environment. Because soil organic matter is the most dynamic of the soil components, effects of changing soil environment are often recorded first in the quality and distribution of organic matter. Faster soil organic matter degradation rates have been shown to result in greater overlap of reduction sequences with depth, indicating the likelihood of abiotic soil organic matter oxidation.

References

Brady, N.C., Weil, R.R., 1999. The nature and properties of soils. Prentice Hall, Inc., Upper Saddle River, NJ.

Beare, M.H., Hendrix, P.F., Cabrera, M.L., Coleman, D. C., 1994. "Aggregate-Protected and Unprotected Organic Matter Pools in Conventional- and No-Tillage Soils"(PDF). Soil Science Society of America Journal. Free PDF download, 58(3).