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# Conservation Discussions

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Soil Health &
Soil Organic Matter (SOM)
"As the Soil Turns"
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There seems to be some question as to what soil organic matter is. Understanding Soil Organic Matter (SOM) is critical to understanding soil function and differences in soils. In some presentations and written articles, different speakers have been using differing definitions of SOM. Discussions of changing the Active Carbon Fraction **IS NOT** the same as changing Soil Organic Matter (even though active carbon is a part of SOM). These contemporary presentations only serve to confuse our co-workers, and those we work with. They may also lead to unrealistic expectations by landowners and producers as to the capabilities and values of their soils. As individuals look at some of the differing costs and benefits of Soil Health, it is important that consistent terms and definitions are used so producers and landowners can make informed decisions.

*Soil Organic Matter* as defined in soil textbooks and technical literature, has traditionally been the soil component referred to as 'humus'. It also is what provides soil its dark color. It is normally one of the components that is measured when soils are submitted for soil testing and analysis. In the glossary of soil science terms (SSSA, 1997) soil organic matter is defined as the organic fraction of the soil exclusive of undecayed plant and animal residues; and is considered synonymous with humus. (1) The only change by the Soil Science Society of America in 2017 was the notation "see also humus" instead of synonymous with humus (2).

In discussing soils, Midwestern prairie soils are darker and more productive soils than many of the Eastern soils. This is explained in part by how they were formed. Many of the Eastern soils were formed under forest, while Midwestern soils formed under tall grass prairie. The organic matter content is high in the Midwest soils formed on prairies due to the dense rooting system of the prairie grasses. Higher organic matter in the surface leads to darker colors in the surface horizon than soils with lower organic matter content.

Soil Organic Matter is a significant portion of what provides the underlying productivity (or productive capacity) of a soil (in addition to climate, landscape position and management when talking about specific soils in specific locations). In fact, soil organic matter has long been suggested as the single most important indicator of soil productivity (Allison, 1973; Campbell, 1978). This is because organic matter greatly affects chemical, physical, and biological properties and processes in soils (3).

Organic matter content is also an indicator of economic value of soil. Farms in Central Illinois will sell at a premium to farms in Southern Illinois due to the difference in soil productivity. This SOM measure provides an indication of the productive capacity of the soil of the farm, and productivity is part of the basis for establishing the value of the farm. It is implied that in a given soil series and region, that an increase in SOM has an increase in productivity. That is part of the reason a soil may be evaluated by buyers based on soil color.

If SOM is able to be changed at the rapid rate being promoted and reported by some (from .1%-.4% per year) in regard to cover crops and soil health, this would indicate that those soil productivities and values would change as well. This would have huge economic and productivity impacts across the state of Illinois, and the country. Part of the confusion comes from measuring what is changed. The change being measured in these cases is typically the change in the ***Active*** carbon fraction; which is not the same as a change in soil organic matter.

Active carbon is being measured, and confused with Soil Organic Matter. Active carbon in soil is one of the current indicators of soil health and relative production capacity. Higher relative numbers of active carbon imply healthy soil which is typically more productive, but requires specific types of management systems to maintain. The active carbon portion of SOM is highly volatile. It can be increased with inputs and management practices that include no-till, cover crops, or additions of green manures or animal manure. The increase in active carbon is typically in the upper few inches of soil, and very quickly breaks down when exposed to the environment through cultivation (4).

Soil Organic Matter, the type of permanent soil organic carbon identified as humus, will not increase in a short time frame. There could be other changes in the soil (like increased filtration or improved soil tilth) and these changes may be beneficial. However, measurable changes to the very stable humus fraction will not occur in this short time frame.

Adding additional residue to the soil is typically beneficial, may increase soil microbial activity, and begin the process of building SOM (which can take anywhere from 100 to 1000 years (5)). This action combined with nutrient cycling may also lead to the ability to reduce some commercial fertilizer applications. Adding residue does not increase SOM in and of itself; and if not carefully monitored, could lead to production losses due to carbon-nitrogen ratios being out of proportion.

Native grassland soils are rich in intermediately labile carbon, which accounts for the long-term fertility of these soils when they are brought under cultivation. Stabilized soil organic matter turns over every 100 to 1000 years and carbon losses from this pool are very gradual (unless erosion is occurring). This pool includes most of the soil humus and constitutes 60–90% of the soil organic matter in most soils. This pool is associated with the colloidal properties of humus and is involved in stabilization of soil structure (6).

What needs to come out of this discussion is an understanding of the differences being discussed, and a description for the contemporary measurements that are being made of changes to the soil. This would allow the discussion to continue on terms that are not in conflict with currently established norms and measurements; yet provide a pathway for inclusion of positive (and negative) effects that may be able to be measured within the soil due to the short-term changes that are being made in soil management. Conservationists and planners need to understand what is being discussed, and be consistent in terminology in order to effectively evaluate conservation practices, and provide clientele with the best information possible.

Additional information on organic matter is also published by Sustainable Agriculture Research and Education (SARE). It can be accessed at https://www.sare.org/Learning-Center/Books/Building-Soils-for-Better-Crops-3rd-Edition/Text-Version/Organic-Matter-What-It-Is-and-Why-It-s-So-Important

Specific citations, technical, and scientific discussions can be found in numerous soils textbooks, scientific Journals, and Society compendiums.


(1) R.Nieder, D.K. Benbi, *Carbon and Nitrogen in the Terrestrial Environment*

*(2)* *https://www.soils.org/publications/soils-glossary#*

*(3)* R.J. Haynes *Libile Organic Matter Fractions as Central Components of the Quality of Agricultural Soils: An Overview* |Advances in Agronomy

*(4)* R. Collman *State Soil Scientist, United States Department of Agriculture, Natural Resources Conservation Service*

(5) F.J. Stevenson *Humus Chemistry: Genesis, Composition, Reactions*

(6) C.A. Cambardella *CARBON CYCLE IN SOILS|Formation and Decomposition* Encyclopedia of Soils in the Environment