

Does Commercial Fertilizer Destroy Humus?

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Some claim that commercial fertilizers degrade soil humus. Among the many myths that pervade society's attitudes about modern agriculture, it's a common misconception. A case in point is a recent international report that attributed the lack of humus in soils to "heavy reliance on chemical fertilizers, rather than on traditional fertilizers and soil amendments, such as manure and compost..." This perceived lack of humus was portrayed as causing continued erosion of soil from agricultural land.

Humus is good, and erosion is bad - there is no argument. Crop producers and advisers have long recognized that humus contributes to soil structure, that erosion of topsoil decimates soil productivity, and that well-structured soil reduces erosion. But is it true that fertilizers need to be organic in order to maintain humus?

Humus is made up of organic matter that has been transformed and stabilized by the activity of soil organisms. Carbon

dominates its composition. But several additional elements form part of its structure, too. Nitrogen is the most important element besides carbon. Soils from a wide range of geography contain the same ration of carbon to nitrogen in humus - about 10 parts to one.

The amount of humus in a soil is determined by organic matter added, balanced against the processes of decay that break it down. Soils receive additions mainly from plants growing on them, in the form of compounds exuded from roots, and residues left in the field following harvest. Manures and composts provide organic matter as well, but their supply is limited, as their ultimate source is from plants that have grown on land elsewhere.

As soil organisms - earthworms, insects, fungi and bacteria - decompose organic matter, they release about two-thirds of the carbon to the air as carbon dioxide, retaining the remaining third within their bodies. In contrast, most of the nitrogen stays in the system - directly incorporated into the body proteins of the organisms or released to the soil for use by growing plants.

Soil organisms die, and other organisms decompose their bodies in turn. In the process, they release more carbon, but combine some of it with

nitrogen to transform it into stabilized humus, with a carbon-to-nitrogen ratio of 10 to one. With less nitrogen in the system, less of the organic matter stabilizes, and less humus accumulates.

Some growers add nitrogen to speed the decay of crop residues. Doesn't that mean it speeds the breakdown of humus, too? Research in Ontario showed no difference in the amount native humus between fertilized and unfertilized plots of corn after 30 years. However, the fertilized plot had accumulated 80% more humus from corn residues. Nitrogen may speed the decay of fresh organic matter with high carbon-nitrogen ratios, but not humus. When the native soils of North America were first cropped, the nitrogen released from the breakdown of humus supplied the crop. But today's higher yields, combined with conservation tillage that slows decomposition, have stabilized or increased humus levels in many soils. Since humus is no longer declining, it's no longer a net supplier of nitrogen.

Inorganic nutrients - including nitrogen, phosphorus and potassium - contribute to organic matter additions by enhancing crop growth. When these nutrients limit yields, the smaller return of crop residue to the soil results in less accumulation of humus. On the other hand, plentiful supplies of these nutrients lead to higher crop residues and in accumulation of soil humus and soil organic matter. In the San Luis Valley, twenty-five years of returning crop residues have built up one grower's sandy loam soil from 0.4% to

2.4% organic matter. Similarly, good farming practices returning high amounts of crop residues to another grower's loamy sand have increased its organic matter from 0.4% to 1%.

Inorganic fertilizers play an important role in the soil's cycling of organic matter. Using them to maximize the growth of crops, the primary producers of organic matter, sustains humus.

