Soil carbon storage is not always influenced by tillage practices

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The practice of no-till has increased considerably during the past 20 yr. Soils under no-till usually host a more abundant and diverse biota and are less prone to erosion, water loss, and structural breakdown than tilled soils. Their organic matter content is also often increased and consequently, no-till is proposed as a measure to mitigate the increase in atmospheric carbon dioxide concentration. However, recent studies show that the effect of no-till on carbon sequestration can be variable depending on soil and climatic conditions, and nutrient management practices.

Researchers at Agriculture and Agri-Food Canada (Québec City) investigated the impacts of tillage (no-till vs. moldboard plowing) and N and P fertilization on carbon storage in a clay loam soil under cool and humid conditions in eastern Canada. Corn and soybean had been grown in a yearly rotation for 14 yr. The results of the study were reported in the 2009 January-February issue of the *Soil Science Society of America Journal*.

The authors concluded that their investigation indicates "…no-till enhanced soil organic carbon (SOC) content in the soil surface layer, but moldboard plowing resulted in greater SOC content near the bottom of the plow layer. When the entire soil profile (0-60 cm) was considered, both effects compensated each other which resulted in statistically equivalent SOC stocks for both tillage practices".

The effects of tillage and N fertilization varied depending on the soil

depth considered. When considering only the top 20 cm of soil, the lowest C stocks were measured in the plowed soil with the highest N fertilizer level, whereas the highest SOC stocks were observed in the NT treatment with the highest N rate. The authors hypothesized that while N fertilization favored a greater residue accumulation in the top 20 cm of no-till soils, mixing of crop residue with soil particles and N fertilizer by tillage stimulated the mineralization of residue and native soil carbon.

However, when accounting for the whole soil profile, these variations in the surface 20 cm of soil were counterbalanced by significant SOC accumulation in the 20- to 30-cm soil layer of tilled soils, resulting in statistically equivalent SOC stocks for all tillage and N treatments. This study further emphasizes the importance of taking into account the whole soil profile when determining management effects on SOC storage, especially when full-inversion tillage is involved. The authors conclude that "only considering the top 20 cm of soil would have led us to an erroneous evaluation of the interactive effects of tillage and N fertilization on SOC stock".

More information: View the abstract at soil.scijournals.org/cgi/content/abstract/73/1/255 .

Source: Soil Science Society of America