

Greenhouse gas implications of cultivating long-no-tilled land

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Abstract

Low disturbance direct seeding (no-till) is an effective method of increasing soil organic matter. This increased organic matter removes carbon dioxide from the atmosphere and thereby accomplishes a net reduction of the net emission of this greenhouse gas. There is much interest in allowing farmers to trade this increased soil carbon as an offset for emissions. However, if this soil carbon is released not only is it lost as a tradable offset the farmer may be liable for the emission. Hence, farmers are concerned about the effect of occasional tillage on their sequester soil carbon.

We cultivated land that had been in long-term (14 to 21 yr) no-till with a heavy-duty cultivator in the Brown soil zone. On a low-quality sandy loam soil, there was large apparent decrease in soil organic matter, as evidenced by increase in crop yield from the release in nutrients from the decomposed organic matter. Although there was no measurable loss of organic matter, possibly because increased residue input from better growth of cultivated land compensated for lost organic matter, the quality and eventually quantity of organic matter on this sandy soil would decrease by such tillage. On better quality loam and clay soils, there was no significant effect of a single tillage on soil organic matter. On the loam soil, we also converted some land from no-till annual cropping to fallow. Including fallow on long-term annually cropped land, whether no-till or tilled fallow, caused significant losses of soil organic matter in one year. Although the losses were large, they were roughly equivalent to gains in soil organic carbon from converting the land from long-term crop-fallow to annual cropping. There is increased mineralization of nitrogen from soil organic matter when tillage or fallow is added. This increased emissions of the greenhouse gas, nitrous oxide, slightly since there is more nitrification and potentially denitrification occurring.

In summary, there are no unpredictable or catastrophic greenhouse gas emissions from applying fallow and/or tillage to land that has been in long-term no-till annual crop production.