The likely impacts of Controlled Traffic Farming on the dynamics of soil organic matter

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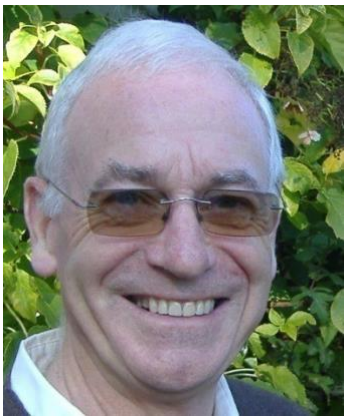

Tim conducted research on tillage and compaction effects on soils and crops for 25 years. Since 1996 he has worked for industry and others on soil/machine interactions.
In 2007 he set up CTF Europe as a facilitator of CTF systems and recently received a doctorate covering field traffic, soils and crops.

ABSTRACT: Soil organic matter (SOM) in all its forms is the principal agent that creates structure in soils. Without it, light sandy soils exhibit poor stability, blowing away in windy conditions and eroding in wet when infiltration rates are significantly lowered. Similarly, heavy clay soils exhibit extreme stickiness in wet conditions, greater susceptibility to compaction and elevated strength when dry. There is a general acceptance that increasing soil organic matter is not controversial; it improves soil and water quality and fertility and biological cycles but care must be exercised to avoid greater emissions of non CO_2 greenhouse gases.

The aim of this review is to elicit the drivers of change in SOM whether this is sequestration or loss. Research from around the world reveals a great diversity in detail but a common theme in terms of the dynamics. Dynamics are however associated with the different forms of organic matter with "labile" having the quickest turnover (less than 5 years), "resistant" (20-40 years) and "stable" (1000s of years) being almost permanent. Most carbon is lost from the soil through the respiration of organisms which break it down but the resistant and stable forms of organic matter are often protected from these organisms within micro-aggregates. This resistant and stable organic matter is only in danger of being exposed with increased tillage intensity and poor timeliness.

Autotrophs are organisms that sequester soil carbon (organic matter), the majority using carbon dioxide and solar radiation in the process known as photosynthesis. The role of agriculture in terms of soil improvement is to maximize mechanisms that sequester SOM (which contains about 55% soil organic carbon (SOC)) and minimize mechanisms or actions that oxidize it into the atmosphere.

Results were often contradictory in terms of the effect of tillage systems. A large proportion found that SOC was unaffected by no-till, chisel or mouldboard ploughing provided these treatments did not affect crop production and that measurements were made to sufficient depth. Others concluded that a raft of measures could increase soil organic matter, including reduced and zero tillage but in combination with improved rotations, organic amendments

and extensive farming techniques. Others considered that effective sequestration could only be achieved through manure addition, intensified crop rotations and cover cropping and that all these measures would be needed just to maintain the status quo if biomass was being regularly removed for energy production. Some models have been produced to predict SOM dynamics but robust input data and error analysis were needed to achieve sound results.

From the information gleaned it may be concluded that controlled traffic farming, with its reduced need for intensity of tillage together with its better rainfall interception and seedbed quality, will encourage conditions conducive to soil organic matter production and retention. Equally, with the more aerobic soil conditions created by CTF, it is likely to reduce the risk of greater non CO_2 emissions associated with increased fertility and soil organic matter content.