Carbon turnover in an agricultural sub-soil

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Maize was added to a grassland subsoil (10 – 50 cm) and the fate of the carbon from the plant material followed for 520 days with nine sampling points over an exponential time series. The carbon and delta 13C signature in five soil fractions: POM (particulate organic matter), fine sand, coarse silt, fine silt and clay were monitored. Over the course of the experiment there was a 57% decline in the total C of the soil principally from the particulate organic matter which contained the added maize equivalent to a half life of 533 days. A single exponential was the best fit to the data indicating that the slower turnover pools proposed in models such as Roth C were not observed in the time course of this experiment.

Carbon rapidly entered the fine sand and coarse silt fractions, it then passed into the clay fraction. The fine silt fraction was not significantly changed. The maize carbon showed a delay to this pattern, but there was accumulation of maize carbon in the fine sand and fine silt fractions. The largest increases in % carbon as a consequence of the introduction of the maize carbon were of the following order clay > fine sand > coarse silt >fine silt.

The results suggest that all these fractions are actively being turnover in this soil and that carbon is most protected in the fine sand and silt fractions, not clay as has been observed by other workers. The results are also discussed in the wider contexts of representative pools for modeling.