



Is old organic matter simple organic matter?

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Bare fallow soils that have been deprived of fresh carbon inputs for prolonged periods contain mostly old, stable organic carbon. In order to shed light on the nature of this carbon, the functional diversity profiles (MicroRespTM, BiologTM and enzyme activity spectra) of the microbial communities of long-term barefallow soils were analysed and compared with those of the microbial communities from their cultivated counterparts. The study was based on the idea that microbial communities adapt to their environment and that therefore the catabolic and enzymatic profiles would reflect the type of substrates available to the microbial communities. The catabolic profiles suggested that the microbial communities in the long-term bare-fallow soil were exposed to a less diverse range of substrates and that these substrates tended to be of simpler molecular forms. Both the catabolic and enzyme activity profiles suggested that the microbial communities from the long-term bare-fallow soils were less adapted to using polymers. These results do not fit with the traditional view of old, stable carbon being composed of complex, recalcitrant polymers. An energetics analysis of the substrate use of the microbial communities for the different soils suggested that the microbial communities from the long-term bare-fallow soils were better adapted to using readily oxidizable, although energetically less rewarding, substrates. Microbial communities appear to adapt to the deprivation of fresh organic matter by using substrates that require little investment.