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Soil organic carbon mining versus priming – controls of soil organic carbon stocks along a management gradient

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Soil carbon (C), nitrogen (N) and phosphorous (P) are assumed to be connected stoichiometrically and C:N(:P) ratios are frequently used to interpret the soils nutrient status. However, plants are capable of initiating the supply of nutrients by releasing rhizodeposits into the soil, thereby stimulating soil organic matter decomposition mediated by the rhizosphere microbial community. To test the relative importance of the two mechanisms across a fertility gradient in the UK we carried out a laboratory experiment. Intact soil cores from two depths (0-15 cm and 85-100 cm) were incubated and C, N and P were added in all possible combinations resulting in a total of 216 soil cores. Soil respiration was measured (1 h incubation, 10 oC) nine times over a 2 week period.

Preliminary results indicate that all soils were C limited at the surface as measured as increased soil CO_2 efflux. N additions increased soil respiration only marginally, whereas C+N stimulated microbial activity on the surface, and was even more pronounced in the deeper soil layer. Belowground responses to C+P were small and even smaller for N+P but similar for both soil depths.

Our results indicate nutrient controls on soil organic matter turnover differ not only across a management/fertility gradient but also vertically down the soil profile.