



Is the rhizosphere priming effect an important mechanism for nitrogen mineralisation in soil?

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In soil, nitrogen is mobilised from soil organic matter (SOM) to pools more readily available to plants (mineralisation), mediated by the microbial biomass. Multiple mechanisms underpin this process, including the priming effect (PE) which is increasingly recognised as an important driver of N mineralisation. The PE is where microbes utilize labile carbon from roots (root exudates or senescing plant material) for energy and subsequently mineralise SOM for nutrients, inevitably mobilising nutrients from SOM to plant available pools. However, the mechanism and regulators underpinning PE's are virtually unknown. This work investigates the importance of priming for N mineralisation. We hypothesized that 1) addition of labile C would increase gross N mineralisation and plant N uptake, and that this is soil-specific; 2) the stoichiometry of primed and basal mineralisation fluxes would be different, indicative of these processes being functionally distinct; and 3) the presence of fertilizer nitrogen and grazing would reduce primed and basal mineralisation and reduce plant uptake of SOM derived N. To do this we coupled continuous steady-state ^{13}C labelling and ^{15}N isotope dilution to measure specific gross C and N fluxes from two contrasting soils. Addition of carbon increased gross C and N fluxes from SOM, but the effect was soil-specific. The C-to-N ratio of the flux from 'primed' SOM was much lower than that of the basal flux indicating that the release of labile carbon from plant roots functions as a nutrient acquisition response, increasing mineralisation of SOM. Addition of N fertiliser resulted in negative priming of SOM, but overall and in both soils, the plant accessed more SOM-derived N. Grazing and priming were closely coupled, with grazing increasing SOM priming. Our results demonstrate that priming effects are an integral component of N mineralisation and should be incorporated into nitrogen cycling models.