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Priming effects in aggregate size fractions induced by glucose addition and grinding

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It is widely recognized that soil organic matter (SOM) mineralization can be accelerated (positive priming) or retarded (negative priming) by addition of easily available substrates to soil. SOM is a heterogeneous mixture, which contains numerous compounds with different degradability and turnover rates times. Nevertheless, so far, there is still lack of knowledge on identifying single fractions of the SOM as the source of C and N released by priming effects. The aim of this study was to determine the priming effect as related to different aggregate fractions, aggregate disruption and the amounts of substrate. In a 49 days incubation experiment, the soil samples were separated into three aggregate fractions (>2 mm, 2-0.25 mm and <0.25 mm), and with one sample left intact while the other were crushed. Then two concentrations of uniformly labeled 14C-glucose were added to the six aggregate fractions. The cumulative CO_2 production was greater in the macroaggregates (> 0.25 mm) than in the microaggregates (< 0.25 mm) after 49 days incubation irrespective of glucose levels and aggregate grinding. This indicates the higher amount of easily degradable organic matter in macroaggregate versus microaggregate. Higher glucose addition increased the portion mineralization to CO_2, but decreased the incorporation into microbial biomass for both intact and crushed aggregate fractions. Compared with the corresponding intact aggregate fraction, grinding resulted in increased glucose mineralization in macroaggregate. The priming effect increased as added glucose increased in all intact aggregate size, and highest priming effect was observed in >2 mm fraction. However, the magnitude of priming effect response to glucose addition depended on the aggregate size after grinding. This study demonstrates that substrate amounts, aggregate fractionation and grinding can have obvious impacts on priming effect, indicating important implications for understanding SOM cycling and stability.