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Investigating the response of the soil microbial biomass to trace amounts of low molecular-weight compounds using ^{13}C-PLFA-SIP

J.A.J. Dungait(1), S. J. Kemmitt(2), L. Michallon(2), R.P. Evershed(1) and P.C. Brookes(2)

(1) Organic Geochemistry Unit, Bristol Biogeochemistry Research Centre, School of Chemistry, University of Bristol, Cantock's Close, Bristol, BS8 1TS, UK (r.p.evershed@bristol.ac.uk / Fax: +44 117 9251295 / Phone: +44 117 9287671), (2) Soil Microbial Biomass Research Group, Agriculture and Environment Division, Rothamsted Research, Harpenden, Herts., AL5 2JQ, UK

Previous respiration experiments have shown that the additions of trace concentrations of low molecular-weight compounds to soils induce two- to five-fold greater expenditure of energy by the soil microbial biomass than that provided by the added substrate (De Nobili et al., 2001). Thus, we investigated the hypothesis that microorganisms maintain metabolic alertness in anticipation of a food event as a strategy for survival in the relatively substrate-poor soil environment. Through application of ^{13}C-labelled substrates at 'trigger molecule' concentrations, we were able to determine the response of the soil microbial biomass in soils from Rothamsted Classical Experiments, using compound-specific ^{13}C isotope analysis of microbial biomarker PLFAs (Evershed et al., 2006). This paper presents results from recent experiments that show the responses of particular microbial groups in soil to addition of single compounds (glucose and glycine) and mixtures (amino acid mixture and root extract). In particular, we found (i) substrate addition caused significant increases in the δ^{13}C values of individual PLFAs without signficant increases in abundance after addition of 15 - 416 μg ^{13}C g^{-1} soil, (ii) differential uptake of ^{13}C over over a 240 h time course in individual microbial PLFAs extracted from a range of soils treated with 15 μg ^{13}C g^{-1} soil, and (iii) similar percentages of ^{13}C uptake regardless of microbial abundance or

population structure. The significance of these findings in the context of the role of the soil microbial biomass in C cycling in soils will be considered.

References

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