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Responses of microbial degradation patterns of soil organic matter to a gradient of anthropogenic pressure on agrosystems

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Context and Objective

Soil microbial functions involved in nitrogen (N) recycling and carbon (C) storage are shaped by human operations such as soil and crop managements and N fertilization. We aimed at characterizing the effects of the intensity of anthropogenic pressure on the microbial patterns of soil organic matter decomposition.

Experimental approach

- Mineral N (net mineralization)
- Chemical composition of litter
- Bacteria + archae (16S rRNA), fungi (18S rRNA) (pyrosequencing)
- +13C-labelled wheat straw
- 16 soils sampled in situ from the gradient
- Incubation 15°C, topsoil (0-10cm), 3 g C added / microcosm determinations after 0, 2, 6, 14, 30 days
- Respiration CO2, 13C-CO2, Priming effect
- Metabolic quotient (qCO2), C-use efficiency (CUE)
- Microbial-C,-13C (fumigation – extraction)

Results and discussion

A marked gradient in soil C, N, C:N, microbial C was observed.

CUE was the highest in permanent grassland.

Priming effect per unit of soil C was the highest in meadow-crop rotation.

The amount of N immobilized per unit of new microbial C from litter was the highest in meadow-crop rotation.

Permanent grassland: microorganisms had the lowest rate of soil C mineralization and of priming effect per unit of soil C, and the highest production of litter-derived microbial C (CUE), i.e. a pattern of strong potential to stabilize C.

Meadow-crop rotation: microorganisms had the ratio soil-N immobilized-to-litter-derived microbial C the lowest, and caused the highest priming effect per unit of soil C, suggesting higher nitrogen requirements, and less stability of microbial communities.

The bacteria-archae-to-fungi ratio did not correlate with the anthropogenic gradient. However this gradient of anthropogenic pressure had a strong influence of soil organic matter degradation functions.