



**HAL**  
open science

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

Gwenaëlle Lashermes, Gonzague Alavoine, Juliette Bloor, Pascal Carrère, Xavier Charrier, Francois Gastal, Mickael Hedde, Katja Klumpp, Frédérique Louault, Bruno Mary, et al.

### ► To cite this version:

Gwenaëlle Lashermes, Gonzague Alavoine, Juliette Bloor, Pascal Carrère, Xavier Charrier, et al.. Responses of microbial degradation patterns of soil organic matter to a gradient of anthropogenic pressure on agrosystems. Ecology of Soil Microorganisms Conference, Jun 2018, Helsinki, Finland. 2018. hal-02785794

**HAL Id: hal-02785794**

**<https://hal.inrae.fr/hal-02785794>**

Submitted on 4 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

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

Lashermes G.<sup>1</sup>, Alavoine G.<sup>1</sup>, Bloor J.<sup>2</sup>, Carrere P.<sup>2</sup>, Charrier X.<sup>3</sup>, Gastal F.<sup>3</sup>, Hedde M.<sup>4</sup>, Klumpp K.<sup>2</sup>, Louault F.<sup>2</sup>, Mary B.<sup>5</sup>, Pommier T.<sup>6</sup>, Vitte G.<sup>5</sup>, Recous S.<sup>1</sup>

<sup>1</sup>FARE laboratory, INRA, University of Reims Champagne-Ardenne, 51100 Reims, France, [gwenaelle.lashermes@inra.fr](mailto:gwenaelle.lashermes@inra.fr)

<sup>2</sup>UREP laboratory, INRA, VetAgroSup, 63000 Clermont-Ferrand, France, <sup>3</sup>FERLUS laboratory, INRA, 86600 Lusignan, France, <sup>4</sup>ECOSYS laboratory, INRA, AgroParisTech, University of Paris-Saclay, 78850 Thiverval-Grignon, France, <sup>5</sup>AgroImpact laboratory, INRA, 02000 Barenton-Bugny, France, <sup>6</sup>LEM laboratory, INRA, CNRS, University of Lyon 1, 69622 Villeurbanne, France

## 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**.

Gradient of anthropogenic pressure



| Crop system                     | Treatment                          | Number              |
|---------------------------------|------------------------------------|---------------------|
| Crop rotations (6 years)        | tillage, N+                        | Mons (T1) 1         |
|                                 | tillage, N-                        | Mons (T4) 2         |
|                                 | reduced tillage, residues recycled | Mons (T2) 3         |
|                                 | reduced tillage, residues exported | Mons (T3) 4         |
|                                 | tillage, N+                        | Lusignan (T1) 5     |
| Crop (3 years)-meadow rotations | meadow 3 years, N+, mowed          | Lusignan (T2) 6     |
|                                 | meadow 6 years, N+, mowed          | Lusignan (T3) 7     |
|                                 | meadow 6 years, N-, mowed          | Lusignan (T4) 8     |
|                                 | meadow 6 years, N+, mowed          | Lusignan (TL3) 9    |
|                                 | meadow 6 years, legumes, grazed    | Lusignan (TL6) 10   |
| Permanent grassland             | NPK, mowed                         | Theix (ID13) 11     |
|                                 | N-, mowed                          | Theix (ID11) 12     |
|                                 | NPK, mowed                         | Theix (ID20) 13     |
|                                 | N-, mowed                          | Theix (ID18) 14     |
|                                 | N+, 1 livestock unit               | Laqueuille (Int) 15 |
|                                 | N-, 0.5 livestock unit             | Laqueuille (Ext) 16 |



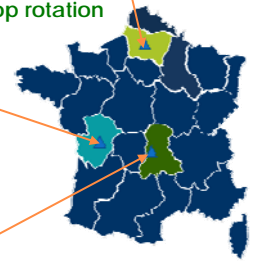
Lusignan: meadow-crop rotation



Estrées-Mons: crop rotation

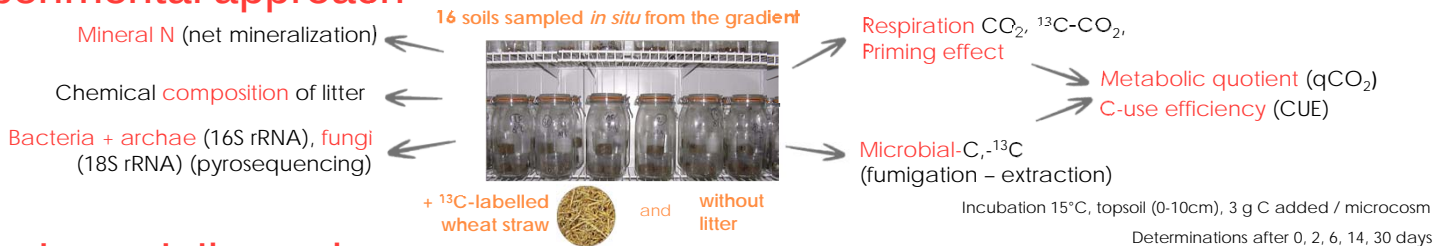


Theix-Laqueuille: permanent grassland

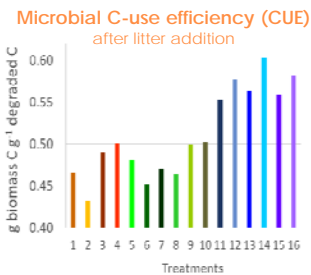
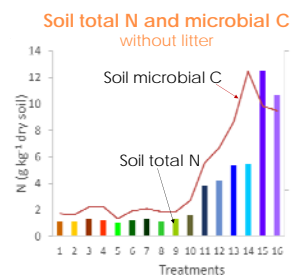


Long Term Ecological Research (LTER) network France

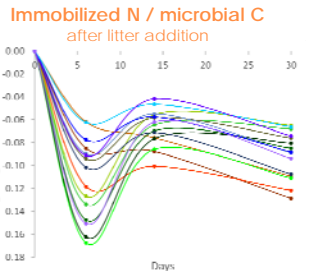
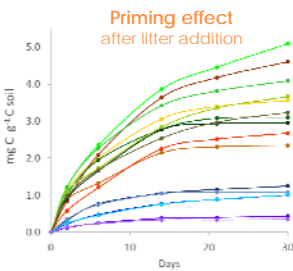
## Experimental approach



## Results and discussion

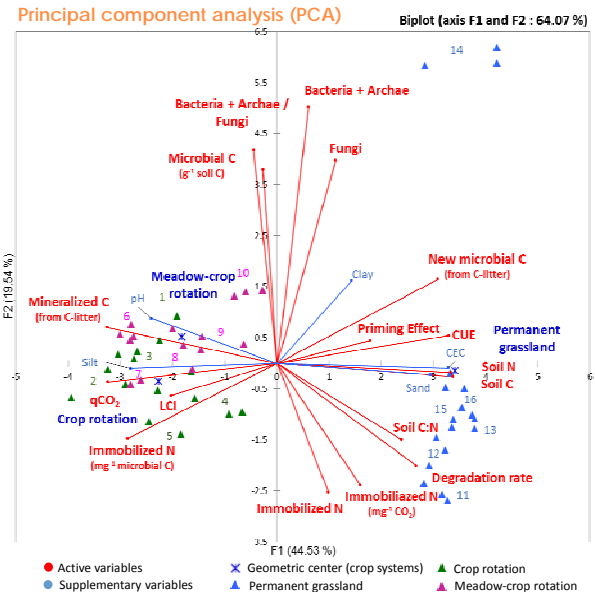


A marked gradient in soil C, N, C:N, microbial C was observed. CUE was the highest in permanent grassland.



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

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**.