RHIZODEPOSITION IN THE PLANT ECONOMIC SPACE ACROSS 15 GRASSLAND SPECIES : HOW DOES IT AFFECT MICROBIAL COMMUNITIES AND CARBON AND NITROGEN CYCLING?

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INTRODUCTION

Rhizodeposition: the release of organic compounds by living roots into the soil, directly or through mycorrhizal fungi.
It is an essential mechanism in plant-soil interactions, crucial for the stimulation of microbially-mediated processes including nutrient mining and soil organic matter formation.

The plant economic space (PES): a theoretical model representing plant strategies based on two independent trade-offs:
(i) **resource acquisition vs conservation** &
(ii) **do-it-yourself vs cooperation with arbuscular mycorrhizal fungi** for soil exploration.
It is known to be related to a set of chemical and morphological traits, as well as physiological "hard" traits, more difficult to measure.

Assessing the relationships between rhizodeposition and other traits would be a useful step in the determination of proxies for hard traits, essential to to advance our understanding of ecosystem processes.

Hypothesis H-A

Rhizodeposition is associated with:

i) Primarily, the **acquisition gradient**, acquisitive species presenting higher rhizodeposition rates;

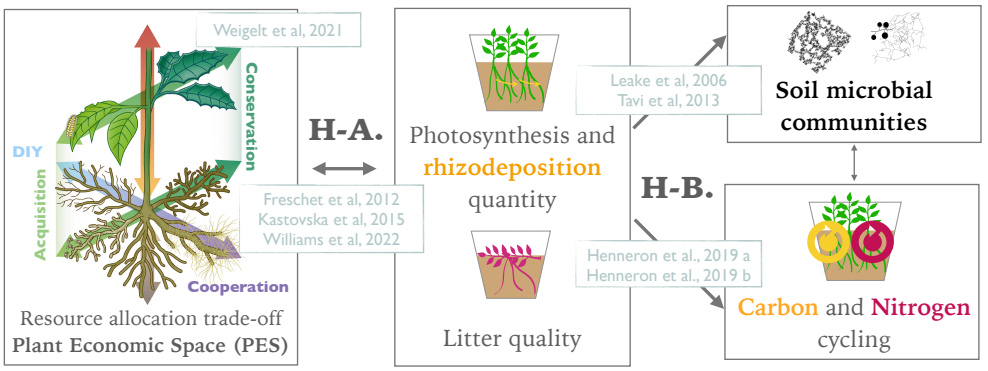
ii) Secondarily, the **exploration gradient**, as higher AMF colonisation promotes higher rhizodeposition rate.

Hypothesis H-B

Higher **rhizodeposition** leads to:

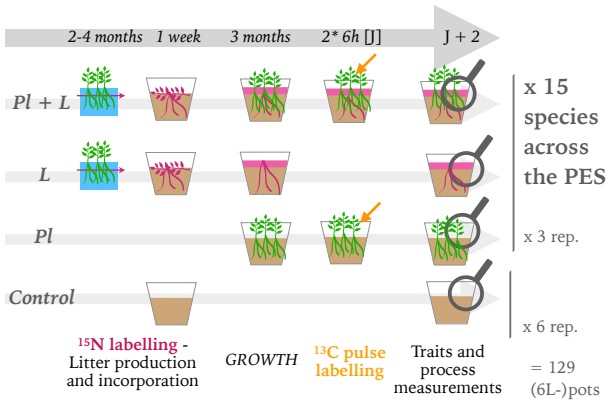
i) A shift in **microbial communities** towards groups more dependent to recent photosynthates such as Gram negative bacteria and arbuscular mycorrhizal fungi (AMF);

ii) Higher **soil respiration** and **nitrogen mineralization.**



EXPERIMENTAL DESIGN

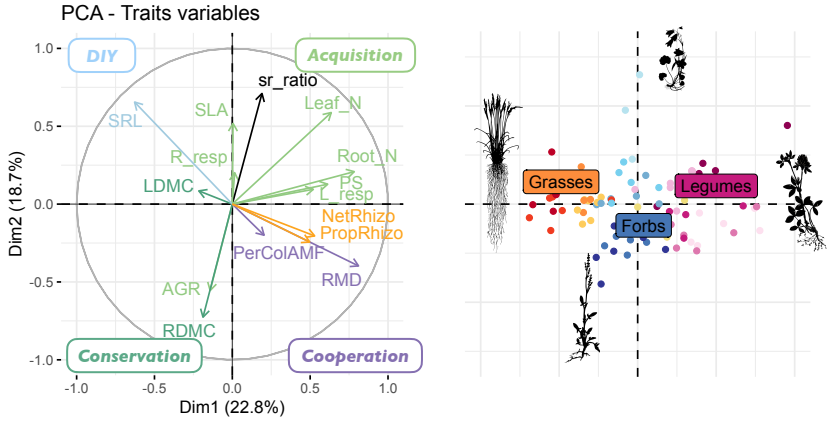
We used STABLE ISOTOPE LABELLING to trace **N-fluxes from litter decomposition** and **C-fluxes from rhizodeposition**.



We measured morpho-chemical and physiological traits on plants, as well as various stocks and fluxes in the soil, and characterized microbial communities with PLFA according to Jorgensen, 2022.

RESULTS H-A.

Contrary to our hypothesis, rhizodeposition is associated primarily with the exploration gradient and secondarily with the acquisition gradient.



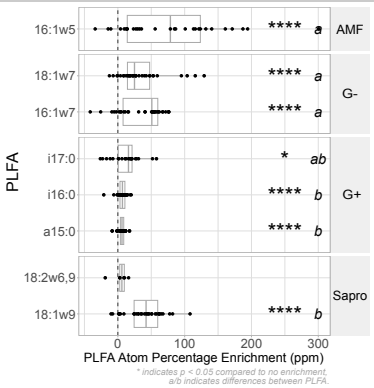
SRL: specific root length; AGR: absolute growth rate; L_resp: leaf respiration; R_resp: root respiration; SLA: specific leaf area; LDMC: leaf dry matter content; RMDC: root dry matter content; PerColAMF: AMF colonisation pourcentage; RMD: root mean diameter ; sr ratio: shoot:root ratio; PropRhizo: percentage of label recovered in soil; NetRhizo: Net Rhizdeposition

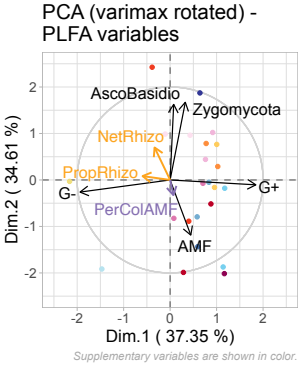
AMF colonisation have been shown to enhance rhizodeposition up to 30% in tomatoes (Zhou et al, 2020) so it's not surprising that the exploration gradient is tightly associated to rhizodeposition (Kaiser et al, 2015). We also have a strong effect of **functional group**.

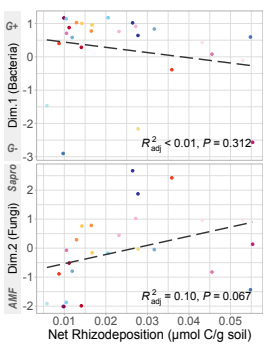
RESULTS H-B.

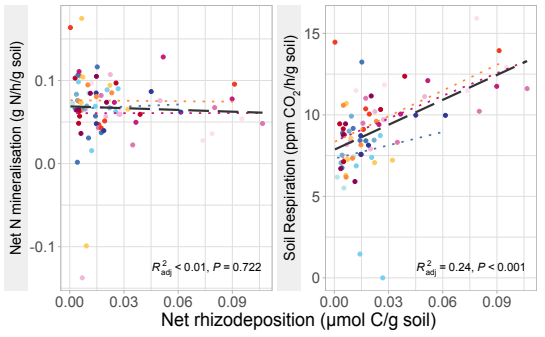
i) Higher rhizodeposition tends to promote saprotrophic fungi, not G- bacteria and AMF, even if G- bacteria & AMF feed more on rhizodeposits.

ii) Higher rhizodeposition does induce higher soil carbon respiration, but not net nitrogen mineralisation.









Ascomycota, Basidiomycota and Zygomycota are supposed to be saprotrophic fungi, but they seem to thrive under higher rhizodeposition species. The importance of recent plant-derived C for saprotrophic fungi is being increasingly recognized (Birgander et Olson, 2021).

We found a significant relationship with C but not N cycling, but we hope to get more extensive characterization of these through growth mineralization, litter-derived plant N and ^{13}C signature of soil respiration in the next months!

Financial Support

Species : *Nardus stricta*; *Festuca ovina*; *Dactylis glomerata*, *Anthoxantum odoratum*; *Holcus lanatus*; *Campanula rotundifolia*; *Gallium verum*; *Plantago lanceolata*; *Centaurea nigra*; *Rumex acetosa*; *Melilotus alba*; *Trifolium pratense*; *Lotus corniculatus*; *Medicaio sativa*; *Trifolium repens*

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