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Impact of diverse soil microbial communities on crop residues decomposition

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Soils provide many basic ecosystem services for our society and most of these services are carried out by the soil communities, thus influencing soils quality.
Soil organic matter (SOM) can be considered as one of the most important soil quality indices for it plays a determinant role in many physical, chemical and biological processes, such as soil structure and erosion resistance, cation exchange capacity, nutrient cycling and biological activity (Andrews et al., 2004).
Since a long time, exogenous organic inputs are largely used for improving agricultural soils, affecting highly soil fertility and productivity. The use of organic amendments such as crop residues influences the soil microbial populations' diversity and abundance. In the meantime, soil microbial communities play a major role in the organic matter degradation, and the effect of different microbial communities on the decomposition of crop residues is not well documented. In this context, studying the impact of crop residues on soil microbial ecology and the processes controlling the fate of plant residues in different management practices is essential for understanding the long-term environmental and agronomic effects on soil and organic matters.
Our purpose in the present work was to investigate the decomposition by two contrasting microbial communities of three crop residues, and compare the effect of different residues amendments on the abundance and function of each soil microbial communities.
Among the main crops which produce large amounts of residues, we focused on three different plants: wheat (Triticum aestivum L.), rape (Brassica napus) and sunflower (Helianthus annuus). The residues degradation in two soils of different management practices and the microbial activity were evaluated by: microbial abundance (microbial carbon, culturable bacteria, total DNA, qPCR), in combination with functional indicators (enzymatic assays and Biolog substrate utilization), kinetics of C and N mineralization, and chemical measures. Physicochemical composition of crop residues was assessed by Fourier transform infrared spectroscopy FTIR technique at 0 and 83 days. The experiment was conducted in microcosms over 83 days for the biological measurements and 175 days for the C mineralization.
The first results showed variations in the C & N rates, and the microbial abundances and functions over time, with a peak at 5 days and a decrease at 83 days for most of the measurements. The soil microbial communities' composition (different management practices) highly impacted the crop residues decomposition. The biochemical composition of crop residues influenced less the microbial communities of each soil.
Further studies on the valorization of these residues into agro materials will be carried out.

References:

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