



Temporal dynamics of soil nitrogen, carbon and microbial activity in conservative and disturbed fields amended with mature white lupine and oat residues

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ABSTRACT

In order to better understand the role of crop residues in soil protection, soil organic matter, nutrient conservation and cycling in Mediterranean agro-ecosystems, it is necessary to develop research since only limited information is available. Few studies have compared the decomposition rates of legume and cereal residues in the field, particularly under soil conservation practice with respect to residue management. In disturbed and undisturbed Portuguese light soils amended with mature lupine and oat labelled ¹⁵N residues, nitrogen, carbon and microbial activity dynamics were investigated *in situ* using undisturbed soil cores in completely randomized blocks with three replications. Crop residue labelled with ¹⁵N allowed the estimation of N mineralization/immobilization and nitrification and the level of leaching losses. Most nitrates were produced in summer, especially in buried top soil with legume residue, and leaching (about 7% of residue-N) occurred mostly in October. A preferentially labile C loss by an intense CO₂ emission by microbial respiration was observed in oat residue managed soil after September, with the consequent increase of greenhouse gas concentration in the atmosphere, overall a 2% of organic C was accumulated in this soil after six months. Legumes, with smaller C:N and total lignin:total N ratios resulted in a more efficient conversion to stable soil organic matter than cereals. Changes in soil microbial activity were largely controlled by the quantity and quality of available C and by N in soil, and less affected by soil disturbance. A more intensive activity was observed in cereal amended plots, especially in the top soil caused by a greater organic N level ($r=0.38$, $p<.05$), although the decomposition rate of oat residue was slower when compared with legume residue.

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