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Abstract

Changes of land use from croplands to natural vegetation usually increase Carbon (C) stocks in soil. However, the contribution of old and new C to various pools still is not clearly analyzed. We measured the δ^{13}C signature of soil organic carbon (SOC) pools after vegetation change from vineyard (C_3) to grassland (C_4) under Mediterranean climate to assess the changes of old and new C in total SOC, microbial biomass (MB), dissolved organic C (DOC), and CO_2 efflux from soil.

Development of the perennial grass *Hyparrhenia hirta* (C_4) on vineyard abandoned for 15 or 35 years ago increased C stocks for 13% and 16%, respectively (in the upper 15 cm). This increase was linked to the incorporation of new C in SOC and with exchange of 25% of old C by new C after 35 years. The maximal incorporation of new C was observed in MB, thus reflecting the maximal turnover and availability of this pool. The DOC was produced mainly from old C of soil organic matter (SOM), showing that under Mediterranean climate DOC will be mainly produced not from fresh litter but from old SOM sources. Decomposition of SOM during a 51 days laboratory incubation was higher in cultivated vineyard than *H. hirta* soils. Based on changes in δ^{13}C values of SOM, MB, DOC and CO_2 in C_3 soil and in soils after 15 and 35 years of C_4 plant colonization, we separated ^{13}C fractionation in soil from changes of isotopic composition by preferential utilization of substrates with different availability. The utilization pattern in this soil under Mediterranean climate was different from that in temperate ecosystems.