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Temporal dynamics of soil aggregates and microbial parameters in permanent and recently established grasslands in the temperate zone

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While changes over time in soil aggregation or microbial parameters are well studied for arable soils, much less is known about such temporal variations in grassland soils. The objective of the present study was to determine the changes that occur within one year (between October 2010 and October 2011) for water-stable aggregate, microbial biomass carbon (C_{mic}) and ergosterol (as a proxy for fungal biomass) concentrations of a sandy soil under a permanent and recently established grasslands The analyzed treatments were (i) permanent grassland, (ii) grassland re-established after tillage of previous permanent grassland, and (iii) grassland established on arable land (both in September 2010). Temporal variations were found for the aggregate distribution and ergosterol concentration in the permanent grassland. For instance, the concentration of large macroaggregates (>2000 μm) in the surface soil (0-10 cm) varied strongly, with the highest concentration (mean $\pm$ standard error) in October 2011 (666 $\pm$ 12 g kg^{-1}) and a 3.2-fold lower concentration in May 2011. An explanation could be less rainfall and decreasing soil moisture contents in May compared to October, which may have decreased the stability of this fraction. A multiple linear regression analysis showed that the large macroaggregate concentration was well described (R^2=0.60) by the gravimetric moisture content, the C_{mic} concentration and the pH. After the tillage event in the grassland and the subsequent grassland renovation, the concentrations of large macroaggregate, C_{mic} and ergosterol decreased in the surface soil, while no difference was found in the soil profile (0-40 cm). In the first year after the conversion of arable land into grassland, the concentrations of C_{mic} and ergosterol increased by a factor of 1.4 and 3.3, respectively, in the surface soil layer, while the macroaggregate concentration was not affected. This study indicates that the aggregate dynamic in grassland is not only affected by management but also by environmental conditions. The fungal biomass seems to be more sensitive to changes in environmental conditions or grassland management than the microbial biomass because the variations for the ergosterol concentrations were stronger than those for the C_{mic} concentrations.