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Temporal variation of microbial and fungal biomass in permanent and recently established grasslands and their impact on aggregate dynamics

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While temporal variations of microbial parameters are well studied for arable soils, much less is known about these dynamics in soils under grassland. Furthermore, information about the influence of microbial biomass and fungi on aggregate dynamics in field experiments is scarce.
The objective of the present study was to investigate temporal dynamics of microbial biomass carbon and ergosterol (as a proxy for fungi) concentrations as well as aggregate distribution in a loamy sandy grassland soil. The samples were taken at six times within one year in a permanent grassland, a grassland with a one-time tillage operation and an arable land converted to grassland.
The one-time tillage operation in grassland led to lower concentrations of large macroaggregates, ergosterol and microbial carbon compared to the permanent grassland in the surface soil layer. Within the first year, the conversion from arable land to grassland increased the microbial carbon and ergosterol concentration in the surface soil markedly, but did not affect the macroaggregate concentration. In the permanent grassland strong variations within one year were found for the ergosterol and large macroaggregate concentrations. In general, the ergosterol concentrations varied much more than the microbial carbon concentrations, which indicates a higher sensitivity of fungi to soil cultivation or changing environmental conditions.
Multiple linear regression analyses showed that microbial carbon, among other factors such as soil gravimetric moisture content and pH, is one explaining variable for the variation in four out of five aggregate size classes, having positive effects on large and medium macroaggregates and negative effects on small macroaggregates and microaggregates. Ergosterol is only involved in one aggregate size class with positive effects on medium macroaggregates. Variations in microbial carbon could be mainly explained by soil organic carbon and the large and medium macroaggregate fractions, while ergosterol was mainly influenced by organic carbon and pH.