



Effect of slurry application and one season of cropping on aggregates and carbon, nitrogen and phosphorus pools in grassland soils

D. Linsler (1), D. Geisseler (1), F. Taube (2), R. Loges (2), and B. Ludwig (1)

(1) Department of Environmental Chemistry, University of Kassel, Nordbahnhofstr. 1a, 37213 Witzenhausen, Germany
(linsler@uni-kassel.de), (2) Institute of Crop Science and Plant Breeding, Grass and Forage Science/Organic Agriculture, Christian-Albrechts-University of Kiel, Hermann-Rodewald-Str. 9, 24118 Kiel, Germany

The temporal dynamics of one season of cropping and slurry application in grassland soils on phosphorus (P), nitrogen (N) and carbon (C) pools are not completely understood. The objective was to study the long-term effects of one season of cropping and five years (2005-2010) of slurry application on soil organic matter (SOM), water stable aggregates and total and labile pools of C, N and P in grassland soils. Soil samples were taken in April 2010 at three depths (0 – 10 cm, 10 – 25 cm and 25 – 40 cm) from loamy sandy soils five years after the insertion of one season of cropping and the commencement of fertilization with cattle slurry. Treatments included permanent grassland (PG, since 1994) and tillage of a grassland followed by one season of winter wheat and grassland (WW). The plots were split and received either cattle slurry totalling 240 kg N per ha and year (+) or no slurry fertilization (-).

The application of slurry over a period of five years led to only slightly higher organic C stocks in the corresponding PG and WW treatments. The application of slurry did have a positive effect on the contents of the large macroaggregates (aggregates >2000 μ m) in the soil profile (0 – 40 cm), but had a negative effect on the other two macroaggregate size classes (aggregate size classes 1000 – 2000 μ m and 250 – 1000 μ m). Furthermore, the SOM contents of the free light fraction were 37 – 66% higher in the unfertilized plots in the top 25 cm soil depth. For the occluded light fraction this effect was also visible, but less pronounced. This might be an effect of the different plant species' composition between the fertilized and unfertilized plots. The fertilization had a positive effect on the labile pools of C, N and P, whereas the effects on the total pools were very small.

The one season of cropping five years before sampling led to 10% and 11% lower organic C stocks in the WW than in the PG treatments in the soil profile of the fertilized and unfertilized plots, respectively. However, this effect was not significant ($p \leq 0.05$). The amounts of large macroaggregates and SOM decreased in the surface soil layer, but there was an increase at the depth of 10 – 25 cm in the fertilized and unfertilized plots. The one season of cropping led to lower amounts in total C, N and P pools.

Our results suggest that after five years of grassland fertilization an effect on organic C stocks, aggregates, SOM and labile pools of C, N and P is still present, however, the effect is still small. Presumably, a longer fertilization period has stronger effects on the above-mentioned parameters. The effect of one season of cropping five years before sampling is still evident, but sporadic cultivation of grasslands may not result in long lasting marked effects.