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Temporal variability of selected chemical and physical properties of topsoil of three soil types

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Temporal variability of soil properties measured in surface horizons of three soil types (Haplic Cambisol, Greyic Phaeozem, Haplic Luvisol) was studied in years 2007, 2008, 2009 and 2010. Undisturbed soil samples were taken every month to evaluate the actual field soil-water content, bulk density, porosity and hydraulic properties. The grab soil samples were taken every month to evaluate aggregate stability using the WSA (water stable aggregates) index, pHH_2O and pHKCl, soil organic matter content and quality. Unsaturated hydraulic conductivity for pressure head of -2 cm was measured directly in the field using the minidisk tension infiltrometer. In addition soil structure was documented on micromorphological images.
In some cases, the similar trends of the pHH_2O , pHKCl , A400/A600, rod, P, θfield or WSA values were observed in different soils. Interestingly, the similar trends were found mostly for the Haplic Cambisol and the Greyic Phaeozem despite the fact that these soils considerably differed (different soil substrate, pedogenetic processes, etc.) and that variable crops (winter wheat and spring wheat) were planted at both locations during two years (2007 and 2006). Mostly different trends were observed for the Haplic Luvisol and the Greyic Phaeozem (soil of the same substrate). The reason could be attributed to a high vulnerability of the Haplic Luvisol to soil degradation in comparison to that of the Greyic Phaeozem.
Parameters of hydraulic properties were highly variable and did not show similar trends for different soils (except the saturated soil water content and the slope of the retention curve at the inflection point for Haplic Cambisol and Greyic Phaeozem). Soil structure, aggregate stability and soil hydraulic properties were interrelated and depended on plant growth, rainfall compaction and tillage. The drier conditions in some soils positively influenced the soil aggregate stability, the slope of the retention curve at the inflection point and hydraulic conductivity. Probably due to the high variation of soil hydraulic properties no closer correlation between them and other properties was detected. Despite that the slope of the retention curve at the inflection point (which should indicate physical quality of the soil, e.g. soil aggregation and consequently soil porosity system) in many cases increased (decreased) when also the soil aggregate stability and hydraulic conductivity values increased (decreased), no closer correlation was revealed when analyzing for the entire 4 year period.
The study showed different trends during different years. This was anticipated in the Greyic Phaeozem where different cops (spring wheat, winter wheat and winter barley) were planted during different years. Different trends were however observed also in the Haplic Cambisol and the Haplic Luvisol, where the same or similar crops (in both cases mostly winter wheat and ones winter barley) was sown. Results showed that climatic conditions (mostly during he winter end spring) played dominant role. Thus data, which were obtained during one year period, could not be used to generalize a soil regime in a particular soil and crop. Our results showed that it is impossible to apply any model, which would be based on statistical analyses, to predict soil properties development during one year or even longer period. Results indicate that findings cannot be used to generalize soil properties for other soil types, plants or climates.

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