Geophysical Research Abstracts, Vol. 8, 10474, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10474

Soil micromorphological study for assessment of soil porous system, soil hydraulic properties and structure stability

R. Kodesova (1), A. Zigova (2), M. Rohoskova (1), V. Kodes (3), M. Kutilek (4)

(1) Czech University of Agriculture in Prague, Department of Soil Science and Geology, Czech Republic (kodesova@af.czu.cz, rohoskova@af.czu.cz), (2) Institute of Geology, Academy of Sciences of the Czech Republic (zigova@gli.cas.cz), (3) Czech Hydrometeorological Institute in Prague (kodes@chmi.cz), (4) Nad Patankou 34, Prague, Czech Republic (kutilek@ecn.cz)

Soil micromorphological properties were studied to explain a soil structure stability and define configuration of a soil porous system that is reflected in a shape of soil hydraulics properties. The study was performed in following soil types on different type of parent materials: Chernozem (loess), Luvisols (loess and loess loam), Cambisols (orthogneiss and paragneiss) and Phaeozem (loess). Undisturbed large soil aggregates, undisturbed 100 cm3 soil samples and disturbed soil samples were taken from each horizon that were specified for each soil type. Micromorphological properties characterizing soil porous structure were studied on soil thin sections prepared from the large soil aggregates. Depending on type of pedogenesis, the soil porous systems exhibit different shape factors, different size classes, and different pore-size distributions that are mono- or multi-modal with random or hierarchical distribution of pore-sizes. Soil structure depends on a soil particle size distribution, presence of organic matter, transport processes within the soil profile, influence of roots and living organism and so on. Irregularity of prior soil pores, pore sizes and modality of pore-size distributions decreases with the depth in studied soil profiles. The sizes and shapes of pores affecting soil hydraulic functions are affected by coatings and infillings. Pores in the top ploughed horizons of all soil types apart from Phaeozem are not affected by coatings. Pores in subsurface horizons are affected by clay coatings in both Luvisols and Phaeozem and also by coatings of amorphous forms of $CaCO_3$, calcite needles and calcite rhombohedras in deeper horizons of Luvisols (loess), and Phaeozem. Coatings and infillings of amorphous forms of $CaCO_3$, calcite needles and

calcite rhombohedras affect pores in subsurface horizons in Chernozem. Pores in both Cambisols are not affected by any coatings. The stability of the soil structure was studied using two different tests that are usually used to study aggregate stability under the different destruction mechanisms. Stability of soil structure initially increases and then decreases with the depth in Chernozem, Luvisol (loess) and Phaeozem. The increase of soil structure stability in horizon below the top one was caused by combination of relatively high organic matter content (that was lower then that in the top horizon), presence of clay coatings and no effect of tillage. Stability of soil structure decreases with depth in the other soil types. The soil structure stability for Cambisols appeared to be greater then that for other soils in spite of purely developed soil aggregates in the Cambisols probably due to presence of iron oxides. Soil hydraulic properties were studied in the laboratory. Soil water retention curves were determined using the sand tank and pressure plate apparatus. The saturated hydraulic conductivities were measured using the constant head test. The multi-step outflow method was applied to estimate soil water retention curves and unsaturated hydraulic conductivity curves via numerical inversion assuming the single-porosity, dual-porosity and dual-permeability model. The ratios of different pore domains were estimated based on micromorphological studies. The points of the soil water retention curves were also obtained from water volume balance in the soil sample. The soil water properties reflect the poresize distribution studied using the images analysis as well as the stability of the soil structure.

Acknowledgement: This study was supported by the grant GA CR No. 103/05/2143 and the grant No. MSM 6046070901.