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Soil infrastructure evolution and its effect on water transfer processes under contrasted tillage systems with preliminary results

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The heterogeneity of soil structure and porosity are highly influenced by external factors like tillage systems and other land management approaches. The aim of this project is to investigate the effect of soil tillage along with residue management on the changing pattern of soil structure. This investigation will help to emphasize the different water flow dynamics especially the preferential flow processes through the soil that are influenced by the changes in structural distribution in the soil profile. Mostly the preferential flow of water is addressed by the apparent velocity through the soil but this study will focus on soil structure along with soil moisture dynamics at pedon scale or more specifically at aggregate scale. The experimentation has been started from June 2013 in the research field known as Solcouvert (objects: strip-till (ST) versus winter ploughing (WP)) and Solresidus (objects: no-till with organic matter restitution (NI) versus no-till without organic matter restitution (NO)). Soil profile description has been carried out in the four objects of land management. Soil sampling has been done in different depths of soil according to the soil profile description. Soil samples will be used for the measurement of water retention capacity (done), hydraulic conductivity and x-ray microtomography. The assessment of soil water retention curves with pressure plate technique show significantly ($p<0.05$) higher water retention (Hwr) in WP than ST at 9.8 to 98 hPa, Hwr in WP than NI at 39 to 14710 hPa, Hwr in ST than NI at 294 to 14710 hPa and Hwr in WP than NO at 69 to 98 hPa. There was no significant difference in the water retention between NO and NI and ST and NO. Since, tillage practices generally increase soil porosity, the correlation between soil hydraulics and porosity distribution would expect to be different for different tillage systems. In our study, WP retains more water due to the increase of macroporosity than ST, NI and NO. As the changes in soil structure are usually noticed in the range of 9.8 to 98 hPa, so, we can conclude that there is certainly structural change between WP and conservation practices of ST, NI and NO. In addition, Hwr in ST also shows increase in macroporosity than NI. In our study, there will be also soil moisture sensors (Decagon 10HS, 5TM and ML3 Thetaprobe) to capture the total soil moisture networks in the field under four different trials. The soils from the different trials and also from different depths (0-15, 25-30 and 50-60 cm) were used for zone specific calibration of the sensors. All the experiments will be repeated twice a year. For the specific spatio-temporal comparison, the monitoring results from electrical resistance tomography will be available from the collaborated project of the same faculty.