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

Parvin N., Bodson B., Vandenbol M., Garré S., Colinet G. and Degré A.

ULg - Gembloux Agro-Bio Tech, Unit: Soil - Water Systems, 5030 Gembloux, Belgium

Introduction

Several experiments showed that tillage and other land management can influence soil structure (Strudley et al., 2008) and more precisely porosity distribution and these changes in soil can significantly alter other soil physical properties (Bouma, 1992) especially, soil hydrological behavior and consequently nutrient losses, microbial activities and water availability for crop production. Combination of soil water retention capacity and hydraulic permeability measurement with X-ray microtomography and investigation of dynamic of soil water in field scale is a promising approach to characterize the differences in soil porosity , soil water flow pattern and soil infrastructure evolution under different land management.

Aim of the project

We aim at investigating the effect of soil tillage along with residue management on soil structure. This investigation will help to emphasize the different water flow pattern especially the preferential flow processes through the soil profile that are influenced by the changes in soil structural distribution.

Materials and methods

The project will take place on the already established 'Solresidus' and 'Solcouvert' experimentations in Gembloux, Belgium. The research will focus on four different practices; **'conservation tillage with organic matter restitution'** versus **'conservation tillage without organic matter restitution'** in the plots of 'Solresidus' and **'strip-till'** versus **'winter ploughing'** in the plots of 'Solcouvert'. There are four replications of four different practices and the investigation will be done in each replication in each year.

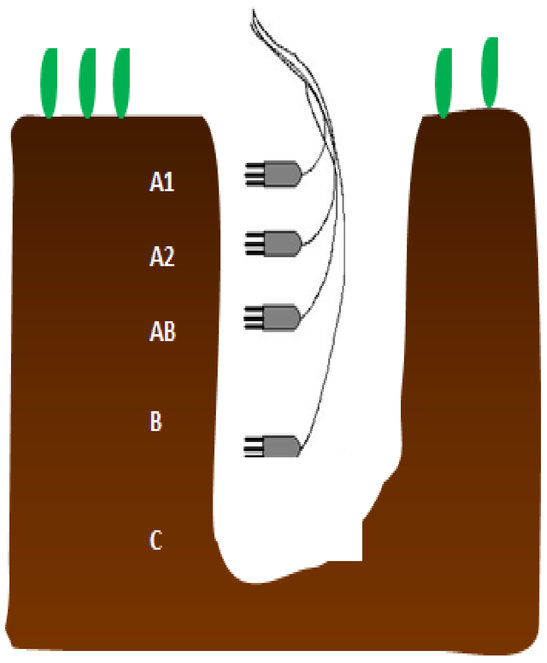

Figure.1. Soil pits observation in four different tillage systems

Undisturbed sampling from different depths for soil water retention, hydraulic permeability and X-ray microtomography measurement

Soil moisture sensors setup at different depths of soil pits

Macro and microscopic distribution of soil pores and hydrodynamic behavior of soil under different tillage and land management

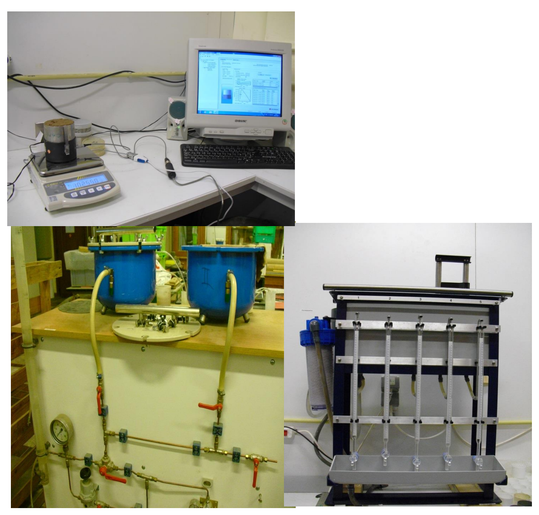

Figure.2. Classical method to measure soil water retention and permeability

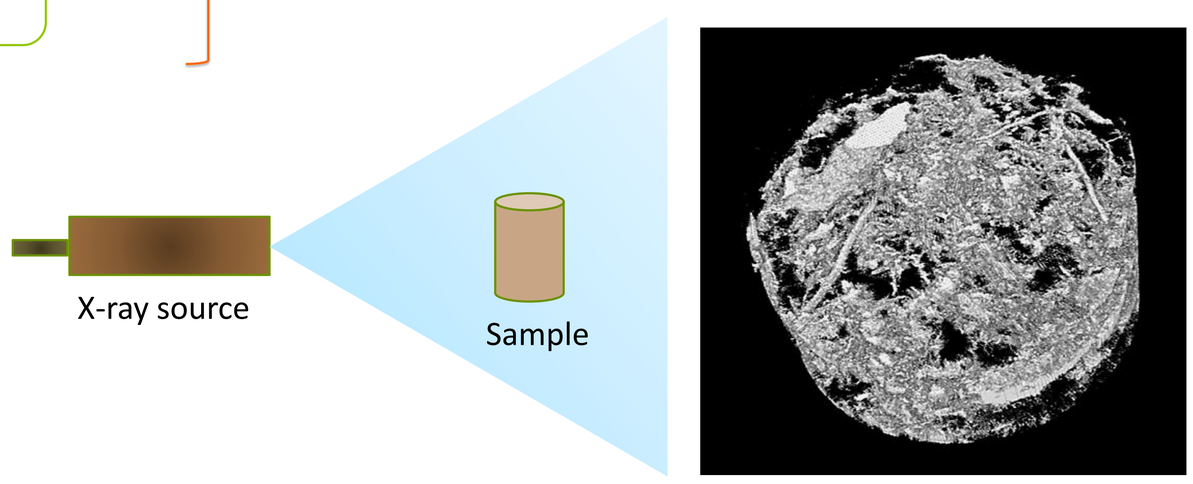

Figure.3. Porosity distribution of a soil sample scanned using Skyscan-1172 high resolution desktop micro-CT system (Skyscan, Kontich, Belgium), (photo courtesy: Eléonore Beckers)

Conclusion and aspects

The experimental setup will help us to characterize the hydrodynamic properties patterns through soil and to understand the effect of tillage and crop residues on soil structure and pore characteristics. Soil water content at different soil depths will be monitored by soil moisture probes. Then, relationship between the effect of different tillage and management practices on water flow processes will be assessed and compared to soil moisture measurement and ERT readings. We will also include the role of soil macro fauna, structural evolution by the effect of roots and microbial activities in soil and quantitative distribution of organic matter by close collaboration with other PhD students who will also work in the same four trials of 'Solresidus' and 'Solcouvert'.

References

Bouma, J., 1992. Effect of soil structure, tillage, and aggregation upon soil hydraulic properties. In: Wagenet, R. J., Baveye, P., Stewart, B. A. (Eds.), Interacting Processes in Soil Science. Lewis Publishers, Boca Raton, pp. 1-36.

Strudley, M. W., Green, T. R., and Ascough, J. C., 2008. Tillage effects on soil hydraulic properties in space and time: state of the science, *Soil Tillage Res*. 99, 4–48.