

Le Corps professoral de  
Gembloux Agro-Bio Tech - Université de Liège vous prie  
de lui faire l'honneur d'assister à la défense publique de la dissertation originale que

**Madame Nargish PARVIN,**

**Titulaire d'un diplôme de *master of science with a major in soil science*,**

présentera en vue de l'obtention du grade et du diplôme de

**DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,**  
le 29 septembre 2017, à 10 heures précises (personne ne sera admis après cette heure),  
en l'auditorium TOPO1 ( Topographie, bât. 3),  
Passage des Déportés, 2 à 5030 GEMBLoux.

Cette dissertation originale a pour titre :

**« Effect of different crop residue management on soil hydraulic properties - a study  
in a silt loam soil in Belgium ».**

**Le jury est composé comme suit :**

Président : Prof. G. COLINET, Vice-président du Département BIOSE,  
Membres : Prof. A. DEGRE (Promoteur), Prof. S. GARRE, Prof. B. BODSON, Prof.  
W. CORNELIS (Ugent), Prof. T. KELLER (SLU – Suède).

## Summary

In recent decades, agriculture is challenged to develop strategies for sustainability which conserve non-renewable natural resources such as soil. Soil improving conservation systems aim at improving soil functions and at the same time ensuring high productivity. Such soil management systems have to be adapted to climate and soil specific conditions, and may include reduced tillage, balanced crop rotation, restitution of crop residues, cover crops, and appropriate timing of field operations. Changes in soil functions have huge impacts on environmental flows like hydrology, crop production, solute transfer, and CO<sub>2</sub> emission at macroscale. Soil structure is considered as one of the key factors for soil functioning. The effect of different land management on soil structure and consequently on soil hydrodynamics is not fully understood and still under investigation.

The main aim of this thesis was to evaluate the effect of crop residue management on soil structure by measuring soil hydraulic properties in pedon and core scale. The agronomic context was different crop residue management in a reduced tillage system. The experimental field is named as Solresidus located in Gembloux, Belgium. Since 2008, the field has been under conservation system. Different residue management includes reduced tillage with incorporation of crop residues (RT-in) and without incorporation (RT-out). A large part of this thesis was methodological development to obtain accurate results from experimentations. Many studies have been made and documented in literature to develop indirect methods to predict soil hydrology from soil water retention curve (SWRC). There is no measuring device available which can determine the SWRC over the entire soil moisture range. Therefore, one of the methodological developments was to obtain complete SWRC by combining three different methods in core scale: X-ray computed microtomography (X-ray CT), HYPROP evaporation and Richards pressure plate method to obtain the entire SWRC. The combination of these methods found well justified to obtain the accurate and complete SWRC. Saturated hydraulic conductivity (Ks), specific connectivity (SC) of soil pores and bulk density of the soil were also measured in core scale. There were soil moisture sensors (capacitance sensors) in the field to observe the soil moisture dynamics in pedon scale. Another important methodological development was to obtain the calibration results with the moisture sensor according to the soil texture and horizons. Calibration results found quite satisfying to get the accurate moisture content of the field; it was also noticed that it could be over estimation of soil moisture without the calibration. Significantly, average higher moisture content was observed by the moisture sensors in RT-in than RT-out during the canopy formation to harvest of winter wheat in 2014. The SWRCs also showed that plant available water content was higher in RT-in than RT-out. SC of soil pores was also significantly higher at the surface soil of RT-in than RT-out. RT-in found to have significant positive effects on soil structure by reducing bulk density, increasing SC, Ks and retention of soil moisture during the observation period of this study. Crop yield was marginally higher and organic matter content was significantly higher in RT-in than RT-out (results from close collaboration). Therefore, reduced tillage with residues incorporation found to have better soil hydraulics together with better crop yield than reduced tillage without incorporation of crop residues.