Gembloux Agro-Bio Tech
Université de Liège

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 DEGRUNE Florine,

Titulaire d'un diplôme de master bioingénieur en sciences et technologies de l'environnement, à finalité spécialisée,

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

DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,

le 16 mars 2017, à 14 heures précises (personne ne sera admis après cette heure),

en l'auditorium PhV (Physiologie végétale, bâtiment 48),

Avenue Maréchal Juin, 13 à 5030 **GEMBLOUX**.

Cette dissertation originale a pour titre :

« Assessing microbial diversity changes associated with different tillage and crop residue managements: study case in a loamy soil ».

Le jury est composé comme suit :

Présidente : Prof. M.-L. FAUCONNIER, Présidente du Département AGROBIOCHEM,
Membres : Prof. M. VANDENBOL (Promoteur), Prof. B. BODSON, Prof. J.-T. CORNELIS, Prof. M. ONGENA, Dr M. HARTMANN (WSL Birmendorf, Suisse), Dr C. ROISIN (CRA-W).

Résumé

The major challenge of modern agriculture is to produce enough food for the growing population, and at the same time, minimize environmental harm. To meet this challenge, *Agroecology* aims to replace non-renewable external inputs with ecological processes to diversify the ecosystem services and attenuate the dis-services of agriculture. In this light, managing the soil microbiota, that has great effects on soil quality, is receiving attention. Plowing, the most widely used tillage practice in intensive agriculture has proven its efficiency in maximizing crop productivity, but its long term detrimental effects, such as soil erosion and organic matter loss, have called for alternative tillage practices. However, the success of the implementation of these practices to improve soil quality is still debated in Europe. In the upper part of Wallonia (Belgium), the soil is highly fertile and 80% of land is occupied by intensive cropping systems. To date, few studies have explored the soil microbiota in association with different soil managements in Walloon cropping systems.

Here, we used metabarcoding to explore changes in soil microbial community structure under two contrasting tillage regimes, conventional (CT) and reduced tillage (RT), either with or without crop residue retention. The effects of these soil treatments were explored at different depths and during the growing season of two crops.

Our work demonstrated clear differences in microbial diversity between tillage regimes, but no clear differences between residue management practices. The observed differences appeared to be associated with differences in physical (e.g. structure and moisture) and chemical (nutrients) soil properties. Notably, the nutrient concentrations and moisture were higher under CT than under RT. Overall, soil under CT had higher or similar microbial diversity than under RT. Analysis of β-diversity revealed differences in the taxonomic structure of microbial communities. Certain microbial groups were more abundant under CT than under RT and *vice versa*. For example, mycorrhizal fungi, economically and ecologically important in agroecosystems, were more abundant under RT. The sampling depth had a substantial and the growing season moderate effect on microbial diversity.

This work highlighted the taxonomic diversity of soil bacteria and fungi in Walloon agroecosystems, and the influence of soil practices on it. We showed that CT was not necessarily unfavourable in maintaining microbial diversity. However, the study raises new questions regarding the impacts of microbial diversity changes on agroecosystem functioning. We encourage researchers to undertake further investigations into the functional role of microbiota in order to improve our understanding of agroecosystem functioning and its sustainability.