

Microbial and physical properties as indicators of sandy soil quality under cropland and grassland

Magdalena Frac, Jerzy Lipiec, Boguslaw Usowicz, Karolina Oszust, and Malgorzata Brzezinska
Institute of Agrophysics, Polish Academy of Sciences, Lublin, Lublin, Poland (j.lipiec@ipan.lublin.pl)

Land use is one of the key factor driving changes in soil properties influencing on soil health and quality. Microbial diversity and physical properties are sensitive indicators for assessing soil health and quality. The alterations of microbial diversity and physical properties following land use changes have not been sufficiently elucidated, especially for sandy soils.

We investigated microbial diversity indicators including fungal communities composition and physical properties of sandy acid soil under cropland and more than 20-yr-old grassland (after cropland) in Trzebieszów, Podlasie Region, Poland (N 51° 59' 24", E 22° 33' 37"). The study included four depths within 0-60 cm.

Microbial genetic diversity was assessed by terminal restriction fragment length polymorphism (t-RFLP) analysis, fungal community composition was evaluated by next generation sequencing (NGS) analysis and functional diversity was determined by Biolog EcoPlate method. Overall microbial activity was assessed by soil enzymes (dehydrogenases, β -glucosidase) and respiration test. At the same places soil texture, organic carbon content, pH, bulk density, water holding capacity were determined.

Our results showed that grassland soil was characterized by higher activity of soil enzymes than cropland. The average well color development of soil microorganisms, the microbial functional diversity and the number of carbon source utilization were significantly affected by land use type and were differentiated among soil depths. In grassland compared to cropland soil a significant increase of carboxylic acids and decrease of amino acids utilization was observed. The quantitative and qualitative differences were found in community of ammonia oxidizing archaea in cropland and grassland soil. The results of fungal community composition help to explain the soil health of grassland and cropland based on the appearance of phytopathogenic and antagonistic fungi. In general bulk density and field water capacity were greater and saturated hydraulic conductivity was lower under grassland than cropland soil.

The study was funded by HORIZON 2020, European Commission, Programme: H2020-SFS-4-2014: Soil quality and function, project No. 635750, Interactive Soil Quality Assessment in Europe and China for Agricultural Productivity and Environmental Resilience (iSQAPER, 2015-2020).