Geophysical Research Abstracts
Vol. 21, EGU2019-18761, 2019
EGU General Assembly 2019

Soil depth influences the responses of C-, N-, and P-acquiring hydrolases to P and N applications in a sub-tropical Chinese fir plantation

Xinyu Zhang (1,5), Chuang Zhang (1,4), Yang Yang (1,5), Huimin Wang (1,5), Xiaoli Fu (1,5), Fusheng Chen (2), Yakov Kuzyakov (6), Sophie M. Green (3), Jennifer A.J. Dungait (3), and Xiangmin Fang (2)

(1) Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, China, (2) College of Forestry, Jiangxi Agricultural University, Nanchang, China , (3) Geography, College of Life and Environmental Sciences, University of Exeter, Rennes Drive, Exeter, EX4 4RJ, UK, (4) Key Laboratory of Agricultural Water Resources, Center for Agricultural Resources Research, Institute of Genetic and Developmental Biology, The Chinese Academy of Sciences, Hebei, China, (5) College of Resources and Environment, University of Chinese Academy of Sciences Beijing, China, (6) RUDN University Moscow, Agrotechnological Institute, Moscow, Russia

The large amounts of carbon (C), nitrogen (N), and phosphorus (P) that are stored in subsoil are often in forms that are not immediately available for microorganisms and plants unless they are modified by hydrolytic enzymes. The activity of hydrolases may be affected directly and indirectly when fertilizers are applied to soil, but the effects vary with the soil depth. We collected samples of the entire soil profile from an experimental area, comprising a control and various fertilizer treatments, that was set up five years ago in a subtropical Chinese fir plantation. The soil in the experimental area has been fertilized for five years with either N (50 kg N ha^{-1} yr^{-1}), P (50 kg P ha^{-1} yr^{-1}), or N and P together. We measured the kinetics of three hydrolases, namely β-1,4-glucosidase (βGluc), β-1,4-N-acetylglucosaminidase (NAG), and acid phosphatase (Phos), and calculated how their potential activities (V_{max}), half-saturation constants (K_m), and enzyme efficiencies (V_{max}/K_m) varied with soil depth. The depth in the soil profile had more influence on the enzyme kinetics than the fertilizer additions. The V_{max}/K_m of βGluc, NAG, and Phos were positively correlated with the soil organic carbon (SOC) contents, indicating that the enzyme kinetics were influenced by the changes in SOC throughout the soil profile. In the control plots, the V_{max} of βGluc, NAG and Phos decreased from 38% to 87%, while simultaneously the K_m of those enzymes decreased from 15% to 80%, respectively, and the V_{max}/K_m of NAG and Phos was relatively stable, at depths at depths from surface to 60 cm. The V_{max} of βGluc above 40 cm and the V_{max} of Phos in the top 10 cm, were higher, but the V_{max} of NAG throughout the soil profile was lower, in soil that was treated with N than in the control. The K_m of βGluc and Phos increased and the K_m of NAG remained stable, and the V_{max}/K_m of βGluc increased, and the V_{max}/K_m of NAG decreased, at various depths in soils treated with N. The relationships between the phosphatase activities and available P were depth specific; i.e., the soils treated with P were less P-limited close to the surface, but were severely P-limited between 10 and 40 cm deep. The potential activities and efficiency of βGluc were higher between 60 and 80 cm in soils treated with P than in the control, which implies that P was assimilated to meet the energy requirements in nutrient-poor subsoil. Our results show that the enzyme kinetics varied in response to changes in resources throughout the soil profile, implying microbes adjusted enzyme productions to survive by various ways.