EGU2020-8512
https://doi.org/10.5194/egusphere-egu2020-8512
EGU General Assembly 2020

C:N:P stoichiometry regulates soil organic carbon mineralization and concomitant shift of microbial community in paddy soil

Zhenke Zhu[1,2], Xiaomeng Wei[1], Tida Ge[1], Jinshui wu[1], and Andreas Richter[2]
[1]Key Laboratory of Agro-ecological Processes in Subtropical Region, Institute of Subtropical Agriculture, Chinese Academy of Sciences, Changsha, China (zhuzhenke@126.com)
[2]Department of Microbiology and Ecosystem Science, Terrestrial Ecosystem Research, University of Vienna, Vienna, Austria

Soil carbon (C), nitrogen (N), and phosphorus (P) contents and their stoichiometric ratios play modifying the microbial metabolism of C. Microbial populations vary in their strategies for C and nutrient acquisition to maintain the microbial biomass C:N:P balance. However, the regulation of soil C mineralization and microbial activities by stoichiometric ratios in input substrates becomes unpredictable in flooded soils because of the frequent redox fluctuations and general oxygen limitation. Stoichiometric control on input substrate (glucose) and soil organic carbon (SOC) mineralization were assessed by a manipulation experiment based on N or P fertilization in paddy soil. Glucose mineralization increased by nutrient addition up to 11.6% with combined N and P applications compared with addition without nutrients. During 100-days incubation, about 4.5% of SOC was mineralized in all five treatments, being increased by glucose and reduced by P fertilization. Glucose and SOC mineralization increased exponentially with the dissolved organic carbon (DOC):NH_4^+-N, DOC:Olsen P, and microbial biomass (MB)C:MBN ratios. The glucose mineralization was negatively associated with the MBC:MBP ratio, suggesting that P addition relieved P limitation for microorganisms and increased microbial activities of labile C mineralization. The shift of bacterial community structure was significantly affected by the soil available and microbial biomass C:N:P stoichiometric ratios. The decrease of negative associations between bacterial taxa in the P-added soil indicated that microbial competition for nutrients was alleviated. 16S rRNA amplicon sequencing showed that combined C and nutrients application stimulated the Clostridia and β-Proteobacteria (r strategists) and increased the enzyme activities of β-glucosidase and β-acetyl-glucosaminidase. In contrast, after 100-day incubation, when the available substrate was exhausted, Syntrophus (K strategist) was found as the keystone species. Hence, soil microbial communities shifted their keystone species to acquire necessary elements to maintain the microbial biomass C:N:P stoichiometric balance in response to the change of resource C:N:P stoichiometry.