Microbial nutrient limitation in rhizosphere soils of different food crop families: Evidence from ecoenzymatic stoichiometry

Xuelian Wang[1], Xiangwei Gong[1], Baili Feng[2]

([1]Shenyang Agricultural University, Shenyang 110866, China; [2]Northwest A & F University, Yangling 712000, China)

Abstract: 【 **Objective** 】 Microbial metabolism directly participates in soil nutrient recycling and ecosystem stability. Although the rhizosphere soil is one of the most active habitats, information on how microorganisms acquire nutrients based on ecoenzymatic stoichiometry is lacking, especially for major food crops under field conditions. 【 **Method** 】 This study aimed to explore the soil nutrient properties and microbial biomass concentrations as well as extracellular enzymatic activities and focused on carbon (C), nitrogen (N), and phosphorus (P) cycling of different crop types, including potato (Solanaceae), maize (cereal), soybean (Leguminosae), and buckwheat (Polygonaceae) in the arid area of northern Shaanxi, China. 【 **Result** 】 Microorganisms in the rhizosphere soil of four crops were subjected to relative C and N limitation tests based on ecoenzymatic activities. Among the crops, potato and soybean exhibited the maximum limitations. Linear regression analysis of soil nutrients, microorganisms (stoichiometric homeostasis), and threshold elemental ratio synthetically supported microbial metabolic limitations. This finding coincided with the highest and lowest microbial carbon use efficiencies in soybean (0.58) and potato (0.51), illustrating the distinguishing physiological responses of microbes. Partial least squares path modeling further confirmed that the soil microbial nutrient limitations were significantly regulated by soil nutrient properties and extracellular enzyme activities. 【 **Conclusion** 】 Soil microbial metabolism in agricultural ecosystems was co-limited by relative C and N regardless of the main food crop families in this region in China (northern Loess Plateau). These observations clarified the nutrient cycling driven by soil elemental stoichiometry at the root–soil interface in arid and oligotrophic ecosystems.

Acknowledgements：National Natural Science Foundation of China (No.32201920)
Xiangwei Gong, E-mail：gongxiangwei@syau.edu.cn; Baili Feng, E-mail：fengbaili@nwsuaf.edu.cn