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Effects of nitrogen and phosphorus additions on transformation and accumulation of plant- and microbial-derived soil organic carbon in alpine grasslands on the Tibetan Plateau

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The availability of nitrogen (N) and phosphorus (P) strongly affects carbon (C) cycling and storage in terrestrial ecosystems. Neutral sugar is an important component of labile soil organic carbon (SOC) pool, which derived from both plants and soil microorganisms. Pentoses originate mainly from plants and hexoses originate mainly from microorganisms in soil. The ratio of microbial-derived hexose (galactose + mannose, G+M) to plant-derived pentose (arabinose + xylose, A+X) is used to represent the relative contribution of microorganisms versus plant in soils. However, the response of labile SOC composition and origin to N and/or P addition is not well understood. This study aims to investigate the effects of N and/or P addition on the composition and origin of labile SOC pool in the topsoil and subsoil of alpine grassland on the Tibetan Plateau with 10-year field N and/or P addition. The concentrations and ratio of neutral sugars in plants and soils were quantified and investigated. The results showed that N and NP addition increased the concentrations of neutral sugars in shoots but decreased it in roots, leading to a not significant change in the total plant input of the concentrations of neutral sugars to soil with different nutrient amendment. The concentrations of neutral sugars decreased significantly with N and P addition in both the top- and subsoil. And nutrient amendment increased the ratio of (G+M)/(A+X) in both the top- and subsoil (except NP addition in the topsoil). Compared with the topsoil, the concentrations of neutral sugars in subsoil were significantly higher, and the ratio of (G+M)/(A+X) was significantly lower, indicating lower microbial contribution in the subsoil. The above comprehensive effects led to different magnitude of decomposition and accumulation of plant- and microbial-derived SOC, which would regulate the availability and stability of SOC in the top- versus subsoil with different amendment in the Tibetan Plateau.