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Influences of Different Grazers on Belowground Production and Root Turnover in Songnen Grassland, China

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Abstract

In temperate grasslands, the belowground system is the central part of carbon allocation and cycle. Belowground primary productivity (BNPP) and root turnover are important indicators of ecological properties of this ecosystem, such as carbon cycle and balance. Songnen grassland is located in north-eastern part of China, and the livestock grazing has been considered as one of the important land-use regimes. This area is under an increasing pressure of degradation as a result of the rising demand for natural resources and animal products. Much of previous studies have only focused on the effects of grazing intensity on aboveground production. However, little is known about the influences of different grazers on BNPP and root turnover.

Based on the different grazers, four treatments were established, including cattle grazing, sheep grazing, mixed cattle and sheep grazing and control without grazing. BNPP and root turnover were measured by Ingrowth Donuts method and the improved root window method, respectively.

The highest value of BNPP was found under sheep grazing followed by cattle grazing and mixed grazing. Un-grazed treatment showed the lowest value of BNPP. Similarly, root turnover was faster under grazing condition than the un-grazed treatment, especially in the cattle grazing treatment. The differences in BNPP observed among grazing treatments can be explained by selective herbivory of different grazers. Furthermore, BNPP and the proportion of root cohort surviving are positively correlated to soil moisture, suggesting soil water availability is an overriding factor controlling the formation of belowground net primary production and root turnover. Positive relationship between BNPP and root turnover indicates that high BNPP under grazing condition may facilitate root replacement, thus increase soil C sequestration.

Keywords: Grazing ecosystem, ingrowth donuts, root cohort surviving, root window