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Effects of Grazing Intensity on Nutritive Value of C3 and C4 Species in Typical Steppe of Inner Mongolia, China

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Abstract

Forage nutritive value is a plant functional trait to reflect forage intake and digestibility, as well as herbivore performance. Understanding the plant nutrient dynamic is important for grassland management and conservation. Here, the nutritive value of five dominant species (three C3 species and two C4 species) in the Inner Mongolia grassland of China were studied, within a large-scale grazing experiment including seven grazing intensities (from ungrazed to very heavily grazed) in a wet year (2008) and a dry year (2010). Our results showed that for the five species, the effects of grazing, year, growing period and their interaction on plant nutritive value were highly significant in nutritive parameters. Grazing increased crude protein (CP) and cellulase digestible organic matter (CDOM) concentration and decreased neutral detergent fibre (NDF) concentration in all species in the wet year, whereas the nutritive value of C3 species were relatively unchanged in the dry year. The trade-off between C3 and C4 species in nutritive value was more obvious in the wet year than in the dry year. Grazing had consistent positive effects on nutritive value of all five species for their stem and leaves. C4 species *Cleistogenes squarrosa* showed increased trend in CP and CDOM concentration over growing season (from June to August), which was inverse to C3 species. Our results suggest that grazing, precipitation and growing period were three main factors in driving species nutritive value dynamics. The nutritive value trade-offs between C4 and C3 species may help to keep the balance of forage nutrient in grassland ecosystems and ecological resilience. Although a strong shift from C3 to C4 species in steppe grassland ecosystems is indicating overgrazing and sward degradation processes, our results show that a moderate increase of C4 species can contribute to ecosystem functioning in terms of offering high forage quality for herbivores in late season.

Keywords: C3 and C4 species, grazing, growing period, nutritive value, precipitation, temperate steppe