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# Feed Intake and Performance of Sheep Grazing Semiarid Grassland in Response to Different Grazing Systems

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## Abstract

Effects of grazing management systems (GS) on biomass production and nutritional quality of rangeland vegetation in semiarid regions are extensively studied; however, limited information is available regarding their effects on diet digestibility and feed intake of grazing livestock. We therefore analyzed digestibility of ingested organic matter (dOM), organic matter intake (OMI), and live weight gain (LWG) of sheep in a grazing experiment established in the Inner Mongolian steppe of China, where two GS were tested for six different grazing intensities (GI) from very light to heavy grazing. For the continuous grazing system, sheep grazed the same plots each year, and for the alternating system, grazing and hay making were alternated annually between two adjacent plots. In July, August, and September 2009 and 2010, feed intake and live weight of sheep were determined. The GS did not affect dOM ( $P=0.101$ ), OMI ( $P=0.381$ ), and LWG of sheep ( $P=0.701$ ). Across both GS LWG decreased from 98 g · d<sup>-1</sup> for GI1 to 62 g · d<sup>-1</sup> for GI6 ( $P<0.001$ ;  $R^2=0.42$ ). There were no interactions between GS and GI for all measured parameters ( $P\geq 0.061$ ), indicating that alternating grazing did not compensate for negative effects of heavy grazing even after 4 yr of grassland use. In summary, our study showed that irrespective of GI, alternating grassland use does not improve dOM, OMI, and hence, LWG of sheep. However, it might enhance revenues and ecological sustainability in the long term when compared to the common practice of continuous grazing at very high stocking rates.

**Key Words:** alternating grazing, continuous grazing, grazing intensity, live weight gain, Inner Mongolia, steppe

## INTRODUCTION

Grazing systems (GS) are considered as an important management tool that can maintain or even increase long-term rangeland and livestock production in pastoral farming systems (Long 1986). In addition to the continuous (CON) grazing system in which a particular area is used for livestock grazing every year, several improved GS have been conceptualized. Their main aims are maintaining rangelands in a productive state and making the most effective use of natural feed resources to generate income from animal products (Clark 1994). In the alternating (ALT) grazing system hay-making and animal grazing are regularly alternated between two or more paddocks or areas (Merrill 1954). This enables the vegetation to recover from grazing during hay-making years and returns

organic matter (OM) and nutrients to the rangelands in grazing years through the deposition of animal feces and urine (Owens et al. 1989). The ALT grazing might thus provide higher quantity and quality of herbage to grazing livestock, and could therefore increase the animals' nutrient and energy intakes, and thus their performance level (Heady 1961).

Many studies analyzed the effects of ALT and CON on herbage production and quality. Reardon and Merrill (1976) stated that forage yields and litter accumulation were higher for ALT than for CON. Similarly, Clarke et al. (1943) showed in an earlier study that ALT grazing increased herbage production and was more favorable for the seasonal development and life cycle of the main forage species than CON grazing. Within the same research project as the presented study, Schönbach et al. (2011) determined a higher aboveground net primary production (ANPP) of the grassland steppe in Inner Mongolia for ALT than for CON heavy grazing intensities (GI). Moreover, Wan et al. (2011) concluded that aboveground biomass of the herbage species preferably grazed by sheep was less affected by moderate to high GI for ALT than for CON. Instead, few studies were conducted to clarify the effects of ALT on grazing livestock, and most of them focused on measuring animal performance rather than feed intake and quality. The objectives of our experiment were therefore to investigate the effects of ALT versus CON grazing on diet digestibility, feed intake, and live weight gain (LWG) of grazing sheep in the semiarid grassland steppe of Inner Mongolia. We aimed to determine whether GS can compensate for the negative effects of increasing GI and plant maturation with advancing vegetation

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