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“Resilience of agricultural systems against crises”

Ecological and Economical Aspects of the Intensity of Sheep Grazing in the Inner Mongolian Steppe

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Abstract

An increasing human population and the growing demand for food of animal origin intensified sheep production and lead to widespread overgrazing of the grassland in Inner Mongolia, China. Hence, strategies for a sustainable livestock husbandry that protect the steppe vegetation and at the same time, satisfy farmers' economic interests are strongly needed. We therefore analysed the effects of different grazing intensities (GI) on herbage organic matter intake (OMi) and liveweight gain (LWG) of grazing sheep.

During July to September 2005–2010, a grazing experiment was conducted in the Xilin River Basin (E 116°42'; N 43°38') using 15-months-old, female sheep (31.5 ± 2.0 kg liveweight). Six GIs were tested on two plots each. Plots were alternately used for grazing and hay-making year-by-year. Stocking rates ranged from very light (GI1: 1.9 ± 0.3 sheep ha⁻¹) to very heavy grazing (GI6: 9.7 ± 1.6 sheep ha⁻¹) and were monthly adjusted to maintain similar herbage allowances. In six animals per plot (2009–2010: 4 animals plot⁻¹) titanium dioxide was used to determine fecal excretion, while digestibility of ingested organic matter was estimated from fecal crude protein concentrations. Feces samples were collected on 5 d each in July, August, and September every year. Sheep were monthly weighed to determine their LWG.

Daily OMi ranged between 68 and 89 g kg^{-0.75} liveweight and was not affected by GI ($p = 0.120$). Nevertheless, LWG decreased from GI1 (101 g d⁻¹) to GI6 (70 g d⁻¹; $p < 0.001$) maybe due to higher physical activity of sheep at highest GIs. GI effects differed between years ($p < 0.01$ for both parameters) depending on the amount and distribution of rainfall. Across all years, mean daily LWG per hectare linearly increased from GI1 to GI5 ($p < 0.001$), but was similar at GI5 and GI6. Moreover, OMi of GI5 and GI6 sheep during the 90-d-grazing period reached 763 and 985 kg ha⁻¹, equivalent to 58 % and 75 % of the mean annual herbage production, respectively.

Increasing GI raises output per unit of land area and hence, income for farmers. However, herbage mass at the end of the grazing period limits further increases in LWG at very high GIs and is insufficient to prevent soil erosion during winter months, and thus to maintain long-term grassland productivity.

Keywords: Grazing, inner Mongolia, sheep, stocking rate