The role of grazing intensity in Integrated Crop-Livestock System: Primary and secondary production

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Integrated Crop-Livestock Systems (ICLS) synergize agricultural practices by combining crop cultivation and livestock grazing to enhance nutrient cycling and overall productivity. This study investigates the effects of grazing intensity on total herbage production (THP) and animal average daily weight gain (ADG) in ryegrass (*Lolium multiflorum* Lam.) and black oat (*Avena strigosa* Schereb) within a long-term ICLS experiment conducted from 2001 to 2023. The experiment, located at Espinilho Farm in São Miguel das Missões, RS, Brazil, utilized a randomized block design with four treatments and three replicates. Each experimental unit comprised twelve paddocks, ranging from 0.9 to 3.6 ha. The treatments included pasture management heights of 10, 20, 30, and 40 cm, representing high, moderate, moderate-light, and light grazing intensities, respectively. Young cattle (*Bos taurus*) with an initial live weight of 200 kg and an average age of twelve months were used. THP (kg of DM ha^{-1}) was assessed via forage cuts and exclusion cages every 28 days. ADG (kg $animal^{-1}$ day^{-1}) was calculated by the weight difference at the beginning and end of the grazing period, divided by the number of grazing days. Data were analyzed using analysis of variance (ANOVA) and correlation tests, with means compared using the Tukey test at a 5% significance level. Over the 20-year period, a significant correlation ($r = 0.66$, $p = 0.018$) was observed between total herbage production (THP) and average daily weight gain (ADG) across different grazing intensities. The light grazing intensity (40 cm) resulted in the highest THP, averaging 7703 kg ha^{-1}. No significant differences in THP were observed between the 40 cm and 30 cm treatments (7390 kg ha^{-1}), nor between the 30 cm and 20 cm treatments (7038 kg ha^{-1}). However, moderate grazing (20 cm) was less productive than light grazing (40 cm). High grazing intensity (10 cm) produced the lowest dry matter yield (6144 kg ha^{-1}). Regarding ADG, the pasture heights of 40, 30, and 20 cm showed equivalent and higher gain levels, ranging between 0.92 and 0.96 kg $animal^{-1}$ day^{-1}. In contrast, high grazing intensity (10 cm) negatively impacted secondary production, resulting in a lower ADG of 0.80 kg $animal^{-1}$ day^{-1} and a weak correlation between THP and ADG ($r = 0.06$). We conclude that satisfactory animal performance is achieved when pastures are managed at heights of 20 cm and above. Moderate and light grazing intensities effectively promote both primary and secondary production.

Keywords: Beef cattle, grazing management, mixed crop-livestock, sward height