Productivity analysis in a soybean-beef cattle Integrated Crop-Livestock System

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Agriculture needs to be more efficient, both in terms of production and resource use. Integrated Crop-Livestock Systems (ICLS) enable better land utilization by combining crops and livestock within the same land unit. However, the intensity of herbivory in these systems can significantly influence the outcome of both components. Our objective was to evaluate the productivity of soybean crops and winter pastures under different grazing intensities compared to ungrazed areas. The data were obtained from a 22 year-database of a long-term experiment conducted in the Brazilian subtropical region. It consists of a succession of soybean (Glycine max L.) and mixed pasture of black oat (Avena strigosa Schreb) and ryegrass (Lolium multiflorum L.) grazed by cattle (Bos taurus). The treatments were delineated in a randomized block with three replications and involved three grazing intensities (high, moderate, and low) defined through the pasture height (10, 20, and 40 cm, respectively), in addition to the ungrazed treatment (UG). Three animal testers were maintained in continuous stocking in addition to put-and-take animals used to match the pre-established target heights. The pasture height was monitored biweekly using a graduated sward stick, measuring 100 points per paddock. Pasture evaluations were conducted at 28-day intervals through forage cuts using exclusion cages to determine the daily herbage accumulation rate (DHAR) (kg DM ha day^{-1}) from each period. At the end of the grazing cycle, DHAR was used to calculate the THP (kg DM ha^{-1}), which consisted of the sum of the initial herbage mass and the sum of herbage accumulation between each evaluation. Soybean yield was assessed at a full grain maturity with 13% moisture content during the final stage of the crop. Five random subsamples, each one consisting of a linear meter in length, were collected from all paddocks. The grains were obtained through mechanized threshing, weighted, and then extrapolated to kg of grains per hectare. The data were subjected to analysis of variance (ANOVA) and the means were compared by the Tukey test, considering a 5% significance level. Moderate and low grazing intensities showed no significant differences compared to the ungrazed treatment, while the high grazing intensity presented the lowest result for both variables. The THP of high grazing intensity was 6202 kg DM ha^{-1}, while the other treatments had resulted in the order of 7502, 7008, and 6868 kg DM ha^{-1} (40, 20 cm, and UG, respectively). Soybean yield was 3005, 2879, and 2873 kg ha-1 to 40, 20 cm, and UG treatment, respectively, while the high grazing intensity (10 cm) resulted in the lowest grain productivity (2712 kg ha^{-1}). Moderate and low grazing intensities presented the same results in pasture and crop production compared to the ungrazed treatment. Thus, including grazing animals in the system is not the determinant factor in productivity, except in high grazing intensity. This study provides insight into the optimal grazing intensities that enhance both crop and pasture productivity, contributing to more sustainable and efficient agricultural practices. The long-term data offer a robust foundation for understanding the impacts of grazing management on the integrated system's overall performance.

Keywords: pasture management, crop, sustainable intensification, pasture height