



Performance of Nelore heifers under Integrated Crop-Livestock and Crop-Livestock-Forest Systems in Cerrado region¹

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Resumo: O objetivo deste trabalho foi comparar o desempenho de novilhas Nelore (220 ± 33 kg) em diferentes sistemas de Integração Lavoura-Pecuária (ILP) e Lavoura-Pecuária-Floresta (ILPF), com oferta de forragem padronizada (10%). O experimento foi realizado na Embrapa Cerrados, em Planaltina-DF, de abril/2013 a janeiro/2015. A gramínea avaliada foi a *Urochloa brizantha* cv. Piatã e a espécie arbórea foi o *Eucalyptus urograndis*. Os tratamentos consistiram de sistemas integrados com: a) pastagem no sexto ano de utilização (controle) – ILP6; pastagem de primeiro ano – ILP1 e pastagem de primeiro ano implantada em sub-bosque de eucalipto com espaçamento entre renques de 22m (417 árvores.ha⁻¹) - ILPF22. Utilizou-se um delineamento de blocos completos casualizados, com três repetições. As médias foram comparadas pelo teste de Tukey ($P < 0,05$). Foram avaliados o ganho de peso médio diário, a taxa de lotação e a produtividade animal. O ganho de peso diário não diferiu entre os tratamentos. Entretanto, a pastagem de primeiro ano implantada via ILP permitiu maiores taxas de lotação em relação aos demais tratamentos e maior produtividade animal (+42%) em relação à mesma pastagem implantada via ILPF. A produtividade em ILP6 (300 Kg PV.ha⁻¹.ano⁻¹) não diferiu dos demais. Apesar da elevada produtividade animal anual observada para todos os tratamentos, o sistema ILPF apresentou menor desempenho animal (244 Kg PV.ha⁻¹.ano⁻¹) quando comparado ao ILP em seu primeiro ano de uso (421 Kg PV.ha⁻¹.ano⁻¹).

Palavras-chave: forragem, ganho de peso, produtividade animal, sistemas integrados, taxa de lotação

Abstract: The objective of this study was to compare the performance of Nelore heifers (220 ± 33 kg) under different Integrated Crop-Livestock (ICL) and Crop-livestock-Forest (ICLF) Systems, with standardized (10%) herbage allowance. The experiment was conducted at Embrapa Cerrados in Planaltina-DF from April/2013 to January/2015. *Urochloa brizantha* cv. Piata grass and *Eucalyptus urograndis* tree were used. The treatments were integrated systems with: (a) 6 years old pasture (control) - ICL6; (b) one year old pasture - ICL1, and; (c) one year old pasture established under trees in a north-south orientation and spacing between rows of 22m (417 trees.ha⁻¹) – ICLF22. It was used a randomized complete block design with three replicates. Tukey test ($P < 0.05$) was used to compare treatment means. Average liveweight daily gain (ADG), stocking rate (SR) and liveweight gain per hectare (LWG) were evaluated. The ADG did not differ among treatments. However, one year old pasture established through ICL allowed higher stocking rates than other treatments and greater animal productivity (+42%) than the same grass established by ICLF system. In terms of LWG, ILP6 (300 kg LW.ha⁻¹.year⁻¹) did not differ from ICL1 and ICLF22. Despite of the high animal productivity for all treatments, Integrated Crop-Livestock-Forest system showed lower animal performance (244 kg LW.ha⁻¹.year⁻¹) when compared to one year old Integrated-Crop-Livestock system (421 LW.ha⁻¹.year⁻¹).

Keywords: animal performance, forage, integrated systems, liveweight gain, stocking rate

Introduction

Integrated Crop-Livestock (ICL) and Crop-livestock-Forest Systems (ICLF) have been indicated as an alternative to diversification and intensification of land use, to reduce costs and increase revenue. Besides, it is a technology with great potential to promote sustainability to cattle farms. In order to benefit from ICLF, knowing animal performance under shaded or non-shaded pastures is an essential information to plan the management on farm. Thus, the aim of this study was to compare the performance of Nelore heifers in different integrated systems with standardized herbage allowance.

Material e Methods

The experiment was conducted at Embrapa Cerrados in Planaltina-DF ($15^{\circ}36'41.51''S$ $47^{\circ}42'08.92''O$ and 988m) from April of 2013 to January of 2015. The evaluated grass was *Urochloa brizantha* cv. Piata and the tree species



was the *Urograndis eucalyptus* (*Eucalyptus grandis* x *E. urophylla*) planted on the north-south orientation. The treatments were integrated crop-livestock system with: (a) 6 years old pasture (control) - ICL6; (b) one year old pasture - ICL1, and; (c) one year old pasture established under *Eucalyptus urograndis* trees in a north-south orientation and spacing between rows of 22m (417 trees.ha⁻¹) – ICLF22. Three pastures replicates (1.3 ha each), containing two animal testers each, were set in a randomized complete block design. Tukey test (P<0.05) was used to compare treatment means. Nellore heifers were used (220 ± 33 kg) to assess average liveweight daily gains (ADG), stocking rates (SR) and liveweight gains per hectare (LWG). Animals were weighed once a month, being the first and last weighing performed on fasting for 16 hours. Paddocks were submitted to a continuous grazing (testers) and regulator animals were used to adjust forage allowance to 10% (10 kg dry matter / 100 kg liveweight/day). Pasture samplings for dry matter availability determination were held monthly during 2013 and in the representative months of each season in 2014. The grass cut was carried out close to the ground according to squared method (1m²). Green forage mass was weighed in the field and a subsample was removed, placed in an oven with forced ventilation at 65 C for 72 hours to determine the dry matter content. Based on the availability of dry matter per hectare and 10% fodder supply stocking rates were calculated for each treatment.

Results and Discussion

The results presented in Table 1 refer to the evaluation period of one year and nine months (from April/2013 to January/2015). The average liveweight daily gains did not differ among treatments. However, the stocking rate (hd.ha⁻¹) and liveweight gain (LWG.ha⁻¹) were, respectively, 45% and 42% higher (P<0.05) in one year old Piata grass (ICL1) when compared to the same pasture established under *Eucalyptus* (ICLF22). In terms of LWG, treatment containing six year old Piata grass (ICL6) did not differ from ICL1 and ICLF22. There was a significant reduction of 26% in stocking rate in ICL6 when compared ICL1. Nevertheless, the LWG of these treatments did not differ, even though ICL6 being 29% lower. Based on LWG results, it were observed for ICL1, ICLF22 and ICL6 treatments averages of 421 (800 kg / 1.9 year), 244 (464 / 1.9 year) and 300 kg LW/ha/year (570 / 1.9 year), respectively. When comparing ICL1 to ICLF22, the lowest SR and LWG verified to the former occurred due to the lowest forage supply. The high LWG observed even to ICL6 can be justified to the 10% herbage allowance, where the animals had greater opportunity to select forage with better quality.

Evaluating small-scale farming systems Aguiar et al. (2002) observed productivities ranging from 150-180 kg LW/ha/year in cultivated pasture. Liveweight productivities found in the present study can be considered competitive even without accounting the possible economic income derived from the wood produced in ICLF22 treatment.

The production per hectare observed by Oliveira et al. (2013) was lower than that obtained in this study, ranging from 229 to 17 kg LW/ha/year in the summer grazing without the presence of trees and in winter in ICLF system (357 trees.ha⁻¹), respectively. The observed stocking rate values were very similar to those obtained in the present study. The values ranged from 2.6 hd.ha⁻¹ in the fall in the system to full sunlight to 0.6 hd.ha⁻¹ in winter in ICLF system with 357 trees/ha. The stocking rate observed by Euclides et al (2009) evaluating animal performance under different *Brachiaria brizantha* cultivars was 2.1 hd.ha⁻¹ for Piata grass, similar to that found in ICL1.

The absence of significant differences among treatments regarding ADG probably occurred due to the standardization of forage supply to 10% for all treatments. Cunha et al. (1993) observed average liveweight daily gains of 380 g in animals grazing *Brachiaria decumbens* pastures. When assessing ADG of beef steers raised in Piata grass, Euclides et al. (2009) observed values of 578 g/animal/day in Campo Grande, MS. When compared to the present study, these highest ADG can be attributed to the rotational stocking grazing system adopted.

Take into account the average Brazilian liveweight yields per hectare, around 90 kg LW/ha/year, all treatments presented superior results.

Table 1 – Stocking rate (SR), average liveweight daily gain (ADG) and liveweight gains (LWG) of Nellore heifers in Integrated Crop-livestock and Crop-livestock-Forest systems from April 2013 to January 2015 and average dry matter availability of integrated systems in the years 2013 (average of 11 samples) and 2014 (average of 4 samples).

Systems	SR	ADG	LWG	Dry Matter (kg DM.ha ⁻¹)	
	(head-450 kg PV.ha ⁻¹)	(kg LW. Animal.day)	(kg.ha ⁻¹)	2013	2014
ICL1	2.06 a	0.361	800 a	3696 a	2880 a
ICLF22	1.13 b (-45%)	0.314	464 b (-42%)	2445 b	2065 ab
ICL 6	1.52 b (-26%)	0.311	570 ab (-29%)	3526 a	1994 ab
CV (%)	9.18	15.18	17.54	11.32	19.39



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Means followed by the same letter in the column are not different by Tukey test at 5% probability. ICL 1 - one year old; ICLF22 - pasture established under *Eucalyptus* with spacing between rows of 22m (417 trees.ha⁻¹) and ICL 6 - six years old Piata grass (control)

The Table 1 shows average dry matter availabilities of treatments in 2013 (mean of 11 samples) and 2014 (average of 4 samples). It was observed a decrease in availability between the years of 22% for ICL1 system, 16% for ICLF22 and 43% for ICL6. The highest decline in forage production observed for ICL6 can be explained to absence of nutrient supply during after pasture establishment. This will probably have extended effect over the years in relation to animal performance.

Conclusions

Despite of the high year based animal yields for all treatments, Integrated Crop-Livestock-Forest system showed lower animal performance per hectare when compared to one year old Integrated-Crop-Livestock system.

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