Enteric methane emissions expressed by carcass productivity of *Nellore* cattle raised in different pasture systems

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I. INTRODUCTION

In 2023, the population reached the mark of 8 billion people in the world, and projections indicate that this number will increase to 9.7 billion by 2050 [1]. To meet the growing demand for food, it became necessary to intensify existing production systems while also, mitigating the environmental impacts caused by the increased exploitation of natural resources [2]. As a strategy to enhance productivity in pastures, the consortium of pigeon pea with tropical grasses can meet the nutritional requirements of animals, which showed better performance in terms of weight gain when compared to animals kept in extensive and poorly managed breeding systems. This consortium system can mitigate up to 70% of methane (CH_4) emissions when expressed by average daily weight gain compared to treatment with degraded systems [3]. Therefore, the objective of this work was to evaluate hot carcass weight (HCW) and enteric CH_4 emissions of *Nellore* cattle in an intercropped pasture system containing grasses and legumes.

II. MATERIALS AND METHODS

The study was approved and followed the guidelines of the Committee for the Use and Care of Institutional Animals (CEUA) of Embrapa (nº 05/2016) and the College of Veterinary Medicine and Animal Science of the University of São Paulo (nº 6228200521). The experiment was carried out at Embrapa Pecuária Sudeste, São Carlos, SP, Brazil and included 27 *Nellore* steers, with a body weight of 221 ± 7 kg and 15 months old, were randomly distributed into three treatments with three grazing replicates in a completely randomized design, totaling nine grazing units (11.7 ha in total): 1) Degraded pasture of *Urochloa decumbens* Stapf cv. Basilisk (DEG); 2) Recovered pasture established with a mixture of *U. decumbens* cv. Basilisk and *U. brizantha* (Hochst ex A. Rich) Stapf cv. Marandu (REC); and 3) Intercropped pasture, a mixture of *U. decumbens* cv. Basilisk and *U. brizantha* cv. Marandu intercropped with *Cajanus cajan* (L. Millsp.) cv. BRS Mandarim (MIX). The CH_4 samples was carried out for two years (2021-2022) during the dry (June) and rainy (January) seasons. In the rainy season (October - March), all animals received mineral mixture supplementation, while in the dry season (April - September), animals from REC and DEG received protein-energy supplementation, and MIX, just a mineral mixture. Enteric CH_4 emissions were determined using the sulfur hexafluoride (SF_6) tracer gas technique. At the end of the experiment the animals were fasted for 16 hours, receiving only water ad libitum, and then weighted. In the same day they were transported to a federal inspected slaughterhouse. Immediately after slaughter, the carcasses were weighed to obtain hot carcass weight. The data were subjected to analysis of variance using SAS PROC MIXED and the means were compared by Fisher's test (5%).

III. RESULTS AND DISCUSSION

Table 1 – Carcass production and enteric CH_4 emissions of *Nellore* cattle under different pasture systems.

Variables	Treatment			SEM	Statistical Probabilities (P value)*
	MIX	REC	DEG		
HCW, kg	298.56^{A}	282.22^{AB}	264.50^{B}	7.76	**0.0191**
CH_4, kg/day	0.2596	0.2621	0.2573	0.0008	0.9146
CH_4/HCW, kg/kg	0.6359^{B}	0.6780^{AB}	0.7101^{A}	0.0280	**0.0422**

^{AB} Capital letters differ (P<0.05) treatments by Fisher's test; * Significant at 5%; MIX, mixture of *U. decumbens* cv. Basilisk and *U. brizantha* cv. Marandu intercropped with *Cajanus cajan* (L. Millsp.) cv. BRS Mandarim; REC, mixture of *U. decumbens* cv. Basilisk and *U. brizantha* cv. Marandu fertilized with 200 kg of N-urea ha^{-1} $year^{-1}$; DEG, degraded pasture of *Urochloa decumbens* cv. Basilisk; HCW, hot carcass weight; SEM, standard error of the mean.

In Table 1, the HCW of MIX was higher about DEG, and it is also possible to observe that although CH_4 emissions did not show a significant difference between the grazing systems, MIX treatment was able to dilute carcass emissions. At the same time, DEG presented 12% more emissions per unit of product than MIX.

As demonstrated by Furtado et al. [3], pigeon pea has high levels of nutrients, which increases the energy and protein density of the diet consumed by the animals. In addition, the greatest consumption of pigeon pea occurs during the dry season of the year, a period in which *Urochloa* spp. presents reduced digestibility and crude protein (CP) values, compromising rumen fermentation and causing non-supplemented animals to lose weight. Another advantage is the presence of condensed tannins in pigeon pea plants, a factor that helps ensure that CH_4 emissions do not increase with the additional consumption of this forage. Meo-Filho et al., [4] when studying the effects of pasture intensification on Canchim breed steers, they found lower values of CH_4 per carcass than those observed in this experiment, which can be justified by the choice of breed used, given that the Canchim is a breed crossed with taurine (precocious) animals, the time of experiment and slaughter weight were lower, which also reduced experiment emissions. Furthermore, supplementing the animals with the corn silage produced may also have influenced the lower emissions.

IV. CONCLUSION

The pigeon pea proved to be a great alternative for mitigating CH_4, reducing the need for fertilization and the use of food supplements, producing more sustainable meat.

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