Herbage intake, methane emissions and animal performance of steers grazing dwarf elephant grass with or without access to *Arachis pintoi* pastures

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Introduction

The inclusion of legumes in diets based on grass has nutritional benefits due to ingestive and digestive interactions (Niderkorn and Baumont 2009). Moreover, it is speculated that tropical legumes can contribute to reducing the emission of greenhouse gases (GHG) compared with diets exclusively composed of grasses (Archimède et al. 2011). However, under grazing conditions, these advantages are not always possible to obtain. This occurs when the spatial distribution of sward grasses limits access to legumes by grazing animals (Solomon et al. 2011). This can be the case, for example, when legumes are overlapped by the leaves of a tufted tall grass like dwarf elephant grass (Crestani et al. 2013).

Considering that management strategies for increasing legume percentage in the diet of grazing animals should be investigated and data on enteric methane emitted by ruminants eating tropical forages are scarce, the aim of this work was to evaluate the effects on herbage intake, animal performance and enteric methane emissions of providing access to an exclusive area of forage peanut (*Arachis pintoi* cv. Amarillo) for cattle grazing dwarf elephant grass (*Pennisetum purpureum* cv. BRS Kurumi).

Methods

The experiment was conducted at Ituporanga, State of Santa Catarina, Brazil (approximate geographic coordinates 27°38' S, 49°60' W; 475 m asl). The assessments were conducted during 3 grazing cycles, from January to April 2012. The experimental treatments were: dwarf elephant grass heavily fertilized (150 kg N/ha as ammonium nitrate); and dwarf elephant grass intercropped with forage peanut plus an adjacent area of the legume which was allowed to be accessed by animals for 5 h/d, from 07.00 to 12.00 h. Each area was subdivided into 16 paddocks of approximately 400 m^2. Twelve Charolais steers, aged between 10 and 12 months and with an average weight of 213 ± 8.9 kg, were distributed in 4 groups, 2 per treatment. The animals were managed in a rotational grazing method with a herbage allowance of 6.0 kg of leaf DM/100 kg BW, and a fixed stocking rate, but a variable period of occupation.

Herbage intake was measured by the technique of n-alkanes (Mayes et al. 1986). To assess the average daily gain, animals were weighed before and after each grazing cycle, with previous fasting of solids and liquids for 12 hours. Grazing time was quantified by visual observations every 5 minutes from 07.00 to 19.00 h and every 10 minutes from 19.00 to 07.00 h. Whereas herbage intake and animal gain were measured in all 3 grazing cycles, enteric methane production was estimated by the technique of sulfur hexafluoride (SF6) (Johnson et al. 1994) in 2 grazing cycles only (February and March/April 2012).

Data were submitted to variance analysis using PROC MIXED (SAS 1996) considering repeated measures and using a model that included random effects of animals and the fixed effects of legume access, grazing cycle and the interaction between legume access and grazing cycle.

Results

There was no interaction between legume access and grazing cycle for any variable. Both average daily gain and

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herbage dry matter intake were higher (P<0.05), while time spent grazing in the morning and total grazing time were lower (P<0.001), for animals grazing legume pastures (Table 1). The daily methane emissions were higher (P<0.05) in animals grazing legume pastures, whereas methane emissions per kg DM intake and per kg LW gain were not affected by treatment.

Table 1. Herbage intake (during 3 grazing cycles), enteric methane production (during 2 grazing cycles) and animal performance of steers grazing dwarf elephant grass (*Pennisetum purpureum* cv. BRS Kurumi) with or without access to forage peanut (*Arachis pintoi* cv. Amarillo) pastures.

Parameter	Grass	Grass + peanut	RSD	P-value
Average daily gain/hd (kg)	0.70	0.97	0.174	<0.001
Herbage DM intake/hd				
(kg/d)	6.7	7.8	1.43	0.048
(% of body weight)	2.7	3.1	0.73	0.086
Methane production/hd				
(g/d)	146	180	23.5	0.009
(g/kg DM intake)	22.9	25.3	5.40	0.387
(g/kg LW gain)	254	230	64.2	0.415
Grazing time (min/d)				
Total	594	535	44.6	<0.001
Morning (6.00−12.00 h)	191	136	25.8	<0.001
Afternoon (12.00−18.00 h)	184	187	29.3	0.756
Evening (18.00−24.00 h)	151	155	13.4	0.372
Night (24.00−6.00 h)	68	57	12.3	0.025

Conclusion

Allowing steers grazing dwarf elephant grass access to forage peanut pastures can increase LW gains and grazing efficiency without increasing methane production per kg of DM intake or per kg of LW gain. Animals should reach slaughter weights at younger ages.

References

Archimède H; Eugène M; Marie Magdeleine CM; Boval M; Martin C; Morgavi DP; Lecomte P; Doreau M. 2011. Comparison of methane production between C3 and C4 grasses and legumes. Animal Feed Science and Technology 166/167:59−64.

Crestani S; Ribeiro Filho HMN; Miguel MF; Almeida EX; Santos FAP. 2013. Steers performance in dwarf elephant grass pastures alone or mixed with *Arachis pintoi*. Tropical Animal Health and Production 45:1369-1374. DOI: 10.1007/s11250-013-0371-x.

Johnson K; Huyler M; Westberg H; Lamb B; Zimmerman P. 1994. Measurement of methane emissions from ruminant livestock using a SF6 tracer technique. Environmental Science and Technology 28:359−362.

Mayes RW; Lamb CS; Colgrove PM. 1986. The use of dosed and herbage n-alkanes as marker for the determination of herbage intake. Journal of Agricultural Science 107: 161−170.

Niderkorn V; Baumont R. 2009. Associative effects between forages on feed intake and digestion in ruminants. Animal 3:951–960.

SAS (Statistical Analysis Systems). 1996. Language guide. SAS Institute Inc., Cary, NC, USA.

Solomon JK; Macoon B; Lang DJ; Parish JA; Vann RC. 2011. A novel approach to grass-legume management. Crop Science 51:1865−1876.

Andrade EA de; Ribeiro-Filho HMN; Liz DM de; Almeida JGR; Miguel MF; Raupp GT; Ramos FR; Almeida EX. 2014. Herbage intake, methane emissions and animal performance of steers grazing dwarf elephant grass with or without access to *Arachis pintoi* pastures. Tropical Grasslands – Forrajes Tropicales 2:4–5.
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