

Stylosanthes cv. Campo Grande in diets of beef cattle: intake and digestibility of nutrients and ruminal fermentation

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Introduction

Recent studies have shown that it is possible to obtain well-fermented silages from tropical legumes (Heinritz *et al.*, 2012). Souza *et al.* (2014) concluded that *Stylosanthes* cv. Campo Grande silage (StS); (*Stylosantes capitata* + *S. macrocephala*), when included in the proportion of 50% dietary dry matter (DM), could replace corn silage in diets of feedlot beef cattle without altering intake and performance.

However, there is a lack of information about increasing proportion of StS that should be included in diets for beef cattle. Thus, the objective of this study was to evaluate the intake and digestibility of nutrients, and ruminal fermentation of beef cattle fed diets with *Stylosanthes* and concentrate in different levels.

Materials and Methods

The experiment was conducted at the “Central de Experimentação, Pesquisa e Extensão do Triângulo Mineiro” (CEPET), Federal University of Viçosa (UFV). Four Holstein × Zebu steers (average BW of 429 ± 15 kg) were used, distributed in a 4 × 4 latin square design, with a 2 × 2 factorial. The animals were kept in individual stalls of 10 m². The treatments consisted of proportions of silage of *Stylosanthes* cv. Campo Grande silage (StS): concentrate (C), based on DM: 80:20 (StS-80:20), 60:40 (StS-60:40), 40:60 (StS-40:60), and a control treatment with 60% corn silage (CS) and 40% concentrate (CS-60:40). The diets were isonitrogenous with 12% crude protein (CP). The experiment lasted 64 days and was divided in four periods of 16 days each (10 days for adaptation and 6 days for samples and data collection). In order to estimate the digestibility of the nutrients in the total tract, rumen, and intestine, samples of the feedstuffs and orts were collected daily during the feeding time from the 11th to 15h day of the experimental period. Samples of feces and abomasum digesta were collected each 26 hours starting at 8h00 from the 11th to the 15th day of the experimental period. All collected samples were packed in plastic bags previously labeled, and stored in a freezer at -15°C. Composite samples from feedstuffs, orts, abomasum digesta and feces were made for each animal and experimental period at the end of the experiment. Both ruminal and intestinal digestibilities were expressed in g/kg of the total tract digestibility. The collection of ruminal fluid to estimate pH and analyze the concentration of ruminal ammonia nitrogen (NH₃-N) was performed before the first feeding, and 2, 4, and 6 hours after feeding the animals on the 17th day of each experimental period. The samples of food and orts were processed and submitted to analysis of DM, organic matter (OM), CP according to AOAC (1990). Neutral detergent fiber was analyzed according to Mertens (2002). Results were subjected to analysis of variance and the means were compared by contrasts ($\alpha = 0.05$).

Results and Discussion

In this study, CS was used as a reference diet and all StS-diets were compared with these diet. The diets SS-80:20 and SE-60:40 showed lower ($P < 0.05$) intake of total digestible nutrients (TDN) compared to CS-60:40 diet (Table 1). Those same diets had lower total apparent digestibility (AD) of DM, and CP than the reference diet ($P < 0.05$; Table 2).

Only the diet containing 80% StS showed with lower ($P < 0.05$) total AD of NDF in relation to CS-60:40 diet, probably due to the high concentration of lignin observed in StS (Da Silva *et al.*, 2015). The contrasts among diets were not significant for the values of ruminal and intestinal AD ($P > 0.05$).

The ruminal pH of animals that were fed the diet StS-80:20 was higher ($P < 0.05$) than those values observed for the diet containing CS (6.75 vs. 6.17; Table 3), probably due to the lower proportion of C in that diet. The other diets containing StS had similar values as CS diet ($P > 0.05$). The concentration of ruminal ammonia was similar among the diets containing StS and CS ($P > 0.05$).

Table 1. Intake of nutrients in beef cattle fed diets containing *Stylosanthes* silage (StS) with different proportions of concentrate (C) or corn silage (CS)

C proportion	CS		StS		SEM	Contrasts*		
	60:40	80:20	60:40	40:60		1	2	3
	kg/day							
DM	7.55	6.23	7.80	8.72	0.32	0.08	0.70	0.11
OM	7.21	5.89	7.41	8.34	0.31	0.07	0.75	0.11
CP	0.90	0.73	0.91	1.03	0.04	0.05	0.86	0.11
NDF	2.31	2.79	2.75	2.31	0.12	0.14	0.16	1.00
TDN	5.52	3.66	4.76	5.91	0.26	<0.01	<0.01	0.24

DM = dry matter; OM = organic matter; CP = crude protein; NDF = neutral detergent fiber.

*Contrasts: 1- StS-80:20 vs. CS-60:40; 2- StS-60:40 vs. CS-60:40; 3- StS-40:60 vs. CS-60:40.

Table 2. Apparent digestibility (AD) of nutrients in beef cattle fed diets containing *Stylosanthes* silage (StS) with different proportions of concentrate (C) or corn silage (CS)

C proportion	CS		StS		SEM	Contrasts*		
	60:40	80:20	60:40	40:60		1	2	3
	Total AD, g/kg							
DM	675.5	573.9	589.7	654.7	15.4	0.01	0.03	0.54
OM	689.8	603.1	615.8	677.6	14.3	0.02	0.04	0.70
CP	626.9	506.4	455.4	555.4	21.5	0.02	<0.01	0.13
NDF	568.2	473.6	514.3	512.7	17.3	0.04	0.20	0.19
	Ruminal AD, g/kg of Total AD							
DM	691.1	693.0	712.7	684.2	25.5	0.97	0.64	0.88
OM	740.7	721.6	749.7	714.3	13.8	0.53	0.76	0.39
CP	328.1	270.6	298.2	310.0	14.2	0.15	0.44	0.64
NDF	836.4	728.9	801.3	830.6	15.8	0.01	0.35	0.87
	Intestinal AD, g/kg of Total AD							
DM	309.0	307.0	287.3	315.8	25.5	0.97	0.64	0.88
OM	259.3	278.4	250.3	285.8	13.8	0.53	0.76	0.39
CP	671.9	729.5	701.8	690.0	14.2	0.15	0.44	0.64
NDF	163.6	271.2	198.8	169.4	15.8	0.01	0.35	0.87

DM = dry matter; OM = organic matter; CP = crude protein; NDF = neutral detergent fiber.

*Contrasts: 1- StS - 80:20 vs. CS - 60:40; 2- StS - 60:40 vs. CS - 60:40; 3- StS - 40:60 vs. CS - 60:40.

Table 3. Values of ruminal pH and concentration of ruminal ammonia (mg/dL) in beef cattle fed diets containing *Stylosanthes* silage (StS) with different proportions of concentrate (C) or corn silage (CS)

C proportion	CS		StS		SEM	Contrasts*		
	60:40	80:20	60:40	40:60		1	2	3
pH	6.17	6.75	6.45	6.30	0.05	<0.01	0.06	0.42
Ruminal ammonia	10.95	10.36	10.45	10.48	0.49	0.69	0.73	0.74

*Contrasts: 1- StS - 80:20 vs. CS - 60:40; 2- StS - 60:40 vs. CS - 60:40; 3- StS - 40:60 vs. CS - 60:40.

Conclusion

The use of *Stylosanthes* silage at 40% on total DM in diets of beef cattle has similar intake of TDN and digestibility of nutrients compared to corn silage, without compromising the pH and ruminal ammonia concentration of the animals.

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