Adição de nitrato encapsulado em suplemento para bovinos Nelore em pastejo durante o período da seca[1]

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Resumo: Objetivou-se avaliar o efeito da inclusão de nitrato encapsulado em suplemento para bovinos Nelore em pastejo no período de seca sobre o desempenho animal e a produção de metano. Os tratamentos foram aplicados aos animais através de suplemento proteico-energético na quantidade de 0,7% do peso corporal (PC), sendo: Controle (SC): suplemento contendo ureia (25 g por 100 kg de PC); Nitrato encapsulado (SN): suplemento contendo nitrato encapsulado de forma a fornecer 70 g de nitrato encapsulado ou 47 g NO_3^- por 100 kg de PC. Utilizou-se sal duplo de nitrato de cálcio e amônio deca hidratado como fonte de nitrato. O período experimental foi de julho a novembro de 2014. O delineamento foi o em blocos completos ao acaso. Os dados foram analisados por meio de modelos mistos, sendo as médias comparadas pelo teste "t" a 10% de probabilidade. O ganho médio diário não diferiu entre os tratamentos (P=0,59); sendo 0,545 e 0,529 kg para SC e SN, respectivamente. Contudo, animais suplementados com SN consumiram menos suplemento em relação a àqueles animais SC, com médias de 5,38 e 6,02 g kg/PC, respectivamente. Houve tendência (P=0,11) de mitigação de CH_4 no tratamento SN em comparação a SC, com médias de 150,5 e 180,7 g CH_4/dia, respectivamente. A adição de nitrato encapsulado em suplemento para bovinos em pastejo no período da seca pode ser uma alternativa à utilização da ureia, sem prejudicar o desempenho, com possíveis benefícios ambientais pela redução na produção de metano. Assim, o grupo continua realizando pesquisas na mesma linha para consolidar esses resultados.

Palavras–chave: aditivo, metano, suplementação

Addition Nitrate-Encapsulated supplement to Nellore grazing during the dry season

Abstract: This study aimed to evaluate the effect of inclusion of nitrate encapsulated supplement to Nellore grazing during the dry season on animal performance and the production of methane. Treatments were applied to the animals via protein-energy supplement in amount of 0.7% of body weight (BW) as follows: Control (SC): supplement containing urea (25 g per 100 kg of PC); Encapsulated nitrate (SN): Supplement of nitrate containing encapsulated form to provide 70 g of encapsulated nitrate NO_3^- or 47 g per 100 kg BW. We used double salt of calcium nitrate and ammonium as the source deca hydrated nitrate. The experiment lasted from July to November 2014. The design was in complete randomized block design. Mixed models analyzed data, the average being compared by "t" test at 10% probability. The average daily gain did not differ between treatments (P = 0.59); and being 0.545 to 0.529 kg SC and SN respectively. However, animals supplemented with SN consumed less supplement compared to those animals SC, with averages of 5.38 and 6.02 g kg / PC, respectively. There was a trend (P = 0.11) of CH4 mitigation in the treatment SN compared to SC, with averages of 150.5 and 180.7 g CH4 / day, respectively. The addition of nitrate-encapsulated supplement for grazing cattle in the dry season can be an alternative to the use of urea, without sacrificing performance, with possible environmental benefits by reducing the production of methane. Thus, the group continues conducting research in the same line to consolidate these results.

Keywords: additive, methane, supplementation

Introduction

Agriculture was responsible for issuing 437.22 Gg CO_2eq of greenhouse gases in 2010, this represents 35% of all Brazilian emissions, the main source of emissions enteric fermentation of ruminants, which contributed 56.4% of this total (Brazil, 2013). Methane (CH_4) is the main pollutant gas emitted during the fermentation processes in ruminants. It is produced by microorganisms in the rumen of Archaea group by use of CO_2 and H^+. The nitrate (NO_3^-) is known to be an acceptor of electrons (H^+) in the rumen (Leng & Preston, 2010), being capable

of competing with these microorganisms by hydrogen, resulting in lower production of methane. Antibiotic additives also have the ability to reduce the production of CH_4 by selecting and lysis of some microorganisms, however, have restrictions on their acceptance in several countries, which does not occur with nitrate. It is noteworthy that methane is a source of energy loss for the animal, the reduction of this gas would increase the energy available for production. Another interesting point is the nitrate ability to supply nitrogen to rumen microorganisms, because the forage used does not have adequate amounts of these nutrients during the dry season, which has a great value, as the basis for creating ruminants in Brazil occurs in grazing system. There are numerous studies that show a reduction in methane production with the addition of nitrate in food (Lee & Beauchemin, 2014), but there is no research on grazing cattle. The research objective was to evaluate the effect of nitrate-encapsulated supplement for Nellore cattle grazing in the dry period on the performance and the production of methane.

Material e Methods

The experiment was conducted at Technological Development of Regional Center of Agribusiness of the High Mogiana in Colina / SP (Pólo Regional de Desenvolvimento Tecnológico dos Agronegócios da Alta Mogiana em Colina/SP), in the period from July to November 2014, divided into one period of adaptation (21 days) and 105 days of evaluation. The experimental area consisted of 12 paddocks of 3 ha each formed by *Panicum Maximum cv*. Tanzania. Treatments were applied to the animals via protein-energy supplement in amount of 0.7% of body weight (BW) as follows: Control (SC): supplement containing urea (25 g per 100 kg of PC); Encapsulated nitrate (SN): Supplement containing nitrate-encapsulated form to provide 70 g of nitrate-encapsulated NO_3^- or 47 g per 100 kg BW. We used double salt of calcium nitrate and ammonium as the source deca hydrated nitrate. Both supplements had the same protein content. The supplement were offered in the afternoon (13: 00). Whereas the average weight of the animals during the trial period, it was estimated that the dose used of nitrate could mitigate about 38 g CH_4, for every 1 mole of ingested nitrate reduces 1 mol of methane (Van Zijderveld et al., 2010). 96 Nellore (testers), not castrated, with initial weight of 197 ± 15.28 kg. The animals were weighed every 35 days without fasting for adjusting the supplied amount of supplement. Also every 35 days the forage characteristics were evaluated. The performance was calculated based on the initial weigh-in and after 105 days, with fasting of 16 hours of solids and liquids. Methane production was calculated by the tracer technique of internal sulfur hexafluoride (SF_6) (Johnson et al., 1994). For this evaluation were used 24 animals, two of each picket, being held for 5 consecutive days, always starting at 7 h for 24 hours in two periods (29/09 to 03/10 and 10/11 to 14/11). The concentrations of CH4 and SF6 were determined by gas chromatography EMBRAPA Environment, Jaguariuna SP. The statistical design was a randomized complete block for the two evaluations, with the pickets portions (6 animals in each paddock for performance and two animals for the production of methane), totaling 12 experimental units. Data were analyzed using the statistical package SAS 9.2 MIXED procedure (SAS, 2008). Means were compared using the "t" test to the 10% level of significance, considering tendency to 15% significance level.

Results and Discussion

The forage characteristics throughout the experimental period were similar (Table 1) (P = 0.20), ensuring that the pasture caused no influence on the treatments. The treatments did not change the final weight (P = 0.75) of animals, consistently, there was also no effect on average daily gain (P = 0.59). It was expected that modulation of ruminal fermentation caused by nitrate could increase the energy available for the reduction of methane animals and hence improve performance. This result probably did not occur at lower consumption of supplementation (P <0.02) animals fed with nitrate (Table 1). With the reduction in consumption, lower is the contribution of available nutrients, it reduces the benefits caused by ruminal modulation. In the dry season pasture presented low quality, with high proportions of fiber, low energy and protein intake, in this scenario the lower consumption of supplement can be very impactful. An indication that the use of the use of nitrate, positively modulates ruminal fermentation efficiency is the use of the supplement, which tended (P = 0.12) improvement for animals supplemented with it.

The enteric methane production of the animals showed a decreasing trend (P = 0.11) of 17% when encapsulated nitrate was added to the supplement. However, this reduction was not more pronounced probably due to lower consumption in this treatment. The dose of nitrate consumed by the animals had CH_4 mitigation theoretical potential of 29 g, with real value observed 30 g, validating the efficiency of use of the product as mitigating CH_4.

Table 1. Quantitative characteristics of Panicum Maximum cv. Tanzania and performance of Nellore during the dry season getting protein-energy supplement with or without encapsulated nitrate

Variable	Treatment		EPM	*P. Value*
	Control	Nitrate-encapsulated		
forage characteristics (n: 12 paddocks)				
Herbage mass (kg DM / ha)	4114	3992	175	0,60
Green leaf (%)	7,29	6,91	0,99	0,79
Green stalk (%)	15,0	15,7	1,73	0,68
Dead leaf (%)	34,3	33,2	1,33	0,55
Dead thatch (%)	43,3	44,1	1,68	0,73
Offer (kg DM / kg BW)	6,97	6,76	0,79	0,60
Animal performance (n = 12 paddocks (72 animals) and methane n: 12 paddocks (24 animals))				
Initial weight (kg)	197,5	197,1		
Final Weight (kg)	259,6	257,3	13,48	0,75
Average daily gain (kg)	0,545	0,529	0,020	0,59
Supplement intake (g / kg BW)	6,02 a	5,38 b	0,010	0,02
Feed efficiency (kg gain / kg supplement)	0,40	0,44	0,040	0,12
Methane production (g / day)	180,7	150,5	23,0	0,11

Means followed by different letters differ in line by "t" test to the 10% level of significance.

Conclusions

The addition of nitrate-encapsulated supplement for grazing cattle in the dry season can be an alternative to the use of urea, without sacrificing performance, with possible environmental benefits by reducing the production of methane. Thus, the group continues conducting research in the same line to consolidate these results.

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