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Relações entre consumo e emissão de metano por bovinos em pastagem natural no sul do Brazil

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Resumo: Objetivou-se estudar as relações entre a emissão de metano e o consumo de matéria seca e de fibra em detergente neutro em bovinos mantidos em pastagem natural do sul do Brasil. O estudo foi realizado em área pertencente a Embrapa Pecuária Sul, localizada no município de Bagé, Rio Grande do Sul. Foram avaliadas quatro estações do ano de 2013; verão (21 de janeiro), outono (29 de abril), inverno (22 de julho) e primavera (28 de outubro). As avaliações de consumo foram feitas com o auxílio do marcador alcano e as medições de metano emitido pelos animais através do gás traçador hexafluoreto de enxofre (SF_6). As relações entre a emissão de metano e o consumo de matéria seca e de fibra em detergente neutro pelos animais em todas as estações do ano, com grande variação entre os animais. O maior coeficiente de determinação foi no verão (R^2 = 0,1876 e 0,1834 para o consumo de MS e FDN, respectivamente). A quantidade de alimento consumido diariamente por bovinos de corte mantidos em pastagem natural não esteve associada com as emissões de metano. São necessários mais estudos para determinar quais são os fatores que devem estar influenciando a emissão de metano entérico.

Palavras–chave: alcano, bioma Pampa, consumo diário, FDN, gases efeito estufa

Relationship between intake and methane emission by steers on natural pasture in southern Brazil

Abstract: The objective was to study the relationships between methane emissions and dry matter, and between methane emissions and neutral detergent fiber intake in cattle on natural grassland of Rio Grande do Sul. The study was conducted in the Embrapa Southern Region Animal Husbandry, located in Bagé, RS. Four seasons were evaluated in the year 2013: summer (January 21), fall (April 29), winter (July 22) and spring (October 28). The dry matter intake (DMI) was measured by n-alkanes and the methane emissions using the sulfur hexafluoride technique (SF_6). There was a negligible relationship between methane emissions and dry matter, nor between methane emissions and neutral detergent fiber intake for animals in all seasons, with high variation among animals. The best determination coefficient was in summer (R^2 = 0.1876 and 0.1834 for the DM and NDF, respectively). The amount of food consumed daily by beef cattle raised on grasslands was not associated with methane emissions. More studies are needed to determine which are the factors that may be influencing the enteric methane emissions.

Keywords: alkane, daily intake, greenhouse gases, NDF, Pampa biome,

Introduction

There is little knowledge about the amount of methane emitted by animals in production systems used in South America, especially by animals raised in the Pampa biome. In fact, there are a few data about methane emissions from beef cattle grazing as of yet. Natural and semi-natural pastures are rich in diversity often composed of species of plants with high cell wall content and therefore lower digestibility (Richmond et al., 2015). Ellis et al. (2009) stated that the use of variables such as dry matter intake, metabolizable energy intake, NDF, cellulose and hemicellulose contents in the prediction equations of methane production by beef cattle improve the accuracy of the results. These findings indicate that these variables have a strong influence on the amount of methane produced by animals' digestion. Thus, the objective was to study the relationships between methane emissions and the dry matter, and between methane emissions and neutral detergent fiber intake in cattle on natural grasslands in southern Brazil.

Material and Methods

The study was conducted in the Embrapa Southern Region Animal Husbandry, located in Bagé, Rio Grande do Sul. The soil of the area chosen to apply the treatments was of the LUVISSOLO Háplico Pálico abrúptico class. The total area used was 61 ha, subdivided into nine paddocks of about 7 ha each. In the paddocks different intensification levels in the use of natural pasture were tested: natural grassland (NG), natural grassland fertilized with nitrogen (NGF) and natural grassland fertilized with nitrogen and overseeded with exotic cool-season species (NGFS). The species used were annual ryegrass (*Lolium multiflorum* Lam.) and red clover (*Trifolium pratense* L.). Treatments were started in the area in 2005. In August 2012, Hereford steers averaging 10 months and 180 kg were introduced into the area to finishing. 27 animals were used for the measurements, three in each paddock. The grazing method was continuous with variable stocking, with enough animals to keep the herbage allowance to 12 kg of dry matter.100 kg^{-1} of body weight (BW; 12% BW). The experimental design was a complete randomized design with three replications areas. Four seasons were evaluated in the year 2013: summer (January 21), fall (April 29), winter (July 22) and spring (October 28).

The animals received cellulose pellets with n-alkane dotriacontane (C_{32}) daily in the morning (8 am) and in the afternoon (4 pm), for 10 days of each experimental period. From the fifth day of dosing, faeces samples were collected twice daily, one in the morning and one in the afternoon, prior the administration of the C_{32} pellet. The faeces samples from all days of collection per season per animal were thawed, homogenized and a sub-sample per animal per season was made. After drying, the faeces were ground in a Wiley mill with 1 mm sieve, identified and stored for later analysis. Forage samples were collected by hand plucking, one for each animal, dried, ground and stored for analysis. After collection, samples were dried at 55 ° C for 72 h, ground and used for the following analyses: DM at 105 ° C for 12 hours; organic matter (OM) by burning in a muffle furnace at 550 ° C, neutral detergent fiber (NDF) without the use of amylase. The determination of alkanes present in the forage and the faeces was performed according to the protocol described by Dove and Mayes (2006).

To study methane emissions from animals we used the technique of sulfur hexafluoride tracer (SF_6). Methane samples were collected close to the animal's nose for five days per trial period. The methane concentrations and SF_6 were determined by gas chromatography.

The relationships between DMI and methane emissions, and between NDF intake (NDFI) and methane emissions per animal evaluated in each season were tested by regression analyses using JMP statistical software (JMP version 9.0.0, 2010).

Results and Discussion

There was a negligible relationship between DMI and methane emission (P>0.05) for all seasons studied (Figure 1). Savian et al. (2014) observed positive linear relationship between the dry matter intake and total methane emission in sheep grazing Ryegrass. For this study, the animals had only one specie to choice to intake.. It is worth remembering that in our study the animals were in heterogeneous environment with large specie diversity, where the options to intake of different forage species was high, which may have led to a greater variability between animals.

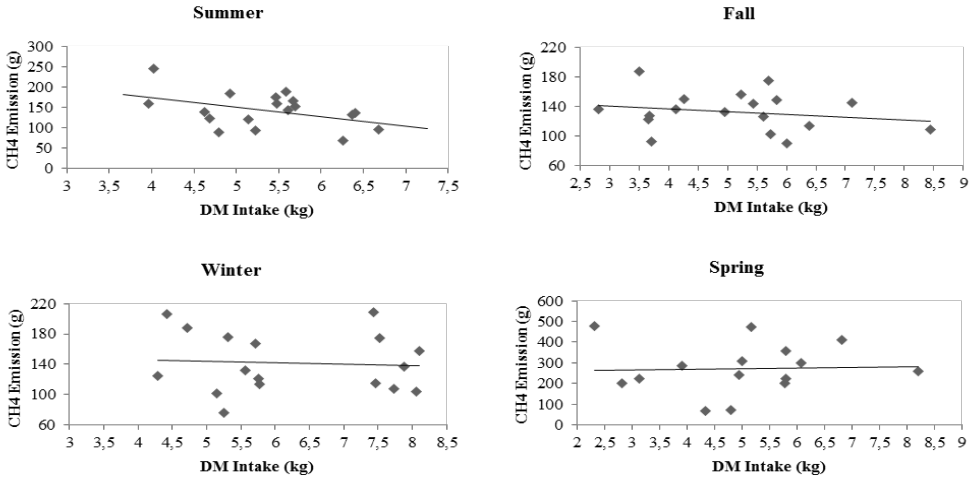

Figure 1. Relationships between daily dry matter intake (DMI, kg) and methane emission ($g.day^{-1}$) by steers. Summer (y = -23.545x + 268.72; R^2 = 0.1876; P=0.0725), fall (y = -3.7721x +

152.20; R^2 = 0.0426; P=0.4114), winter (y = -2.1794x + 155.29; R^2 = 0.0057; P = 0.7726), spring (y = 3.1145x + 257.50; R^2 = 0.0016; P = 0.1832).

Likewise the DMI, no relationship was observed between methane emission and NDFI by the animals (P>0.05) in the different seasons of the year (Figure 2). Pinares-Patiño et al. (2003) observed a good relationship between NDFI and methane emission (r=.61) by cows grazing monospecific pasture of Phleum pratense. However, the correlation between NDFI and methane emissions were not significant in this study. These results showed that the animal's grazing behavior on grasslands, other factors must have been influencing DMI, NDFI and methane emissions. Cezimbra (2015) studied the relationship between structural traits of natural pasture and DMI and its consequences on methane emissions. He found the structural sward traits affect the DMI and the methane emissions and it explained more than half of DMI an methane emissions variation from the animals grazing grasslands.

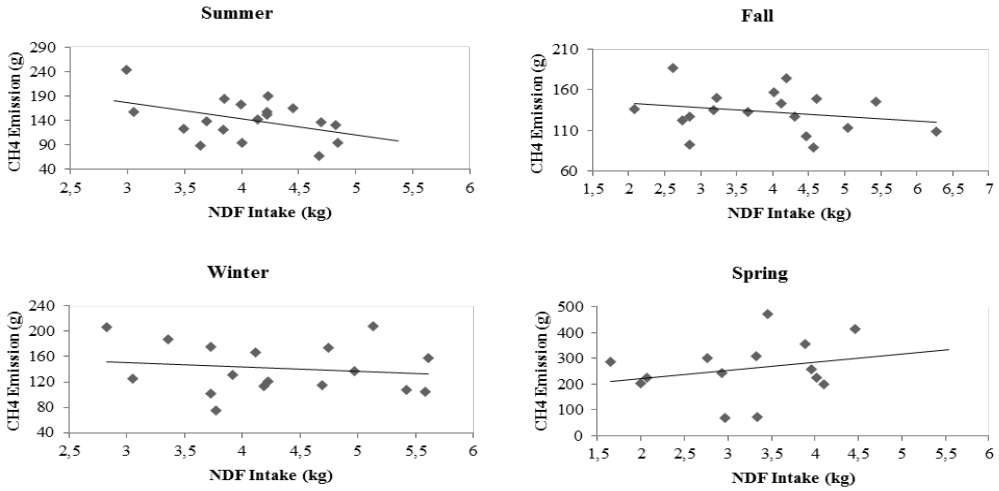

Figure 2. Relationships between daily NDFI (kg) and methane emission (g. day^{-1}) by steers. Summer (y = -33.10x + 276.34; R^2 = 0.1834; P=0.0762), fall (y = -5.3556x + 153.77; R^2 = 0.0503; P=0.3710), winter (y = -6.9688x + 171.64; R^2 = 0.0233; P=0.5589), spring (y = 32.249x + 155.04; R^2 = 0.0607; P=0.5540).

Conclusions

The amount of food consumed daily in beef cattle raised on grasslands was not associated with methane emission.

More studies are needed to determine which are the factors that may be influencing these variables.

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