Determination of methane production on grass fed goats

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Introduction Methane emissions from cattle are already known, but for goats that value is still estimated (IPCC, 2006). Around the world, the number of goats is estimated on 910 million head, mostly are raised on pasture. To measure the methane production from animals under grazing conditions, the sulfur hexafluoride (SF_6) tracer technique is considered appropriate for cattle.
This study aimed to adapt the SF_6 technique to use in small ruminants, and measure the methane (CH_4) emission in goats under grazing conditions.

Material and methods Two experiments were performed. The first was to adapt the SF_6 tracer technique, described by Johnson *et al*. (1994) for measure in goats and the second had the objective of quantifying the emission of CH_4 from these animals. The first study we used one adult male weighing 78.5 kg, under generous grazing conditions to test adaptations. The major adjustments were: making collector cylinders with a capacity of 2 liters, although smaller, and the change of position from the neck to the back of the animal with the aid of an apparatus similar to a saddle, so not to adversely affect the movements and access to food (Figure 1). Another important test was related to the emission rate of tracer gas capsules, on which were evaluated, in the animal, two emission rates (622 and 1217 ng / min.). For each emission rate, four samples of methane eructed by the animals were collected. Concentrations of CH_4 and SF_6 in the collection cylinders were measured by gas chromatography, for such the cylinders were positively pressurized with N_2 and connected directly into the chromatograph (Agilent ® Model 6890). From the known rate of clearance of the tracer gas in the rumen, and concentrations of methane and trace gas in gas samples captured, the methane release by the animals were calculated. In order to quantify the methane emissions the second trial was initiated with five goats, adult females of the Anglo Nubian breed, with an average weight of 54.4 kg under intermittent stocking, grazing for 11 hours in areas formed with *Panicum maximum* cv. Tanzania, with *ad libitum* access to water and mineral salt, being gathered into the fold at night.

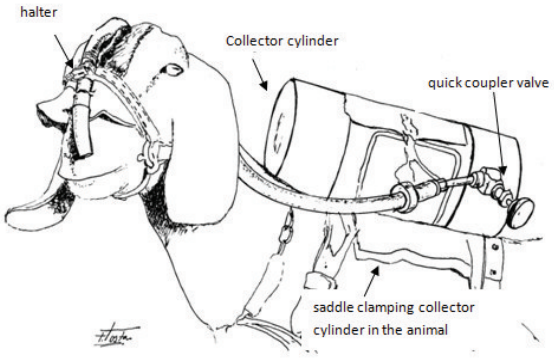

Figure 1. Goats with halter and methane collector cylinder

Based on the results of the first experiment, the capsules introduced into the rumen were in the range of 500 to 1,000 ng/min. emission of SF_6. The pre evacuated collector cylinders (-12.00 to -12.60 psi) were placed in the animals at 7am before releasing them in the grazing area and changed every 24 hours. The collections were made for six consecutive days. The statistical analyses in experiment 1 was the Pearson's correlation between CH_4 and CF_6 concentration, and in experiment 2 the GLM procedure was used to test the model, and the Student Newman Keuls Test to analyze the averages considering 5% of probability.

Results In experiment 1, the average CH_4 emission was 1.4 ± 0.2 and 1.2 ± 0.1 g/day/metabolic body weight (body weight$^{0.75}$) for emission rates 622 and 1217 ng/min. respectively. Highest correlation was observed between the concentrations of SF_6 and CH_4 in the samples taken when the animal received the capsule with emission of 622 ng/min. ($r = 0.99$) when compared with the rate of 1217 ng/min ($r = 0.41$). In the second experiment the average CH_4 emission was 17.59 g/day/animal or 0.88 g/day/ metabolic weight for the goats used in the experiment, corresponding to 0.91 g/day or 5.3 kg/year in 40 kg goats.

Conclusions After adjustments, the SF_6 methodology was considered adequate for measuring methane emission on grass fed goats. The emission of methane per kg of metabolic body weight of 0.91 g/day or 5.3 kg/year for 40 kg goats can be used as reference in grazing goats. This value is close to the one estimated by IPCC of 5 kg/year.

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IPCC: Revised IPCC. Cambridge: University Press, 2006.