Effect of release rate of the SF6 tracer on methane and carbon dioxide emission estimates based on ruminal and breath gas samples

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T06. Effect of release rate of the SF6 tracer on methane and carbon dioxide emission estimates based on ruminal and breath gas samples

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Release rate (RR) of SF_6 tracer appears to be positively associated with CH_4 emission estimates. Gas samples of breath and of ruminal head space were collected simultaneously in order to evaluate the hypothesis that transactions of SF_6 in the rumen are the source for this relationship. Six non-lactating dairy cows fitted with rumen cannulae were subdivided in two groups and randomly assigned in a two-period cross-over design to permeation tubes with low (LRR=1.577 mg/d) or high (HRR=3.147 mg/d) release rate (RR). Each period consisted of 3-d gas sampling. The cows were limited fed on maize silage (80% ad libitum) and split into two meals (40% at 0800 and 60% at 1600). Ruminal gas samples (50 mL) were withdrawn throughout the cannula equipped with stoppers avoiding to open the cannula, immediately before the morning feeding and then each hour over 8 h. Simultaneously, 8-h integrated breath gas samples were collected on the same period. Ratios of concentration of CH_4/SF_6, CO_2/SF_6 and CO_2/CH_4 and emission estimates of CH_4 and CO_2 were calculated for each sample source using the SF_6 tracer technique principles. As expected, the LRR treatment yielded higher ($P<0.001$) ruminal CH_4/SF_6 (by 1.84 times) and CO_2/SF_6 (by 1.87 times) ratios than the HRR treatment, but these differences were lower than the 2.0 times difference expected from the RR between the LRR and HRR. Consequently, the LRR treatment was associated with lower ($P<0.01$) ruminal emissions of CH_4 over the 8-h collection period than with the HRR treatment (101 vs. 114 L, respectively), a difference also confirmed by the breath samples (110 vs. 123 L, respectively). RR treatments did not differ ($P=0.53$) in ruminal or breath CO_2 emissions. Relationship between rumen and breath sources for CH_4 emissions were better for LRR than for HRR treatment, suggesting that tracer performance is better at lower RR of SF_6. Hypothesis is discussed in regards to the mechanism responsible for the relationship between RR and emission estimates. The use of permeation tubes with small range in release rates appears essential in animal experiments.

T07. Nitrous oxide emissions from grassland in animal agriculture production systems in Uruguay

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In Uruguay, there is a growing awareness among scientists and the society about the impacts of grazing animals on nitrous oxide (N_2O) emissions due to the importance of the bovine meat production sector in the national economy. The national inventory estimated that agricultural activities are responsible for more than 90% of N_2O emissions being the animal agriculture sector is the main contributor with more than 80%. These estimations are based on the Tier 1 or Tier 2 methodologies using IPCC default emission factors. However, it is well known that N_2O emissions are very dependable on local factors such as type of pasture, soil properties, and climatic conditions. The general objective of the present study is to quantify N_2O emissions from grassland systems in Uruguay and to compare the measured data with estimations using IPCC factors. The specific objectives are: 1) to quantify the effect of seasonal climate and pasture type on N_2O emissions from bovine urine in Uruguay; and 2) to develop country specific N_2O emission factors for bovine urine. Experiments are conducted on two sites, one on an exotic pasture (experiment 1, with > 18% protein) and the other one on a native pasture (experiment 2, with < 8% of protein). Stainless steel chambers were installed at each field site one month prior to treatment application. Chambers are 40 cm in diameter and are inserted 10 cm into the soil surface. A 25-cm-high stainless steel headspace cover with a thermal membrane insulation is used to form the chamber headspace. Two treatments were applied in March 2010, urine application and control, arranged in a complete randomized block design with four repetitions. Urine was collected from meat cows grazing the same