Proceedings of the *Society of Nutrition Physiology*

Berichte der Gesellschaft für Ernährungsphysiologie

Editor: Society of Nutrition Physiology
Herausgeber: Gesellschaft für Ernährungsphysiologie

Volume 26, 2017
Band 26, 2017

71st Conference 14th – 16th March 2017 in Göttingen
71. Tagung vom 14. – 16.03.2017 in Göttingen

- Review *(Übersichtsreferat)*
- Abstracts *(Kurzfassungen der Originalmitteilungen)*
- Communications of the Committee for Requirement Standards of the Society of Nutrition Physiology *(Mitteilungen des Ausschusses für Bedarfsnormen)*

24.

Methane emissions from grazing dairy cows: comparison of data using the sulphur hexafluoride tracer technique and the GreenFeed system

Methanemission weidender Milchkühe: Vergleich von Daten gemessen mit der Schwefelhexafluorid-Tracertechnik und dem GreenFeed System

*Dohme-Meier F., Denninger T., Dufey P.- A., Martin C., Rochette Y., Schwarm A., Kreuzer M., Münger A. – Posieux/ Zurich/Theix

Enteric methane (CH4) emissions are produced as a result of ruminal fermentation and represent an energy loss to the animal, which can vary between 2-12% of gross energy intake. In order to quantify methane emissions from grazing ruminants and to develop nutritional strategies to mitigate CH4 emissions on pasture it is necessary to evaluate methods for efficient collection of data from animals in their accustomed environment regarding their accuracy and feasibility. The sulphur hexafluoride (SF6) tracer technique is an established method to measure ruminal CH4 emissions from free-ranging ruminants (1) but it is labour intensive. The GreenFeed (GF) system (C-Lock Inc., Rapid City, SD, USA) may be an alternative (2). It is a mobile device measuring respiration gas output during voluntary visits of a feeding station. However, up to now it is still unclear how many days of measurement are necessary to obtain reliable data on CH4 emission per cow per day. The objective of the present study was to determine the extent to which data obtained from dairy cows with the GF system reflect those using the SF6 technique by assessing relationships and differences of emission data from the two methods.

Methods: The study was carried out with 13 multiparous Holstein-Friesian dairy cows averaging 21.7 ± 4.7 kg/d of milk and 589 ± 25 kg of body weight. The cows grazed as a single herd on a pasture without concentrate supplementation. Before the measurements started, the cows got accustomed to the GF system and were equipped with a calibrated permeation tube releasing SF6, which was administered orally in the forestomach using a balling gun. During a 5-d period, when the SF6 tracer technique and the GF system were applied simultaneously, daily individual respiration gas samples were collected into evacuated canisters fixed on the cows' back; a collection tube with capillary controlled flow was connected with the canister and mounted on a halter such as to position it close to the nostril. Daily CH4 emission was calculated from the SF6 release rate (4.31 ± 0.72 mg/d) and CH4/SF6 ratio of the gas sample, taking background concentrations of the two gases into account. The daily CH4 estimations from GF were based on integrating measurements of ventilation air flow and gas concentration during visits to GF, which were delimited by detection of head proximity. Visits were encouraged by offering small portions (33 g) of bait feed (pelleted dried whole maize plant); this up to eight such portions per visit. Overall, the GF measurements were performed during a period of 11 consecutive days. Within this period daily CH4 emission data were averaged per cow over 5 d (P1), 7 d (P2) and 11 d (P3) and compared with daily CH4 emission data determined with the SF6 technique and averaged per cow over the 5-d sampling period. Data were analysed with the ANOVA procedure of SYSTAT 13 and Spearman rank correlation coefficients were calculated.

Results: The average number of GF visits was 1.64 ± 0.72, 2.23 ± 0.56, 2.24 ± 0.52 times per day for P1, P2 and P3, respectively. Using P1, the estimated CH4 emission (g/d) from the GF (331 ± 54) was higher (P4 emission determined by the SF6technique (245 ± 39). The same was observed using P2 and P3 with greater ($P<0.001$) emission values found with GF (318 ± 35 and 311 ± 35 g/d). The Spearman correlation coefficient between the methods was moderately high in P1 (0.57, $P = 0.042$) but slightly improved when increasing the observation time with GF in P2 (0.59, $P = 0.036$) and P3 (0.62, $P = 0.025$).

Conclusion: Overall, the CH4 emissions estimated by GF were higher than those obtained using the SF6 technique. Number and temporal distribution of GF spot measurements relative to patterns of CH4 emission may partly explain this. Spearman correlation of ranked individual emissions shows moderate relationship between the methods. The correlation got slightly stronger and the variation within the GF measurements lower when the measurement period with the GF was extended from 5 to 11 d. Further studies have to show whether there is a systematic overestimation of CH4 emission with GF on pasture which can be corrected by standard adjustments.

1) JOHNSON, K, HUYLER, M, LAMB, B, WESTBERG, H, ZIMMERMAN, P (1994): Environ. Sci. Technology 28, 359-362.
(2) HRISTOV, AN, OH, J, GIALLONGO, F, FREDERICK, T, WEEKS, H., ZIMMERMAN, PR, HARPER, MT, HRISTOVA, RA, ZIMMERMAN, RS, BRANCO, AF (2015): J. Vis. Exp. 103, e52904.

*Agroscope, Tioleyre 4, 1725 Posieux, Switzerland, frigga.dohme-meier@agroscope.admin.ch