



## Ruminal methanogens are enhanced by tropical environment

Moufida Rira, Diego Morgavi, Milka Popova, Carine Marie-Magdeleine, Tatiana Silou-Etienne, Harry Archimède, Michel M. Doreau

### ► To cite this version:

Moufida Rira, Diego Morgavi, Milka Popova, Carine Marie-Magdeleine, Tatiana Silou-Etienne, et al.. Ruminal methanogens are enhanced by tropical environment. 5. Greenhouse Gases and Animal Agriculture Conference (GGAA 2013), Jun 2013, Dublin, Ireland. 1 p. hal-02745240

**HAL Id: hal-02745240**

**<https://hal.inrae.fr/hal-02745240>**

Submitted on 3 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## Ruminal methanogen population is enhanced by tropical environment

M Rira<sup>1</sup>, D P Morgavi<sup>1</sup>, M Popova<sup>1</sup>, C Marie-Magdeleine<sup>2</sup>, T Silou-Etienne<sup>2</sup>, H Archimède<sup>2</sup>, M Doreau<sup>1</sup>

<sup>1</sup>INRA, Saint-Genès Champanelle, France, <sup>2</sup>INRA, Petit-Bourg, Guadeloupe Email: [michel.doreau@clermont.inra.fr](mailto:michel.doreau@clermont.inra.fr)

**Introduction** Ruminants fed tropical forages would produce more enteric methane (CH<sub>4</sub>) than those fed temperate forages because of structural and physiological differences between C4 plants, native of tropical areas, and C3 plants, native of temperate areas. Methane production is closely linked to rumen microorganisms such as cellulolytic bacteria and protozoa that produce hydrogen and methanogens that use this hydrogen to produce CH<sub>4</sub>. The environment, the diet and the animal breed can influence the composition and hence the function of the rumen microbial ecosystem. A companion abstract showed that CH<sub>4</sub> emissions were higher with C4 forages than with C3 forages but that the environment or breed had no effect (Archimède *et al.*, 2013). This study aimed to understand these differences in CH<sub>4</sub> emissions between temperate and tropical sites by monitoring selected rumen microbial populations.

**Material and methods** Two parallel experiments were carried out in temperate (France) and tropical (West Indies) environments with the same forages in a double 4×4 Latin Square design (one per site). We used two breeds, Texel (T), temperate origin, and Blackbelly (B), tropical origin. Animal of both breeds were born and grown in the environment where they were used for the experiment. In both sites, sheep were fed forages from permanent grasslands grown in temperate or tropical areas. For each forage, there were two maturity stages which determined forage quality (high H and low L quality). Rumen contents were sampled before morning feeding. Microbial groups (total bacteria, *Fibrobacter succinogenes*, *Ruminococcus albus*, *Ruminococcus flavefaciens* and total methanogens) were enumerated by quantitative PCR (qPCR) using group-specific primers targeting the *rrs* gene for bacteria and the *mcrA* gene for methanogens. Protozoa were counted by microscopy. Statistical analyses were performed using the mixed procedure of SAS with period, site, forage, breed, and their interactions as fixed effects and animal as random effect. Statistical differences were declared significant at P ≤ 0.05.

**Results** Concentrations of total rumen bacteria, *F. succinogenes* and methanogens were higher in the tropical environment (Table 1). The number of methanogens was higher in sheep fed C4 grasses than in those fed C3 grasses. There was not site effect on *R. albus* but a breed×site interaction was observed. There was no difference in *R. flavefaciens* numbers between sites, breeds and type of forage (average 6.56 *rrs* copies/g DM log<sub>10</sub>). Protozoal numbers were similar among sites, type of forage and breeds but a site× forage interaction was observed.

**Table 1** Rumen microbes of Texel and Blackbelly sheep fed C3 and C4 forages in 2 sites

Forage Breed	C3-H		C3-L		C4-H		C4-L		s.e.m.	P
	B	T	B	T	B	T	B	T		
Total bacteria ( <i>rrs</i> copy number/g DM (log <sub>10</sub> ))										
France	11.64	11.64	11.46	11.41	11.49	11.47	11.26	11.17	0.089	<0.001 (Site), 0.019 (Forage) 0.001 (Site*Forage)
West Indies	11.51	11.59	11.61	11.80	11.71	11.74	11.62	11.65		
<i>Fibrobacter succinogenes</i> ( <i>rrs</i> copy number/g DM (log <sub>10</sub> ))										
France	9.67	9.78	9.57	9.59	9.60	9.54	9.42	9.30	0.143	<0.001 (Site)
West Indies	9.06	9.00	9.23	9.41	9.13	9.27	9.10	9.03		
<i>Ruminococcus albus</i> ( <i>rrs</i> copy number/g DM (log <sub>10</sub> ))										
France	8.76	8.76	7.19	8.43	8.33	7.81	7.86	7.67	0.302	0.009 ( Site*Forage)
West Indies	7.57	7.62	8.07	8.48	8.45	8.47	8.00	8.17		
Total methanogens ( <i>mcrA</i> copy number/g DM (log <sub>10</sub> ))										
France	8.92	8.93	8.91	8.80	8.83	8.89	8.71	8.65	0.072	<0.001 (Site), 0.013 (Forage) 0.004 (Site* Forage)
West Indies	8.93	9.22	9.20	9.31	9.24	9.26	9.23	9.09		
Total protozoa (log <sub>10</sub> cells / ml)										
France	6.21	6.26	6.36	6.36	6.12	6.22	6.16	5.96	0.10	0.008 (Site* Forage)
West Indies	6.94	5.45	6.13	6.31	6.15	6.33	6.34	6.45		

**Conclusions** Methanogens along with total bacterial numbers were higher in sheep raised in the tropical environment. However, this factor does not seem to concur with actual methane emissions from the same animals that were more affected by other factors such as forage type and quality.

**Acknowledgements** The authors gratefully acknowledge funding from the French government (EPAD project, ANR)

## Reference

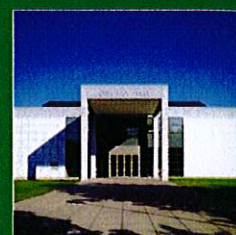
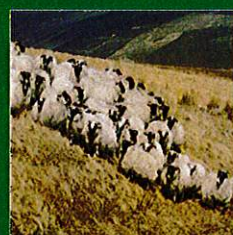
Archimède, H., Rira, M., Eugène, M., Morgavi, D.P., Anaïs, C., Periacarpin, F., Calif, B., Martin, C., Marie-Magdeleine, C., and Doreau, M., 2013. Proceedings of GGAA Conference.



ISBN 978-0-906562-69-7  
ISSN 2040-4700

JUNE 2013

VOLUME 4 PART 2



# Advances in Animal Biosciences

Proceedings of the 5th Greenhouse Gases and  
Animal Agriculture Conference (GGAA 2013)

**CAMBRIDGE**  
UNIVERSITY PRESS

