

STSM Report

Easy to record and inexpensive proxies for methane emissions to be used for genetic evaluations

General info:

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Host institution: Agri-Food and Biosciences Institute (AFBI), Hillsborough, County Down UK

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Purpose of the visit

Enteric methane mitigation strategies in ruminants require accurate quantification of methane production under practical conditions. Calorimetric chambers and sulfur hexafluoride are used to obtain quantitative methane production data of individual animals. The chamber method is regarded as 'gold' standard for measuring the daily production of methane from housed animals but has limited capacity with regards to the number of animals. Therefore it cannot be used for screening animals, e.g., for assessment of heredity of methane emission. The sulfur hexafluoride technique can be used in grazing or stall-fed animals, however, its methane estimates is associated with a greater variation than those using the respiration chambers. Also, these technical devices are difficult, labour intensive and expensive. Thus, it is important to develop rapid, robust and easily-applied techniques to estimate enteric methane emissions from dairy cattle and beef cattle. The purpose of this visit was to learn and practice all the activities related to the effects of dietary inclusion of white clover on enteric methane emissions of lactating dairy cows in a zero grazing study and also evaluate milk and faeces MIR (mid-infrared) estimates of methane emissions using respiration calorimeter measurements.

Description of the work carried out during the STSM

During my stay at AFBI Hillsborough I joined the experiment of Dr. Tianhai Yan's PhD student in Agri-Food and Biosciences Institute. When I arrived at AFBI-Hillsborough, the experiment had just started. David Wills, the head operator of the respiration facility in AFBI Hillsborough, explained a lot of details concerning the design and function of the chambers. During my STSM, I carried out some routine activities such as feeding cows, taking samples from faeces, urine and rumen, cleaning the chambers, operation and control of the respiration chamber. During the STSM, I had also the opportunity to participate to other activities carried out at the AFBI Hillsborough. The sulfur hexafluoride method was shown by David Wills. I worked in the Lab on the analysis of milk related with proxies of methane production. Additionally Dr. Tianhai Yan, the head of Ruminant Nutrition Laboratory in AFBI Hillsborough, explained in detail about the milk and faeces MIR estimates of methane emissions using respiration calorimeter measurements.

Main results

This STSM enabled me to understand all the processes related with respiration measurements from the customization of the animals to the chambers until the analysis of the data. I had the opportunity to understand some routine activities on the care of these equipment and others like calibration of them. Also, I learned how to evaluate milk and faeces MIR estimates of methane emissions using respiration calorimeter measurements. It was good to get to know another approach to methane estimation.

The calorimeter chamber study I was involved in AFBI was to evaluate the effect of replacement of fresh grass with fresh white clover on energy utilisation efficiency and methane emissions of lactating dairy cows in a zero-grazing experiment. The feeding study was completed just prior to the end of my visit, but the laboratory analysis of feed, milk, faeces and urine samples had not been finished at the time for preparation of this report. The preliminary results indicate the clover treatment had little effects on feed intake, milk yield and methane emissions. Feeding white clover can reduce the application of nitrogen fertiliser and use of protein feed ingredients (e.g., soyabean meal), thus reducing total greenhouse gas

emission per kg of milk production in the life cycle assessment of carbon footprint within farm gate.

Future collaboration with the host institution.

First time I worked with the respiration chamber. When go back home, I will try to establish these units in my department in collaboration with my colleagues. Thus, I will stay in contact with AFBI Hillsborough, but also with other institutions using the respiration chamber, in the future.

Foreseen publications/articles resulting or to result from the STSM

The experiment finished two weeks ago before my STSM finished. There are still some laboratory and statistical analysis need to be done. After analysis, if we succeeded in feasibility of direct methane prediction from milk and faeces MIR spectra, this could be used to identify low-methane emitting cows. The results of this study are expected to be published in the future. The published articles will be shared with METHAGENE network. The METHAGENE network would benefit from this information to be used for genetic evaluations.

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Acknowledgements

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Confirmation of the host institution of the successful execution of the STSM

See the attached letter from the host institution

