

Report to the Stapledon Memorial Trust

1. Information of Fellow

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2. Main purpose of the Fellowship

- Review existing knowledge of ruminant nutrition and methane emission of ruminant agriculture
- Determine the potential for high water-soluble carbohydrate (WSC) perennial ryegrass to decrease methane emissions per animal and per unit output
- Learn methodologies to assess plant chemical composition and measure methane emissions from ruminants using both *in vitro* and *in vivo* methodologies.

3. Dates for start and end of Fellowship

Start date: 20 March 2008

End date: 15 January 2009

4. Name of the UK lead organisation and contact person with address and email

Leader: Prof Nigel D Scollan

Email: nigel.scollan@aber.ac.uk

Telephone: +44-1970-823075

Lead organisation: Institute of Grassland and Environmental Research (IGER) (before 1 April 2008), and then the Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University (After 1 April 2008 due to merger)

Address: Plas Gogerddan
Aberystwyth
SY23 3EB, UK

5. Outline of work done during the Fellowship

I was involved in several experiments and research activities during my visit funded by the Fellowship as outlined below:

- Monitoring water-soluble carbohydrate and nitrogen contents from mono- and mixed-culture high WSC perennial ryegrass differing in its heading dates with or without white clover (Experiment PG125)
- Measuring methane production and microbial profile in the rumen from three high water-soluble carbohydrate perennial ryegrass monocultures differing in their heading dates using RUSITEC (Experiment PG127)
- Examining the effect of water-soluble carbohydrate and nitrogen in fresh forage on the utilisation of nitrogen and methane production by growing lambs (Experiment TR195)
- Examining the effect of grass polyphenol oxidase activity on methane production, microbial protein synthesis and C18 polyunsaturated fatty acid biohydrogenation using RUSITEC (Experiment PG128)
- Monitoring diurnal variation of gas production of high sugar ryegrass (*Lolium perenne* L.) (Experiment PG125A)

I attended four meetings during the fellowship visit as outlined below:

- 2008 Annual Conference of BSAS (British Society of Animal Science). Scarborough, UK. 31 March - 2 April 2008. This trip was supported by Professor Nigel Scollan, Animal and Microbial Sciences Division, Aberystwyth University.
- Meeting of collaboration with Agri-Food and Biosciences Institute. Belfast, UK. 22-23 June 2008. This trip was supported by Professor Nigel Scollan, Animal and Microbial Sciences Division, Aberystwyth University.
- 2008 Joint Meeting of XX International Grassland Congress and XIII International Rangeland Congress. Hohhot, China. 28 June – 5 July 2008.
- Project meeting of Ruminant Nutrition Regimes to Reduce Methane and Nitrogen Emissions. Wolverhampton, UK. 14-15 November 2008. This trip was supported by Professor Nigel Scollan, Animal and Microbial Sciences Division, Aberystwyth University.

6. Indication of experience gained or contacts made that will be of particular value for the Fellow or their organisation

In order to improve the productivity and sustainability of farming systems in western China, my research focuses on analysis of greenhouse gases emission of the integrated crop/rangeland-livestock production system. Research experiences that I have gained during my visit will be extremely valuable to strengthen my research in those areas. Some specific details I have experienced in terms of research methodologies as following:

- Application of continuous rumen simulation technique (RUSITEC) and *in vitro* gas production technique to simulate rumen metabolism. Both techniques are very quick and cheap method to evaluate herbage and therefore are easily adaptable and useful in my laboratory. I will employ these technologies to evaluate native herbage in my long-term grazing experiment, which started in 2001.
- Using high WSC perennial ryegrass to improve N use efficiency and reduce greenhouse gas emissions. There are diverse ruminant production systems in China with high N pollution and

low N use efficiency. Novel forages with a high level of WSC content will provide new opportunities for the animal production industry in China. I have already introduced two groups of ryegrass varieties in Loess Plateau and Hexi Corridor respectively, and all varieties are performing very well so far.

- Using both dry (using Near-Infrared Spectroscopy) and wet (traditional) chemical method to analyse chemical composition of herbage. In the near future we will be developing a laboratory to study the interaction between herbage and the animal and both dry and wet methods of herbage nutrient analysis will play a key role in this study. Further collaboration between the UK and China is expected on this issue.

I also have gained some novel research ideas, as following:

- To develop more internal and international collaboration and share interests via frequent communication. One of the projects which I have been involved in is associated with five universities and another one will be conducted in three countries. It is a very good opportunity to learn from each other.
- To develop a systematic study of the interaction between herbage and the animal. Ideally it should include both *in vitro* and *in vivo* facilities that could analyse herbage nutrients and their metabolism in the rumen using a livestock metabolism chamber for measuring gaseous emission and controlled grazing paddocks for extensive grazing study.
- To develop research into greenhouse gas (GHG) emissions from ruminant agriculture. GHG emissions and their control are becoming an important research point in many disciplines in China.

7. Plans for follow up from the Fellowship

In respect to the novel forage germplasms with a high level of WSC developed at Aberystwyth University, we have already initiated a joint project entitled, 'Monitoring water-soluble carbohydrate and nitrogen contents from mono- and mixed-culture high WSC perennial ryegrass differing in its heading dates (Agronomy Experiment of HSR in China)', in China. I intend to invite Professor Nigel Scollan and his team to visit China to explore further opportunities for collaboration.