Report to the Stapledon Memorial Trust

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Research on the development of a rapid and accurate system to determine ME concentration in fresh grass, a system similar to that of grass silage currently used in AFBI Hillsborough Feed Information System.

1. The main purpose of the Fellowship

The main purpose of this fellowship was to develop a rapid and accurate system to determine ME concentration in fresh grass, a system similar to that of grass silage currently used in AFBI Hillsborough Feed Information System.

2. Dates for start and end of Fellowship

The Fellowship was undertaken between 1st August, 2008 and 31 January, 2009

3. UK lead organisation and contact person with address and email

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4. Details of research I have been involved with during the Fellowship

I have participated in two researches during the Fellowship, one entitled *Measurement of Metabolisable Energy Concentration of Fresh Grass,* and the other entitled *Effects of Dairy Cattle Breed (Holstein vs. Jersey-Holstein Heifers) Offered Two Levels of Concentrates on the Efficiency of Nutrient Utilization,* The details of the two researches were summarized as following:

Measurement of Metabolisable Energy Concentration of Fresh Grass

Fresh herbage was harvested daily at 13.00 h for a seven week period (from early growth through to late maturity) from the primary growth of a perennial ryegrass sward. Herbage was offered to two groups of dry, non-pregnant dairy cows at maintenance level of energy intake. Fresh herbage was offered twice daily, with one portion offered at 14.00 h and the other stored at 4 º C and offered at 09.00 h the following day. The first group of four cows was on treatment for four weeks, with total collection of faeces and urine from weeks two to four. During the fourth week, grass for the first group was also offered to the second group of four cows, and faeces and urine collected for the second group for the last three days. Measurements with the second group of cows continued until the end of week seven. A similar procedure was repeated for the first regrowth from a second sward and for the second regrowth from a third sward. Grass ME concentration was calculated using methane energy output, predicted from an equation developed using the same dataset presented in the present study. Three-day mean data

(n = 37) were used to develop prediction equations for ME concentration using nutrient digestibility and DE concentration.

Effects of Dairy Cattle Breed (Holstein vs. Jersey-Holstein Heifers) Offered Two Levels of Concentrates on the Efficiency of Nutrient Utilization

A Four-period study (6 weeks/period) was conducted after a 28-d preliminary period, to determine effects of cow breeds and concentrate levels on nutrient utilization, N excretion and methane emission. Eight Holstein (Hol) and eight Jersey-Holstein (JH) first lactation cows were used, and each breed was divided into 2 groups, with 4 cows in each group. In the 1st period, animals in group one and two of each breed were offered diets containing either a high (HC) or low (LC) proportion of concentrates. The 4 treatments were thus defined as Hol-HC, Hol-LC, JH-HC, and JH-LC for Hol and JH cows offered diets containing high and low levels of concentrates, respectively. In the 2nd period, the 2 groups of animals within each breed were changeover on diet containing high or low levels of concentrates. There was a 10-week breaking period following the completion of the 2nd period. The 3rd and 4th trial were designed to repeat the study undertake in period 1 and 2.

During the first 31 days of each period, all cows were housed in cubicle accommodation as a single group. All animals were then transferred to metabolic units for 8 days with total collection of faeces and urine during the final 6 days. Afterwards, animals were housed in indirect open-circulate respiration calorimeter chambers for 3 days, with gasous exchange measured during the final 48 hr.

Nutrient intakes, utilizations and losses through difference channels (faeces, urine, and methane) were compared between the two breeds across concentrate levels.

5. Experience gained or contacts made that will be of particular value for me or my organisation

The rapid and accurate determination of nutrient concentration in fresh grass has both scientific and practical importance. The lack of accurate information on estimation of ME concentration in fresh grass results in under-prediction of animal production from grazed forage – often leading to use of higher levels of concentrate supplementation than is necessary. The present project was thus designed to address this important issue by developing a NIRS evaluation system to determine ME concentration in fresh grass. This project was particularly relevant to ruminant livestock production systems in China. There are large grassland areas in Northern and Western China, but the management strategies and animal productivity are relatively poor and one main cause is the lack of systematic evaluation methods of grass. Therefore, participation in this project present me an opportunity to learn the procedures and techniques on the measurement of ME content, the NIRS scan technique and calibration in an international scientific centre. This would enable me to apply these approaches to develop systems to evaluate Chinese forages (fresh grass, silages and cereal straws). Dr. Tianhai Yan has done a lot of work on developing NIRS evaluation system to determine ME concentration in fresh grass, I think we may cooperate on this aspect in the future.

Nutrient utilization is very important in dairy cow nutrition. During the last decade, nutritional management of dairy cows has been used not only as a tool to maximum the animal products (milk and meat), but also to minimize the output of environmental pollutants such as manure N and methane. During the Fellowship, I learned a lot about researches on energy feeding systems, methane emission and manure N output, of dairy cow, which was a great experience and could be applied to the future study on these aspects in China. Dr. Tianhai Yan is a pioneer on these aspects; we established contacts for the possible future cooperation.