Effects of Grass Growth Stage on Metabolisable Energy Concentration of Fresh Grass

Tianhai Yan
Agri-Food and Biosciences Institute, UK

C. P. Ferris
Agri-Food and Biosciences Institute, UK

M. G. Porter
Agri-Food and Biosciences Institute, UK

C. S. Mayne
Agri-Food and Biosciences Institute, UK

The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

Effects of grass growth stage on metabolisable energy concentration of fresh grass

T. Yan, C. P. Ferris, M. G. Porter and C. S. Mayne
Agri-Food and Biosciences Institute, Hillsborough, County Down, Northern Ireland BT26 6DR, UK, E-mail: Tianhai.yan@afbini.gov.uk

Key words: cattle, chemical composition, fresh grass, grass maturity, metaboliisable energy

Introduction Fresh grass is the most important forage for ruminant animals across the world, whilst it is widely recognised that the nutritive value of fresh grass varies considerably with stage of growth. There is little information in the literature on the relationship between stage of growth and nutritive value within the same sward. The objective of the present study was to develop a prediction method for ME concentration of fresh grass from chemical composition.

Materials and methods Fresh herbage was produced from the primary growth of perennial ryegrass swards. Swards were harvested daily at 13.00 h, for a 7 week period, from early growth to late maturity, and offered to 2 groups of dry, non-pregnant dairy cows at a maintenance level of energy intake. Fresh herbage was offered twice daily with one portion given at 14.00 h and the other stored at 4℃ and offered at 09.00 h the following day. The first group of 4 cows was on treatment for 4 weeks, with total collection of faeces and urine from week 2 to 4. During the 4th week, grass for the first group was also offered to the second group of 4 cows, and faeces and urine collected for the second group for the last 3 days. Measurements with the second group of cows continued until the end of week 7. A similar procedure was repeated for the first regrowth from the same swards. Grass ME concentration was calculated using methane energy output, predicted from the equation developed using the same dataset with the present study (Yan, 2008). Weekly mean data were used to examine effects of stage of grass growth on ME concentration.

Results and discussion Data obtained during week 4 (overlap period) were used to evaluate effects of cow group. There was no significant difference in nutrient digestibility between the two groups. As expected, increasing grass maturity from week 1 to 6 increased DM (176 to 236), ADF (225 to 292) and NDF (474 to 542) contents (g/kg DM), while reducing CP (145 to 69), lipid (37 to 17) and GE contents (18.5 to 18.1 MJ/kg DM). Consequently, digestible OM in total DM (DOMD) and ME content (12.4, 12.2, 12.2, 11.8, 11.5 and 10.9 MJ/kg DM) decreased from week 1 to 6. In the UK energy rationing system (AFRC, 1993), DOMD is used to predict ME concentration for forage (ME (MJ/kg) = 16 DOMD (kg/kg)). The same relationship developed using the present dataset indicates a slightly lower coefficient (15.5, $R^2 = 0.71$).

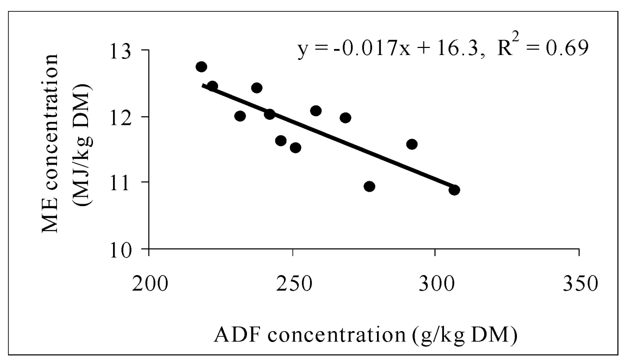

Figure 1 *Relationship between ADF and ME content in fresh grass.*

However, measurement of DOMD requires assessment of digestibility, which is not practical in commercial situations. An alternative option is to predict ME concentration from the chemical composition of the fresh herbage. In the present study, ME concentration was positively related to ($P < 0.001$) CP ($R^2 = 0.69$) and lipid ($R^2 = 0.65$) concentrations, and negatively related to ADF concentration (Figure 1, $P < 0.001$). Using a stepwise technique, a strong relationship was developed to predict ME concentration (Eq. [1]), where WSC = water soluble carbohydrates; unit for GE and ME is MJ/kg DM and for other nutrient g/kg DM.

$$ME = 2.587GE + 0.023DM - 0.055ADF - 0.133Lipid - 0.014WSC - 19.5 \quad (R^2 = 0.93, s.e. = 0.20, P < 0.001) \quad [1]$$

Conclusions The ME concentration of fresh grass was significantly related to DOMD and CP, lipid and ADF concentration. A very strong relationship was developed to predict grass ME concentration from chemical composition.

References

AFRC, (1993). Energy and protein requirements of ruminants. *CAB International, Wallingford*, Oxon, UK.
Yan, T. and Mayne, C. S. (2008). Prediction of methane emission of dairy cows offered fresh grass at maintenance feeding level. *Presented in the present Proceedings*.