BRIEF COMMUNICATION: Intake of ewe lambs is influenced by the dry matter percentage of the feed consumed

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Keywords: feed intake; dry-matter percentage; lambs.

Introduction

For most New Zealand farmed animals species energy is derived predominately from pasture but the plant species that comprise the pasture sward vary within and between properties. The ultimate energy obtained by an animal from the pasture it consumes is driven by several factors including the concentration of energy in the pasture, expressed most commonly as Metabolisable Energy per kilogram of dry-matter (MJ ME/kgDM); the dry- matter (DM) percentage of the feed, which is an indication of the water content versus actual nutritive component of the pasture and the digestibility of the feed (Waghorn et al. 2007). The DM% of New Zealand pastures is influenced by the vast variety of climatic conditions that the pastures are exposed to including temperature, wind (speed and direction) and moisture as well as the pasture species and stage of growth of the plant. The DM% of a variety of fresh-cut pastures from different locations throughout New Zealand has been reported by a number of authors to range from 13% to 25% (John and Ulyatt 1987; Waghorn 2002; Piggott 2009). It is hypothesised that if production animals consume feed with a DM% less than 16% that the energy requirements of the animal may not be met due to water creating bulk which prevents the intake of sufficient dry matter (John & Ulyatt 1987; Waghorn et al. 2007).

A pilot study set up to investigate feed efficiency in ewe lambs involved the feeding of fresh-cut ryegrass over several months. The data collected from this pilot study allows the relationship between feed intake and DM% to be investigated, and whether there is an influence on the ability of the animal to consume their energy requirements given varying DM%.

Materials and methods

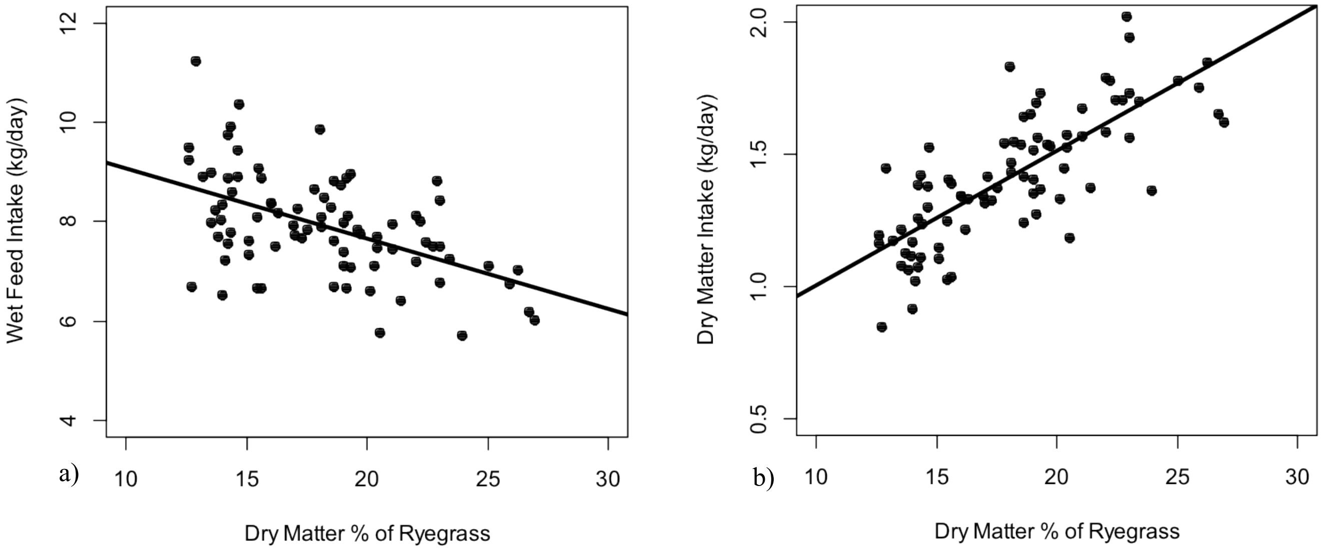
Permission for this trial was granted from the AgResearch Invermay Ethics Committee (AE13270). Forty non-pregnant ewe lambs were individually penned undercover and fed fresh-cut ryegrass for two consecutive periods of 42 days. Part one of the trial commenced in early July 2014 (New Zealand winter) at AgResearch Woodlands near Invercargill, New Zealand. During the first period, all lambs, and for the second period, a sub-set of 20 lambs, were fed ryegrass provided *ad libitum* (the other 20 lambs were fed Lucerne pellets). The ryegrass was harvested the day before they were fed, and feed residual weighed the following day prior to feeding. The amount of wet feed consumed by the animal was calculated. A sub-sample of the ryegrass harvested each day was oven dried for 24 hours at 100°C, and the weight of the samples after drying divided by the weight of the sample at the time of collection to estimate the DM% of the feed offered. The wet weight of feed consumed by an individual was converted to dry matter intake (DMI) by multiplying the wet weight intake by the DM% for that day. The ME of the feed offered was estimated using NIRS as described by Corson et al. (1999) once a week on samples that were oven dried for 48 hours at 60°C. The rye-grass used had an energy content between 11.8 and 12.5 MJ ME/kgDM.

Live weights were recorded at the same time of the day twice weekly. A linear model was fitted to the liveweight data to estimate the average daily gain (ADG) during Part 1 and Part 2 of the trial. The average daily DMI requirements of the animals was estimated using the requirements for maintenance and growth over the period of the trial as calculated by Nicol and Brookes (2007). The difference between DMI consumed and the amount estimated was calculated as the Difference (DIFF). The relationship between DM% and DMI and DM% and DIFF was determined through the fitting of linear and polynomial models.

Results and discussion

The DM% ranged from 13 to 27% over 84 days of fresh-cut pasture collection, which is similar to the ranges observed in the literature (John and Ulyatt 1987; Waghorn 2002; Piggott 2009). A range of climatic conditions were experienced during the trial which may have resulted in surface water or added respiration and evaporation to cause the variation in DM%. Although there was a trend for the DM% to increase over the duration of the trial, even at the end of the trial, several samples had DM% less than 16%, and the days with the highest DM% (>25%) were in the middle of Part 1 of the trial. The average individual daily DMI across the lambs ranged from 0.85 - 2.02 kg. The estimated DM requirements of the animals varied across the trial as a result of liveweight change. Using the liveweight and growth rate data, the estimated average required intakes ranged from 1.29 kg DM per animal per day at the start of the trial to 1.61 kg DM per day at the end of the trial.

The average intake (wet feed or DM) of the lambs on a given day was correlated to the DM% of the feed consumed. As shown in Figure 1a there was a negative relationship with wet weight, and when expressed as DM (Figure 1b) there is a positive relationship best described



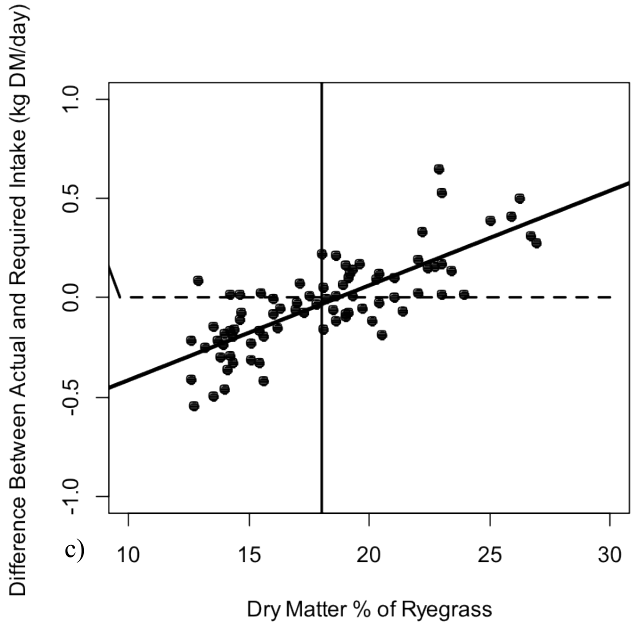


Figure 1 a) Relationship between dry matter % and wet intake derived from data from the feeding of growing ewe lambs fresh-cut ryegrass for 82 days (model Wet Intake = -0.1415*DM%^{2} +10.48; R^2 = 0.26). b) Relationship between dry matter % and dry matter intake derived from data from the feeding of growing ewe lambs fresh-cut ryegrass for 82 days (model DMI = -0.0021*DM%^{2} + 0.1315*DM% - 0.2394; R^2 = 0.61). c) Relationship between dry matter % and difference between actual and required intakes based on the weight and growth of the ewe lambs (model DIFF= 0.0555*DM% – 0.98; R^2 = 0.63). The horizontal line represents the zero line where animals were consuming their exact requirement for their live weight and growth profile, and the vertical line at 18% DM is the value below which animals for the most part could not eat enough feed to meet their requirements for liveweight maintenance and growth.

by a quadratic model. These relationships demonstrate that when the DM% of the feed consumed by the animals is low, the intake of wet feed increases as the animals attempt to obtain their energy requirements, but that the net effect after adjustment for the DM% of the feed is such that they are actually consuming less DM. This relationship is not as strong as that observed by John & Ulyatt (1987) who observed an R^2 of 0.81, although it is not clear whether all data points were used in their analysis as they only plot 18 points but reported that data was collected over 25-30 days. In Figure 1c the DM% was plotted against to the difference (DIFF) between the predicted (required to achieve the maintenance and growth rate of the lambs on a given day) and actual DMI. The general interpretation of this relationship is that when the DM% is low, animals cannot meet their energy requirements for maintenance and growth,.

Although the relationship is not perfect, on days where the DM% is less than 18%, there are very few days when the animals meet their energy (ME) requirements. This figure is higher than estimates from published literature (John & Ulyatt 1987; Waghorn et al. 2007) where it is reported that animals cannot consume sufficient feed to realise their energy requirements when the dry matter of the feed consumed is less than 16%.

The data in this paper were obtained from a study that was investigating residual feed intake (as a measure of feed efficiency) between individuals. These results have significant implications for the subsequent analysis of these data for that purpose, as these results show that on days when low DM% feed was consumed, that the weight/bulk of the feed is the driving factor limiting the absolute intake of an animal via gut fill, whereas on days where the dry matter of the feed was high the DMI is limited to the energy requirements of the animal for maintenance and growth. Such relationships mean that determination of whether or not an animal was consuming more or less feed than it required is not straight forward.

Conclusions

The results of this analysis support observations from cattle that the growth and maintenance energy requirements of an individual can not be met when animals consume pasture with a dry matter content below a certain level, which in this study was 18% DM..

Acknowledgements

Funding for this trial was provided by Beef+Lamb New Zealand Genetics. The authors would like to acknowledge the contribution of other members of the Woodlands team specifically Dion Hewitson, Linda Hewitson and Mel Hall in collection of the data.

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