Increasing Feed Conversion Efficiency in Automatic Milking Systems: The Impact of Grain-Based Concentrate Allocation and Kikuyu (*Pennisetum clandestinum*) Pasture State on Kikuyu Pasture Digestibility

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Introduction

Automatic milking system (AMS) farms, rely upon voluntary cow traffic (the voluntary movement of cattle around a farm) for milk harvesting and feed consumption. Dairy cows on a pasture-based AMS farm typically move from depleted to fresh allocations of pasture in small groups, or individually, at differing times. The first cows moving to an allocation of fresh pasture get access to rapidly fermentable, *ad libitum*, high quality pasture in contrast to those cows accessing the same allocation towards the end of the access period. At the same time, grain-based concentrate (GBC) is allocated independent of the pasture state that cows access. Inclusion of a high level of GBC in the diet with high or low nutritive value forage, or variable states of forage, may create dramatic variations in rumen fluid pH, which may induce subacute ruminal acidosis (Bramley 2004), reduce feed conversion efficiency and negatively impact animal health. The aim of the current study was to determine the impact of pasture state and GBC allocation on the digestibility of kikuyu pasture.

Methods

Ninety mixed-age dairy cows in mid-lactation grazed kikuyu grass (*Pennisetum clandestinum*), and were offered GBC, as two allocations per day as per Table 1. After 6 days of adaptation, 50mL of rumen fluid was pumped from 3 matched, pre-selected cows out of each treatment (n=12 treatments) after the morning (AM) milking on Day 1 and 7 of the experimental period (n = 2 periods). Kikuyu pasture samples were taken on day 1 of the experimental period from three blocks of the Day 2 pasture allocation and split into 5 to 10, 10 to 15 and >15cm fractions measured above ground level. These fractions were then dried at 60^0C for 48 h, weighed and ground (1 mm) for *in vitro* ruminal incubation (Wang *et al.*, 1999) to determine *in-vitro* dry matter digestibility (IVDMD). Rumen fluid samples for each cow were pooled by treatment (3 rumen fluid samples combined) before the commencement of two incubations on Day 1 and 7. Data were fitted with linear mixed models and parameters were estimated using the restricted maximum likelihood procedure. Pasture state group, pasture fraction, GBC allocation and period were fixed effects and block was a random effect.

Table 1. Experimental design with treatment groups, pasture state group (F=Fresh, D=depleted), grain-based concentrate (GBC) allocation sub-group (kg DM/cow/day) and pasture allocation schedule.

Treatment	GBC	n	Pasture state	
			AM	PM
1	2.7	10	F	F
2	5.4	10	F	F
3	8.1	10	F	F
4	2.7	10	D	D
5	5.4	10	D	D
6	8.1	10	D	D
7	2.7	5	F	D
8	2.7	5	D	F
9	5.4	5	F	D
10	5.4	5	D	F
11	8.1	5	F	D
12	8.1	5	D	F

F is ad-lib allocation of 60kgDM/cow/day to ground level per cow, D is 40 kg DM/cow/day to ground level per cow

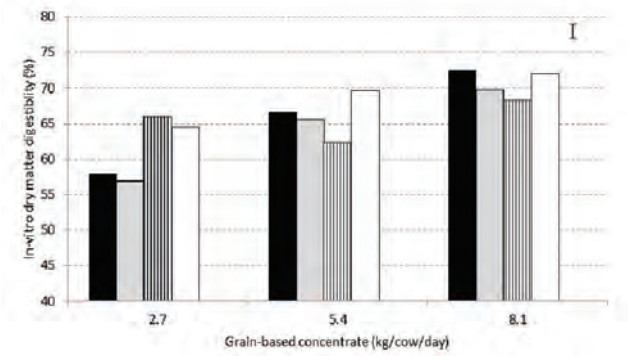

Figure 1. The *in-vitro* dry matter digestibility (%) of kikuyu grass for FF (black), DD (grey), FD (vertical stripe), and DF (white) treatments when offered 2.7, 5.4 or 8.1 kg DM grain-based concentrate/cow/day. Error bar denotes SED.

Results

There was no interaction between kikuyu fraction and treatment for IVDMD. The IVDMD of kikuyu grass increased as GBC allocation increased from 2.7 to 8.1 kg

DM/cow/day (Fig. 1). The IVDMD was similar for a consistent diet of fresh or stale kikuyu pasture. There was a difference in IVDMD between variable pasture state, and consistent pasture state treatments, particularly at reduced levels of when 2.7 kg DM/cow/day GBC was offered.

Conclusions

These findings highlight an opportunity to increase FCE on AMS farms by differentially feeding GBC to cows based on the pasture states that they will imminently access. If a limited amount of GBC were available, GBC could be targeted at those cows consistently accessing fresh or stale pasture to significantly increase kikuyu grass digestibility and potentially milk production. Work is underway to determine the causes of the difference in IVDMD between. treatments to enable FCE to be increased on pasture-based AMS farms

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