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EFFECT OF SUPPLEMENTARY HAY FED TO NON-LACTATING COWS OFFERED TWO ALLOWANCES OF PASTURE

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Abstract

The objective of this study was to measure the effects of giving hay as a supplement to cows grazing at two different daily herbage allowances. Pregnant, non-lactating Friesian cows were allocated to four treatments: low herbage allowance with hay (LA+) or without hay (LA); and high allowance with hay (HA+) or without hay (HA). hay was fed at 5 kg DM/cow daily, and the two herbage allowances were 9 or 14 kg DM/cow daily.

Supplementing with hay increased total dry matter (DM) intake, but decreased herbage DM intake at both allowances. The decreases in herbage intake were 0.26 and 0.40 kg herbage OM eaten per kg hay DM eaten, at the lower and higher allowances respectively. The corresponding values, expressed as MJ metabolisable energy (ME), were decreases of 0.44 and 0.65 MJME from herbage per MJME eaten as hay. The decreases in herbage intake resulted in increases in residual herbage yield at both allowances.

The implications of these results for grazing management during the winter are briefly discussed.

Keywords: supplementary feeding, hay, substitution rate, condition scow dairy cattle.

INTRODUCTION

The importance of adequate body condition at calving, and of generous feeding after calving, have been demonstrated by many experiments (Grainger & McGowan 1982; Bryant & Trigg 1982). Hay is commonly fed to non-lactating cows during the winter on many New Zealand dairy farms, in order to ensure both an adequate level of feeding and to save pasture for consumption after calving.

However, the feeding of supplementary feeds to grazing cows is known to decrease consumption of pasture (Bines 1979). It is important to understand these effects in quantitative terms in order to facilitate the calculation of feed requirements of non-lactating cows offered a diet of pasture and hay. The present experiment was designed to study the DM intake and other effects on cows fed various combinations of pasture and hay.

MATERIALS AND METHODS

The experiment was conducted over 42 days during June and July 1985 at Massey University's Dairy Cattle Research Unit, Palmerston North.

Animals and treatments

Twenty-four pregnant, non-lactating Friesian cows were randomly allocated to four treatments in a 2x2 factorial design. The four treatments were: low daily herbage allowance with hay (LA+) or without hay (LA) and high daily herbage allowance with hay (HA+) or without hay (HA). Details of the feed allowances are given in Table 1. The level of feeding offered to the LA group was calculated to satisfy the maintenance and pregnancy requirements of these cows. The hay offered was 35% and 27% of the total dry matter (DM) allowance in the low and high herbage allowance, respectively. The pasture consisted mainly of a mixture of perennial ryegrass (*Lolium perenne)* and white clover (*Trifolium repens*). The hay was made from pasture of similar composition.

Management

The cows received a fresh area of pasture daily in the morning, and had permanent access to water. The hay was offered every morning in troughs.

Measurements

Herbage mass was measured before and after grazing on each treament, every three

days, by cutting quadrats to ground level. Apparent pasture intake was calculated from these measurements and hay intake was calculated from the quantities of hay offered, all of which was consumed. Metabolisable energy (ME) concentration of the feed was calculated from measured gross energy concentration and in vitro digestibilities (Roughan & Holland 1977). It was assumed that the digestibilities of the feeds were unaffected by the treatments.

The cows were weighed on two consecutive days at the start and the end of the experiment. Cows were fasted for 18 hours prior to weighing. The body condition score of each cow was assessed at the same time.

Statistical analysis

The data for feed offered and consumed and sward characteristics were subjected to analysis of variance, according to a 2x2 factorial design. The data for liveweight and body condition score were subjected to analysis of covariance using the pre-experimental values as the covariate.

RESULTS

Mean values for quantities of feeds offered and apparently consumed, together with values for pregrazed and residual herbage masses, are given in Table 1. The interactions between herbage allowance and hay supplementation for the different parameters were not significant (P>0.05).

As had been intended, the treatments LA+ and HA both had similar values for total DM allowance. The measured in vitro DM digestibilities of the pasture and hay were 77% and 58% respectively, and the corresponding values for calculated metabolisable energy concentration were 11.5 MJ/kg DM and 7.6 MJ/kg DM, respectively.

At both allowances, supplementation with hay increased total DM intake but decreased pasture herbage DM intake. The effect of eating 1 kg DM as hay were decreases of 0.28 and 0.40 kg pasture DM at the low and high allowance respectively. When expressed in terms of metabolisable energy, the effect of eating 1 MJME as hay were decreases of 0.44 and 0.65 MJME as pasture at the low and high allowance respectively. However supplementation did increase total DM intake by 44% and 29% at the low and high allowances respectively. But the corresponding increases in ME intake were only 23% and 11%.

Table 1: Mean values for herbage mass. feed offered and apparent feed intake for the four treatments, and levels of significance of the two main factors.

Herbage Allowance	LOW		High			Sig. Level[1]	
Hay	(−)	(+)	(−)	(+)	SE_{LSM}	ALL	HAY
Pregrazed herbage mass (kg DM/ha)	2662	2606	2640	2620	85.3	*	NS
Herbage allowance (kg/cow/day)	9.2	9.1	13.4	13.4	0.32	***	NS
Hay offered (kg DM/cow/day)	0.0	5.0	0.0	5.0			
Total OM offered (kg/cow/day)	9.2	14.1	13.4	16.4	0.32	***	***
Total ME offered (MJME/cow/day)	106	143	154	192	3.6	I..	**
Residual herbage mass (kg DM/ha)	362	7 4 9	566	953	78.6		***
Apparent DM intake (kg DM/cow/day)							
as Pasture	6.1	6.7	10.5	6.5	0.45	***	..
as Hay	0.0	5.0	0.0	5.0			
total DM Intake	6.1	11.7	10.5	13.5	0.45	***	**
Apparent total ME Intake (MJME/cow/day)	93	115	121	134	5.2	***	**

NS: Not significant (P>0.05). The symbols (*), (**) and (***) indicate the significance levels of P<0.05, P<0.01 and P<0.001, respectively. [1]The interactions between herbage allowance and hay supplementation were not significant (P>0.05).

As a consequence of the reduced pasture intake by cows given the hay supplement, residual herbage mass (RHM) was increased by about 400 kg DM/ha for both allowances. It should be noted that because of the methods used, apparent pasture intake and RHM are inevitably negatively correlated. The quantities of hay fed, expressed on a per hectare grazed basis, were about 1550 and 985 kg DM/ha at the low and high allowance respectively.

RHM was also increased by about 200 kg DM/ha by offering the higher allowance (both with and without hay).

The estimated total ME consumed was increased by 24 MJME/cow/day by the higher herbage allowance ($P<0.001$), and by 18 MJME/cow/day by supplementation with hay. The LA+ and HA treatment groups had similar values for ME intakes and gains in liveweight and condition score, but DM intake and RHM were higher for LA+ than for HA.

Mean values for liveweight and condition score and for changes in these parameters are shown in Table 2. The ranking of treatments for change in liveweight and condition score was the same as the ranking of treatments for apparent ME intake (See Table 1).

Table 2: Mean values for final liveweight and body condition score, adjusted by covariance, and for change in liveweight and condition score.

Herbage Allowance	LOW		High			Sig. Level[1]	
Hay	(−)	(+)	(−)	(+)	SE, SM	ALL	HAY
Liveweight							
Final	499	519	524	525	4.87		..
Gain (42 days)	9.8	28.4	33.7	35.3	4.87	NS	..
Body Condition (Score)							
Final	5.2	5.7	5.8	6.7	1.77	*	..
Change (42 days)	0.05	0.52	0.71	1.56	1.85		..

[1] See Footnote Table 1

Cows supplemented with hay gained more liveweight and body condition score than cows not supplemented. Cows given the higher pasture allowance gained more condition than those given the lower allowance, but the difference was not significant for gain in liveweight. The final liveweight was significantly affected by the hay supplementation and by the herbage allowance. The interactions between herbage allowance and hay supplementation were not significant ($P>0.05$).

DISCUSSION

The low pasture allowance (LA) level of feeding was about maintenance as shown by zero change in condition, and low change in maternal liveweight (after allowance for increase in the uterus). Therefore the experiment studied cows which were fed in the range 1 to 1.5 times maintenance.

Estimation of herbage intake from herbage masses measured before and after grazing by pasture cuts has some limitations, which were discussed by Meijs *et al.* (1982). However, in the present study, there is general agreement between estimated ME intake and gains in liveweight and condition score. However the present esimate of maintenance requirements, provided by the ME intake of cows on treatment LA, is considerably higher than the corresponding values defined from calorimetric studies (ARC. 1980). A similar discrepancy was reported by Holmes & McClenaghan (1980).

The feeding of hay decreased pasture intake at both allowances. There were no interactions between the effects of herbage allowance and hay supplementation. Similar data were reported by Stockdale et *al.* (1981) and Rogers (1985) for lactating cows supplemented with hay and silage respectively. The substitution rates (the decrease in pasture DM intake per kg of hay DM consumed) of 0.28 and 0.40 were in the ranges reported by other studies with lactating cows (Meijs 1981). However a very important implication of these results arises because the supplement, hay, was of lower quality than the pasture (8.7 compared with 11.5

MJME/kg DM respectively). The net result of the decrease in pasture consumption associated with the increase in hay consumption was a smaller increase in ME than in DM intake. Offering 5 kg DM hay (38 MJME) increased total ME intake by 20 and 14 MJME/day at the low and high allowances respectively, or only 3 to 4 MJME increase per kg hay DM consumed. Feeding hay also resulted in an increase in residual herbage mass at both allowances. This is an effective saving of about 400 kg pasture DM/ha grazed, as a direct consequence of feeding about 1550 and 985 kg hay DM/ha at the low and high allowances respectively.

Cows offered hay consumed all the low digestible feed (hay) but reduced their intake of the high digestible feed (pasture); this reduction occurred even at the lower allowance, so that it seems unlikely that pasture intake was limited by factors such as gut fill, ME intake or dietary digestibility.

Regression analyses of the data for RHM, and DM intake or ME intake, suggests that at a common value for DM intake, both supplemented and unsupplemented treatments would have had a similar value for RHM. However at a common value for ME intake the supplemented groups appear to have a higher value for RHM, by about 200 kg DM/ha. This may indicate that the willingness of the present cows to continue grazing on short pasture was influenced more strongly by their intake of DM than by their intake of ME. So, it may be related to a greater degree of satiety caused by the probable increase in rumen-fill or to the measured short-term increase in rumination time in the cows which consumed hay during the daytime.

Certainly, the present results indicate that supplementary hay influences the relationship between intake and RHM; this must be taken into account if RHM is used as an indicator of intake. Similar recommendations were made by Caird & Holmes (1986) for concentrate supplementation.

The present results have some important implications for winter management. The increases in intake of ME and gain of liveweight and body condition are smaller than might have been predicted from the quantity of hay fed, because consumption of hay caused decreases in pasture intake. However the consequent increase in residual herbage mass was effectively a saving of pasture, which might also have resulted in faster regrowth after grazing.

The present results provide a basis from which to consider the overall consequences of feeding hay as a supplement to non-lactating cows.

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