Effects of feeding silage and extending lactation on the pastoral dairy system

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ABSTRACT

Short lactation length is one of the main reasons for the low milk yield per cow in New Zealand. This experiment used replicated farmlets to measure the effects of extending the lactation, and feeding extra silage on the dairy farm system. On the 4th April 54 lower yielding cows were dried-off and divided into two equal herds (D). The remaining 64 cows were also divided into two equal herds, and milked for another 54 days (M). Each of the four herds was grazed on a self- contained farmlet, at 2.9 cows/ha. D herds received only grazed pasture (16 kg dry matter (DM)/cow/day allowance), while M herds received pasture (30 kg DM/cow/day allowance) plus silage (5.5 kg DM/cow/day). At the end of the experiment the M system produced 57.7 kg milksolids (fat+protein) per cow, but had lower ($P<0.05$) average pasture cover (by 584 kg DM/ha) and lower ($P<0.001$) body condition scores (by 0.33/cow) than the D system. Extra milk can be produced from extra days in milk, but the extra feed required must be planned and monitored very carefully, to prevent losses in body condition and pasture cover.

Keywords: dairy cow; milk production; pasture silage; supplementary feeding, extending lactation; pasture cover; condition score; drying-off.

INTRODUCTION

The short lactations of New Zealand dairy herds (208 to 230 days in the last 5 years; LIC 1995) are one of the reasons for the low average milk yield per cow (Holmes and Hughes 1993), and are due to the need to dry-off cows before the slow pasture growth rates in winter, in order to avoid excessive losses in body condition (CS) and in farm average pasture cover, and thereby protect next season's performance (Parker *et al.* 1995).

Extra days in milk in the latter stages of lactation are normally associated with loss of CS (Bryant 1978) and pasture cover (Holmes *et al.* 1994), which in turn are likely to affect the next season's performance, but which could theoretically be prevented by giving extra feed. The present experiment was designed to measure the effects of extra feed given in late lactation, combined with extra days in milk, on milk production, CS and pasture cover. The two alternative systems of management in autumn (dried-off, or given supplement and milked) were compared in a replicated farmlet study.

MATERIALS AND METHODS

The experiment was carried out during April and May 1995, at the Dairy Cattle Research Unit, Massey University, with 118 cows, mainly Holstein-Friesians, on 40 hectares of ryegrass- white clover pastures. Fifty-four cows were dried off (D treatment) on 4th April (average of 219 days in milk) because they were low yielding, thinner or younger, while the remaining 64 cows continued to be milked (M treatment) until 29th May. The 54 D cows were divided into two equal herds, balanced for age, liveweight (LW), CS and milk yield, and each herd grazed on a self-contained farmlet of 9.2 ha. Similarly, the 64 M cows were divided into two herds and each herd grazed on a self-contained farmlet of 10.8 ha. The initial values for both treatments are given in Table 1; the treatments differed in age and LW of the cows due to the reasons given above for drying-off the D cows.

TABLE 1: Mean values for animal and pasture conditions at the beginning of the experiment (4th April) (mean±s.e. for two dried-off and two milked farmlets).

Parameters	Dried-off (D)	Milked (M)	Sig[1]
Age of cows (years/cow)	4.9±0.3	6.3±0.3	**
Liveweight (kg/cow)	452±6.0	484±5.5	***
Condition score (scale 1 to 10 units)	4.43±0.07	4.29±0.07	ns
Average pasture cover (kg DM/ha)	2231±18	2228±18	ns

[1] Significance of difference: nsP>0.05; **P<0.01; ***P<0.001.

Each of the 4 herds and farmlets were managed and grazed as 4 separate farms, and were given a fresh break of pasture each day. The D herds ate only grazed pasture, but M herds were supplemented with pasture silage (DM, 34%; M/D, 9 MJ ME/kg DM; and CP, 13.2 %DM), which was fed on the paddock once a day at between 0 to 12 kg DM/cow/day. All farmlets were managed in an attempt to meet common targets of 2000 kg DM/ha pasture cover and CS 5 on 29th May.

Apparent daily herbage DM intake was calculated from measurements of herbage mass (HM) made before- and after-grazing of every paddock, using a rising plate meter (Earle and McGowan 1979). The average pasture cover of each farmlet was also calculated from measure-

ments of HM on every paddock made at intervals of 2 weeks. LW and CS (assessed visually on a scale 1 to 10) of the cows were measured after the morning milking on two consecutive days at the beginning, the middle and the end of the experiment. Milk yields and composition were measured on 2 consecutive days per week. Silage samples for analysis of quality and hand-plucked (from cage-protected areas) herbage samples for analysis of quality and botanical composition were taken fortnightly.

Statistical Analyses

Weekly averages of daily herbage measurements, final conditions in LW and CS, and pasture cover and their respective changes in the period were analysed by the one-way analysis of variance. The differences between treatments were analysed using least square means.

RESULTS

Level of feeding

Mean values for daily feeding management are given in Table 2. The M cows were given a larger grazing area each day, with a lower daily stocking density, and a larger daily pasture allowance. The apparent pasture intake was higher for the M cows than the D cows. The D farmlets had higher pre-grazing herbage masses, but lower residual herbage masses than the M farmlets.

Total apparent daily intake of DM and metabolisable energy (ME) were larger for cows in the M treatment.

Final conditions in liveweight, condition score and pasture cover

The effects of the systems of management on LW, CS and average pasture cover measured at the end of the experiment were statistically significant (Table 3). The conditions on the D farmlets were close to the original targets (i.e. 2000 kg DM/ha average cover and 5 CS). On the other hand, for the M cows, conditions were well below the targeted values (by 405 kg DM/ha average cover, and 0.38 CS/cow).

TABLE 2: Mean values of daily feeding management and apparent intakes during the 54 days of the experiment (mean±s.e.).

Parameters	Dried-off (D)	Milked (M)	Sig[1]
Daily feeding management:			
Area grazed (m^2/cow)	48±1.5	109±1.5	***
Stocking density (cows/ha)	212±6.3	95±6.3	***
Herbage allowance (kg DM/cow)	16.3±1.4	29.9±1.4	***
Pre-grazing herbage mass (kg DM/ha)	3449±105	2734±105	***
Residual herbage mass (kg DM/ha)	1042±29	1421±29	***
Daily apparent intakes:			
Pasture (kg DM/cow)[2]	11.6±0.7	4.2±0.7	*
Silage (kg DM/cow)[3]	0	5.5±0.7	***
Total (kg DM/cow)	11.6±0.3	19.7±0.3	***
Total (MJ ME/cow)[4]	115±3.8	206±3.8	***

[1] Significance of difference: *P<0.05; ***P<0.001.
[2] Estimated from before- and after-grazing difference in herbage mass.
[3] Estimated as total DM silage fed divided by the number of cows in the herd.
[4] Total DM apparently eaten multiplied by the average M/D (MJ ME/kg DM) values: Pasture on D treatment:10; Pasture on M treatment:11; Silage: 9.

TABLE 3: Mean values for final animal and pasture conditions and total silage fed, milk yields, change in liveweight (LW), condition score (CS) and average pasture cover during the 54 days of the experiment (mean±s.e.1).

Parameters	Dried-off (D)	Milked (M)	Sig[1]
Final conditions (29th May):			
Liveweight (kg/cow)	499.2±6.8	519.0±6.3	*
Condition score (scale 1 to 10 units)	5.06±0.08	4.62±0.08	***
Average pasture cover (kg DM/ha)	2182±73	1595±73	*
Totals for period (54 day):			
Silage fed (kg DM/cow)	0	295±5	
Silage fed (kg equivalent pasture DM/cow)[3]	0	241±4	
Milk produced (kg MS/cow)	0	57.7±8.2	
Change in LW (kg/cow)	48.9±2.0	33.6±1.8	***
Change in CS (scale 1 to 10 units)	0.65±0.06	0.31±0.05	***
Change in pasture cover (kg DM/ha)	-49±61	-633±61	*

[1] mean±s.d., for silage fed and milk production.
[2] Significance of difference: *P<0.05; ***P<0.001.
[3] Calculated in basis of ME contents of silage and pasture on M treatment (see Table 2).

Cows on both treatments gained LW and CS, but the D cows gained more. The D farmlets showed little change in pasture cover, while M farmlets showed a large decrease.

Response to the silage supplementation and extra days in milk

During the 54 day period, the M groups were given 295 kg silage DM/cow and produced 57.7 kg MS/cow (33 kg milkfat/cow)(Table 3), and the short term, marginal response to silage feeding (and losses of CS and pasture cover) was 196 g MS/kg silage DM. Alternatively, when pasture DM required to overcome the deficits in CS and pasture cover of the M treatment were included in the calculations (the M cows to regain 0.33 CS must eat an extra 55 kg DM per cow (Holmes and Grainger 1982), and to regain the 584 kg DM/ha pasture cover, the M cows must eat an extra 200 kg DM/cow (at 2.9 cows/ha stocking rate), from a source other than pasture), and the silage input was expressed in terms of equivalent pasture DM (see Table 3), the total marginal response was 116 g MS/kg equivalent pasture DM.

DISCUSSION

In contrast to most of the previous supplementary feeding studies (see Kellaway and Porta, 1993), the results of this experiment measured the milk production response to pasture silage supplementation plus extra days in milk

in late lactation. Thus, the 295 kg silage DM given combined with the 54 extra days in milk resulted in an extra 57.7 kg MS/cow being produced, i.e 196 g MS/kg silage DM immediate marginal response. However, this simple index does not account for the probable carryover effects on next season's milk production, caused by the decreases in pasture cover and CS for the M treatment. Therefore, an alternative measurement, the total marginal milk production response to the total DM consumed and required by the M cows was calculated.

The 116 g MS/kg DM total marginal response calculated is higher than that (92 g) reported by Holmes *et al.* (1994) for a similar experiment, but using a 50:50 mixture of grass silage and apple pomace, and the response of 66 g MS/kg DM to silage fed in late lactation (36 days), with 7 extra days in milk reported by Clark (1993). The apparent daily ME intakes (Table 2) by D and M cows were 15 and 26% higher than their theoretical requirements, probably due to underestimation of residual herbage mass (due to trampling of pasture) for both treatments, and silage wastage by the M cows.

The results suggest that there is a scope for effective increase in milk production at the end of lactation, but extra feed must be managed very carefully to ensure that the extended lactation does not cause reduced average pasture cover and CS at the start of next season.

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