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Milksolids response in early lactation to condition score at calving and concentrate feeding

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ABSTRACT:

Effects of condition score (CS) at calving and concentrate supplementation over early lactation on milksolids production (MS), liveweight, CS change and intake were investigated in spring 1995. Differential feeding before calving resulted in high CS (HCS) and low CS (LCS) herds of 5.6 and 4.7 ($P<0.001$), respectively. After calving (10 August) the HCS and LCS herds were split (n=10) and either fed (+) or not fed (-) 3 kg DM/cow/day of rolled barley for 48 days. During the treatment period each herd was offered a similar pasture allowance of 22 kg DM/cow/day. A 27 day carryover period followed with no supplementation. Treatments were grazed separately throughout. During supplementation the liveweight gain ($P<0.01$) and change in CS ($P<0.05$) was greater for LCS than HCS. Cows on + concentrate gained more liveweight ($P<0.01$) than - concentrate. CS at calving had no effect on milk yield or composition. Concentrate increased ($P<0.001$) milk, fat, and protein yields and protein %. Feeding 144 kg DM/cow of concentrate increased ($P<0.001$) milksolids by 16.5 kg/cow. No significant interaction occurred between CS at calving and concentrate but for HCS cows the response to feeding concentrates was 21.2 kg MS/cow compared to the response for LCS cows of 11.8 kg MS/cow. During the feeding period, pasture intake was greater ($P<0.05$) for LCS (12.5 kg DM/cow/day) than HCS (11.0 kg DM/cow/day). Concentrate had no effect on pasture intake. No treatment effect on pasture intake occurred in the carryover period. These results suggest, that at the pasture allowance post calving of 22 kg DM/cow/day, a CS at calving of 4.7 is adequate to sustain similar milksolids production in early lactation as cows calving with a CS of 5.6.

Keywords: Milksolids production; early lactation; calving condition score; concentrate feeding.

INTRODUCTION

With seasonal calving, a period of feed deficit often coincides with early lactation. Bryant and Trigg (1982) and Rogers (1985) showed milk production responses to feeding supplements in early lactation to be small and uneconomic. These conclusions have been confirmed in farm systems studies by Penno *et al.*, (1996). Broster (1971) and Grainger and McGown (1982) suggested that cows calving in good condition were able to mobilise body reserves in early lactation to partially compensate for feed shortages. Thus cows with a high condition score (CS) at calving were able to maintain higher milk production and lower intake than cows of low CS (Grainger and McGown, 1982). These authors also showed that fatter cows at calving responded better to supplements fed in early lactation. Kelloway and Porta (1993) suggested responses to concentrate feeding in early lactation would be maximised if the cows were in good condition at calving. The objective of this trial was to determine, for New Zealand grazing conditions, if CS at calving influenced milksolids (MS) responses to feeding a rolled barley concentrate in early lactation.

METHODS

The above objective was examined in a 2x2 factorial design experiment. The treatments were: CS at calving of 4.6 or 5.6 and levels of concentrate of 0 or 3 kg DM of rolled barley/cow/day, fed to cows on a moderately restricted pasture allowance of 30 kg DM/cow/day (Thomson *et al.*, 1984) for 47 days in early lactation (treatment period). The treatment period was followed by a 27 day carryover period when cows were fully fed on pasture at an allowance in excess of 40 kg DM/cow/day.

On 25 May 1995, 46 Friesian cows aged between 2 and 7 years were allocated to two treatment groups. Each group was balanced for age (20% rising 2 year olds), predicted breeding index, predicted calving date, previous season's production for multiparous cows, liveweight and CS. The two groups grazed separately for 76 days through winter (25 May - 8 August) with the objective of maintaining one herd (LCS) at their drying off condition, while feeding the other herd (HCS) to increase CS by 1.0 unit by calving. Throughout winter liveweight and CS were recorded fortnightly and feeding levels adjusted to ensure CS targets were achieved.

After calving the supplemented groups were fed after the morning and evening milking in equal proportions. Each treatment group was grazed separately. During the carryover period (26 September - 22 October) each group returned to the same areas they had grazed during the treatment period at an equal stocking rate of 4.0 cows/ha.

Measurements: Cows were weighed and CS assessed fortnightly for the duration of the trial. Herbage mass before and after grazing was visually assessed fortnightly during the winter. During the treatment and carryover periods, herbage mass was assessed before and

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after grazing, four times each week, using a rising plate meter (Ashgrove Pastoral Products, Palmerston North, NZ). Meter readings were converted to herbage mass levels using the equations of L'Huillier and Thomson (1988). Milk yield was measured twice each week with fat and protein content analysed weekly using a Milkoscan 133B (Foss Electric, Denmark). During the treatment and the carryover periods, pasture intakes of individual cows were assessed using the alkane technique (Dove *et al.* 1988).

Statistical analyses: The results were subjected to a least squares analysis of variance for a factorial design, utilising the general linear model procedure of SAS (SAS version 6.08, SAS Institute Inc., Cory, NC, USA). All milk production and composition results were adjusted for calving date using covariance analyses. Least squares means are presented with their corresponding standard error of the difference (SED).

RESULTS

The daily pasture allowance offered to all treatments during August was less than 20 kg DM/cow and averaged only 22 kg DM/cow over the treatment period. Average values for pre and post grazing herbage mass were 2350 and 1540 kg DM/ha for the treatment period, increasing to 4000 and 2550 respectively during the carryover period.

Calving commenced on July 25 and all cows had calved by August 16. At the commencement of calving the HCS treatment was 31 kg heavier and in better condition (0.9 CS) than the LCS herd (Table 1). The difference in both liveweight and CS between the LCS and HCS treatments declined after calving but CS differences were still significant ($P<0.001$) at the end of the carryover period. Throughout the treatment period the LCS treatment gained more liveweight and condition than the HCS treatment. Similarly, the (+) concentrate treatment gained more liveweight than the (-) concentrate treatment. For the concentrate fed group, differences in liveweight gain recorded during the treatment period reversed in the carryover period, and from calving to end of carryover period liveweight gains were similar for both treatments. For the entire trial the LCS gained more liveweight than HCS treatments. Cow CS changes were similar for all treatments over the entire treatment and carryover period.

Milk yield and composition: Cow condition had no effect on the yield or composition of milk in either period whereas concentrate feeding increased milk yield, protein % and MS production but only during the period of supplementation (Table 2). No significant interaction occurred

TABLE 2: Main effects of calving condition score and concentrate feed on milk yield and composition.

	Composition (%)		Yield (kg/cow/day)			
	Fat	Protein	Milk	Fat	Protein	Milksolids
Treatment Period (48 days)						
LCS	4.57	3.32	18.7	0.85	0.62	1.47
HCS	4.57	3.37	19.0	0.87	0.64	1.51
SED	0.15	0.06	0.77	0.03	0.03	0.06
Significance	NS	NS	NS	NS	NS	NS
- Concentrate	4.64	3.24	17.2	0.79	0.56	1.35
+ Concentrate	4.50	3.45	20.5	0.92	0.71	1.63
SED	0.15	0.06	0.77	0.03	0.03	0.06
Significance	NS	***	***	***	***	***
Carryover Period (27 days)						
LCS	4.69	3.59	21..3	0.99	0.76	1.75
HCS	4.78	3.58	21.3	1.01	0.76	1.78
SED	0.19	0.07	0.96	0.04	0.03	0.07
Significance	NS	NS	NS	NS	NS	NS
- Concentrate	4.74	3.52	20.9	0.98	0.73	1.71
+ Concentrate	4.73	3.65	21.7	1.02	0.79	1.81
SED	0.19	0.07	0.96	0.04	0.03	0.07
Significance	NS	NS	NS	NS	NS	NS
Total (65 days)						
LCS	4.61	3.42	19.6	0.90	0.67	1.56
HCS	4.65	3.44	19.8	0.92	0.68	1.60
SED	0.16	0.06	0.81	0.03	0.03	0.06
Significance	NS	NS	NS	NS	NS	NS
- Concentrate	4.68	3.35	18.4	0.86	0.62	1.47
+ Concentrate	4.58	3.52	20.9	0.96	0.74	1.69
SED	0.16	0.06	0.81	0.03	0.03	0.06
Significance	NS	**	**	**	***	***

Significance: NS not significant, ** $P<0.01$, *** $P<0.001$.

TABLE 1: Main effects of calving CS and concentrate feeding on liveweight (kg LWT), liveweight gain post calving (kg LWT/cow/day), CS, and CS change/cow/period post calving over the winter, treatment and carryover periods.

	At start		At calving		End of Treatment				End of carryover				Trial period	
	LWT	CS	LWT	CS	LWT	CS	LWT gain	CS change	LWT	CS	LWT gain	CS change	LWT gain	CS change
LCS	459	4.6	475	4.7	420	4.5	1.0	0.3	438	4.6	0.8	0.1	0.9	0.4
HCS	459	4.6	506	5.6	425	5.1	0.7	0.1	447	5.2	0.9	0.2	0.7	0.3
SED	13	0.2	14	0.2	12	0.16	0.1	0.13	13	0.18	0.14	0.13	0.08	0.14
Significance	NS	NS	*	***	NS	**	**	*	NS	**	NS	NS	*	NS
- concentrate			500	5.1	416	4.6	0.7	0.2	440	4.7	1.0	0.1	0.7	0.3
+ concentrate			481	5.1	429	4.9	1.0	0.1	445	5.0	0.7	0.1	0.9	0.4
SED			14	0.2	12	0.16	0.1	0.13	13	0.18	0.14	0.13	0.08	0.14
Significance			NS	NS	NS	*	**	NS	NS	NS	*	NS	NS	NS

Significance: NS, not significant, * $P<0.05$, ** $P<0.01$, *** $P<0.001$.

between CS and concentrate feeding for any of the milk production traits. Total milksolids produced over the treatment and carryover periods by the individual herds were: 111, 123, 110, 131 kg/cow for the LCS-, LCS+, HCS-, and HCS+ treatments, respectively.

Intake: Measurements taken by the alkane method towards the end of the treatment period showed the LCS cows had a higher intake of pasture than the HCS cows (Table 3). The feeding of concentrate had no effect on pasture intake. During the carryover period there was no effect of treatment on pasture intake.

DISCUSSION

TABLE 3: Cow intake (kg DM/cow/day); assessed by the alkane method during the treatment and carryover periods.

	Treatment period		Carryover period
	Pasture	Pasture + concentrate	Pasture
LCS	12.5	14.0	13.5
HCS	11.0	12.5	13.1
SED	0.7	0.7	0.4
Significance	*	*	NS
- concentrate	11.3	11.3	13.1
+ concentrate	12.2	15.2	13.5
SED	0.7	0.7	0.4
Significance	NS	***	NS

Significance: NS not significant, * $P<0.05$, *** $P<0.001$.

The trial was undertaken in a difficult spring with pasture production below budget. This was why the target pasture allowance over the treatment period was not achieved. Under such conditions, increasing CS at calving from 4.7 to 5.6 had no effect on either milk yield or milkfat content, contrary to the result of Rogers *et al.*, (1979) and Grainger *et al.*, (1982). Possible explanations for the lack of a CS effect are: (i), no loss in liveweight was recorded over the treatment period (Table 1) indicating a higher level of feeding occurred than the pasture allowance data suggests. (ii), the LCS cows consumed 1.5 kg DM/cow/day more pasture than HCS cows. The greater intake for cows of poorer condition was similar to that reported by Grainger *et al.*, (1982) and Garnsworthy (1988) in a review of UK trials. The lack of a CS effect on MS production may also be explained by a difference in management used in this trial compared with Rogers *et al.*, (1979) and Grainger, *et al.*, (1982). In their trials the LCS and HCS cows were grazed as one herd after calving whereas in this study the 4 treatments were grazed separately throughout. Under common grazing, the LCS cows may not have the opportunity to increase intake due to competition from the more aggressive heavier cows (Brackel and Leis 1976).

The average response to feeding concentrate over the duration of the trial (115 g MS/kg concentrate DM fed) was greater than reported by Bryant and Trigg (1982), Rogers (1985) Kelloway and Porta (1993) and Penno *et al.*, (1996). The larger response recorded in the current study was possibly due to the low pasture allowance through the treatment period resulting in minimal pasture substitution (Grainger and Mathews 1989). Similar pasture intake recorded for (+) concentrate and (-) concentrate fed cows (Table 3) supports our contention that the availability of pasture was restricted and that no pasture substitution occurred.

The response to feeding concentrates was mainly due to an increase in milk yield (12%) and an increase in protein content (0.21% unit increase) resulting in a 19% increase in protein yield (Table 2). Using the 1995/96 milksolids price of the New Zealand Dairy Group (milkfat at $2.67/kg and protein at $6.04/kg) the return to concentrate feeding was calculated as $74.40/cow, or $0.51/kg concentrate DM fed.

Kelloway and Porta (1993) in reviewing the effects of CS on the response to supplementary feeding concluded the response to supplements will be greater for cows of higher CS. Although there was no significant interaction between CS and concentrate feeding the trend in the data did support this conclusion. Concentrate feeding to LCS cows increased milksolids by 11.8 kg/cow (82 g MS/kg concentrate DM), a response similar to the average effect of concentrate feeding presented by Rogers (1985) whereas the response in the HCS cows was 21.2 kg MS/cow (147 g MS/kg concentrate DM).

The practical recommendations arising from these results are that an average herd CS at calving of 4.7 was adequate, compared to CS 5.6, to sustain milk production in early lactation when pasture was restricted (average pasture allowance from 8 August - 26 September, 22 kg DM/cow/day). Under such pasture conditions, the average response to feeding concentrates was 115 g MS/kg DM of concentrate fed.

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