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# Effects of level of feeding at different times of the year on milk production by Friesian cows of high or low genetic merit

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## ABSTRACT

Friesian cows of high (126) or low (104) breeding index (BI) were differentially fed during late gestation, early lactation and late lactation, and milkfat (MF) yield and condition score (CS) responses measured. In 40 cows fed to calve in either thin (CS=4) or fat (CS=5.3 in 1981; CS=6.0 in 1982) condition, a similar non-significant response to extra CS at calving was observed in both BI groups (3.0 to 8.6 kg extra MF/extra CS).

For up to 4 weeks in early lactation, 24 and 32 cows in 1982 and 1983 respectively, were offered either restricted (12 to 15 kg DM/cow) or generous (50 kg DM/cow) daily allowances of pasture. Feed restriction reduced daily MF yields by 0.2 to 0.4 kg/cow, but subsequent production recovered rapidly. The extent of this recovery was less for cows of low than for cows of high BI in 1983 but not in 1982. In weeks 27 to 30 of lactation in 1983, 24 cows were offered either restricted (18 kg DM/cow) or generous (80 kg DM/cow) daily allowances of pasture. In weeks 28 to 31 of lactation in 1984, 32 cows were offered 30 kg pasture DM daily, either with or without a daily supplement of 5 kg of concentrates. Feed restriction reduced daily MF yields by a similar extent for both BI groups (0.2 to 0.3 kg MF/cow) and recovery during the final 6 weeks of lactation was similar for both groups.

**Keywords** Breeding index; milk; milkfat; condition score; pasture; Friesians; cows; feeding level; genetic merit; concentrates

## INTRODUCTION

Cows with a high breeding index (HBI) for milkfat (MF) production eat more feed per unit metabolic live weight (by 7 to 10%), produce more milkfat, lose more body condition during lactation and have a higher gross efficiency than cows with a low breeding index (LBI) (Bryant and Trigg, 1981; Davey *et al.*, 1983). The effects of body condition score (CS) at calving (Grainger and McGowan, 1982), and level of feeding in early and late lactation (Bryant and Trigg, 1982; Wilson and Davey, 1982) on milkfat production are well documented. However, the possible effects of genetic merit of the cows on such responses have not been studied in grazing cows.

The experiments reported in this paper were designed to provide information on the possible interactions between genetic merit and level of feeding in late gestation and early and late lactation.

## MATERIALS AND METHODS

Six experiments were conducted using Friesian cows at the Dairy Cattle Research Unit, Massey University from 1981 to 1984. The origins of these cows were described by Davey *et al.*, (1983). The cows consisted of a HBI group (BI=126) and a LBI group (BI=104).

### Experiments 1 and 2: Effects of Body Condition at Calving

In the autumns of 1981 and 1982, 20 HBI and 20 LBI

cows were randomly allocated to 1 of 2 treatments and the feeding levels during the seventh and eighth months of gestation adjusted so that the cows calved in either thin (CS=4) or fat (CS=5 to 6) condition. In 1981, 4- and 5-year-old cows with a mean calving date of 21 August were used. In 1982, the cows were 5 and 6 years of age and had a mean calving date of 23 August. After calving, the cows were grazed together except for short periods in 1982-83 when some cows were used in the experiments described below. Each treatment in those experiments contained equal numbers of thin and fat cows. Total milkfat yields over the lactation and condition score at the end of lactation were recorded. For a variety of reasons, complete records were not obtained for all cows, and the numbers in some treatment groups were reduced accordingly (see Table 1).

### Experiments 3 and 4: Effects of Feeding Level in Early Lactation

In the spring of 1982, 12 HBI and 12 LBI cows (5 to 6 years old) were allocated to 2 treatment groups and during the 7th to 9th weeks of lactation were offered either a generous (G, 50 kg DM/cow/d) or restricted (R, 15 kg DM/cow/d) allowance of mixed ryegrass-white clover pasture. In 1983, a similar experiment using 16 HBI and 16 LBI cows (3 to 7 years old) was conducted in the 4th to 7th weeks of lactation. The generous and restricted daily herbage allowances were 50 and 12 kgDM/cow respectively. Herbage mass was measured before and after grazing by cutting

**TABLE 1** Effect of body condition score at calving of cows of high and low breeding index (BI) on milkfat production and condition score.

	High BI		Low BI		SEM	Significance
	Fat	Thin	Fat	Thin		
<b>Experiment 1</b>						
No of cows	10	7	9	8		
BI	127	127	104	103		
CS at calving	5.27	3.93	5.19	4.03	0.10	F>T***
CS at drying-off	4.67	4.29	5.11	4.80	0.18	H<L*
Total MF yield (kg)	177	173	144	139	8	H>L***
Peak MF yield (kg/d)	0.98	0.88	0.76	0.73	0.04	H>L***
<b>Experiment 2</b>						
No of cows	10	9	9	10		
BI	124	125	105	105		
CS at calving	6.03	4.09	6.10	4.01	0.13	F>T***
CS at drying-off	4.78	4.87	5.83	5.46	0.25	H<L**
Total MF yield (kg)	223	210	171	153	11	H>L***
Peak MF yield (kg/d)	1.12	0.94	0.90	0.71	0.04	H>L***, F>T**

0.188m<sup>2</sup> random quadrats to ground level with a shearing handpiece. The herbage was then washed, dried and weighed. The volume of milk produced by each cow and the milkfat concentration were measured on 2 or 3 days each week before, during and after the treatment period. The cows were weighed and condition scored at the beginning and end of each period. Data from 1 LBI cow offered a generous allowance of pasture in 1982 were unavailable.

#### Experiments 5 and 6: Effect of Feeding Level in Late Lactation

In the summer of 1983, 12 HBI and 12 LBI cows (6 to 7 years old) were allocated to 2 treatment groups and during the 27th to 30th weeks of lactation were offered either a generous (G, 80 kgDM/cow/d) or a restricted (R, 18 kgDM/cow/d) allowance of mixed ryegrass-white clover pasture. In 1984, in a similar experiment using 16 HBI and 16 LBI cows (4 to 8 years old) in the 28th to 31st weeks of lactation, all cows were offered an allowance of 30 kg pasture DM/cow/d. The generous treatment group received a daily supplement of 5 kg concentrates/cow. No supplement was fed to the restricted treatment group. The measurements made were the same as those in Experiments 3 and 4. Data from 1 LBI cow in the restricted treatment group in 1983 were unavailable.

#### Analyses of Data

The data from Experiments 1 and 2 were subjected to analyses of variance. In Experiments 3, 4, 5 and 6, changes in milkfat yield and condition score between the preliminary, treatment and post-treatment periods were analysed by analysis of variance.

## RESULTS AND DISCUSSION

### Experiments 1 and 2

The effect of differences in BI and CS at calving on milkfat yields and condition score are shown in Table 1. In both years, HBI cows produced significantly more milkfat than LBI cows. Cows which were fat at calving produced between 3.0 and 8.6 kg extra milkfat/extra CS unit compared with thin cows. Although this was not significant, the magnitude of the effect of CS at calving on MF production was similar to results cited by Grainger and McGowan (1982). In 1982, fat cows produced significantly more MF at peak than did thin cows, which supports the conclusions of Rogers *et al.* (1979) that the effect of CS at calving on MF production is largest in the early part of lactation. No difference between HBI and LBI cows in their response to additional CS at calving was evident. This does not agree with the implications drawn from a survey of commercial herds by Macmillan *et al.* (1982).

### Experiments 3 and 4

Restricting the feeding level in early lactation significantly reduced MF yields and CS in both experiments, but the magnitude of the depression was not significantly different between BI groups (Table 1). In the post-treatment periods, the restricted groups showed a significant recovery in MF yield, with the length of this recovery period varying from 3 to 6 weeks. This is in general agreement with the results of Bryant and Trigg (1979) in showing relatively small and short-lived carry-over effects. Only in Experiment 4 was there a significant interaction between BI and feeding level in that restricted LBI cows did not recover so completely as

**TABLE 2** Effect of generous (G) and restricted (R) feeding level (FL) in early lactation on milkfat (MF) yield and condition score (CS) of cows of high (H) and low (L) breeding index (BI). (All effects of BI non-significant ( $P>0.1$ )).

BI	H		L		SEM	Significance of change from previous period		
	FL	G	R	G		R	FL	BI x FL
Experiment 3								
MF yield (kg/d)								
	Prelim. (wk 5-6)	1.14	1.13	0.86	0.93	0.06	-	-
	Treatment (wk 8-9)	1.08	0.86	0.87	0.73	0.05	***	-
	Post-treatment (wk 13-15)	0.99	0.99	0.80	0.79	0.05	***	-
Final CS								
	Prelim.	4.50	4.92	5.08	4.45	0.29	-	-
	Treatment	4.57	4.70	5.32	4.57	0.25	-	-
	Post-treatment	4.42	4.52	5.40	4.63	0.19	-	-
Experiment 4								
MF yield (kg/d)								
	Prelim. (wk 3)	1.05	1.08	0.88	0.84	0.07	-	-
	Treatment (wk 5-7)	1.05	0.73	0.90	0.64	0.07	***	-
	Post-treatment 1 (wk 8-13)	0.94	0.75	0.84	0.59	0.06	*	†
	Post-treatment 2 (wk 14-16)	0.84	0.87	0.81	0.64	0.06	***	*
Final CS								
	Prelim.	4.28	4.45	4.32	5.02	0.20	-	-
	Treatment	4.61	4.06	4.65	4.63	0.16	***	-
	Post-treatment 1	4.63	4.10	4.50	4.76	0.16	**	*
	Post-treatment 2	4.75	4.28	4.70	5.16	0.16	-	-

†  $P<0.10$

**TABLE 3** Effect of generous (G) and restricted (R) feeding level (FL) in late lactation on milkfat (MF) yield and condition score (CS) of cows of high (H) and low (L) breeding index (BI). (All effects of BI x FL non-significant ( $P>0.05$ )).

BI	H		L		SEM	Significance of change from previous period		
	FL	G	R	G		R	BI	FL
Experiment 5								
MF yield (kg/d)								
	Prelim. (wk 25-26)	0.82	0.78	0.68	0.64	0.03	-	-
	Treatment (wk 28-30)	9.75	0.46	0.65	0.41	0.03	*	***
	Post-treatment (wk 31-36)	0.64	0.56	0.56	0.47	0.04	-	***
Final CS								
	Prelim.	5.32	5.03	5.65	6.88	0.35	-	-
	Treatment	4.83	4.58	5.45	6.62	0.37	-	-
	Post-treatment	4.48	4.55	5.00	6.24	0.33	-	-
Experiment 6								
MF yield (kg/d)								
	Prelim. (wk 27)	0.70	0.74	0.54	0.62	0.02	-	-
	Treatment (wk 29-31)	0.72	0.61	0.59	0.52	0.03	-	***
	Post-treatment (wk 32-35)	0.64	0.62	0.49	0.54	0.03	-	***
Final CS								
	Prelim.	4.71	4.50	5.07	4.83	0.19	-	-
	Treatment	4.90	4.58	5.22	5.00	0.19	-	-
	Post-treatment	4.99	4.83	5.45	5.28	0.20	-	-

did HBI cows. At the same time, these LBI cows initially increased CS to a greater extent following restriction than did the HBI cows.

### Experiments 5 and 6

In both experiments MF yield was significantly reduced by restricting the level of feeding in late lactation (Table 3). In Experiment 5 only, the reduction in MF yield during the treatment, compared with the preliminary period was greater for the HBI than the LBI cows. The significant recovery in MF yield of the restricted groups during the post-treatment period resulted in no significant carry-over effect in Experiment 5. In Experiment 6, however, there was a carry-over effect ( $P < 0.05$ ) of generous feeding. The mean response to concentrate feeding in Experiment 6 was 25 g MF/kg concentrate over the treatment period, similar to responses cited by Wilson and Davey (1982).

The results of Experiments 3 to 6 are in general agreement with the data of Bryant (1981) and Grainger (1982), who reported that the differences in milkfat production caused by differences in feed intake were not statistically different between cows of high or low breeding index. However, examination of Grainger's data reveals that in each of 3 experiments the high BI cows showed larger responses to extra feed than the low BI cows.

### CONCLUSION

The present results show that in only 1 case out of 6 was there a marked and significant interaction between the effects of genotype and the effects of feeding, which suggests that the interaction, if present at all, is relatively small. Therefore larger number of animals would be required in order to measure the possible interaction.

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