The effect of breeding index on the performance of non-lactating Jersey cattle

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ABSTRACT

Data from 4 experiments involving comparisons of cows of high (HBI) and low (LBI) breeding index are summarised. In 2 stall feeding experiments, the differences (H-L) in daily intake (kg DM/100 kg LW) were -0.08 ± 0.11 and 0.14 ± 0.10. The cows differed in live weight by 36 ± 16 and 47 ± 15 kg and intake increased by about 0.18 MJ ME/kg live-weight difference.

A 63-day grazing trial involved 100 cows in 6 HBI and 5 LBI groups that differed in initial condition. Daily herbage allowance was inversely related to initial condition. Change in live weight or condition was not significantly affected by breeding index indicating feed requirements of the HBI and LBI cows were similar. Efficiency of grazing of HBI cows was greater than that of LBI cows.

In a second grazing trial of 56 days involving 60 cows, groups consisting of 5 HBI and 5 LBI cows were offered daily herbage allowances inversely related to their initial condition. The HBI cows achieved higher gains in live weight and condition than the LBI cows, the differences tending to be greater at lower allowances.

Keywords Grazing; breeding index; non-lactating; efficiency; intake; live weight; condition; cows

INTRODUCTION

Bryant and Trigg (1981) reported on the effect of breeding index (BI) on the performance of Jersey cows. Observations have now been extended to the non-lactating cow. This paper summarises the results of 4 experiments, each involving comparisons of cows of high (H) and low (L) BI. As in the previous work the BI of the H and L cows was approximately 125 and 100 respectively.

The objective of Experiments 1 and 2 was to establish the *ad libitum* intake of the cows. Experiments 3 and 4 were grazing trials. Their objectives were to determine whether BI influenced the rate of change in live weight (LW) and condition score (CS) when cows within groups were of similar BI (Experiment 3) or a mixture of each BI (Experiment 4).

EXPERIMENTAL

Experiment 1

Five, 5-year-old and 4, 6-year-old cattle of each BI in about their 7 month pregnancy were confined to individual pens for 28 days. The pens (6 × 2 m) allowed continuous access to feed and water. Freshly cut pasture (DM content, 13.5%; *in vitro* OMD, 71.9%) was offered to provide 33% of daily DM intake at 0900 h, and wilted pasture silage (DM content, 21.7%; *in vitro* OMD, 65.7%) to appetite at 1300 h. Residues were removed and weighed at 0800 h. DM content of feeds and residues were determined daily. All cows were weighed and condition scored on 3 consecutive days at the start of the second week and at the end of the trial. Intake data for the first week were excluded from the analyses.

Experiment 2

Twelve cows of each BI, 4 years of age or older and in about their first month of pregnancy were used. They were offered freshly cut pasture to appetite for 21 days. Otherwise procedures were as for Experiment 1.

Experiment 3

The experiment used 54 HBI and 46 LBI cows and started after drying off in April 1980. Six HBI and 5 LBI groups of 8 to 11 cows were formed so that cows within groups were of similar CS. The initial CS of the groups differed, that of the HBI groups ranging from (mean ± SD) 2.9 ± 0.2 to 6.5 ± 1.4 scores and 4.5 ± 0.2 to 6.2 ± 0.3 scores for the LBI groups. For 63 days from 7 May the groups were offered separate areas of pasture each day. Daily herbage allowances were inversely related to initial CS so that all groups achieved a CS of about 5.5 at the end of the experiment. Estimates of herbage mass before and after grazing were made for all groups each day using a combination of visual assessment and calibration cuts. All cows were weighed and condition scored twice each week, the change for individual cows being calculated by regression.

TABLE 1 Intake, live weight and condition score (Experiments 1 and 2).

	Experiment 1			Experiment 2		
	HBI	H-L	SEd	HBI	H-L	SEd
Initial LW (kg)	373	36	16.4	413	47	14.9
Initial CS	3.91	0.15	0.27	6.63	0.67	0.31
DM intake						
kg/d	10.06	0.68	0.51	10.42	1.73	0.30
kg/100 kg LW	2.70	-0.08	0.11	2.53	0.14	0.10
LW change (kg/7 d)	3.49	1.20	0.43	-0.01	0.13	0.13
CS change (scores/7 d)	0.08	0.01	0.2	—	—	—

Experiment 4

Following drying off in April 1981, 60 cows were sorted into groups of high, medium and low condition. There were 2 groups in each CS classification and each consisted of 5 HBI and 5 LBI cows. For 56 days starting 6 May, the groups were offered a fresh area of pasture each day that provided daily herbage allowances inversely related to initial CS. Other procedures were as for Experiment 3.

RESULTS AND DISCUSSION

Voluntary Intake (Experiments 1 and 2)

The HBI cows were heavier than the LBI cows in both experiments (Table 1). Their daily DM intake was also higher in both experiments, significantly so only in Experiment 2. Intake expressed as a percentage of live weight was not significantly different in either experiments.

The metabolisable energy (ME) content of the diet in Experiment 1, calculated from *in vitro* OMD was 9.21 MJ ME/kg DM. Digestibility data from 12 cows in an associated experiment gave a mean for the pasture used in Experiment 2 of 11.35 MJ ME/kg DM. Regression analysis showed that in Experiment 1, ME intake (MJ ME/d) was related to LW (kg) but not BI, or change in either LW or CS (Fig. 1). The regression was:

$$\text{ME intake} = \underset{\pm\ 16.1}{21.9} + \underset{\pm\ 0.045}{0.190\ \text{LW}} \qquad (R^2 = 0.53)$$

In Experiment 2 ME intake was related to both LW and BI as follows:

$$\text{ME intake} = \begin{matrix}94\ (\text{HBI}) \\ 77\ (\text{LBI})\end{matrix} + \underset{\pm\ 0.047}{0.060\ \text{LW}} \qquad (R^2 = 0.64)$$

The significant difference (16.6 ± 3.9) in the intercepts and the lack of significance of the coefficient may have arisen from the limited overlap and spread of the LW data (Fig. 1). The relationship for a common intercept was:

$$\text{ME intake} = \begin{matrix}42\ (\text{HBI}) \\ 20\ (\text{LBI})\end{matrix} + \underset{\pm\ 0.05}{0.17\ \text{LW}} \qquad (R^2 = 0.33)$$

Based on the data from both experiments, it is concluded the *ad libitum* intake increased by about 0.18 MJ ME for each additional 1.0 kg LW. The *ad libitum* intake of the HBI cows is therefore likely to be higher than that of the lighter LBI cows.

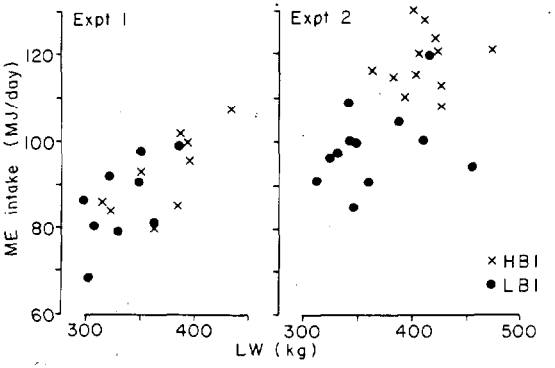

FIG. 1 Relationship between metabolisable energy intake and live weight.

Grazing of HBI or LBI Groups (Experiment 3)

The relationships between change in mean group CS (scores/cow/63 d) or LW (kg/cow/63 d) and mean group DM intake (kg/cow/d) were not significantly affected by BI.

$$\text{CS change} = \underset{\pm\ 0.034}{-2.45 + 0.504\ \text{DMI}} \qquad (R^2 = 0.96,\ \text{RSD} = 0.152)$$

$$\text{LW change} = \underset{\pm\ 2.04}{-6.38 + 5.80\ \text{DMI}} \qquad (R^2 = 0.49,\ \text{RSD} = 8.43)$$

These relationships suggest that at a common intake HBI and LBI cows achieve similar gains in LW and

TABLE 2 Pooled coefficients and adjusted means when various parameters were regressed on average daily herbage allowance.

	Coefficient ± SE	Adjusted Y mean		
		HBI	H-L	SE(d)
Degree of defoliation (%)	-1.53 ± 0.17	65.3	4.31	1.03
DM intake (kg/cow/d)	0.431 ± 0.02	7.4	0.48	0.14
CS change (scores/63 d)	0.22 ± 0.02	1.2	0.20	0.09
LW change (kg/63 d)	2.41 ± 0.93	42.6	7.04	5.48

CS and therefore have similar requirements during the dry period. Requirements were for example, 4.9 kg DM/d to maintain condition and 125 kg DM in addition to maintenance to increase condition by 1.0 scores.

BI did, however, affect efficiency of grazing. Regression of degree of defoliation, intake, change in CS and change in LW on herbage allowance are summarised in Table 2. Pooled coefficients only are shown since in all instances coefficients for HBI and LBI cows did not differ significantly. Differences between BI groups are therefore described by the differences between adjusted means of the dependant variate. The data show that at a given herbage allowance, HBI cows achieved a greater degree of defoliation than did LBI cows, and as a consequence, higher intake and gain in CS. Gains in LW were not significantly different.

Grazing of Mixed BI Groups (Experiment 4)

Daily herbage allowances for the high, medium and low initial CS groups averaged 9.6, 13.2 and 17.4 kg DM/cow/d respectively of which 70, 61 and 49% was removed by grazing. Respective residual herbage masses were 0.99, 1.31 and 1.74 t DM/ha.

The HBI cows were on average 35.0 ± 6.9 kg heavier than the LBI cows at the start of the trial (Table 3). Initial CS was similar. Compared to the LBI cows, the daily gains in LW and CS for the HBI cows were higher by 0.21 ± 0.05 kg and 0.004 ± 0.002 scores respectively. Further, there was a trend for HBI cows to achieve higher LW and CS gains, relative to those of the LBI cows, as herbage allowance decreased. This BI × initial CS interaction was significant ($P < 0.10$) for LW only. Apparently at low allowances, the HBI cows maintained their intake and therefore gains in LW and CS at the expense of those achieved by the LBI cows.

CONCLUSIONS

Non-lactating cows of HBI gain more condition and LW when grazing than do LBI cows. Factors contributing to this are that they consume a greater proportion of the herbage offered, are better competitors

TABLE 3 Live weight and condition score when mixed BI groups were grazed at herbage allowances inversely related to initial condition score (Experiment 4).

	BI	Herbage allowance (kg/cow/d)			SEd	Mean	SEd
		17.4	13.2	9.6			
Inital CS	H	3.10	4.15	4.85		4.03	
					0.21		0.12
	L	3.23	4.03	4.95		4.07	
Initial LW (kg)	H	352	364	356		357	
					12.0		6.9
	L	304	322	341		322	
Change in CS (scores/d)	H	0.056	0.045	0.034		0.045	
					0.004		0.002
	L	0.054	0.039	0.029		0.041	
Change in LW (kg/d)	H	0.98	0.95	0.87		0.93	
					0.08		0.05
	L	0.87	0.73	0.57		0.72	

for available grazing, and because of their higher LW, have a higher *ad libitum* food intake.

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REFERENCE

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