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PRE-CALVING NUTRITION OF BEEF COWS

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SUMMARY

From day 182 to day 276 of pregnancy, mature Angus cows were offered daily pasture allowances of 6, 12, 18 or 24 kg DM. Birth weights varied with treatment in a curvilinear manner. Calf growth rate was positively related to birth weight within treatments and negatively related between treatments. The interval from calving to oestrus was 1.2 days shorter for each kilogram increase in pasture allowance before calving. There was little effect of treatments on serum levels of somatomedins in cows or calves. The lower pasture allowances did not reduce milk intake in the first 3 weeks of suckling.

INTRODUCTION

Rational use of scarce winter feed for beef cows requires balance between economy of feed use and possible deleterious effects of underfeeding on birth weight, growth rate, and health of calves and subsequent reproductive performance of cows as found by Wiltbank *et al.* (1962), Hight (1966, 1968), Dunn *et al.* (1969), Corah *et al.* (1975) and Whitman (1976). The absence of adverse effects of restricted feeding in other studies (Bellows *et al.*, 1972; Hodge *et al.*, 1976; Drennan and Bath, 1976) highlights the need for quantitative definition of levels of feeding and of their effects particularly under grazing conditions.

Somatomedin levels, as a possible index of level of nutrition, were recorded together with animal production data in a pasture allowance trial.

EXPERIMENTAL

From a group of Angus cows artificially inseminated with semen from one Hereford bull on November 15, 1976 (day 0), 70 pregnant cows (6 to 8 years old) were allocated to one of four levels of pasture dry matter (DM) allowance (6, 12, 18, or 24 kg/d) from day 182 to day 276. Data are presented for 58 cows that reared calves (minimum group size of 14). From days 277 to 373 all cows received a pasture allowance of 18 kg/d.

Pasture yields were measured by cutting to ground level and drying the pasture from randomly placed quadrats before and after grazing for 24 hours so that estimates of allowance, utilization and apparent intake could be made.

Twice daily during calving, new calves were identified and weighed. Dairy-type calves were fostered on to cows losing their own calves at birth. However, calf data presented here relate only to Hereford × Angus calves (minimum group size of 11). During the first 3 weeks of life, milk intake was estimated by tritiated water dilution (Wright *et al.*, 1974).

Oestrus was detected by androgenized cows (Kiser *et al.*, 1977) (day 310-351) or Angus bulls (from day 352) fitted with chin-ball harnesses.

Liveweights were recorded without prior fasting. Weights of uterus and contents were estimated by the method of Bereskin and Touchberry (1968) and were deducted from liveweights to give net liveweights.

Rates of liveweight change were calculated by regression of weight on time from 10 observations per cow (net liveweight days 190 to 274) before calving, 11 per cow (days 302 to 373) after calving and 12 per calf (days 302 to 373) for calf growth. Body condition of cows was subjectively graded on a 1 to 10 scale weekly from day 225.

Serum levels of somatomedins were measured by a receptor-binding assay (Brinsmead and Liggins, 1977).

RESULTS AND DISCUSSION

Data from pasture measurements (Table 1) indicate that actual allowances before calving were close to planned levels and that utilization decreased as allowances were increased. After calving, pasture yields were considerably higher than before calving and

TABLE 1: PASTURE DATA

	Nominal Allowance Pre-calving (kg/d)			
	6	*12*	*18*	*24*
Pre-calving (days 182-276):				
Yield (kg/ha)	2680	2620	2620	2640
Allowance (kg/d)	5.9	12.8	18.0	24.6
Utilization (%)	84	73	68	58
Calving and post-calving (days 277-373):				
Yield (kg/ha)	4040	4080	3930	4160
Allowance (kg/d)	18.6	17.4	18.3	17.8
Utilization (%)	73	70	68	68

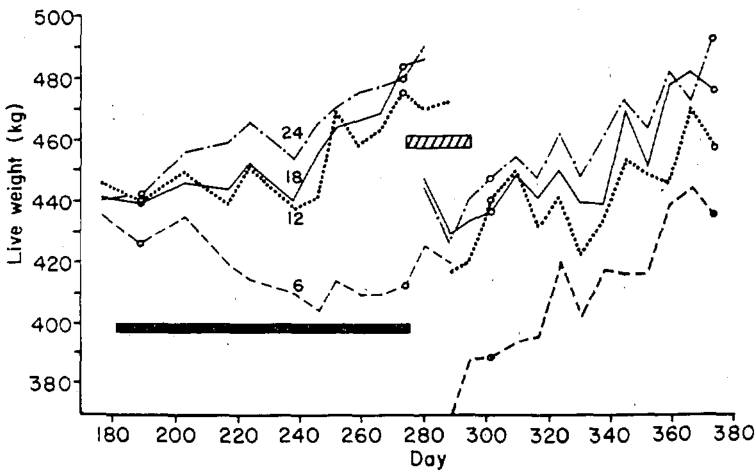

FIG. 1: Mean liveweights of cows receiving allowances of 6 (— —), 12 (......), 18 (———) and 24 (—.—) kg/d from days 182 to 276.

there was a tendency for cows previously on low allowances to continue at higher levels of utilization (Table 1) than cows previously on higher allowances.

Liveweights of the cows (Fig. 1) did not change linearly with time before calving, but net cow weights did so. Rates of change in net cow weight before calving were similar in groups receiving allowances of 12, 18, and 24 kg (Table 2).

Condition scores (Table 2) of the cows in the 12, 18, and 24 kg allowance groups were also similar and rose slightly from day 225 to calving, whereas those of cows on the 6 kg allowance declined steadily until calving.

Mean gestation length was 283 days (range 275 to 293). At birth, heifers were lighter ($P < 0.01$) than bulls by 3.1 kg. Pasture allowance affected birth weight ($P < 0.05$) but not in a simple manner, with lightest weights being recorded on the lowest and highest allowances (Table 2). Birth weights within treatments were not significantly related to gestation length, net cow weight before calving or changes in net cow weight during pregnancy (days 190 to 274).

After calving, weight gain was highest in cows on the lowest pre-calving allowance (Fig. 1, Table 2). Winter treatment of dams produced significant differences in calf growth between pairs of treatments (Table 2). Growth rate of calves tended to be negatively related to birth weight on a between-treatment basis, sug-

TABLE 2: ANIMAL PERFORMANCE

	Pre-calving Allowance (kg/d)				
	6	*12*	*18*	*24*	*S.D.*
Pre-calving					
Cow weight changes (kg/d)					
Gross	— 0.17	+ 0.42	+ 0.53	+ 0.45	—
Net	— 0.60[a]	— 0.07[b]	+ 0.03[b]	— 0.02[b]	0.243
Birthweight (kg)	29.4[a]	34.0[b]	32.8[b]	31.5[ab]	3.88
Post-calving					
Weight changes (kg/d)					
Cows	0.73[c]	0.33[a]	0.60[bc]	0.55[b]	0.176
Calves	0.98[b]	0.87[a]	0.85[a]	0.95[ab]	0.115
Milk intake (l/d) weeks 1-3	7.1[b]	6.4[ab]	5.8[a]	6.2[ab]	1.02
Cow weight (kg)					
Day 117 (net)	422[a]	430[a]	426[a]	425[a]	38.4
Day 310	393[a]	447[b]	449[b]	453[b]	43.9
Interval (days)					
Calving-oestrus	71.8[b]	62.3[ab]	59.6[ab]	49.1[a]	18.2
Cow condition					
Day 225	5.7[a]	6.1[ab]	6.8[b]	6.5[b]	0.92
274	4.7[a]	7.1[b]	7.6[bc]	8.1[c]	0.78
373	6.3[a]	7.3[b]	8.0[bc]	8.7[c]	1.05

Means lacking a common superscript differ significantly ($P < 0.05$).

gesting compensatory growth, possibly via differences in milk intake, after prenatal restriction (Table 2). By contrast, growth rate was positively related to birth weight ($r = 0.54$) within treatments where higher birth weights were presumably a reflection of higher growth potential expressed both pre- and post-natally. Within treatments, calf growth rate was negatively related to change in dam's weight over the same period ($r = -0.38$).

The relative lack of effect of differential feeding on calf birth weight and subsequent growth rate in this and in some published experiments is probably related to maternal body reserves at the beginning of the experiment. Cows in the present trial were mature and in good initial condition, whereas those of Wiltbank *et al.* (1962), Dunn *et al.* (1969), Corah *et al.* (1975) and Whitman (1976), where effects of nutrition during pregnancy were observed on the calves, were mainly two-year-old heifers. Where little or no effect was observed, cows were mature (Drennan and Bath, 1976; Hodge *et al.*, 1976) or very large heifers (Bellows *et al.*, 1972). The experiments of Hight (1966, 1968) stand out as recording the most severe effects of pregnant cow nutrition on calves. Degree of restriction was not quantified but was clearly very severe because, although the cows were in good initial condition, post-calving weights were down to 330 kg, representing a loss of about 80 kg from initial liveweight (Hight, 1966), compared with about 60 kg in the present data.

The interval from calving to first oestrus was shortened by 1.2 days for each extra kilogram of winter allowance even though differences between the top three allowances in liveweight at the beginning of oestrus recordings (day 310) were small (Table 2). Some cows in all groups, despite adequate post-natal feed, could not maintain a calving index of 365 days. Thus improvement of calving index requires consideration not only of adequate feeding but also of such measures as crossbreeding, early weaning, induced calving of late calving cows and treatment with progestagens.

TABLE 3: SERUM LEVELS OF SOMATOMEDINS (ng/ml)

	Cows			Calves	
Pre-calving Allowance	*Day 247*	*Day 274*	*c. 30 Days Post-partum*	*Days Post-partum 2*	*4-8*
6	2770[b]	2230[a]	2430[a]	3690[a]	2800[a]
12	2260[a]	1840[a]	2210[a]	3450[a]	3050[a]
18	2190[a]	1890[a]	2110[a]	3940[a]	3090[a]
24	2310[a]	2030[a]	2390[a]	5890[b]	2550[a]

Means in the same column lacking a common superscript differ significantly ($P < 0.05$).

Levels of somatomedins — serum constituents that mediate many of the effects of growth hormone — tended to be higher in cows on the lowest allowance (Table 3). This contrasts with the decrease in somatomedin levels in rats subjected to low levels of nutrition (Takano and Shizume, 1978). Levels in calves showed no clear pattern except for an apparent fall with time.

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