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Winter feeding of twinning beef cows

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ABSTRACT

A grazing trial was conducted in southern North Island hill country during 1994, to determine the influence of pasture allowance during winter on cow/calf performance of 40 twin- (T) and 40 single-calf (S) bearing Friesian-cross beef cows. Groups of T and S cows were grazed at low (L), medium (M) and high (H) pasture allowances for the last 4 months of gestation.

Average LW in late autumn was 467 kg, and change up to 4 weeks pre-calving was LS -7.8%, MS -2.4%, HS +1.5%, LT -8.1%, MT -3.0%, HT -3.5%, suggesting S cows responded to a increased pasture allowance in late gestation, but T only to M and no further to H. Blood serum βOH concentration, which was used as a measure of energy status, was not influenced by allowance treatment, but T (2.2 mmol/l) had higher concentrations than S (0.9). Twinning cows had a shorter gestation length than S cows (277 vs 284 d). Twin calves were lighter at birth (30.9 vs 44.2 kg), had lower perinatal survival (73 vs 96%), and grew more slowly to 4 months of age than single calves (0.76 vs 1.11 kg/d).

Our results suggest that “traditional” management techniques to winter Friesian-cross beef cows in southern North Island hill country, involving loss of up to 15% of the cow's autumn LW, will compromise her ability to successfully rear two large calves.

Keywords: beef cow; twin calves; winter management; pasture allowance; *in vitro*; embryo transfer.

INTRODUCTION

The role of beef cows on hill farms includes generation of income; maintenance of feed quality; and provision of increased management flexibility. Current recommendations for winter management include a 15% loss of autumn liveweight (LW) by 4 weeks before calving, and maintenance or slight gain in LW to calving (Pleasants et al 1991).

Twinning of cattle through embryo transfer has potential for increasing biological efficiency and profitability of cow/calf systems, and enhancing access to superior genetic material. Twinning cows have a higher energy requirement for pregnancy and lose more body weight in late-pregnancy than singles; have a shorter gestation period; produce calves with a lower birth weight; and subsequently produce more milk (Koong *et al* 1982, Reid *et al* 1986, Guerra-Martinez *et al* 1990, Diskin & Sreenan 1985). These differences suggest that current feeding recommendations for single-bearing cows may be inadequate for twinning cows, and realistic guidelines for their management in hill-country grazing systems need to be developed.

MATERIALS AND METHODS

Cows

Eighty Friesian*Hereford and Friesian*Angus cows, half diagnosed as carrying twins and half as carrying singles, were grazed at the AgResearch Ballantrae Hill Country Research Station near Woodville during 1993/94.

Embryo transfer

Seventy two of the cows had 2 fresh *in vitro* produced (IVP) embryos (Pugh *et al* 1994) transferred non-surgically (McMillan & Macmillan 1989) during 10 December 1993 to 21 January 1994. Donor cow breed was unknown, and semen was from a Maine Anjou. The other 8 cows were naturally mated during the same period then received one in vivo produced embryo of mixed parentage 7 days later. Pregnancy status (0, 1, 2) was assessed by ultrasound scanning in mid February, and by veterinary palpation (+ or 0) in late March.

Pasture allowance treatments

Cows were grazed according to normal farm practice until late May 1994. From then until 4 weeks before calving, 20 cows diagnosed as single-bearing (LS) had a low pasture allowance; 20 single-bearing (MS) and 20 twinning cows (MT) which were grazed as one mob had a medium allowance; and 20 twinning cows (HT) had a high allowance. Because prediction of pregnancy status was not completely accurate, some cows produced twins in the LS treatment (=LT), and some produced singles in the HT treatment (=HS). The number of cows in some treatment combinations of this extended (in retrospect) design was less than desirable in some cases (Table 1).

The different allowances were intended to result in nominal liveweight (LW) losses from late autumn (early April) until 4 weeks pre-calving of 15% (LS), 10% (MS & MT) and 6% (HT). Information available for calculation of pasture allowances which lead to specified changes in LW of pregnant beef cows is limited. Extrapolations from relationships given by Nicol & Nicoll (1987), suggested initial allowances of 4, 5, and 6 kg dry matter (DM)/cow/d for LS, MS & MT, and HT respectively. These were increased in mid-June as it was felt achievement of the target LW’s could compromise cow survival. New targets of 10% (LS), 5% (MS) 4% (MT) and 0% (HT) LW loss were set (the difference in projected LW loss of the MS and MT cows being to account

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for differences in conceptus weight) and allowances of 5.4 (LS), 6.6 (MS & MT) and 11.8 (HT) were used from 20 June.

Four weeks before calving, allowances were increased to 8.2, 10.0 and 15.0 kg DM/cow/d respectively until calving, to 15 for all groups for 4 weeks post-calving, to 20 kg DM/cow/d until late December, then cows were grazed together under normal farm practice. Groups were break-grazed, and received a fresh break 3 times weekly.

Measurements

Pasture allocation was based on pre-grazing ground level cuts, and post-grazing pasture DM residual was also measured. Digestibility of the harvested pre-grazing herbage was estimated by near infra-red spectroscopy.

Cow LW and body condition score (0-8 scale) were monitored weekly while allowance treatments were in place, and rapid decreases were used as early warning of incipient metabolic problems. Calving date and calf birth weight were recorded, as was calf LW at the end of January at an average age of 4 months.

Blood samples were taken at 1 or 2 weekly intervals from mid-July until 4 weeks before calving, and serum analysed for beta-hydroxybutyrate (βOH) concentration. Cows with a level >3 mmol/l were removed from their group and fed on *ad lib* pasture allowances for a week, then resampled. Generally βOH was then sufficiently low (<2) for them to be returned to their group.

Data analysis

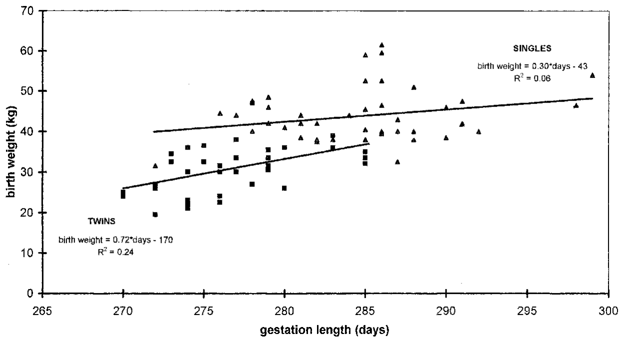
Analysis of variance of results treated cows/calves as replicates within 6 pregnancy status*allowance combinations. All means presented here are least squares means. Linear regression analysis was used to derive relationships between serum βOH concentration and cow LW change, and between calf birthweight and gestation length.

RESULTS

From late May to 4 weeks pre-calving, average pre-grazing pasture mass (kg DM/ha) was 2230, 2910, and 2210 for L, M and H respectively; post-grazing mass (kg DM/ha) was 520, 790, and 910; DM utilisation (%) was 77, 73, and 59; and DM digestibility (%) of pasture offered (harvested to ground level) was 60, 56, and 58.

Cow LW in late autumn (30 March) averaged 464 kg, and had changed little when allowance treatments were

FIGURE 1: Birth weight vs gestation length for singles and twins



imposed (Table 1). Loss in LW from May to 4 weeks pre-partum was greatest under L and least under H allowance, and there was a tendency (P<0.10) for T cows to lose more weight than S cows (Table 1). There were no significant (P>0.05) overall allowance*status interactions, however in the H treatment a significant (P<0.05) effect of pregnancy status was noted: T cows lost, and S cows gained weight (Table 1).

Cow body condition score was similar across treatments in early July (average 6.2) and had declined to an average 4.6 by 4 weeks pre-partum. As for LW change, condition declined more for T than L cows, and L cows lost more condition than H (Table 1). Serum βOH concentration, averaged across 5 samplings, was higher for T than S cows and was not significantly (P>0.05) influenced by the allowance treatments (Table 1).

Average length of gestation for twinning cows was 7 days shorter than for cows delivering singles, and was not influenced by pasture allowance (Table 2). Birth weight of single calves was 43% greater than that of twins, but was not influenced by allowance (Table 2). Birth weight of single calves increased by 0.30 kg/d increase in gestation length of individual cows, and by 0.72 kg/d for twins (Fig. 1). Perinatal calf survival was greater for singles than twins (Table 2), however this result was not subjected to statistical analysis because of lack of within treatment-combination replication.

Effect of level of winter feeding level on calf LWG to 4 months of age could only be tested for singles, as most twins reared on their own mothers were from one (M) allowance treatment. LWG tended to increase (P<0.10) with pasture allowance (1.03 ± 0.04, 1.11 ± 0.04, 1.19 ± 0.06 kg/d). Calf LWG was 46% greater (P<0.01) for calves born and reared as singles (1.11 ± 0.04 kg/d) than those born and reared at the

TABLE 1: Number of cows in each treatment, cow liveweight and body condition score in late pregnancy, and average serum beta-hydroxybutyrate concentrations during July/August (±SE)

							Nutritional status				Pregnancy Status		
	LS	MS	HS	LT	MT	HT	L	M	H	Sig.	S	T	Sig.
Number of cows	16	24	9	3	13	6	19	37	15		49	22	
Cow LW at 23 May (kg)	470	466	459	480	463	481	475±12	465±9	470±14	ns	465±8	475±11	ns
Cow LW change (kg)	-37	-11	7	-39	-15	-18	-38±5	-13±3	-6±5	***	-14±3	-24±4	ns
Cow LW change (%)	-7.8	-2.4	1.5	-1.8	-3.0	-3.5	-7.9±1.0	-2.7±0.7	-1.0±-1.1	***	-2.9±1.0	-4.8±0.9	ns
Condition score (CS) at 4 July	6.3	6.3	6.0	6.3	6.1	6.3	6.3±0.2	6.2±0.1	6.2±0.2	ns	6.2±0.1	6.2±0.2	ns
CS change to 4 weeks pre-partum	-1.8	-1.3	-0.6	-2.7	-1.9	-1.5	-2.2±0.2	-1.6±0.2	-1.0±0.2	**	-1.2±0.1	-2.0±0.2	**
Blood BOH concentration (mmol/l)	0.98	0.88	0.78	2.43	1.64	2.48	1.7±0.2	1.3±0.1	1.6±0.2	ns	0.9±0.1	2.2±0.1	***

TABLE 2: Gestation length, calf birth weight and calf survival (±SE)

	LS	MS	HS	LT	MT	HT	Nutritional Status L	M	H	Sig.	Pregnancy Status S	T	Sig.
Gestation Length (d)	285	284	283	278	277	275	281±1	281±	279±1	ns	284±1	277±1	***
Calf Birth weight (kg)	42.5	43.8	46.4	30.0	30.9	31.9	36.4±1.4	37.2±1.0	39.2±1.6	ns	44.2±0.8	30.9±1.3	***
Calf survival (%)	100	88	100	83	69	67	92	79	83		96	73	

same allowance (M) as twins (0.76 ± 0.06 kg/day), and they were 47 kg (36%) heavier at 4 months of age.

DISCUSSION

Although digestibility of pasture samples cut to ground level was low, digestibility of ingested material could be expected to be higher, as stem and dead material which are of low quality are concentrated in the base of the canopy and relatively inaccessible to grazing animals. Accordingly, as utilisation of pasture decreased from L to H allowances, diet digestibility probably increased. In general, change in LW and body condition were strongly related to pasture allowance. However, the HT cows, in contrast to the HS cows failed to respond to the highest allowance during months 6 to 8 of gestation, despite the probable enhanced quality of their diet resulting from low pasture utilisation. Probably the large conceptus physically restricted rumen volume and hence intake, and this effect may have been exacerbated by low pasture quality. Daily shifts to a new break may have assisted in overcoming these limitations, through reduction in pasture fouling (which was considerable) and possible depression in voluntary intake.

Blood βOH analysis proved to be an effective tool for monitoring energy status of twinning cows, as noted by Morris et al (1992). Despite allowance treatment influencing LW change in twinning cows, there was no systematic effect on average βOH level (Table 1). However, there was a relationship between rate of LW change and βOH concentration across all T cows: over a LW change range of +8 to -10% LW, βOH was 0.13 mmol/l greater per 1% increase in rate of LW loss (R^2=0.39, P<0.01). The influence for S cows, over a range of +5 to -15% LW change was smaller: 0.04 mmol/l per 1% increase in rate of LW loss (R^2=0.26, P<0.001). Change in βOH level in late gestation, coupled with visual appraisal of cow shape, was successfully used as an aid (as well as ultrasound scanning in early gestation) in predicting pregnancy status.

Our results suggest that the T cows would have needed to achieve a 3.7% LW increase up to 4 weeks before parturition, in order to maintain the same average βOH level as that of the LS cows [a concentration similar to the upper limit of the "normal" range (MAF Animal Health Laboratory, Palmerston North) of 1.0 mmol/l]. Under the trial conditions such a weight gain was not achieved in late pregnancy. The "normal" βOH range will probably not be appropriate for twinning cows, as concentrations of >1.0 mmol/l were not necessarily associated with cows in (visually observed) poor physiological condition.

The 7 day shorter gestation length for twins than singles was intermediate to literature values of 2 to 11 days (Morris et al, 1992). The difference in birth weight of single compared to twin calves (13.3 kg) was greater than has been reported eg., average birthweight of singles and twins of 37.7 and 29.5 kg respectively in Australian work (McLeod *et al,* 1992; Clark et al, 1992). The particularly high birth weight of some individual single calves (Fig. 1) may have been associated with the particular IVP embryo production system (eg., Behboodi *et al* 1995), or may have been a trait of the sire used.

Average calf survival of 96% for singles is in line with those of commercial practice, however requirement for calving assistance was considerably greater than would normally be the case at Ballantrae. This was most likely a consequence of the large single calves. Average calf survival of only 73% for twins was less than the 88% over 4 years reported by Cummins (1994) for more intensive management conditions. Such levels of mortality would likely limit farmer uptake of this technology. In the year following the work reported here we achieved calf survival of 100% and 94% for single and twin calves respectively, and the birthweight differential was similar to that of other studies. In the latter trial, we used IVP embryos from the same system but semen from a different sire, and employed a much more intensive calving management system. The limited data available from our current work suggests twin calf survival was not adversely affected by reduced cow nutrition levels, provided cows were in a healthy state at calving.

The lower growth rate of twin vs single calves up to weaning has been well documented. The higher milk production of twin-suckling cows is presumably insufficient to meet the increased demands of two calves. In our work T cows had lower body condition than S cows over late pregnancy, and hence less body reserves available for mobilisation for lactation, and this may have limited their ability to increase milk supply in response to twin-suckling. This is supported by the effect of winter pasture allowance on single calf growth, presumably through a carryover effect on milk production.

Successful management of twinning beef cows will involve paying particular attention to provision of forage of adequate *quality* as well as quantity, to frequency of shifts in break-grazing systems, and to maintenance of, or gain in LW in mid and late gestation. High accuracy in detection of pregnancy status will be a prerequisite to successfully implementing such a programme, and intensive management during calving will be necessary to ensure acceptable calf survival rates.

Use of "traditional" management techniques to winter Friesian-cross beef cows in southern North Island hill country will compromise the cow's ability to perform at an optimum level ie., survive, rear 2 large calves, and conceive within an annual cycle.

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