

Pre- and post-weaning growth of beef calves reared by cows on one of five lifetime nutrition levels

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Abstract

The hypothesis that currently recommended liveweights for beef cows are too high was tested at Whatawhata Research Centre. Industry claims have been that high levels of reproductive efficiency can be achieved with cows running up to 20% lighter than current targets, and eating proportionately less pasture. We ran 150 Hereford X Friesian cows on 1 of 5 lifetime feeding levels or treatments. Average liveweights of the five treatments ranged from 470 to 390 kg at mating but pregnancy rate was *not* affected. Calf weaning weight was affected, however ($P<0.001$), especially of the calves from the lowest cow treatment. Hence, although these light cows were eating less than their heavy contemporaries, in practice, farmers might be reluctant to run them unless their light calves were able to compensate before slaughter. The objective of this trial was to determine the degree of compensatory growth by the lighter calf treatments. The impacts of meal supplementation at weaning, and weaning date, were also tested. The calves were weaned in either mid-February or mid-March and half of them were supplemented with meal for 5 weeks. A major finding, confirming earlier research, was that rearing effects in early life are not readily compensated for later. Calves weaned from the lightest cow treatment had shown no compensation ($P<0.001$) up to 6 weeks after being run together with their heavier contemporaries. Meal supplementation gave a substantial improvement in liveweight (+19 kg, $P<0.01$) in the calves weaned early onto poor quality summer pasture. However, 10 weeks after supplementation ceased, this benefit was reduced to 2.4 kg. In the late-weaned calves, supplementation resulted in a 10 kg advantage, which, unlike the above, was retained 6 weeks later ($P<0.05$). Late weaning was almost as effective as meal feeding the early-weaned calves. At 10 weeks after late weaning, the late-weaned calves were still 16 kg heavier ($P<0.01$) than their early-weaned contemporaries. These results suggest, firstly, that cow lifetime nutrition, below a threshold level may permanently affect calf liveweight; secondly, the benefits of meal

supplementation at weaning may not be permanent or economic, thirdly, weaning early, particularly in a dry season is not recommended.

Keywords: beef calves, compensatory growth, cow nutrition, meal, weaning date

Introduction

A major reason for running beef cows on hill country is their flexible feed demand in the face of a seasonal pasture growth curve (McCall 1994; Pleasants *et al.* 1994). Furthermore, they fit in well with other stock classes such as sheep or finishing stock because of their ability to assist in the management of feed quality (Pleasants *et al.* 1991). These attributes are obvious in the spring when pasture is growing rapidly. While the cow is lactating, her intake doubles at least (Smeaton *et al.* 1979). Then, during summer and early autumn she still supports good calf growth rates even though other stock, perform poorly at this time (McCall 1994). Subsequently in late autumn and winter she can sustain a period of below maintenance intake by losing a substantial amount of weight provided her body condition is adequate to start with.

To assist farmers to use the cow as above, target liveweight and feeding guidelines have been published (Smeaton *et al.* 1979; NZ Beef Council *circa* 1990). However, some members of the beef industry claim that these targets are more generous than necessary and that high levels of reproductive efficiency and calf weaning weights can be obtained off cows running up to 20% lighter.

These claims were tested in a 4-year study at Whatawhata Research Centre. Beef cows were run at 1 of 5 lifetime feeding levels (treatments) to generate 1 of 5 cow liveweight profiles (Table 1).

Table 1 Effects of lifetime nutrition on cow liveweight.

Time	Cow lifetime nutrition treatment or liveweight profile					Typical target
	High 1	2	3	4	Low 5	
Post-calving	426	307	370	367	356	410
Start-mate	472	446	423	415	390	450
Weaning	485	469	414	420	408	440

The major treatment effect was on calf weaning weight, with reproductive efficiency of the cows hardly affected (Smeaton, unpublished). At weaning time, the lightest treatment cows were 17% lighter on average than the heaviest treatment (Table 1). Measurements of intake (Smeaton *et al.* 1995) indicated they had eaten up to 15% less. Their calves were 10–12% lighter. However, although these light cows appear to have been more efficient, farmers could still be very reluctant to run them unless the light calves were able to compensate later. Our objective was to measure compensation by these calves after weaning and to determine any potential benefits of weaning the calves earlier along with meal supplementation.

Materials and methods

The present trial was carried out on the 1994-born crop of calves from the above trial. The 138 calves were all suckled by Hereford × Friesian cows running at one of the five lifetime nutrition levels described above.

The five cow nutrition treatments were set such that the heaviest treatment cows were at least 70 kg heavier on average than the lightest treatment. The treatments were also set so as to be above and below currently recommended target weights (Table 1).

The calf trial was conducted in 2 parts:

Part 1: All the calves from the treatment 1 and 5 cows above and 25% of the treatment 2, 3 and 4 cows, were weaned “late” (15 March 1995). From this time on, they ran together on pasture.

Part 2: Calves from the treatment 2, 3 and 4 cows above were weaned either “early” (E) on 8 February 1995 or “late” (L) on 15 March 1995. In addition, the calves at each weaning time were either given *ad lib.* meal supplement (+M) or not (-M). In other words, Part 2 was a 3×2×2 factorial design with 3 cow nutrition treatments × 2 weaning dates × 2 meal levels (nil or *ad lib.*). The meal used was a suitable calf meal currently commercially available (“Grow-up”) and was supplied by NRM Feeds (NZ) Ltd. The meal was a composite product with a cereal base, containing 18% crude protein (DM basis) and 11.5 MJ ME/kg DM. At each weaning time, all weaned calves were also given *ad lib.* pasture (Table 2). The unweaned calves remained on their mothers with their lifetime nutrition treatments. The L -M calves were also used in the Part 1 analyses as

Table 2 Pasture, meal and weather data for the weaning date and meal supplementation treatments.

Period	Meal offered (kg/hd/day)	Pasture allowance (kgDM/hd/day)	Green DM content (% of total)	Residual pasture (kg/DM/ha)	Rain (mm)
Early wean (8 Feb to 15 Mar, 35 days)	1.7	11.5	6.0	1470	150
		12.3	5.6	1480	150
Late wean (15 Mar to 4 May, 35 days)	2.0	11.3	6.4	1370	356
		11.2	7.2	1270	356

* over 8 weeks starting 4 weeks before the stated period.

described in Part 1 above. Pasture allowance and pasture quality were estimated using techniques involving visual assessment and pasture cuts as described by Smeaton *et al.* 1983.

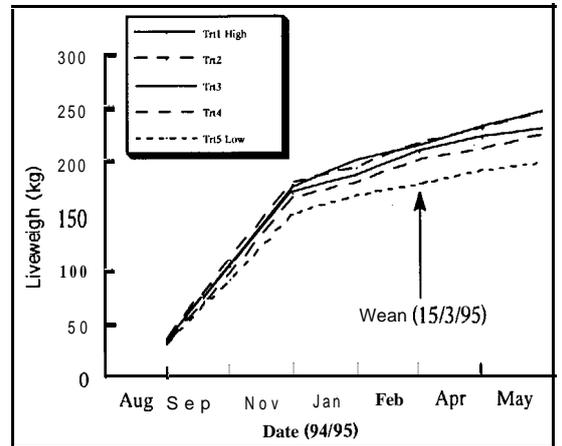
Calves were weighed approximately fortnightly. Statistical analyses were carried out on calf weights using covariance analyses and adjusting for calf sex. Calf birth date was fitted as a covariate after it was found to not be affected by cow lifetime nutrition level. Calf birth weight was affected (P<0.05) by cow treatment and so it was not used as a covariate in the Part 1 analyses. In the Part 2 analyses, liveweight at early weaning (8 February) was used as a covariate.

Results and Discussion

Part 1: Cow lifetime nutrition treatment substantially affected calf liveweight at all stages (P<0.001; at birth P<0.05) (Figure 1).

The biggest effect of cow treatment on calf weight occurred in those calves reared by the treatment 5 cows (lightest treatment), with all the other treatment averages

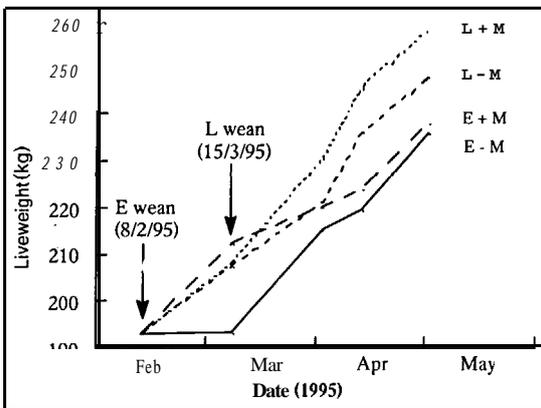
Figure 1 Effects of cow treatment on calf liveweight.



being within $\pm 5\%$ of the treatment 1 calves. By the end of May 1995, 10 weeks after weaning, compensation by the lighter groups was negligible. This finding is very similar to those described by Berge (1991) and Everitt *et al.* (1975) who found that compensatory growth, even 1 year later, did not occur in steers poorly reared up to 16 weeks of age.

Part 2: Meal supplementation benefited calf liveweight ($P < 0.001$) especially in the E +M group (Figure 2). Both E +M and L +M groups grew at similar rates during their supplementation periods but the E -M calves hardly grew at all during this time. Pasture quality as affected by rainfall (or lack of) may have contributed to this result (Table 2). The late-weaned calves were weaned onto higher quality pasture than the early-weaned calves and were able to gain some weight even without meal (Figure 2).

Figure 2 Effects of weaning date and meal supplement on calf liveweight.



The E-M calves showed considerable compensation to the end of April and by the end of May were similar in weight to the E +M calves. This is common in older animals differentially fed for short periods (Nicol & Kitessa 1995). Of some surprise therefore, is the lack of compensation in the L -M calves to the end of May (interaction NS). Further weighings are required to determine if their 11 kg disadvantage compared with the L +M calves is permanent. Again, however, this result is not inconsistent with the variable nature of compensatory growth in cattle (Nicol & Kitessa 1995).

In both the E +M and the L +M groups, 60-70 kg of meal per calf was fed during supplementation. About 90% of this was consumed. The retail cost of the meal was \$35-\$40 excluding GST per calf. At a schedule value of \$2/kg carcass weight, a break-even liveweight

improvement of over 30 kg is required. Clearly this was not achieved in this study.

Figure 2 also demonstrates that early weaning is likely to be detrimental to calf liveweight. The late-weaned calves (while still on their mothers) grew almost as well as the E +M calves. The benefits of late weaning appeared to be permanent, at least until the end of May when the late-weaned calves were still 15.8 kg heavier ($P < 0.001$) than the early-weaned calves. In terms of cow liveweight, there was no cost in achieving this. At early weaning, the early-weaned cows at 434 kg were 9 kg lighter than the late-weaned cows. This non-significant difference still applied at late weaning. These findings are at variance with those of McCall *et al.* (1988) who, even so, concluded that the benefits of late weaning outweighed any costs of cow liveweight loss and reduced the demand for quality autumn pasture.

Conclusions

1. The major result of this experiment was that cow lifetime nutrition treatment or liveweight profile affected calf weight from birth onwards and these affects appeared to be permanent. However, the effect occurred only when cows were run below a threshold liveweight profile about 5-10% below currently recommended targets.
2. Meal supplementation resulted in significantly improved liveweight gain in weaned calves with the benefits greatest in calves weaned onto poor (summer dry) pastures. These benefits appeared not to be permanent and were unlikely to be economic especially in light of 3) below.
3. Late-weaned calves showed superior liveweight gain than those weaned early, even 6 weeks after late weaning had occurred.

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