A comparison of rearing systems for dairy beef calves

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Abstract

A demonstration of the performance and cost of artificial calf rearing systems was undertaken using 4-day-old Friesian bulls. Three commercial calf rearing systems (recommended by calf feed manufacturers) were compared with a cheaper variation which involved substituting a proportion of meal with pasture. The same calf milk replacer and meal was used in all four systems, so that this was a comparison of rearing systems, not of products. System 1 was a conventional twice-a-day milk feeding regime for 6 weeks, with access to pasture from 4 weeks of age and restricted meal fed to 12 weeks. System 2 involved twice-a-day milk feeding for 10 days, followed by once-a-day milk feeding for a further 50 days together with restricted meal and access to pasture from 4 weeks. System 3 involved once-a-day milk feeding for 5 weeks and *ad libitum* meal feeding before being allowed access to pasture at 10 weeks of age. System 4 was similar to System 3 but instead of *ad libitum* meal, calves were allowed access to pasture from 4 weeks and fed restricted meal. Feed input costs ranged from $83 per calf in System 4 to $127 per calf in Systems 2 and 3. At 12 weeks, average calf liveweights ranged from 98 kg for calves reared using System 1 to 110 kg for calves reared using System 3. There were significant differences in 12-week liveweight ($P<0.05$) between calves reared using System 1 and those reared using Systems 2 and 3. The liveweight penalty at 12 weeks was still apparent at slaughter at 26 months, but at an average liveweight of 593 kg these differences were no longer significant. This study demonstrated that calves can be successfully and cost-effectively reared using a low cost once-a-day milk feeding system for 5 weeks and by substituting grass for meal as part of their diet.

Keywords: dairy beef, calves, calf rearing

Introduction

In recent years, traditional breeding cows have decreased in number making the rearing of calves of dairy origin an increasingly important component of New Zealand beef production systems. The profitability of calf rearing is dictated by the purchase price of 4-day-old calves and the input costs of calf milk replacer (CMR) and proprietary calf meals. A wide range of rearing systems have been used historically by calf rearers. Given the diversity of potential feed inputs available and apparent costings of various calf rearing regimes, a calf rearing demonstration was undertaken in July 1996. The objective was to compare the performance and cost of three commercial calf rearing systems (recommended by calf feed manufacturers) with a cheaper variation which involved substituting a proportion of meal with pasture. The same CMR and meal was used in all four systems, so that this was a comparison of rearing systems, not of products.

Materials and methods

Eighty Friesian bull calves with an average liveweight of 44.7 kg were purchased at approximately 4 days of age. No details of the genetic background of the calves were available but all were typically well marked Friesian calves. Upon arrival at the Poukawa Research Station calves were fed 60 g of a proprietary electrolyte (Dexolyte, BOMAC), then weighed and penned in groups of 10 such that all pens had a similar average weight. Calves were allocated to four feeding systems and group-fed as detailed in Table 1. System 1 was a conventional twice-a-day milk feeding system, System 2 a combination of twice-a-day followed by once-a-day milk feeding and System 3 a once-a-day milk feeding regime, with indoor housing for 10 weeks and *ad libitum* meal feeding similar to that reported by Kellaway *et al.* (1973). System 4 was similar to System 3 but featured restricted meal and early introduction to pasture. All calves were fed a CMR marketed by Ngahiwi Farms (27% crude protein, 21% fat) and a proprietary calf meal (HiPro) marketed by PCL Industries (20% crude protein, 13.0 MJME/kg DM). Meal intakes by each pen of 10 calves were recorded on a weekly basis. All calves were allowed access to clean water and barley straw throughout the rearing period. Calves were offered 1500 and 1800 kg DM/ha of cocksfoot/ryegrass/sub clover pasture. Calves were weighed at 5 weeks and thereafter at 10 and 12 weeks. Calves were vaccinated against clostridial diseases using

2ml subcutaneous injections of Multine™ (COOPERS) at 4 and 8 weeks. At 14 weeks, the calves were transported to the Whatawhata Research Station and farmed for 6 months as a single group, and then subsequently as two randomised groups until slaughter at 26 months.

Analyses of variance were performed on the calf liveweights over the experiment using the SYSTAT statistical package (Version 8.0, SPSS Inc, 1998).

Results and discussion

Calf milk replacer consumed per calf ranged from 16 kg to 35 kg, and the intake of meal from 70 kg to 146 kg (Table 2). The cost of calf milk replacer and meal ranged from $83 per calf in System 4 to $127 per calf in Systems 2 and 3. For this calculation the cost used for CMR and meal was $2450 and $600 per tonne respectively, based on retail prices for bulk product (i.e., tonne lots) delivered in Hawke's Bay in spring 1996. System 1 was a relatively low-cost system in terms of feed inputs ($91.10/calf) but it is worth noting that the labour inputs would be considerably higher in System 1, with 84 milk feeds per calf compared to 35 milk feeds per calf in Systems 3 and 4 (Table 2).

Rearing system had no significant effect on calf growth rate to 5 weeks, with calves having an overall growth rate of 0.62 kg/day and averaging 66.8 kg at 5 weeks (Table 3). By 12 weeks, calves reared using a conventional twice-a-day milk feeding regime (System 1) were significantly lighter than those reared using Systems 2 and 3. Presumably, the lower pellet consumption of calves reared on System 1 meant that they were more reliant on pasture to meet their feed requirements. Calves of 80 kg liveweight growing at 0.75 kg/day have a daily energy requirement of 26 MJME (Moran 1993). Calves reared on System 1 would have received an estimated 13.25 MJME from meal and would need to make up the remaining 12.75 MJME from pasture. Assuming 15% moisture and an energy density of 11.2 MJME in spring pasture (Ulyatt *et al.* 1980), these calves would need to consume 7.5 kg of pasture fresh weight per day to meet their energy requirements. Considering the age of these calves, it is likely that rumen capacity may have been limiting intake.

Calves reared using Systems 2 and 3 were heavier at 12 weeks (Table 3) but had markedly higher feed inputs (Table 2). In fact, the difference in weight of 6.1 kg at 12 weeks between calves reared using System 3 and those reared using System 4 amounted to 5% of bodyweight and came at a cost of $43 ($7 per kg of liveweight difference). Since calves reared on System 4 had post-weaning growth rates of 0.75 kg/day, the liveweight penalty at 12 weeks would have been

Table 1 Feeding systems used in the Poukawa calf rearing demonstration.

System 1 – *Twice-a-day milk feeding with restricted meal.* Calves fed milk replacer twice daily at a rate of 125 g/litre of water. Meal fed on a restricted basis. Calves housed for 4 weeks before being introduced to pasture.

	Milk volume	Meal
Day 1 – 4	4.0 (2 x 2.0)	50 g
Day 5 – 9	5.0 (2 x 2.5)	75 g
Day 15 – 21	6.0 (2 x 3.0)	450 g
Day 22 – 28	6.0 (2 x 3.0)	600 g
Day 10 – 14	5.5 (2 x 2.75)	200 g
Day 29 – 35	3.5 (2 x 1.75)	750 g
Day 36 – 42	2.5 (2 x 1.25)	900 g
Day 43 – 84	Weaned	1200 g

System 2 – *Once-a-day milk feeding with restricted meal.* Milk replacer fed twice a day for the first 10 days, then once a day for a further 50 days. Milk replacer initially mixed at 150 g/litre of water, gradually increased to 200 g/litre after 10 days. Meal fed on a restricted basis. Calves housed for 4 weeks before being introduced to pasture.

	Milk volume	Meal
Day 1 – 4	4.0 (2 x 2)	Up to 100 g
Day 5 – 10	4.0 (2 x 2)	Up to 250 g
Day 11 – 17	3.0 (1 x 3)	Up to 350 g
Day 18 – 24	3.0 (1 x 3)	Up to 550 g
Day 25 – 31	3.0 (1 x 3)	Up to 750 g
Day 32 – 38	3.0 (1 x 3)	Up to 900 g
Day 39 – 45	3.0 (1 x 3)	Up to 1100 g
Day 46 – 55	3.0 (1 x 3)	Up to 1400 g
Day 56 – 60	2.0 (1 x 2)	Up to 1400 g
Day 61 – 70	Weaned	Up to 2000 g

System 3 – *Once-a-day milk feeding with* ad libitum *pellets.* Once daily milk feeding for 5 weeks. Increasing concentrations of milk powder added to 2 litres of water. Meal fed *ad libitum* until 12 weeks. Calves housed until 10 weeks then introduced to pasture with restricted meal (1.5 kg/head) for a further 2 weeks.

	Milk replacer weight	Meal
Day 1	200 g	*Ad libitum*
Day 2	300 g	*Ad libitum*
Day 3 – 5	350 g	*Ad libitum*
Day 6 – 8	400 g	*Ad libitum*
Day 9 – 12	450 g	*Ad libitum*
Day 13 – 35	500 g	*Ad libitum*
Day 36 – 70	Weaned	*Ad libitum*
Day 71 – 84		*Restricted to 1500 g*

System 4 – *Once-a-day milk feeding with restricted pellets* Identical feeding regime to System 3 but with calves introduced to pasture at 4 weeks in order to reduce pellet consumption. Meal restricted to 1.5 kg/head from weeks 4 to 10.

Table 2 Number of milk feeds/calf, amount of milk replacer and meal consumed/calf and total feed cost involved in rearing a calf to 12 weeks in the 4 systems demonstrated.

System	Number of milk feeds	Milk replacer (kg)	Pellets (kg)	Feed cost to 12 weeks ($)
1	84	20	70	91.1
2	70	35	70	127.2
3	35	16	146	126.8
4	35	16	74	83.6

Table 3 Liveweights (± SEM) of calves at the start of the experiment, at 5 and 12 weeks, and before slaughter at 26 months.

System	Start weight (kg)	Weight at 5 weeks (kg)	Weight at 12 weeks (kg)*	Weight at 26 months (kg)
1	44.7 ± 1.09	66.7 ± 1.52	97.8 ± 2.26 **a**	587.6 ± 7.44
2	44.7± 1.09	66.6 ± 1.52	107.7 ± 2.27 **b**	597.9 ± 7.03
3	44.6 ± 1.07	67.1 ± 1.48	109.6 ± 2.21 **bc**	597.1 ± 6.93
4	44.7 ± 1.09	66.7 ± 1.65	103.5 ± 2.46 **abc**	589.0 ± 7.92
Significance	ns	ns	**	ns

*Mean weights without a letter in common differ at P<0.05.

overcome by an additional 8 days of pasture feeding. The liveweight penalty at 12 weeks remained with the calves and by 26 months the difference in liveweight between bulls reared on System 3 and those reared on System 4 was 8.1 kg (1.4% of liveweight) and was not significant. At a 50% dressing out and a carcass value of $3/kg, this would have amounted to $12.15 per head in carcass value. This difference in value could also be overcome by a further 8 days grazing, assuming a liveweight gain of around 1 kg per day.

In spite of the wide range in costs and labour requirements in these calf rearing systems, all methods used proved satisfactory for rearing calves. Typically, calves should achieve 100 kg liveweight at 12 weeks and average calf weights exceeded this in three of the four rearing systems used in this study. The level of liveweight penalty incurred at 12 weeks appeared to persist throughout the animals' lifetime but was relatively insignificant in weight and monetary terms by time of slaughter. The study demonstrated that calves can be successfully reared using a low cost once-a-day milk feeding system for 5 weeks and by substituting grass for meal as part of their diet.

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