BRIEF COMMUNICATION: Are dairy heifers achieving liveweight targets?

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Introduction

The reproductive performance of the national dairy herd has declined (Harris et al. 2006). Heifer rearing is one of eight "ingredients" for achieving good reproductive performance identified by the InCalf project (Burke et al. 2007). Many New Zealand dairy farmers graze their heifers on a run-off or pay a grazier to grow the heifers, with heifers commonly leaving the dairy farm at weaning, or nine months of age and returning at around 22 months of age.

Liveweight targets for heifers are well established and related to the expected mature live weight of the animal. Heifers should be 30%, 60% and 90% of mature live weight at six months, mating (15 months) and pre-calving (22 months) (Burke et al. 2007; Penno 1997; Troccon 1993). There is little published data, particularly in recent years, to suggest whether heifers are reaching these growth targets.

Poor calf and heifer management is a potential limiting factor to herd reproductive performance and milk production in New Zealand dairy cattle. In a study of heifer synchrony programmes, 40% of 1,137 animals were reported to be prepubertal 13 days prior to the start of mating (S. McDougall, Personal communication). This is likely to be related to failure to achieve liveweight targets, as puberty onset is regulated mainly by live weight (Hafez 1993). Macdonald et al. (2005) reported an inverse relationship between age at onset of puberty and rate of liveweight gain, leading to fewer animals that had been grown at low growth rates having reached puberty by the planned start of mating. However, there was no impact of the rate of liveweight gain during the heifer-rearing period on future reproductive performance. This may have been due to all animals undergoing a controlled internal drug releaser (CIDR) oestrus synchrony programme prior to first mating (Macdonald et al. 2005). Data from the New Zealand Grazing Company indicated that the lightest animals at mating at 15 months of age calved later and had significantly lower 21-day submission rates in their first lactation (Hayes et al. 1999).

Live weight at calving has also been identified as having a significant impact on milk production in the first lactation (van der Waaij et al. 1997; Carson et al. 2002; Macdonald et al. 2005). The aim of this study was to determine how many live weight records are being entered in the MINDApro^{TM} herd recording software, and to determine how well these animals are being reared by comparing actual live weights to liveweight targets.

Materials and methods

Animal live weights, live weight breeding values and birth dates for animals born between 2006 and 2010 were extracted from the Livestock Improvement Corporation (LIC) database (Animal Evaluation run 4/11/2011). Animals that were located overseas, where the live weight was less than 20 kg or where the animal was greater than 730 days of age, were removed.

Records were also removed where one or more of the following conditions were met:

- Older than 150 days and live weight less than 60 kg (24,334 records)
- Older than 250 days and live weight less than 90 kg (6,704 records)
- Older than 350 days and live weight less than 120 kg (3,303 records)
- Older than 450 days and live weight less than 180 kg (4,680 records)
- Equal to 500 kg, 600 kg or 700 kg, as records appeared to have been rounded to these numbers and were clustered (2,529 records)

This gave a dataset of 642,491 observations on 211,542 animals. Live weights were evaluated at 3, 6, 9, 12, 15 and 22 months of age. Animals that had a live weight recorded within 15 days of any of the ages were included in the dataset, giving 105,894 animals with 171,064 observations.

Liveweight targets were calculated for individual animals, using their live weight breeding values by applying the equation:

> Expected mature live weight = 503 kg + live weight breeding value (Burke et al. 2007).

Target live weights at 3, 6, 9, 12, 15 and 22 months of age are 18, 30, 40, 50, 60 and 90% of mature live weight (Burke et al. 2007).

Results

The number of live weight measurements recorded on the LIC database increased every year, from 4,290 records at 3 months of age in 2006 to 20,468 records in 2010. The average live weight breeding value for animals born between 2006 and 2010 and with an eligible live weight recorded on database was 3.4 kg (reliability 23 %). Target and actual live weights, live weight breeding values and number of records are summarised in Table 1.

Table 1 Target live weight, actual mean live weight, lower and upper quartile, proportion above and below target weight, live weight breeding values and number of records for animals born between 2006 and 2010 at different ages.

Parameter	Age (months)					
	3	6	9	12	15	22
Target weight (kg)	91	152	202	254	304	459
Actual weight (kg)	90	144	190	218	278	407
Lower quartile (kg)	80	126	167	192	247	369
Upper quartile (kg)	99	159	211	242	306	441
Proportion above target (%)		34			26	14
Proportion on target (%)		13			13	12
Proportion 6-10% below target (%)		13			15	18
Proportion 11-20% below target (%)		22			26	35
Proportion > 20% below target (%)		18			20	21
Live weight breeding value (kg)	3.5	3.7	1.8	4.5	2.9	6.7
Number of records	52,796	35,425	35,491	17,121	18,846	11,385

Table 2 Target growth rate, actual growth rate and the lower and upper quartile achieved by the animals in the current study.

Growth rate	Age (months)				
	3-6	6-9	9-12	12-15	15-22
Target (kg/day)	0.67	0.55	0.58	0.55	0.73
Actual (kg/day)	0.59	0.52	0.32	0.65	0.60
Lower quartile (kg/day)	0.51	0.45	0.27	0.60	0.57
Upper quartile (kg/day)	0.66	0.57	0.34	0.70	0.64

At six months of age, 53% of animals were more than 5% below their individual liveweight target. This increased to 61% and 73% at 15 and 22 months, respectively. Growth rate targets and actual values are summarised in Table 2. Growth rates were lowest from 9 to 12 months of age (0.32 kg/day) and highest from 12 to 15 months of age (0.65 kg/day), coincident with the autumn/winter period, and winter/spring period respectively for spring-calving dairy herds. The growth rate achieved between 12 and 15 months was the only time when the target growth rate was exceeded.

Discussion

The majority of young stock in the present study are failing to meet industry liveweight targets. Calf rearing practices appear to be adequate; a conclusion supported by the fact that at 3 months of age this population averaged only 2% below their target, but by 22 months the average was 11% below. There was only one period, from 12 to15 months of age, when average daily gains exceeded the target. This coincided with the early spring period when pasture would be abundant and of high quality. This did not compensate for months of below target gains, particularly during the winter period at 9 to 12 months of age where average daily gains of only 0.32 kg/day were achieved.

Live weight at 15 months of age is crucial for reproductive performance. Heifers need to have reached puberty and be ready to be mated between 13 and 15 months of age. In the current study 61% of animals were more than 5% below target live weight, and 18% of animals were more than 20% behind target, putting these heifers at risk of being prepubertal at the start of mating. Byerley et al. (1987) found that beef heifers bred to puberal oestrus had significantly lower conception rates than those bred to the third oestrus following puberty.

Estimates of the effect of live weight on first lactation milksolids (MS) production vary. In New Zealand dairy cattle, van der Waaji et al. (1997) reported that every 1 kg of extra live weight at 21 months of age was associated with a 0.44 kg increase in MS production, compared with a 0.12 kg increase in Friesians and a 0.14 kg increase in Jerseys reported by Penno (1997). If an increase of 0.2 kg MS/kg live weight is assumed, heifers in the current study would, on average, would be expected to produce 10.8 kg less MS than if they had reached their 22 month targets. This would lead to a reduction in annual income of $64.80 per heifer at $6/kg MS, plus any effects on reduced reproductive performance.

While there has been a substantial increase in the number of live weight records being recorded through the MINDApro™ herd management software package between 2006 and 2010, the proportion of the population with a live weight record

remains small. The dairy cow population averaged 4.2 million between 2006/2007 and 2010/2011 (LIC and DairyNZ, 2011). If a replacement rate of 22% is assumed, around 920,000 heifers are reared annually and less than 5% of these animals have a live weight record prior to 730 days of age. Therefore, although the study population is numerically large it represents a small, self-selected population that may not be representative of the national population.

Dairy heifers in this study on average failed to meet liveweight targets at all ages. This will reduce milk production and reproduction in the future. The relationship between heifer live weight, milk production and reproduction will be examined in future research.

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