

THE DOLLARS AND SENSE OF WELL REARED HEIFERS

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Dexcel

Key points

- A consistent message over the last 50 years – heifers should achieve between 85 and 90% of mature liveweight by first calving, for optimal productive and reproductive performance.
- At a payout of \$4/kg milksolids, and for heifers between 80 and 90% of mature liveweight, each additional kilogram of liveweight at 22 months will return around \$1 in the first lactation.
- Calve heifers at a body condition score of 5.5. This level of body condition is associated with an early return to oestrous and subsequent in-calf rates. Heifers weighing 85 to 90% of mature liveweight at calving are likely to be at this level of body condition.
- Heifers should achieve 60% of mature liveweight by 15 months. This target maximises the proportion of heifers cycling prior to the start of mating.
- Heifers should reach their calving liveweight target by 22 months. Consider the feed demands of the rapidly growing foetus and low pasture growth close to calving.
- Start with the end in mind – the mature liveweight of individual heifers can be predicted using the liveweight BV enabling individual heifer liveweight targets to be set.
- The regular monthly drenching of heifers is no longer standard protocol – assessment of parasite drench resistance and planning a drench programme should be made in conjunction with your veterinarian.
- Electronic scales are the best (most accurate) way to obtain the liveweight of heifers

Background

Poor reproductive performance and/or low production were the reasons for 60% of the cows that were culled in an analysis of 101,000 animals over 3 seasons (Xu and Burton, 2003). Poor heifer rearing has a part to play in this high level of culling as it affects mammary and reproductive development and subsequent performance (Burke et al, 1995; Sejresen et al, 2000; Macdonald et al, 2005). A profitable, seasonal, pasture-based production system requires heifers that fall pregnant close to 15 months of age, get in-calf quickly after calving and have a level of milk production close to their older counterparts (around 80% of mature production).

This paper reviews heifer rearing from weaning to calving, and gives the on-farm application of important findings. For heifer rearing up to weaning, see the excellent paper by Muir et al (2003) from the 2003 SIDE conference.

The history of heifer liveweight targets in New Zealand

The history of heifer liveweight targets in New Zealand can be broadly classed into three periods:

1950s (McMeekan, 1954)

Based on Ruakura work from 1947 to 1957, McMeekan (1954) pioneered the use of liveweight targets to reduce the level of replacement wastage in New Zealand.

McMeekan recommended that Jersey cattle achieve 100 kg of liveweight at weaning (4.5 months), 230 kg at mating (15 months) and 320-340 kg at calving (24 months). These liveweight targets were increased by 40% for Friesian cattle due to their heavier mature liveweight.

1980s (Holmes and Wilson, 1984)

The targets recommended by Holmes and Wilson were marginally lower than those of McMeekan (see Table 1). However, these targets were recommended as the minimum level of growth required.

Table 1: Minimum heifer target liveweights (kg) and growth (kg/day). (Source: Holmes and Wilson, 1984).

Age	Jersey		Friesian	
	Liveweight (kg)	Growth (kg/day)	Liveweight (kg)	Growth (kg/day)
Birth	25		35	
		0.48		0.56
Weaning	55		70	
		0.40		0.54
Mating	210		280	
		0.39		0.50
Calving	320		420	

Notes:

1990s to now (Penno, 1997)

Troccon (1993) related growth targets to the potential to grow which is sensible given the variability in mature liveweight within a breed. Troccon also suggested that for each breed, heifers reach 30% of their mature liveweight by six months, 60% by mating (15 months) and 90% of mature liveweight by calving. These findings were later endorsed in a New Zealand heifer rearing study (Penno (1997); Table 2) and are similar to international recommendations (Table 3).

Interestingly, the heifers in the now 50 year old study by McMeekan (1954) as 6 year old cows weighed an average mature liveweight of 854 lbs (384 kg). In this respect, the 330 kg heifer liveweight target for calving recommended in his study equates to 86% of mature liveweight, similar to current recommendations.

Table 2: Breeding values for liveweight (BV LW), heifer liveweight (LW) targets (kg) and subsequent pasture intake required (kg DM/cow/day).

Targets						
6 months		15 months		22 months		Mature
Liveweight (kg) (30% Mat. LW)	Pasture intake* (kgDM/day)	Liveweight (kg) (60% Mat. LW)	Pasture intake* (kgDM/day)	Liveweight (kg) (90% Mat. LW)	Pasture intake* (kgDM/day)	Liveweight (BV LW) (kg)
120	2.8	240	4.7	360	6.7	400 (-78)
135	3.1	270	5.3	405	7.6	450 (-28)
150	3.5	300	5.8	450	8.5	500 (22)
165	3.8	330	6.4	495	9.4	550 (72)
180	4.2	360	7.1	540	10.4	600 (122)

*Assumes a pasture metabolisable energy (ME) of 11MJ ME/kg DM, MJME / kg LW gain = $(0.071 * LW + 14.04)$ and a ME for maintenance of $0.62 * (LW^{0.75})$. A drop in feed quality of 1MJ ME requires that pasture intake increases by 10% and vice versa. Pasture intake should increase by 5% if heifers are grazing rolling or steep land to achieve liveweight targets.

Table 3: International heifer liveweight targets as a % of mature liveweight.

Source	Country	Heifer liveweight target at calving (%)
Van Amburgh et al. (1998)	United States of America	82-90
Dobos et al. (2004)	Australia	85
Moss et al. (1996)	Australia	85
McMeekan (1954)	New Zealand	86
Troccon (1993)	France	90
Penno (1997)	New Zealand	90

The research behind the targets

15 month (mating) target

Puberty occurs when heifers reach 42 to 47% of predicted mature liveweight (Garcia-Muniz, 1998; McNaughton et al, 2002). The heaviest and lightest heifers in the study of Penno (1997) had liveweights approximately 15% above and below the mean, respectively. Further, Penno found that a 15 month liveweight target of 60% of mature liveweight (45 + 15%) was needed to minimise the incidence of anoestrous at the start of mating.

In summary, *all* heifers should be *at least* 50% of their respective mature liveweight *before* mating.

Progesterone via controlled internal drug release devices (CIDRs) can be used for the synchronisation of oestrous. However, it would seem better biologically to rear the heifer so that she conceives when her body is ready to take on the burden of a calf. Also, there is the potential that hormonal intervention will not be available in the future.

Calving target

Notes:

The effects of heifer liveweight at calving on subsequent production and reproductive performance are summarised below:

Production

Three papers were reviewed to determine the effects of heifer growth on future milk production:

1. McMeekan, 10 year study of Jersey cattle

The production of 'well' (330 kg, 86% of liveweight) and 'poorly' (284 kg, 74% of liveweight) reared heifers was determined. The well reared heifers had an advantage of 14 kg milkfat (0.3 kg milkfat/additional kg LW) in the first lactation, 9 kg fat in the second and no advantage in the third.

Assuming a fat to protein ratio of 1.6 for Jersey heifers, this equates to an additional 22 kgMS (0.48 kg MS/kg LWT) in the first lactation.

2. Bryant and McRobbie (1991), review

In a review of NZ research, each additional kg LW of heifers before calving was associated, on average, with an extra 0.25 kg milk fat and 0.13 kg milk protein (0.38 kg MS/kg LWT).

3. Penno (1997), four year study on Jersey and Holstein-Friesian cattle

Holstein – Friesian (HF) and Jersey (J) calves were fed fresh pasture to achieve average daily growth rates of 0.77, 0.53, or 0.37 kg of LW/day (HF), and 0.61, 0.48, or 0.30 kg LW/day (J) pre-puberty, and 0.69 or 0.49 kg LW/day (HF) and 0.58 and 0.43 kg LW/day (J) in the post-pubertal period. High feed allowance in the pre-pubertal period did not affect production during the first two lactations, but did reduce milk production in the third.

Growth rate in the post-pubertal period and subsequent liveweight at calving were positively correlated with first lactation milk production. Friesian and Jersey heifers reared to 90%, as opposed to 80% of mature liveweight, produced an extra 18 and 12 kg MS (0.25 kg MS/kg LWT) in the first lactation, respectively.

Reproduction

Good evidence exists that low BCS at calving is associated with prolonged intervals to first heat after calving. Research on 2500 cows in six Waikato commercial dairy farms (Compton and McDougall, 2007) showed that cows with BCS ≥ 4 at start of mating had a 4% higher 8 week in-calf rate (these cows were at, or above, a BCS of 5 at the start of calving). Heifers calving at a low BCS are commonly mated on their first oestrous cycle resulting in conception rates about 7-8% lower than cows inseminated after their second heat (Morton, 2003). McNaughton (2004) also found calving heifers at a BCS of 5.5 minimised anoestrus treatment.

Interestingly, data from the study of Macdonald et al. (2005) showed that heifers, at a BCS of 5 to 5.5 at calving, had a liveweight equivalent to 85-90% of mature liveweight.

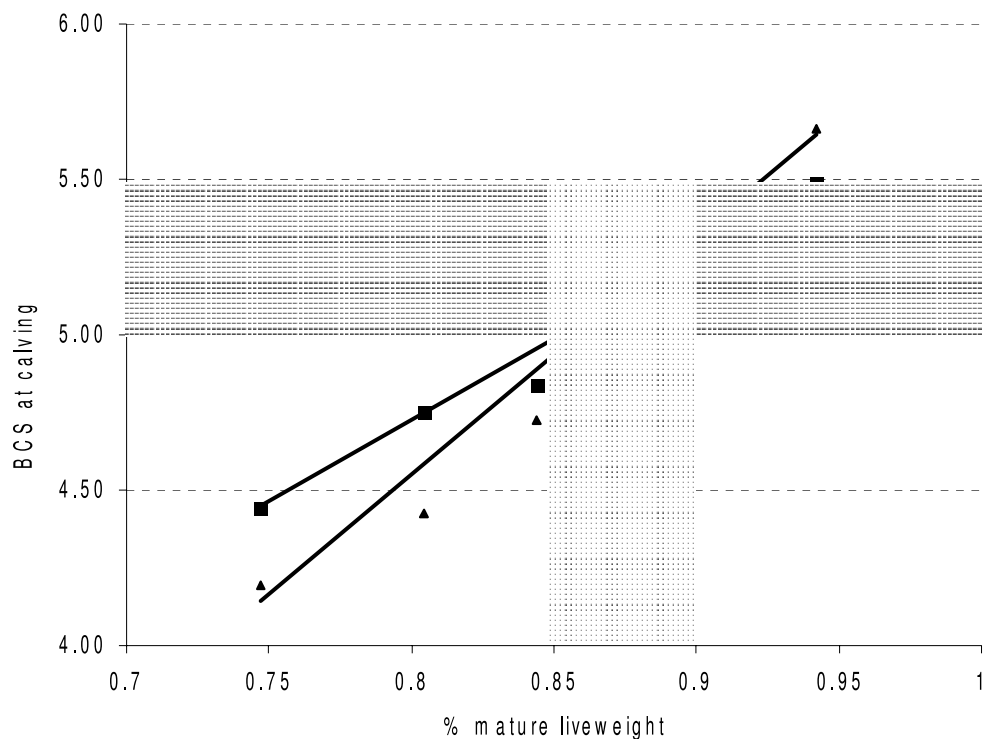


Figure 1: The relationship between % mature liveweight and body condition score for five feeding regimes, Friesians (▲) and Jerseys (■). The green shaded area is the target calving body condition score and target liveweight as a % mature liveweight. (Source: Macdonald et al., 2005).

Potential change to the timing of the calving liveweight target

A 22 month calving liveweight target (90% of mature liveweight) is recommended. The nutrient demands of the rapidly developing foetal calf in the two months leading up to calving (equivalent of ½ kg of LW gain per day; NRC, 2001) combined with the seasonality of pasture

Notes:

production in NZ (low feed availability in winter) suggest that the requirement for heifer growth should be minimal in this period.

Heifers should remain within the liveweight boundaries given in Figure 2. Individual heifers not on track to achieve target liveweights should be isolated from the group and fed preferentially so that targets are met by all stock.

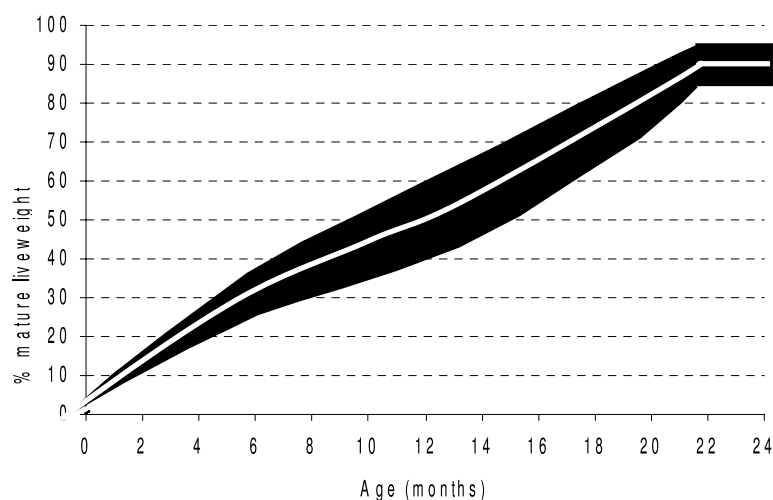


Figure 2: Target % mature liveweight (white line) and range (black shaded area) below and above which action should be taken to get heifers back on target.

Economics

Friesians at 90% compared to 80% of mature liveweight at 22 months produced an additional 20 kg, and Jerseys an extra 11 kg, of MS in the first lactation (Penno, 1997; Macdonald et al., 2005). At a payout of \$4/kg MS, each additional kg of liveweight at 22 months between 80 and 90% of mature liveweight will return around \$1 in the first lactation.

Heifers fed to achieve differing calving liveweights in the study of Macdonald et al (2005) had similar liveweights to cows. These results suggest that growth is going to occur at some stage so the productive and reproductive economic advantage of achieving heifer target liveweights should be captured.

Management steps to help achieve heifer liveweight targets

Calculate mature liveweight – start with the end in mind

Two methods can be used to estimate the mature liveweight of heifers:

1. Use the liveweight breeding value (BV) of the heifer

Large differences in the mature liveweight of individual cows, even of the same breed, occur on-farm. Bryant et al (2004) showed that the breeding value (BV) for liveweight can be used to estimate individual heifer mature liveweight using the following equation:

$$\text{Liveweight at maturity (kg)} = 529 \text{ kg} + (\text{BV Liveweight} - 51 \text{ kg})$$

The BV liveweight can be sourced for each animal from MINDA. Customised reports are available at a cost of \$60 with an extra \$1.15 for each additional animal.

Calculated values for BV Liveweight (BV LW) are shown beside the mature liveweights in Table 2.

2. Weigh the 6-8 year old cows in the herd

By 6-8 years of age, cows have stopped growing. April-May is the best time to determine the mature liveweight of different cow breeds in the herd. Liveweight measurements taken in early lactation underestimate mature liveweight as cows are at their thinnest, and measurements taken in the dry period will overestimate mature liveweight as a proportion of the weight consists of the foetus and foetal components. As half of the actual mature liveweight of heifers will be determined by the sire, the average mature liveweight of Jerseys (407 kg) and Friesians (528 kg), from the 2004/5 Livestock Improvement Corporation Sire Proving Herds, can be used to correct the estimated mature liveweight.

For instance: If a cow at 6-8 years weighed 500 kg and this cow was mated to an average Friesian bull (528kg cows), the progeny of this cross would weigh around 514kg $((500 + 528) / 2)$.

Monitor heifer growth

Growth of heifers can be monitored in three ways:

1. Scales – the most accurate and safe way to monitor heifer growth.
2. Eye appraisal – many factors need to be considered such as age, breeding, height, coat condition
3. Girth – used to estimate the liveweight of the heifer via a calibration equation relating girth circumference to liveweight. This method can be used to determine the average liveweight of a

Notes:

group of heifers as it is not accurate on an individual heifer basis. It is often difficult to get the band around the girth particularly if the heifers are not used to the cattle crush/yards.

Offer high quality feed

Young stock should always be offered high quality pasture as their size limits high intakes of poor quality feed. Table 2 shows the pasture intake required by heifers to achieve differing target liveweights.

Maintain animal health

Young stock are particularly susceptible to internal parasites. “Wormwise”, the national worm management strategy advises that drenching programmes should be developed in consultation with a veterinarian, after considering a number of factors including level of challenge, nutritional inputs and the drenching history. Routine drenching at set intervals such as 3-4 weeks is no longer recommended.

A recent national survey has shown that 94% of beef farms have parasite resistance to at least one drench (chemical) family, a figure that is likely to be mirrored in many heifer rearing situations. The level of parasite drench resistance can be monitored by carrying out faecal egg count reduction tests. Diagnosis of internal parasites at lower levels includes methods such as faecal egg-counting, blood testing, and monitoring weight gain. Assessment of parasite drench resistance and planning a drench programme should be made in conjunction with your veterinarian.

On-farm application of research

Pete and Vanessa Wilcox (Matamata, Waikato)

Background

Pete and Vanessa Wilcox are 50:50 sharemilkers, importing around 10% of their feed into the system (System 2). They purchased scales in conjunction with their neighbour to make sure the 115 heifers that they rear each year achieve target liveweights. (In total, 200 calves are run over the scales each year). Their programme includes:

Management

Drench heifers every 5-6 weeks up to mating (from the information above this may need to be changed).

Feeding novel endophytes (AR1 and AR6) that do not contain the toxin causing ryegrass staggers allows for easy movement of the heifers in the yards.

They graze heifers in front of the cows as one group until January (moving every day, 4-5 days ahead of cows) when they go behind a wire and are allocated feed according to a feed budget.

Results

This season their heifers are on track to achieve 90% of mature liveweight by 22 months of age.

The 115 heifers were mated (3 weeks AB starting 10th October 2007 and then 4 bulls were used until the 20th January 2007) using oestrous alerts to detect heat without the use of CIDRs or prostaglandin. They had two empty heifers, one of which was a freemartin.

Last season's heifers are currently producing 74% of the production of the mature cows.

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