

Economics of heifer rearing

When rearing dairy replacements, the objective is to achieve a heifer of adequate size, calving at a suitable age to sustain a long and productive life within the herd. Management and feeding strategies should direct resources between the lactating herd and growing heifers in a balance to achieve the most profitable level of farm output. Although today's income is obtained from the milking herd, replacement heifers also need to be well-grown to achieve desired production when they enter the herd. Management to minimise heifer rearing costs will not achieve the most profitable outcome as these costs will be recovered in future milk production.

The best result will be achieved by feeding heifers to achieve growth targets that allow them to be mated to calve at about 2 years of age. Under-feeding lowers their rate of gain, increasing heifer age at mating and calving. For high production the first calf heifer should be of sufficient size and condition to support her production in early lactation. Milk yield and conception rates will be lower if the heifer needs to partition nutrients consumed for continued growth or gain body condition, plus lactation and reproduction. Increased calving age impacts negatively on herd productivity by reducing capacity to cull and through competition for feed resources.

Targets

To decide how much we need to spend on heifer rearing we first need to decide what we aim to achieve. Management decisions must be based on full consideration of input costs as well as their effects on overall productivity and bottom-line profit. Profitability can be increased using a few methods.

Reducing age at first calving

This requires increased feeding. The cost of the additional feed necessary to increase growth is less than the costs associated with, and income foregone, by extending the period that heifers remain unproductive through low input rearing management.

Optimum size of heifers at calving

To milk to her potential, the heifer should be reared to achieve most of her skeletal and muscle development before calving and also achieve a level of body condition that allows her to utilise some body reserves in early lactation when she is in negative energy balance. In early lactation, the dairy cow is able to mobilise fat reserves to produce more milk than could otherwise be achieved from nutrients derived in feed consumed.

Age

Optimum economic age at calving for heifers is around 24 months. Older calving increases the numbers of non-productive (growing) animals in the herd competing for feed (Table 1), reduces lifetime productivity, reduces opportunities for herd improvement through production culling, can contribute to milk quality problems and increase herd health and management costs as herd age structure is greater. Calving too young (less than 21-22 months) or below desired live weight is not recommended as productivity is lower and complications greater (dystocia, poor conception).

Table 1. Number of growing heifers of all ages present per 100 cows in a dairy herd

Herd replacement rate	Average age at first calving		
	24 months	30 months	32 months
20%	44	55	59
25%	55	69	73
30%	66	82	88

Source: R. Elliot, Coulburn Dawes (pers. comm.)

Live weight

Optimum live weight at calving is dependent on breed and is related to herd productivity. A heifer pre-calving live weight target of 85% of mature live weight pre-calving, or about 90% of weight for mature cows in early lactation is recognised. Herds producing 10,000 L/cow will have higher targets than those averaging 5000 L. Milk production and fertility are lower and incidence of calving problems (dystocia) higher for heifers calving under weight.

For larger breeds such as the Holstein-Friesian, preferred live weight pre-calving will be about 550 kg, with a range of 520-600 kg depending on herd production (5000-10,000 L). For smaller breeds (Jersey) the target range is 400-450 kg pre-calving. To achieve these targets by 2 years of age Holstein-Friesian heifers need to maintain an average live weight gain of 0.65-0.7 kg/day, (about 0.5 kg/day for Jersey). This will allow Holstein-Friesian heifers to reach a live weight of 330-350 kg by 15 months for mating (Jersey 260 kg).

Underweight heifers will not produce to their potential in the herd but there can also be a downside if heifers grow too rapidly (gains above 0.8 kg/day) or are over conditioned, especially in the critical period prior to sexual maturity. Not only could the extra feed resources be better utilised by the milking herd, there is some risk of negative effects on subsequent milk production and fertility. Diets with too high an energy to protein ratio favour fat deposition over muscle growth, as can occur with maize silage or high grain diets. Over conditioning may result in adipose (fat) deposition in the developing udder to the detriment of alveolar (milk secretory tissue) development so heifers produce less rather than more milk. If at risk heifers (too rapidly grown) are of sufficient size (350 kg) they can be mated earlier than 15 months to minimise possible negative effects of over fattening. High quality diets balanced with adequate protein are less likely to cause these problems. High growth rates after sexual maturity do not adversely impact on the heifers ability to produce milk but over feeding in late pregnancy may increase the size of the foetus and hence incidence of dystocia.

Costs to achieve targets

Feed source

Homegrown pasture is our cheapest feed resource. However just as unimproved pasture cannot support acceptable milk yields, low-quality unfertilised forage is not a satisfactory diet for dairy replacement heifers. The heifer requires an adequate dietary nutrient balance for optimum growth. As she grows and matures the heifer passes through several phases of physical development and her requirements for protein and energy change. The young weaner calf needs a diet nutrient concentration at least as high as that for a high producing dairy cow (16% CP, 11 MJ ME/kg dry matter (DM)). At 12 months 14% CP, 10 MJ/ME kg DM will be adequate, while much of the nutrients required by the pregnant heifer can be met by good-quality forage alone (12% CP, 9 MJ ME/kg DM). It is energetically more efficient and hence cheaper to rear heifers for consistent growth rather than to try to catch up later, particularly as periods of slow growth will delay mating. It is also cheaper to grow quality feed than to purchase concentrates. Supplementary feeding required to achieve gains of 0.7 kg/day thus will depend on the amount and quality of forage available and the nutrient requirements of the heifer relative to her size and age.

Tropical grass pasture is the major forage source for heifers in coastal sub-tropical and tropical regions, with crop forages such as sorghum and lab lab used in lower rainfall areas. Although capable of producing high DM yields in summer, tropical grass pastures have a low leaf-stem ratio (25-35% leaf). Even when fertilised and actively growing, these pastures are inherently low in nutritive value, with high levels of structural carbohydrate (cellulose, lignin), and low energy and protein concentrations (70% NDF, 8-9 MJ ME/kg, 12-18% CP) in green DM. Concentrate supplements (digestible carbohydrate plus protein) will be necessary to support live weight gains of 0.7 kg/day.

When tropical grasses are not growing or are of low quality (autumn, winter, spring), forage crops (oats, lucerne), temperate pastures, conserved hay or silage should be utilised. Temperate pastures have a higher nutrient content (40% NDF, 10 MJ ME/kg, 20-25% CP), but their availability for growing heifers is usually limited.

In more temperate environments pastures have a higher nutrient content (40-60% NDF, 9-10.5 MJ ME/kg, 20-25% CP), and need for additional energy or protein with green forage is lower. However because of short production seasons and/or lower yields, the overall requirement for concentrate or conserved feed may be similar.

Herd production level

To rear a heifer to 550 kg live weight calving at 2 years of age will cost farmers approximately \$1000 a heifer, with around \$700 of that for feed and fertiliser. For herds averaging 5000 L/cow or less, a live weight target of 520-530 kg at 24 months is acceptable and requirement for supplementary feeding may be slightly lower. However profitability can be improved at higher productivity levels as a greater proportion of feed consumed is available for milk production rather than maintenance.

False economy of low input

Saving on feed costs for heifers can negatively impact on farm profit by reducing productivity per dollar spent. Adopting a low input feeding program, reducing the amount of concentrates, conserved feed and/or fertiliser might lower these costs by about \$300 per heifer. 60% of the cost of heifer rearing is spent in the first 9 months when survival is a major consideration and management requirements are greater. Cost reduction in this phase would result in poor growth and increase mortality. Cost saving 'strategies' inevitably are applied to the older animal where negative effects are less obvious. The consequences of this, however, will be to increase age at calving (30 months is the current norm throughout Queensland and Australia), often with lighter weight at calving, probably below 500 kg. Research (Cowan et al. 1974; Kerr 1985; Freeman et al. 1992) has shown that live weight of heifers at calving strongly influences their subsequent milk yield. Additional studies (Brown et al 1982; Reeve 1986; Moss et al. 1996) have demonstrated a positive correlation between herd productivity and live weight of cows and heifers in the herd. Cows and heifers in higher producing herds are larger because of their increased level of feeding and they have more body condition reserves to support lactation. Reduced feed inputs reduce milk yield and the effects of this are maintained for several lactations.

Budget example

Table 2. Costs to calve heifers at 2 years of age with a target live weight of 550 kg Items

Items	Cost	Your estimate (\$)
Feed requirements		
Birth to weaning - milk/replacer, concentrate, roughage	\$100	
Weaning to calving: Concentrate 2-8 months 16% CP (1.5-2 kg/d) 400 kg @ \$250/t	\$105	
8-24 months 11% CP (1-2 kg/d) 500-1000 kg @ \$180/t	\$90-180	
Pasture 0.25 ha fertilised pasture per heifer a year for 2 years: fertiliser (200N 11P, 60K), fuel etc. @ \$300/ha/year	\$150	
Temperate forage - oats etc. - 0.25 ha per heifer a year @ \$200/ha/year	\$100	
and/or Conserved forage at up to 1 t DM/heifer e.g. hay @ \$200/t or maize silage @ \$40/t as fed	\$100-200	
Total feed costs approximately	\$650	
Management costs		
Health treatments: scours, disease management medicaments	\$20	
Vaccinations: clostridial, leptospirosis (seven-in-one) plus booster	10	
Parasite control: Internal - nematodes tapeworm, fluke External - cattle tick, buffalo fly, lice	\$20 (\$10 each)	
Disease testing: EBL, other	\$5	
Loss due to mortalities (4% of feed costs)	\$30	
AI Costs	\$10	
Salvage value of bobby calves	\$80	
Total management costs	\$175	
Labour costs		
Birth to weaning: 6 hours per calf Wean to 15 months: 5 hours per heifer Mating to calving: 1 hours per heifer 12 hrs @ \$10/hr Total labour costs	\$120	
Total rearing costs approximately	\$950	

Assumptions applied to budget example

Table 3. Inputs and values used for calculation of rearing costs in Table 2

Feed costs	
Grain plus minerals	\$180/tonne
Protein concentrate (16%)	\$250/tonne
Molasses	\$110/tonne
Lucerne hay	\$150-\$200/tonne
Barley straw	\$100/tonne
Maize silage	\$30-\$50/tonne as fed
Fertilised tropical grass pasture (rain-grown) (200 kg N; 11 kg P; 62 kg K/ha per year)	\$300-350/ha
Forage Oats (100 kg N; 11 kg P; 62 kg K/ha per year)	\$250-300/ha
Irrigated pastures - higher cost but higher stocking rates similar cost/heifer	
Feed inputs	
Concentrate	Quantity
Concentrate (grain, pellets)	Ad libitum to weaning at 2 months
(grain plus protein)	2 kg/day to 10 months of age
Grain/molasses	1.5-2 kg/day to calving
Forage	Stocking rate
Pasture: tropical grass, oats is equivalent to	8 - 10 weaners /ha or 5 yearlings /ha or 3 heifers (pregnant)
Conserved forage	Quantity
Hay, Silage	0.5 kg DM per day as required
Pre-weaning	Ad libitum hay/straw, pasture or silage
Post-weaning	Dependent on pasture availability and quality
Proportional allocation of feed costs	
Birth to weaning	\$100
Weaning to 12 months	\$400
12 months to calving	\$300

Income foregone

Live weight

Failure to reach optimum live weight could cost 7 litres milk per kg live weight per year for at least 3 years (Cowan et al. 1974) i.e.. a reduced life time production potential of 1050 litres of milk per cow if heifers calve at a live weight 50 kg below their target.

Age

Production potential is further reduced by increased age at calving, with up to half a lactation per heifer forgone in year round calving herds and greater management problems for seasonally calved herds. Production sacrificed could be conservatively estimated at 2000 L/heifer. Valued at 15 cents/litre, milk forgone (total 3050 L) would be worth \$457.50 per heifer.

Keeping heifers to 30 months instead of 24 months at calving can have additional effects on herd productivity through competition between growing and lactating animals for limited resources (feed, labour, land, capital). Assuming a herd replacement rate of 25%, delaying calving by 6 months will mean an extra 14 non-productive animals competing with the herd for resources (Table 1). If these resources were used to feed more cows, an extra 5 cows could be milked.

For a herd producing 5000 L/cow this equates to 12,500 L milk ($\frac{1}{2}$ lactation):

- valued at 15 cents/L nett = \$1875, or \$134 per heifer
- this is a total income foregone of \$591.50 per heifer
- for a cost saving of about \$300.

The potential for lost income increases with higher herd productivity.

Breeding and selection

Other unseen costs of later calving include a slower rate of genetic progress in the herd and an older age structure, with increased incidence of age-related problems (mastitis, infertility). As a consequence the level of involuntary culling is higher, reducing the opportunity to select and cull for production within the herd.

Conclusion

Most farms rear heifers well to about 9 months of age. However if then grown out on unimproved paddocks with limited supplementation, adequate live weight gains can not be maintained. Six months of restricted nutrition can cost six months of lost production together with sub-optimal lifetime performance. This is not good economic management. The value of potential production foregone is substantially greater than the additional feed and fertiliser necessary to achieve desired growth targets for heifers to calve at 2 years of age.

References

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Source: Queensland Department of Agriculture, Fisheries and Forestry; 2009