

Feed management post-weaning to calving

Post-weaning to about 8 months (live weight 60 to 200 kg)

After weaning the dairy heifer is dependent on solid feed for her nutrition and growth. Some of her nutrients are derived from the digestion of feed at the hind stomach (abomasum) but a large component is supplied as microbial protein resulting from the initial fermentation of feed in the rumen. By understanding the heifer's requirements in proportion to her size and age, how much feed she can eat and the nutritive value of feed options, we can calculate how much supplement we need to feed to achieve a growth target. Energy and protein must be fed in an optimum balance for rumen fermentation as well as at levels required for growth.

Fertilised tropical grass supplies only 8 to 9 MJ ME/kg dry matter (DM) and will only support gains up to 0.25 kg/day by weaners (Moss and Murray 1992). The weaned calf is able to consume leafy tropical pasture at about 2.5% of her live weight, or pasture plus concentrate to about 2.8% of live weight per day (Moss and Goodchild 1992).

Requirements

To maintain a live weight gain of 0.7 kg/day the weaned dairy calf needs a diet supplying 16% crude protein (CP) and 11 MJ ME/kg DM (Figure 1). In spring and summer a concentrate of grain plus a protein meal (e.g. cottonseed meal, canola, sunflower, soybean meal) containing 16-18% CP is required, fed at 1.5 to 2 kg per heifer per day. Declining quality of mature pastures in autumn may necessitate additional concentrate, an increase in the protein content of the concentrate, or the feeding of alternate higher quality forages or hay. Whole cottonseed can be gradually introduced at levels up to 0.5 kg/heifer/day to provide both protein and digestible energy. Although urea can be used with digestible carbohydrate to increase protein available through rumen microbial fermentation, most of the heifer's protein requirements need to be supplied as true protein (concentrate meal, forage). Unimproved pastures cannot meet the needs of these animals.

Molasses, an alternative to grain on an equivalent DM basis for older cattle, is limited in its potential for use post-weaning. Its mineral imbalances with high levels of potassium may cause health or neurological problems in young animals at >30% in the diet. This restriction plus a lower voluntary intake, limit live weight gains achievable by animals grazing tropical pastures to below 0.5 kg/day. It can be partly substituted for grain with higher quality forages such as lucerne or lucerne hay but generally is not recommended for heifers below about 6 months of age. It is not suitable as a supplement with high potassium forages such as ryegrass. Salt can improve growth responses to molasses, possibly by balancing potassium intake or aiding excretion of excess.

Mineral supplementation with calcium (Ca) and phosphorus (P) (e.g. DCP - 20 g/day), and possibly sodium (Na) (salt - 5 g/day per 100 kg live weight) should be provided in concentrates. Sufficient sodium is usually available in feed and drinking water, except where environmental levels are low - for example red, basalt derived soils, typically growing kikuyu pastures. Salt is beneficial with molasses and where natural water and soil are low in sodium.

In winter with dead or frosted tropical pasture or slow growth, additional forage as green crop, pasture, hay or silage (oats, lucerne, temperate pasture) is necessary to maintain live weight gain above 0.6 kg/day. This needs to be of good quality, supplying at least 9 MJ ME/kg DM. If only mature or senescent tropical pasture is available, higher levels of protein and energy concentrates required will add to rearing costs.

Maize silage can be substituted for grain and/or alternative to tropical pasture. This will satisfy or exceed the heifer's requirement for DE but will not supply sufficient protein to balance the diet. High protein supplements and urea can be used to meet dietary protein requirements (16% CP) for growth. If fed ad libitum, voluntary intake of a complete ration based on maize silage plus supplementary protein can exceed 3% of live weight, with live weight gains above 1 kg/day (Figure 1). This could result in over-fat heifers with lower milk productivity. Feeding levels may need to be restricted to about 2.8% of live weight to avoid excess conditioning. Diets with too high an energy: protein ratio favour fat deposition rather than muscle growth, exacerbating this problem. Excess conditioning is of greater concern pre-puberty (heifers below 250 kg).

8 to 15 months - mating (live weight 200 to 350 kg)

When the Holstein-Friesian heifer reaches about 200 kg live weight (8-9 months) she requires a dietary energy density around 10 MJ ME/kg DM, with protein content of 14% CP (Figure 1). Leafy green fertilised tropical pasture can satisfy her protein needs, but energy levels in tropical grass pasture (8.5 to 9 MJ ME/kg) will only support live weight gains of 0.4-0.5 kg/day. She still requires additional digestible energy supplementation to maintain growth rates of 0.7 kg/day. This can be achieved with cereal grain fed at 1.5 to 2.0 kg/day. Molasses plus minerals (Na, Ca, P) can be substituted for cereal grain at the rate of 1.25 kg molasses:1 kg grain. Additional protein or urea may need to be included with molasses to ensure that dietary protein is maintained at 14% CP.

More digestible forages such as oats, lucerne, ryegrass and clover pastures can provide higher nutrient levels to ensure that growth targets are met, minimising the need for purchased concentrates.

Other concentrate sources include whole cottonseed, PKE or copra meal. Supplying both energy and protein they can be fed at up to 1.0 kg/day. At higher levels their high oil content can impair digestion of cellulose (pasture or hay) by rumen microflora reducing their effectiveness.

Maize silage is suitable as a supplement or as a partial or complete substitute for pasture if rations are balanced for protein and feed intake is controlled to avoid too rapid growth or fattening. Rapidly grown heifers may be mated earlier than 15 months to prevent excess fattening before calving.

Urea (NPN) can be used as a rumen nitrogen source when pasture protein is low, fed at up to 30 g/heifer a day with a readily digestible carbohydrate source such as molasses, grain or maize silage. Urea requires careful mixing to avoid toxicity. Allow animals to empty a molasses trough before adding more urea and pour off water after rain.

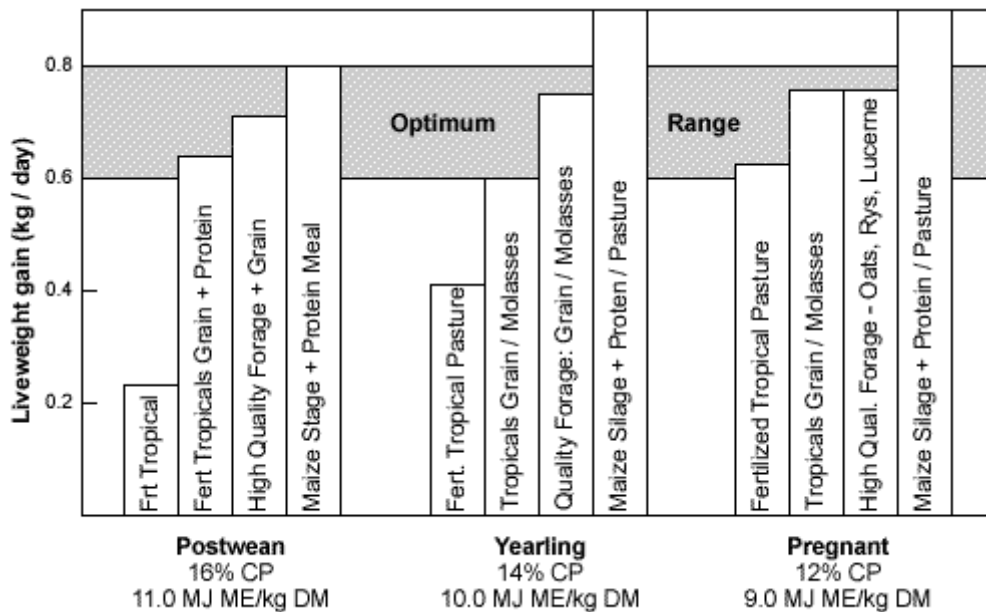


Figure 1. Protein and energy requirements for optimum growth of dairy replacement heifers at each development phase, and capacity of forage and concentrate combinations to meet these requirements.

15 to 24 months - mating to calving (live weight 350 to 550+ kg)

Above about 300 kg live weight (12 months of age), the heifer can achieve live weight gains up to 0.7 kg/day on good quality tropical grass pasture supplying 9 MJ ME/kg DM plus 12 % protein. However as such pasture is usually only available during the wet season or with irrigation, it may be limited for replacement heifers, except possibly in high rainfall areas - and concentrate supplementation should be considered.

The mated heifer (>350 kg) is now building up her body condition in readiness for her subsequent lactation, so her requirement for protein to energy in her diet is lower. She still needs more protein and energy than the adult dry cow as she is continuing to grow muscle tissue plus provide the nutrients for her developing foetus. A dietary intake of 12% CP will meet her requirements and those of her calf. She needs a dietary energy concentration of about 9 MJ ME/kg DM. These requirements can be met by fertilised, green tropical pasture, or with supplements such as molasses, grain or whole cottonseed fed

at 0.5 to 1.5 kg/day, if pasture quality and quantity are not adequate. Concentrate supplements are not required with higher quality forages (oats, ryegrass, lucerne) if quantity fed is not limiting (Figure 1).

Molasses is a convenient and cheaper supplement for growing cattle, allowing less frequent feeding. When forage supply is adequate, molasses intake is self-limiting, but excess intakes will occur if pasture is restricted. Molasses intakes above 25-30 % of the diet in the short term will increase feed costs, but in longer term may have negative physiological or neurological effects. Because of its high potassium content (as KCl) it is less suitable for use as an energy supplement in the last month of pregnancy. By adding to the potassium load of the diet, it may interfere with cation/anion balance predisposing the animal to metabolic disease (hypocalcaemia (milk fever), hypomagnesaemia) at calving. Risks are greater for high potassium pastures such as kikuyu and ryegrass. The potassium (cation) in molasses is balanced by chloride ions (anion) and molasses can be used to encourage intake of unpalatable DCAD salts (fed to stimulate calcium homeostatic hormones to reduce hypocalcaemia post-calving).

Live weight targets and feed requirements

Table 1 shows expected dry matter (DM) intakes for Holstein-Friesian heifers of increasing weight and their metabolisable energy (MJ ME/day) requirements to maintain growth rates of 0.6 or 0.7 kg/day. Use this table to calculate how much concentrate or forage supplement needs to be fed to heifers at differing stages of growth to achieve our growth targets.

Table 1. Feed intake and metabolisable energy (MJ ME/day) required to maintain live weight gains of 0.6 to 0.7 kg/day

Liveweight (kg)	DM intake (kg/day)	Required metabolisable energy intake (MJ ME/day)	
		Gain = 0.6 kg/day	Gain = 0.7 kg/day
100	2.8	29	32
200	5.0	47	50
300	7.0-7.5	65	70
400	9.0-10.0	80	85
500	11.0-12.0	98	105
550	13.0	108	115
600	15.0	118	126

Summary

- The growing season of unimproved pastures is too short and their leaf content too low to provide an adequate forage base for the growing dairy replacement heifer.
- If the age of heifers at calving is to be reduced and their live weight increased, improved pastures and forages adequately fertilised must be used.
- Tropical pastures alone will not support necessary growth rates by pre-pubertal heifers.
- Concentrate supplements correctly formulated to balance pasture availability and the heifer's nutrient requirements relative to her stage of growth will ensure she meets her growth target.
- Forages of higher digestibility and/or increased supplementation are necessary to sustain live weight gains of 0.7 kg/day.
- Expenditure on fertiliser to improve pasture growth and quality will reduce the need for more expensive purchased feeds such as grain and protein concentrates or hay.

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