13

Feeding decisions driving profit

This chapter presents examples of manipulating farm resources to improve the feed efficiency of milk production, hence increase farm profits.

The main points in this chapter

- It is always energetically more efficient to feed fewer cows better. To produce 50 000 kg milk/yr, a milking herd of 10 cows utilises 81% of its annual feed energy for milk production, compared to 78% with 13 cows and only 76% with a 17-cow milking herd.
- There may be other benefits through better milk quality and composition and improved reproductive performance.
- To provide sufficient quality of home-grown forage for a well balanced diet to all stock, the typical 0.5 ha smallholder farm should have no more than two to five milking cows plus replacement heifers, depending on the management of the forage production area.
- There are many profit drivers on a dairy farm that can be managed by the farm operator to improve nutritional efficiency, and these are presented in a series of flow charts.

Manipulating farm resources to improve the feed efficiency of milk production, hence increase farm profits, is good evidence of effective business management. This chapter demonstrates this, firstly through optimising herd size or forage production area and, secondly, by taking into account all the farm management practices driving farm profit.

In any dairy system, whether it is a temperate grazing or an Asian smallholder operation, the principles for feeding milking cows should be to feed sufficient quality forages first, then supplement with concentrates which are formulated to overcome specific nutrient deficiencies, in order to achieve target milk yields.

With knowledge of the feeding value of the forages and concentrates, and their relative costs, more objective decisions can be made on how much concentrate should be fed to achieve target milk yields.

13.1 Determining the optimum herd size

It is always energetically more efficient to feed fewer cows better. The same total farm volume of milk can be produced with fewer better fed cows. Table 13.1 presents three annual energy audits for herds producing 50 000 kg/yr of milk, with varying numbers of milking cows. Herd A has 10 cows each producing on average 17 kg/d, Herd B has 13 cows, each producing 13 kg/d, while Herd C has 17 cows each producing 10 kg/d. Daily energy requirements are the same as those for Cows 2, 3 and 4 described in Chapter 12 (Table 12.3). The cows produce milk for 300 days and are dry for 65 days. Each herd has a 30% heifer replacement rate, meaning that the farmer must rear three, four or five heifers each year. Total energy requirements to rear one heifer for one year are assumed to be 22 000 MJ of ME.

Cows in the higher yielding Herd A use less of their daily energy intakes for maintenance (40 v 46 v 52%), allowing them to be more efficient on a day-to-day basis. Compared to Herds B and C, milking cows in Herd A then require 12% and 29% respectively less of their daily energy intakes to produce the same total volume of milk.

After taking into account all the farm dietary energy costs associated with producing milk (including maintaining dry cows and rearing heifers), Table 13.1 expressed this as the total energy requirements to produce the same volume of milk. In MJ/kg milk, this amounted to 11.0 for Herd A compared to 12.8 for Herd B and 15.0 MJ/kg for Herd C.

Table 13.1 also presents the 'Productive feed energy' or the proportion of total farm energy used by milking cows when lactating. Again Herd A is the most efficient with 81% of its annual feed energy used by to produce milk in the lactating cows, compared to 78% (Herd B) and 76% (Herd C).

Table 13.1 Annual energy audit for three herds producing 50 000 kg/year of milk

	Herd		
	A	B	C
Milking cows	10	13	17
Total milk yield (kg/cow/yr)	5000	3846	2941
Average milk yield (kg/cow/d)	16.7	12.8	9.8
Daily energy requirements (MJ/d)	148	128	113
Energy for maintenance (%)	40	46	52
A. Total farm energy for milk prod ('000 MJ/300d)	**444**	**499**	**576**
Daily energy cost to produce milk (MJ/kg)	8.9	10.0	11.5
B. Total farm energy for dry period ('000 MJ/65 d)	**39**	**51**	**66**
C. Rearing heifer replacements ('000 MJ/yr)	**66**	**88**	**110**
Total farm requirements or A+B+C ('000 MJ/yr)	**549**	**638**	**752**
Productive feed energy (%) = A/(A+B+C)	81	78	76
Total energy cost to produce milk (MJ/kg)	11.0	12.8	15.0

This table clearly shows the energetic efficiency of feeding fewer higher yielding cows. However, as well as considering the costs of sourcing that energy, other factors must be taken into account when determining herd profitability, and these will be discussed in the following section.

13.1.1 Other factors influencing herd profitability

'Milk income less feed costs'(Chapter 12) is based on the daily feed intake of milking cows and, because Herd A is energetically the most efficient, this would also be expected to be higher than for the other two herds, as they are for Cow 2 in Table 12.5. However, this conclusion is based on the assumption that the milk responses to supplements do not differ between herds. Consequently, the profitability of feeding supplements in Herd A, compared to those in Herds B and C, may be reduced as Herd A cows would have been fed better to produce more milk.

Another factor influencing herd profitability is the marginal cost, or the cost of each additional unit of energy that is fed. For example, higher quality forages and concentrates often cost more, and better fed cows may require these higher quality feeds. To maintain their higher levels of milk production, Herd A cows would require rations providing extra protein and less fibre. Higher yielding cows have greater demands for protein even if their marginal energy requirements are the same per litre of milk produced. Furthermore, such animals must maintain higher feed intakes, which would be more adversely affected by high fibre diets. The cost of providing such rations for high yielding cows may be higher than for lower yielding cows. As this would increase feed costs, profitability levels are likely to decline.

Milk composition depends on nutrient intake and Herd A cows would be fed a better balanced ration supplying more energy and protein and less fibre each day than Herds B and C. It is then likely that milk composition may vary between herds. Herd A cows would produce milk with more milk protein, because of their better energy status, and more milk fat, unless their ration becomes deficient in dietary fibre, which is unlikely because all tropical forages have such high fibre levels. In most Asian countries, higher milk solids contents return a higher unit milk price, thus providing financial benefits to better fed herds.

Unit milk price can also be affected by milk quality, or the level of bacterial contamination. This is greatly influenced by on-farm hygiene. In Asia, milk quality payments are given on both objective and subjective assessments. For example, in Thailand, the objective assessments are actual measures of bacterial contamination, while the subjective assessments are based on inspection of farm equipment and facilities. For cows in Herd A to produce 5000 kg milk/lactation, their overall farm management must be excellent. Not only does this include feeding, but also the health, milking, reproduction and rearing of young stock. It is then likely that any subjective assessment for milk quality would provide maximum premiums, hence increase unit milk price, hence milk income less feed costs.

Table 13.1 was calculated on the assumption that cows produced one calf each year and 30% of the heifers were used as herd replacements. Cows provided with adequate energy have higher fertility because they are more likely to cycle earlier post-calving. It is quite likely that Herd A cows will cycle earlier than Herds B or C cows because of their higher feed, hence energy intakes. Consequently, heifer replacement rates may differ as a result of different culling pressures in the three herds.

If 'Milk income less feed costs' were calculated on a whole farm basis over a 12-month period, Herd A would be the most profitable. Its higher energetic efficiency and greater unit milk price would offset any greater substitution rate and higher unit feed costs discussed above. The above factors highlight the complex interactions between feeding management, milk responses and herd profitability. Ideally we should express all biological responses in terms of financial returns less cost inputs. At least in nutrition, we now have the tools to do this with more confidence than in other areas of farm management.

13.2 Determining optimum on-farm stocking capacities

Very rarely do farmers and advisers calculate the optimum stocking capacity of any one farm. Unfortunately herd sizes are usually the result of 'trial and error' whereby farmers increase cow numbers until they become too expensive to feed or their milk yields decline below acceptable levels. Estimated forage yields must be taken into account when determining how many cows and young stock can be adequately fed from a particular sized smallholder dairy farm.

The following scenarios are to assist in such a mathematical exercise. To calculate stocking capacities, a series of assumptions have to be made:

1. Forages contain 15% DM (not the 20% as often assumed) and yield:
   - 10 t DM/ha/yr (67 t fresh/ha/yr) under poor management, e.g. only fertilising with cow manure.
   - 20 DM/ha/yr (130 t fresh/ha/yr) under average management, e.g. fertilising with cow manure and limited inorganic fertiliser.
   - 30 t DM/ha (200 t fresh/ha/yr) under good management, e.g. fertilising with sufficient inorganic nitrogen and phosphorus fertilisers to match forage requirements.
2. The management allows for forage conservation to transfer wet season excess pastures for dry season feeding.
3. Smallholder farmers use their forages to rear replacement heifers as well as feed their adult cows, when lactating and dry. Farmers rear 20% of their milking herd as replacements, which first calve at 27 months of age.
4. An adult cow milking unit is therefore one adult cow plus 20% of a replacement heifer.
5. In year-round calving systems, only 75% of the adult cows are milking at any one time. Therefore each year, adult cows milk on average for 275 days and are dry for 90 days.
6. The forage feeding program allows for feeding:
   - 50 kg/day of fresh forage (7.5 kg DM/day) to milking cows.
   - 30 kg/day of fresh forage (4.5 kg DM/day) to dry cows.

Figure 13.1 Smallholder dairy farmers source a wide variety of forages, many of which are very low in nutritive value for milking cows (West Java, Indonesia)

- 20 kg/day of fresh forage (3.0 kg DM/day) to heifers, averaged over a full 24 months of feeding weaned stock.

7. Concentrates are fed to provide the balance of the diet to achieve target milk yields. However, such feed inputs are not relevant to these scenarios.

The annual forage requirements for each milking unit are then:

- 13 750 kg fresh (or 2065 kg DM) for the milking cow (71% of total).
- 2700 kg fresh (or 405 kg DM) for the dry cow (14% of total).
- 2920 kg fresh (or 438 kg DM) for 20% of a replacement heifer (15% of total)

or a total of 19 370 kg fresh (or 2905 kg DM) for each milking unit.

The stocking capacities, or number of stock that could be fed from one hectare of forage, are presented in Table 13.2.

Therefore, to provide sufficient quality home-grown forage for a well-balanced diet to all stock, the typical 0.5 ha smallholder farm should have no more than two to five milking cow units, that is two to five adult cows plus one replacement heifer, depending on management of the forage production area.

This is further evidence that farmers should concentrate on feeding fewer cows better. With increasing dependence on purchased forages, feed costs are invariably more expensive and dietary quality generally poorer than when basing dairy production systems on home-grown forages.

Table 13.2 Optimum stocking capacities for smallholder dairy farms with different levels of forage management

Quality of forage management	Poor	Average	Good
Forage yield t DM/ha/yr t fresh/ha/yr	 10 67	 20 130	 30 200
Milking units/ha forage	3.4	6.9	10.3
Adult cows/ha forage	4.0	8.1	12.1

One milking unit is one adult cow plus 20% of a replacement heifer
Assumed forage intakes: 7.5 kg DM/day for 275 d/yr for milking cows
4.5 kg DM/day for 90 d/yr for dry cows
3.0 kg DM/day for 365 d/yr for 20% of a replacement heifer

13.3 Flow charts of feeding decisions that drive profit

Figures 13.3 and 13.4 present flow charts of the major feeding management decisions driving profit. For each component in Figure 13.3, the feed inputs, the cost of home-grown inputs depend on their quality and availability, both of which are under farmer control. However, the cost of purchased feed inputs are driven by market forces, although farmers can influence these by purchasing when in plentiful supply, when they are likely to be cheaper.

For fresh forages, such as maize green chop or grasses, or for wet by-products, such as brewers grain or soybean curd, total costs must include conservation (as silage) until required. Dry feeds could also be purchased when cheapest but would then require some

Figure 13.2 Smallholder cropping farmers growing forage maize under contract for a large feedlot dairy farm in East Java, Indonesia

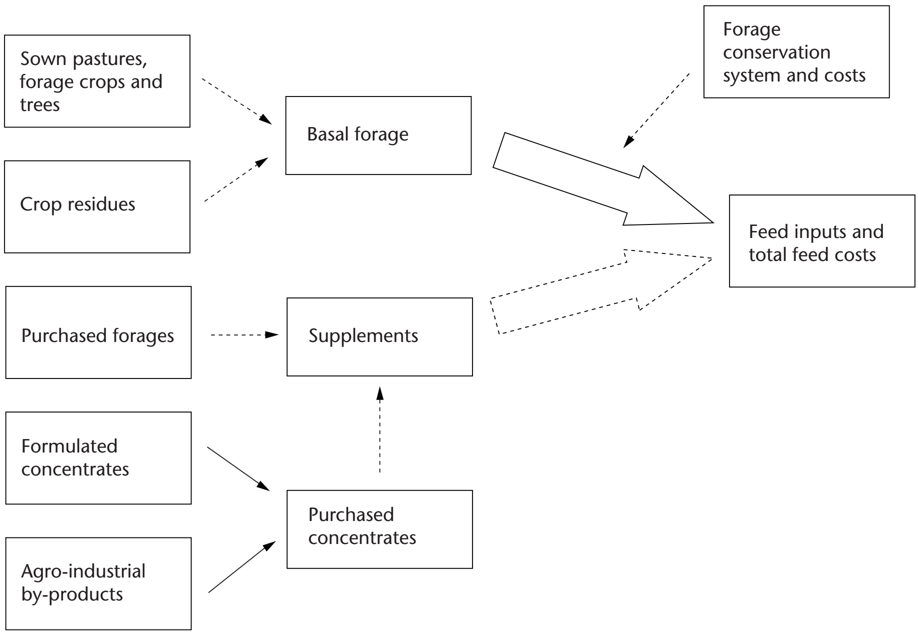

Figure 13.3 Components of feed inputs in smallholder dairy farms

storage costs. In addition, such purchases may necessitate relatively large cash investments, hence some opportunity cost (such as ongoing interest rates) should be incorporated.

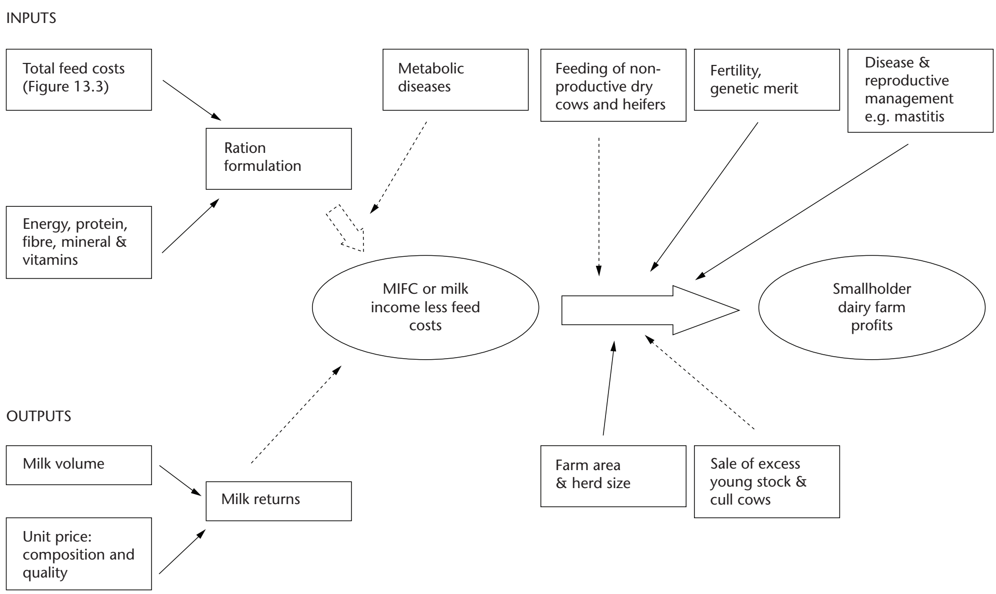

Figure 13.4 Feeding management decisions driving farm profits

Home-grown forages should also be fully costed, preferably on the basis of cost per unit nutrient, keeping in mind that agronomic decisions to optimise quality, such as using inorganic fertilisers or using a short harvest interval, may increase cost per unit DM, but not necessarily per unit feed nutrient. Furthermore, the cost of supplementing with additional nutrients from other feed sources is included in the final calculation of daily total feed costs per animal. This often leads to the conclusion that an investment in optimising forage quality (which can also improve milk yield) is worthwhile as it reduces supplement costs and/or increases milk return thus increasing MIFC.

Figure 13.4 incorporates other factors influencing overall farm profits, such as feeding non-productive dairy stock, disease, fertility and cow genetic merit. Costing such factors is beyond the scope of this manual.