9

Stock management on Asian small holder dairy farms

This chapter discusses the management of South East Asian small holder dairy (SHD) farms highlighting the key constraints to cow performance and how these impact on cow welfare.

The main points of this chapter

- In far too many cases, SHD farmers develop their production systems based on the 'traditional way of doing things'. Such farm management decisions and practices are based on how their father, friends or neighbour does things, together with their own trial and error experiences and some advice from service providers.
- Grazed forages provide only a negligible proportion of the stockfeed on SHD farms in the tropics. Some of the reasons for this are listed in this chapter.
- The short answer to the question of why cows are zero grazed in the tropics is the combination of high land costs and cheap labour.
- In many tropical Asian countries, considerable attention has been given to cow colonies, which consist of large dairy sheds, holding 50 or more cows that are owned by a number of SHD farmers. The perceived benefits of cow colonies lie in the economies of scale the farmers are hoping from the total herd management. Such an approach can overcome many constraints to production but may introduce others.

- On any dairy farm, no matter its size or location, the dairy production technology can be broken down into nine key activities, which can be considered as steps in the supply chain of profitable dairy farming. Just as any chain is only as strong as its weakest link, each step in this supply chain must be properly managed.
- Within a list of 34 key on-farm constraints to milk production technology on tropical SHD farms, the majority (26 of them) have implications for animal welfare. There is a close association between profitable farming and good animal welfare. This highlights the importance of understanding the necessity of, and practising, good animal welfare to improve farm performance, profitability and sustainability.
- The average milk production of all lactating cows in the herd can provide a useful guide as to the adequacy of the current dairy farm management practices. On tropical SHD farms, this can vary from less than 5 to more than 20 kg/cow/d due to genetics, feeding management and other farm factors.
- An assessment was made of the comparative performance of 15 SHD farms in the humid tropics, half in the lowlands and the rest in the highlands of the same dairy region in SE Asia. The striking difference was their average daily milk production, 8.3 (lowlands) v 13.5 (highlands) kg/cow/day. This could be attributed to climatic stress, herd and feeding management which impinged on their animal welfare.
- A study of 30 dairy farms in Peninsula Malaysia provided many valuable insights into why some farms are productive and profitable and why others are not. In essence, higher per cow milk yields and farm profitabilities were recorded on farms that were better equipped and better managed.
- This chapter contains a checklist of current farm management and stock welfare observations to assess the performance and likely profitability of the farm.

9.1 Dairy farming in the developing tropics

Globally, agriculture provides a livelihood for more people than any other industry (primary or secondary) while dairy farming is one of these major agricultural activities. In fact, Hemme and Otto (2010) estimated that 12 to 14% of the world's population (or 750 to 900 million people) live on dairy farms or within dairy farming households. Livestock provide over half the value of global agricultural output and one-third of this is in developing countries. Growth in agricultural production and productivity is then needed to raise rural incomes and to meet the food and raw material needs of the faster-growing urban populations. Because livestock products are more costly than other staple foods, their consumption levels

are still low in these countries, although they are increasing as incomes rise. Milk is nature's most complete food and dairy farming represents one of the fastest returns for livestock keepers in the developing world. Furthermore, increased dairy production and greater self-sufficiency save on foreign exchange.

Milk is a cash crop for small holders, converting low value forages and crop residues, and using family labour, into a valued market commodity. The dairy industry occupies a unique position among other sectors of agriculture as it gives a regular income to farmers due to milk being produced every day. Furthermore, milk production is highly labour intensive, providing a lot of employment. Accordingly, SHD farming was established as part of social welfare and rural development schemes throughout the developing tropics to supply a regular cash flow for poorly resourced and often-landless farmers. It now provides regular income to farmers, especially to women, enhances household nutrition and food security and creates off-farm employment. As many as one job is created for each 20 kg milk processed and marketed (Hooten 2008). The development of SHD also addresses the opportunities to overcome the persistent problem of rural poverty. This is by transferring income from affluent urban households to their poorer rural counterparts as well as improving the food and nutritional security for poor rural and urban households.

In many developing countries, the availability of meat and milk improves the level of human nutrition. These sectors are largely produced from land that is unsuitable for cropping, and utilises agro-industrial by-products that would otherwise be expensive to dispose of – such as straw. In addition, cattle farming provides draught power, meaningful employment for some of the poorest members of the community and also can provide them with dung, a useful source of fuel to reduce reliance on wood and fossil fuels.

The advantages of integrating dairy production in crop systems offer great potential. This is because, compared to pastoralists and agro-pastoralists, these farmers have more control over feed inputs and are able to capture complementarities in feed resource use and nutrient recycling, which increase overall farm efficiency and reduce vulnerability to market shifts. These crop–livestock systems generally support higher rural population densities than other solely livestock systems.

Unlike other tropical regions, milk from cattle, buffaloes and goats is not a traditional component of diets in South-East (SE) Asia. Rather, the milk they consumed came from coconuts, not livestock. Only over the last few decades has there has been increasing interest in dairying throughout this region. Higher population pressures and changes in eating habits have increased the demand for dairy products. Many countries now have school milk programs to encourage young children to drink more milk and hence improve their health through increased consumption of energy, protein and minerals (particularly calcium and phosphorus). In future years, as these children grow and have families, milk

consumption will increase at a faster rate. Consequently, many SE Asian countries are striving towards self-sufficiency in dairy products, at least in drinking milk.

The demand for milk in SE Asia is expected to continue increasing well into the future, driven by population growth and affluence. Per capita consumption is rising fastest in regions where rapid income growth and urbanisation result in people adding variety to their diets. Because of the relatively high cost of handling perishable final products and taste factors, most of this milk will be produced where it is consumed, aided by increasing imports of feed grains.

Now SHD is an accepted rural industry in virtually every tropical country in the world. The climatic, soil and socio economic environments of the tropics have created a very different type of industry to that found in the temperate developed countries and this is the subject of this chapter. It discusses the current systems of managing SHD farms in tropical Asia and their implications with stock behaviour and welfare.

Table 1.1 in Chapter 1 lists the Asian countries with low self-sufficiencies of, hence large imports of, milk and dairy products. These countries all have active programs to import dairy heifers to increase their national dairy herd populations. It is apparent that many of these countries do not have the same knowledge of how to manage high producing dairy cows as exporting countries, and so this leads to significant welfare concerns.

This chapter essentially discusses the limitations of traditional management and how, in too many cases, SHD farmers are developing their production systems based on the 'traditional way of doing things'. Tradition is a generic word used in this case to mean basing farm management decisions and practices on how their father, or friends or even nextdoor neighbour does things. This is complementary with their own trial and error experiences and maybe some advice from service providers, such as dairy cooperative or government advisers. Rarely do SHD farmers take full advantage of all the information sources available to them, with many of them available for free. As reported in the African small holder farmer case study in Chapter 8.2.2, farmer ignorance is a common cause of cow welfare problems in the developing tropics.

9.2 Shedding dairy stock in tropical Asia

9.2.1 Why are dairy stock generally housed in tropical Asia?

Grazed forages provide only a negligible (often zero) proportion of the stockfeed on SHD farms in the tropics for a wide variety of reasons, as listed below. However, the short answer to the question of why cows are zero grazed in the tropics is due to the combination of high land costs and cheap labour.

- High population pressures provide considerable competition for land, hence it is expensive to purchase or rent.

- Labour costs are low, therefore the use of machinery to harvest forages is minimal and forages are commonly harvested by hand on most SHD farms.
- Maintaining forage quality through grazing management is more difficult with tropical forages, compared to slower growing temperate forage species, so its regular harvesting and fertilising are best undertaken by humans at predetermined intervals rather than by livestock.
- Forage can be more easily hand harvested from erect, rather than prostrate, forage species that are fast growing and so more productive in the hot and humid climates of the tropics.
- The efficiency of removing all the forage from the pasture is invariably greater using a hand-held machete (or sickle) or a mechanical brush cutter than could possibly be achieved by a grazing animal that selectively chooses the most palatable parts of the forage and frequently defecates and urinates on other parts of the sward.
- The high temperatures and humidities encountered in the tropics necessitate the provision of shade, controlled ventilation (through shed designs and occasional fans) and water cooling (using hoses or sprinkler systems) which is best provided in sheds, preferably with open sides.
- Shedding provides weather proofing against climatic extremes, such as monsoonal rains which upset stock and SHD management routines such as herding grazing stock twice daily for milking.
- Security, particularly biosecurity, can be a major concern, both from people who can steal stock from open pastures and from other livestock that can spread contagious diseases.
- It makes tick and other parasite control easier.

These benefits of 100% shedding of stock are offset by the extra labour required to harvest the forages and to clean and maintain the shed facilities. The other problem is that shedding removes the opportunity for the cows' to graze and so express the associated normal behaviour arising from the freedom to move around and socialise in relatively large areas. Welfare issues are more likely to arise in the confinements of a shed than out at pasture. Animal health issues would be less prevalent at pasture with its healthier environment (hence lower exposure to pathogens) and greater opportunity for stock to move around, interact with each other and relax in the open air. The only extra precaution needed would be to more closely monitor and control parasites (external and internal) to prevent them rapidly infesting the stock once housed. Intakes of forage by grazing stock are also harder to monitor than if they were in the shed, making ration formulation more difficult.

If the opportunity arises, weaned heifers or non-lactating cows would be the easiest to put out to graze as they do not require the closer daily attention of milk-fed calves and milking cows.

9.2.2 Problems of confinement

Dairy stock imported from Western countries have almost invariably been reared under grazing conditions, and therefore have never been exposed to a continual shed environment, as is common on most tropical SHD farms. Compared to grazing, confinement creates specific problems such as:

- Restricting opportunity to seek comfort, for example, if they are only provided with cement floors.
- Physical problems related to continuously lying on cement, such as bed sores and ulcers, inflamed and infected joints (arthritis) and muscle damage causing pain.
- Creating problems of high humidity in poorly ventilated sheds, that can be just as detrimental as high temperatures.
- Limiting opportunity for exercise, hence the need for routine hoof trimming.
- Increasing exposure to infectious diseases.
- Other health issues, such as mastitis and uterine infections when hygiene is poor during milking and calving.
- Creating problems of heat detection for artificial insemination in the confinements of a shed.
- Requiring greater efforts to ensure good sanitation.
- Magnifying problems of social dominance in the herd.
- Often upsetting natural behaviour patterns.
- Increasing capital investment.

9.2.3 Potential role for cow colonies

In many tropical Asian countries, considerable attention has been given to large-scale investments in 'cow colonies'. These consist of large dairy sheds, holding 50 or more cows that are owned by several SHD farmers. These are generally located in close proximity to areas of forage production. Although small holders still own and manage their own herds in these large sheds, the perceived benefits of cow colonies lie in the larger size of the total herd and shared management costs. Such an approach can overcome many constraints to production, but may introduce others as listed below:

Potential benefits of cow colonies

- Greater investment potential since cooperatives have more borrowing power than individual farmers
- Use of mechanical forage choppers and milking machines
- Can employ contract labour to rear young stock
- Can grow large areas for forages, such as maize, for livestock feeding
- Less wastage in recycling manure to forage production area, through building effluent ponds to minimise volatilisation of nitrogen from urine

- Bulk handling of conserved forages using large-scale silage ensiling and storage systems
- Easier communication between advisers and farmers and between farmers themselves
- Easier to implement training programs involving practical skills as well as technical theory
- Easier to monitor post-training the application of new skills
- Better motivation of farmers to improve management practices as they can more easily observe such benefits
- Easier monitoring of individual farmer's milking hygiene practices and hence individual remuneration for better quality milk
- Concentrating farmers in the one place provides an ideal opportunity to introduce other motivation techniques such as regular awards for best management practices
- Better coordination of forage production, cow feeding, insemination, animal health, milk handling etc.
- Upskilling of farmers in specialist skills such as machine milking or calf rearing so they can take over much of these responsibilities in cow colonies
- Installation of milk cooling units on site
- More rapid cooling of milk and greater availability of hot water for more effective cleaning and sanitising equipment
- Increased likelihood of sufficient milk production to justify small value-adding operations to benefit small dairy cooperatives
- Greater potential returns to the local dairy cooperative, and so to the farmers themselves.

Unfortunately, such impressive facilities go hand in hand with high profile projects such as stocking them with imported pregnant Friesian heifers. The high mortality rates all too often experienced in these tropical countries suggest that the current colony feeding and herd management has yet to be improved to an appropriate level to achieve many of the production benefits from these high genetic merit animals. Also, animals with genetics more suitable to the conditions should be utilised, with the long-term higher productivity gains being weighed up against short-term production reduction. This would also result in more desirable welfare, and farmer satisfaction outcomes.

Potential problems with cow colonies

- Sheds are constructed and filled with cows before the forage production area has been developed, leading to many poorly fed cows.
- Insufficient attention is given to growing out non-revenue generating, young stock.

- Poorly planned forage production areas, e.g. with minimal water for irrigation during the dry season.
- Insufficient land allocated to forage production, partly because of provision of insufficient daily forage allocations to achieve more realistic target milk yields.
- Incorrect perception that rice straw, sugarcane tops and over mature maize stover are suitable forage sources for milking cows, particularly when target milk yields are 15 L/cow/day or more (Moran 2014).
- Lack of understanding of the potential of quality forages and tree legumes as important roughage sources for high yielding cows.
- Potential spread of disease because of variable management between individual farmers, e.g. during calf rearing, mastitis – if using milking machines.
- Poor concept of the need for more sophisticated milking hygiene when using milking machines, e.g. regular replacing of milk liners and testing of machine performance.
- Continual breakdown of machinery, choppers and milking machines.
- Need for highly trained and well-skilled labour for year round supply of quality forages.
- Need for senior managers to develop both short-term and long-term views on development program.
- Difficulties of regularly sourcing finances for completion of these large-scale capital development projects, such as provision of milking equipment, durable forage choppers.
- Inherent problems of passing over responsibility to individuals within small management teams. The larger the operation the more essential it is that skilled individuals be given more responsibility in specialist areas, such as forage production, animal health, milk quality.
- Management teams for large-scale cow colonies should not be expected to oversee those of any nearby small holder farms.
- Need for senior managers to find and keep quality staff with capabilities of solving both day-to-day small management problems as well as contribute to large-scale development. This problem could be addressed by employing bright, practically minded young animal science graduates who would be prepared to live as well as work in villages near cow colonies.
- With the penalties imposed by milk processors, returns on these large capital investments are markedly reduced because of the low unit milk returns through poor quality milk. Small investments, such as steam cleaners, small hot water units become even more effective in light of the large capital costs of sheds, silage bunkers etc.
- As with all small holder ventures, it is more profitable to ‘feed fewer cows better’.

Poorly resourced SHD farmers, whose businesses are often in 'survival mode', can become very individualistic and take time to develop the cooperative, sharing nature required for successful cow colonies. This has been given as a common reason for their poor success rate in countries with relatively new SHD industries such as Indonesia. However, small holders in countries like China, which have more of a history of collective farming, utilise these benefits of magnitude of scale, particularly with some of their specific farm operations such as preserving and storing large amounts of silage and sharing a milking parlour so it can operate more efficiently for many hours of each day and night.

9.3 Constraints to farm performance and profitability

9.3.1 Supply chain for profitable dairy farming

On any dairy farm, no matter its size or location, the dairy production technology can be broken down into nine key on-farm activities, that can be considered as steps in the supply chain of profitable dairy farming (Moran 2009a). Just as any chain is only as strong as its weakest link, each step in this supply chain must be properly managed. Weakening any one link through poor decision-making and farming practices can have severe ramifications on overall farm performance and hence profits. In chronological order of their role in ensuring a profitable dairy enterprise, the 'links' are presented in Figure 9.1. Of these 9 steps, numbers 2, 3, 4, 5, 6 and 7 would all have implications for animal welfare.

9.3.2 Identifying the key constraints to animal welfare within the supply chain

The dairy industries of tropical Asia have failed to keep pace with the speed of dairy development in Western countries over recent decades. Granted, the tropical environment is not ideal for dairy cows as high temperatures and humidities and seasonal rainfall reduce both the nutritive value of available forages and the level of cow comfort, that is the production potential and welfare of the stock. In addition, many of the farmers, usually small holders with less than 10 milking cows, have not been able to develop the skills of efficient milk production. This has primarily been due to poor extension services more so than lack of technical knowledge on tropical dairy farming. Constraints to profitable dairy farming in tropical Asia are many and varied and can be categorised into institutional, government, socio-economic, technical and post-farm gate.

Within the technical constraints, Moran (2013) identified 34 key on-farm constraints to milk production technology, based on their position in the supply chain. An extra category 'Other on-farm constraints' is included in the following tables to take into account those skills covering farm business management. The ones with direct implications for animal welfare are presented in Table 9.1 while

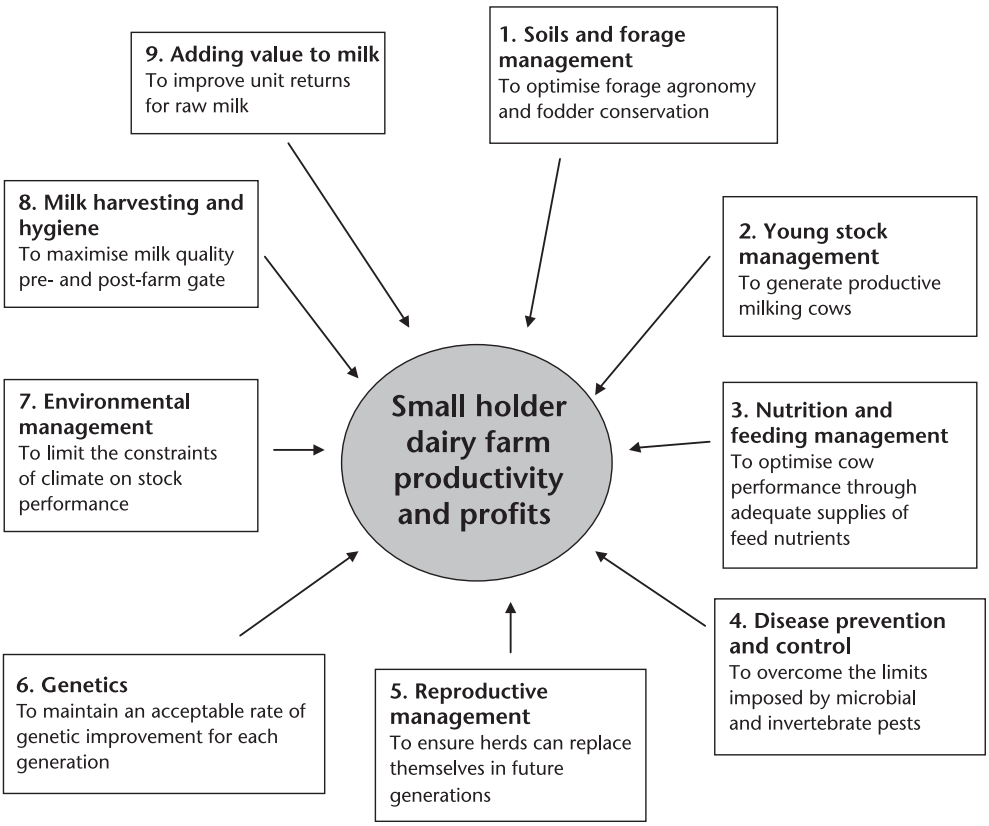

Figure 9.1: The nine steps in the on-farm supply chain of profitable dairy farming.

those with little or no direct implications for animal welfare are presented in Table 9.2.

From Table 9.1, 26 of the 34 constraints have implications for animal welfare, while the remaining constraints (listed in Table 9.2) could be considered to have little or no direct implications. The only ones without implications for animal welfare were those related to milk quality and unit returns, increasing the proportion of heifer calves in the herd, collecting robust herd performance data and improving farmer–management dairy co-op relationships. In other words, the majority of farm management decisions and practices would impinge on animal welfare issues. This highlights the significance of understanding the importance of, and practising, good animal welfare to improve farm performance, profitability and sustainability. We would expect that in any region of tropical Asia, or in fact in any dairying region around the world, there would be a close correlation between profitable and sustainable farms and good animal welfare practices. In other words, not only is sound animal welfare essential from the cows' contented

Table 9.1. On-farm constraints to milk production technology (from Moran 2013) with direct implications for animal welfare.

Key activity	Key constraints with implications for animal welfare
1. Soils and forage management	Shortage of dry season forages
2. Young stock management	High calf mortality Poor post weaning growth rates High wastage rates (from birth to conceiving in 2nd lactation)
3. Nutrition and feeding management	Low quality of by-products and formulated concentrates Poor performance of cows during early lactation (poor peak and daily milk yields, delayed cycling) Cows (particularly high genetic merit cows) do not cycle for many weeks after calving Seasonality of milk production Little profits in milking cows
4. Disease prevention and management	Problems with lameness Problems with mastitis High calf and heifer morbidity and mortality General animal health problems
5. Reproductive management	High age at first calving Low 100 day in calf rate (pregnant within 100 days from calving) or high 200 not in calf rate (not pregnant within 200 days of calving) High number of services per conception Low % mature cows are milking
6. Genetics	Poor milking cow quality Most suitable genotype for the system
7. Environmental management	High incidence of heat stress during the 24 h period High incidence of animal health problems due to poor shed hygiene
8. Milk harvesting management	Poor milk composition (fat and protein contents)
9. Value adding milk	–
10. Other on farm constraints	Poor profitability of dairy farming Low capital resources for investing in farm infrastructure Poor dairy farming skills Underdeveloped entrepreneurial skills in dairy farmers

existence and hence the farmers' ethical viewpoint, it is also an essential ingredient of the farmers' smorgasbord to ensure a long-term and profitable future.

9.3.3 Farm Key Performance Indicators and animal welfare

Moran (2009b) developed a range of Key Performance Indicators (KPI) to help farmers diagnose the strengths and weaknesses in their dairy enterprise. Table 9.3 presents 10 questions that should be asked on any farm, big or small. The full paper presents the relevant values for each question. The first six, being feed related, have few implications for animal welfare, apart from the need to ensure the stock have sufficient forage supplies to ensure normal rumen function and that their appetites

Table 9.2. On farm constraints to milk production technology (from Moran 2013) with little or no direct implications for animal welfare.

Key activity	Key constraints with little or no implications for animal welfare
1. Soils and forage management	Low yields of forage Poor forage quality
2. Young stock management	–
3. Nutrition and feeding management	–
4. Disease prevention and management	–
5. Reproductive management	Increasing the proportion of heifer calves
6. Genetics	Difficulty of collecting robust data from genetic improvement programs
7. Environmental management	Reduced forage quality due to high temperatures and rainfall
8. Milk harvesting management	Poor milk quality (bacterial contamination)
9. Value adding milk	Poor milk unit returns
10. Other on-farm constraints	Poor farmer–management dairy co-op relationships

Table 9.3. Ten KPIs of small holder dairy farm performance.

Measure	Questions to ask
Feeding management	
1. Stocking capacity	Is the farm carrying too many cattle for the available forage supplies?
2. On farm forage production	How much of the farm's annual forage requirements must be purchased?
3. Forage quality	Is the forage being harvested or purchased at its optimal quality for milking cows?
4. Concentrate feeding program	What is the quality of the concentrates being fed and how much is allocated per milking cow?
5. Total feed costs	Are the forages and concentrates costing too much per unit of feed energy or protein?
6. Milk income less feed costs	How does this compare with those of other farmers with good feeding management?
Herd management	
7. Percentage productive cows	What is the percentage of adult cows actually milking? What is the proportion of milking cows in the entire dairy herd, expressed as a percentage?
8. Pattern of milk production	What is the peak milk yield of the herd and what is its lactation persistency (rate of decline from peak milk yield)?
9. Reproductive performance	How many days after calving do cows cycle? What is the submission rate and the conception rate to first insemination?
10. Heifer management	What are the pre-weaning calf mortality and the wastage rate of heifers from birth to second lactation? What is their age and live weight at first calving?

are not adversely affected by poor cow comfort. However, the remaining four are all directly affected by poor animal welfare practices.

One of the major problems on tropical small holder farms is the high calf mortality and the very high ages at first calving of replacement heifers. Pre-weaning calf mortality rates of 15 to 25% would be typical on many tropical dairy farms (Moran 2011) and can be as high as 50%; this contrasts to the 3 to 5% mortality rates on farms in temperate developed countries. Ages at first calving vary from 30 to 36 months on most tropical SHD farms, compared the 24 to 30 month targets. These clearly indicate poor calf and heifer rearing practices. Many of these are due to poor stock welfare, such as inadequate housing and hygiene, which exaggerate the other shortfalls in feeding and disease management. This again highlights one of the main themes of this book that improving welfare will lead to production and productivity improvements.

9.3.4 Assessing adequacy of the current herd management using cow milk yields

All the above KPIs can be quantified to provide guidelines as to which ones require priority in any dairy farm improvement program. Although some are relatively easy to quantify, others are quite difficult. Probably the most simple, and most used, single measure of SHD farm performance is the average milk yield of the milking cows. The correct term for this figure is 'rolling herd average' as it is the average milk yield of all the lactating cows, which will be at various stages in their lactation cycle.

This single value provides a summation of all the important aspects of SHD farm management, so any interpretation must take into account a diversity of feeding, herd and farm factors. Accordingly, many dairy specialists may query its usefulness as a single measure of dairy farm performance. However, it is routinely used by farmers to describe their farm's performance in relation to their neighbour's farm and also in relation to production targets provided by many government advisers. In addition, it is often quoted by government officials when summarising the stage of development of their national dairy industries. Table 9.4 describes the adequacy of the farm's dairy farm management practices using the rolling herd average; other factors to consider are listed below the table (see also Figures 9.2 and 9.3).

Other factors to consider

- It is important to differentiate between rolling herd averages and peak milk yields
- Milk composition is also a good indicator of feeding management
- Excessive body condition is indicative of nutrient status

Table 9.4. Interpreting the adequacy of dairy farm management from cow milk yields.

Range in average herd milk yields on tropical South-East Asian dairy farms

Herd milk yield (kg/cow/day)	Adequacy of dairy farm management practices
5 7	Very poor feeding and herd management and low genetic merit cows (or milking buffalo)
9	Typical of many SE Asian small holder farms, even with high grade Friesians
11 13 15 17 19	Gradual response with grade and crossbred Friesian cows to improved feeding, herd, young stock and shed management. *Milk yields of 15 kg/day are considered acceptable by many government dairy advisers.*
20	Potential level in **lowland humid tropics** following improved management of body condition throughout lactation
25	High genetic merit cows in **tropical highlands** or **lowland dry tropics** with good farm management
30	Typical peak milk yields in herds with 25 kg/cow/day rolling herd averages
35	Unrealistic in SE Asia except where all major constraints to milk production have been overcome

Figure 9.2: Typical housing system for tropical small holder dairy farmers; tie stall and concrete floor with very poor floor hygiene.

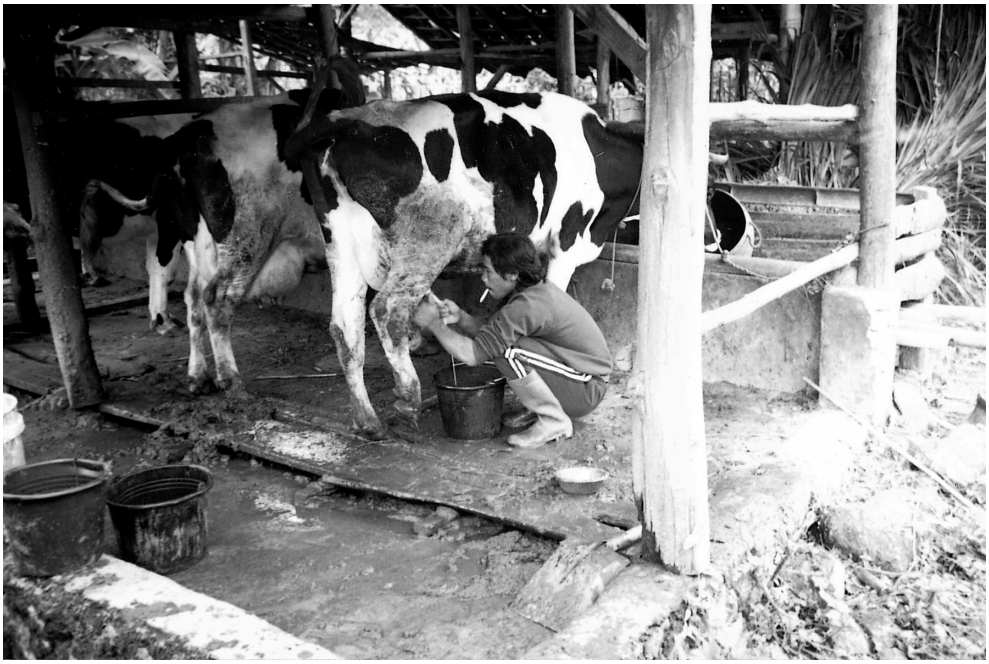

Figure 9.3: Permanently tethering milking cows that are maintained in very unhygienic conditions like this, could not be expected to produce much quality milk.

- Herd dynamics (number of dry cows and percentage of lactating adult cows in the herd) can also indicate adequacy of herd management.

9.3.5 Case study of small holder dairy farming in Indonesia

The adequacy of dairy farm management was assessed on a brief visit to a dairy farming region in the humid tropics of Indonesia during March 2013 where many SHD farms were located, some in the lowlands (at sea level) and others in the highlands (up to 1000 m above sea level). The milking cows were all crossbred Friesian and were tethered all day. The forage was essentially Napier grass (*Pennisetum purpureum*) or native grass sourced from the roadside or paddy fields while the concentrates were formulated commercially and supplemented with by-products from soy and cassava processing. The only drinking water offered to the cows was in the slurry mixed with the concentrates. There was no evidence of fans or water used to cool the cows on any of the farms. The temperature and humidity were recorded inside each cowshed and farmers were asked about their feeding management and cow milk yields. Local dairy advisers provided more information about the background of the farmers. The data and subjective assessments collected from these visits are presented in Table 9.5.

Table 9.5. Comparative performance of 8 lowland and 7 highland SHD farms in Indonesia.

	Lowland	**Highland**
Temperature in shed (°C)	31–33	26–30
Temperature Humidity Index in shed*	81–85	74–79
Milking cows per farm (range and av)	7–35, 16	1–7, 3
Range in farm milk yield (kg/cow/d)	6–11	8–16
Average farm milk yield (kg/cow/d)	**8.3**	**13.5**
Range in farm peak milk yield (kg/cow/d)	10–14	16–25
Forage sources	Roadside	Production areas/roadside
Forage quality	Poor to average	Average to good
Sheds	Densely populated, low roofs	Less densely populated, higher roofs
Drinking water	Slurry	Slurry
Natural ventilation	Poor	Better
Rubber mats	Very few	More
Shed hygiene	Not good	Better
Farmers	Conservative	More progressive
Cow body condition	Not good	Better
Stock welfare	Not good	Better

*Temperature Humidity Index, the higher the more heat stress, 78–89 is severe stress.

The lowland farms suffered from more severe heat stress and the cows were more poorly fed and managed than those on the highland farms. The sheds there provided better housing conditions and natural ventilation and there were more rubber mats per cow in the highland farms while the level of cow hygiene and the body condition of the cows was also better. The striking difference between the two areas was the higher daily average milk yield, 8.3 compared with 13.5 kg/cow/d for the lowland and highland farms respectively.

Clearly the difference in level of climatic stress and the herd, feeding management and welfare accounted for 5.2 kg/cow/d difference in the milk yields of farms in the two regions. The smaller size of highland herds would also have contributed to their better level of management and stock welfare.

9.3.6 Case study of small holder dairy farming in Malaysia

Farm production and business performance data were collected from 30 dairy farms in Peninsula Malaysia during September 2012 by Moran and Brouwer (2013). Observations of the stock, cowshed, farm facilities and forage production area were made to assess current farm practices and the general state of the stock and the supporting dairy infrastructure. Farmers were interviewed about key aspects of their farm management, the costs of farm inputs and their herd performance to

develop a series of Key Performance Indicators. The business focus covered specific aspects of milk returns and feeding management to calculate total feed costs, feed efficiencies and feeding profits. Gross farm profits were calculated, including and excluding imputed labour costs. The farms were split into three groups to assess the impacts of farm management on cow milk yields. The key data findings are summarised in Table 9.6.

Herds with higher average milk yields contained a greater proportion of adult cows and replacement heifers. The milking cows had higher feed intakes and higher ration quality while the cows had higher feed efficiencies in that they converted more of their feed into saleable milk. Even though the farmers spent more money on feeding their milking cows better, these more productive herds yielded greater feeding profits from milk sales and they had lower costs of unit milk production. As these cows increased their milk production, the efficiency with which these farmers utilised their farm assets (both gross assets and assets that they actually owned) also increased.

The survey provided many valuable insights into why some farms are productive and profitable and why others are not. In essence, higher per cow milk yields and farm profitabilities were recorded on farms that were better equipped

Table 9.6. The impact of herd average daily milk yield on farm performance and business data of 30 farms in Peninsular Malaysia. The farms are grouped into either A, B or C (10 farms per group) based on increasing per cow milk yields.

Farm data	A	B	C	Sig
Herd average daily milk yield (kg/cow/d)	7.5	9.7	12.4	*
Size of milking herd (cows)	22	48	27	
% milking cows in adult herd	49	53	61	
% replacement heifers	47	73	80	*
Dry matter intake (kg/cow/d)	10.8	12.4	14.6	*
Ration metabolisable energy content (MJ//kg DM)	8.1	8.5	9.0	*
Ration crude protein content (%)	11.6	12.1	12.3	
Feed conversion efficiency (kg DM/kg milk)	0.70	0.82	0.87	*
Total feed costs for milkers (RM/cow/d)	7.44	8.75	11.41	*
Total feed costs as % milk income	78	76	49	*
Milk income less feed costs for entire herd (RM/kg milk)	0.53	0.57	1.24	*
Gross farm profit (RM/kg milk)	–2.01	–0.75	–0.05	*
Cost of production (RM/kg milk)	4.77	3.53	2.82	*
Feed costs (% total farm costs)	38	40	43	
Return on assets (%)	–0.6	–0.4	0.1	*
Return on equity (%)	–0.9	–0.5	0.1	*

* Significant difference between herds; RM, Malaysian ringgits.

and better managed resulting in better welfare. The more productive and profitable farmers had more reliable electricity and water supplies, provided specific calving down areas, did not graze their milking cows and did not suckle their calves on milkers. In addition, they used artificial insemination rather than natural mating, used calf milk replacer as part of their milk rearing program, routinely used dry cow therapy as part of the mastitis control program, kept farm records and had fewer problems with mastitis, lameness and young stock rearing. More of the cows on the most profitable farms had high peak milk yields and fewer had short lactations. Although these farmers invested more in feeding for their milking cows, the resultant greater feed conversion efficiencies on these farms and resultant better animal welfare yielded higher feeding profits and higher returns on total farm assets and equities.

Cowshed designs were generally poor in that roofs were low, shed hygiene had much that could be improved and fans and cooling sprinkler systems were virtually non-existent on any of the 30 farms. In addition, many of the farms suffered from a lack of productive cows in their herds. Future herd management must concentrate on improving reproductive performance and, in some instances, reducing young stock mortality as well as improving the nutritional status and therefore performance of the milking herd. Of the 30 farms surveyed, only eight had positive gross farm profits, although this increased to 18 farms if farmers excluded their family labour from the costs of milk production.

9.4 Checklist to assess current farm management and herd welfare

A series of observations can easily be made when visiting any dairy farm to assess the management and welfare of the stock and the performance and likely profitability of the farm. Answers to a series of questions could also be sought to help understand the current farm management. The following checklist has also been presented as Appendix 2.

Shed and facilities

- Roof height and natural ventilation
- Temperature and humidity inside shed
- Shed floor and cow lying area (cement, mats)
- Mats, enough for all cows, thin v thick
- Other forms of bedding material
- Stalls; tie stalls v free stalls v open lot
- General stocking density and space for cows to rest
- Adequacy and cleanliness of pens for young stock (heifers, milk-fed calves)
- Area for outside resting at night

- Adequacy and cleanliness of feed troughs and water containers
- Access to clean drinking water, not only as slurry feeding
- Source and adequacy of water for drinking and cleaning
- If sufficient cows, use of mechanical forage chopper
- Room for feed processing and preparation
- Adequacy and hygiene of milking area, including teat dipping and access to hot water
- If machine milking, state of rubber linings
- Cleanliness of milking buckets and milk cans
- General hygiene and condition of cow teats and coats
- Adequacy of effluent disposal and storage system
- Adequacy of office and farm staff area

Stock

- General condition (thin v good v fat)
- Obvious health issues, such as lameness
- Freedom from obvious injuries
- Is mastitis an issue? If so, what are the management procedures?
- Rumen fill
- Cow cleanliness (udder, thigh and hips, legs)
- Signs of heat stress (> 70 respirations/minute)
- % cows ruminating at rest
- % of cows lying down and ruminating
- Cow 'comfort' and contentment (obviously hungry and unsettled)
- Flight zone (< 3 m, 3 to 5 m, > 5 m)
- Evidence of good or poor stock handling practices
- Herd numbers and structure
  - ➤ Milking cows
  - ➤ Dry cows
  - ➤ Heifers (weaning to calving)
  - ➤ Milk-fed calves
  - ➤ Other dairy stock (bulls, steers)

Feed supplies

- Enough fresh forage fed each day? Typical amount fed per milking cow in wet/dry season
- State of forage (improved v native v forage by-products, immature v mature)
- Sourcing fresh forage, grown v off farm
- Enough concentrates fed each day? Typical amount fed per cow
- Concentrates (formulated v mixed)
- What by-products are fed?

- If on farm mixing, specific feed additives (macro minerals, vitamins/minerals, rumen buffers)
- Use of shed effluent for forage production

Answers to simple questions

- How many cows did you milk yesterday?
- How much milk did you sell yesterday?
- How much milk did you use to feed your milk-fed calves yesterday?

These answers should allow you to calculate the average milk yield per milking cow:

- How much per kg of milk were you paid yesterday?
- If there is a milk grading scheme, what grade was your milk yesterday?
- What was the typical composition of your milk (fat, solids not fat, protein)?
- What was the typical quality of your milk (measured using somatic cell count, toal plate count or TPC, Methelyne blue reductase test or MBRT)?

Answers to more complex questions

- How aware are you of the importance of colostrum feeding to your newborn calves and what are your normal practices?

Figure 9.4: Cow colony incorporating many small holder farmers' animals.

Figure 9.5: Cows continuously tethered in a darkened shed.

- Do you keep any farm records? If so, which ones?
- What financial/business records do you keep?
- Do you consider mastitis to be a problem?
- Do you consider cow lameness to be a problem?
- What is the typical peak yield of your cows in early lactation?
- What is the typical lactation length of your cows (< 250, 250–275, 275–300, > 300 days)?
- What are your typical number of days between calving to conception?
- What is your typical number of days between cows drying off and then calving?
- What is your typical age (number of months) of heifers when they first calve down?
- What is your typical percentage of calves that show signs of ill health during milk rearing?
- What is your typical percentage of calves that die during milk rearing?

Figure 9.6: A very poorly reared Jersey dairy heifer.

- How many years have you been milking cows?
- Will you still be milking cows in a year's time or 5 years' time?
- Do your children want to follow you on the farm?
- Name three of your biggest problems on your farm. This can be any constraint at all, such as labour supplies, government/co-op or milk processor support and services, dry season forage supplies. Poor milk returns and high cost of production are universal problems for all small holder dairy farmers, so should not be included unless they are an obvious problem on this farm.

Figures 9.4, 9.5 and 9.6 illustrate cow welfare in SE Asia in different farm systems that can all be improved with better farm management practices.