

1

Introduction

This chapter presents an outline of the book. It highlights the importance of improved understanding of dairy cow behaviour and how this behaviour changes under small holder dairy (SHD) farm management.

The main points of this chapter

- In the process of developing tropical SHD farms, farmers and animal researchers have taken a domesticated species of livestock and greatly changed its physical and social environment.
- Animal welfare is important for producers because it can affect the health, production and contentment of cows. Having an understanding of factors that influence welfare can have important implications for production.
- South and East Asia are growing markets for imported dairy products as well as imported dairy stock to increase domestic milk production.
- Greater attention should be placed on management practices in tropical SHD farms to reduce any adverse effects on cow welfare and production.
- It can take up to 6 months for imported temperate dairy heifers to fully adapt to the living conditions of a tropical SHD farm.
- The wants and needs of dairy cows have been summarised as nine key factors.

1.1 What this book is all about

This book is primarily about how dairy (and beef) cattle communicate between themselves and with their keepers, namely the stockmen, women and farmers who run their everyday lives. Cattle are naturally gregarious animals preferring to socialise in groups, rather than as individuals. They also prefer space to congestion. Space allows them to sort out their social dominance relationships so the more subordinate cows can rest away from their dominant herd mates. When constricted in sheds, such social grouping is more difficult. Free stalls provide a sanctuary for submissive cows while the tie stall barn virtually removes such social interrelationships altogether.

The husbandry or management of cattle evolved many centuries ago in large areas of natural vegetation where the animals could freely graze. However, nowadays on most Asian farms livestock are restricted to small sheds where they are dependent on their keepers to supply them with everything from feed and water to minimised climate stresses and health support. Likewise, as a full range of natural behaviours when on heat cannot be expressed in small spaces or when tethered, stockpeople have had to be more adept at detecting cows on heat. This means that natural systems, where cows respond positively to the bull's attention, have had to be altered and now it is the person in charge of stock who identify signs of heat, then seek the bull or source the semen for artificial insemination.

The high cost of land, due to population pressures, and the low cost of labour, arising from the socioeconomic factors in developing countries, have led to continual shedding of stock. Even in developed countries, the more intensively managed cattle are housed. However, where possible, cattle are run outdoors because of the high costs of sourcing feed and water and the capital costs of infrastructure. Labour inputs are grossly different, for example, one stockperson can manage over 100 grazing dairy cows in Australia in contrast to only 20 fully housed cows in Asia.

When stock are housed in the tropics, sheds need to be designed and built to optimise natural ventilation and provide a flooring that is easy to clean yet comfortable to walk and rest on. High roofs and open sides together with gently sloping cement floors and specific cow resting areas on bedding material or mats are common features in well-designed sheds. The resting area should provide stock with non-abrasive bedding materials as well as a comfortable place and space to relax so they are able to more efficiently generate more of the products for which they are farmed, namely milk, meat and calves. Enduring climatic stresses such as high temperature and humidity are generally easier to cope with in the open, provided shade is available and access to natural ventilation is not impaired. It requires careful planning in a cowshed.

By concentrating stock in small or highly stocked areas, not only is it less natural for the stock to exhibit their normal behaviour, but it also provides an ideal

environment for the propagation of pathogens. Therefore, attention to stock hygiene and health management must be prioritised to ensure stock do not unduly suffer from the intensive stock diseases associated with hard cement floors, manure and high density housing, namely lameness, mastitis, infectious diseases and respiratory problems.

Housing also means complete dependence on their keepers for feed and water. Even when provided with free grazing, cows depend greatly on the ability of the farmer to provide a diet balanced for the essential nutrients of profitable livestock performance. Out in the field grazing stock can select the most palatable, and presumably the most nutritious, parts of the plant. This is less likely to occur with most housed stock unless they are provided with large excesses, which increase wastage and reduce feeding profits. Hand-fed stock are entirely dependent on their keeper's skills to provide sufficient quantities of diet ingredients which can supply adequate amounts of feed nutrients and fibre to optimise their performance. This then assumes first, that the farmer has the knowledge and skills to formulate such a diet and second, the ingredients are available and so can be sourced at realistic prices to generate feeding profits.

Housing means increased interaction between stock and humans. The temperament of cattle can vary from wild, hardly tamed beef stock (commonly bulls) to quiet, very tractable and easily managed dairy cows. Housing can magnify the aggressive behaviour traits as cattle are forced to interact more closely with each other and with humans. As with any interaction between living creatures, communication is the key. Humans have developed language skills as the essence of such interaction, although non-verbal communication still plays an important part. Cattle have learnt to communicate between themselves through all their five senses while humans mainly communicate with animals using their ears and eyes and voice.

Communication between animals and humans then forms the basis of expressing the degree of stock comfort; that is how animals are at ease with their environment. If they are not comfortable and clearly indicate this state, it is up to humans to modify the environment to improve the animal's degree of comfort (see Figures 1.1 and 1.2). Unless they are made more comfortable, their primary objective, namely to produce saleable livestock products, will be compromised. If this is grossly compromised and sales of animal products are greatly reduced, their welfare can often be put at further risk, which indicates the humans' obligations to look after such animals are not being fulfilled.

Briefly, farmers and animal breeders have taken a domesticated species of livestock and completely changed its physical and social environment, particularly in the case of the SHD farmer in tropical Asia. After breeding and selecting the animal for high levels of production of livestock products of economic value (whether milk, live weight gain and/or calves), people then expect them to function

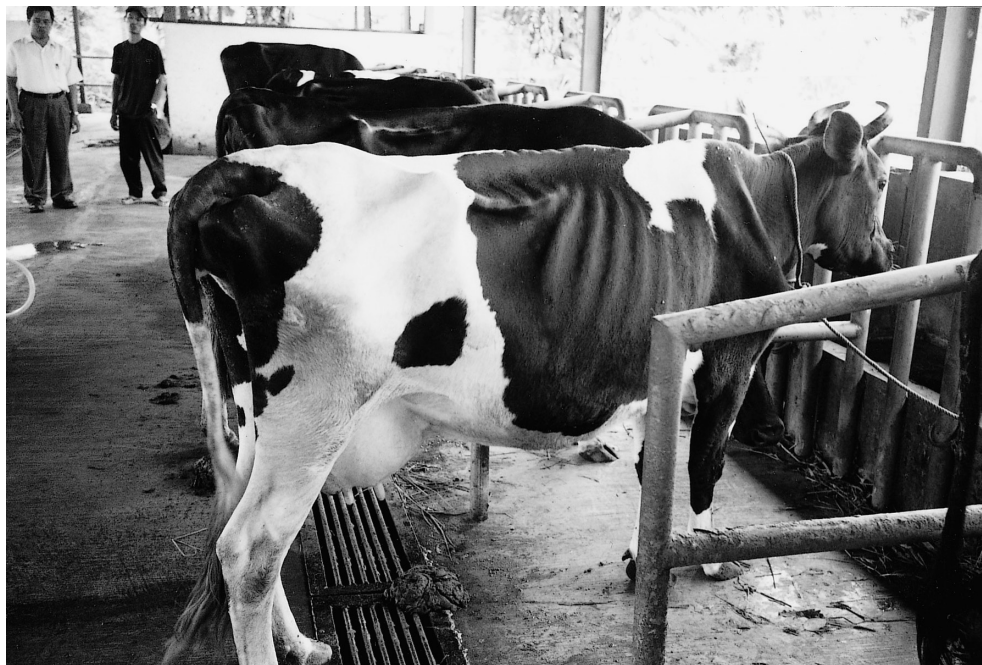


Figure 1.1: Very thin milking cows are an indicator of poor welfare, mainly due to poor feeding management.

in harmony with their new environment. It is only through better understanding and the provision of their needs to ‘behave’ normally, that we can hope to develop more profitable and sustainable systems of livestock farming. This then is the major objective of this book.

1.2 Outline of this book

This manual covers a wide range of topics primarily related to ensuring the sustainability of dairy production systems in tropical developing countries. Clearly, to achieve this aim, closer attention needs to be given to the economics of current systems. Sourcing high yielding dairy cows, but providing the feeding and management that only utilises a small proportion of their potential is just not sustainable in the long run. It is also a contributory factor to their suboptimal animal welfare because such animals are more susceptible to the traumas of heat stress, poor housing conditions and, all too often, subsistence feeding management.

This book is written for all the stakeholders in SHD production systems in the tropics, with an emphasis on South-East (SE) Asian countries. While small holders are the major suppliers of milk in the tropics, numerous larger farms are becoming established throughout the tropics to satisfy the increasing demands for fresh milk. It is hoped that both production systems farmers and their advisers will gain much



Figure 1.2: Cows are naturally curious creatures.

from this manual and improve the welfare and production of their cows. In addition, the book provides relevant key information from research scientists on aspects of cow behaviour and stock welfare. Policy makers and senior management should also benefit from reading selected chapters.

Most tropical countries have proactive programs to increase local supplies of milk, which require increasing numbers of well-trained workers to service their dairy industries. Consequently, educators from agricultural schools, universities and technical colleges need to be kept abreast of the latest technical developments and applications in dairy farming. This book also aims to serve this purpose.

The key target audiences for this book are:

- Farmers and stockpeople who want to improve and ensure adequate animal welfare.
- Farm advisers who can assist farmers to improve their welfare practices.
- Educators, usually at a technical level, who develop training programs for farmers.
- Educators, usually at a university level, who train dairy advisers in the basics of dairy production technology and stock welfare.

- Other stakeholders in tropical dairy production, such as local agribusiness, policy makers and research scientists.

These chapters are written so that they can be understood by advisers and tertiary students. As the trainers must ensure that other target audiences can comprehend their course material, they should select the most relevant sections to incorporate into basic programs for farmers. Each chapter has been written as a 'stand alone' document, which can be individually downloaded from the internet. For this reason, there may be a minimal amount of repetition between chapters. Chapter outlines are as follows:

- Chapter 2 provides an introduction to animal welfare, why it is important and the common welfare issues on dairy farms.
- Chapter 3 provides an insight into domestication, including the impact this has had on natural cattle behaviour.
- Chapter 4 discusses the details of cattle behaviour such as the five senses of the body, the various ways stock communicate with each other, behaviour indicating poor welfare, human–animal relationships and behavioural problems arising from clashes with their environment.
- Chapters 5 and 6 discuss practical signals you can use to assess cow wellbeing and welfare, how they can and should be interpreted and also how many of them have been quantified to improve the impact of their messages.
- Cow comfort is the topic of Chapter 7. This specifically covers what cow comfort is, the implications of this for welfare and how shed design and other facilities on the farm can influence this.
- Chapter 8 provides examples of farm audits and other ways to quantify animal welfare and its impact on dairy cow wellbeing and performance.
- Chapter 9 discusses the management of SE Asian SHD farms highlighting the key constraints to cow performance and how these impact on cow welfare.
- A protocol for the welfare of stock on tropical SHD farms is presented in Chapter 10.
- Chapter 11 concludes the manual with some final overviews.

Every profession has its jargon, or words developed specifically for that profession, and agriculture is no exception. There are some very specific terms and acronyms that are routinely used by dairy researchers and advisers. These are explained in the Glossary and when they are first mentioned in this manual. Full publication details of all sources of information are presented in the References and further reading section, while the Appendices include a list and websites of government and non-government agencies within Australia which are involved in cattle welfare. They also include checklists on how to quantify heat stress, what to look for when assessing good farm management and a simple scoring system of

farm stock welfare. Finally, for ease of finding specific information, the Index lists all the key topics covered in the book and their relevant page numbers.

Many of the behavioural studies cited in this manual, particularly those in Chapters 3 and 4, have been reported in some of the standard textbooks on cattle behaviour, for example those written by Albright and Arave (1997), Grandin (1998), Phillips (2002) and Grandin (2007). As the actual researchers who conducted these studies were referenced by these textbook authors, they have not all been cited in this book. However, where a specific chapter has been written for an edited book, the original authors have been cited.

Several of the topics covered in this manual have previously been extensively reviewed in other books about tropical dairy farming, written by John Moran. Accordingly, duplication of these topics has been kept to a minimum by referring the reader to specific chapters in these previously published texts. All chapters of these books are freely downloadable on the Internet from the website <www.profitabledairysystems.com.au>. The full web addresses to source these books and chapters are also included in the bibliography of this book. Topics covered in specific chapters of previous texts include:

- Development of SHD farming in Asia; Chapter 3 of Moran (2009a)
- Body condition scoring; Chapter 18 of Moran (2005)
- Alleviating heat stress; Chapter 19 of Moran (2005) and Chapter 12 of Moran (2012a)
- Housing systems; Chapter 13 of Moran (2012a) and Chapter 7 of Moran (2012b)
- Key Performance Indicators of SHD herd performance; Chapter 14 of Moran (2009a)
- Communicating with the calf; Chapter 12 of Moran (2012b).

For the sake of brevity, when referring to farm operators and managers, this book uses the male possessive noun and pronoun, this does not necessarily assume them only to be men. In many situations, the description could apply equally to the farming women who make key management decisions.

It is not easy to write a book about small holder tropical dairy farming in which every fact is relevant to every reader. What is of most importance to the actual farmer may not be the most crucial fact for the educator of technical or university level students or the dairy adviser who chooses to read this book. Furthermore, tropical dairy farms take many forms ranging from very small holdings with fewer than five milking cows who are all hand milked, to larger operations with say 50 milking cows that are milked using ‘bucket milkers’; these could be all owned by the one farmer or constitute a colony farm with many farmers owning small herds. Although grazing the milking herd is a rare feature of most tropical farms, the larger ones, with adequate land may be able to graze their dry cows or yearling

heifers. Herd dynamics in a grazing situation can be very different to those in the confines of a shed, particularly one based on tie stalls. In future years, farmers may expand and be able to incorporate a milking parlour with fixed in line milking equipment. In fact virtually all sustainable dairy farms grow in the medium to long term, so for today's farmer with 10 cows or fewer who may become tomorrow's farmer with 30 or 50 cows, his knowledge of and practices to optimise cow behaviour with its consequential impact on their wellbeing, will need to be updated. This book, although not aiming to be 'all things to all people' has been written for a very diverse audience, so there will be technical aspects that are less relevant for some readers.

It is quite likely that many SHD (and even large-scale) farmers would find this book too technical and difficult to comprehend. In the first place, if English is not their mother tongue and unless they were well educated and/or travelled, very few would fully understand the English language. In the second place, the book is not simply a practical guide of how to ensure good stock welfare. Rather, it is a technical manual about:

- How modern day dairy cows evolved from their wild ancestors.
- What are natural behaviour patterns of cattle, how did they evolve in response to the changing management of dairy stock and how can we recognise abnormal behaviour?
- Since animals use different mechanisms to communicate, how do humans understand their needs? How do we interpret the many signals that they give out every day and what do we need to do to maintain their wellbeing under the constraints of commercial livestock farming?
- What is cow comfort and how do we measure it?
- How should we address animal welfare in current dairy production systems and how should this differ between countries and societies that farm dairy cattle for their milk and meat?
- How can good animal welfare best become profitably integrated into SHD systems in tropical Asia?

In other words, the book provides the theory as well as the practice behind the observations arising from poor stock welfare practices so farmers and advisers can understand the reasons why these practices need to be improved, that is 'why unacceptable things happen' and 'how they should be changed' to ensure they do not happen again.

1.3 Small holder dairy development in tropical Asia

SHD farmers supply over 80% of the annual global 240 billion litres of milk, with average herd sizes often as small as one to five milking cows. The Asia-Pacific

region has seen the world's highest growth in demand for milk and dairy products. Total consumption has doubled over the last 30 years, contributing to more than 60% of the total increases in global consumption. For example in SE Asia, per capita milk consumption is expected to rise from the current 10 to 12 kg/hd/yr to 19 to 20 kg/hd/yr by the year 2020 (Delgado *et al.* 2003). This 3% per annum growth will lead to a total milk consumption of 12 million tonnes/yr by 2020, which Delgado *et al.* (2003) predicts will require 9 million tonnes milk/yr net imports to satisfy; this is up from 4.7 million tonnes milk/yr imported in 2000. Therefore by 2020, SE Asia will only be producing 25% of its milk requirements.

Such growing demands, prompted by higher incomes and increasing urbanisation, have combined with economic reforms and market liberalisation policies to heighten the import dependency of many countries in the region, where such imports have nearly doubled over the past decade. Asia has become increasingly dependent on highly competitive, but ever increasingly volatile, global dairy commodity markets. With production falling short of consumption gains, there has been a threefold increase in the importation of milk and dairy products.

Table 1.1 presents FAOSTAT (2010) data from 19 countries in South and East Asia on the numbers of dairy cows and milking buffalo and their total annual milk production, together with their changes in self-sufficiency over the last 10 years or so. To give an idea of the role of dairy products in their diet, the per capita consumption of all dairy products is also included in this table. These range from extremes of Pakistan (over 170 kg/capita/yr) to Laos (with only 2 kg/capita/yr).

For more detailed information on changes in the size and production of national dairy herds, the reader is referred to Chapter 3 in Moran (2009a). With regard to changes in self-sufficiency of milk and dairy products, several countries have maintained close to 100% self-sufficiency, while others have been unable to maintain previous levels of self-sufficiency because demand has greatly exceeded supply. Others have minimum levels that have hardly changed over the last 10 years.

The relevance of these data to this book is that most Asian countries that rely heavily on imported dairy products have active government policies to increase domestic milk production, often through importing large numbers of breeding stock. These animals are usually exotic heifers, either unbred or up to 5 months pregnant, in that they originate from temperate dairy industries where they have been reared on pasture in a largely climatically comfortable environment. Upon arrival, they then have to adapt to all the constraints of tropical SHD farming, such as high temperatures and humidities, limited quantities of poor to moderate quality feed and the vastly different rearing environment of a low investment system with limited to no grazing and a small cowshed. Changes in animal behaviour clearly indicate that this adaptation period can be quite traumatic and

Table 1.1. The size and self-sufficiency of selected Asian dairy industries in 2010.

	Total dairy consumption (kg/capita/yr) [2009 data]	Dairy cow population (000 head)	Buffalo population (000 head)	Total annual milk production (Kt or million kg/yr)	Self-sufficiency in milk (%)		
					2000	2005	2009
South Asia							
Afghanistan	–	3500	–	1401	100	100	100
Bangladesh	20.2	4059	90	866	74.7	66.7	70.5
India	72.2	44 900	37 131	117 253	100	100	100
Nepal	43.0	974	1291	1495	99.1	98.6	98.0
Pakistan	171.9	10 493	11 864	34 716	99.5	99.8	99.8
Sri Lanka	35.9	251	90	209	32.9	24.7	33.8
East Asia							
China	30.0	12 298	5706	39 136	87.0	91.8	95.1
N Korea	4.5	36	–	95	100	91.2	84.4
Japan	76.5	1000	–	7720	79.8	80.4	81.2
Mongolia	150.5	623	–	243	99.2	96.4	96.7
S Korea	22.9	186	–	2073	90.7	86.1	82.2
SE Asia							
Cambodia	4.3	137	–	27	48.5	52.1	33.4
Indonesia	11.5	597	–	840	37.6	31.9	30.0
Laos	2.2	35	–	7	26.5	22.5	35.2
Malaysia	36.7	147	10	74	3.3	3.5	6.1
Myanmar	29.0	2600	540	1387	83.0	85.6	92.2
Philippines	13.3	6	–	10	0.7	0.8	1.1
Thailand	21.9	285	–	851	28.8	45.5	50.3
Vietnam	11.5	133	32	341	19.5	19.6	30.6

lengthy, up to 6 months according to experienced small holder farmers. This is exacerbated by the often different standards of acceptable practices of stock welfare on their new home farm (see Figure 1.3).

There is a group of Asian countries with low per capita milk consumption and low self-sufficiencies and these are likely to be the ones with most proactive dairy heifer importation programs. These include Philippines, Indonesia, Thailand, Malaysia, Vietnam, Cambodia and Laos.

1.4 What do dairy cows really want?

While many of the welfare issues discussed in this book relate to the herd, it is important to remember that the welfare of an individual animal is important. With that in mind, Bos *et al.* (2009) list nine key factors in any dairy husbandry system that help reduce any negative impacts on dairy cow welfare:

- Resting space: provide at least one spacious resting spot for each cow so they can all rest at once if they want.



Figure 1.3: The typical method of nasal tethering a milking cow on small holder Asian dairy farms.

- Feed and water: you must provide feed that will enable the cow to maintain her body functions and produce milk. A continuous supply of fresh water is also a crucial requirement.
- Space to perform natural behaviours: cows need to be able to perform natural, healthy behaviours and freely move within the area and within the herd.
- Calm and predictable handling by people will reduce fear and improve milk production.
- No negative stimuli such as leakage of current and cow trainers (electric wires placed on top of free stalls): negative stimuli will cause (chronic) stress which adversely influences health and welfare.

- An environment without obstacles is needed for cows while getting up, lying down and during resting. Cows also require the opportunity to be able to lie down at some distance from other cows: they like to lie down in the way they would in the pasture. They want their own personal space, but may still like to lie close together.
- A comfortable climate: this is one with a Temperature Humidity Index below 71, which is equivalent to 27°C at 30% relative humidity or 24°C at 70% humidity (Moran 2005 and Appendix 1), and so avoiding heat stress.
- Passage ways and feeding areas with a non-slip, dry and clean floor without sudden changes in the level, slope or texture: if the floor is too smooth, cows may slip, if too rough, they may damage their hooves. Uneven, wet or dirty floors are detrimental to leg and hoof health.
- Sufficient light during the day and dark conditions for rest at night: cows must be able to see their surroundings properly, so they can recognise their herd mates, explore their surroundings or interact with their companions. Lighting in the day of more than 200 lux is recommended.

Providing all these prerequisites will ensure a happy, contented and productive herd. As will be outlined in the coming chapters, animal welfare is closely tied to the health and productivity of cows too, making it important to the producer from several different angles. The importance of these requirements and how they contribute to good welfare and production will be explained in the subsequent chapters.