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Introduction

This chapter presents an outline of the manual, which highlights the basic components of successful small holder dairy farming in tropical climates.

The main points in this chapter

- This is the third book I have written on tropical dairy farming, with the previous two concentrating on feeding management and on-farm business management of small holder farms.
- This book deals specifically with overcoming the many problems of poor adaptation of exotic high grade dairy stock to the stresses of tropical climates and small holder herd management.
- Small holder dairy farmers (with herds up to 20 milking cows plus replacement heifers) are generally competitive and sustainable.
- Dairy development is associated with technical changes to improve milk yield per cow.
- Most countries have development programs involving importing high genetic merit dairy stock, usually Friesians.
- Dairy production technology can be broken down to nine links in a supply chain on any dairy farm, no matter its size or location.

This book is a companion to two previous books I have written on small holder dairy (SHD) farming in the tropics. The first book, *Tropical Dairy Farming* (Moran 2005), details the production technology of SHD farming, with emphasis on nutrition and feeding management. The second book, *Business Management for Tropical Dairy Farmers* (Moran 2009a), discusses the farm business management (FBM) skills required to ensure such systems can remain financially sustainable. This third book, *Managing High Grade Dairy Cows in the Tropics*, deals specifically with a major problem encountered by many tropical dairy farmers: namely the poor performance of exotic, high grade (that is, high genetic merit) dairy cows when exported from their country of origin to a new, more stressful environment.

The first book addresses the management of the farm's natural and biological resources to produce quality milk – the climatic environment, soils, forages, concentrates and the livestock. The second book concentrates more on the human side of SHD farming, namely the farming family and their support structures, which include village communities, cooperatives, marketing and government agencies and other service providers and, importantly, the consumers. This third book incorporates a checklist to assess current farm management practices with an example framework for grading the suitability of individual farmers to receive high-quality dairy stock.

Over 75% of the world's poor people (i.e. 2.6 billion people) live in rural areas, with many of these dependent on farming for their livelihood. SHD farming is an enormous global industry, with 12–15% of the world's population (i.e. 900 million people) living on 150 million SHD farms. In the Indian subcontinent alone, there are 75 million SHD farms in India and 15 million SHD farms in Pakistan. Herd sizes on these farms are only 2.4 cows per farm, with each farm producing only 11 kg/day of milk. However, milk production supports a very large post-farm gate workforce, because every million kilograms of milk creates 200 jobs, compared with only five jobs in developed countries.

During the last three to four decades, governments throughout Asia have established SHD farming as part of their social welfare and rural development schemes, to provide a regular cash flow for poorly resourced and often landless farmers. Now these have become accepted rural industries. The need is for a more business-minded approach to management decisions on each farm. Dairy farmers across the world, even the small holder mixed farmer with only one or two cows, milk cows to make money. As the dairy value chain becomes more liberalised, and farmers become more exposed to the pressures of global markets, their daily farming decisions must become more based on changes to their farm profitability. This and the previous manuals describe the technical principles, practical processes and business decisions required to optimise their farming operations both in terms of profit and long-term sustainability.

1.1 Who are the tropical small holder dairy farmers?

Geographers categorise the humid (or rainy) tropics as areas with at most one or two dry months and no winter, with the coolest month above 18°C mean temperature. Other tropical zones are:

- **wet and dry tropics**, which have a well-developed dry season, with one or two rainy seasons
- **semiarid tropics**, with light rainfall and high evaporation
- **hot arid tropics**, with negligible rainfall and high evaporation.

My first book, *Tropical Dairy Farming* (Moran 2005) limited its scope to the humid tropics of South-East (SE) Asia. As with my second book, *Business Management for Tropical Dairy Farmers*, this book extends its scope to all the above zones within tropical Asia, although dairying is more likely to be restricted to just the humid and the wet and dry tropics. In addition, it covers both South and East Asia, not just SE Asia, as in *Tropical Dairy Farming*. Tropical Africa and Central America are not discussed in any great detail.

There are often arguments as to what constitutes small holder (as against large-scale) dairying. This manual uses the following descriptors of dairy farms:

- **Small holder:** up to 20 milking cows plus replacement heifers
- **Semi-commercial:** 20 to 50 milking cows plus replacement heifers
- **Commercial:** more than 50 milking cows plus replacement heifers.

SHD farmers are generally competitive and are likely to endure for many years to come, particularly where the opportunity costs of family labour and wages remain low. In addition, dairying is a viable enterprise even among the landless and socially marginalised groups.

Policymakers should resist the all too common assumption that development efforts should move from small holders towards supporting larger scale, 'more efficient' milk producers to meet growing consumer demand. Instead, that growing demand should be used as a stimulus to help continue and sustain SHD enterprises, particularly when they face increasing barriers to participate in value chain markets.

1.2 Dairy development and farm technology

Dairy development is generally associated with technical changes to improve milk yield per cow. However, it should be noted that:

- The use of exotic cattle is a rapid and potentially sustainable path to higher productivity, even for small-scale resource-poor farmers and in warm, semi-arid or humid climates. However, there have been many repeated failures of such schemes for obvious, but often ignored, reasons.
- National and local breeding strategies need to address the realities of climate and disease risk to increase the likelihood of successful crossbreeding programs.
- Fodder technology should be an integral part of any dairy development program, particularly if it incorporates importation of high genetic merit stock.

After several decades of dairy development in many Asian countries, average milk yields per cow per day still range between 8 and 10 kg, compared with average yields of 20–30 kg in developed countries. In addition, calving intervals of dairy cows on Asian SHD farms is commonly as long as 16–20 months, when it could be reduced to 14–15 months. This clearly shows their low levels of farm productivity. Some technical solutions are available but they must be carefully selected so they will be suitable for small farmers and their socio-economic conditions. This means that scientists and extension worker must be able to understand factors influencing the acceptance of technology by SHD farmers.

Granted, the genetic potential of local cattle to produce milk can become a constraint as the quality and quantity of farm inputs increase, but the introduction of new improved breeds must be accompanied by other investments in feeding, health, hygiene and housing, lest the system fail.

Scientific knowledge alone cannot solve small-scale farm problems. As well as technological innovations to improve farm performance, there is considerable knowledge on dairy herd management that is not being readily adopted by small holder farmers. In

all too many cases, the flow of such information does not reach the individual farmer even though it has been shown to be applicable to many farming situations. This then is the rationale behind this manual in that it presents current farm practices that are already being routinely used by many successful small holder farmers throughout the tropical dairy industries.

1.3 Importing high genetic merit stock onto small holder dairy farms

Most countries with SHD industries have development programs involving increasing cow numbers and genetic quality through importing dairy stock, usually Friesians. This is because their rate of natural multiplication of their national dairy herds is too slow to supply the stock to satisfy the increasing demand of milk and other dairy products.

The major oversight by both the importers – whether private investors or government organisations – and the farmers for whom these stock are destined, is not 'preparing the environment' for the imported stock. The greatest shortfalls are:

- lack of knowledge of the quality of local feedstuffs, particularly forages
- lack of understanding of the cows' nutrient requirements for acceptable performance, to reduce stress
- low skill levels of local labour to handle the high level of technology in genetics of imported stock
- poor sanitation practices for manure disposal, fly control and drying of all floor surfaces
- lack of sufficient quarantine to minimise spread of disease while heifers are still susceptible
- lack of knowledge and management skills to address problems during parturition
- difficulty in supplying an optimum diet during early lactation to ensure limited live weight loss, hence short lactation anoestrus
- minimising environmental stress during early lactation so newly calved heifers will cycle normally after 2 months.

Other factors to consider include:

- selecting the most appropriate heifers prior to transport
- providing good calf and heifer rearing management so that calves from imported heifers are well grown and have the opportunity to express their true genetic merit when milking.

1.3.1 Genetic merit of imported stock

The decision on the most appropriate type of stock to import should be seriously considered. Selection of high genetic merit heifers or cows to import will force farmers to improve their feeding management to provide sufficient energy to allow these animals to better express their superior genetic merit. This is very important in early lactation, when such stock are expected to cycle as well as produce high levels of milk.

Cows can produce the same milk yield in early lactation with whole body energy balances ranging from +4 to –25 MJ/day (see Chapter 5). This is the energetic equivalent of 0.8 kg milk to build body reserves or to lose the energy derived from losing 0.8 kg/day of body weight. Clearly cows that are genetically 'programmed' to lose excess weight in early lactation are less desirable in small holder systems where feed shortages are all too common.

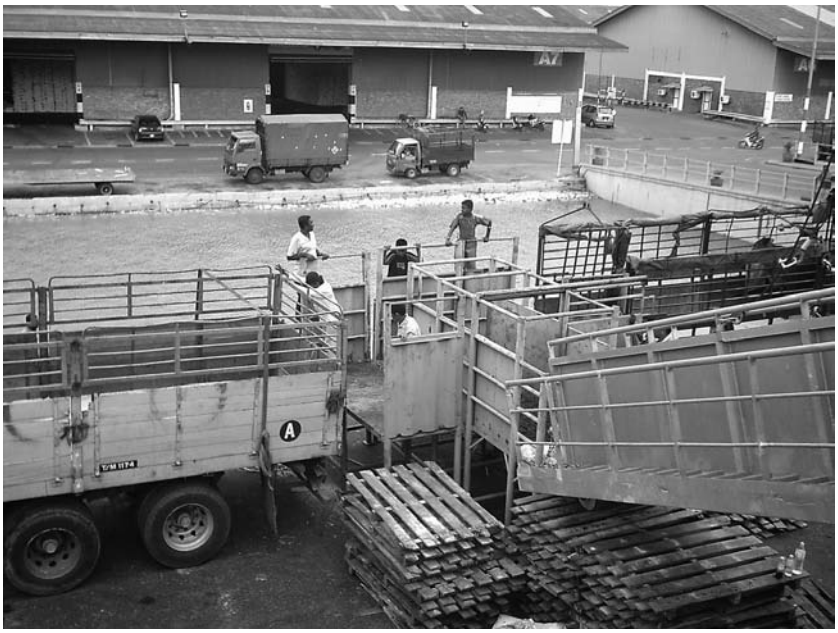
Perhaps it would be wiser to import stock of lower genetic merit, and then feed them to produce less milk, but at least improve their chances of getting back in calf within 100 days post-partum. The best farmers in Australia can achieve 58% 100-day-in-calf rates (Morton *et al.* 2003), compared with only 40% in a well-managed farm in Vietnam (Moran and Tranter 2004).

It is not uncommon for Asian importers of Friesian heifers from Australia to request '5000 litre heifers'; that is, heifers likely to produce 5000 L during their first lactation on their home farm. It is highly likely that, once in their new farm in Asia, such animals would only be capable of producing 2000 or 3000 L during their first (and even later) lactation given the existing feeding management. If such animals, managed to produce 25 L/day in peak lactation (as a starting point to achieve their 5000 L first lactation yield), their daily energy deficit would be highly likely to impair their fertility.

1.3.2 Importing young heifers

The high cost of importing pregnant heifers makes alternative methods of increasing cow numbers feasible. For example, consideration could be given to purchasing heifer calves, and growing them out for say 6–12 months in their home country prior to their importation. Granted, this will only supply one animal, compared with the heifer plus embryo when importing pregnant heifers, and delay initiating income, but this will allow an additional 12 months for adaptation to the new environment before calving.

Boat carrying Australian dairy heifers coming into the Kuala Lumpur offloading port (Malaysia).



Preparing for the unloading of stock (Malaysia).

Such adaptation includes adjustment to the climate, feeds and management regime, and developing resistance to local disease organisms. Over the short term, importing pregnant heifers may give higher returns, but in the long term, importing younger heifers can be more economic (McDowell 1994).

This discussion does not even consider the greater susceptibility of high genetic merit cows to their physical environment. High milk yields, through increased feed intake, generate more internal heat, thus requiring a less stressful environment to dissipate such heat. Therefore, unless such cows are allowed to regain their normal heat balance, their appetite will fall, so they will eat less. The only way they can produce milk close to their desired level is by partitioning body reserves towards milk synthesis, thereby increasing energy deficits through greater live weight losses.

It is then likely that these animals will be unable to produce their target milk yields and will not easily get back in calf. Such animals are generally more susceptible to other constraints of the tropical environmental, such as parasites and disease. This further increases their likelihood of being culled as non-productive animals. Even if their high purchase cost and their 'status' as exotic cows reduces pressures to cull them, they will become poorer investments compared with locally adapted, and less potentially productive stock.

1.3.3 The renewed relevance of embryo transfer technology

The practice of multiple ovulation and embryo transfer (MOET) is only slowly being accepted in Western dairy industries as another method to more rapidly improve genetic merit, albeit mainly in the pedigree dairy industry. The general consensus is that MOET

is not yet a sound economic approach for widespread use in dairy operations whose entire or main business is selling milk. This was first mentioned by McDowell in 1994 and is equally valid in 2012.

However, for large-scale multiplication of national herds – where genetic progress is less of an issue and where, in their new country as lactating cows, imported heifers cost two to three times more than their original purchase cost – MOET may have an economic role. Countries such as China are currently assessing its relevance to national industry development.

1.4 Outline of the manual

This book is written primarily for the stakeholders of SHD production in the tropics. Small holders are the major suppliers of milk in the tropics. However, numerous larger farms with many hundreds of milking cows, using intensive feedlot or less intensive grazing systems, have been established throughout South and East Asia in recent years to satisfy the increasing demand for fresh milk. These farmers and their advisers will also gain much from this manual. In addition, the book provides relevant key information to research scientists on aspects of tropical dairy production and business management, such as forage production, and herd and feeding management. Policymakers and senior managerial personnel would 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 the dairy industry. Consequently, educators from agricultural schools, universities and technical colleges need to be kept abreast of the latest technical developments and applications in dairy farming.

Chapter 2 covers the pre-departure planning and management of stock on arrival at their new destination. Chapter 3 reviews the soil and forage management on the new farm to ensure adequate year-round supplies of quality forage: the essence of any profitable tropical dairy farming operation. This includes a section on silage to make the best use of any excess forage production. Chapter 4 discusses the management of young stock, covering both the pre-calving period of imported heifers and the early milk feeding period of their progeny. Scours, a major calf rearing problem on many small holder farms, is discussed in detail.

Chapters 5 and 6 discuss improved nutrition and feeding management on tropical SHD farms, firstly highlighting the key principles of dairy nutrition (Chapter 5) then some of the more successful practices (Chapter 6). Chapter 6 also provides insights into feeding problems and unbalanced diets, such as lactic acidosis.

Disease prevention and control are covered in Chapter 7, with particular emphasis on two common problems on SHD farms, namely lameness and mastitis. Chapter 8 deals with improved reproductive management, an all too common problem with high-yielding dairy cows. Chapter 9 discusses some of the farm decisions regarding genetic improvement of the dairy herd, while Chapter 10 addresses the management of any stock surplus to the milking herd. Chapter 11 highlights an ongoing issue with exporting countries, namely the welfare of confined animals under traditional farm management.

The principles and practices of overcoming heat stress are discussed in Chapter 12 and more specifically in Chapter 13, with recommended housing systems for tropical SHD farms. Milk harvesting and milking hygiene are reviewed in Chapter 14, while Chapter 15 describes an Indonesian case study of value adding to milk.

The business management of SHD farming is reviewed in Chapter 16, while Chapter 17 describes the planning and implementation of farmer workshops on improved herd management. Chapter 18 incorporates a checklist to assess current farm management practices with an example framework for grading the suitability of individual farmers to receive high-quality dairy stock. Chapter 19 is a series of photographs depicting tips and traps in managing high grade dairy stock around Asia.

Full publication details of all sources of information are presented in 'References and further reading'.

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 farm management economists and consultants. These are explained in the Glossary and when they are first used in this book.

Appendices are included to facilitate sourcing specific information and learning the skills of ration formulation. Appendix 1 presents the Temperature Humidity Index: the universal method of quantifying heat stress in dairy stock. Appendix 2 provides conversion factors to the standard metric system from a wide variety of systems used for describing weights and measures. Appendix 3 presents typical expectation and evaluation forms developed for farmer workshops on improved herd management.

In the process of developing a series of workshops on dairy production technology for Indonesian small holder farmers, I prepared a summary on tips for proper managing of dairy cows on Indonesian small holder farmers. Appendix 4 presents this four-page booklet, which highlights the key features of good feeding, herd and milking management on profitable farms throughout Asia.

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

1.5 The role of the manual in training programs

This manual is multipurpose in that it forms the basis of structured training programs in small holder dairying for advisers and educators (for farmer training organisations, agricultural high schools and universities), while also providing background information to researchers and policymakers in tropical dairy industries. Unlike my previous manuals, a series of training programs were developed alongside this book and are being used for adviser and farmer workshops in the SHD industries that import Australian dairy stock (MLA 2009). This manual has been written as a reference text for these training programs.

These chapters are written to be understood by advisers and tertiary students. Because 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. Because each chapter has been written as a 'stand alone' document

that can be individually downloaded from the Internet, there is some repetition, but this has been kept to a minimum.

1.6 The key task areas in any dairy production system

Dairy production technology can be broken down into nine key task areas (see Figure 1.1), which can be considered as steps in the supply chain of profitable dairy farming, whether a SHD or large holder. 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 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' in Figure 1.1 and the relevant chapters in this manual are as follows:

1. Chapter 3. Soils and forage management, to optimise forage agronomy and fodder conservation.
2. Chapter 4. Young stock management, to generate productive milking cows.
3. Chapter 6. Feeding management, to optimise cow performance through adequate supplies of feed nutrients.
4. Chapter 7. Disease prevention and control, to overcome the limits imposed by microbial and invertebrate pests.
5. Chapter 8. Reproductive management, to ensure herds can replace themselves in future generations.
6. Chapter 9. Genetics, to maintain an acceptable rate of genetic improvement for each generation.
7. Chapter 12. Environmental management, to limit the constraints of climate on cow and heifer performance.
8. Chapter 14. Milk harvesting and hygiene, to maximise milk quality pre- and post-farm gate.
9. Chapter 15. Adding value to milk, to improve unit returns for raw milk.

This approach then systematically addresses the key aspects of herd and feed management that require attention when including high genetic merit stock in the milking herd. Additional chapters are included in this manual to aid understanding of some of the technical aspects of these basic components. These are:

- Chapter 2. Planning the consignment and management of the imported stock immediately on arrival.
- Chapter 6. Principles of dairy nutrition, as background information on feeding management of the milking herd.
- Chapters 10 and 11. Managing stock surplus to the milking herd and stock welfare, to complement other chapters on herd management.
- Chapter 13. Housing systems, to provide more specific details on environmental management.
- Chapter 16. Business management of small holder dairy farms, to assist with implementing farm practices to optimise farm profits and long-term sustainability.

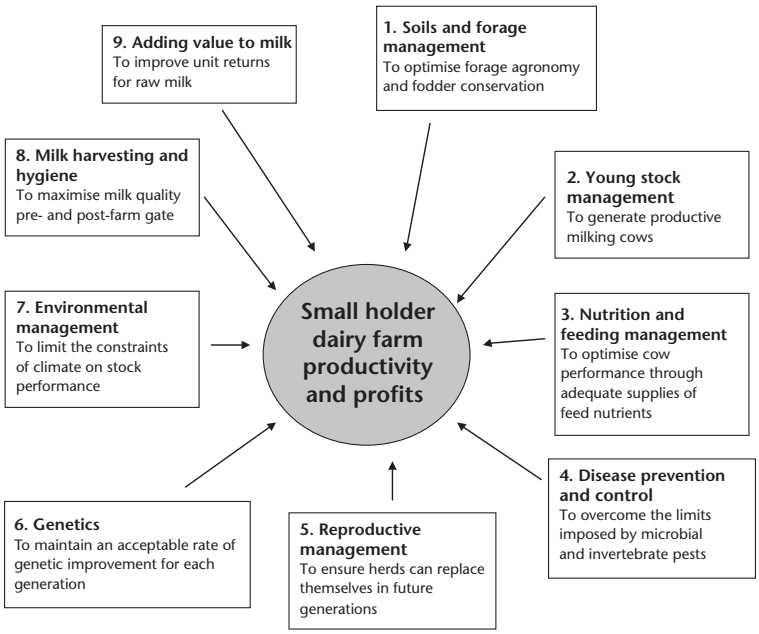


Figure 1.1. The nine links in the supply chain for a profitable dairy enterprise

- Chapter 17. Conducting farmer workshops on improved herd management, so farmers can plan and implement relevant strategies.
- Chapter 18. Assessing current farm practices, to highlight, and hence tackle, examples of poor herd and farm management.
- Chapter 19. Tips and traps in managing high-quality dairy stock: a series of photographs depicting examples of poor and good herd management.
- Appendix 4. A four-page brochure on 'Tips for proper handling of dairy cows on Indonesian smallholder farms'. This brochure highlights the key features of good feeding, herd and milking management on profitable farms throughout Asia.

To understand more fully the key factors influencing these basic steps of dairy production technology, they have been highlighted in diagrams at the beginning of each chapter. This will provide extension workers and other dairy specialists with a checklist when using this manual to develop farmer training workshops.

As previously mentioned, this is the third manual specifically written on tropical SHD farming. There is some inevitable overlap in topics covered within these three books, so some repetition is inevitable because not all readers of this third manual will be familiar with the technical aspects covered in the first two manuals. This is particularly the case with nutrition of the milking herd, because it is important to quantify the intakes of feed nutrients to better understand any production responses to improved feeding management. Before nutrients can be quantified, they must first be defined in terms of energy, protein and fibre intake.