

Review on Commercial Dairy Production in the Tropics

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Abstract: Commercial dairy production is a more specialized farming practiced in state sector and very few individuals on commercial basis. Because of an increasing demand for milk and milk products and other livestock productions, tropical farming systems with livestock are in a great need to increase their productivity. Animal products are critical to the nutrition, food security, livelihoods and resilience of hundreds of millions of people throughout the world. Thus, dairy production is a key element of agriculture in the tropics and the subtropics. However, these vast regions of the globe are seldom associated with commercial dairy production that is more common and developed in temperate regions. Different factors influence this reality although most of them are inherent to specific local conditions: heat stress, the low nutritional value of tropical and subtropical fodders, diseases and parasites. In general, most tropical countries have large number of livestock but its production and productivity remains low. Therefore, it is better to mitigate feed shortage through expanding animal feed processing plant, in addition to this use AI service to increase milk production by improving genetic potential of local dairy cattle, to save indigenous gene pool, use modern production system with improved technology in urban area and in rural area improve traditional system through feed supplementation and better health care and make market channel to be increase marketing of dairy cattle and its products.

Key words: Dairy • Production • Tropics

INTRODUCTION

In recent decades, there has been enormous growth in livestock production, driven by increasing demand for animal-source foods among large segments of the world's population. The driving forces behind this growth have principally been population growth and changes in dietary preferences associated mostly with increasing wealth and urbanization. Growing demand for animal-source foods has important implications for agricultural production systems and for producers in poor rural areas, who need to adapt continuously to the changing environmental, social, economic, market and trade circumstances [1].

Livestock production in the tropics dominates the global scene when it comes to the number of animals, total output and number of beneficiaries when compared with livestock production in the western world [2]. In recent times tropical livestock

production has become more prominent in scientific and societal discourses for a number of reasons. Among the other the most is the presence of increasing demand for animal products in the developing countries of tropics. One of which is increasing demand for milk and milk products. Thus, dairy production is a key element of agriculture in the tropics and the subtropics. Very different systems from small-scale subsistence farming to high-tech dairy farms, like commercial dairying, exist in these areas. Nevertheless, these vast regions of the globe are seldom associated with commercial dairy production, more common and developed in temperate regions. The key elements that determine the dairy species kept are feed, water and climate. Other factors that may influence the presence of a dairy species are market demand, dietary traditions and the socio-economic characteristics of individual households (e.g., poorer families tend to rely more on small ruminants) [3].

The dairy industries in many tropical countries do not produce enough milk for the countries to be self-sufficient of raw milk. Constraints to farm production include adverse weather conditions (high ambient temperatures and humidity), the many livestock diseases and the farmers' poor understanding of the high management requirements of dairy stock. The milk yield of tropical dairy farms can be increased by improving feeding and other management practices. Given the projections for human population growth, particularly in tropical regions, it is necessary that, in the near future, the availability of high-quality animal protein products, namely milk and dairy, increases. Indeed, this problem is one of the most pressing challenges for humankind. Tropical dairy production is a biologically efficient system that converts large quantities of the most abundant feed in the tropics (forages) into the most nutritious of all human foods (milk). Forages are produced as a by-product of crop production or as a specific crop in itself. In return, cattle can improve soil fertility through recycling of nutrients (nitrogen, phosphorus, potassium) and organic matter [4, 5].

In developing countries, milk producing animals are often raised in subsistence and smallholder systems. These animals are usually multi-purpose and grow and produce under difficult conditions, such as low inputs, minimum management and harsh environments. They are well adapted to local conditions, but have low genetic potential for milk production [6].

Overall milk production is almost entirely derived from cattle, buffaloes, goats, sheep and camels, which also hold true for tropics. The presence and importance of each species varies significantly among regions and countries. Intensification is characterized by increasing farm sizes, upgrading of local cattle and buffalo using more suitable dairy breeds and an increasing reliance on purchased fodders and concentrates. Intensification can pave way for organizing market-oriented dairy (Commercial) production system. Big issues are only possible to meet the considerably increasing demand for milk in developing tropical countries by commercialization of dairying. This has pushed the force to overview the status and cognize the status dairy production system in tropics, in order to conclude and recommend what is and what will be the fate of commercial dairy production tropics [7].

Therefore, the objectives this review were to have some understandings of commercial dairy production system in the tropics and to search and know the status of dairy production in the tropics from literatures.

Concept of Commercial Dairy Production: Milk and dairy products are one of the most important sources of animal protein for human diets worldwide. Indeed, milk is produced and consumed fresh or processed in almost every country in the world. Raw milk may be transformed into a vast array of products. Commercial or urban dairy production is a more specialized farming practiced in state sector and very few individuals on commercial basis. Dairy production is a key element of agriculture in the tropics and the subtropics. However, these vast regions of the globe are seldom associated with commercial dairy production that is more common and developed in temperate regions. Different factors influence this reality; although, most of them are inherent to specific local conditions: heat stress, the low nutritional value of tropical and subtropical fodders, diseases and parasites. Economic and political factors like imported cheap powdered milk and dairy products from Western countries influenced the commercialization dairy production in these regions [3].

Features of Tropical Dairy Systems: Milk is a cash crop for small holders, converting low value forages and crop residues and using family labor, into a valued market commodity. The dairy industry occupies a unique position among other sectors of agriculture as milk is produced every day, giving a regular income to farmers. Furthermore, milk production is highly labor intensive, providing a lot of employment. Schelhaas listed four special features of tropical dairying [8]. These included the bulky of the fresh milk and its high perishable required high-cost transportation which limited how far it can be profitably sold from its point of production; the vast majority of producers were small scale, with a weak and vulnerable position in the market place. Consequently, in many countries, for its initial establishment, the dairy industry has required considerable market protection; cooperatives play an important part in the dairy industry in developing countries where they are mainly responsible for processing and marketing dairy products; and milk is invaluable as a source of high quality nutrients. Consequently, the processing industry is far more important in dairying than in other sectors of agriculture and such operations must satisfy high technical and quality standards.

Dairy Cattle Production in the Tropics: a Preeminent Role for Physiology: The strategies used in dairy production in the last century, which was based on increased milk productions, have been changing over the years and nowadays they focus not only on productivity

and but also on efficient and sustainable milk production. Therefore, the old-fashion question of “how much milk is produced” has been replaced currently by “how milk is produced”. This new advancement involves aspects such as the use of more sustainable feed resources, animal health and welfare, milk quality and the impact of animal production activities on the environment. In the next 50 years, dairy producers in the tropics will need to deal with the above-mentioned aspects in a world where the population will continuously grow, arable land will decrease and climate conditions will be more adverse for both crops and dairy cows [9].

Therefore, the selection and use of dairy breeds adaptable to specific tropical regions and improvements in quality and digestibility of diverse crops tolerant to droughts and high temperatures will be essential in the coming years for dairy production in the tropics. Selection for environmental-related traits will contribute for instance to select cows based on methane emissions, tolerance for heat stress and/or adaptability to the seasonal scarcity of pasture. On the other face, selection for health-related traits will contribute to breeding cows more tolerant of metabolic diseases and with an improved immune condition. These traits will be of special interest during the transition period when dairy cows were more susceptible to milk fever and mastitis [10, 11].

Objectives Commercial Dairying: Dairying, branch of agriculture that encompasses the breeding, raising and utilization of dairy animals, primarily cows, for the production of milk and the various dairy products processed from it. Thus, objective of good dairy farming practice is the on-farm production of safe, quality milk from healthy animals under generally acceptable conditions, in order to suffice the increased demand for milk and milk products in tropical regions. To fulfill the goals of improving the potential adaptive genetic merit of animals, raising the quantity of feed available to livestock and improving health, breeding and husbandry services; as well as organizing farmers into milk producing, processing and marketing co-operatives are required [12].

Breeding Practice: Milk producers can improve productivity and returns from dairying through selective breeding and control of reproduction. Reproductive efficiency (e.g., calving intervals, conception rates) can be improved by using genotypes that are suitable to the production environment and appropriate husbandry practices. Reproductive performance of dairy animals is affected by such factors as the environment, animal nutrition, producers’ socio-economic conditions, dairy

animals’ adaptability and genetic characteristics and type of production system (intensive or extensive). Small-scale dairy producers have no scientific knowledge of genetics and breeding, but they have valuable traditional knowledge regarding breeds and their management. They have breeding objectives and strategies even though these are not formalized or written down. For instance, producers may share sires with their neighbors or the entire community. Many indigenous groups or communities have developed their own local breeds [13].

Artificial insemination (AI) is used mainly for cattle and to a lesser but growing extent for other dairy animals such as sheep and goats. In developing countries, AI is routinely used by large-scale dairies, which often produce breeding males that are sold to smaller producers for natural mating. The use of AI by small-scale livestock keepers was less common and was largely restricted to peri-urban dairy producers [14].

Feeding Practice: Under the conditions that prevail in developing countries, poor-quality feed (of low digestibility and low nutritive value or unavailability of high-quality fodders and feedstuffs) was one of the major factors limiting dairy production. Dairy animals were often fed on fibrous feeds mainly crop residues and low-quality pasture which are deficient in nitrogen, minerals and vitamins [15].

Camels, small ruminants, water buffaloes, yaks and equines are more able to use low-quality forage compared to cattle. Small-scale milk producers in developing countries generally use locally available feed resources, such as natural pastures, crop residues, cut-and-carry grass, forage crops and local feedstuffs (including agro-industrial by-products). Communal grazing of livestock is a common practice throughout developing countries of tropics. Grazing fields often lack conservation practices and are of poor nutritional quality. Grazing without supplementary feeding is widely practiced in Latin America and some regions of Africa. In much of Asia and the Near East, dairy animals were largely fed on straw from cereal crops, with and without supplementation with oilseed cakes and other by-products such as brans [16].

The use of supplements (energy- and/or protein-rich feeds) is particularly important for dairy animals, as milk production is a high energy consuming process. Small-scale dairy producers cannot generally feed conventional supplements such as grain-based concentrates, oilseed cake and minerals, because of their high cost and scarce availability. Small-scale producers’ milk output therefore depended mainly on seasonal

fluctuations in the quality and quantity of natural forage. Conservation of forage as hay or silage permits the production and sale of milk during periods of feed shortage. Milk producers in Africa and Asia increased their use of forage from trees and shrubs (fresh, dry or processed) to overcome the high costs of dairy feeds and deal with seasonal fluctuations of other sources of fodder [17].

Major Diseases: Animal diseases lead to mortality and reduced productivity in dairy herds worldwide, causing substantial economic losses. Production diseases such as mastitis and external and internal parasites do not generally result in the death of the animal, but always reduce the efficiency of their systems. Animal health is crucial for the productivity of dairy animals. The spectrum of diseases is however often different in the tropics, for many reasons. While intensive dairy was evolving in many countries, dairy production was characterized by small-scale farms with low inputs and low outputs, which reduces the risk of many production-related diseases [18].

The low input systems were not only in terms of quantity but may also be in terms of quality. Feed contained different byproducts which may be low in nutrients, possibly resulting in nutrient deficiencies in the dairy animals. Both feed and water were limited resources in many settings and in addition to these, they may be contaminated by both biological and chemical hazards, including mycotoxins, heavy metals, pathogens and antimicrobials, either intentionally added or in the form of residues and these contaminants contributed to diseases, in addition to the promotion of antimicrobial resistance [19].

Dairy farms in the tropics are also often handicapped by a low level of bio-security, limited possibilities for isolations and frequently limited training and knowledge about disease prevention, which rendered them more vulnerable for infectious diseases. In addition, the tropical climate was often beneficial for the transmission of a number of infectious diseases that are not as easily spread in temperate climates, including a number of vector borne diseases such as East Coast fever and nagana (African animal trypanosomosis), due to the dependence of the vectors on climate and environment. Overall; mastitis, brucellosis, trypanosomosis, fasciolosis, lumpy skin disease (LSD), blackleg, bovine pasteurellosis, anthrax and foot and mouth disease (FMD) are common. In addition, external parasite (tick), leech parasite and mastitis as the main health concern for dairy production are some among diseases prevalent in tropical regions [20].

Marketing: In most of tropical countries, milk and milk products were marketed through informal and formal marketing systems. In the dominant informal marketing system, milk producers sold to consumers directly or to unlicensed traders or retailers. Price was usually set through negotiation between the producer (seller) and the buyer; this system was predominant in the rural dairy production system [21].

In the formal marketing system there were cooperatives and private collecting and processing plants that receive milk from producers and channel to consumers, caterers, supermarkets and retailers. Informal market involved direct delivery of fresh milk by producers to consumers in the immediate neighborhood and sale to itinerant traders or individuals in nearby towns. For instance, in Ethiopia, dairy products (fresh milk, butter, buttermilk and cottage types of cheese) were distributed through the informal and formal marketing systems. The informal market involved direct delivery of dairy products by producers to consumers in the immediate neighborhood and to itinerant traders or individuals in nearby towns [22]. Milk-marketing group can be defined as a group of smallholder farmers who individually produce at least one liter of saleable milk and were willing to form a group with the objective of collectively processing and marketing milk. In their review, indicated very useful involvement of the government of India [23] at every step of the development for expansion of dairy cooperatives in the country for the successes of dairying and suggested that the pattern of dairy development (India) can be emulated at least around the major milk sheds in Ethiopia [24].

Marketing and processing in tropical countries like Tanzania was characterized by a poor transportation system hindering the delivery of goods to markets. The low price and poor marketing of milk, including limited promotion of dairy-product consumption and a shortage of dairy technologists, hindered the development of the formal sector. The consequent thriving informal trade in raw milk was coupled poor milk quality control and enforcement mechanisms increased the risk of zoonotic disease outbreaks. The absence of quality-based pricing incentives was reflected in the limited supply of dairy products on the market, overwhelmed those with a short shelf life, rather than a consumer-driven demand market [16].

Major Constraints of Dairy Development System in Tropical Countries: The livestock sub-sector in general and the dairy sub-sector in particular did not make a contribution to the national income considering with it

size. The reasons for this were numerous and included both non-technical and technical constraints [25].

Non-technical Constraints: The non-technical constraints of dairy development generally included a variety of socio-economic and institutional considerations, which was most cases and were well common constraints to other agricultural sector in the country [26].

Technical Constraints: Animal health and improved management was also one of the major constraints of dairy development in tropics which caused poor performance across the productive system. Many of the problems resulted from the interaction among the technical and non-technical constraints themselves e.g. poorly fed animals developed low disease resistance, fertility problem, partly because the animal health care system relied heavily on veterinary measures, poor grazing management systems continue to cause high mortality and morbidity (e.g. internal parasites), many of the disease constraints which affect supply were also a consequence of the non-technical constraints e.g. insufficient money to purchase drugs or vaccines [27].

Feed and Nutrition: The supply of animal feed, including concentrate feed and roughage was erratic, both in terms of quality and quantity. In highland zones, high population growth and density were causing the shortage of grazing land on which livestock production by small holders depends. In the lowland areas, the shortage of feed and water during the dry season forces animals and livestock keepers to trek long distances in search of food. The quality of feed also deteriorated during the dry season in both the mixed farming and pastoral system [28].

Genetics: The genetic of most tropical countries' livestock had involved largely as a result of natural selection influenced by environmental factors. This had made the stock better conditioned to with stand feed and water shortages, disease challenges and harsh climates. In spite of this, it was characterized by the low genetic potential of indigenous animals and the limited availability of quality efficient artificial insemination services [16].

Milking Hygiene: Most small-scale dairy producers in developing countries milked their animals by hand, often in the presence of the calf to stimulate milk release. Where sufficient labor was available, hand-milking allows milk extraction with minimal capital investment, equipment

dairy farms; where improved dairy breeds were used, it is more common and convenient to maintenance and cleaning. In many societies, milking was traditionally done by women, but women were prohibited from milking in some pastoral and mixed farming communities. With modernization, these milking customs were being lost. On medium to large milk animals with milking machines, irrespective of the milking method (hand or machine), it was crucial to avoid contamination of the milk during and after milking. Good dairy farming practices for milking hygiene were ensuring that milking routines do not injure the animals or introduce contaminants into the milk; that milking is carried out under hygienic conditions; and that milk is handled properly after milking [29].

Animal Welfare: Animal welfare was the application of sensible and sensitive animal husbandry practices to the dairy animals on a farm. These practices must be applied to not only milk producing animals, but also young stock, replacements and males in rearing units. Animal welfare was primarily concerned with the well-being of the animals. Dairy farming practices should aim to keep animals free from hunger, thirst and malnutrition; from discomfort; from pain, injury and disease; from fear; and to engage in relatively normal patterns of animal behavior [5].

Environmental Stress: Concomitant to the improvement in the quality of livestock through the crossbreeding, there had been an increase in the susceptibility of these animals to various diseases, including exotic ones. Simultaneously, a number of disease control programs had been initiated with an aim of reducing the morbidity and mortality [30].

Socio-economic Management: Social responsibility and economic sustainability were integral to good dairy farming practice, as they address two key risks to the farming enterprise. Human resource and financial management ensure the sustainability of the enterprise. Good dairy farming practices for the socio-economic management of dairy farms implemented effective and responsible management of human resources; ensuring that farm tasks were carried out safely and competently; and managing the enterprise to ensure its financial viability [25].

CONCLUSION AND RECOMMENDATION

In the face of the rapid growth of the human population in tropical, especially that in urban areas,

internal market conditions is becoming more favorable for the intensification of livestock systems. Recent changes in public policy mean that, in many countries, producers were faced with better market opportunities and were supported by more effective institutions. Prospects for technology adoption leading to increased livestock productivity and profitability are therefore improving rapidly. At the same time, developments in computer-based systems greatly facilitate the accessing and synthesis of the enormous bank of information on technologies available for testing in these responsive farming systems. It is expected that most transfer of available technologies and the demand for new technologies will be from the mixed (crop-livestock) farming systems and often in response to the demand for increased production stimulated by an urban market. A systematic approach is required for the identification and resolution of the major technical constraints to meet these demands for technology. Such a systematic approach can lead to technological interventions with major impact on agricultural productivity and farmer confidence.

To be successful in commercial dairying, demand for considerable institutional collaboration, cutting across ministries, departments and disciplines, including social, crop, animal and veterinary sciences are very important. A prerequisite is the close and continuous interaction between our clients, the farmers and us, the technicians.

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