# Smallholder Dairy Herd Management in Kenya

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## Introduction

Kenya has one of the most successful dairy industries in sub-Saharan Africa based on some 3 million cattle of mostly high grade *Bos taurus* dairy breeds and a relatively advanced milk marketing infrastructure. The main breeds for dairy production are Friesian, Guernsey, Ayrshire and their crosses with the local East African Zebu (EAZ). The EAZ population is estimated at about 10 million, and produces relatively small amounts of milk per cow, little of which is marketed. Kenya's dairy cattle population make up at least 70% of the total in eastern and southern Africa, a major factor contributing to the per capita milk availability of about 106 kg in Kenya (Table 1) compared to only 20-40 kg milk per capita in most neighbouring countries.

**Table 1. Cattle population and annual milk production and availability per capita in Kenya**

| Indigenous cattle | | Dairy cattle | | Human population | Milk per Capita |
|---|---|---|---|---|---|
| Population ('000) | Milk prod ('000 MT) | Population ('000) | Milk prod ('000 MT) | ('000) | |
| 9,831 | 574 | 3,045 | 2,501 | 29,000 | 106 |

Source: MoA Annual Reports and Peeler and Omore (1997).

In contrast to current trends of increasingly large and specialized dairy production units in most industrialized countries, about 80% or 2.5 million of the dairy cattle in Kenya are on mixed crop-livestock smallholdings typically with 1-4 cattle on approx. 1 to 2 ha. of land. Most dairy production occurs in fertile highland areas supporting large human populations close to major urban centres where demand for milk is high. About 60% of total milk is produced from less than 10% of the country's landmass in the central districts where 80% of exotic and crossbred dairy cattle are found. Over two-thirds of households keep dairy cattle in most of these areas (Staal et al., 1998). Most consumers prefer and buy raw unprocessed milk. This preference has become increasingly apparent in urban areas where processed milk sales were dominant until market liberalisation in the early 1990's.

Besides dairying, smallholder farmers keep other livestock (mostly chickens, sheep and goats), grow crops for sale (e.g., coffee, tea) and subsistence (e.g., maize, vegetables). Horticultural crops grown for sale are becoming increasingly important. The interactions and complementarities between crop and livestock enterprises improve farm efficiency through nutrient cycling. In a few instances, the value of manure is seen by farmers to be the same as, or supersedes, the value of milk especially where milk markets are not reliable. Most smallholders do not maintain farm records. Labour resources consist of available family labour, hired casual and/or permanent labour. Dairying is often cited as the most important source of income and cash flow.

**Milk production and feeding management**

Lactating cows generally are milked twice a day by hand. Milk production is low, averaging only 5-8kg/day, the low production mainly the result of under-nutrition (Omore et al., 1996; Staal et al., 1998). The effects of under-nutrition are reflected in lactation curves that follow a logarithmic (Figure 1) rather than the classical gamma function curve that characterises milk production in temperate countries, and farmers therefore do not realise the full milk production potential in early lactation (Tanner et al., 1998).

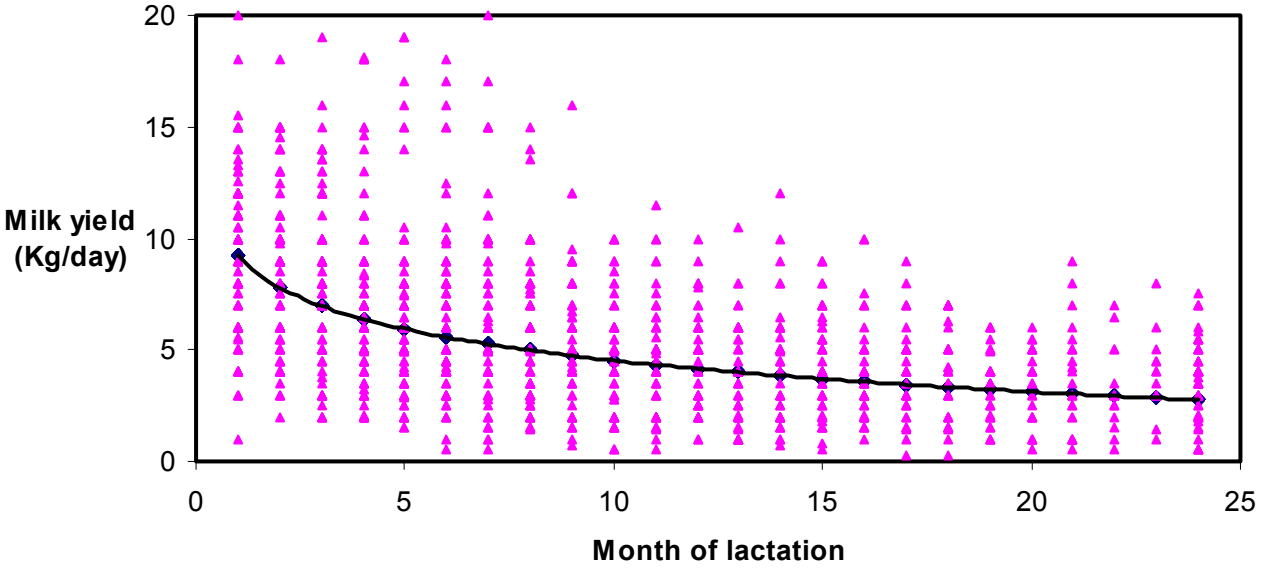


**Figure 1. A logarithmic function lactation curve on smallholder dairy farms in central Kenya: Milk yield=9.20-2.03ln(month of lactation)**

Source: Omore (1997).

The poor nutrition is mainly due to seasonality in the quantity and quality of available feed resources. Increasing land sub-division aggravates this shortage. Strategies employed to alleviate the limited feed supply include the feeding of crop by-products, fodder cultivation on roadsides and reliance on fodder markets. The practice of feeding crop by-products also serves to increase efficiency between the livestock and crop enterprises through nutrient cycling, an important factor given the deficiency of important soil nutrients resulting from the intensive cropping based on few purchased inputs. For example, manure that is rich in organic and inorganic nutrients is applied to crops, whose residues are fed back to cattle to supplement the planted forage and that collected from common properties. This practice cycles important soil nutrients particularly nitrogen and phosphorus, that could otherwise only be replenished through the purchase of more expensive inorganic fertilizer.

**Table 2. Distribution of some farm management practices recorded on smallholder dairy farms in central Kenya.**

| Variable | % |
|---|---|
| Stall feeding (zero grazing) | 67 |
| Use of artificial insemination | 52 |
| Use of tick acaricide | 71 |
| Cattle vaccinations | 63 |
| Use of anthelmintics | 89 |
| Use of private veterinary service | 41 |
| Fodder mainly sourced from own farm | 56 |

Source: Staal et al. (1998).

A high proportion of smallholders stall-feed (commonly referred to as zero-grazing) their cattle (Table 2). The frequency of stall-feeding increases with decreasing land sizes, especially in areas close to major urban centres. The most commonly fed fodder is Napier grass (*Pennisetum purpureum*). Planted legumes are fed occasionally. Farmers also feed purchased grain concentrates such as dairy meal and milling by-products such as brans and wheat pollard. The amount of grain concentrates that is often fed, however, does not usually result in increased milk yield because only limited quantities (about 2kg/day throughout lactation) are fed, and these contribute to meeting maintenance requirements due to the inadequate dry matter intake and low digestibility of forage.

**Reproductive management**

Calving intervals averaging 600 days are common (Odima et al., 1994; Staal et al., 1998) (Table 3). The prolonged calving intervals are due not to disease but due to the fact that many farmers only consider breeding cows after they have been milked for at least 200 days (Odima *et al.*, 1994). The lactation length (estimated by doubling the median months of lactation) was 16 months. The decision by farmers to voluntarily lengthen calving intervals and the low milk yields seem to be linked and need to be resolved together (Tanner et al., 1998)

Smallholders use artificial insemination (AI) services or rely on communal bulls where private or public AI services cannot be accessed easily. Very few farmers raise bulls for breeding on their own farms because they would rather use their limited fodder supplies for cows and female replacements. A shortage of own-produced replacements due to low calf survival and heifer and cow mortalities implies that many farmers obtain replacements from large-scale farms.

**Table 3. Indices for continuous health and production variables of animals on smallholder dairy farms in central Kenya**

| Variable | Number of observations | Range | Median | Mean | s.e. |
|---|---|---|---|---|---|
| Milk yield (kg/day) | 1734 | 0.3 - 25 | 5 | 5.8 | 0.08 |
| Months of lactation | 1670 | 1 - 39 | 8 | 9.9 | 0.17 |
| Age at 1st calving (yrs) | 28 | 2.2 - 5.0 | 3.4 | 3.4 | 0.15 |
| Calving interval (days) | 176 | 308 -1256 | 620 | 633 | - |
| Calf growth rate (kg/day) | | | | | |
| males | 181 | -0.4 - 0.9 | 0.20 | 0.22 | 0.01 |
| Females | 180 | -0.2 - 0.8 | 0.28 | 0.26 | 0.01 |
| Quarter level somatic cell counts ($x10^3$) cells/ml | 6092 | 10 - 19920 | 620 | - | 78 |

Sources: Odima et al., (1994); Omore et al., (1996a)

**Health constraints**

Infectious and vector-borne diseases can be locally important but often their incidence decreases with increasing subdivision of farms and stall-feeding. Tick-borne diseases (TBDs) are a major cause of morbidity and mortality in extensive farming systems, warmer climates and lower altitudes (e.g., Maloo et al., 1994), but are of low importance in cooler areas of higher terrain elevation, especially if animals are stall-fed (Deem et al., 1994; Omore et al., 1996a). TBDs are controlled through hand spraying of acaricides of mostly organophosphate origin.

Because production is generally low, diseases of intensification, such as mastitis or lameness have not become a serious constraint to milk production. In a recent investigation (Omore et al., 1996b), the incidence of clinical mastitis was found to be 13.3 per 100 cow-years at risk (Table 4). However, somatic cell counts were high and highly (Table 3). The prevalence of bacteria pathogens is high, with *Staphylococcus aureus* the most-common (22.1% of all samples) but the infectious agents only modestly associated with increases (highest increase of 5% for *S. aureus*) in the natural logarithm of somatic cell counts. *S. aureus* was the only bacteria associated with a small decrease (3%) in milk yield. This led to the conclusion that mastitis is not currently an important constraint to productivity despite the high prevalence of infectious agents. However, it is expected that mastitis will be a big problem once milk yields are increased, given the large proportion of cows with bacterial infections, the confined housing practised and the minimal mastitis control measures performed (udder disinfection or dry-cow therapy is rarely practised).

**Table 4. Annual morbidity and mortality rates for cattle on smallholder dairy farms in Kenya**

| Variable | Animal years at risk | Risk rate (%/Yr) |
|---|---|---|
| Mortality | | |
| Female calves ≤ 3 months | 13.3 | 20.3 |
| Males calves ≤ 3 months | 14.2 | 24.6 |
| Heifers >3 months | 107.4 | 3.3 |
| Young males >3 months | 55.2 | 19.2 |
| Cows | 165.5 | 8.5 |
| Clinical mastitis | 165.5 | 13.3 |
| Lameness | - | 17.5 |
| East Coast fever risk | | |
| Central highlands | 358.9 | <3.0 |
| Coastal lowlands (free grazing) | 87 | 46 |

Source: Maloo et al, (1994); Omore et al., (1996a)

Cattle are predisposed to lameness and foot lesions due to confinement in the zero-grazing housing systems. Gitau (1995) found a high incidence of foot lesions with monthly incidence rates for interdigital cleft lesions, heel erosion and flat soles being 4.5%, 4.4% and 1.6% respectively, but the incidence of lameness was relatively uncommon (1.46% per month or 17.5% per year). He concluded that though lameness was currently not a serious constraint to production in these farms, if cows are pushed to higher levels of production, these lesions may become more important in constraining milk production.

**Calf rearing**

Low calf growth rate (mean weight gain only 0.24 kg/day, up to 5 months of age and high annual calf (up to one year of life) morbidity and mortality of 27% and 22% respectively (Tables 3 and 4) were recorded in a recent study in central Kenya (Gitau et al., 1994a,b). Diarrhoea was found to be the most important cause of calf morbidity and mortality. The poor growth rates result in late age at first calving (Table 3). Besides high reproductive wastage due to high calf mortality, the farmers also lack the ability to select between female replacements. Most female calves that survive have to be retained, irrespective of their potential. The low milk production by their dams is also probably an important constraint to optimal calf growth. Farmers reported bucket-feeding about 3kg of milk up to three months of age (Gitau et al., 1994a). Many farmers slaughter or give away male calves.

**Marketing services**
The marketing of milk has increasingly become decentralised, with increasing private sector participation since market liberalisation. Most milk from smallholders is sold unprocessed to neighbours or in local village markets. There are also numerous informal milk traders and a few formal milk market agents, such as farmer controlled dairy co-operatives (over 200), a few private processors (about 50) and, to a limited extent, the national Kenya Co-operative Creameries (KCC). Payment by all market agents, including processors, is by volume, not composition. Most dairy co-operatives and processors handle less than 2000 litres of milk per day and pay farmers monthly. Prior to market liberalisation in 1992 KCC handled all the processed milk sales but their share (currently estimated at about 100,000 MT annually) has declined to approximately half of all processed milk sales in the country (MoA/KARI/ILRI, 1998). Poor market access is a considerable constraint to profitable dairy farming in some high rainfall areas lacking all-weather roads to major urban centres. Fresh raw milk, which is favoured by most rural and urban consumers, mainly due to lower cost, represents 80% of all milk marketed in Kenya. Ordinarily, farmers would sell morning milk and keep evening milk for home consumption.

As well as milk, manure is an important product of the smallholder dairy enterprise and is highly valued as a crop fertiliser and soil improver. Various types of manure preservation are practised (including composting and mixing with wasted feed) and manure products are bought and sold.

**Input services**
Likewise, the provision of input services has experienced dramatic changes in the last decade because policies have supported private enterprise and government support input services for dairy production has declined. The lack of efficient supply of inputs including livestock services is a serious constraint in almost all areas. In some areas, especially those in close proximity to Nairobi, dairy co-operatives provide several input services beyond milk marketing, including some or all of the following: credit; the bulk supply of feed, drugs and other dairy inputs; and AI and veterinary services. In terms of provision of services, larger co-operatives (with many members) are best placed (Ombui et al., 1995, Owango et al., 1996). To enjoy the same services at a cheaper cost, smaller co-operatives have began to pool resources, to be able to provide more services at a cheaper cost. Some private milk processors also provide input services. About 200 veterinarians are officially licensed to practice but most of their services are directed at larger farms. Many more veterinarians and para-veterinarians provide services informally.

**Future prospects for smallholder dairying**
Smallholder dairying is viewed by both farmers and development agencies as a promising avenue for rural poverty alleviation, asset building and the efficient utilization of intensified land use. It is therefore expected that the number of smallholder dairy farmers will continue to increase in the foreseeable future. There is an urgent need that mechanisms for the delivery of both efficient marketing and input services are expanded, since these are no longer delivered by the public sector. Because of their lack of resources, smallholders need strong institutions to support them; both for service provision and for innovative research support under intensifying conditions. The strengthening of these support organisations is an urgent priority in order to improve productivity on these farms.

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