Smallholder dairy production in Kenya; a review

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Abstract

Kenya's dairy sub sector contributes about 8% of Gross Domestic Product (GDP) with an annual milk production of 3.43 billion litres. Kenyan milk production is 3% of the 18% global production by Sub Saharan Africa. Dairy cattle population is estimated at 4.3 million kept under extensive, semi-intensive and intensive systems of production. Dairy cattle in Kenya consist of exotic breeds, crosses between exotic and local breeds and local breeds. Although smallholder Dairy farmers make up to 80% of total dairy producers and produce 56% of total milk in Kenya, they are constrained by low quantity and quality of feeds, lack of reliable statistical information on milk market outlets, poor rural infrastructure, lack of collateral for loans, low technical skills on husbandry practices, reduced access to veterinary and artificial insemination (AI) services. This paper highlights the Kenyan dairy sector, the role played by the smallholder dairy farmers in the dairy industry, the constraints to smallholder milk production and suggestions to the Kenyan government and the relevant stakeholder's on ways of promoting the smallholder milk productivity.

Key words: *farmers, government, livelihood, milk production*

Introduction

Dairy farming is the single largest sub sector of agriculture in Kenya. It contributes 14% of Agricultural (GDP) with an annual growth rate of 4.1% compared to 1.2% of Agriculture (IFAD 2006). Kenya's dairy sector account for 6-8% of the country's GDP (USAID/GoK 2009). It is a major activity in the livestock sector and an important source of livelihood to approximately 1 million small scale farmers (IFAD 2006). It is the most rapidly expanding dairy sub sector in sub-Sahara Africa with over 85% of the dairy cattle population in Eastern Africa (ILRI 2000). Kenyan dairy cattle population is estimated at 4.3 million (Fig 1) with an estimated milk production of 3.43 billion litres (RoK 2015) comprising 18% of the 3% global contribution by sub-Saharan Africa (IFAD 2006). About 54% of households with 1 acre or less keep cattle (IFAD 2006). More than three-quarters of the households in the dairy production regions are engaged in agricultural activities, with 73% practicing integrated crop dairy production. Smallholder dairy farmers own over 80% of the dairy cattle, producing over 56% of total milk (Peeler and Omore 1997). They are kept under intensive and semi intensive systems of livestock production (Mbugua et al 1998). The remaining 20% is from large dairy farms and indigenous herd (Omore et al 1999). The main breeds for dairy production are Friesian, Guernsey, Ayrshire, Jersey and their crosses (Kibiego et al 2015). Also the exotic breeds are crossed with the local East African Zebu (EAZ) (Omore et al 1998). Although smallholder milk production is a viable economic enterprise in Kenya it is constrained by inadequate quantity and quality of feeds, poor access to breeding, diseases, poor access to credit facilities and poor access to output markets (inadequate processing and informal milk markets) (Muriuki et al 2003; Kembe et al 2008; Omunyin et al 2014; Kibiego et al

2015; Mutavi et al 2016).

Figure 1. Kenyan Dairy cattle population by years. Source RoK 2015

Smallholder dairy production systems in Kenya

The dairy production system adopted in a particular area depends on human population density and agro ecological zones (Staal et al 2003). In the Kenyan highlands with high population densities, there is highly intensive smallholder dairy production systems (zero grazing) involving stall feeding crop residues and planted fodder crops supplemented with concentrates (Njarui et al 2016). In these areas, more than three-quarters of the households in the dairy production regions are engaged in agricultural activities, with 73% practicing integrated crop dairy production. The households in the Kenya highlands practicing dairy production, 44%, 33% and 23% practiced zero, semi-zero and free ranging systems respectively (Bebe et al 2003). However in areas with moderate population densities, semi intensive system is practiced where animals are grazed and stall fed depending on the season (Mbugua et al 1998).

Intensive/ Stall feeding/ Zero grazing system

After independence most large farms owned by white settlers were bought and subdivided to create settlement schemes and also formation of large land buying companies (cooperatives) who bought land and sold to individuals in small pieces (Muriuki 2003) encouraging the development of small scale dairy production. Dairy production of smallholder is typically conducted on a few acres, with a herd of pure and crossbred cows ranging from 1 to 5 in size. Production is based on the close integration of dairy cattle into the mainly maize-based farms, with 71% of farmers keeping one to three cattle (Bebe et al 2003; Mugambi et al 2015) and is sometimes accompanied by cash crops such as coffee, tea, or pyrethrum. The cattle are usually Friesian or Ayrshire or their crosses (Mugambi et al 2015). An important element of this system is the use of the manure to fertilize food and cash crops, allowing sustained multiple cropping on the smallholdings. The advantages of the system include: fitting well in the integrated smallholder production system because there is interdependency and recycling of resources, animals provide manure used on crops, reduction in feed wastage cut and carry reduces trampling and save nutrients (Mcintire et al 1992; De haan et al 1997). Animals can also be fed according to level of production, are easy to manage due to close proximity of the animals and it is easy to control parasites and infectious diseases (Njarui et al 2016).

Semi- Intensive

The system is practiced in areas of greater land availability, medium to high potential areas where there are less intensive practices of combined grazing and stall feeding or purely paddock grazing. It is characterized by grazing at daytime and stall feeding at night, the animals are supplemented during milking and farmers keep crosses of the dairy breed of cattle (Muia et al 2011). Milk production/cow/year averages 1,510kgs which is lower than zero grazing intensive system (Karanja 2002).

Feeds and feeding

The main feeding system is stall-feeding based on cut- and carry with about 40% of households in the smallholder regions offering dairy cattle improved or preserved fodder with supplementation (Muia et al 2011). Cattle are fed planted fodder like Napier grass, maize Stover, weeds, grass and crop residues (Njarui et al 2011) and sometimes supplemented with concentrate feeds such as grain

millings or compounded dairy feeds (Mbugua et al 1998; Njarui et al 2011). It is important to note that in some cases, a large proportion of fodder is gathered from public or common land or is purchased, so feed resources are by no means limited to those produced on farm. According to Njarui et al (2011) approximately 95% of dairy farmers stored crop residues for their livestock but the storage methods were inappropriate to maintain the quality with 93% of the smallholder farmers experiencing seasonal fluctuation of feed availability and therefore milk production.

Milk production

Estimated milk production was 1300 Kgs and 4000 Kgs per cow per year (Omore et al 1999) and (Peeler and Omore 1997) respectively. This depended on the degree of intensification and agro ecological zones, going up to 4575kg/cow/year in high potential areas (Mugambi et al 2015). This difference in production was attributed to the availability of high quality feeds, differences in animal breeds and production system which was influenced by agro ecological zones (Muia et al 2011). The production per individual animal was low as compared to worlds best of 9000 litres per year (Technoserve 2008). There is therefore a potential for even higher production with good management and better feeding practices, since the genetic potential of Kenyan dairy cattle is far much higher than the milk production (USAID/GoK 2009).

The cost of milk production

Cost of milk production reflects substitution of primary inputs (Karanja 2002; Staal et al 2003). It therefore depends on degree of intensification, with profit per litre reducing with increased intensification reflecting increased cost of production (Kibiego et al 2015). Fodder and feed make up the highest proportion of milk production costs (55-70%). According to Karanja (2002), production cost varies according to production system, location of farm in relation to market, input supply, labour, fodder availability, use of purchased feeds etc. Calculations are affected by the way family labour and land are calculated or included (Kibiego et al 2015). Incomes therefore vary with the season, location of farm, yields achieved, formal and informal milk sales and the value of by- products as manure (Staal et al 2003). This implies that the profits are different in various locations in the country. The intensive zero grazing system gives the highest cost of production because of high cost of factors of production. According to Kibiego et al (2015), the smallholder zero grazing farmers had the highest returns on investment at 40.22% but the cost of producing a litre increased as intensification increased as it depends on high level of supplementation with purchased feeds.

Milk marketing

Since the early 1990s the government liberalized the dairy industry with private milk processors coming into the industry where demand and supply controlled market forces with uncertainty in milk payment (Technoserve 2008). According to Machira (2014), milk intake by the formal sector went down due to unpredictable prices and delayed payment by some processors (fig 3). This led to farmers selling milk through the informal milk market. Informal milk market is one which handle, mostly raw milk and other dairy products and may not conform to milk market regulations (Staal et al 2003). It is estimated that about 80% (fig 2) is neither processed nor packaged but is bought by the consumer in raw form in the informal milk outlet (Karanja 2002; Kembe et al 2008), due to traditional preferences for raw milk and the unwillingness of resource poor consumers to pay the costs of processing and packaging (Omore et al 1999). The informal market has milk prices 22% higher than the formal market, there is also the reliability of payment either cash on delivery or month end. However there are low quality standards as there are no tests done on delivery (Muriuki 2011). Most farmers therefore prefer the informal milk market as milk rejection at collection points is minimal

posing health risks to consumers. According to Kembe et al (2008) informal milk channels in which smallholder producers and traders dominate is the largest single market outlet for farmers, 36% consist of direct sales to nearby households, 28% to small traders brokers and hawkers who deliver the milk to consumers or other retail outlets and 19% to formal dairy processors (Omore et al 1999). Advantages of formal milk outlet, includes value addition, employment creation, observation of quality standards i.e. no adulteration, ensures hygienic and clean healthy products, safety of the consumer, improved keeping quality and earns export income from the surplus (Muriuki 2003).

Figure 2. Milk value chain in Kenya. Adopted from Omore et al 1999

Figure 3. Yearly Milk intake in the formal sector in litres. Adopted from Machira 2014.

Animal genetics

According to Karanja (2002), there are several inter related ways of improving milk production, by improved feeding, good management and good genetics. However this is hampered by existence of several uncoordinated breed improvement organizations (Muriuki et al 2003) by Kenya Stud Book (KSB), Livestock Recording Centre (LRC) and Kenya Livestock Breeders Organization (KLBO). Since early 1990s the government liberalized the dairy industry leading to entry into the industry of private milk processors and AI service providers leading to informal milk marketing and use of bulls respectively (Technoserve 2008). This has also reduced genetic progress of the dairy herd due to inbreeding and uncoordinated breeding. According to Mutavi et al (2016), only 16.4% of the smallholder farms are currently using AI in the country, 23% own bulls while 61% are using hired bulls with AI declining by 76% (Karanja 2002). The current average cost of AI using local semen is US$ 15 while that of imported semen US$ 40 (Mutavi et al 2016). Imported semen is estimated to have a market share of 22 % (Karanja, 2002). However, Muia et al (2011) reported better AI use at 44% in smallholder farms. This difference could be due to intensification of production and good extension services over the years encouraging farmers with common interests to form groups leading to more farmers' accessing services as, input acquisition, access to credit or training as compared to individual farmers accessing similar services as this is done by group members together.

Disease incidences and control

The main disease of dairy cattle especially the exotic breeds was a tick borne disease East coast Fever (ECF) at 43.1 % of the total diseases in smallholder farms (Omunyin et al 2014). According to Staal et al (2002) and Omunyin et al (2014), ECF causes mortality particularly in herds that graze, whose exposure to ticks is greater. Other diseases were Pneumonia, Anaplasmosis, mastitis, Foot and Mouth Disease (FMD) and eye conditions at 22%, 13%, 8%, 6% and 4% respectively (Mungube et al 2014). The control of all tick borne diseases is by dipping or spraying of animals with acaricide twice or once a week depending on the disease prevalence. FMD is controlled by vaccinations. Other diseases are controlled by prevention, proper hygiene and treatment when they do occur. The acaricides, drugs and vaccines are available at local agro vets and Sub County veterinary offices (Ondwassy et al 1999). According to Bebe et al (2003), culling on the smallholder farms was at 85% of heifer calves, 38% of heifers and 36% of the cows due to diseases leading to short cow productive life at 3.8 years compared to free grazing at 4.8 years. The replacement stock was sourced from outside the farms increasing the production costs. ECF reduced drastically the profits from milk due to high treatment costs, post management costs and loss of animals which would reduce the herd size by 30% (Staal et al2002).

Challenges to smallholder dairy production

Despite most animals in the smallholder farms having good genetics (USAID/GoK 2009), they are not able to reach a distinct and high peak production (Mbugua et al 1998) due to inadequate quantity and quality of roughages (Njarui et al 2016), given at (52.2 Kg) against the recommended 100kgs, concentrates (2.2 Kg) and mineral supplements (37 g) (Mugambi et al 2015), disregarding the individual animal daily feed requirement pegged on level of production and body weight. Omunyin et al (2014), reported the feed constraint at 22.5% of the total constraints.

According to Muia et al (2011), poor infrastructure especially the road network affected milk delivery and input acquisition increasing costs. Cattle diseases was also a major constraint especially ECF (Staal et al 2002; Omunyin et al 2014). Odima et al (1994) reported long calving intervals of (568-681 days) compared to the ideal of 365 days. Eighty % of smallholder dairy farmers used bulls due high prices of AI services leading to inbreeding and slow genetic progress (Mutavi et al 2016).

According to Staal et al (2003) and Kibiego et al (2015), smallholder dairy producers are able to capture useful profits and are likely to continue to be competitive and that dairy enterprise has above normal profits hence the returns are higher than those provided by rural wage labour. However, this opportunity is constrained by poor infrastructure, low access to credit, poorly developed markets and unreliable market outlets experienced especially by women and youths though they are the main players in smallholder dairy production. This was due to lack of collateral needed for bank loans (Kembe et al 2008). Further, Kenduiwa et al (2016) reported that amount of microfinance credit accessed influenced the type of breeds kept by smallholder dairy farmers thereby affecting individual animal productivity.

It is therefore important to note that carefully targeted development assistance to the dairy sub-sector especially the smallholder farmers is likely to translate into substantial benefits in terms of nutrition, improvement of livelihoods and creation of employment for rural poor.

Opportunities for improvement of the smallholder dairy farms productivity

According to Mugambi et al (2015) milk production in smallholder farms could be increased by 16.3% through better use of available resources given the current state of technology without extra cost, while the cost of milk production could be decreased by about 4.4% without decreasing output. Also Mbugua et al (1998) reported stall fed exotic breeds performed better than grazed exotic breeds where 47% of the animals were on heat within 70 days post-partum and therefore shorter calving intervals of 437 days compared to grazed animals of 513 days. Improving the management of the exotic dairy cattle under stall feeding in the smallholder farms in terms of nutrition and disease prevention and general management could improve productivity of the smallholder dairy farms. Also Rademaker et al (2016), reported Kenyan per capita milk consumption at 110 litres, the highest in sub Saharan Africa with an annual consumption growth of 5.8%. This is expected to create ready market for milk and milk products.

Conclusions and recommendations

Any attempts at improving the Kenyan dairy industry should be geared towards minimizing the constraints experienced by the smallholder dairy farmers. This should be done by;

- The government of Kenya instituting policies that support information provision through facilitation of extension staff and institutional building and with relevant stakeholders, work in

promoting the smallholder dairy milk production. The government should also revert management of Agriculture in the Country to the national government to ensure proper facilitation, uniformity and proper coordination of livestock extension services.

- Infrastructure improvement as upgrading of rural roads to all weather roads. Staal et al (2003) reported that by simply upgrading the poor feeder roads to good murram roads could reduce transport costs by 30%. Most rural roads in the high potential areas are impassible during the rainy season when incidentally milk production is highest.

- Rural electrification projects in smallholder regions should be intensified to allow for putting up of milk cooling centres. This would prolong the shelf life of milk before delivery to the processors and thereby reduce milk spoilage and increase milk price. Also it will ensure that more milk is channeled through the formal milk market, this would increase milk prices and protect consumers from milk borne diseases.

- Provision of loans to the farmers at low interest rates through agricultural finance cooperations that are government parastatals. Currently private financial institutions are giving farmers loans based on provision of collateral as tittle deeds. Most youths and women who make the bulk of smallholder dairy producers cannot access loans as they do not have collateral. Loans should be given through financial institutions that must be financed by the government and work together for monitoring of interest rates charged. Also provision of grants whose use should be closely monitored.

- Farmers should be encouraged to keep few high producing dairy animals to allow for easy management to increase production per animal and thereby increase smallholder dairy farmers' profits. This is good for the dairy industry and using the figures from KDB the industry has the potential for growth

- The government regulate the operations of private AI providers. Ensure professionalism is maintained in terms of professional charges, quality of semen and proper observation of genetic progress in line with the farms and national dairy breeding goals.

- Commercial dairy feeds and other inputs should be subsidized to encourage farmers to supplement animals according to weight and level of production using dairy meal. This will increase milk production and reduce the cost of milk production. Also the government and the stakeholders in the dairy industry should sensitize dairy farmers through extension staff on importance of Livestock insurance and create subsidized livestock insurance schemes.

- Bodies promoting livestock improvement as KAGRC (Kenya Animal Genetics Recourse Centre), LRC, KLBO, KSB and Kenya Dairy Board (KDB) should operate under one umbrella to allow for better coordination. Currently, there is no proper coordination leading to conflicting information on AI service provision, milk keeping records and proper identification of animals in smallholder farms leading to inbreeding and slow genetic progress.

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