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Review

Dairy production and marketing in Uganda: Current status, constraints and way forward

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Dairy production in Uganda is mainly based on low-input traditional pasture production systems. This makes Uganda one of the few countries in the world that are low cost producers of milk. Dairy farming could play a greater role in the economy considering its strong potential to provide rural employment and regular income to the many resource-poor households. However, milk production is still largely subsistence. There is therefore a huge potential to increase dairy production and productivity. The aim of this article was to review the current status of the dairy sector in Uganda, to identify the major constraints to dairy production and productivity and to suggest possible areas of intervention so as to enable Uganda exploit its competitive advantage in dairy production for socio-economic development. The article identified and discussed the following as major constraints to dairy production in the country: breed factors, feed resources, climatic factors, particularly high ambient temperature, socio-cultural factors, and dominant informal sector in milk marketing. Selective crossbreed utilization, feed resource development, specific disease prevention and control strategies, support for pastoral production systems, and establishment and support for dairy co-operative societies were recommended for improvement of dairy production and marketing in the country.

Key words: Dairy production, Uganda, current status, constraints

INTRODUCTION

Uganda's economy is still dominated by agriculture. More than 80% of Uganda's workforce is engaged in agriculture based primarily on smallholder farms that are on average only 2 ha in area (Bahiigwa, 1999; RoU, 2004; FAO, 2010). The share of agriculture in the national gross domestic product (GDP) is about 14.6%. Although the contribution of the livestock sub-sector to the national GDP decreased from 1.5% in 2005 to 1.3% in 2010, the share of livestock in the agricultural GDP increased from 8.4 to 8.9% over the same period (MAAIF, 2010). The dairy industry is estimated to contribute more than 50% of the total output from the livestock sub-sector, making it the second major agricultural activity contributing to the national GDP after cereal products (RoU, 2004; Grimaud et al., 2007a; DDA, 2010; Balikowa, 2011). The livestock sub-sector in Uganda is evolving in response to rapidly increasing demand for livestock products that is largely driven by human population growth, income growth and urbanization (Delgado et al., 1999; Faye and Alary, 2001;

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Thornton, 2010).

Dairy production in Uganda is mainly based on the low-input traditional pasture production system. This makes Uganda to be one of the lowest cost producers of milk globally, an advantage that should be exploited (Hemme, 2007). Dairy farming could play a greater role in the economy, considering its strong potential to provide employment and regular income to the many resource-poor rural households. Uganda is one of the few African countries that has attained self-sufficiency in the production of milk (Hemme, 2007; FAO, 2010; Balikowa, 2011). However, milk production is still largely subsistence with the attendant inefficiencies and quality problems commonly associated with such production systems (Balikowa, 2011). Although total annual national milk production grew from 365 million litres in 1991 to over 1.5 billion in 2008 (Wozemba and Nsanja, 2008; DDA, 2010), the observed growth in milk production has been attributed mainly to growth in the cattle population rather than increased milk productivity per cow. Higher productivity per cow is still hindered by low adoption of improved technologies and management practices (Elepu, 2006). Therefore, there is considerable potential to increase dairy production and productivity in Uganda. The aim of this article is to identify the major constraints to increased dairy production in Uganda and to suggest possible areas of intervention so as to enable the country to exploit its competitive advantage in dairy production for socio-economic development.

CURRENT STATUS OF THE DAIRY SECTOR IN UGANDA

Annual total milk production was about 1.5 billion litres in 2008 (DDA, 2010). However, actual milk output in the country would be more than the recorded 1.5 billion litres if supplies were added from the Karamoja sub-region; the milk production from which is currently excluded from data collection due to hygiene consideration. About 85% of milk in Uganda is produced from indigenous cattle, mainly Ankole (Aliguma and Nyoro, 2004;Wozemba and Nsanja, 2008). The Ankole breed, a genetic intermediate between *Bos indicus* and *Bos taurus* and related to the Sanga cattle (Grimaud et al., 2007a), is not a dairy breed per se. Each Ankole cow produces on average 2 L of milk per day and graze over a wide expanse of land often in search of fresh forage and water. Approximately 70% of total milk production is marketed, with the balance consumed by producing households and their neighbours. The annual consumption of milk per person in Uganda was 54 L in 2009 (DDA, 2010) which is 73% less than the 200 L per capita consumption recommended by the FAO. However, the potential for expansion is high given the natural resources available for dairy production in Uganda. Seventy-five percent of the land (18 million square kilometers) could be used for crops or grazing. Currently only 5 million hectares is used as pasture and grazing land.

Dairy production in Uganda takes place under any of four systems (Wozemba and Nsanja, 2008):

(1) Communal grazing which involves pastoral grazing on communal land owned by clan. Although discouraged, it is still practiced in Northern and Eastern parts of Uganda. It is deeply rooted in the culture of these communities who are either pastoralists or agro-pastoralists historically.
(2) Free range grazing; where cattle are grazed by moving them all over the farm. It is a traditional practice in the extensive grasslands in the Southern part of Uganda. The farmland is often not paddocked, but the boundaries are fenced with local hedgerow plants.
(3) Fenced/paddock grazing which involves grazing cattle in paddocks, with supplemental feeding with feed concentrates, is a common farming practice in areas where the land holdings are fairly small. This type of grazing requires land clearing and improved pasture. It Is largely practiced by farmers of hybrid and cross-breed cattle.
(4) Zero grazing where animals are confined in a small enclosure and fodder, feed concentrates, and water are brought to the animals. According to a study by Mbabazi (2005), at least 20% of low income households in Ankole sub-region in Western Uganda have received a zero grazing cow from either government or from such non-governmental organizations as Send a Cow (UK) and Heifer International.

Uganda is divided into six milk-sheds or dairy regions that are defined by agro-ecological and milk production factors as well as their dairy market situation (Figure 1). Milk producers in the different agroecological areas use different means of dairy herd management, from pastoral and extensive systems to agro-pastoral and agricultural intensive zones (Grimaud et al., 2007a). In the intensive systems, herds often include exotic cows, with a predominance of the Friesian-Holstein breed (Grimaud et al., 2004).

The six dairy regions exhibit significant differences in terms of milk production, cattle numbers, market dynamics, and dairy infrastructure, among other factors (DDA, 2004; Balikowa, 2011). These have largely been influenced by the dominant dairy production systems, with the North and Eastern regions (including Karamoja) lagging behind in terms of milk production. A significant part of the national milk production is provided by the Mbarara area, located in the South-West milk-shed (DDA, 2004).

The infrastructure for rural milk collection is still limited. Where it exists, chilled milk is delivered to processing plants and raw milk markets in insulated milk transport tankers. Uganda has a very limited capacity to process milk into value-added products. There are over twenty

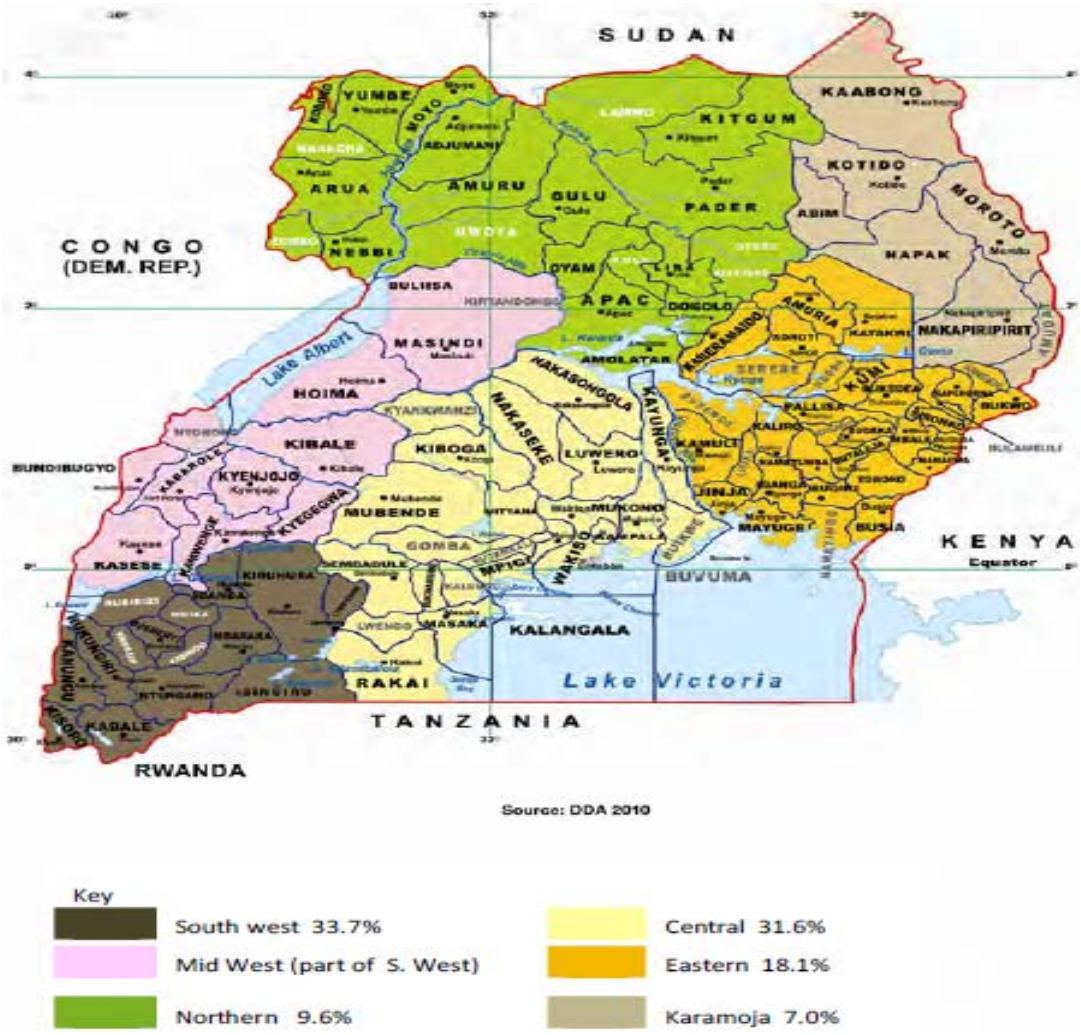

Figure 1. The dairy regions (milk sheds) of Uganda.

dairy processing companies, thirteen of which are milk processing plants and mini dairies. The combined installed capacity for processing plants was 463,200 L per day in 2008 (DDA, 2010). Only 10 to 20% of milk is currently marketed through the regulated formal market. The informal milk market takes up 80 to 90% of the marketable milk produced (Mpairwe, 2005; Grillet et al., 2005; DDA, 2010). The total quantity of milk and milk products imported into Uganda has been declining progressively from about 6,200 metric tons in 2003 to 800 metric tons in 2007. As a result of the decline in the imports, the amount of money spent on importing milk and milk products has experienced a steady decline from about $20 Million in 2001 to $1.6 Million in 2007. Between 2000 and 2008, Uganda exported an average of 380 metric tons of milk per year (DDA, 2010). UHT milk is the main dairy product exported to regional markets, including Rwanda, Kenya, Tanzania, DR Congo, Southern Sudan and Mauritius. Since May 2008 when one Ugandan milk processor began producing milk power, some milk powder has also been exported. Informal dairy trade however goes on across all of Uganda's borders, but the volume traded is generally not significant.

MAJOR CONSTRAINTS TO DAIRY PRODUCTION AND MARKETING IN UGANDA

Breed factors

Cattle are the major source of milk in Uganda. The population of dairy goats and other milk animals (buffalo and camel) is insignificant (Balikowa, 2011). However, most regions in Uganda have cattle breeds that are slow growing and have low feed conversion ratios with very low milk yield and market weights. Currently the average adult live weight in the predominantly Zebu herds of Teso

sub-region, for example, is only 180 to 350 kg per head, and this requires about five years to attain even if adequate pasture is available (Jain and Muladno, 2009). Of the 11.4 million cattle in Uganda, the Ankole longhorn (Sanga) breed is the most common, comprising 50% of the population. The small East African Zebu breed follows with 30% of the total population (MAAIF and UBOS, 2009). The Nganda intermediate breed represents 16% of the total population. Exotic breeds and their crosses make up only 4% of the total cattle population. The indigenous breeds generally have limited genetic potential for milk production and remain mediocre producers (500 to 1500 kg per lactation) even when the best possible husbandry conditions are available to them (Pagot, 1992).

Feed resources

While the nutritional needs of dairy animals with respect to energy, protein, minerals and vitamins have long been known and refined over many years, dairy animals are highly sensitive to changes in feeding regimes, and production can fall dramatically with small variations (Thornton, 2010). As understanding of the science of animal nutrition continues to expand and develop, most of the world's livestock, particularly ruminants in pastoral and extensive mixed systems in many developing countries, suffer from permanent or seasonal nutritional stress (Bruinsma, 2003). Natural and planted pastures are the major components in the diet of both indigenous and improved dairy cattle in Uganda. Because Uganda has many agro-ecological zones, the common naturally occurring pasture species vary from one region to another (Grimaud et al., 2007b). In the traditional cattle corridor, common sources of forages include grasses such as *Hyparrhenia rufa*, *Chloris gayana, Brachiaria decumbens, Cynodon dactylon, Themeda triandra*, *Digitaria* spp., *Hyparrhenia filipendula*, *Panicum maximum*, *Paspalum dilatatum* (Balikowa, 2011).

Most of the milk in Uganda is produced by smallholder producers that rely almost entirely on rain-fed natural pastures. However, a severe decline in the quantity and quality of pastures occurs during the dry season. This is often accompanied by widespread invasion of unpalatable grasses (mainly *Cymbopogon afronardus* and *Sporobolus pyramidalis)* as well as bush encroachment, with subsequent overgrazing of the palatable species, mainly *Brachiaria brizantha and Themeda triandra* (Grimaud et al., 2007b; Balikowa, 2011). Only a small number of households keeping improved dairy cattle make the effort to plant improved pastures. Consequently, very few of farms with improved dairy cattle produce enough fodder to meet the needs of their herds throughout the year (Balikowa, 2011). In addition, shortage of grazing land is becoming a serious constraint to dairy farming in most regions of Uganda.

The human population has been increasing rapidly, resulting in increased demand and competition for arable land. Households give priority to production of food crops. Land available for grazing is steadily dwindling in most regions. Extensive grazing of cattle, which has always been the most common management system, and is steadily becoming less popular except in the traditional cattle corridor (Balikowa, 2011). Hence, most animals thrive on sub-optimal energy levels for most of the year. Poor nutrition is one of the major production constraints in smallholder cattle systems of Uganda. Research on improvement of quality and availability of feed resources, including work on sown forages, forage conservation, use of multi-purpose trees, fibrous crop residues and strategic supplementation is available (Thornton, 2010).

Livestock diseases

Efforts to increase milk production in Uganda started in the 1950s with the importation of temperate dairy cattle (*Bos taurus*). However, the susceptibility of improved dairy cattle to local diseases and parasites, particularly tick-borne diseases and trypanosomiasis, and the high management costs remain the biggest impediment to development of commercial dairy farming in Uganda. Improved dairy cattle are still very unpopular among the poor farmers. The total population of improved dairy cattle was estimated at 5.57% of the national herd (MAAIF and UBOS, 2009; Balikowa, 2011). Tick-borne diseases remain a major constraint to the improvement of dairy production in Uganda (Norval et al., 1992; Bell-Sakyil et al., 2004). The cost of controlling ticks and tick-borne diseases is estimated to constitute about 85.6% (pastoral) and 73.8% (ranches) of total disease control costs (Ocaido et al., 2009).

The major tick-borne diseases in Uganda are anaplasmosis, babesiosis, cowdriosis and East Coast fever (ECF). Together, these diseases constitute the most important constraint to livestock production in Uganda (Ekou, 2013). In 1984, the government of Uganda stopped importing and distributing subsidized veterinary drugs and chemicals to farmers. Since then, government only imports certain veterinary products for use in control programs of particular endemic diseases such as Foot and Mouth Disease, Contagious Bovine Pleural Pneumonia, Lumpy Skin Disease, rabies and vectors such as tsetse flies. Instead, from 1994, it has been encouraging veterinarians to leave public service and set up private veterinary practice. To date, Government is still the major provider of animal health services (Wozemba and Nsanja, 2008; Balikowa, 2011). It has been reported, however, that routine strategic vaccinations often are not carried out, targeted vaccinations during outbreaks are delayed, and that in instances where vaccines were availed for targeted vaccinations, the vaccines did not cover all the livestock

population in affected areas resulting in livestock becoming susceptible to preventable livestock diseases (RoU, 2009).

Climatic factors

Popularity of the high yielding temperate stock among the local farmers has been curtailed by their inability to withstand the tropical conditions (Balikowa, 2011). Numerous experiments have shown that a prolonged period in which temperatures are more than 25°C, particularly in humid air conditions, leads to a reduction of dry matter intake by milking cows and, as a consequence, a drop in their production. Experiments have shown that a fall in appetite due to heat is the principal factor in the depression of production. High ambient temperatures have another depressive action on milk production by reducing the fertility of the cows, thus lengthening the interval between lactations (Bligh, 1976; Pagot, 1992; Igono and Aliu, 1982). Heat stress significantly impacts animal production and profitability in dairy cattle by lowering feed intake, milk production and reproduction (Chase, 2006). Climate change will likely worsen the situation. It is predicted that climate change will have severely deleterious impacts in many parts of the tropics and subtropics, even for small increases in the average temperature (IPCC, 2007). It will undoubtedly increase livestock production risks as well as reduce the ability of farmers to manage these risks (Thornton, 2010).

Socio-cultural factors

Exploitation of cattle for milk is one of the features of pastoral communities that have lived in symbiosis with their cattle for millennia. Herding people are often nomadic or transhumant and do not practice agriculture. Pastoralism, an economic and social system well adapted to dryland conditions and characterized by a complex set of practices and knowledge has permitted the maintenance of a sustainable equilibrium among pastures, livestock and people for generations (Koocheki and Gliessman, 2005). However, this livestock production system, which does not permit a place for intensive forage production, has limited possibilities for improvement (Pagot, 1992). Notably, milk hygiene practices among herding communities are usually poor. In Uganda, the Karamojong are a classic example. Due to hygienic consideration, milk supplies from the Karamoja sub-region are currently excluded from records on national milk production. As is the case in many countries, raw milk safety is a major public health concern in Uganda. Any improvement in the quality of milk contributes to the insurance of public health while at the same time having positive economic consequences (Grimaud et al., 2007b).

Dominant informal sector in milk marketing

The Dairy Development Authority (DDA), a statutory body under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), is responsible for regulating and developing the dairy industry. DDA implements this mandate through enforcement of quality standards and implementation of regulations such as registration, inspection of premises and factories and issuing of licenses for milk collection centres, outlets, small-scale processors, importers, factories, coolers and freezers, Storage facility, milk road tankers, and input suppliers. However, Uganda's dairy industry has too many players along the entire value chain (DDA, 2010). There are millions of small scale dairy farming households, tens of thousands of scattered middlemen trading in milk, and a handful of dairy processors. The informal sector handles about 80% of the traded milk. This informal segment, comprising mostly scattered middlemen and often beyond the reach of DDA operations, is driven by price and not by quality. This poses a big challenge regarding ensuring quality of the milk that reaches the low income segment of the consumers.

STRATEGIES FOR IMPROVING MILK PRODUCTION AND MARKETING

Developments in breeding, nutrition and animal health will continue to contribute to increasing dairy production (Thornton, 2010). Here the following factors are discussed.

Selective crossbreed utilisation

The use of conventional livestock breeding techniques has been largely responsible for the increases in yield of livestock products that have been observed over recent decades (Leakey, 2009). Of the conventional techniques, selection among breeds or crosses with the most appropriate breed or breed cross followed by selection within the resultant population has extensively been exploited to improve livestock production, especially in developed countries (Simm, 1998; Simm et al., 2004). While most of the gains from selective breeding have occurred in developed countries, there are considerable opportunities to do the same in developing countries. Crossbreeding can result in rapid productivity improvements, but new breeds and crosses need to be appropriate for the environment and to fit within production systems that may be characterized by limited resources and other constraints (Simm et al., 2004 Thornton, 2010).

The potential to produce milk in hotter climates, previously not given due attention, can no longer be ignored. Previous studies in the tropics have shown that

at various heat intensities above 27°C, half Friesian-Zebu cattle produce more milk when compared to the three-quarter cross during the stage of maximum lactation, despite the higher genetic potential of the latter (Bligh, 1976; Igono and Aliu, 1982). Therefore crossing European breeds, such as the small sized Jersey, with local Zebu cattle that have proven to be more adaptable to local conditions is an appropriate dairy cattle breeding strategy for Uganda. This cross would produce relatively small animals with low feed requirements but high productivity. However, as pointed out by FAO (2007), institutional and policy frameworks that encourage the sustainable use of traditional breeds and *in situ* conservation need to be implemented so as to avoid losing the genetic merit of these local breeds.

Feed resources development

In tropical countries, modern agronomic practices, such as selection of forage species, fertilisation, and irrigation, levels of productivity comparable to the best obtained in temperate countries (Pagot, 1992). In Uganda, a thorough agronomic assessment of grasses and legumes could be conducted in the different agro-ecological zones. Multilocational trials would test various forage legumes, grasses and browses for their adaptability and performance on different soil types and in various environments. These trials would be supported by pot experiments to determine soil nutrient status and pinpoint any trace-element deficiencies (Reynolds, 1981; Kayastha, 1982). Forage grasses and legumes found suitable in multilocational trials could then be recommended for planting (Servoz, 1983). Dairy farmers should be supported to cultivate fodder species of high value on one to two acres of land per dairy cow through provision of planting materials. Examples of such fodder species include grasses such as *Pannisetum purpereum*, *P. maximum*, and *Bracharia mulato*; legumes such *Pueraria phaseolois, Chemaecrista rutondifolia*, *Arachis pintoi,* and *Centrosema arienarium*; and trees such as *Sesbania sesban*, *Calliandra calothyrsus*, *Leucaena leucocephala,* and *Leucaena diversfolia*. Trees can be interplanted with legumes.

Disease prevention and control

Through risk analysis, the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF) could identify areas prone to disease outbreaks and carry out routine strategic vaccinations in those locations. MAAIF also could also enter into contracts with vaccine manufactures to keep vaccine stocks readily available for delivery when disease outbreaks occur (RoU, 2009). Better still, government can establish a national veterinary drugs centre with sufficient resources to procure, store and avail existing vaccines and drugs of priority endemic diseases in the country. This would be the equivalent of the now largely successful strategy of the National Medical Stores for the health system in Uganda. Rehabilitation and construction of community dip tanks as a key intervention in the control of ticks and tick-borne diseases has been recommended, especially in areas where pastoral or communal grazing is still being practised (Ekou, 2013).

Support for pastoral production systems

Unhygienic handling practices in traditional milk production and in the informal milk trade represent serious obstacles for the introduction of modern dairy processing and marketing. The influence of pooling of different milk batches along the collection and marketing chain exacerbates the problem.

The successful adaptation of pastoral subsistence production to the needs of an improved milk production and marketing system will depend, to a large extent, on safeguarding the milk quality at production, during transport, processing and marketing. Optimising milk hygiene under pastoral conditions requires the availability of safe clean water, which is an unrealistic expectation in most situations.

However, the introduction of clean metal containers to producing herds has had a measurably positive effect on raw milk quality (Younan, 2004). Pastoral communities therefore ought to be supported to acquire simple metal containers in addition to continuous education on hygienic milk handling procedures and practices.

Establishment and support for dairy co-operative societies

Co-operative societies are an important forum for bringing together small holder farmers. Farmers should be mobilized to form cooperative groups in various milk producing areas. Government and development partners could support these farmers with startup capital and training.

Farmers can also be linked to the buyers through close and regular market interaction. These farmer groups would collect milk from various farmers to one collection centre where processors come and buy. This can bring many advantages. Because of the organised bulking (selling in large quantities), there is ready market for milk since processors come and take all the collections from one place.

It makes it easier for farmers to acquire milk coolers, generators and other equipment from processors at friendly terms to ensure quality standardisation and increased production of milk (EADD, 2013). Farmers can even receive other dairy services like farmer education

On improved breeding, disease control, pasture improvement and milk production enhancement from the dairy society.

Conflict of Interests

The author have not declared any conflict of interests.

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