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DAIRY PRODUCTION

Dairy production in Botswana: current status and prospects

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ABSTRACT
This paper provides an overview of the dairy industry in Botswana. The paper is structured around the milk production and importation to meet the national shortfall in milk and milk product requirements. The prospects for sustained growth in national dairying require some changes in dairy management practices. Also, there are significant opportunities to develop small-scale processing plants to serve smaller urban settlements. Botswana augments its milk production with dairy products imported mainly from the Republic of South Africa. The dairy imports are mainly fresh milk, ultra high temperature (uht) milk, milk and cream in solid forms, buttermilk, flavoured milk, whey, butter, cheese, dairy spreads, fats and oils derived from milk. Given the current growing demand and limited availability of resources, achieving self-sufficiency in dairy products is an almost impossible task in the short term. Dairy self-sufficiency can be achieved only if more investments are made into dairy production and necessary infrastructure, training and policies provided to the industry.
Key words: Dairy production, imported dairy products, Botswana

INTRODUCTION
Botswana's dairy cattle population, was estimated at over 5 304, with only 1 763 cows in milk, and produces about 15 551.6 liters of milk per day. Generally large-scale dairy cattle production is attempted across the country with total of about 191 farmers across the country. During the period (2003-2004), Botswana imported 7 174 014 liters of raw milk through Clover Botswana and Sally dairy processing plants. The imported milk was to augment 5 676 298 liters produced locally. Average production per cow in the year 2003 – 2004 was 8 liters/cow/day (Mosielele, 2004). Milk production in Botswana is low, as the quantity and quality of animal feed are also low due to inadequate farming infrastructure. Between 2001 and 2006, the production quantity decreased slightly from 105 400 tons in 2000, to 105 350 tons in 2006 (Dairy mail Africa, 2008). As the demand for milk and milk products is substantially higher than its production, an average of approximately 150 000 tons per year is imported, mainly from South Africa. Total consumption of milk and milk products is approximately 250 000 to 260 000 tons. In 2004, Botswana imported a total of 23517tons of dairy products valued at more than US$13.3 million. It exported 47 tons of dairy products valued at US$100 000 (Dairy mail Africa, 2008). The country has four main dairy processing plants namely, Prime dairy, Sally and Dairy King with a production capacity of 20 000 litres per day each while Delta dairy is the newest dairy plant. They are also involved in a limited range of products, ranging from pasteurized and sterilized milk, to yoghurts and cheese. In addition to the four main dairy plants, a substantial number of smaller plants are active, mainly at village level. Botswana currently has over 5000 dairy cows, but at any given time only 33% of them are producing milk instead of at least 80% (Dairy mail Africa, 2008).

Traditional systems have dominated milk production in Africa for several years and still supply considerable amounts of milk today

and accounts for above 90% of dairy ruminants' population in Sub-Saharan Africa (Olaloku and Debre 1992). Boitumelo (1992) reported that increase in milk production by peri-urban small-scale farmers in Botswana became a major objective of the Ministry of Agriculture during the National Development plan 6 (NDP6). It was envisaged that increased production in this sector would not only increase local supplies for home consumption but would also lead to surpluses available for sale. He reported that the common breed used for both milk and meat production is the indigenous Tswana breed. However, there are few commercial dairy farmers who keep exotic breeds such as the Holstein-Friesians, Jerseys, Simmental, Brown Swiss and some crossbred animals. The development of a milk industry in Botswana is affected by both technical and non-technical constraints. The improvement of the Tswana breed for milk production has been done through crossbreeding using performance tested Simmental bulls. Generalization about the best policy for increasing milk production are difficult, both because of the variety of systems and different technical and economic constraints which affected them. Poor planning and the setting of unrealistic targets have contributed to past failures. Often the financial aspects of the operation have not been properly assessed and the level of management expertise required to meet target not planned. There is a holistic approach of development, which should address the basic issues of dairy production such as water availability, strategy to overcome frequent drought, infrastructure and organizational development for marketing and processing of dairy products through market channels and institutional mechanism.

Mpapho (2000) stated that nutritional constraints are caused by seasonal qualitative and quantitative feed shortage due to the climate and the fact that nothing is done to preserve and store fodder for the dry season by a lot of small-scale dairy farmers. Water is undoubtedly the most important nutrient for lactating cows since milk contains 87 % water (Aganga *et al.*, 2002). The study traced the development of the dairy industry sector in Botswana. It also determined the constraint to further development of dairy industry, evaluates current production systems and suggests possible solutions for a sustainable industry.

Table 1: Personal variables of respondents

Respondent (N= 10)	**Frequency**	**%**
1*Age (in years)*		
21-25	1	10.0
26-30	1	10.0
31-35	1	10.0
36-40	6	60.0
41-50	1	10.0
51-55	0	0.00
56 and above	0	0.00
Gender		
Male	9	90.0
Female	1	10.0
Educational status		
Non formal education	4	40.0
Primary education	1	10.0
Junior certificate	3	30.0
Tertiary education	1	10.0
Post graduate	1	10.0
Marital status		
Single	3	30.0
Married	7	70.0
Divorced	0	0.00
Separated	0	0.00

METHODOLOGY

Ten dairy farms were randomly selected and a structured questionnaire was administered to dairy farmers using face-to-face interviews. The questionnaire covered the personal demographics of the farmer, production systems, dairy breeds, production constraints and milk production. Also secondary data was obtained from Trade Statistic Unit, Ministry

of Finance and Development Planning on milk imports and trade. Data collected was analyzed using descriptive analysis of means and frequencies. Across age groups of milk production data was analyzed using multiple regression and ANOVA while Duncan's Multiple Range test to separate the means (SAS, 2004).

RESULTS AND DISCUSSION

Characteristics of respondent

Table 1 shows that majority of the respondents (60%) were within the age range of 36 – 40 years, indicating that most of the respondents were still in their middle age of life, on which majority were men (90%). About seven tenth (70%) were married and 40% had no formal education and at least 30% had junior certificate. Commercial dairy production is a technical field of animal production, therefore many of these dairy farmers require training in dairy animal management and feeding.

Table 2: Herd management

Management practices in dairy	Frequency (N=10)	%
System of raising animals		
Semi-intensive	10	100
Type of housing		
Unroofed round kraal	1	10.0
Unroofed rectangular kraal	8	80.0
Roofed rectangular kraal, no wall	1	10.0
Dipping/spraying frequency		
Monthly	10	100
Method of milking		
Hand milking	9	90.0
Machine milking	1	10.0
De-worming		
Internal parasites	1	10.0
Vaccination schedule		
Own schedule	0	0.00
Government	10	100

Herd management

Table 2 reveals that 80% of the respondents keep their animals in unroofed rectangular kraals and 10% keep them in a roofed rectangular kraal with no wall and unroofed round kraal respectively. It also shows that 100% of the respondents did not confine and feed their dairy animals. All respondent have shown that monthly dipping/spraying (100%) of animals was carried out and only 10% of respondents treated animals for internal parasites. Majority (90%) of the respondents used hand-milking method and 100% of them relied solely on government schedule of vaccination for their animals.

Table 3: Feeding system and watering of animals

	Frequency (N=10)	%
Type of feeding		
Stall fed	0	0.00
Mixed	10	100
Source of water		
Stream	2	20.0
Borehole	7	70.0
Dam	1	10.0
Watering frequency		
Adlibitum	10	100

Feeding and watering of dairy animals

Table 3 indicates that all respondents (100%) were practicing mixed type of feeding, i.e. grazing and stall-feeding. It also indicated that 70% of respondents watered their dairy animals from boreholes and all respondent (100%) supplied animals with water ad libitum.

Table 4: Crop residues used in feeding dairy animals

Types of crop residue	Frequency (N=10)	%
Sorghum	6	60.0
Millet	5	50.0
Lablab	5	50.0
Maize Stover	9	90.0
Beans	2	20.0
Water melons	2	20.0

Crop residues used in feeding animals

It is evident from Table 4 that crop residues harvested from the farm were used to feed dairy animals that is 90% of the respondent fed maize stover to their stock, 60% sorghum, followed by millet and lablab at 50% respectively and the least being beans residues and water melon at 20% each.

Supplementary feeding

Table 5 shows that all respondents (100%) included dairy meal and salt + bran in their supplementary feeds during dry and wet seasons. It also shows that majority of respondents (80%) fed dairy animals with di-calcium phosphate during dry season and only 20% of respondents fed their animal's di-calcium phosphate during wet season. Crop residue is only fed to dairy animals during dry season by all the respondents. Monkhei and Aganga (2005) reported that low rainfall which is experienced by the country has led to seasonal fluctuation in quantity and quality of forage leading to feed shortage for grazing ruminants and inducing poor reproductive performance and low milk yield in dairy cows that are reared with little or no feed supplementation.

Table 5: Supplementary feeds fed to dairy animals

	Frequency (N=10)	%
During wet season		
Dairy meal	10	100
Salt + bran	10	100
Crop residue	0	0
Di-calcium phosphate	2	20
During dry season		
Dairy meal	10	10
Salt + bran	10	100
Crop residue	10	100
Di-calcium phosphate	8	80

Fodder crop production

Table 6 indicates that majority of the respondents did not grow most of the common fodder crops. It was clear that 30% of respondents produce Lucerne and 20% of respondents cultivate lablab, beans, elephant grass and leucaena in their farms. Cattle production depends on the availability of adequate feed supplies and good management. Recurring drought, unreliable rainfall and poor soil fertility cause feed supplies to fluctuate both in quantity and quality. Protein and natural pastures is generally low, especially during the dry season. Conservation and storage of feed from the time of its maximum availability to the time of its use could be a useful strategy. At present approximately half of the cost of milk production can be attributed to feed costs, emphasizing the need for accurate feeding systems to guide diet formulation and the allocation of feed resources and to facilitate milk management decisions on feed inputs relative to milk output. Dairy production constraints of smallholder farmers in Tanzania included animal disease; shortage of feeds, water and markets for milk; lack of animal breeding services and shortage of capital (Kusiluka *et. al.* 2006). Ngongoni *et. al.* (2006) reported that the performance of cows in terms of low milk yield, low calving rates, late age at first calving and long calving intervals were observed in Zimbabwe and attributed to low levels of nutrition and management.

Table 6: Type of fodder crop produced by respondents' dairy farmers

Type of crop	Frequency (N= 10)	%
Lablab	2	20
Salt bush	1	10
Cowpeas/beans	2	20
Lucerne	3	30
Elephant grass	2	20
Leucaena leucocephala	2	20

Milk production

Table 7 shows that substantial amount of milk (over 90 liters per day) was produced by 60% of the respondents and that 100% of milk produced was sold as sour milk. Table 7 also

indicates that all dairy animals kept by respondent were meant for production of milk only.

Table 7: Dairy animal's production

	Frequency (N=10)	%
Uses of dairy animals		
Milk production only	10	100
Quantity of milk produced (lrs/day)		
Below 20	0	0.00
21-40	1	10.0
41-60	1	10.0
61-90	2	20.0
More than 90 liters	6	30
Uses of milk produced		
Sale	10	100
Form in which milk is sold		
Sour milk	10	100
Fresh	0	0.00

The smallest-scale processing is done by the household where fresh milk is fermented to sour milk (madila) and consumed or sold locally. Also, smaller urban settlements may be adequately served by small-scale processing. Also, small-scale technologies may be advantageous because they do not require high levels of energy, employee skill, maintenance and repair. A small dairy plant may be very appropriate where transport is a constraint. Milk must reach a cooling facility or processing plant within two to five hours of milking, or chemical changes occur that make it unsuitable for processing (Bachman, 1987). Small dairy plants may foster local economic development. It may stimulate greater milk production and sales from the local farmers. In addition, employment will be provided in the plants themselves, in their marketing, operations and in various support serves, such as collecting milk from farmers (Shapiro *et.al.* 1990).

Disease and causes of death in dairy animals

Table 8 shows that 50% of respondents reported that some of their dairy animals died from unexplained sudden death and 30% of respondents had animals that died from diarrhea. It also shows substantial improvement of the respondent regarding treatment of mastitis, which is a common disease of dairy animals. It also indicates only 10% of respondent experienced foot rot and pneumonia in their farm respectively.

Table 8: Diseases and other causes of death

	Frequency (N=10)	%
Diarrhea	3	30.0
Foot rot	1	10.0
Pneumonia	1	10.0
Mastitis	0	0.00
Unexplained sudden death	5	50.0

Record keeping

Table 9 indicates that majority of respondents (90%) kept labor records and 60% kept records on expenses, cash and debt. It also indicates that 80% kept records on milk production of dairy animals.

Table 9: Types of records kept by respondents' dairy farmers

Type of Record	Frequency (N=10)	%
Labor record	9	90.0
Record of expenses	6	60.0
Record of production	8	80.0
Record of debt	6	60.0
Cash book	6	60.0

Importation and exportation of milk and milk products

A lot of milk and milk products used in Botswana were imported from other countries. Some few items of milk products were exported with highest being milk and cream in solid form of < 1.5 fat (227,510 kg) and lowest being dairy spreads (8 kg). Between the years 1990 and 2004, the demand for milk and dairy products in Africa was growing at an average rate of 4.0% per annum; mean while production only grew at a

rate of 3.1%. Growth in consumption was pushed both by a growth population (2.8% per annum) and a small growth in per capita milk consumption (of 0.8% per annum) between 1990 and 2004 (Ndambi *et. al 2007*). Meanwhile, milk export, though very little (consisting of only 1.2% of total production), was increasing rapidly at the rate of 7.8% per annum during the period 1990-2004 (FAO, 2006; IFCN 2006). In 1997 Botswana imported about 24.9 million liters of liquid milk plus about 15.8 million kg of other milk product, excluding milk powder. In addition, there were imports of about 5 900 tons of milk powder, equivalent to approximately 88 millions liters. Local milk production in the same year is estimated at only 2.6 million liters, which is 9.6% of the liquid milk consumed in the country (NAMPAAD, 2000). Swartz (2004) stated that in order to boost the dairy industry in the country, the ministry of Agriculture (MoA) has established a dairy nucleus herd to breed and sell quality dairy pregnant heifers and bulls to farmers. The MoA has established a National Agricultural Master Plan for Arable Agriculture and Dairy Development (NAMPAAD) to support the establishment of commercial dairy farms in the country and developing milk collection centre. Swartz reported that the demand for fresh milk is increasing the number of dairy units from 88 in 1996 to 190 in 2004 with dairy head of 2256 in 1996 and 5304 in 2003 respectively. Marketing is a very important aspect of the dairy chain. Presence of close by markets for milk and dairy products is a key motivating factor for milk producers. The promotion of marketing will require gathering of milk from several producers, transforming it to an acceptable marketable product and delivering it to consumer at the desirable time and at an affordable price (Ndambi *et. al* 2007).

Figure1 shows the total values (Pula) of some the milk and milk products imported into the country over a period of five years. Recently in 2008 the country experienced a tremendous shortage of milk, more especially ultra heat treated (UHT) milk. Figure 2 shows the quantities of some of the milk imports from years 2003 to 2007. Fig.1 shows that the monetary value in pula over the period under review amounted to millions of pula for import payment on milk and milk products into Botswana to feed a population of 1.795 million. An increase in importation bill was 3,017,480 for milk product with less than 1% fat, not concentrated or sweetened while 12, 470,146 was recorded for milk and cream in solid form of >1.5% fat, sweetened over the 5 year period. There was generally a huge increase in low fat milk products imports, which shows the consumption pattern of the people in Botswana. Ultra high temperature (uht) milk in containers holding 1 liter or less and milk and cream of >6% fat, not concentrated and sweetened has increased from zero in 2003 to 181,274 in 2007 respectively. The growth in dairy imports and the consequent costs is disturbing. The need to conserve foreign exchange and generate employment in the dairy sector requires urgent attention.

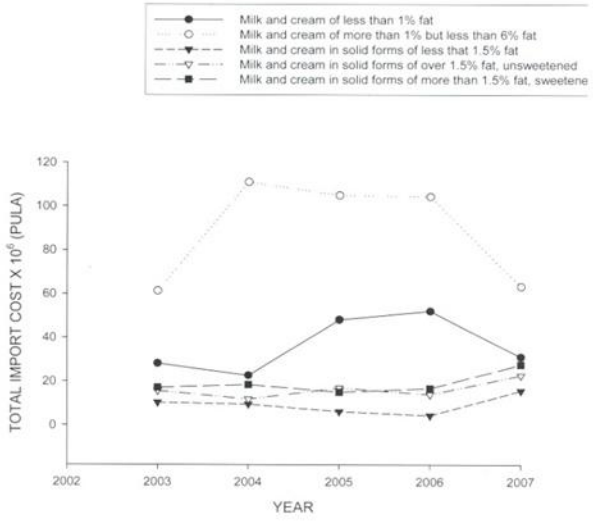

Figure 1: Monetary values (Pula) of milk and some milk products importation over five years from 2003 to 2007

CONCLUSIONS

The milk and milk products market in Botswana is growing but local producers are not responding to the increasing demand for milk and milk products. There is a huge deficit in milk supply compared to demand. The deficit is met with huge import of dairy products at high cost. There is a lot of money spent on milk and milk products importation, which can be used to support local dairy production and create employment in the dairy industry.

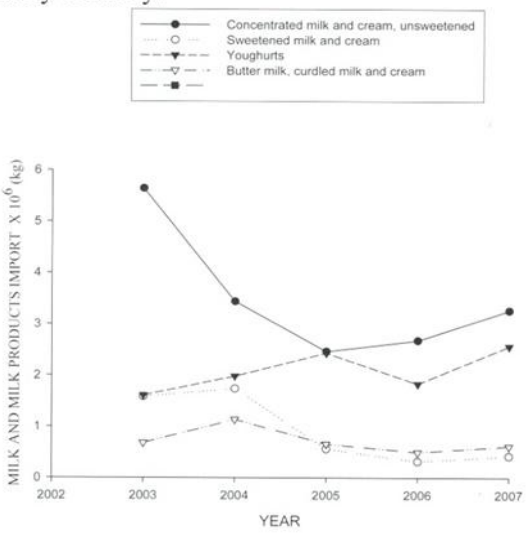

Figure 2: Quantities (kg) of Milk and some milk products importation into Botswana over five years from 2003 to 2007

Since most of the respondent dairy farmer fall within the class with a relatively lower educational background, dairy extension services face a challenge of simplifying knowledge to an acceptable form to these farmers, which would also prevent conflict with indigenous knowledge and traditional practices. Small-scale processing may be important for dealing with the low levels of supply that resulted from low production per cow and from few cows per farm.

RECOMMENDATIONS

Farmers should improve management such that output is increased. They should vaccinate their dairy animals against common diseases like heartwater and provide animals with adequate supplementary feeding. Dairy development needs to be accomplished through policies that can attract various stakeholders to invest in this sector. The initial step will be seeking the right policies and also having supportive institutions and services for stakeholders. Dairy farmers should form cooperatives that will help them to pull their resources together towards breaking into the dairy market.

REFERENCES

Aganga, A.A., Amarteifio J. O. and Nkile N., 2002. Effect of stage of lactation on nutrient composition of Tswana sheep and goats milk. *Journal of Food Composition and Analysis (FAO).* 15: 533 -543.

APRRD 1999 – 2001, Animal production and range research division, Annual report, Ministry of Agriculture, Government printing and publishing services, Gaborone, Botswana.

Bachmann, M. 1987. Products and processes, possibilities and limitations of decentralized milk processing. In: dairy Development in east Africa. *Bulletin of the International dairy Federation* 221: 95-96.

Boitumelo, W.S. 1992. peri-urban small-scale dairy research programme in Botswana. Proceedings of the workshop held at Kadoma Ranch Hotel, Zimbabwe, 20-23 July 1992. (Eds) J.A.Kategile and S.Mubi. http://www.fao.org/Wairdocs/ILRIx5485E/x5485e0f.HTM. accessed 23-02-09.

Dairy mail Africa. 2008. Botswana. July 2008.page 13-14.

FAO 2006. Statistical Yearbook. Food and agriculture organization of the United Nations, Volume 1. Rome 2006.

Kusiluka, L. J.M. Karimuribo, E.D., Mdegela, R.H., Kapanga, A., Bundala, A., Kivaria, F., Kabula, B., Manjurano, A., Turuka, F.M., Loken, T., and Kambarage, D.M., 2006.

Constraints associated with production in smallholder dairy farms in the eastern coastal zone of Tanzania, *Bulletin of animal health and production for Africa,* 54: 286-296.

Monkhei, M. and Aganga, A. A., 2005. Mutton and Milk production and trade in Botswana, *Journal of Animal and Veterinary Advances* 4: 17-21.

Mosielele, S.K, 2004, Dairy annual report, Department of animal health and production, Ministry of Agriculture, Gaborone, Botswana, page 2.

Mpapho, G.S., 2000. An evaluation of the nutritional constraints of dairy cow of Botswana. Pages 60-63. In: Optimal Feeding of Grazing Animals in Botswana. Eds. Aganga, A. A., Chabo, R.G., Kgosimore, M., Letso, M., AND Omphile, U.J. Proceeding of Livestock Feeding Systems Workshop held in Centre for In-Service and Continuing Education, Botswana College of Agriculture, Gaborone, Botswana.

National Master Plan for Agricultural Development (NAMPAAD) 2000, Final report for the Ministry of Agriculture, volume 1, September 2000, unit 2-1 and 5-2, Tahal consulting Engineering Ltd.

Ndambi, O, A. Hemme, T, and Lataz-Lohmann, 2007. Dairying in Africa – Status and recent developments: Livestock Research for Rural Development 19(8) http://www.ciap.prg.co//Irrd/Irrd19/8/ndam19111.ht:, Accessed 8/8/2008.

Ngongoni, N. T., Mapiye, C. Mwale, M., and Mupeta, B. 2006. Factors affecting milk production in the smallholder dairy sector of Zimbabwe: Livestock Research for Rural Development (LRRD) 18 (5): http://www.cipav.co/Irrd/Irrd18/5/ngon18072.ht, Accessed 8-8-2008.

Olaloku, E. A. and Debres, S. 1992, Research priorities for the development of appropriate feeding systems for dairy production in sub–Sahara Africa, In: Stares J., Said A. Kategile: The complementary of feed Resources for Animal production in Africa. Proceeding of the Joint Feed Resources Networks workshop held in Gaborone, Botswana 4-8 March 1991.

SAS (2004) User's Guide: Statistical Analysis System Procedures. SAS Institute, Inc., Cary, NC. USA.

Shapiro, K. Jesse, E. and Foltz, J. 1990. Dairy marketing and development in Africa. In. Dairy marketing in Sub-Saharan Africa. Proceedings of a symposium held at ILCA, Addis Ababa, Ethiopia, 26-30 November 1990. (Eds) Brokken, R.F. and Seyoum, S.ISBN 92-9053-202-5.

Swartz, J., 2004. Botswana 44% self sufficient in milk. Botswana Daily news. 2:6