Herd management, milk production and reproduction of Urban dairy farms in the Harar milkshed

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Abstract

A monitoring study on 26 urban and peri-urban dairy farms was undertaken to evaluate the production characteristics and identify the major constraints of the Harar milk shed in eastern Ethiopia. In this study, it was noted that important threats to productivity in the urban and per-urban dairies may be the constraints posed by irregulars calving distribution and irregulars milk production over the year. Reproductive performance of cows studied deviated negatively from the target values and these deviations were larger in farms of larger herd size compared to medium and small herds. Lower body weight and poor body condition scores before and after calving were found to be important in management of urban dairy farms influencing the productivity of the dairy farms in the milkshed. Reproductive and breeding problems were also identified as important problems in the urban and peri-urban dairy production systems. Although the artificial insemination (AI) service is used by a relatively large groups of the farms continuous interruption of the service seems to have forced the farmers to resort to the bulls of unknown pedigree. The access to AI services for dairy operation in urban area is mixed with apparently successful private entry into veterinary services, but no attempt is made so far in the private provision of AI services. However, these services are used mostly by the large and advanced dairy farmers in the urban areas. Thus, the reproductive and breeding problems and general management problems were identified, in this study, as important limiting factors for dairy production and will have to be looked into in the future dairy improvement strategies of the Harar milkshed.

Keywords: *Urban & Peri-Urban; Herd Management; Milk Production; Reproduction; Calving Distribution*

Introduction

Livestock production is rather poor in Ethiopia when compared to the rest of Africa. Milk production in tropical Africa in particular is limited by the quantity and quality of feed and animal genotype. Tropical pastures mature rapidly

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and are generally deficient in crude protein and phosphorus and low in energy (ILCA, 1978) which is major limiting factor for milk production (ILCA, 1978). Studies in the tropics have consistently shown that zebu breeds produce low milk yields per lactation period (which is usually also quite short), even under moderate to good feeding and management conditions. Especially zebu cows are considered poor milkers in comparison with the exotic breeds or crosses (Schaar *et al*., 1981; Kiwuwa *et al*., 1983; Mbah *et al*., 1987; Kurtu *et al*., 1999). Hence, the development of milk production systems in tropical conditions such as Ethiopia requires improvements, both in the genotype and in the feeding strategies.

Many countries in the tropics have attempted to replace their indigenous cattle breeds through breed substitution with exotic dairy types (Mbha *et al*., 1987) in order to meet the growing demand for dairy products. However, the imported dairy breeds have generally not achieved the same levels of production in the tropics as those in temperate environments. Some countries have resorted to upgrade the poor milk yielding indigenous breeds with imported semen (Brannang *et al*., 1980; Kurtu *et al*., 1999). This strategy was aimed at improving milk production by combining the adaptive traits such as efficient utilization of poor quality roughages, tolerance to diseases and high ambient temperatures and the general hardiness of the indigenous zebu breeds with the high milk production capacity and good temperament of the exotic *Bos taurus* (Syrstad, 1990).

Urban and peri-urban dairy production systems are among the many forms of dairy production systems in the tropics and sub-tropics. These systems involve the production, processing and marketing of dairy products that are channeled to consumers in urban centers (Rey *et al*., 1993; Staal & Shapiro, 1996). Urban and peri-urban dairy production systems have emerged to meet the increasing demand for milk in urban centers as a result of growing urbanization and increasing cost of imported dairy products. Peri-urban and urban dairy production systems contribute to the overall economic development through income and employment generation, food security, asset accumulation, poverty alleviation and improving human nutrition and health (Tegegne *et al*., 2000).

The development and sustainability of urban and peri-urban dairy production systems require a relatively large initial capital and long-term commitment. Furthermore, the major constraints related to these dairy production systems need to be addressed. Studies on characterization of the urban and peri-urban dairy production systems in and around Adiss Ababa have been carried out by

Yoseph and Azage (2003). However, little is known about the characteristics and the associated problems of the urban and peri-urban diary production systems of the Harar milk shed. However, this is required to know and have better understanding and adequate knowledge about the production systems and related problems. Subsequently, knowledge of the productions characteristic features and identifying problems limiting milk production of the Harar milkshed will assist to come up with appropriate interventions that will increase milk production and enhance dairy productivity in the Harar milkshed.

This study was therefore, undertaken to assess certain aspects of the herd management, milk production and reproduction performance of diary cattle and to identify the major constraints of the urban and peri-urban dairy production systems of the Harar milkshed.

Materials and methods

Study Site

This study was conducted on the dairy farms in and around the Harar town as a component of dairy productions systems in the Harar milkshed in eastern Ethiopia. In fact, this milkshed includes two adjacent areas, namely the Harari region and the Babile district from the Oromia region of Ethiopia. In this particular context, the milkshed refers to the geographical areas where milk is produced and marketed in a specific centre, in this case, the Harar town.

The Harar milkshed includes the whole Harari region and the Babile district (*warada*) from the bordering Oromia region to the east of Harar. Bisidimo is a small town in the Babile district and is located 18 km southeast of Harar town and 3km off the main road leading from Harar to the town of Jijiga.

The Harari region is one of nine administrative regions of Ethiopia. It supports a densely populated area located in eastern Ethiopia where crop- livestock, agro-pastoralist and pastoralist farming systems are predominant.

The Babile district and the area around Bisidimo are identified as important components of the Harar milkshed and supply milk to Harar town. The Harari region lies between latitude 9° 24’N and 9°42 03E and 42° 16’E longitude. The Harar town is situated about 500 km east of Addis Ababa. The Babile district lies between 8 °9’N and 9 °23’N latitude and 42 °15’E and 42 °53’E longitude and is about 35 km to the southeast of Harar town.

More than 99% of the population in the Harari region and the Babile district are Muslim and belong to the Harari, Oromo, Argoba and Somali ethnic groups (ECSA, 1999).

The Harari region has a wet tropical and receives an annual rainfall between 600 and 900 mm in a bimodal pattern. The bimodal pattern is characterized by a short rainy season that occurs between March and April and a long rainy season that occurs between July and September.

Data Collection

Fifty dairy farms were identified in the urban and peri-urban dairy production systems of the Harar milkshed. These farms were classified into three sub-systems or clusters on the basis of major variables that include: herd size, gender of the household head, education levels and off-farm businesses. The sub-systems were: Urban Resource Poor Dairy Subsystem (URPDSS) farms, Urban Medium Resource Dairy Subsystem (URMDSS) farms and Specialized Urban Dairy Subsystem (SUDSS) farms. In these 50 farms there were about 900 high grade crossbred cattle of Frisian exotic breed.

From these 50 farms a total of 26 farms, representing 16 URPDSS, 7 URMDSS and 3 SUDSS subsystems were purposively selected on the basis of easy accessibility and short distances between the farms. As the numbers of farms in SUDSS were only three, all were sampled while samples for the URPDSS and the URMDSS farms were taken on proportional basis. Data on herd composition, number of calving, mortalities, sales and purchases of animals, milk production performance, live weight of the cows before and after calving and body condition scores (BCS) were collected over a period of one year. For age at calving and calving intervals, data and information were obtained from the available records or by directly questioning the owners.

The reproductive performances of dairy cows were obtained from farm record books (where available), farmers were interviewed and information was gathered during the monitoring period of one year. From these data, the herd composition was calculated and compared with values that were suggested for optimum production in small-scale dairy farms (Radostits *et al*., 1994; Hoffman, 1999) (Table 1).

Table 1. Ideal target values for the distribution of cows in the different phases of the production cycle in urban dairy production systems

Variable	Lactating Cows		Dry Cows	
	Pregnant	Not pregnant	Pregnant	Not pregnant
Ideal Target Value	42%	41%	17%	0%

Source: Radostits *et al*., 1994; Hoffman, 1999

Determination of milk production

Milk produced at each of the 26 farms were measured using a graduated measuring cylinder and recorded for individual animals at both morning and evening milking; the sum of which was recorded as the daily individual yield per cow. The total daily milk production was also calculated for each herd. This was done once a month during the monitoring period by the resident enumera-tors.

Monitoring reproductive performance

Recently calved cows were considered from the herd at each site to monitor the reproductive performance of post partum dairy cows. Cows were monitored from the fourth day of lactation until the cows were confirmed pregnant by an AI technician by means of rectal palpation. During the one year observation period for the 26 herds the following parameters were monitored: number of services per conception and type of mating (natural or AI) practiced until the cows were confirmed pregnant. Pregnancy diagnoses were performed by an experienced operator 60 to 90 days after the last service by means of rectal examination.

Body weight and condition score fluctuations

Body weights were estimated with the aid of a heart girth measuring tape calibrated in cm and were applied to estimate body weight 30 days before and 30 days after calving. A Tropical Livestock Unit (TLU) is equivalent to a mature head of cattle of 250 kg live weight (ILCA, 1993). The number of TLU's was calculated for each herd. Body condition scores on a scale of 1-5 (Wildman et al., 1982) were determined concurrently with the live weight estimates of the cows.

Statistical Analysis

Data on herd management, milk production, reproduction, live weight changes and body condition score were analyzed using the General Linear Model (GLM) procedures of SAS (SAS, 2002). The model employed was as follows:

$y_{ij} = \mu + D_j + e_{ij}$

Where;

y_{ij}= Response variables (herd management, milk production, reproduction, body weight, body condition score)

μ= Overall mean
D_i= j^{th} Dairy Production Sub-System e_{ij}=
Residual

Chi-square test was used to compare number of calves born, died, slaughtered and retained across the different dairy production sub-systems.

Results and discussion

Herd composition and reproductive status of cows

The results in terms of herd composition of the urban dairy farms are summarized in Table 2. The dairy farms selected for the monitoring had a total population of 553 crossbred dairy animals that included cows, heifers, calves and bulls.

Table 2 Herd composition of the urban dairy farms in the Harar milk shed

Production Sub-System	No. of Dairy Farms	Cows		Heifers		Calves		Bulls		Total
		N	%	N	%	N	%	N	%	N
URPDSS	16	99	55	27	15	51	28	3	1.6	180
URMDSS	7	155	84	18	9	44	24	7	3.8	184
SUDSS	3	112	59	39	21	40	21	1	0.5	189
Total	26	323	58	84	15	135	25	11	2.0	553

There were changes in the herd dynamics during the study period of one year and the main sources of these changes included the birth or death of calves and slaughtering of animals (Table 3). No animals were sold or purchased in any farm across all the groups of farms (Subsystems) except one heifer and one bull sold from URPDSS farm. A total number of 246 calves were born from 323 cows in the three Subsystems. An overall calving rate of 76% was observed for all the farms. This calving rate shows that under the existing management condition, the reproductive performance of the cow herd is not too poor. Vandeplassche (1982) and Diag (1985) reported calving rates in Mozambique ranging from 69.1 to 74.8% and from 51.2 to 76.4%, respectively for crossbred dairy cows on small-scale farmers. A large number of the calves that were born, died (8%) mainly because of calf scour and 37% of male calves were slaughtered at a young age before weaning and fed to either dogs or wild beasts with no apparent economic benefit to the farms (Table 3). This was mainly because of lack of alternative ways of disposal particularly for male calves and the shortage of feeds.

Overall calf mortality was 8%. Farms in SUDSS had the highest mortalities (13%) and farms in URPDSS had the lowest (4%) mortalities. The observed mortality rates indicate that the smaller the herd the lower the calf losses under small-scale farm conditions. Similar trends have been reported by Hoffman (1999) in the Addis Ababa milkshed.

Table 3. Number of calves born, died, slaughtered and retained on the farm in the urban dairy farms of the Harar milk shed

Dairy Production Sub-Systems	**Calves Born**		**Calf Mortality**		**Calves Slaughtered (Male)**		**Calves Retained on the farm**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
URPDSS (no. of farms=16)	80	32.52	3	15.79	26	33.33	51	37.78
URMDSS (no. of farms=7)	88	35.77	6	31.58	36	46.15	44	32.59
SUDSS (no. of farms=3)	78	31.71	10	52.63	16	20.51	40	29.63
Significance	ns		ns		*		ns	

ns=not significant (P>0.05); *=P<0.05

The distribution of the cow herds in the different production and reproductive phases in the urban dairies by Subsystem is presented in Table 4. A total of 76% cows were lactating and 24% were dry in the three clusters. Of the total number of cows, 31% were pregnant and milked, 46% were milked and non-pregnant, 10% were dry and pregnant and 14% were dry and non-pregnant. It is interesting to note that the highest number of cows were non pregnant and lactating. A large deviation of about 11% from the target value of 42% as set in Table 1 was found in milking and pregnant cows. An even larger deviation from the target value was observed in dry pregnant cows. In this group, the number of cows was about 10% below the target value of 17%. A higher (14%)

percentage of cows were found to be dry and not pregnant, compared to the target value of zero. This means that the overall reproductive performance of the cows studied deviated negatively from the target values. However the 76% calving rate observed show that under the existing management condition, the overall reproductive performance of the crow herd is still acceptable.

The percentage of cows that were dry and not pregnant (14%) suggest reproductive management problems in the farms studied. These dry and non-preg-nant cows will have to be culled from the farms for economic reasons. A large percentage of dry and non-pregnant cows were recorded in large and specialized farms, compared to the smaller urban dairy farms in URPDSS. Hoffman (1999) has reported similar findings in peri-urban and urban dairy areas around Addis Ababa. She reported values of 18% for pregnant and dry, 21% for milking and pregnant, 21% for milking and not pregnant and 9% for dry and non-pregnant cows. Compared to the current study, Hoffman (1999) found a lower number of dry and non-pregnant cows. This might be owing to the improved feeding conditions and better reproductive management provided for dairy cows around Addis Ababa compared to those in the Harar milkshed.

Table 4. Distribution of the dairy cow herds in different phases of the productive cycle in the urban dairy farms of the Harar milk shed

Production Sub-Sys-tems	**No. of Dairy Farms**	**Milking Cows**				**Dry Cows**				**Total**
		Pregnant nant		**Non-preg-**		**Pregnant nant**		**Non-preg-**		**(N)**
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
URPDSS	16	33	33%	47	47%	14	14%	5	5%	99
URMDSS	7	34	30%	54	47%	11	10%	16	14%	115
SUDSS	3	32	29%	46	42%	6	6%	25	23%	109
Total	26	99	30%	147	46%	31	10%	46	14%	323

Monthly calving distribution

The monthly calving distribution of the urban dairy farms is shown in Figure 1. A total of 246 calvings were recorded during the study period of one year. The highest calving rate was recorded in March (17%), followed by September (12%). The lowest number of calvings occurred in November (1%) and December (4%). The highest number of calving was recorded during March to May which falls during the short rains (39%) and the lowest number of calving was during October to December which falls in the later part of the dry season (11%). Almost similar patterns of calving were observed in the three clusters.

These results agree well with those of Kiwuwa *et al*. (1983) and Kurtu *et al*. (1999), who reported an almost similar pattern of calving distribution, but with slightly higher values for the main rainy season followed by the short rainy season. These authors found that there were calving percentages of 56%, 43% and 41% in June to September, March to May and October to February, respectively. The difference between their findings and the present results could probably be as a result of the feeding and management systems because those reports were under open-grazing conditions which are more affected by the effects of the season. In addition, their data was obtained from research station conditions where the environments are better controlled.

The seasonal calving distribution observed in this study can partially be explained by the season's effect because the majority of the cows conceived during the main rainy season (June to September) and calved during the short rainy season (March to May). During this main rainy period, feedstuffs like green and succulent plant materials, including green grasses, green maize and weeds provide the cows with more protein and especially β-carotene, the precursor of vitamin A, mostly associated with cow fertility causing the cows to come in heat (Slater, 1991). On the other hand this pattern of calving tends to provide an irregular distribution of calving through the year and subsequently irregular supplies of milk. Milk production is highly dependent on the availability and quality of feedstuffs which are normally influenced by the season.

In addition, there were little attempts to meet the feed requirement of the cows over different lactation stages. Nutrient and energy requirements of a cow differ considerably at different stages of lactation, calling for appropriate feeding strategies (Slater, 1991). Apparently no appropriate feeding strategies seem to have been applied to meet the different cows' requirements over the production cycle. The urban dairy farms in the Harar milkshed seem to follow a calving distribution throughout the year, coupled with traditional feeding and management as well as milk production patterns. This would hardly enable the farms to ensure a continuous milk production and supply on a regular basis over different seasons of the year in order to meet the market demand and subsequently meet the desired profit expected by the producer on a sustainable and regular basis.

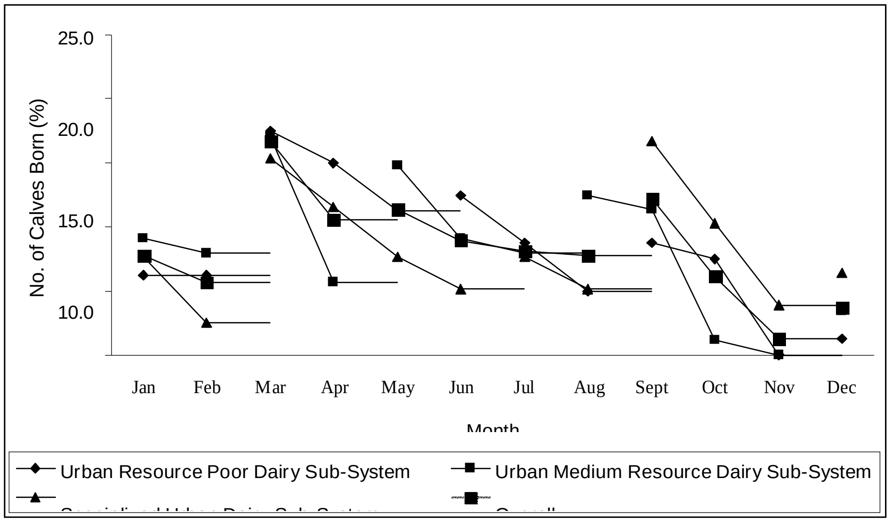


Figure 1. Calving distribution (%) in the Urban Dairy farms of the Harar Milk shed by month and production sub-system

Milk production

A total of 246 cows gave a total milk yield of 84312 liter during the study period of one year. The seasonal distribution of milk production in the urban dairy farms of the Harar milkshed is presented in Table 5.

Table 5. Seasonal distribution of milk production in the urban dairy farms of the Harar milkshed

Seasons	Months	Milk Production	
		Litre	%
Early dry season	October to December	16 171a	19
Late dry season	January to February	11 879b	14
Short rains season	March to May	28 014c	33
Long rains season	June to September	28 248c	34
Total		84 312	100

a-c Means with different superscripts within columns differ significantly ($P<0.05$)

The highest milk yield was obtained during the rainy seasons and the lowest during the dry season. More than 28000 liter (34%) of milk was produced during the long rainy season (June to September) and only about 12000 liter (14%) of milk was produced during the dry season. This difference was significant

(P<0.05) and may be explained by the irregular annual calving distribution, which is partly associated with the unbalanced feed conditions over the seasons. During the wet seasons the bulky feeds especially green plants including weeds, are available to the animals while during the dry season these feedstuffs were in most cases not available (Slater, 1991). In addition, the available literature indicates that tropical pastures tend to mature rapidly and are generally deficient in crude protein, phosphorus and energy during dry season of the year (ILCA, 1978).

The mean milk yield/cow/day seems to vary little over the 12 months of the year (Figure 2 a). However, during the rainy seasons, total milk tends to be higher. The highest total milk yield occurred during March and April, followed by July and September, while the lowest occurred during December and February (Figure 2 b). This was strongly influenced by the number of cows that calved (Figure 2 c). The same type of result was reported for crossbred cattle in Ethiopia (Kiwuwa *et al.*, 1983; Kurtu *et al*., 1999). Apparently, the difference in total milk production seems to be more differentiated between Subsystems than between months (Table 6).

Table 6. Average daily milk yield per cow and total milk production per cluster of the urban dairy farms in the Harar milkshed

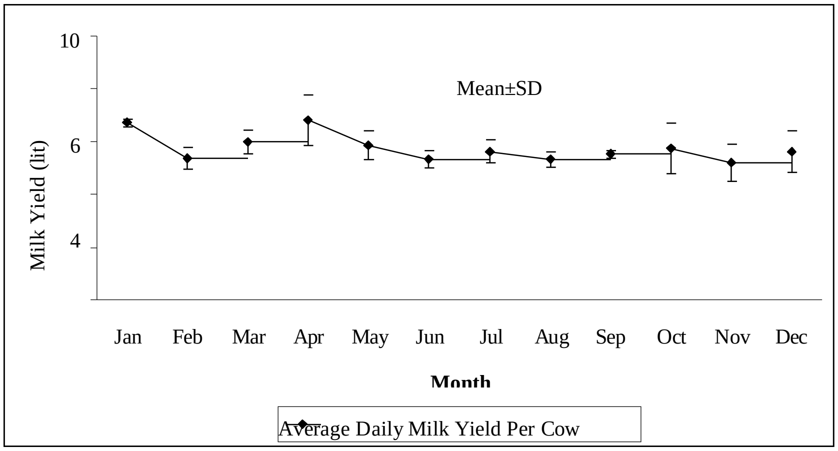
Production Sub-Systems	Milk/cow/day (liter)	Total milk (liter)
URPDSS	5.71±1.31	28611[a]
URMDSS	5.89±1.21	29508[a]
SUDSS	5.62±1.32	26193[b]

a, b Means with different superscripts within columns differ significantly (P<0.05)

Differences in milk production between Subsystems tend to reflect the discrepancy in management practices, particularly feeding, of the herds in the three Subsystems. Average milk yield per cow per day was almost the same in all three Subsystems. The total milk yield between the three Subsystems was significantly different (P<0.05). Farms in URMDSS produced 29508 liter per month, the highest yield, followed by URPDSS with 28611 liter and USDSS with 26193 liter (Table 6). Differences in milk yield between the Subsystems could probably be explained by differences in the herd size, feeds available and the commitment of the owners. The smaller the herd (URPDSS) the easier the management, but shortages in feeds results in lower milk production. The larger the herd size (USDSS) the more feeds and more commitment are required. However, the commitments for improved production seem to be lacking in this group as they are also engaged in other businesses. Tegegne *et al.*

(2000) indicated that as the dairy herd size increases, more feeds, better management and long-term commitment are required to get increased production.

In conclusion, the irregular calving distribution over the year, irregular milk production and a lack of strategic feeding systems were important management problems identified in the urban dairy production systems. It was also noted that these problems were more pronounced in USDSS compared to URPDSS and URMDSS and require intervention to improve dairy productivity in the Harar milkshed.



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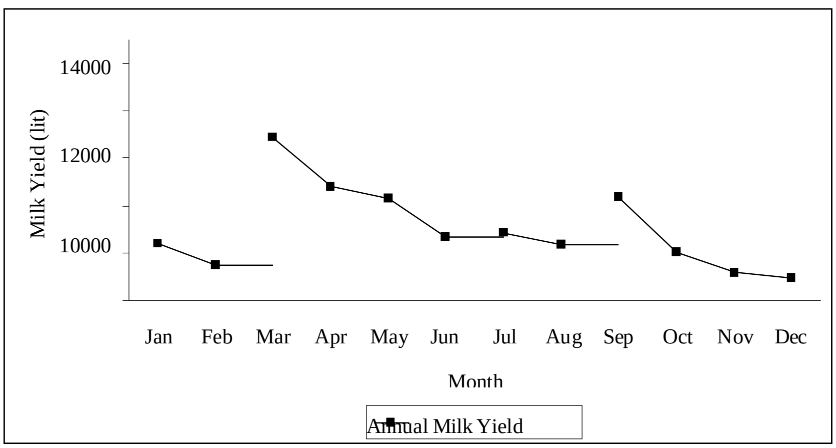

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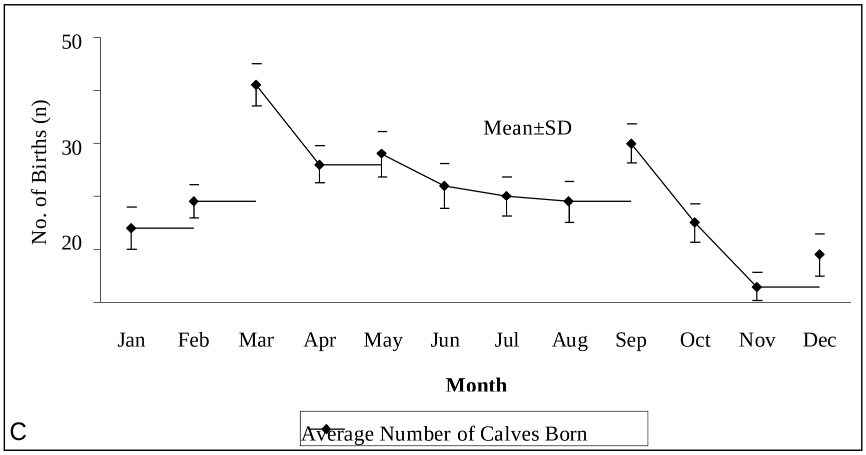

Figure 2. Average daily milk yield per cow (A), total milk yield (B) and number of calves born (C) in urban dairy farms in the Harar milk shed

Reproductive performance

Available data only allowed the analysis of age at first calving, lactation length, number of services per conception and calving intervals (Tables 7 and 8). The rest of the reproductive traits could not be addressed owing to a lack of data.

The overall mean age at first calving was 30.6 months, but differences between clusters were observed. Cows in URPDSS and URMDSS calved for the first time two months earlier than cows in SUDSS. The overall age at first calving is 6 months later than the target age of 24 months and requires attention because it is greater than the 28 months suggested by Radostits *et al.* (1994). However, these crossbred cows had their first calves much earlier compared to local pure breds, which normally do not give birth to their first calves before 4 years of age (Swenson *et al*., 1981; Albero, 1983). This is supported by several reports on crossbred cattle in Ethiopia that have shown better reproductive performances than the indigenous cattle (Albero, 1983; Kiwuwa *et al*., 1983). Differences among the clusters for age at first calving however, could be attributed to the different management levels provided to the crossbred cow. As indicated by Preston (1989) the relative advantages of crossbred cows depend on the level of management and adequate nutrition provided.

The overall mean calving interval observed in this study was very long (498 days) whereas the optimum is around 365 to 400 days as suggested by Kiwuwa *et al.* (1983). The calving interval observed, however, is in agreement with Bekele *et al*. (1991) who reported 15.8 months in Ethiopia.

Table 7. Average age at first calving, calving interval and lactation length of urban dairy cows in the Harar milk shed

Production Sub-Systems	Age at 1st calving (months)	Calving interval (months)	Lactation length (months)
URPDSS	30.97 [a]	16.8 [a]	310 [a]
URMDSS	29.72 [a]	15.5 [a]	322 [a]
SUDSS	32.50 [c]	17.5 [b]	332 [a]
Over all mean	30.06	16.6	321

[a-b] Means with different superscripts within columns differ significantly (P<0.05).

Table 8. Number (mean ± SD) of services per conception in urban dairy farms in the Harar milk shed

Production	Number of Services Per Conception	
Sub-systems	No. of cows	Mean ± SD
URPDSS	88	2.9 ±1.4 [b]
URMDSS	74	2.5 ±1.3 [a]
SUDSS	81	3.1 ±1.3 [b]
Overall		2.8±1.3

[a-b] Means with different superscripts within columns differ significantly (P<0.05)

Longer calving intervals are generally reflections of the problems associated with poor nutrition, health and reproductive managements (Kiwuwa *et al.,* 1983). The calving interval needs to be shortened for improved reproductive and productive performances (Kiwuwa *et al*., 1983). Thus, the results of the present study regarding calving interval calls for an appropriate intervention.

The overall mean number of services per conception is 2.8±1.34, which is higher than that reported by Bekele *et al*. (1991) in Ethiopia as 1.83 ± 0.90. However, Tegegne (1997) in Ethiopia reported 2.6 services per conception, which is in agreement with the results of this study.

Cows in URMDSS required a smaller number of services (P<0.01) compared to those cows in URPDSS and especially SUDSS. Cows in SUDSS had slightly more services/conception than cows in URPDSS, but the difference was not significant (P>0.05). Higher number of service means longer calving interval as cows in SUDSS had longer calving interval compared to cows in URPDSS and URMDSS.

However, all required more services than the target 1.5 recommended by Radostits *et al.* (1994). It is important to note that all the target values used are based on the North American and European dairy production systems, because there are no established standards either for Ethiopia or for tropical Africa as such. Larger numbers of services per conception are the result of a number of factors including poor management, feeding, heat detection, time of services, semen quality and skills of the inseminator (Branning & Person, 1990) and requires attention.

It was noted that majority of urban and peri-urban dairy are using Artificial Insemination (AI) service for breeding their cow herd. However, the AI service was very often noted to be irrupted causing reproductive problems on the dairy farms. Consequently, the dairy farms were forced to use bulls of unknown pedigree for breeding the dairy cows. There is no private AI service delivery system in the Harar milkshed which might have helped to mitigate the AI problem

It can be concluded that the overall reproductive performance of the cows in this study deviated negatively from the target values and these deviations were larger in SUDSS compared to Subsystems URPDSS and URMDSS. Therefore, reproductive problems were also important factors that reduce the productivity of urban dairy farms and need to be addressed to improve productivity in the urban sub-system of the Harar milkshed.

Pre-partum and post-partum body weight changes

The average body weight of the cows in all Subsystems was 446 and 419 kg before and after calving respectively (Table 9). Cows in URMDSS were the heaviest and cows in SUDSS the lightest before calving. Cows in SUDSS were significantly (P<0.05) lighter than those in URMDSS and URPDSS after calving. For URPDSS and URMDSS this difference was not significant (P>0.05). The weight differences before and after calving for URPDSS and URPDSS was almost the same (6%) whereas this weight difference for cows in URMDSS was a bit higher (7%). These small differences in the body weights noted for cows in URPDSS and URMDSS before and after calving compared to the cows in SUDSS could be attributed to the better feeding levels provided to the cows, especially before calving.

The overall mean BCS's of the cows were 3.15 and 3.00 before and after calving respectively. This means that cows in all clusters were not in good conditions after calving with body scores ≤ 3 BCS, which has been described as poor by Wildman *et al*. (1982). This might be the result of underfeeding particularly resulting from a lack of adequate feed supplies. There were differences among the dairy farms in the different Subsystems. The BCS of cows in UMRDSS had the highest score and cows in SUDSS the lowest score before and after calving (P<0.05). Differences in BCS before and after calving between cows in URPDSS and SUDSS were not significant (P>0.05 However, for cows in SUDSS the average BCS before and after calving was lower than the acceptable level of BCS suggested by Wildman *et al*. (1982) for optimum production. BCS changes before and after calving in the present study indicate that cows, particularly in URPDSS and SUDSS, were in sub-optimal condition probably because of a lack of proper feeding before calving. This would subsequently result in lower milk production. Poor BCS at or after calving (<3) often results in lower peak milk yield and lower total milk lactation yield.

Cows with high condition score URMDSS gave more yield (13%) total milk than cows with lower condition score in SUDSS (Table 6). Cows with high condition score URMDSS had heavier body weight (Table 9).

Table 9. Pre-partum and post-partum body weights and body condition score (mean ±SD) of cows in urban dairy farms in the Harar milk shed

Production Sub-Systems	N	Body weight (kg) Pre-partum	Body weight (kg) Post-partum	N	Body Condition Score(Scale 1-5) Pre-par-tum	Body Condition Score(Scale 1-5) Post-partum
URPDSS	88	454.1 ±11.6[b]	427.3 ± 14.6[b]	80	3.1 ±0.9 [b]	3.0 ±0.3 [b]
URMDSS	74	474.6 ±13.6[c]	448.6 ± 13.8[b]	88	3.3 ± 0.0 [a]	3.2 ± 0.0 [a]
SUDSS	81	411.3 ± 14.5[a]	382.3 ± 11.2[a]	78	2.9 ± 0.1 [b]	2.8 ± 0.7 [b]
Over all mean	81	466.6±13.2	419.4±13.2	82	3.15±0.5	3.0±0.3

[a-b] Means with different superscripts within columns differ significantly (P<0.05)

Dairy cows should not lose more than one point in BCS soon after calving because excessive loss of body condition in early lactation has been shown to reduce the reproductive efficiency (Wildman *et al*., 1982). The low body weights and body condition scores of cows before and after calving in this study appears to have resulted from the feeding systems employed.

Conclusions

Lower body weight and poor body condition scores of the cows before and after calving were found to be important factors in management of urban dairy, influencing productivity of the dairy herds in the milkshed.· The irregular calving distribution over year and related reproduction problems, irregular milk production distribution over the year were also known to constitute important problems limiting milk production in the dairy herd of the milkshed. These problems were noted to be more apparent in the dairy herds in large sized herd or specialized dairy farms than in resource medium and resource poor farms. It is thus, recommended to have high level of management that would require better skill, knowledge of husbandry of dairy cattle and commitment than the traditional knowledge to make the specialized dairy farms productive.

References

Albero,M.,1983. Comparative performance of F1 Friesian x Zebu heifers in Ethiopia. *Animal Production 37, 247-252*.

Bekele, T., Kasali, O.B. &Alemu, T., 1991. Reproductive problems in crossbred cattle in central Ethiopia. *Animal Reproduction Science 26, 41-49.*

Brannang, E., Meskel, L.B.,Schaar , J. & Swemsson, C., 1980. Breeding Activities of Ethio-Swedish Integrated Rural Development Project. 1 Planning and goals in multiplier herd system. *World. Animal Review 36, 34-36.*

Brannang, E. & Person, S., 1990. Ethiopian animal husbandry handbook. Southern Agricultural Development Zone. Uppsala, Sweden.

Diag, J., 1985. Results from AI in dairy cows in Mozambique. Livestock Production Seminar. Ministry of Agriculture and FAO. 2-7 December, 1985. Maputo, Mozambique. pp. 321-324.

Hoffmam, Amut, 1999. Cross-site and cross-location on farm investigation on the re-productive status and reproductive disorders of dairy cows in market oriented ur-ban/peri-urban production systems in the Addis Ababa region, Ethiopia. Diploma thesis. Post graduate diploma course Animal Health Management, 1998-1999. January 1999, Berlin.

ECSA (Ethiopian Central Statistical Authority), 1999.Crop Livestock and Population Census 1997/98 (1990.E.C.) Volume II. Report on Livestock, Poultry Population and Beehives. The federal Democratic of Ethiopia Central Statistical Authority and Harari Regional Agricultural Bureau. Harari Regional Regional Agricultural Bureau, Addis Ababa, Ethiopia, January, 1999.

ILCA (International Livestock Centre for Africa), 1978. Mathematical modeling of livestock production systems: application of the Texas A & M University of beef cattle production model to Botswana. International Livestock Centre for Africa. Addis Ababa, Ethiopia.

ILCA ((International Livestock Centre for Africa)), 1993. Annual Report. International Livestock Center for Africa. Addis Ababa, Ethiopia.

Kiwuwa, Gebruiel/.H.,Trial, John, C.M., Kurtu, M.Y., Grsvhew, Worku, Anderson, Frank & Durkin, M., 1983. Crossbred dairy cattle productivity in Arsi region, Ethiopia. Arsi Rural Development Unit, Asela and International Livestock Center for Africa, Addis Ababa, Ethiopia.

Kurtu, M.Y., Tawah, C.L., Rege, J.E.O., Nega, ALemayehu & Mesfin-Shibre,1999. Lactation performance of purebred Arsi cows and Friesian X Arsi crosses under pre-partum and post-partum supplementary feeding regimes. *British society of Animal Science 68, 625-633.*

Mbah, D.A., Mbanya, J. & Messine, O., 1987. Performance of Holsteins, ersey and the zebu crosses in Cameroon. Pre1iminary results. Review of Science and Technology, Agronomy Science Series, Ministry of Scientific and Technical Research, Yaounde, Cameroon, 3, 115-126.

Preston, T.R., 1989. The development of milk production systems in the tropics. Technical Centre for Agriculture and Rural Cooperation. ACP-EEC Lome Convention, Wageningen, The Netherlands.

Radostits, O.M., Leslie, K.E. & Fetrow, J., 1994. Maintenance of reproduction efficiency in dairy cattle. In: Herd health: Food animal production Medicine. 2nd ed. Philadelphia: W.B. Saunders Company. pp. 141-158.

Rey, B., Trop, W., Smith, J., Shapiro, B., Osiji, P., Mulins G. & Agyemang, K., 1993. Improvement of dairy production to satisfy the growing consumer demand in Sub-saharan Africa. A conceptual frame work for research. International Livestock Center for Africa. Addis Ababa, Ethiopia.

SAS, 2002. Statistical Analysis Systems for mixed models. SAS Institute Inc., Cary, NC, USA.

Schaar, J., Brannang, E. & Meskel, L.B., 1981. Breeding activities of the Ethio-Swed-ish integrated rural development project. 2. Milk production of zebu and crossbred cattle. *World Animal Review 37, 31-36.*

Slater, Ken 1991. The principles of dairy farming. Farming Press Books. Friars Court yard, 30-32 Princes Street. Ipswich IPI IRJ, United Kingdom.

Staal, S.J. & Shapiro, B.I., 1996. Impacts of dairy input and output price policy on producer incentive in Ethiopia. In: Proceedings of the 3rd National Conference of the Ethiopian Society of Animal Production. Addis Ababa, Ethiopia, 24-42.

Syrstad, 0, 1990. Dairy cattle crossbreeding in the tropics. The importance of genotype X environmental interaction. *Livestock Production Science* 24, *109*119

Tegegne, A., 1997 Importance of herd recording in improvement of Reproduction in dairy cattle. Paper presented at ILRI, CANET/Luxemberg Smallholder

Tegegne, A., Million,Tadeses & Alrmu, Ysmi., 2000. Peri-urban Dairy Systems. Urban Agriculture Magazine. Volume 1 no. 2, 23-24.

Yoseph, M., and Tegegne, A., 2003. Milk Production, Milk Composition, and body weight change of Cross bred Dairy Cows in Urban and Peri-Urban Dairy Production Systems in Ethiopia. Proceeding of Ethiopian Society of Animal Production (ESAP), 2003. Addis Ababa, Ethiopia.

Vandeplassche, M., 1982. Reproductive efficiency in cattle: a guideline for projects developing countries. Faculty of Veterinary Medicine Department of Reproduction and Obstetrics, State University, Ghent (Belgium).

Wildman, E.E., Jones, G.M., Wanger, P.E., Boman, R.L., Trout, H.F. & LSCH, T.N., 1982. A dairy cow body condition scoring systems and its relationship to selected production variables in high producing Holstein dairy cattle. *Journal of Dairy Science 77, 2695-2703.*