ASSESSMENT OF REPRODUCTIVE AND PRODUCTIVE PERFORMANCE OF CROSSBREED AND LOCAL DAIRY CATTLE UNDER SMALLHOLDERS MANAGEMENT PRACTICES IN URBAN AND PERI-URBAN DAIRY PRODUCTION SYSTEM IN ALETA WONDO DISTRICT, SIDAMA REGION, ETHIOPIA

MSc THESIS

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HAWASSA UNIVERSITY

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APPROVAL SHEET - I

SCHOOL OF GRADUATE STUDIES

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This is to certify that the thesis titled "ASSESSMENT OF REPRODUCTIVE AND PRODUCTIVE PERFORMANCE OF CROSSBREED AND LOCAL DAIRY CATTLE UNDER SMALLHOLDERS MANAGEMENT PRACTICE IN URBAN AND PERI-URBAN DAIRY PRODUCTION SYSTEM IN ALETA WONDO DISTRICT SIDAMA REGION ETHIOPIA**"** is submitted in partial fulfillment of the requirements for the degree of Master of Science in Animal and Range Sciences with a specialization in Animal production of the Graduate Program of the School of Animal and Range Sciences, Hawassa College of agriculture, and is a record of original research carried out by **Gizachew Endeshaw I.D.No GpAProR/0005/13**, under our supervision and no part of thesis has submitted for any degree or diploma. The assistance and the help received during the course of this investigation have been appropriately acknowledged. Therefore, we recommend that it will be accepted as fulfilling the thesis requirements.

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DEDICATION

I dedicate this thesis manuscript to my mother Zenebech Gilo and my Families, for their nursing with all affection, love and for their dedicated in my success endeavor throughout my life

LIST OF ABBERVIATIONS

AFC	Age at First Calving
AI	Artificial Insemination
AFS	Age at First Service
CI	Calving Interval
CSA	Central Statistical Agency
D	Days
DMY	Daily Milk Yield
DO	Days Open
FAO	Food and Agriculture Organization
FGD	Focused Group Discussion
FMD	Foot-and-mouth disease
GDP	Gross Domestic Product
GLM	General linear model
HF	Holstein Friesian
LL	Lactation Length
LMY	Lactation Milk Yield
LSD	Lumpy skin disease
LSM	Least square means
NGO	Non-government organization
NSC	Numbers of Service per Conception
VWP	Voluntary Waiting Period

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By Gizachew Endeshaw

Major advisor: Sintayehu Yigrem (PhD)

ABSTRACT

The aim of the study was to assess productive and reproductive performance of local and their crossbred of different exotic blood level of dairy cows and factors affecting their performance in urban and peri-urban, farming system of aleta wondo district sidama region Ethiopia. A total of 155 small-scale dairy cows owners were purposively selected and interviewed with pre-tested structured questionnaire to obtain information. For Monitoring study from 155 farmers 36 Dairy farmers who have lactating cow by identifying exotic blood level of each crossbred animal (0%, <50%, 50-75% and >75% were purposively selected. Monitoring study was also conducted to obtain milk production based on, lactation stages production system and exotic blood level and parity of cows. The results of the study showed that from the follow-up study, the average daily milk yield for local, <50%, 50-75% and > 75% caws was 2.81L, 8.65L, 17.68L and 20.83L respectively. Daily milk yield of the cows found in monitoring study was support milk yield found in survey study. From the survey results, the overall average lactation length for local and their crossbred of < 50%, 50- 75% and > 75% was 7.65, 8.05, 8.95 and 9.65 month respectively and average mean for crossbred was 8.88 months. The mean age at first service (Months) for local and their crossbred of < 50%, 50-75% and >75% was 42.87, 35.57, 21.88 and 17.54 months

respectively and average for crossbred was 24.99, age at first calving (Months), for local and their crossbred of < 50%, 50-75% and > 75% was 49.26, 41.56, 27.86, and 26.61 respectively and the average for all crossbred was 32.01, Calving interval (Months) for local and their crossbred of<50%, 50-75% and >75% was 22.41, 16.73, 13.41 and 12.75 respectively and average for all crossbred was 14.29, Days open till conception (Days) for local and their crossbred of < 50%, 50-75% and > 75% was 201.3, 173.7, 87.15 and 86.1 respectively and average for all crossbred was 115.65, and number of services per conception for local and their crossbred of < 50%, 50-75% and > 75% was 3.53, 3.1,1.6 and 1.4 respectively and average for all crossbred was 2.03. There was observed that all exotic blood level of crossbred and local dairy cows are good performed under urban than peri-urban setting. The present study showed that even if productive and reproductive performance of crossbred cows owned by peri-urban and urban dairy producers in study area was comparatively good,it need to advance breeding strategy to assign right exotic blood level at right production system and also supply of improved genotypes and dairy inputs like (feed, health care and artificial insemination), proper breeding management in the study area suggested.

Key words: *Crossbred, local, Productive and Reproductive traits, Urban, Peri-urban, sidama region Ethiopia.*

1. INTRODUCTION

1.1. Background

Milk is one of the most important sources of animal protein for human diets and dairy production is a key element of agriculture worldwide (FAO, 2018). Milk from dairy cow represents nearly 100% of the milk produced in Latin America and Oceania (FAO, 2019). In Africa, above 75% of the milk comes from cow grazing natural pastures (Gebrekidan *et al*., 2019). Despite the economic importance of dairy production systems and their major role for the household security of millions of people, the productivity is low (FAO, 2019). The total numbers of dairy cattle in the world are in Africa (77%) and Asia (33%), in Europe and North America (49% and 51%, respectively) of the world's milk production (FAO, 2018).

Ethiopia is the first country having largest population of cattle in Africa (CSA, 2018). The sector contribute significantly to the national economy and the livelihood of the people especially in the rural area by generating income to the farmers, ensuring food security and contributing to the asset, social, cultural and environmental values in order to sustain the people livelihoods (Azage *et al*., 2011; Mebratu *et al*., 2018; FAO, 2019; Gebrekidan *et al*., 2019). According to the report of CSA (2018), the total cattle population of the country (60.39 million); where female cattle constitute about 54.68%, out of this dairy cows are estimated to be around 6.66 million (11.03%) and 45.32% are male cattle.

Dairy cows offer an important source of cash income, calories and key nutrients, and mitigate the effects of often large seasonal fluctuations in availability of cereals through milk production (Aynalem *et al*., 2011; Kebede *et al*., 2017 and Kasa *et al*., 2018). Milk is a good source of dietary fat, energy, protein and other nutrients in general and provides substantial amounts of

nutrients such as calcium, magnesium, selenium, zinc, riboflavin, vitamin B12 and pantothenic acid particularly (Azage *et al*., 2013; Ayalew, 2017 and Kiros *et al*., 2018).

Despite the largest cattle population the production and reproduction performances of dairy cows are very low due to a number of reasons. The low genetic potential of the indigenous cattle for milk and meat production, low adaptation ability of exotic and hybrid dairy cows, substandard feeding, poor health care and other management practices can be mentioned as some of the challenges (Belay *et al*., 2012; Azage *et al*., 2013; Abunna *et al*., 2018; Kasa *et al*., 2018; Mebratu *et al*., 2018). In order to identify the major factor that affects the performance efficiency of the dairy cows, investigation of the all aspects of management practices under small holders in their production systems is very important task to be encouraged.

Several studies have been carried out to investigate the production and reproduction performance of dairy cows (Asrat *et al*., 2013; Belay and Janssens, 2016, Kiros *et al*., 2018; Alemu, 2019). However, a lot of previous studies neglects the dairy cows being kept under small holder management systems in dairy production systems notably under rural setups (Belay *et al*., 2012, Ayalew and Feyisa, 2017). Thus, the milk production and its supply in the small towns and rural area needs findings to assess and explore the reproductive efficiency of dairy cows under small holders within the peri-urban and urban dairy production systems (Belay *et al*., 2012; Azage *et al*., 2013; Dejene, 2014 ;Ayalew, 2017).

In Ethiopia, dairy cows play a crucial role in development and represents a significant part of the urban, peri-urban and rural economy (Azage *et al*., 2013; Alemu, 2019). Unfortunately, the reproductive efficiency of crossbred and indigenous dairy cow is poor in most cattle production systems, mainly because cows fail to become pregnant primarily due to management problems,

shortage of feed and high prevalence rate of reproductive diseases as well as high calf mortality rates (Belay *et al*., 2012; Ayneshet *et al*., 2018). In the study area, there has been a substantial effort of holding crossbred and indigenous dairy cow by smallholder farmers under urban and peri-urban production system (SZLFRD, 2020). However, farmers are being troubled due to the factors such as shortage of feed, feed resources and problem of reproductive diseases. Besides, the reproduction performance of dairy cow it has not been studied in the study area. Consequently, there is a need to assess the current reproductive performance of dairy cows in the study area. Therefore, the aim of the present study was to assess the productive and reproductive performances of crossbred cows managed under smallholder management conditions, and compare different genotypes and management conditions. Key challenges of productive and reproductive management in the study areas were assessed, and comparisons were made between urban and peri-urban dairy farming system in study area.

1.2. Objective of the study

1.2.1. General objective

- To investigate the productive and reproductive performances of crossbreed and local dairy cattle under smallholder management system in urban and peri-urban Dairy Farming Systems in Aleta wondo district

1.2.2. Specific objectives

- To compere productive and reproductive performances of different exotic blood level of crossbreed and local dairy cattle in study area
- To evaluate milk production performance of different exotic blood level of crossbred and local dairy cows by monitoring milk productions in selected kebeles

2. LITERATURE REVIEW

2.1. Dairy production systems in Ethiopia

In the traditional milk producing regions, especially those of Africa, milk production is mainly occurring on small farms. Smallholder dairy production systems, where milking is done manually, are highly labor intensive and heavily rely on family labour Anteneh, (2010). Dairying uses feed resources efficiently and as milk is produced and sold daily, provides regular income to the producer (Ayenew *et al*., 2008). Milk is perishable and bulky, that is why it requires strict quality regulations and has high transport cost (Walshe *et al*., 1991). A large variety of high quality milk products is produced which are highly palatable and nutritious and provide added value (Ayenew et al., 2008). The Ethiopian dairy sector has been classified in various ways. Ketema and Tsehay (1995) distinguish four major systems of milk production. These are the pastoralist system, rural highland smallholder dairy farming, urban and peri-urban small scale farming and intensive large-scale systems. Relevant for this study were the rural highland smallholder and the urban/ peri-urban small scale dairy farming systems.

2.1.1. Urban Dairy Production System

This system is developed in towns located in the different agro-ecology of Ethiopia. Itcomprises medium to large sized dairy farms which are capable of keeping improved dairy stock. Cattle are housed in improved shelters made of locally available materials (Desta, 2002). As farmers have limited access to farming or grazing land, they are often based exclusively on livestock under stall feeding conditions (Ayenew *et al.,* 2008). The main feed resources are agro-industrial by-products and purchased roughage. The primary objective of milk production is generating additional cash income (Aneteneh *e al.,* 2010 and Desta, 2002). This production system serves as the main milk supplier to the urban market (Ayenew *et al.*, 2008; Ahmed *et al.*, 2004). Milk is

either sold to dairy cooperatives, on the local informal market or directly to consumers from the farmers' gates (Tegegne *et al.,* 2007).

2.1.2. Peri-Urban Dairy Production System

This system is located around major cities and towns. It comprises of small sized to medium dairy farms which are also capable of keeping improved and local dairy stock. Cattle are housed in improved shelters made of locally available materials (Desta, 2002). The farmers have small size of grazing land; they use semi-grazing systems and also practice under stall feeding conditions for improved animals (Ayenew *et al.,* 2008). The main feed resources are agro-industrial by-products, purchased roughage and in addition they use crop residue and pasture land. The primary objective of milk production is also generating additional cash income (Ketema and Tsehay 1995; Aneteneh *et al.,* 2010; Desta, 2002).

2.2. Reproductive Performance of Dairy Cattle

Reproductive efficiency of a herd is an important component of dairy cattle productivity in the world. Economic losses because of poor fertility can be attributed to the cost of prolonged calving interval, increased insemination costs, reduced returns from calves born and forced replacements in the event of culling. A delay in conception because of poor fertility increases calving interval mostly due to the increase in the number of days from calving to conception, (Nishida *et al.,* 2006).

2.2.1. Age at first effective service (AFS)

Age at first effective service is one of the most important fertility properties in dairy cattle. It has direct impact on age at first calving since duration of gravidity has physiologically constant value. Age at first effective service includes the period from the birth of heifer to first

insemination at the age when animal has reached breeding maturity enabling it normal gravidity. Age when animal reaches sexual and breeding maturity for long time was in the center of attention of expert and scientific public in regard to the possibility for shortening of the generation interval. Age at first effective service is determined within defined time limits. Bottom limit is date of birth, and top limit date of conception (Novaković *et al*., 2011).

Age at first breeding coupled with reproductive efficiency to first and subsequent breeding determines age at first calving because gestation length is a fixed interval (282 days) once conception occurs. Thus, the major reproductive challenge for breeding age heifers is to achieve conception by 14 to 16 months of age. Rearing heifers to initiate puberty by 11-13 months so that breeding can occur in a timely fashion is critical to the overall success of a heifer rearing program (Head, 1992). Habib (2011) and Amin et al. (2013) reported that average age at first effective service was 40.2 months and 42 months respectively.

Age at onset of puberty is related to body weight and Holstein heifers normally exhibit their first estrus at a body weight of between 550 to 650 pounds. Nutritional management resulting in poor body weight gain early during development causes reproductive problems because it delays onset of puberty, age at first breeding and ultimately age at first calving. By contrast, research has consistently shown that nutritional management resulting in excessive pre pubertal weight gain reduces milk yield during first and subsequent lactations due to subnormal development of mammary secretory tissue (Head, 1992). Thus, nutritional management of pre pubertal heifers profoundly influences age at puberty, age at first breeding and hence age at calving (Head, 1992).

2.2.2. Age at first calving (AFC)

Age at first calving is the earlier measure of reproductive performance in dairy cattle; only after first calving production cycle commences (Dabdoub, 2009). The age at first calving changes the heifer from a non-producing expensive item into an income generating cow. Early AFC reduces unproductive period and higher the AFC was the additional rearing cost of the animal (Panja and Taraphder, 2012).

Age at first calving is closely related to generation interval and, therefore, influences response to selection. Under controlled breeding, heifers are usually mated when they are mature enough to withstand the stress of parturition and lactation. This increases the likelihood of early conception after parturition. In traditional production systems, however, breeding is often uncontrolled and heifers are bred at the first opportunity. This frequently results in longer subsequent calving intervals (Dayyani *et al*., 2013). Sarkar et al. (2007) studied that the effect of different agro climatic zones on age at first calving was not significant. Estimates of AFC reported by some authors summarized in Table 1

Table 1; Estimates of age at first calving and calving interval

Breed	Country	AFC (d)	CI (d)	Source
Holstein-Friesian cows	Pakistan	987	505	Sattar *et al*. (2005)
Friesian cows	Sudan	870	433	Abdel *et al.* (2007)
Holstein-Friesian cows	Cameron	927	399	Gwaza *et al*. (2007)
Holstein-Friesian Friesian	Egypt	1272	478	Besufekad (2008)
Friesian cows	Ethiopia	921	403	Hammoud *et al*. (2010)
Jersey cows	Ethiopia	1035	450	Habtamu *et al*. (2010)
Jersey cows	Pakistan	1010	487	Suhail *et al.* (2010)
Holstein–Friesian	Ethiopia	1265	561	Amene *et al.* (2011)
Red Chittagong cattle	Bangladesh	1491	422	Habib (2011)
Friesian X zebu cattle	Ethiopia	1041	419	Nuraddis *et al*. (2011)
Holstein-Friesian	Pakistan	894	408	Sandhu *et al.* (2011)
Crossbred dairy cows	Ethiopia	1044	372	Belay *et al.* **(**2012)
Zebu X Holstein-Friesian	Ethiopia	1115	640	Belay *et al.* (2012)
Friesian X zebu cattle	Ethiopia	972	402	Nibret (2012)
Red Chittagong cattle	Bangladesh	1518	454	Amin *et al*. (2013)
crossbred dairy cattle	Pakistan	1300	543	Hassan and Khan (2013)

d=days, CI=calving interval, AFC=age at first calving

2.2.3. Days open

Days Open measures overall reproductive performance for the previous 12 months. This is the interval in days between calving and successful insemination. This is more reliable parameter when determining the reproductive efficiency of a dairy herd to attain an optimal calving interval of 12-13 months, cow should conceive within 85-110 days after parturition (Gizaw *et al*., 2011)). Reproductive parameter is influenced by Feed shortage, silent estrus and lack of proper heat detection might have contributed considerably to the long days open (Belay *et al*., 2012).

Also influenced by estrus detection rate, conception rate, VWP (voluntary waiting period) and culling (Gizaw *et al*., 2011)). Estimates of days open reported by some authors summarized in Table 2.

Table 2: Estimates of days open and number of service per conception

Breed	**Country**	**DO (d)**	**NSC**	**Source**
Holstein–Friesian	Egypt	120	1.95	Oudah *et al*. (2001
Holstein cattle	Turk	114	2.01	Turkyilmaz (2005)
Holstein–Friesian	Ethiopia	174	2.01	Yosef (2006)
Friesian cows	Ethiopia	177	1.72	Gebeyehu *et al.*, (2007)
Holstein–Friesian	Ethiopia	206	2.1	Besufekad (2008)
Friesian cows	Egypt	130	2.1	Hammoud *et al*.,(2010)
Holstein–Friesian	Ethiopia	285	1.69	Gizaw *et al*., (2011)
Friesian X zebu cattle	Ethiopia	171	1.29	Nuraddis *et al*., (2011)
Horro x Friesian	Ethiopia	123	1.97	Gizaw *et al*., (2011)
Horro x Jersey	Ethiopia	109	1.92	Gizaw *et al*., (2011)
Horro (zebu)	Ethiopia	134	2.00	Gizaw *et al*., (2011)
Tunisian Holstein cows	Tunisia	150	2.55	M'Hamdi *et al,*. (2011)
HCrossbred dairy cows	Ethiopia	85	1.52	Hunduma (2012)
Zebu X Holstein Friesian	Ethiopia	155	1.56	Belay *et al*., (2012)
Friesian X zebu cattle	Ethiopia	87	1.2	Nibret (2012)

Iranian dairy cattle	Iran	111	2.1	Motlagh *et al*., (2013)

d=Days, DO=Day open, NSC=Numbers of service per conception

2.2.4. Number of service per conception (NSC)

NSC is one of the measurements for reproductive efficiency. It expresses the fertility level of the dairy herds. It is simple and easy to calculate and understand and it is a good measure of reproductive status, but still, it usually does not indicate reasons on heifers and cows that fail to conceive. The NSC depends largely on the breeding system used. It is higher under uncontrolled natural breeding and low where hand-mating or artificial insemination is used. The NSC was significantly affected by herd, season, placenta expulsion time, lactation length and milk yield (Abdel and Alemam, 2008).

The number of service per conception is directly related to the conception rate in a herd. Conception rate or the proportion of cows inseminated which actually become pregnant, is often reported as "percent successful services". As previously mentioned, estrus detection accuracy may significantly influence conception rate. It should be noted that even though estrus detection accuracy plays a major role, it is not the only thing that affects conception rate. Physiological stress from increased milk production or heat stress, disease (i.e. retained placenta, metritis, mastitis, cystic ovaries (Whittier *et al*., 2002). Motlagh *et al*. (2013) found that the number of service per conception tends to increase significantly with increase age (47 to 48 month). The possible cause of the low NSC for younger cows was not clear. Razi *et al*. (2010) absorbed that the conception rate of parity 3 and 4 was 77% and 75%, respectively. Cows with parity 3 and 4 have several times increased conception rate than nulliparous. Among the age group, the highest conception rate was in between 4 and 5 years, 71% and 74%, respectively and lowest conception rate was in cows of 9 years of age or above. Animals with 1-2 services showed conception rate

61% and animals with 3 and more than three services showed conception rate was 50%. Conception rate was significant Increased in both parity 3 and parity 4 than nulliparous, but cows with age group more than 9 have significantly decreased conception rate than other age group.

However, Habtamu *et al*. (2010) working with Jersey cows observed that there is insignificant effect of parity number on number of services per conception. Similar results also were reported by Hammoud *et al*., (2010) study on reproductive performance of Friesian cows under semiarid conditions in Egypt, Who reported that Parity had no significant effect on NSC. The NSC was highest at the third lactation followed by the first lactation. Estimates of NSC reported by some authors summarized in Table 2.

2.2.5. Calving Interval (CI)

Calving interval is a time elapsed between two consecutive successive parturitions (Gebrekidan *et al*., 2012 and Yifat *et al.* (2012) reported that cross breeds have slightly shorter calving intervals than indigenous Cattle. Another study supporting this verdict reported in North Showa zone indicated that indigenous breeds have larger calving interval than crossbreds (Mulugeta and Belayneh, 2013). Calving interval can be divided into three periods: gestation, postpartum, anestrus (from calving to first estrus) and the service period (first postpartum estrus to conception). Days open is the part of the calving interval that can be shortened by improved herd management (Malik, 2017).

Calving interval closely matched to a yearly production cycle and influences the amount of milk a cow is likely to produce in a given period. Calving interval is an important index of cow productive performance and calving interval of 365 days is desirable for efficient production (Esslemont and Peeler, 1993). Longer calving interval affects overall life time production and

reproduction performance through reduced milk production and less number of calves being born. The shorter the length of calving interval in turn the higher will be life time productivity. Length of calving interval depends on reproduction management of the herd (Suhail *et al*., 2010). Estimates of CI reported by some authors summarized in Table 1.

2.3. Milk Production in Ethiopia

Dairy production, among the sector of livestock production systems, is a critical issue in Ethiopia where livestock and its products are important sources of food and income, and dairying has not been fully exploited and promoted in the country. Despite its huge numbers, the livestock subsector in Ethiopia is low in production in general, and compared to its potential, the direct contribution it makes to the national economy is limited (Sintayehu *et al*., 2008). The national average milk yield per cow per day is 1.54 liters for indigenous cows per capita/year milk consumption in the country is about 16 kg/year, which is much lower than African and world per capita average of 27 kg/year and 100 kg/year, respectively (Belay *et al*., 2012).

Unlike Kenya, the large cattle population of Ethiopia has relatively limited numbers of exotic dairy cattle and their crosses (Muriuki and Thorpe, 2001). According to the report of the Central Statistical Agency (CSA, 2010) the indigenous cattle breeds accounted for 99.19 percent, while the hybrids and pure exotic breeds were represented by 0.72 and 0.09 percent, respectively. Despite its large livestock resource base and an ecological setting suitable for dairy production, is not yet self-sufficient in milk production. Although it was difficult to trace the ownership of improved dairy animals, it is estimated that state and private farms own a total of 128,745 grade and pure female dairy animals of which the small holders sector owns 32,204 crosses and improved female dairy cattle. Consequently, milk productivity in Ethiopia is low. The indigenous zebu breed produces about 400-680 kg of milk/cow per lactation period compared to

grade animals that have the potential to produce 1,120-2,500 liters over 279-day lactation (Mohamed *et al*., 2004). Milk production systems can be broadly categorized into urban, peri-urban and rural milk production systems. Both the urban and peri-urban systems are located near or in proximity of Addis Ababa .The urban milk system consists of 5,167 small, medium and large dairy farms producing about 35 million liters of milk annually. The peri-urban milk system includes smallholder and commercial dairy farmers in the proximity of Addis Ababa and other regional towns. This sector controls most of the country's improved dairy stock. The rural dairy system is part of the subsistence farming system and includes pastoralists, agro pastoralist, and mixed crop livestock producers mainly in the highland areas (Mohamed *et al*., 2004).

Also the dairy sector in Ethiopia can be categorized based on market orientation, scale, and production intensity. Doing so identifies three major production systems: traditional small holders privatized state farms, and urban and peri urban systems (Gebre *et al*., 2000). The traditional smallholder system, roughly corresponding to the rural milk production system described above, produces 97 percent of the total national milk production and 75 percent of the commercial milk production. This sector is largely dependent on indigenous breeds of low-productivity native zebu cattle, which produce about 400-680 kg of milk per cow per lactation period.

The state dairy farms, now being privatized or in the process of privatization, use grade animals (those with more than 87.5 percent exotic blood) and are concentrated within 100 km distance around Addis Ababa. The urban and peri-urban milk production system, the third production system, includes small and large private farms in urban and peri-urban areas concentrated in the central highland plateaus (Felleke and Geda, 2001). This sector is commercial and mainly based on the use of grade and crossbred animals that have the potential to produce 1120-2500 liters

over 279-day lactation. This production system is now expanding in the highlands among mixed crop-livestock farmers, such as those found in Selale and Holetta, and serves as the major milk supplier to the urban market (Gebre et al., 2000; Holloway et al., 2000).

2.3.1. Lactation length

Lactation length is defined as the period between two consecutive calving during which are capable of producing milk or lactating (Amasaib *et al*., 2008). Lactation length is an important production trait as it influences the total milk yield. In most modern dairy farms, a lactation length of 305 days commonly accepted as a standard. This standard allows for calving every 12 months with a 60-day dry period. The 12-month interval has considered "Ideal" for many years. If a cow milked longer than 305 days, her yield for the first 305 days taken as the lactation yield. Some cows are not milked for a full 305 days because they go dry or the lactation terminated for any of several reasons (Zewdu *et al.,* 2013).

Lactation length classes were significant source of variation for milk yield. Among imported Holstein Friesian cows, maximum milk yield was observed in cows with lactation length of >400 days (Lateef *et al*., 2008). Under the traditional system of management milk yield is about 700 kg per lactation, while under improved management milk yield is about 2254 kg per lactation. Holstein-Friesian milk yield is significantly affected by ambient temperature under tropical conditions (Amasaib *et al.,* 2008).

Although, milk yield increased with increase in lactation length, yet it did not seem advantageous to have lactations exceeding one year. The daily milk yield in the later stages of lactation decreases and hence affects the lifetime production. Moreover, longer lactations prolong the calving interval, thereby decreasing the number of calves that could be obtained during the life

span of a cow. Therefore, attempts should be made to select cows on the regularity in breeding so that they should produce calves each year with a lactation period of about ten months (Javed *et al*., 2004).

2.3.2. Daily Milk Yield

Indigenous breed of cows are generally considered low milk producers. However, they are the major source of milk in Ethiopia that account for 97 % of the total milk production in the country (Abaye *et al.,* 1991). Milk yield has remained extremely low with national average of 1.09 liter/day/cow (Dagenae and Adugna 1999). Similarly, Lemma *et al.* (2005) reported that the average milk yield of local Arsi cows was 1.0 liter/head/day. For Fogera cattle the overall average estimate lactation yield was 506.78 liters, which is very low due to poor genetic make-up and shortage of feed and poor management conditions (Mulugeta, 2005) and also shorter lactation length (Gebeyehu, 1999). Milk production per day per head is very low and this is further affected by relatively short lactation length and extended post-partum anoestrus resulting in low production efficiencies (Azage and Alemu 1997).

Table 3**:** Estimates of lactation of milk yield and lactation length

Breed	**Country**	**LMY (kg)**	**LL (d)**	**Source**
Holstein- Friesian	Ethiopia	3183	368	Million and Tadelle (2003)
Sahiwal cattle	Pakistan	1475	248	Bajwa *et al*. (2004)
Friesian cows	Pakistan	3391	278	Javed *et al*. (2004)
Friesian cows	Sudan	3475	294	Abdel *et al*. (2007)
Imported Friesian	Sudan	5468	332	Amasaib *et al*. (2008)

Locally born Friesian	Sudan	4222	321	Amasaib *et al.* (2008)
50% Friesian blood	Sudan	2645	402	Amasaib *et al.* (2008)
56.5% Friesian blood	Sudan	2052	375	Amasaib *et al*. (2008)
62.5 Friesian blood	Sudan	2564	376	Amasaib *et al.* (2008)
Holstein-Friesian Cattle	Pakistan	3977	314	Sandhu *et al.* (2011)
Holstein-Friesian cross	Ethiopia	2314	274	Belay *et al*. (2012)
Tunisian Holstein cows	Tunisia	5807	309	M'hamdi *et al.* (2012)
Holstein Friesian	Pakistan	3438	366	Usman *et al. (*2012)
Brown Swiss	México	3564	348	Utrera *et al*. (2013)
Holstein cows	México	3825	358	Utrera *et al*. (2013)
Indigenous cow	Ethiopia	403	204	Niraj *et al.* (2014)
Holstein Friesian cross	Ethiopia	2123	325	Niraj *et al*. (2014)

LMY=lactation of milk yield, LL=lactation length

2.4. Factors Affecting Milk Yield

Performance of dairy animal is judged from the milk it produces during a specified period of lactation. Variation observed in lactation milk yield from lactation to lactation in the same animal. The main reason of variation attributed to the physiology of lactation is the given set of genes and their reaction with non-genetic factors. The lactation performance of dairy cattle is usually measured by determining total milk yield per lactation or per year, average daily milk yield, lactation length (Zewdu *et al*., 2013). Management, nutrition, lactation turn or the age, year and season in which lactation started are the leading environmental factors affecting lactation performance in cattle (M'hamdi *et al.*, 2012). Also, lactation performance in dairy cattle

depends upon genetic and environmental factors. Genetic background, climate, diseases, feeding, year and season of calving, Breed, age, stage of lactation, parity and milking frequency have been reported to affect milk production and lactation length (Msanga et al., 2000 and Epaphras *et al*., 2004).

2.4.1. Location

The climate in a certain geographical area, particularly temperature and relative humidity, greatly influence the production potential of the animals (McManus *et al*., 2011). In lactating cows body heat production is associated with increases milk yield because metabolic processes, feed intake and digestive requirements increase with yield (West, 2003). The heat stress to which a lactating cow is exposed is a combination of heat accumulated from an environment and a failure to dissipate heat associated with metabolic process (Usman *et al*., 2013).

According to West (2003) the temperature (28°C) at a high humidity (80%) showed more effect on the cows' feed intake, milk yield, milk composition, heat production, evaporative heat loss and time spent lying down than when humidity was low (40%). The effects of humid hot conditions are more severe than the dry hot. High temperature and relative humidity reduces evaporative cooling, so under hot and humid conditions the dairy cattle cannot dissipate sufficient body heat to avert a rise in body temperature.

2.4.2. Parity

Parity is one of the major sources of variation in milk yield (Mulindwa *et al.*, 2006). The finding tallies with other studies and may be partly explained by highest milk production capacity coupled with greater feed intake in older cows than young ones. However, cows in 4th and more lactations were no longer better producers compared to those in their 3rd lactation. The older age

may contribute to reduced milk production through turnover rate of secretory cells, with higher numbers dying compared to the newly produced active secretory cells. Fat tissue cells usually replace dead secretory cells. More data are needed to support this suggestion, since only 70 and 33 cow months were registered for 3rd and 4th and more lactation, respectively (Epaphras *et al*., 2004). Thakur and Singh (2001), Javed *et al*. (2004), Sattar *et al*. (2004a), Komatular *et al*. (2010) and Zewdu *et al*. (2013) reported that the lactation milk yield was significantly affected by parity. First lactation cows had lowest milk production, and highest production occurred in 5th parity. Also Sattar *et al.* (2005) observed that the highest and the lowest milk yield were in cows during 3rd and 6th lactation, respectively. The lactation milk yield during 7th lactation was significantly lower when compared with that of 3rd lactation. The lactation milk yield during 6th lactation was also significantly lower as compared to that of 3rd, 4th and 5th lactations. However, Zewdu *et al*. (2013) have reported non-significant effect of parity on lactation milk yield.

2.4.3. Lactation season

Various reports indicated that season of calving play an essential role in most of the productive traits in dairy animals (Amasaib *et al.*, 2008). Zewdu *et al*. (2013) reported that the LMY was affected by season of calving. Lateef *et al*. (2008) found higher lactation milk yield in autumn than those which calved during winter, spring and summer seasons .The difference in milk yield among winter, spring and summer calves was non-significant. Stadnik and Louda, (1999), Abdel *et al*. (2007), Gaur (2007) and Mishra and Joshi (2009) reported that milk production was highest in winter than the other seasons. Whereas Bilal *et al.* (2008) and Usman *et al*. (2011) found non-significant effect of season of calving on lactation of milk yield.

Seasonal variation in animal performance in tropics is expected to be primarily a manifestation of variation in feed quality and quantity (Javed *et al*., 2004). Afridi, (1999) suggested that milk yield was sensitive to seasonal variation. Generally, the cows calving in autumn produced the maximum milk, apparently due to low environmental temperature and availability of good quality fodder. The animals that calved in spring were next in order of merit. The cows calving in dry hot and humid hot seasons were the poorest producers. The cows calving during summer season would have gone through the last trimester of the gestation period during the scarcity period of fodder and severe dry and humid hot season and were immediately confronted with the dry and second scarcity of fodder period (November- December) as they approached peak lactation.

2.4.4. Calving year

Milk yield showed much fluctuation in different years. Year of calving significantly influenced LMY as reported by Atil (2000), Bajwa *et al*. (2004), Javed *et al*. (2004), M'hamdi *et al*. (2012) and Hassan and Khan (2013). The variation in milk yield from one year to other could be attributed to changes in herd size, age of the animals and good management practices introduced from year to another (M'hamdi *et al*., 2012). Stadnik and Louda (1999), Javed *et al.* (2004), Abdel *et al*. (2007), Sandhu *et al.* (2011) and Usman *et al*. (2011) found that milk production was higher in cooler part of the year and was adversely affected by hot weather. The variation in milk yield observed in different years reflected the level of management as well as environmental effects (Javed *et al.*, 2004)

3. MATERIALS AND METHODS

3.1. Description of the Study area

The study was conducted in Aleta Wondo town which is located in Sidama National Regional State Ethiopia, 349 KM south of Addis Ababa and around 60 km from Hawassa, the capital city of Sidama National Regional State. Aleta wondo is bordered with Yirgalem woreda on its northern direction, on the south Dara otilicho woreda, on the East Teticha woreda and on the west Aleta cuko woreda. It has an altitude of Aleta wondo town 2037_2400 m.a.s.l and average annual rainfall of about 900-1400 mm. The temperature of the area ranges between minimum 10^0C and maximum 24^0C. Its geographical location extends from $6^0$36'N to $7^0$01'N and $38^0$04'E to $38^0$24'E. Administratively the Aleta wondo district has 2 urban and 3 pri-urban Kebeles. The town has an estimated land area of 20.4 square kilo meters. The area is characterized by midland agro-ecological zones.

Rainfall is bimodal resulting in two growing seasons, namely the ''belg'' growing season (extending from March to May) and the ''meher'' growing season (extending from June to August). "Belg" is major growing season and a period of land preparation and planting of crops like coffee, maize, enset, and potato. During "meher" season crops such as potato and sweet potato are grown. Coffee, enset (enseteventricosum), maize and pineapple are the main potential crops in the area. Farmers grow enset for multi-purpose uses such as for food, animal feed, to construct traditional houses and for other purposes. In general mixed agriculture (crop and livestock production) is practiced in the study area.

The dominant crops are "Enset", Coffee, Fruit (Pineapple, Banana, Mango, and Avocado), and Annual crop includes Maize and Vegetables like Potato, Tomato and Cabbage etc.

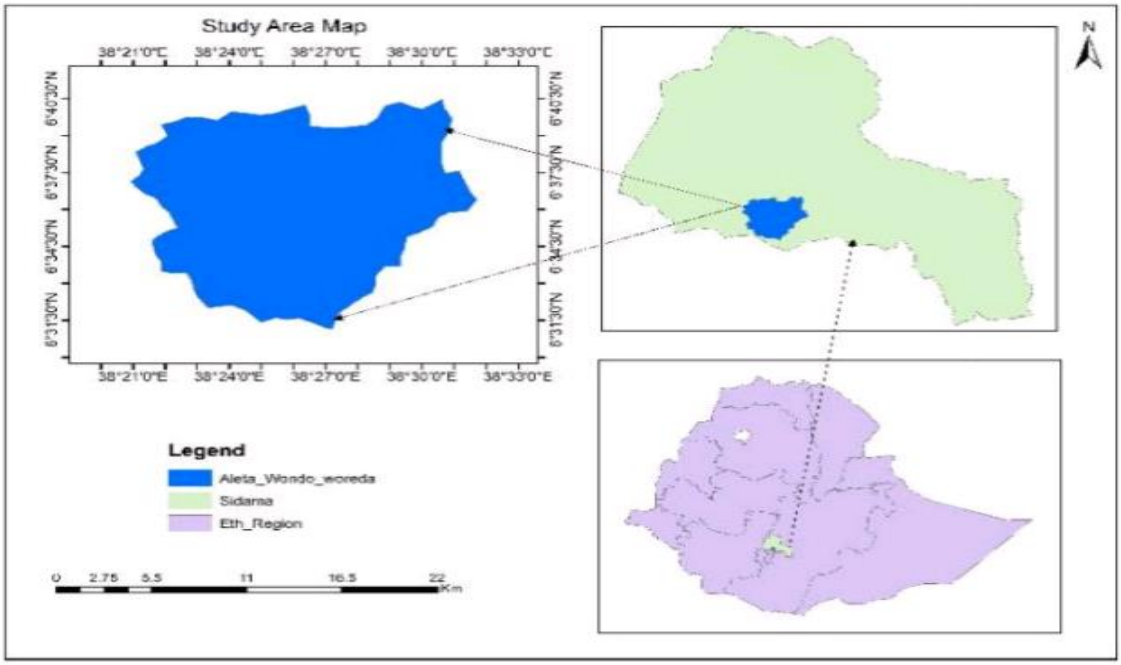

Figure 1 Map of the study area

3.2. Design of the study

The research design for this particular research was cross-sectional survey or non-experimental with households using sem-structured questionnaires, FGDs (Focus group discussions), and key informant interview.

3.3. Sampling Technique and sample size determination

The study was conducted in one purposively selected district Alatta Wondo. It was purposively selected based on its proximity to the all-weather road and potential of crossbred and local dairy cattle population. A multi-stage household sampling technique was used. The district was selected based on the population and availability of crossbred and local dairy cattle. Five kebeles were randomly selected, which included Cheffe and Mesalemiya from urban and Della, Woto

and Titira from peri-urban. Sample size was determined using the formula given by Yemane (1967) for survey studies:

n= $\frac{N}{1+N(e^2)}$ where n = number of sample size, N= number of population in the study area and e= level of precision. According to the above formula,.

n= 2520/1+ 2520(0.078)^2 = 155

Therefore, the sample size for the socio-economic data was 155 households.

The sample size of each kebeles was calculated as follows.

$\mathbf{nk1 = \frac{Nk1*n}{N}, nk2 = \frac{Nk2*n}{N}, nk3 = \frac{Nk3*n}{N}}$**=442*155/2520=27**

Table 4: The Sample Size of the Study Kebeles in the Aleta Wondo district

No	Name of Kebeles	Production system	Total Number of Households	Sample Size
1	Chaffe	Urban	442	27
2	Mesalemya	Urban	483	30
3	Deella	Peri-urban	500	31
4	Woto	Peri-urban	552	34
5	Titira	Peri-urban	543	33
	Total		2520	155

Source: Aleta wondo town agricultural office 2021/2022

3.4. Data Types and Data Sources

Primary data was collected. Primary data are collected from households, FGDs and key informants. Data which are collected from household are by oral interviews.

3.4.1. Primary Data

Primary data was collected directly from the respondents selected farmers from the kebeles. To collected primary data from the respondents, a well-developed interview schedule was prepared both for qualitative and quantitative data. In addition to this, a key informant from Aleta wondo district agriculture office, development agents from the selected kebeles and focused group discussion (FGD) was considered to obtain in-depth information about the study objectives.

3.5. Data collection method and survey study

Structured questionnaire was prepared and used to collected information from crossbred and local dairy cow owners under smallholder condition through one visit interview mainly on production and reproduction of dairy cows. The questionnaire was checked and pretested for clarity of the questions prior the interview. Prior the interviews, Respondents were briefed about the objective of the study before the actual questions and questionnaires were presented. Accordingly, information about the reproductive and production performance of crossbreed and local dairy cattle 0%, >50%, 50-75 and <75% blood levels (age at first calving, age at first service, calving interval, days open, number of service per conception and, daily milk yield and lactation length was collected). The questionnaire was first prepared in English and translated later into the local language (Sidamigna) so that the respondents can easily understand the questions. Data collection from households was carried out by different enumerators, knowledgeable bodies about data collection and the researcher by applying face to face

interview. The selection of enumerators was done depending on the knowledge of the study area, their local language, the educational level and personal willingness to take part in the survey.

After the selection process completed, orientation and discussion about the objectives of the survey, discussions on each questions was also undertaken. Before the collection of actual data, the questionnaire was pretested. Following this, interview schedule was used to collect information from selected respondents.

3.6. Data Collection method for Monitoring Study

For follow-up study, from the total 155 household, 36 households that had lactating crossbred or indigenous cows were identified, from these 28 were crossbred (with different exotic Blood level (<50%, 50-75% and >75% of crossbred) and 6 were for local dairy cows. Whenever the exotic blood level of crossbred cow was identified by looking its certificate that was given from the source of crossbred cows/heifers and asking the bull and dam type it was born from. Based on these data, lactating cows were stratified into early (1–2 months), mid (3–4 months), and late (> 5 months) stages of lactation, for both crossbred and local dairy cattle. This is line with Kedija Husen, (2007) who stratified cows into early (1–2 months), mid (3–4 months), and late (5–6 months) stages of lactation.

Follow-up study information on milk yield of cows was collected based on lactation stages, exotic blood level and parity. During that the amount of milk production produced by sampled crossbred and local dairy cows (n = 36) was recorded. Daily cow milk yield (morning and evening) was measured by using calibrated plastic jog (capacity 1 liters) once a week (as test days measurement fixed for every (Thursdays)) which continued for 6 (six) month from the total 36 dairy cows. In case of crossbred daily milk yield was measured from each exotic blood level of (< 50%, 50-75% and >75% crossbred). The objective of using these criteria was to receive

information on differences in milk yield performance of both indigenes zebu cows and crossbred of different exotic blood level cows across the defined production systems for comparing

3.7. Key informants

This was employed, to gather in-depth data which related with the study objectives. Those key informants are from district sector of agriculture and livestock resources office, concerned with the study issue and participating in availing required information or data that the researcher need. Thus, experts from different sectors, such as livestock resources in general and dairy resources development as well as veterinary experts in particular, and development agents from each kebeles' were included a key informant interview.

3.8. Method of Data analysis

The data was entered and organized in the excel spread sheet and then they were analyzed using SPSS (Statistical Package for Social Sciences), version 22. Descriptive statistics was used to display the result such as mean and standard deviation. ANOVA comparison was performed using significance level at ($p < 0.05$). The following linear models have been used during analysis of quantitative survey data**:**

Model statement regarding the effect of different fixed effects on various performances parameters of crossbred and local dairy cows

$\mathbf{Y_{ijk} = \mu + m_i + b_j + \varepsilon_{ijk}}$ **Where**

Y_{ijk} = is the cows' performance parameters estimate for cow in Age at first calving , Age at first service, lactation length, calving interval, days open and number of service per conception

μ = is the overall mean

,m_i = is fixed effect of production system that affects performance of cows(i= peri-urban and urban)

b_j= is fixed effect of exotic blood levels that affects performance of cows (j= 0%, <50%, 50-75% and > 75%) and

ε_{ijk} = is the residual error.

3.10.1. Data-analysis for monitoring study

Monitoring data was also subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) software, version 22 (SPSS 2003). To analyze continuous monitoring data procedure means was used to compute minimum, maximum and means, and the general linear model (GLM) to compute least square means (LSM) were used. To examine Milk production significance differences between different stage of lactation, parity, Exotic blood level and production system at critical probability of $P<0.05$ was used.

To analyze monitoring data of cows' milk productivity, the following Model statement about the effect of different fixed factors on cow's milk production was used

$Y_{ijsc} = \mu + m_i + l_j + k_s + p_c + \varepsilon_{ijk}$ Where

Y_{ijsc}= the amount of cow's milk produced by i^{th} exotic blood level in the j^{th} production system at s^{th}lactation stage and c^{th} parity

μ = the overall mean,

m_i = the fixed effect of exotic breed blood level (i=0%, <50%,50-75% and >75%)

l_j = fixed effect of production system of the area (j= peri-urban and urban)

k_s = fixed effect of lactation stage (s= early,

mid and late)

P_c = parity of the cows (c= parity 1-4)

ε_{ijk} = the residual error.

4. RESULTS AND DISCUSSION

4.1. Socio economic characters of respondents in the study area

Table 5 shows the socio-economic characteristics of farm households. According to the result 68.4% and 66.3% families were headed by male in urban and peri-urban respectively whereas 31.6% and 33.7% were headed by the female who were widowed and divorced in the urban and peri-urban respectively.

As to the religion of the respondents, was 21.1%, 24.6% and 54.4% in urban and 29.6%, 20.4% and 50.0% in peri-urban categories were Orthodox, Muslim and Protestant respectively. The marital status of the respondents were 64.8%, 24.6%, and 1.8% 8.8% and 67.3%, 23.5%, 2.0% and 7.1% married, single, widowed and divorced in the urban and peri-urban respectively. The occupation of the respondents was 68.4%, 14.0%, 10.5%, 7.0 in the urban and 70.4%, 8.2%, 10.2 and 11.2% in the peri-urban farmers, house wife, merchants and government respectively. The majority (67.1%) of the families in the study area were headed by the males with no difference between urban and peri-urban production system. This is due to the majohrity of the respondents in the area were married.

The number of families headed by males in current study was comparable with the finding of Gebrehiwet *et al*. (2019) who reported 85% and 15% male and female headed respectively in Seharti Samre, South East zone of Tigray regional state, Ethiopia. The result revealed that most (66.5%) of the respondents were married and there was no difference between both production system. The current result was in accordance with the finding of Bereda *et al*. (2012); Belay *et al*, (2012) and Bernabas *et al*. (2018) in Jimma,zone Ezha and Quara district. The results in table 5, revealed that the number of farmer respondents were higher in peri-urban than in urban

production whereas the number of respondents who were participating as merchant in addition to agriculture were higher in peri-urban than in urban production. In general majority (69.6%) of the respondents in the study areas were farmers with no difference between both production systems. The current result was in accordance with the finding of Gebrehiwet *et al*. (2019). South East zone of Tigray regional state, Ethiopia

Table 5: Socio-economic characteristics of respondents in study area

Parameters	Variables	Household Description					
		Urban (n= 57)		Peri-urban(n=98)		Overall (N= 155)	
		Frequency	%	frequency	%	Frequency	%
Sex	Male	39	68.4	65	66.3	104	67.1
	Female	18	31,6	33	33.7	51	32.9
	Total	57	100	98	100	155	100
Age	30-40	20	35.1	35	35.7	55	35.5
	40-45	19	33.3	29	29.6	48	30.9
	45-50	18	31.6	34	34.7	52	33.6
	Total	57	100	98	100	155	100
Religion	Orthodox	12	21.1	29	29.6	41	26.5
	Protestant	31	54.4	49	50	80	51.6
	Muslim	14	24.6	20	20.4	34	21.2
	Total	57	100	98	100	155	100
Marital status	Married	37	64.8	66	67.3	103	66.5
	Widowed	1	1.8	2	2.0	3	1.2
	Single	14	24.6	23	23.5	37	23.9
	Divorced	5	8.8	7	7.1	12	7.8
	Total	57	100	98	100	155	100
Occupation	Farmer	39	68.4	69	70.4	108	69.6
	House wife	8	14	8	8.2	16	10.3
	Farmer	6	10.5	10	10.2	16	10.3
	and merchant	4	7.0	11	11.2	15	9.6
	Government	57	100	98	100	155	100
	Total						

According to the figure 2, the largest proportion of households in the urban production system have a family size of 2-4 (56.9%), which is followed by this 5-8 (37.5%) and above 9 (5.6%). However in the peri-urban system the largest proportion of farm households have a family size of 5-8(60.5%) which is followed by 2-4 (34.9%), and above 9 (4.6%).

This result agreed with reported by Mulugeta and Mabrate, (2017) the number of the respondents who had a family size of 5-8 persons per households in peri-urban production was higher compared to the urban production. In general the family size of the study area was 2-4(44.9%), 5-8(50%) and above 9(5.1%) families. The highest proportion of family size 5-8 (50%) in current study was higher than that of the average national family sizes 5.2 persons per households. The number of high respondents with large family size in the study area may show that family planning should be encouraged to practice. Similarly, Bereda et al. (2012); Belay et al. (2012) and Bernabas et al. (2018). They reported an average of 6 persons living per household in Jimma, Ezha and Quara.

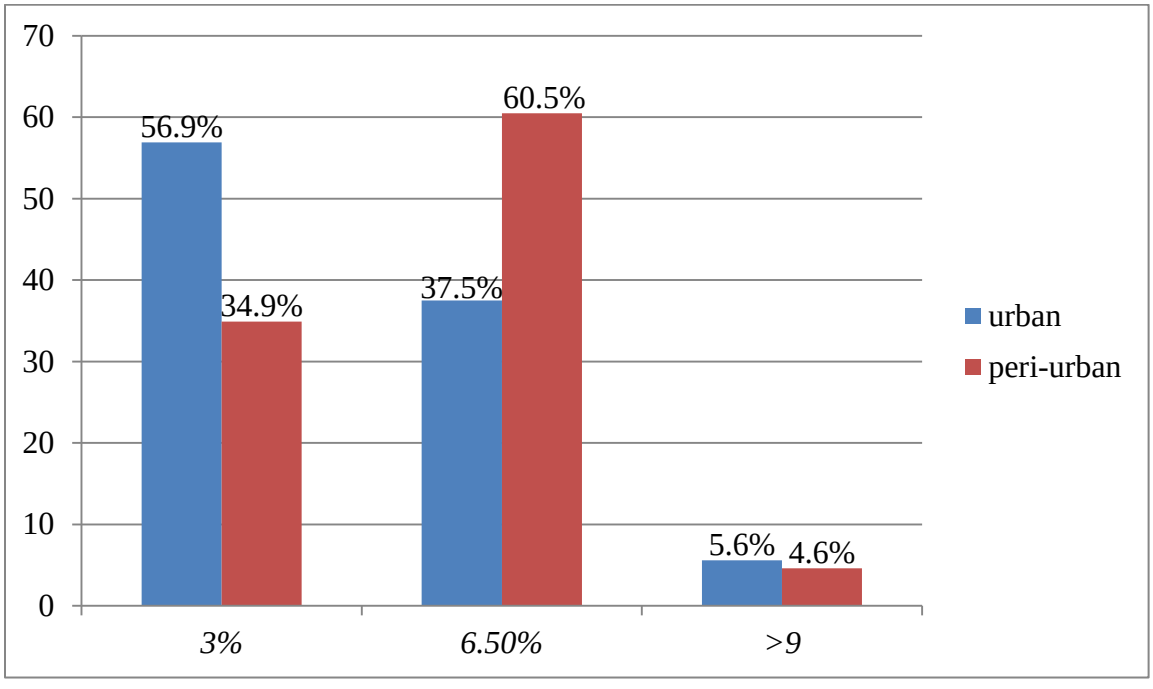

Figure 2: Family size in the study area

According to the figure 3, the largest proportions of farm households in urban system falls in the household head age categories is 30-40 years (35.1%) and 40-45 (33.3%) and above 45-50 years (31.6%); whereas in peri-urban areas it was 30-40 (35.7%), 40-45 (29.6%) and above 50 years (34.7 %) in peri-urban. Overall 35.4% and 30.9% of the respondents in the study area were found in age category of 30-50 (the first two categories) years and above 50 years, respectively. This show as most farmers were at the productive age and can actively manage their own dairy farms.

The result is similar with the finding of (Yohanis and Tilahun, 2021), who reported the same finding around Adama town oromia region. This showed 82 % of dairy producers are up to age of 50. This implies that young farmers have been attracted to the dairy sector; good opportunity to intensify, modernize and optimize economic use

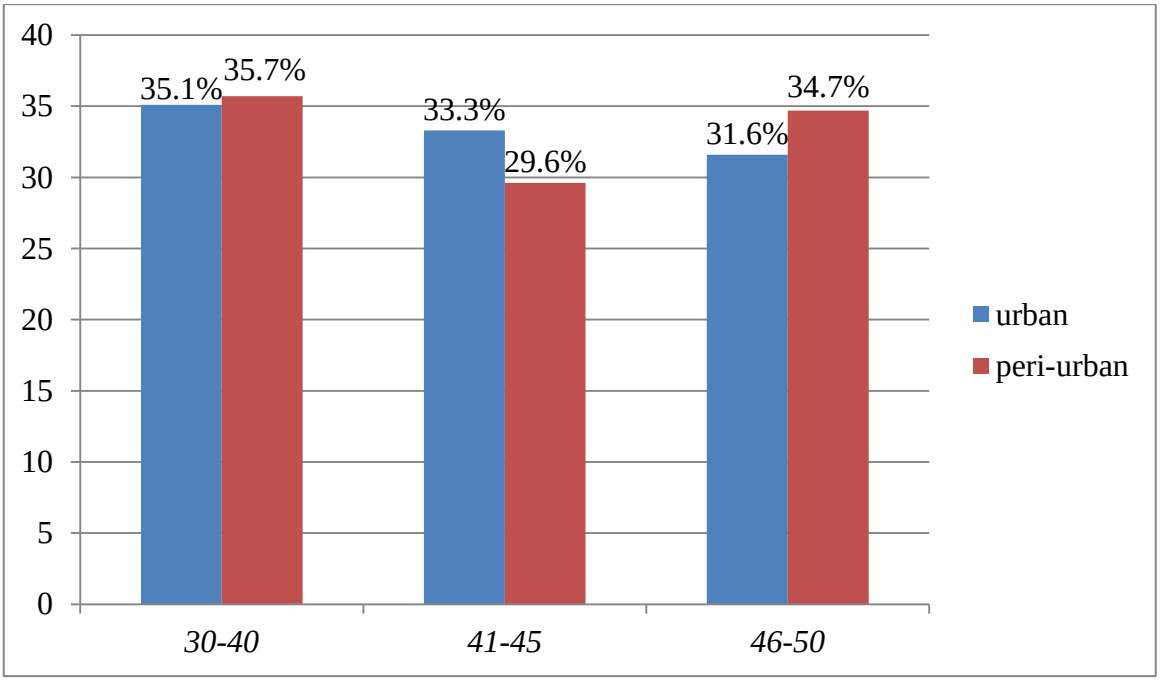

Figure 3: Age category in the study area

Figure 4 shows the education status of the respondents in the study area. Accordingly, 27.4% and 37.8% households were in illiterate in urban and peri-urban areas, respectively. Overall, 32.6% of the household heads were illiterate. The high percentage of illiteracy in peri-urban indicates the education should be encouraged in the area. Those farmers who can read and write were 29.8% and 25.3% in the urban and peri-urban areas, respectively.

This indicates that the presence of high percentage of literate individuals in farming community can be an opportunity for easily training, transfer and adoption of improved management practice. The current result was in accordance with the finding of The illiteracy level of smallholder dairy farmers under the present study area was considerably higher than a central Zone of Tigray, which is 24.25%, as reported by (Gebrekidan *et al*., 2019). Illiteracy negatively affects dairy improvement efforts by slowing the rate of intensification and hindering the adoption of new technology.

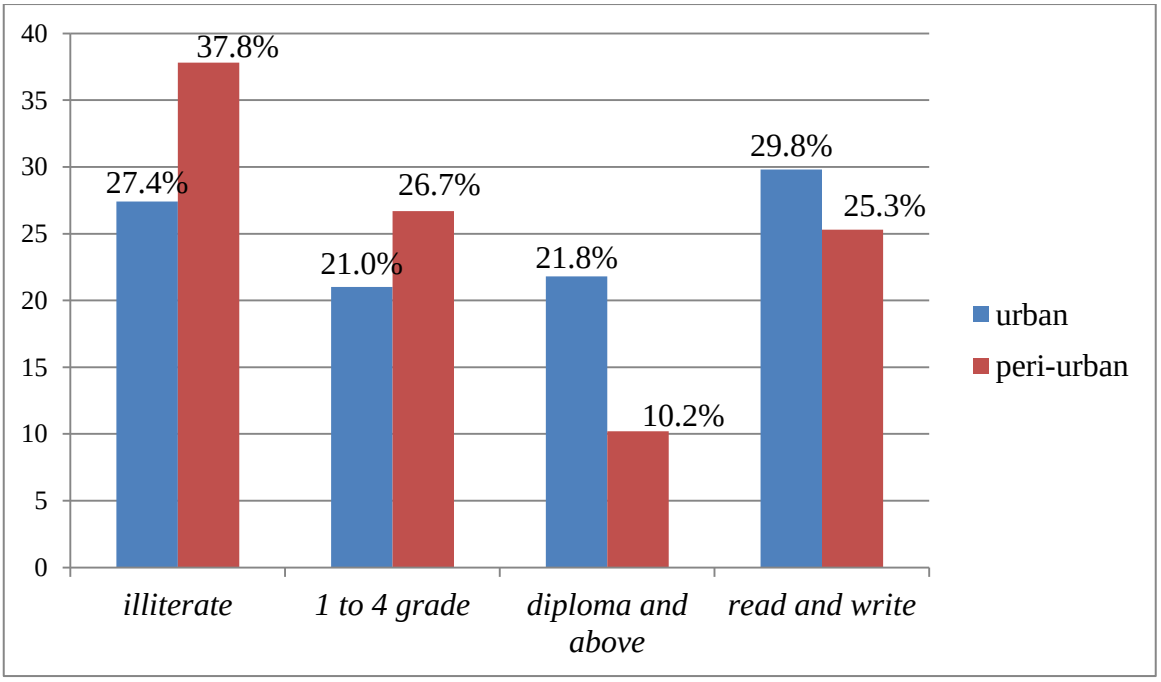

Figure 4: Educational status in the study area

4.2. Cattle Herd size and Composition

In this study the predominant breed of cattle owned by farmers in all production systems were zebu population which is non- descriptive local cattle. On average, the lactating cows were higher (70.3% and 29.7%) in the local breed and crossbred, respectively. On average, the heifer were (43.8 %) and (56.1%) in the local breed and crossbred, respectively. The average, the male calves were (43.8%) and (56.2%) and female calves (60%) and (40%) in the local and cross breed respectively.

Similarly reported by, (Bereda *et al*., 2014) also found lactating cows with the highest proportion in the Gurage Zone. The average, the dairy cows were higher in 64.6% and 35.4% in the local and crossbreed respectively. And the average dairy cows were higher (64.6 %) and (35.4%) in the local and cross breed respectively. Keeping the largest proportion of cows may be advantageous because of their multifunctional usage in milk production, replacement stock, and manure. In the present study, this lower average of heifer could be attributed to a significant land constraint on providing sufficient feed for their animals. In general, more local breeds were kept in the herd than crossbreds. The proportion of cattle herd mean obtained in this finding was less than that reported by Beriso (2015) and Tesfaye & Wondossen (2019) in Aleta Chuko and Gurage Zone

Table 6: Cattle herd size and composition across production system

Cattle breed and type		Urban (n=57)		Peri-urban (n=98)		Overall (n=155)	
		Frequency	%	Frequency	%	Frequency	%
Lactating cows	Local	42	73.7	67	68.4	109	70.3
	Cross	15	26.3	31	31.6	46	29.7
Dairy cows	Local	38	66.7	62	63.3	100	64.6
	Cross	19	33.3	36	36.7	55	35.4
Heifer	Local	23	40.4	45	45.9	68	43.8
	Cross	34	59.6	53	54.1	87	56.1
Male calves	Local	24	42.1	44	44.9	68	43.8
	Cross	33	57.9	54	55.1	87	56.2
Female calves	Local	35	61.4	58	59.2	93	60.0
	Cross	22	38.6	40	40.8	62	40.0

4.3. Feed Supplementation and types of feeds

According to the table 7, all respondents in the study areas were supplementing their local and crossbreed dairy cattle both in dry and wet seasons with interval of 28.1% and 8.8% in urban and 29.6% and 12.2% in peri-urban area daily, once in 2 days and whenever available respectively. The types of feed used for supplementation were about 47.3%, 52.7% and 47%, 53% respondents supplement their dairy cattle with wheat bran, salt and concentrate feeds in urban and peri-urban respectively.

Natural pasture does not fulfill the nutritional requirements of animals particularly in the dry season due to poor management and poor quality. Thus, provision of supplementary feeds to increase the productivity of livestock is essential (Duguma and Janssens, 2016). Although feed types used for supplementation differs, all (100%) respondents in the study area were supplemented their dairy cattle both in dry and wet season. The current result was greater than that of Alemu *et al*., (2013), who reported about 92.7% of farmer's practice supplementing feeds for dairy cattle in Esera Woreda, Dawuro Zone. In general feed supplementation interval for dairy cattle was 60% and 29.0% daily and once in 2 days in the study area.

A similar finding was reported by the Alefa and Quara district (Ayeneshet *et al*., 2018), Ada'a and Adama Zuriya district (Bekele *et al*., 2019), and the southern Ethiopian rift valley (Bedada *et al*., 2021). Due to high cost, a limited number of smallholder farmers used commercial concentrate feed.

About 47.3% and 47% respondents supplement their dairy cattle with wheat bran and salt in addition to the above listed feed types in urban and peri-urban area respectively. The current result was greater than that of 23.5% and 24.7%, similarly reported by, 80% of dairy farmers in Jimma area didn't used concentrate feed for the same reason (Duguma, 2020).

Thus, across all the different Ethiopian dairy cattle production systems, major roughage feeds, including natural pasture and crop residues, were used as main feed sources (Ayenew and Tegegne, 2007). Both feeding strategies have been observed in the peri-urban areas of Ada'a and Adama zuriya (Bekele *et al*., 2019), peri-urban Sululta and urban Holetta (Kiros *et al*., 2018), and the Amhara and Tigray areas of Ethiopia (Makkar *et al*., 2018) In the current study, stall feeding practices were lower than in North Shoa's urban and peri-urban production contexts, where around 77 % of smallholder dairy farmers practiced it (Lakew *et al*., 2019).

Table 7: Feed supplementation for local and crossbreed dairy cattle in the study area

Feed supplementation	Variable	urban(n= 57)		Peri-urban(n=98)		Overall(N=155)	
		Frequency	%	Frequency	%	Frequency	%
Do you provide your dairy cattle with supplementary feeds?	Yes	57	100	98	100	155	100
	No	-	-	-	-	-	-
Season of feed supplement	Both during dry and wet season	57	100	98	100	155	100
In what interval do you supplement?	Daily	36	63.1	57	58.2	93	60
	Once in 2 days	1 6	28.1	29	29.6	45	29.0
	Whenever available	5	8.8	12	12.2	17	11
Type of feeds for supplement	wheat bran and salt	27	47.3	46	47	73	47.0
	Concentrate feeds	30	52.7	52	53.0	82	52.3

4.4. Water sources and frequency of watering

As described in the table 8, all respondents in urban and peri-urban provided water for their dairy cattle in the study area. And also during dry season river in urban area (34.0%) and pond (66.0%) were the main sources water in peri-urban whereas pond (39.8%) and deep well (60.2%) were main sources of water. During dry season respondents in peri-urban area were not using river as source of water due to pollution from coffee industries from nearby areas. During wet season the sources of water was river (23%) and pond (27%) in urban whereas river (38.8%), pond (44.9%) and deep well (16.3) used as sources of water in peri-urban area. In general pond (48.2%) and deep well (40.7%) during dry season and river (33.6) and pond (39%) during wet season were the main sources of water in the study area. Similarly reported by, Tesfaye and Wondossen, (2019) for Gurage Zone, Bekuma and Addisu, (2021) for Buno Bedele Zone, and Hosanna town have all indicated such water sources. And also Similar to the Alefa district of North Gondar Zone (Ayeneshet *et al*., 2018), near half of (44.1 %) of dairy producers in Dilla Zuriya provided water twice a day. Although farmers in Jimma and Gurage areas use similar water sources to the present area, the frequency of watering in those areas has been affected by seasonal changes Tesfaye and Wondossen, (2019) and Duguma, (2020)

As summarized in the table 9, during dry season most of the respondents (75%) provide water for dairy cows once a day in the study area. During wet season all of the respondents who provide water for dairy cows them once a week in urban area whereas 23.4% and 76.6% of respondents in peri-urban area were provide once in 3 days and once a week respectively.

The result was in accordance with the report of Tesfaye and Wondossen, (2019) for Gurage Zone, Bekuma and Addisu, (2021) for Buno Bedele Zone, and Hosanna town have all indicated such water sources. Similar to producers Alefa district of North Gondar Zone (Ayeneshet et al.,

2018), provides water once to the dairy cattle during dry season. The current result was different from report of Tesfaye and Wondossen, (2019) and Duguma,(2020), the provided water twice a day who noted most of the respondents in provide water twice for dairy cows during dry season. According to the discussion with key informants most (80.1%) of the respondents in the study area were provide water for dairy cattle once a week by considering moisture content of the feed during wet season. The current result was different from report of (Bekele *et al*., 2019), peri-urban Sululta and urban Holetta (Kiros *et al*., 2018), and the Amhara and Tigray areas of Ethiopia (Makkar *et al*., 2018) who noted all of the respondents provide water once a day for dairy cattle during wet season.

Table 8: Sources of water for local and crossbreed dairy cattle in the study area

Parameters	Variables	urban(n= 57)		Peri-urban(n=98)		Over all(N= 155)	
		Frequency	%	Frequency	%	Frequency	%
Do you provide water for dairy cattle?	Yes	57	100	98	100	155	100
	No	-	-	-	-		-
	Total	57	100	98	100	155	100
Sources of water during dry season	River	16	34.0	-	-	16	11.1
	Pond	31	66.0	39	39.8	70	48.2
	Deep well	-	-	59	60.2	59	40.7
	Total	47	100	98	100	145	100

Sources of water during wet season	River	11	23	38	38.8	49	33.6
	Pond	13	27	44	44.9	57	39
	Deep well	-	-	16	16.3	16	11
	Not provided	24	50	-	-	24	16.4
	Total	48	100	98	100	146	100

Table 9: Frequency of watering and reason for not watering for dairy cattle in the study area

Parameters	Variables	Local and cross breed dairy cattle in the study area					
		urban (n=57)		Peri-urban(n=98)		Overall (N= 155)	
		Frequency	%	Frequency	%	Frequency	%
Frequency of watering during dry	Once a day	32	64	79	80.7	111	75
	Twice a day	18	36	19	19.3	37	25
	Total	50	100	98	100	148	100
Frequency of watering during wet	Once in 3 days	-	-	23	23.4	23	19.9
	Once a week	18	100	75	76.6	93	80.1
	Total	18	100	98	100	116	100
Reason for not watering	Due to disease	33	100	-	-	33	100
	Total	33	100	-	-	33	100

4.5. Water shortage and reason for water shortage

According to the table10, 22.9% and 55.1% respondents had the problem of water during dry season in urban and peri-urban respectively. In general majority (43.2%) of the respondents had the problem of water shortage during dry season in the study area. As described in table 10, reason for the shortage of water was 28.1% and 71.9% and 47.9% and 52.1% due to drying of water sources and pollution from coffee industries in urban and peri-urban respectively. Similarly, Tesfaye and Wondossen, (2019 and Duguma, (2020).reported that 44.1% of the respondents who had the shortage of water in Gurage Zone in Southern Ethiopia.

The reason for the shortage of water was 69.6% and 30.4% and 47.2% and 52.8% due to drying of water sources and pollution from coffee industries in urban and peri-urban respectively. The majority of respondents in urban area faced water shortage due to pollution from coffee industries. The reason for this problem was Aleta Wondo District specializes coffee in peri-urban production system and there were many coffee industries planted on the water sources (river) in this area where as most parts of the urban area specializes annual crops like barley, wheat, bean, pea and others than coffee plants. According to the discussion with key informants farmers who had the problem of shortage use water sources like deep well and other sources from neighbor farmers.

Table 10: Water shortage, season of shortage and reason in the study area

Parameters	Variables	urban (n= 57)		Peri-urban (n=98)		Overall (N= 155)	
		Frequency	%	Frequency	%	Frequency	%
Is there water shortage in your area	Yes	13	22.9	54	55.1	67	43.2
	No	44	77.1	44	44.9	88	56.8
	Total	57	100	98	100	155	100
Season for water shortage	Dry season	20	100	69	100	89	100
	Wet season	-	-	-	-	-	-
	Total	20	100	69	100	89	100
Reason for water shortage	Drying of water	16	28.1	47	47.9	63	40.6
	Due to pollution	41	71.9	51	52.1	92	59.4
	Total	57	100	98	100	155	100

4.6. Diseases, Parasites and health management in local and crossbreed dairy cattle

According to the table 11, LSD, Mastitis and parasites (internal and external) were the main diseases and parasites which affect dairy cattle in the study area. The interview result revealed that 15.8%, 59.7% and 24.5% respondents in urban areas used ethno-veterinary practices in addition to Government veterinary center, whereas in pri-urban area 15.3% 77.6% and 7.1% respondents were used Government veterinary center, ethno veterinary center and private veterinary center respectively. Dairy cattle disease and parasites were the main constraints for

cattle productions. Disease lowers the productivity of animals and may cause economic loss. According to the results of interview Fasciolosis disease was more occur in urban than in peri-urban production. The current result was in accordance with the finding of (Ayeneshet *et al.*, 2018) and West Hararghe Musa and Mummed, (2020). Besides, Lombebo & Wosoro (2019) stated that Hosanna town's urban dairy farmers who reported internal parasites, external parasites in order of their importance in Hosanna town's Hadiya Zone.

According to the discussion with key informants farmers were using ethno veterinary practices and buying medicines from private veterinary centers due to the problem of access and cost of medicines. According to the similarly reported by, Gebremichael and Haile Mariam, (2019) and Alefa and Quara Districts in dilla zuriya (Ayeneshet e t al., 2018). Due to distance, awareness and cost of veterinary service, farmers use traditional methods to control common diseases following by veterinary services in Ethiopia.

Table 11: Diseases, Parasites and health management of local and cross breed dairy cattle in the study area

Parameters	Variables	Urban(n= 57)		Per-urban(n=98)		Overall(N=155)	
		Frequency	%	Frequency	%	Frequency	%
Do you have access to Veterinary center?	Yes	57	100	98	100	155	100
	No	-	-	-	-	-	-
	Total	57	100	98	100	155	-
Diseases	LSD	57	100	98	100	155	100
	Fasciolosis	32	56.1	23	23.4	55	35.4
	FMD	25	43.9	54	55.1	79	60
	Mastitis	57	100	98	100	155	100
Parasites	Internal parasites	57	100	98	100	155	100

	External parasites	57	100	98	100	155	100
What do you do if your dairy cattle sick?	Use ethno and vet center	9	15.8	15	15.3	24	15.4
	Take to vet center	34	59.7	76	77.6	110	71
	Use private vet center	14	24.5	7	7.1	21	13.6
	Total	57	100	98	100	155	100

4.7. Housing of local and crossbreed dairy cattle

Table 12 shows housing systems, types of houses, reason for housing and frequency of house cleaning. Accordingly 75.4 % and 24.6% in urban and 40.9% and 59.1% in peri-urban respondents practiced housing dairy animals using separate barn. All respondents in the study area housed their local and crossbreed dairy cattle during night, sun and rain and to protect from theft and predators with no difference between both are urban and peri-urban respectively.

Frequency of cleaning house during dry season was practiced once by all respondents in study area. During wet season 33.3% and 66.7% in urban and 39.8% and 60.2% in peri-urban practice cleaning house once and twice respectively. In general majority (62.6%) of the respondents clean dairy houses twice a day. Tesfaye and Wondossen,(2019) reported by Similarly in Gurage Zone.

The overall result revealed that 53.6% and 46.4% respondents in the study area were housed their dairy cattle in main house with separate barn and in separate barn respectively. The current result is in lined with the finding of (Broucek *et al*., 2017). The majority (56.7 %) of dairy farmers in Dilla Zuriya district Zone of Southern Ethiopia. The result was different from the report of (Beyene *et al*., 2015). In Dilla Zuriya district, traditional housing types were

common, and majority (93.3%) of dairy farmers construct dairy who noted different report in different parts of the country.

According to the discussion with key informants, all farmers in the study area housed all classes of cattle together except new born calves and late pregnant cows. The current result was in accordance with the finding of (Jalel *et al*., 2020). Who noted the same report in oromia zone. All respondents in the study area were housed their cattle during night, sun and rain and to protect from theft and predators with no difference between both production.

Table 12: Housing, types of houses, reason for housing and frequency of house cleaning in the study

Parameters	Variables	urban (n= 57)		Peri-urban (n=98)		Over all(N=155)	
		Frequency	%	Frequency	%	Frequency	%
Types of houses	In main house with separate barn	43	75.4	40	40.9	83	53.6
	In separately constructed	14	24.6	5	59.1	72	46.4
	Total	57	100	98	100	155	100
Reason for housing	During night	57	100	98	100	155	100
	During sun and rain	57	100	98	100	155	100
	To protect from predators and theft	57	100	98	100	155	100
Frequency of house cleaning during dry	Once a day	57	100	98	100	155	100
	Twice a day	-	-	-	-	-	-

Frequency of	Once a day	19	33.3	39	39.8	58	37.4
house cleaning	Twice a day	38	66.7	59	60.2	97	62.6
during wet	Total	57	100	98	100	158	100

4.8. Crossbreeding program AI/bull service

According to the table 13, in urban production system in the major failure of local and crossbreed AI/bull service ranked by the respondents were shortage of AI technician at first ranked with an index result 0.27 and Disease problem at 2nd ranked with an index result 0.22 and heat detection problem at the 3rd ranked with an index result 0.18 and AI technician problem at 4th ranked with an index result 0.17 and Shortage of input delivery at 5th ranked with an index result 0.10 and Distance of AI service center at 6th ranked with an index result 0.07 respectively. In peri-urban production system, in the major failure of local and crossbreed AI/bull service ranked by the respondents were Shortage of AI technician at 1st ranked with an index result 0.24 and Disease problem at 2nd ranked with an index result 0.20 and AI technician problem at 3rd ranked with an index result 0.16 and Shortage of input delivery at 4th ranked with an index result 0.14 and Heat detection problem at 5th ranked with an index result 0.13 and Distance of AI service center at 6th ranked with an index result 0.12 respectively. Major constraint of AI service were presented in table 13, according to the respondents response, lack of regular delivery of AI service, lack of input(liquid nitrogen and semen), and distance to AI center, lack of AI technician, heat detection problem, and disease problem were the major constraints of AI service delivery system in the study area. Among the constraint, respondents prioritized the major and primary constraints of AI service were lack of regular delivery of AI service followed by lack of input(liquid nitrogen and semen) in the study area. Similarly, according to morrel jm., (2011) reported that heat detection, AI technician problem and fertility level of the herd was the most

severe problem of AI delivery system. Additional shortage of input for AI activity particularly semen and liquid nitrogen was reported as the constraint of AI service in the current study, which harms semen quality and reproductive performance of dairy cows. As per the finding of this study Ibrahim , (2014) and CSA, (2020) also reported that the most common constraint of AI service and conception failure in selected similarity districts of jimma zone. They also reported other constraint of AI service like insufficient AI centers, poor awareness among dairy farmers about the AI service, lack of managerial and technical support, and shortage of inputs.

Table 13: Crossbreeding program AI/bull service ranked by respondents in the study area

Productio	Variable	Rank							
n system		1st	2nd	3rd	4th	5th	6th	Score	Index
Urban	Heat detection problem	11	2	27	0	11	6	212	0.18
(n=57)	AI technician problem	0	6	11	39	1	0	193	0.17
	Distance of AI service	0	0	4	6	5	42	86	0.07
	Shortageof AI technician	42	13	2	0	0	0	325	0.27
	Shortage of input delivery	0	0	0	12	40	5	121	0.10
	Disease problem	4	36	13	0	0	4	260	0.22
Peri-	Heat detection problem	0	10	9	11	68	0	255	0.13
urban	AI technician problem	5	21	23	23	4	22	326	0.16
(n=98)	Distance of AI service center	7	15	21	5	0	50	266	0.128
	Shortage of AI technician	49	25	12	8	0	4	495	0.24
	Shortage of input delivery	0	6	20	48	8	16	286	0.14
	Disease problem	37	21	13	4	17	6	431	0.20
Overall	Heat detection problem	11	12	36	11	79	6	467	0.14

(N= 155)	AI technician problem	5	27	34	62	5	22	519	0.16
	Distance of AI service center	7	15	25	11	9	92	352	0.10
	Shortage of AI technician	91	38	14	8	0	4	820	0.26
	Shortage of input delivery	0	6	20	60	48	21	407	0.13
	Disease problem	41	57	26	4	17	10	691	0.22

Index=the sum of (6 times for First order +5times for second order + 4times for third order + 3 times for fourth order + 2 times for fifth order +1 times for sixth order) and divided this by the sum of all weighted items mentioned by the respondents.

4.9. Exotic Blood Level Preferences by farmers

In this study as presented in Table 8 exotic blood level had a significant effect on both productive and reproductive performance. Farmers experienced running of high graded of crossbreds to have higher daily milk yield, earlier age at first calving and short calving interval. In urban production system cow/heifers with an exotic blood level of <50% are preferred by the majority of respondents and ranked at 1st preference with an index result were 0.064 and they prefer 50- 75% exotic blood level of crossbred as 2nd with an index result 0.063 as well as the 3rd and 4th rank > 75% and local (0 %) with an index result 0.03, and 0.026 respectively. In peri-urban production system, farmers prefer crossbred of 50-75% exotic blood levels as 1st rank with an index result of 0.10 and <50% exotic blood level as 2nd preference with an index result of 0.094 Moreover they prefer > 75% and local as 3rd and 4th rank with an index of 0.061 and 0.054 respectively. As a whole across the production systems, farmers prefers 50-75% exotic blood level crossbred as first rank with an index result of 0.171 and as 2nd, 3rd and 4th rank > <50%, local and 75%, with an index result of 0.159, 0.084 and 0.081 respectively. This is in

agreement with previous reports from Ethiopia by Desta, (2002); Demeke *et al.* (2004); Bitew *et al*. (2011) and other developing countries such as Galukande, (2010). They state those high graded crossbred animals were more preferred by the majority of dairy farmers to get the advantage of exotic inheritance.

Table 14: Preference of farmers to exotic blood level cow/heifers across production systems of study area

Production system	Variable	1st	2nd	3rd	4th	Score	Index
Urban(n=57)	Local	9	11	8	8	93	0.03
	<50%	21	19	19	21	200	0.064
	50-75%	19	20	20	20	196	0.063
	>75%	8	7	10	8	81	0.026
Peri-urban(n=98)	Local	20	11	19	16	167	0.054
	<50%	27	34	27	27	291	0.094
	50-75%	31	37	31	35	332	0.10
	>75%	20	16	21	20	190	0.061
Overall(n=155)	Local	29	22	27	24	260	0.084
	<50%	48	53	46	48	491	0.159
	50-75%	50	57	51	55	528	0.171
	>75%	28	23	21	28	251	0.081

Index=the sum of (6 times for First order +5times for second order + 4times for third order + 3 times for fourth order + 2 times for fifth order +1 times for sixth order) and divided this by the sum of all weighted items mentioned by the respondents.

4.10. Production and reproduction performance dairy cows

4.10.1. Age at First Service (AFS), Age at First Calving (AFC) and Calving Interval (CI)

Overall result of AFS and AFC of local cow was 42.87 and 49.26 months, respectively. The mean AFS for < 50%, 50-75% and >75% exotic blood level was 35.57, 21.88 and 17.54 months, respectively. The mean AFC of crossbred cows of <50%, 50-75% and >75% exotic blood levels were 41.6, 27.9 and 26.7 months, respectively with overall mean of 32.01 months for all groups of crossbred cows. AFS and AFC were significantly different ($p < 0.05$) between locations . The AFS and AFC decreased as production system is intensified from urban to peri-urban and as exotic blood level was enhanced. The variation in AFS and AFC between different exotic blood level and between production systems is probably due to difference in genetic potential among different exotic blood levels and difference in management and feeding systems among production systems. Age at first services for local dairy cows differed significantly ($P < 0.05$) in all production systems with the mean values (39.34 and 46.41) in urban and peri-urban respectively). The average age at first service was (42.87) months. The difference might be due to widely use of crossbred animal that disregard the attention to local breed in study area. Similarly, age at first services for crossbred dairy cows differed significantly ($P < 0.05$) in all production systems with the mean values for < 50%, 50-75% and >75% exotic blood level has 35.57, 21.88 and 17.54 months urban and peri-urban respectively. The average age at first service was (24.9) months. According to Desselegn *et al*.,(2016) reported that the average age at first service was 18.7 and 18.7 months for cross breed cattle reared by the farmers in Bishoftu and Akaki, respectively. Moreover, Belay *et al*., (2012) where report that the AFS for crossbred dairy cows was 24.30 in Jimma town and 23.2 months in Gonder town (Kumar *et al*., 2014). The irregularities in feed supply and differences in management systems could be contributed to

bring about variations in age at first service in different areas. The difference may be due to that previous result was studied under control environment rather than under farmers' condition.

Age at first calving for local dairy cows differed significantly ($P < 0.05$) in all production systems with the mean values were 47.35 and 51.18 in urban and peri-urban respectively. The average age at first service was (49.26) months. Similarly, age at first services for crossbred dairy cows differed significantly difference ($P < 0.05$) in all production systems with the mean values of different exotic blood level crossbred cows of <50%, 50-75% and >75% exotic blood level is 41.6, 27.9 and 26.7 months respectively with the average value (32.01) for crossbred cows. (Table15). According to the Taju (2018), the overall age at first calving (AFC) of local dairy cow was 48.9 months or approximately 4 years in Dawro zone. Higher AFC was reported by Kebede *et al*., (2017) who reported those 4.7, years for Gofa cattle. The overall estimated average age at first calving was found to be 40.9 months, of which 47 .16 months for indigenous dairy cows, and 37.95 months for crossbreed cows, which was higher than the expected to be achieved (Taju, 2018).

As presented in Table 15, the average mean of CI of indigenes zebu cattle and their crossbred of < 50% and 50-75% and >75% exotic blood level were, 22.41, 16.73,13.41 and 12.75months and the mean average CI for all crossbred was14.29 months. Current result was different from finding of Aynalem *et al.,* (2009), who reported that the level of management achievable in Ethiopia is unfavorable to higher exotic inheritance levels more than 50% exotic inheritance. Longer calving interval as exotic blood level increased as 50, 75 and 87.5% have CI of 15.26, 15.83, 17.5 months.

Calving interval of crossbred cow with exotic blood level of 50- 75% and >75% significantly ($P \leq 0.05$) shorter in urban than those of peri-urban. It may be due to intensified management of

animal in urban area than in peri-urban. Current result of CI for local cows 22.42 months was comparable to that of Mulugeta and Belayeneh , (2013) reported 24.94 months for indigenous animal in North Showa zone of Amhara Region .and, (Desalegn *et al*., 2016; Demitie *et al*., 2016 and Mebratu et al.,2018). According to Belay *et al*., (2012) in North Showa zone and Jimma Zone indicated that crossbreds have calving interval of 22 and 21.36 months, respectively. On the other hand, longer CI of 54.1months (Dejene, 2014) and 18.72 months (Ayneshet *et al*., 2018) for Kerrayu and cattle around Gonder area, respectively, was reported. This might be due to relatively good long run intervention of different Government and Non-Government organization in dairy industry of the study area. For example Government Organization like Holleta research center, Adabera Dairy farm, District Livestock and fish resource office and Cooperative association office played a great role in adoption of dairy knowledge and Technology by giving training for framers on Crossbred management (feeding, housing, breeding, improved forage development and conservation, health care and Dairy product marketing and how to make Cooperative and Union to solve market problem), supplying dairy input (Crossbred heifers/bull, Feed, Liquid nitrogen, Semen, medicines, improved forage seed and Dairy equipment's). In addition, NGOs like Self-help, Land Oleks and World Vision in different period made cooperation with the listed Government Organization doing huge task in adoption of Crossbred dairy technology in the area. As a result, most of farmers advance their knowledge on Crossbred management, and also they launch to make a decision on theirs crossbred exotic blood level and most of them have greater than 50% of exotic inheritance of crossbred animal and they also make Zero grassing/ stall feeding system for their crossbred animal. Consequently relatively, they can get high production and reproduction performance that expected from exotic inheritance.

The current finding was confirming the expectation of shorter calving interval in higher inheritance level. This might be indicative of relatively; excellence of crossbred management under smallholder farmers in handling, breeding management, accesses of artificial insemination service, relatively shorter days open, diseases control and relatively good experience of farmers on all management practices.

Table 15 shows age at first service (AFS), age at first calving (AFC) and calving interval (CI) in the study area

Parameters	Production System	Breed type and Exotic Blood level			
		Pure local	<50%	50-75%	>75%
Age at First Service (month)		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
	Urban(n=57)	39.34±.088[b]	31.3±.134 [b]	17.4±.048 [b]	16.45±.22[b]
	Peri-Urban(n=98)	46.41±.081[a]	39.85±.137[a]	19.3±.042 [a]	18.64±.21[a]
	Average	42.87±.84	35.57±.14	21.88±.045	17.54±.43
	LSD	4.72	5.21	1.03	0.87
	Sig. deff	*	*	*	**
	P-Value	.003	.002	.0001	.000
Age at first Calving(month)	Urban(n=57)	47.35±.154 [b]	38.45±.097 [b]	27.26±.046 [b]	25.10±.06 [b]
	Peri-Urban(n=98)	51.18±.065 [a]	44.68±.163 [a]	28.47±.087 [a]	28.12±.05 [a]
	Average	49.26±.10	41.56±.13	27.86±.06	26.61±.05
	LSD	2.47	4.67	0.58	2.05
	Sig. deff	*	*	*	*
	P-Value	.008	.007	.005	.004
Calving interval (month)	Urban(n=57)	21.95±.02[a]	16.25±.02[a]	12.98±.04[b]	12.12 ± .02[b]
	Peri-Urban(n=98)	22.88±.03[a]	17.21±.03[a]	13.84±.05[a]	13.38±.04[a]
	Average	22.41±.02	16.73±.02	13.41±.04	12.75±.03
	LSD	0.53	0.66	0.47	0.87
	Sig. deff	NS	NS	*	*
	P-Value	.25	.47	.008	.003

NS=non-significant **=significant SD=standard deviation LSD=least significant difference

4.10.2. Day open, lactation length and number of service per conception of crossbred of different exotic blood level and local cows

4.10.3. Days Open for Dairy cows (DO)

As presented in the previous Table 16, the average days open in indigenous dairy cows included in the current study was 201.3 days. From the analyzed collected survey data there was no significant difference ($p>0.05$) in day open of dairy cows among production system. But significant difference occurred among different exotic blood levels. Day open for different exotic blood level of crossbred with < 50% 50-75% and >75 was 173.7,87.15 and 86.1 days, respectively with the average mean values of 115.7 day for exotic blood level crossbred. As analyzed survey result there is no significant difference ($p>0.05$) among production system on day open for crossbred animal, but decreasing day open was seen as exotic blood levels increased. The current result showed that days open for indigenous cows is exceptionally longer than previously reported by Belay*et al.* (2012), Tadele Alemayehu and Nibret Moges *(*2014) in North, Gondar Zone Amhara Regional State. They stated that the overall LSM of day open for indigenous cows was estimated to be 86.4 days and Study on Reproductive Performance of indigenous Dairy Cows at Small Holder Farm Conditions in and Around Maksegnit town stated that the LSM for day open in indigenous dairy cows was 86.5 days. The variation could be attributed to differences in management practices like lack of giving attention for local animal; feed shortage and lack of proper heat detection might be contributory factors for long day open in local dairy cows reported in this study.

The average mean day open for crossbred was 115.7 days was slightly lower than that 155.7days reported by (Belay *et al.,* 2012) at Jimma Town Ethiopia. The differences might be indicative of relatively; perfection of crossbred management under smallholder farmers in breeding

management, accesses artificial insemination service, diseases control and relatively superior experience of farmers on all management practices in the study area. In other way current study results showed that the mean value for days open of higher exotic blood level of 50-75% and >75% crossbred was 90.82 and 89.3 days respectively which are similar with the findings of Hunduma (2012), who reported day open 85.6 days in Asella town, Oromia regional state, Ethiopia and 87 days reported in crossbred cattle in and around Gondar, North Western Ethiopia (Moges, 2012).

4.10.4. Lactation length (LL)

As indicated in the Table 16, the average mean lactation length of indigenous cows was 7.65 months and their cross of <50%, 50-75%, and >75% exotic blood level was 7.65, 8.05, 9.5 and 10.8 months. With the mean average of lactation length for all crossbred animal was 9.45 month. Current result lactation length for local cows was agrees with the report of (Addisu 2013) who reported 6.79 months for indigenous and 8.74, 9.47 and 9.80 months for 50, 75 and 87 crossbred cows respectively. This agrees with the lactation length of, 10.1months reported by Asaminew and Eyasu, (2009) in northwest and central Ethiopia.

Lactation length of crossbred exotic blood level of < 50% and 50-75% dairy cow was significantly longer in urban (9.3 and 10.5) month than in peri-urban (8.2 and 9.0) month respectively. The difference may be due to the reason of the farmers in peri-urban area having more experience to control lactation length of their cows than in urban area. That means in study area lactation length of cows depends mostly on the management objective of the herder, the herder may prolong the lactation length for the sake of continues milk production or dry off the dam at early stage for the purpose of breeding the cows. There was an increment trend in lactation length revealed as exotic blood level increased, even if it could not reach generally

accepted 305 days of lactation length for crossbred still 10.3 month wasperceive for crossbred exotic blood level of >75% .

4.10.5. Number of service per conception (NSC)

As indicated in the Table 16 .The average number of service per conception in the present study for local and theirs crossbred of<50%, 50-75% and >75% was 3.53, 3.1, 1.6 and 1.4 respectively, with the mean average for all crossbred was 2.03 respectively. Number of services per conception (NSPC) is one of the measurements for reproductive efficiency, expresses the fertility level of cows and depends largely on the breeding system used and it is higher under uncontrolled natural breeding than hand-mating and artificial insemination reported by (Azage et al., 2013; Kumar et al.,2014; Abunna et al., 2018; Gabrikedan et al., 2019). Lack of knowledge, in appropriate time of insemination, unqualified technician, hygienic problem, and disease are the most common reasons for frequent breeding (Desselegn et al., 2016, Ayneshet et al., 2018). According to Kumar et al. (2014), indigenous cows had the significantly higher NSPC (2.2) than that of crossbreds (1.5) in Gonder under small holder management system. The variation may be due to the difference in householders' knowledge on proper heat detection and also time of insemination and perfection of AI technician of study area from previous study. The result is state that higher exotic blood level of crossbred have better performance conception rate than indigenous and with lower exotic blood level cross breed.

4.10.6. Daily milk yield (DMY): monitoring

As listed in Table 16, the respective average, daily milk yield of local animal across the production system was 2.65 and 2.31 in urban and peri-urban of study area with an average milk yield of 2.48. Daily milk yield of different exotic blood level of crossbred of < 50% was 7.04 and 8.49 in peri-urban and urban respectively with average daily milk yield of 7.76. For

crossbred exotic blood level of 50-75% 15.06 and 13.45 in urban and peri-urban respectively with an average daily milk yield was 14.25 litters and for crossbred exotic blood level of > 75% was 27.05 and 14.17 in urban and peri-urban respectively with an average daily milk yield was 20.61 litters. The average daily milk yield of crossbreds with different exotic blood level was significantly ($P<0.001$) difference in all production systems. The result is difference from that of the findings reported by Mulugeta, (2005) indicated that the average daily milk yield of indigenous and crossbred cows was 1.09 and 5.97 liter per day, respectively. The present study result showed slightly higher yields for indigenous cows and lower for crossbred cows. In addition, the present finding for the crossbred cows average daily milk yield was lower as compared with Belay, (2012) who reported 8.52 liters. According to (Azage et al 2013), the average daily milk yield of indigenous and crossbred was 1.85 liter which ranged from 1.24 to 2.31 liter/day in rural areas of Mieso and for crossbred cows it ranged between 10.21 to 15.9 liter/day. This result is higher than the present study. Who stated that peri-urban production system was the predominant milk production system for national milk production? Which was higher in peri-urban production system than urban as well exotic blood level was increasing milk production also increase. The difference in daily milk production of the same exotic blood level of crossbred under different production system also indicate that to receive expected production from exotic inheritance properly designing breeding policy and dissemination method of exotic blood levels for each production system was needed.

Table 16**:** Day open, lactation length, number of service per conception and daily milk yield

Parameters	Production system	Breed type and Exotic Blood level			
		Pure Local	<50%	70-75%	>75%
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
Day open (days)	Urban(n=57)	198.2±.16[a]	158.2±.16[a]	86.2±.65[a]	85.2±.44[a]
	Peri urban(n=98)	204.4±.22[a]	189.2±.14[a]	88.1±.91[a]	87.0±.65[a]
	Average	201.3±.19	173.7±.15	87.15±.78	86.1±.54
	LSD	7.6	35	2.8	3.02
	Sig. deff	NS	NS	NS	NS
	P-Value	.522	.124	.121	.252
Lactation length (month)	Urban(n=57)	7.2±.33[a]	7.3±.306 [a]	8.4±.41 [a]	9.0±.410[a]
	Peri-urban(n=98)	8.1±.39[a]	8.8±.254 [b]	9.5±.35 [b]	10.8±.356[a]
	Average	7.65±.36	8.05±.28	8.95±.38	9.65±.38
	LSD	1.3	0.75	0.55	2.1
	Sig. deff	NS	*	**	NS
	P-value	.100	.018	.001	.716
Number of service per conception	Urban(n=57)	3.1±.10 [b]	2.7±.10 [b]	1.5 ±.10[a]	1.2±.11[a]
	Peri-urban(n=98)	3.97±.15 [a]	3.5±.11 [a]	1.7±.09[a]	1.6±.12[a]
	Average	3.53±.12	3.1±..910	1.6±.09	1.4±.11
	LSD	0.48	0.3	0.71	0.67
	Sig. deff	***	***	NS	NS
	P-value	.000	.000	.118	.179
Daily milk yield	Urban(=57)	2.65±.32[a]	8.49±.43[a]	15.06±3.7[b]	27.05±1.5[c]
	Peri-urban(n=98)	2.31±.41[b]	7.04±.84[b]	13.45±.64[b]	14.17 ±1.4[c]
	Average	2.48±.36	7.76±.63	14.25±2.17	20.61±1.45
	LSD	0.22	1.04	1.31	6.78
	Sig. deff	**	**	***	**
	P-value	.0001	.0001	.000	.0002

NS=non-significant **=significant SD=standard deviation LSD=least significant difference

4.10.7. Daily Milk yield across the Production System: monitoring result

As presented in Table 17, from the monitoring data result the average daily milk yield of local animal across the production system was 2.37 and 3.25 in urban and peri-urban, respectively. The daily milk yield of different exotic blood level of crossbred of < 50% was 7.63 and 9.67 in urban and peri-urban, respectively with over average 8.65 for crossbred exotic blood level of 50-75% of 19.78 and 15.59 in urban and peri-urban respectively with an average daily milk yield was 17.68 litters and for crossbred exotic blood level of > 75% was 25.36 and 16.31 in urban and peri-urban respectively with an average daily milk yield was 20.83 litters. According to (Azage et al 2013), the average daily milk yield of indigenous and crossbred was 1.85 liter which ranged from 1.24 to 2.31 liter/day in rural areas of Mieso and for crossbred cows it ranged between 10.21 to 15.9 liter/day. The average daily milk yield of crossbreds with different exotic blood level and local cow was also showed significant ($P<0.05$) difference in all production systems. The result of monitoring study on milk production per day of dairy cows in study area was similar to the survey study. In both studies productivity of crossbred animal was increase as exotic blood level was increase.

The same exotic blood level having different productive performance in different production systems. In all case milk production of cows was higher in urban production system than peri-urban and in rural. The difference may be due to different management practice among production systems and it may be indicate that to receive expected production from exotic inheritance properly designing breeding policy and dissemination method of exotic blood levels for each production system was needed.

Table 17: Daily milk yield (litter/day/cow) of local animal and their crossbred with different exotic blood level cows across production system**.**

Breed type and Exotic blood level	Mean ± SE of Daily milk yield in litters from monitoring data					
	Urban	Peri-urban	Average	LSD	Sig. deff	P-value
Local(n=6)	2.37±.15[b]	3.25±1.2[a]	2.81± .67	0.5	***	0.000
<50%(n=9)	7.63± 2.03[b]	9.67±3.43[a]	8.65± 2.73	1.07	***	0.000
50-75%(n=9)	19.78±7.23[a]	15.59±6.52[b]	17.68±6.8	2.78	**	0.003
>75%(n=12)	25.36±5.77[a]	16.31±6.88[b]	20.83±6.32	6.42	**	0.0001
Total	13.78±3.79	11.20±4.50	12.49±4.14	0.88	*	0.029

**= significant deference SE=standard error LSD=least significant difference

4.10.8. Estimated Milk Production against Stage of Lactation: monitoring result

The milk production performance at different stage of lactation and lactation dairy cows across the production system were revealed in (Table 18). The average daily milk yield at early, mid, and late lactation stages for local of 1.92, 1.58 and 2.45 respectively with mean average daily milk yield was 1.98 liters. 7.18, 7.40, and 6.97 litters in early, mid and late lactation stage respectively for <50%, with mean average daily milk yield was 7.18 litters and 21.36, 13.91 and 7.44 litters in early, mid and late lactation stage respectively for 50-75% and with mean average daily milk yield of 14.24 litters and 21.38, 17.80 and 15.24 respectively for > 75% with the mean average daily milk yield was 18.14 litters.

The milk production was significantly (P<0.001) reduced in late lactation than in mid and early stage of lactations for both local and crossbred cows. Current result average milk production for all crossbred with different exotic blood level in compare with lactation stage was 17.69L,

13.54L and 9.8L at early, mid and late lactations which was higher than previously reported by Adebabay, (2009), who stated that daily milk production from unknown exotic blood level of crossbred cows was; 10.96, 9.12 and 5.04 liters for first, second and third lactations stages. The average daily milk yield 13.93L for all different exotic blood level observed in this study was higher than the average values reported by Asaminew and Eyasu (2009), Yitaye et al. (2007) which was 7.8, 7.8 liters respectively from unknown exotic blood level crossbred cows. The main reasons for high daily milk yield of crossbred cows in current study may be due, improvement knowledge of small holder farmers on general management such as (feeding, watering, housing, health care and breeding management of crossbred animal in study area.

In case of local dairy animal, from the monitoring study, the mean daily milk yield of local cows in the study area was 2.31liters, which was better than the national average 1.09 L, and those reported by Kedija, (2007) in Mieso District. The reason for higher daily milk production of local cows may be due to the season of in which the monitoring study was conducted during which more feed was availablefor local cows in current study.

Table 18: Milk yield (litter/day/stage of lactation) of crossbred level and local cows

Exotic blood level	Mean ± SE of Daily Milk yield in Litters compare with Stage of lactation					
	Early stage	Mid stage	Late stage	mean average	Sig. deff	P-value
Local(n=6)	1.92±.21[a]	1.58±.42[b]	2.45±.24[c]	1.98±.29	**	0.0012
<50%(n=9)	7.18±1[a]	7.40±.21[b]	6.97±.11[c]	7.18±.44	**	0.0001
50-75%(n=9)	21.36±0[a]	13.91±2.8[b]	7.44±1.5[c]	14.24±1.4	**	0.0001

>75%(n=12)	21.38±5.4[a]	17.80±4.9[b]	15.24±6.3[c]	18.14±5.5	***	0.0000
Total	12.96±1.65	10.17±2.08	8.02±2.03	10.38±1.9	**	0.0001

***=significant difference SE=standard error Sig. deff= significant difference

4.10.9. Milk Production Performance against Parity: monitoring result

As presented in Table 19, the effect of parity was highly significant (P<0.001) for daily milk yield for both local, and their cross of <50%, 50-75% and >75%. Milk production increased as parity increased until three then decreased with the advance of parity. This result agrees with the finding of Mohamed (2004) who demonstrated that milk yield increased with advancing lactation up to 4th parity in the Sudan.

High milk yield was recorded in 3rd parity followed by 4th parity. Similar results were reported by Nyamushamba *et al. (*2014) in Red Dane and Jersey cattle in Zimbabwe. Lactation milk yield was significantly (p<0.01) lower during 7th lactation compared to other lactation. Lactation milk yield during 6th lactation was also significantly (P<0.01) lower as compared to that of 1st, 2nd, 3rd, 4th, lactation. Significant parity effect as in the present study was also reported by Bajwa *et al*. (2004) in Sahiwal cattle in Pakistan, Javed *et al*. (2004) in Friesian cows in Pakistan, Sattar *et al*. (2004) in Jersey cows in Pakistan , Sattar *et al. (*2005) in Holstein Friesian in Pakistan, Tadesse *et al.* (2010) in Holstein Friesian dairy cows in Ethiopia, Usman *et al*. (2012) in Holstein Friesian in Pakistan, Niraj *et al.* (2014) in indigenous and HF crossbred dairy cows in Ethiopia and Nyamushamba *et al. (*2014) in Red Dane and Jersey cattle in Zimbabwe. In contrast, the result differed from that of Habib *et al.* (2003), Amasaib *et al*. (2008), Jemila and Achenef (2012) in Red Chittagong cattle in Bangladesh, 62.5 Friesian blood in Sudan and cross of Holstein Friesian cows in Ethiopia, respectively. The significant effect of

parity on lactation milk yield may be due to differences in size of the udder, body weight of cows, feed requirement related to the development of gastro intestinal tract and environmental conditions among lactation.

Table 19: Daily milk yield of cow/day/parity crossbred with different exotic blood level and local in compare with Parities

Exotic blood level	Mean ± SE of Daily Milk yield of compare with Parities						
	1st parity	2nd parity	3rd parity	4th parity	Mean average	Sig. deff	P-value
Local(n=6)	1.3±.22[a]	2.01±.42[b]	2.2±.37[c]	3.1±.26[d]	2.15±0.3	***	0.0001
<50%(n=9)	4.71±.02[a]	5.15±.31[b]	9.64±.21[c]	6.8±.11[d]	6.5±.16	**	0.0003
50-75%(n=9)	8.47±.11[a]	13.17±2[b]	25.15± 2.9[c]	19.4±.30[d]	16.54±1.3	***	0.000
>75%(n=12)	14.34± 2.10[a]	19.3±2[b]	20.8±1.6[c]	18.33±.5[d]	18.19±1.5	***	0.000
Total	7.2±.61	9.9±1.2	14.5±1.2	11.9±.29	10.9±.82	**	0.0002

***=significant difference Sig. deff =significant difference SE=standard error

Least-squares mean with same superscript in the same row for same variable indicate non-significance among genotype across the production system.

5. SUMMARY AND CONCLUSIONS

The current study was conducted to evaluate the productive and reproductive performance of crossbred and indigenous dairy cows at farm level under small scale farmer's management conditions. Accordingly the productive performance traits like daily milk yield and its projected lactation milk yield and lactation length; and reproductive performances traits like (age at first service and at first calving, calving interval, number of service pre conception, lactation length days open) of local and their crossbred with different exotic blood level cows and breed preference of the farmers was studied by analyzing survey and monitoring data captured from 155 household. It was observed that significance difference on production and reproduction performances existed among different blood grade categories (< 50%, 50-75% and above>75%) within two production systems being defined urban and prei-urban setting. The survey result in this study confirmed that the performance of crossbred cows for production traits had increased as exotic blood level increase cows with exotic blood level <50%, 50-75% and >75% have 7.76 L/day, 14.25 and 20.61 L/day, respectively. This is indicative of improved of crossbred management under smallholder farmers in handling, breeding management, and better accesses of inputs in the study area. From the result of monitoring study, productive performances (Daily milk yield and milk production) for crossbred of different exotic blood level of < 50%, 50-75% and >75% dairy cows was 8.65 L/day, 17.68 L/day and 20.83 L/day, respectively. It was observed that daily milk yield of cows was affected by different factors like parity, stage of lactation and production systems. Monitoring study had shown similar trend of performance improvement in crossbred animals to that of the survey study in terms daily milk yield and total projected lactation yield.

The study had also shown that productive and reproductive performance traits of the same exotic blood level crossbred dairy cows showed different performance under peri urban and urban production systems. Each exotic blood level crossbred dairy cows had best production and reproduction performance in urban setting than peri-urban. The variation in performance of the same exotic blood level animal in different production system was due to difference in management of animal such as feeding, housing, health care and breeding management of the farmers in each production systems.

A shortage of inputs delivery and unbalanced cost of dairy inputs like feed (concentrate feed and mill byproduct, roughage and forage seeds), improved breeds (heifers or bulls), AI facilities (liquid nitrogen, semen, AI technician) and health facilities (medicine) and lower price of milk compared to price of dairy input were the major problems that hindering dairy production in the study area. Generally, from the summary it conclude that reproductive and productive performance of crossbred with different exotic blood levels and local dairy cows was affected by different factors like exotic blood level, production systems and management practices also shortage of dairy inputs and unbalance price of milk is the major problem in dairy production in the study area.

6. RECOMMENDATION

Reproduction and production performance of crossbred and local dairy cattle are mostly affected by management (feeding, housing, health care and breeding), production system. Based on the present study, the following areas need us attention to support dairy production to be developing into a market-oriented business operation in study area.

- To receive expectation profit from exotic inheritance, it calls for creating strategic breeding systems independently under each production system to allocate right exotic blood level at right place with consideration of adaptation problem, market access and management practice of farmers in each production systems.
- Dairy union and cooperatives can solve shortage of concentrate feed and seed of improved forage through regularly supplying it, additionally Union can planting feed mixer mill and recycle the budget as revolved fund.
- Non-Governmental Organizations, feed supplying companies be supposed to initiating dairy industries by doing on forage development, genetic improvement, solving market by acting in value chain of milk production.
- Governmental organization should be performing to solving problems on price of milk by creating foreign chain to realize profitability of dairy producers and supplying crossbred heifers/bulls and other dairy inputs with subside price
- As exotic blood level of crossbred animal was increased the reproduction and production performance is increase and it reach optimum condition so; it's a best making backcross after reaching high production and reproduction of crossbred exotic blood level of greater than 87.5% to re enhance heterosis effect.

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8. APPENDIX

8.1. Appendix tables

Appendix Table 20: Descriptive Statistics for Socio economic characters of respondents in the study area

Descriptive Statistics					
Parameters	N	Minimum	Maximum	Mean	Std. Deviation
Gender of farmer	155	1	2	1.37	.485
Age of farmer	155	1	3	2.05	.809
Religion of farmer	155	1	3	2.25	.850
Marital status	155	1	4	1.41	.804
Educational level	155	1	4	2.75	1.029
Occupation of the farmer	155	1	4	1.68	1.132
Valid N (listwise)	155				

Appendix Table 21: Descriptive Statistics for Cattle Herd size and Composition in the study area

Descriptive Statistics					
Cattle herd size	N	Minimum	Maximum	Mean	Std. Deviation
Number of farmer	98	2	2	2.00	.000
lactating cows	98	1	2	1.32	.467
dairy cows	98	1	2	1.37	.485
Heifer	98	1	2	1.54	.501
male calves	98	1	2	1.55	.500
female calves	98	1	2	1.41	.494
Valid N (listwise)	98				

Appendix Table 22: Production and reproduction performance of dairy cows

Tests of Between-Subjects Effects						
Source	Exotic blood level	Type III Sum of Squares	df	Mean Square	F	Sig.
AFC	Local	.122	1	.122	.217	.008
	<50%	.281	1	.281	.251	.007
	50-75%	.237	1	.237	.268	.005
	>75%	.037	1	.037	.033	.004
AFS	Local	.460	1	.460	.818	.003
	<50%	10.699	1	10.699	9.563	.002
	50-75%	.076	1	.076	.086	.000
	>75%	1.581	1	1.581	1.439	.000
CI	Local	2.051	1	2.051	3.646	.252
	<50%	6.189	1	6.189	5.532	.470
	50-75%	.239	1	.239	.270	.008
	>75%	.300	1	.300	.273	.003
DO	Local	.001	1	.001	.002	.522
	<50%	.228	1	.228	.204	.124
	50-75%	1.541	1	1.541	1.739	.121
	>75%	1.954	1	1.954	1.778	.252
LL	Local	1.813	1	1.813	3.223	.100
	<50%	.162	1	.162	.144	.018
	50-75%	.001	1	.001	.001	.001
	>75%	7.873	1	7.873	7.165	.716
DMY	Local	.227	1	.227	.404	.000
	<50%	.668	1	.668	.597	.000
	50-75%	2.281	1	2.281	2.572	.000
	>75%	.403	1	.403	.367	.000
NSC	Local	.040	1	.040	.071	.000

	<50%	4.264	1	4.264	3.812	.000
	50-75%	.352	1	.352	.397	.118
	>75%	1.812	1	1.812	1.649	.201
Error	Local	82.687	147	.562		
	<50%	164.462	147	1.119		
	50-75%	130.319	147	.887		
	>75%	161.507	147	1.099		
Total	Local	504.000	155			
	<50%	972.000	155			
	50-75%	885.000	155			
	>75%	921.000	155			

Appendix Table 23: Daily milk yield (DMY): monitoring Study area

Tests of Between-Subjects Effects					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4.248[a]	15	.283	1.510	.092
Intercept	.693	1	.693	3.692	.069
early stage	.036	1	.036	.191	.001
Mid stage	.775	1	.775	4.133	.000
Late stage	.001	1	.001	.003	.000
First parity	.012	1	.012	.062	.000
Second parity	.305	1	.305	1.626	.000
Third parity	.042	1	.042	.225	.000
Fourth parity	.005	1	.005	.025	.000
AM1	.000	1	.000	.001	.004
PM1	.206	1	.206	1.097	.307
AM2	.027	1	.027	.143	.053

PM2	.043	1	.043	.230	.637
AM3	.039	1	.039	.209	.003
PM3	.013	1	.013	.072	.003
AM4	.047	1	.047	.249	.623
PM4	.073	1	.073	.387	.541
Error	3.752	20	.188		
Total	108.000	36			
Corrected Total	8.000	35			

8.2. Appendix II: Questionnaire Used to collect information from dairy farmers

Title: - Assessment of reproductive and productive performance of cross breed and local dairy cattle under smallholders management practice in urban and peri-urban dairy farming system in aleta wondo district sidama region Ethiopia

Region_____ District _____ PA _____ Altitude (m a.s.l.) _____

Name of data collector……Date…….Signature……

A. Socio economic profile of the respondent

1. Name of respondent…….

2. Gender A). Male B). Female

3. Age of respondent……

4. Religion of household head (HHs) A) Orthodox B) Muslim C) protestant

D) Catholic E) others

5 Marital status A) Married B) Single C) Widow D) Divorced E) Not relevant

6. Family size: …….. A) Male---------- B) Female ----------

7. Educational level of the households: A) Illiterate B) Read and write C) 1-4 grade

D) 5-8 grade E) 9-12 grade F) Diploma and above

8. Respondent land holdings (ha/ timed);- A). Crop land…… B). Pasture land----------

---------- C). Forest land ----------

8.1. Occupation of the farmer: A) farmer B) house wife C) merchant D) government employee

9. What are the major activities on your farm? A) Crops farming only B) Crops and livestock/ mixed C) Livestock only

10. Number of Livestock resources

No	Livestock type		Breed type		Total	Most important species
			Local	Cross/exotic		
1	Lactating cows					
2	Dairy cows					
3	Heifer	Age(<1yr)				
		Age(<1yr)				
4	Calves(<1year)	Male				
		Female				

11. What the Reproduction and production performance of indigenous and crossbred different exotic blood level of your dairy cattle?

No	Progeny history	Breed	%CB-HF	Parity	Age	AFC	AFS	CI**	DO**	LL**	DMY	NSC
1	Cow 1											
2	Cow 2											
3	Cow 3											

**for last two calving only

12. Have you faced failure of any cross breeding program (AI/Bull service)?

A) Yes B) No

13. If yes what do think the reason for the failure?

No	Variable	Priority/Rank with(1-5)
1	Heat detection problem	
2	AI technician efficiency problem	
3	Distance of AI/bull service centre	
4	Shortage of AI technician	
5	Shortage of input delivery	
6	Disease problem	
7	Other specify	

Management of Dairy Animal

14. What did/do you feed crossbreed and local dairy cow cows? (Rank them 1-6) A) Grazing/ Foraging _____B). Hay----------

C). Green feed (legumes, grass, legume & trees) ----------

D). Crop residue (Sorghum and maize Stover, wheat straw)_____

E). Concentrate (Grains, oil seed cakes, wheat bran, commercial mix, and molasses) ----------

F) Mineral supplement (Common salt)_____

15. Do you use new feedstuffs since you started with crossbreeding? A) Yes B) No

16. If yes which new feedstuffs have you introduced?

A) Improved forage B) Industrial by product C) Concentrate feeds D) All the above

17. How did you learn about these new feedstuffs? Through Training by?

A) Government through extension program B) By NGO C) By Cooperative

D) From neighbor

18. How do you feed crossbreed and local cattle? A) Grazing cows by its own self B) sub grazing

C) Cut andcarry system

19. Did you house your cattle before crossbreeding? A) Yes B) No

20. Do you need the veterinarian more often now or before crossbreeding? A) Yes B) No

21. For what do you need the veterinarian more often? A) Vaccinations

B) Treatment of sick animals C) prophylaxes against parasites D) help for calving difficulties E) other specify

22. Do you face to any adaptation problem in case of indigenes and crossbred dairy cattle? A) Yes B) No

23. If yes in case of what adaptation problem you face? A) Feed B) Environment

C) Housing D) All

24. What the opportunity for you to continue your dairying with crossbred animal

A) Availability of input delivery B) Increase demand of milk C) My area is milk shed area

D) All of them

25. How do you get the first information about Crossbreeding program__? A) Extension agent B) AI technician C) Project agent farmers D) Neighbors E) From other area (specify)

26. If yes which other people did you ask for information on crossbreeding? A) Farmer B) extension staff C) NGO staff D) Researcher E) cooperative member

27. As a user of dairy animal for milk and milk products do you get the service (AI/Bull) regularly and without interruptions? A) Yes B) No.

If your answer for question 34 No.is no, what is the reason for this?

A) The service is not available on weekends & holidays B) There is shortage of AI technicians (AITs) C) There is shortage of bull service D) Shortage of input F) All of the above

28. How do you communicate with AI technicians for breeding purpose?

A) AITs visit us daily B) We call AITs when we need them C) We take our cows to the AIstation

29. Do you have any say in the selection of the type of semen you use? A) Yes B) No

30. In relation to the above question, what factors would you use to choose the type of semen given, the chance? A) Milk production B) Beef type

C) 1&2 D) Others

31. Have willing use if sexed semen is supply for you? A) Yes B) No

32. If yes what type sex you want to use A) Male B) Female

33. What you think breed improvement speed with sexed semen compared to unsexed semen?

A) It is very accelerating B) It is the same C) It is less than the normal AI or nochange

34. Which breed do you consider suitable for cross breeding with zebu? A) Holstein B) Jersey C) Graded Crossbred

Questionnaire on feed delivery

35. What do you feed your crossbred animals? A) Wheat bran B) Fagulo

C) Mixed feeds D) Home-gown improved forages like Napier, E) Atella

F) Natural grass grass

36. Does feeding differ during early, mid and late lactation period? A) Yes B) No

37. Do you get concentrate feed for your animal? A) Yes B) No

38. If yes, who are the suppliers? A) BoA supplies concentrate feeds, B) Traders C) Uniens D) Cooperatives

39. What are the constraints on feeding? A) Not available, B) Very cost

C) Seasonality offeed availability. D) Lack of knowledge on feeding

40. Is there forage development practice in your area? A) Yes B) No

Questioner for Crossbred Animal beneficiary

41. Have you used a different exotic breed for crossbreeding with local cattle?

A) Yes B) No

42. Which breed have you used for crossbreeding?

A) Holstein-Friesian B) Jersey C) Locally crossbred animal

43. Would you be continued using a different exotic breed for future crossbreeding? A) Yes B) No

44. How did you learn about exotic breed(s)? A) From agricultural extinction

B) From research center C) Cooperatives C) From Neighbor

45. Why would you like this exotic breed? A) Milk production B) Butter fat content C) Ability to resistance D) Simple Management

Questionnaire used to collect information from researcher / ranch for input delivery

1. Have your institution provide different exotic breed/ cross of dairy cattle for farmers forgenetic improvement strategy? A) Yes B) No

2. If yes what type of breed it distributes for users? A) Holstein-Friesian B) Jersey

C) Locally crossbred animal

3. Where the institution is getting those exotic breeds/ cross?

A) Reproduce by own self B) Import from other country C) Select best performed fromfarmers and redistribute it

4. Which exotic breed is more acceptable by users/ farmers?

A) Holstein-Friesian B) Jersey C) Locally crossbreds

5. Why it is more acceptable by users? A) Due to milk yield B) Due to resistance of disease C) Due to butter fat content

6. Have this institution was distribute other inputs for dairy development in the area? A) Yes B) No

7. If yes what type of input it supply for beneficiary? A) Concentrate feed B) Industrial by products C) Improved forage seed D) Milkprocessing materials

8. What the status/ Ideology of farmer /beneficiary on the Dairy development in the last tenyears?

A) Positively changed B) Negatively changed C) No change

9. is there satisfaction of farmers/ beneficiary on the technology the institution wasprovided?

A) Yes B) No

Questioner for Milk monitoring study

1. What the about your cows which you used for milk production now (Indigenous, crossbred or Exotic) cows?

Sheet of Milk yield Monitoring:- Production system of the area

Name of House hold_____Woreda_____kebele_____

No.	Animal Code	Breed 1-3 1=local 2=cross 3=exotic	Blood level(%)(1-4) 0=0% 1 <50% 2<50-75% 3>75%	Duration of lactation (1-3) 1=early 2=mid 3=late	Days of milk yield in Litter(L)Monitoring Morning and afternoon lactation														Remark
					Month 1- Month 6														
					Week1			Week2			Week3			Week4					
					Thursday			Thursday			Thursday			Thursday					
					AM	PM	Tot	AM	PM	Tot	AM	PM	Tot	AM	PM	Tot			
1																			
2																			
3																			
4																			

Note. Thursday was test day AM= Morning PM = Evening Tot = Total daily milk yield

1. Type of Breed (1-3)1. Local 2. Crossbred 3. Exotic animal

2. Exotic Blood level (%) (1-4) 0=0%, 1=<50%, 2=50-75%% 3= >75%

3. Stage of lactation (1-3) A) Early (1–2 months) B) Mid (3–4 months) C) Late (5–6 month)

Dairy cattle management practices

1. Do you provide water to your dairy cattle? A) Yes B) No

2. If yes, what are the common water sources of cattle in the area? A) River B) Pond

C) Pipe D) Deep well

3. If not, why? A) Due to shortage of water B) sickness C) sheep not need water

4. At what intervals do you provide Indigenous and crossbreed dairy cattle with water?

s/no	Frequency	Season	
		During dry season	During wet season
1.	Any time needed		
2.	Once in 3 days		
3.	Twice a day		
4.	Once a week		
5.	Not provided		

5. Is there any water shortage/problem to dairy crossbreed? A) Yes B) No

6. If yes, when? A) Dry season B) Wet season C) both

7. Why shortage of water? A) Drying of water sources B) Far distant from water Sources

C) Pollution

Crossbreed dairy cattle health management

8. What are the common diseases and parasites that affect health and production of dairy cattle?

s/no	Diseases name	Symptoms	Seasons/months
1.	Pasteurolosis		
2.	Fasciolosis/swelling around neck		
3.	FMD		
4.	Mastitis		
	Parasites		
1.	Internal parasites		
2.	External parasites		

10. Are you accessible to veterinary center? A) Yes B) No

11. What would you do when you're Cattle sick?

A) Treat with ethno veterinary practices B) Takes to veterinary center

C) Treat with treatments from local traders D) others, specify

12. Did your cattle get vaccine in last and current year? A) Yes B) No

13. If yes, how? A) After report of disease cases B) after certain animals died C) before outbreaks

14. Where do you confine your cattle? A) In main house B) In main house with separate barn C) in separately constructed house

15. When do you house them? (Circle all options) A) At night only B) during rain and sun C) at any time

16. at what frequency do cattle house cleaned?

s/no	Frequency of leaning	Season	
		During dry season	During wet season
1.	Any time		
2.	Once a day		
3.	Twice a day		
4.	Once a week		