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Assessment of Husbandry Practices, Reproductive and Productive Performance of Crossbred Dairy Cows in and Around Debre Tabor Town, South Gondar Zone of Amhara Region, Ethiopia

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BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES

GRADUATE PROGRAM

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M.Sc Thesis

By

Yichlal Getnet

June, 2024

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Submitted in Partial Fulfillment of the Requirements for the Degree of Master Science (M.Sc)
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THESIS APPROVAL SHEET

As member of the Board of Examiner of the Master of Science (M.Sc.) thesis open defense examination, we have read and evaluated this thesis prepared by Yichlal Getnet Endalew entitled "**Assessment of husbandry practices, reproductive and productive performance of crossbred dairy cows in and around Debre Tabor town, South Gondar Zone of Amhara Region, Ethiopia.**" We hereby certify that; the thesis is accepted for fulfilling the requirement for the award of the Degree of Master of Science (M.Sc) in ANIMAL PRODUCTION.

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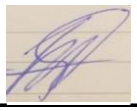
Shashie Ayele (PhD)		25/7/2024
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This is to certify that this thesis entitled "**Assessment of husbandry practices, reproductive and productive performance of crossbred dairy cows in and around Debre Tabor town, South Gondar zone of Amhara region, Ethiopia.**" submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in "ANIMAL PRODUCTION" to the Graduate Program of College of Agriculture and Environmental Sciences, Bahir Dar University by Mr. Yichlal Getnet Endalew, (ID. No. BDU1129195PS) is an authentic work carried out by him under our guidance. The matter embodied in this project work has not been submitted earlier for the award of any degree or diploma to the best of our knowledge and belief.

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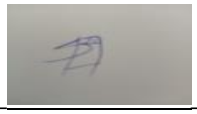
Signature 

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Assessment of husbandry practices, reproductive and productive performance of crossbred dairy cows in and around Debre Tabor town, South Gondar zone of Amhara region, Ethiopia

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ABSTRACT

The study was conducted with the aim of assessing the husbandry practices, reproductive and productive performances of crossbred dairy cows in urban and peri-urban areas of Debre Tabor town, Amhara region, Ethiopia. The study had two parts survey and monitoring study. A total of 180 respondents which had crossbred dairy cows were selected for the survey study. The survey sample included 180 individuals who owned crossbred dairy cows. A total of 28 dairy producers participated in the monitoring study, and 40 crossbred dairy cows (20 cows from urban and 20 cows from peri-urban) with various genotypes (25%, 50%, 75%, and >75%) and parity were purposefully selected. The findings revealed that high cost of feed, shortage of animal feed, and water scarcity were the main problems in the area. Natural mating and AI service were practiced in the study area. Financial constraint and low milk yield were the major reason why farmers culled their dairy animal. Average ages at first service of crossbred dairy cows in urban and per-urban were 20.28±4.35and 26.05±8.85 months, respectively. The mean number of services per conception of crossbred dairy cows in urban and per-urban was 1.54±0.54 and 1.85±1.05, respectively. The average days open of crossbreed dairy cows in urban and per-urban were 154.02±65.33 and 218.22±82.74 days and the average calving intervals in the urban and per-urban were 14.80±3.25 and 18.83±5.27months, respectively.The monitoring results showed that, average daily milk yield for 25%, 50%, 75% and >75%, genotypes of crossbred dairy cows in urban were 5.85 ± 2.15, 9.55 ± 3.32, 10.32± 3.50 and 13.05 ±3.70 liters per day with an overall 10.14 ± 3.96 liters of milk per day per cows. In per-urban area the average daily milk yield for 25%, 50%, 75% and >75% were 4.14 ± 1.29, 7.27± 2.63, 7.74 ± 3.19 and 9.95± 3.56 liters per day with an overall 7.10±3.44 liters of milk per day per cows. The overall average lactation lengths of crossbred dairy cows in urban and per-urban were 294.66±54.63 and 277.00±59.50 days, respectively with overall 285.83±57.64 days. It is concluded that the crossbred cows' reproductive performance is longer, and the milk yield also does not match to their milking potential. Therefore, it is recommended that crossbred dairy cows' reproductive and productive performances be improved by improving the overall husbandry practices.

Keywords: Crossbred dairy cows, husbandry practices, productive and reproductive performance, urban and per-urban dairy production systems.

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ABBREVIATIONS AND ACRONYMS

AFC	Age at First Calving
AFS	Age at First Service
AI	Artificial Insemination
CI	Calving Interval
CSA	Central Statistical Agency/Authority
DMY	Daily Milk Yield
DO	Days Open
EMDIDI	Ethiopian Meat and Dairy Industry Development Institute
FAO	Food and Agriculture Organization of the United Nation
FMD	Foot and Mouth Disease
GDP	Agricultural Gross Domestic Product
GLM	General Linear Model
ILRI	International Livestock Research Institute
LL	Lactation Length
LSIL	Livestock Systems Innovation Lab
NSPC	Number of Service Per Conception
SAS	Statistical Analysis System
SPSS	Statistical Package for Social Sciences

CHAPTER1. INTRODUCTION

1.1 Background and Justification

Ethiopia has the largest livestock population in Africa, with 70 million cattle, 42.9 million sheep, 52.5 million goats, 57 million chickens, 2.15 million horses, 10.80 million donkeys, 0.38 million mules and 8.1 million camels (CSA, 2021). Out of the total cattle population, the female cattle constitute about 56 percent and the remaining 44 percent are male (CSA, 2021). About 97.4% of the total cattle in the country are local breeds. The remaining are hybrid and exotic breeds that accounted for about 2.3 percent and 0.31 percent, respectively.

The milking cows are about 15.04 million heads (CSA, 2021). There was 4.96 billion liters of cow milk produced per year in the country (CSA, 2021). From the total milk production, 98% is contributed by smallholder dairy farmers, representing about 85% of milk producers (Mebrate Getabalew *et al*., 2019). The sector contributed up to 40% of agricultural Gross Domestic Product (GDP), nearly 20% of total GDP, and 20% of national foreign exchange earnings (World Bank, 2017). Livestock is a major source of animal protein, power for crop cultivation, means of transportation, export commodities, manure for farmland and household energy, security in times of crop failure, and means of wealth accumulation.

The mean values of daily milk yield (DMY) range from 1 to2.8 liter/day with lactation length (LL) of 6.78 to 9.13 months for indigenous breeds and the mean values of daily milk yield (DMY) range from 6.5 to 15 liter /day with lactation length of 7.52 to 11.67 months for crossbreed cows (Zewde Melkamu and Mustefa Wazir, 2022). Ethiopians consume less dairy products than other African countries and far less than the world consumption. The present national average capita consumption of milk is 19kg/year as compared to 27 kg for other African countries and 100kg to the world per capita consumption (Abebe Bereda *et al.*, 2013). The recommended per capita milk consumption is 200 liter/year.

Despite the large number of indigenous breed milking cows in the country, their milk production and productivity remain low. Inadequate quality and quantity of feed, disease and parasites occurrence, poorly management of dairy animals like housing, feeding, and

absence of marketing practice are affecting the productive and reproductive performance of dairy cows (Getachew Tadele, 2015). Exotic breeds (e.g. Holstein Friesian and Jersey) have increasingly been imported and cross-bred with indigenous breeds for better milk yields (Kassa Awoke, 2019). Cross-breeds and high-grade breeds, varying in their exotic gene level, are mostly found within research institutes, cooperatives, and small- scale and large-scale commercial dairy farms.

Genetic improvement of indigenous breeds is possible by way of selective breeding and/or strategic crossbreeding, some effort has been exerted to date to improve any of the indigenous; breeds (Kefyalew Alemayehu and Chencha Chebo, 2012) increase in milk yield in the F1crossbred (50% exotic blood level) as compared with local stock. To meet the ever-increasing demand for dairy products (i.e. milk and milk products), genetic improvement of the indigenous cattle has been proposed as one of the options. Genetic improvement of the indigenous cattle, basically focusing on crossbreeding, has been practiced in many developing countries (Niraj *et al.,* 2014).

Information is limited about the milk production and reproduction performance of dairy cows in smallholder dairy farms in the tropics, particularly in Ethiopia. Performance record of local and crossbred dairy cows is essential for designing breeding as well as management strategy development for the dairy sub-sector.

1.2. Statement of the Problem

The livestock population is expected to increase driven by population growth, urbanization, income growth, and shifts in dietary pattern or preference for animal sources foods. Despite the huge number, livestock productivity remained very low to meet the expected demand due to several challenges.

These are feed shortage, high prevalence of diseases and parasites, low genetic potential of indigenous breeds, limited or lack of access to artificial insemination (AI) services, inadequate veterinary services, lack of access to credit, poor market infrastructures, water shortage, land scarcity, and poor management practices across all production systems (Dawit Assefa *et al*., 2013).

However, in Ethiopia, the sector is yet to fully realize its potential to produce enough milk and dairy products to meet the domestic demand. The demand for milk and milk products is increasing in the study area. The drivers of change to the dairy sector are demography, growing economies, underserved markets, conducive policy and enabling environment, globalization, and market opportunities (Shapiro *et al.*, 2017). In the study area there is limited documented information on the husbandry practices, reproductive and productive performances of crossbred dairy cows. Therefore, this study is designed to know the husbandry practices, reproductive and productive performances of crossbred dairy cows in and around Debre Tabor town, South Gondar Zone of Amhara Region, Ethiopia.

1.3 Objective of the Study

1.3.1 General Objective

To know the husbandry practices, reproductive and productive performance of crossbred dairy cows and suggests intervention strategies so as to improve milk productivity and production in and around Debre Tabor town, South Gondar Zone of Amhara Region, Ethiopia.

1.3.2 Specific Objectives

- To assess the husbandry practices of crossbred dairy cows in the study area.
- To investigate the reproductive and productive performances of crossbred dairy cows in the study area.

1.4. Research Questions

- How are the husbandry practices of crossbred dairy cows in the study area?
- What are the reproductive performances of crossbred dairy cows in the study area?
- How much milk is produced from crossbred dairy cows in the study area?

CHAPTER 2: LITERATURE REVIEW

2.1. Dairy Production in Ethiopia

Dairy production systems in Ethiopia is categorize to rural, peri-urban, and urban and commercial dairy production systems from which rural dairy small-holder system supply includes pastoralists, agro-pastoralists, and mixed crop–livestock producers share largest total milk produced and contributing 98% of the milk (Gobena Metawork, 2016). Per capita consumption of milk is approximately 19 kg per year in Ethiopia (FAO, 2018). The quality of milk produced in Ethiopia is poor and below the standard due to poor pre-milking and post-harvest handling practices and highly characteristics of the milk perishability (Tsadkan Zegeye and Belay Gurja, 2018).

2.1.1. Rural production system

Pastoralists, agro-pastoralists, and mixed crop-livestock producers are grouped under the rural dairy cattle production system. From the total milk production, 98% is contributed by small-holder dairy farmers which representing about 85% of milk producers (Mebrate Getabalew *et al.,* 2019). Due to highly perishable nature of dairy products and its potential to transmit zoonotic disease and other pathogens and toxins, it is difficult for dairy farmers to exchange in urban markets (Bekuma Amanuel *et al.,* 2018).

The rural milk production system is highly reliant on the low productivity of the indigenous zebu cattle breeds that can produce 400–680 liters of milk per cow per lactation period. The main feed resources for dairy cattle in rural areas are natural pasture, cop residues, crop aftermath or stubble grazing, improved forages with their minimal contribution and beverage by-products that are produced locally such as *atela* (Kassahun Gurmessa *et al.,* 2015).

2.1.2. Peri-urban dairy production

Peri-urban dairy production systems are mainly located at the edge of the town areas which have comparatively better access to urban centers in which dairy cattle products are extremely wanted (Alemu Menale, 2019). Most of the dairy cattle producers depend on hybrid cows and they practiced supplementary concentrate feeding. It possesses animal types ranging from 50% crosses to high grade Friesian in small to large sized farms. This sector owns most of the country‘s improved dairy stock (Gobena Metawork, 2016). Their

main source of animal feed is home produced hay for some, and pastured hay for other with or without additional supplemental feed.

2.1.3. Urban milk production

This system is located in cities or towns and farmers are specialized dairy producer for sale of fluid milk without or little land resources and few numbers of farmers practice commercial dairy farming unless practiced in state sector. It is the most market oriented dairy cattle production system compared to other production systems (Asrat A *et al.,* 2016). Urban areas producers use crossbred, as well as high grade, dairy animals. However, only 1% of the dairy cattle from the total population of dairy cattle of the country are kept under urban dairy cattle production system (Gezu Tadesse and Zelalem Yilma, 2018).

Cattle are housed in improved shelters made of locally available materials (Bekele Aysheshim *et al.,* 2015). Concentrates, roughages and non-conventional feeds are the main feed resources which are used in urban dairy cattle production system. Moreover, road side grazing, fruits of plants and wastes also used in urban dairy cattle production system (Asrat A *et al*., 2016).

Under the use of intensive management system urban dairy cattle production systems has better access to inputs and services providing by the public and private sectors as compared to other dairy cattle production systems (Gezu Tadesse and Zelalem Yilma, 2018). They have also access to animal health services, use more intensive systems. Milk is sold to consumers and processing plants through informal market.

But milk supply is low due small number of dairy cattle population kept under this system (Gezu Tadesse and Zelalem Yilma, 2018). Generally, the urban and peri-urban dairy cattle production systems use improved dairy cattle or hybrid cows with relatively better management, purchased and conserved feed and stall-feeding As a result cows shows the better performance and highly profitable as compared to other systems.

According to Assaminew S and Ashenafi M (2015), the average number of hybrid dairy cattle were greater in urban than that of peri-urban dairy cattle production system (Gillah *et al.,* 2012).

It is known that in big towns there is high demand for dairy cattle products consumption and the urban and peri-urban dairy cattle production systems have their own role in filling demand-supply gap for milk and milk products in towns. In addition to this, dairying practice in urban and peri-urban areas increased income (Gillah KA *et al*., 2012).

2.2. Dairy Cattle Husbandry Practice in Ethiopia

2.2.1. Housing and record-keeping practices

According to the interview, 89.4% of urban farmers and 68.5% of peri-urban farmers built dairy cattle barns with corrugated iron roofs for increased durability. Animal housing is necessary to protect animals from predators, theft, adverse weather conditions, and to facilitate husbandry methods (Asrat Ayza et al., 2013). All sampled dairy herd owners in the research locations housed their animals in separate barns designed specifically for dairy cattle. This has the advantage of limiting disease transmission from animals to people, and vice versa.

Asrat Ayza *et al.* (2013) reported that 83% of the total respondents in Wolayta zone kept their animals in the same house where the family lives. The majority of the respondents (89.4%) and (68.5%) in Urban and peri-urban areas constructed dairy cattle barns with corrugated iron roofing material for better durability, while the rest constructed with thatched grass and few are constructed with Plastic/Geo-membrane. The materials used to make the floor of the barns in urban and peri-urban (65.9-88.9%) of the respondents used stone for flooring.

Clean, dry and comfortable bedding material is important to minimize the growth of microorganisms. However, none of the respondents were reported to use bedding material for the dairy animals. The majority of the surveyed HHs (99.5%) cleaned the barn daily. Housing conditions in many of HHs were unclean, wet and not providing a comfortable setting for the dairy animals. This may have a negative impact on the production of clean milk and milk products, in addition to increasing animal health problems. Therefore, cow sheds must be designed in such a way that it gives comfort for the animals and easy for routine daily activities like cleaning and feeding Admasu Lakew *et al.* (2019).

In many of the study areas dairy producers were not keeping records. Similarly, in urban and peri-urban areas of Central Highlands of Ethiopia farmers have not practiced record

keeping (Abebe K *et al.,* 2018) and around Boditti town, South Ethiopia 95% of dairy farmers were not practiced record keeping (Asrat Ayza *et al.,* 2013). The main reason raised for not keeping records was farmer's lack of awareness on the benefits of keeping records. The lack of record keeping may have a negative impact on productivity, decision making on progress and also may lead to inbreeding between closely related herds (Desalegn G/ Medhin, 2011).

Record keeping is the basis for proper livestock husbandry. As indicated by Markos Tibbo (2006), livestock development in Ethiopia has been handicapped to a great extent due to the lack of recorded data. The study found that farmers do not keep the necessary farm records pertaining to their dairy animals. However, 14.1% with of the sampled dairy herd owners in urban areas to some extent tried to keep records on breeding dates until the animals give calves and daily milk sales using an informal sheet.

It is therefore essential to provide training on this useful practice to dairy herd owners to make the decision for better livestock management and thereby optimize the utilization of the available resources in the study area. In the present study, milk yield, service and calving dates were the main parameters recorded by dairy producers. Inline to these results, Asrat A *et al.* (2016) also stated that in and around Wolaita Sodo town 42.7 % (Town) and 27.8% (Surroundings) of dairy farmers were found to maintain breeding/AI and reproduction records, respectively.

2.2.2. Animal feeds and feeding practice

In urban and peri-urban areas of the study areas the majority of the respondents revealed that stall feeding as the main feeding system. Furthermore, free grazing and stall feeding were the second feeding systems. Similar to the present findings, Abebe K *et al.* (2018) stated that in urban and peri-urban areas of Central Highlands of Ethiopia and Dessalegn *G et al.* (2016) reported 74.6% and 25.4% of the dairy owners in Bishoftu and Akaki towns use stall (intensive) feeding and stall feeding with limited grazing feeding systems, respectively as the major feeding practices.

Adebabay Kebede (2009) also reported that the types of feeding systems noted in Bure district of Amhara region, Ethiopia were communal grazing and stalls feeding. Parallel to the feeding managements in peri-urban town, Girma Chalchissa *et al.* (2014) also stated

that stall feeding practiced in urban areas. Additionally, in Addis Ababa milk shed and Dire Dawa town grazing was not practiced by urban dairy farms (Emebet Moreda, 2006). Bereda A *et al.* (2017) also reported that stall feeding as the main feeding system in the study areas. Of the interviewed farmers 65.9% from urban and 45.6% from peri-urban reported using tap water for dairy cattle.

The availability of feed resources in the area depends on seasons. However, concentrate feeds, crop residues (teff straw, wheat straw and barley straw) and conserved forage (hay), were used both in wet and dry seasons. Barely (*Hordeum vulgare*), Faba bean (Vicia faba L), Bishoftu Wheat (*Triticum aestivum*) and Oat (*Avena spp*) residues reported being the major crop residues (CR) available for dairy animals in study areas. The previous report of (Bereda A *et al.,* 2017) indicated that crop residues were used as a feed source for dairy animals in Debre Berhan, Sheno and Sendafa areas. Livestock feeds are obtained from different sources including crop residues (CR), grazing lands (GL), crop aftermath and fallow land and purchased.

2.2.3. Source of water and frequency of watering

Either from the river (54.3%) or from pipe (45.8%) (Tesfaye Feyisa and Wondossen Ayalew, 2019) for Gurage Zone, Bekuma and Addisu (2021) for Buno Bedele Zone, and Hosanna town have all indicated such water sources. Similar to the Alefa district of North Gondar Zone Ayeneshet Bernabas *et al.* (2018) reported that 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 Feyisa and Wondossen Ayalew, 2019).

2.2.4. Breeding systems

The breeding practices of dairy cattle in most parts of Ethiopia include use of AI and natural mating. According to the findings of Dessalegn *G et al.* (2016) 29% of the producers used AI only for breeding the dairy animals, and those who used the combination of AI and improved bulls constituted 37.7%. However, Asrat A *et al.* (2016) reported that 51.7% of the households in the urban system of Boditti town used natural mating by local bulls and the remaining 48.4% used AI. The differences could be determined by access and cost of AI service, ease of getting preferred service, access to

breeding bull and farmers' awareness. Duguma *et a.* (2015) in East Wollega zone, Ethiopia stated that the majority of the dairy owners (50.5%) used both natural and artificial insemination for breeding their dairy cattle alternatively which disagree with the current results.

The differences might be due to herd type and management variations. Because of government subsidies, farmers are charged only 4 birrs per AI service in Ethiopia. However, the actual cost of AI service obtained was extremely expensive. This might be due to the fact that the service is mostly provided by private AI technicians. The use of bulls for natural service is common in Ethiopia and breeding bulls not reared in their herd, while only about 18.1% of them used homebred bulls. The average bull service charge was estimated to be 104 ETB/service, which is expensive when compared to the AI services.

2.2.4. Weaning and culling systems

In Ethiopia in most cases calf weaning practiced when the cows stopped giving milk. In urban and peri-urban areas the majority of the dairy producers experienced calf weaning in their farm. In agreement to these results, about 75-100% dairy cattle producers both in town and the surrounding of central highlands of Ethiopia, practiced partial suckling prior to milking and colostrum is given to calves freely (Roelofs Judith, *et al.*, 2010). Additionally, in Bure area Adebabay Kebede (2009) stated that only 8.9% of the respondents exercise weaning, 64.3% of the respondents exercise partial weaning and the rest 26.8% employ sudden weaning. Culling was practiced by the majority of the respondents in urban areas than peri-urban areas.

Inline to these results, a study in central highlands of Ethiopia (Adebabay Kebede, 2009; Bereda A *et al.*, 2017), Fogera, Jeldu and Diga districts of the Nile Basin (Ethiopia) indicated that in case of emergencies both financial and agricultural the farmers tend to sell the growing herd first and breeding females were maintained in the herd for older age until reproductive performance was nearly stopped. Furthermore, in Bishoftu and Akaki areas male calves were not economical to keep and farmers sold them cheaply or culled them from the herd as soon as possible (Dessalegn *G et al.*, 2016).

2.2.5. Health Care Practices

In dairy farm the common nutritional related diseases that occur include bloating emaciation, and milk fiver. It is also common to vaccinate dairy cattle for different types of disease. About 83.3% of the respondents vaccinate their animal for disease like CBPP, FMD, Pasteurellosis and black leg, and about 10.8% for black leg, anthrax and FMD and about 5.9% FMD (Ketema Hirpha and Amanuel Bekuma, 2018).

Almost all of the respondents de-warm their animal (98%) and the remaining 2% were not de-warm and those spray their animals were 48%. Most of the respondent spray their animal during prevalence of external parasites (90.2%) and 9.8% of the respondent practice spraying twice a year in the April and May. This health control practices in the study areas could contribute for effective dairy production. Market oriented smallholder dairy farms have access to veterinary services due to the income they get from the sale of milk that enable them to cover veterinary costs (Ketema Hirpha and Amanuel Bekuma, 2018).

2.3. Reproductive Performance of Crossbred Dairy Cattle in Ethiopia

In dairy farming dairy cattle reproductive rate with genetic improved trait is economically importance for herd replacement and milk productivity. Although reproductive performance has great importance for dairy farming but due to environmental, diseases, nutrition, management and genotype constraints tropical cows have low fertility rate. The productivity of cattle depends on their reproductive performance. Reproductive performance of dairy cows is determined by traits like age at first services (AFS), age at first calving (AFC), calving interval (CI), days open (DO) and number of service per conception (NSC). Milk yield per day (MY/D), lactation milk yield (LMY) and lactation length (LL) are considered as an indicator of the productive performance Ayeneshet B *et al.* (2018). The level of management and breeding practice, management difference, variation of climatic condition over season of birth, year of birth and year of calving might be lower the value of reproductive traits Mengistu D *et al.* (2016). Adequate plane of nutrition before and after calving, good breeding management and keeping the health condition of animals in the farm will help to increase the onset of cycling activity in the breeding season and help to minimize the longer DO and CI Mengistu D *et al.* (2016).

The year of calving and year of births influence the performance of the existing breed and the great attention should be given for the inconsistent management practice across the

years Mengistu D *et al.* (2016). Cattle production is found to be important enterprise and significantly contribute to poverty alleviation, food security, improved family nutrition and income and youth employment (Wondossen Ayalew and Tesfaye Feyisa, 2017).

2.3.1. Age at first service (AFS)

AFS is the age at which the breeding heifers reach for sexual maturity and accepting mating for the initial period. The economy of the farm can be feasible by showing estrous as early as possible for female animal (Belay Duguma, 2016). Average age at puberty ranges from 8 to 10 months for European type dairy cows and 17-27 months for zebu dairy cows. The recommended body weight of Holstein at the first service is 340 kg.

2.3.2. Number of service per conception (NSPC)

Number of service per conception has been defined as the number of services required for a successful conception. The number service of per conception depends largely on the breeding system used. It is higher under uncontrolled, natural breeding than hand mating and artificial insemination (AI). The measurement of service per conception is determined on a herd or flock basis by dividing total services by the number of pregnancies.

Service per conception have little value for a large population of animals, but is a valid measurement of a single herd or an individual female. On herd basis unidentified sterile female make the calculation less meaningful. The average NSPC for Holstein Frisian cattle is 1.3 Mengistu D *et al.* (2016) which is lower than their cross breeds with Zebu cattle (F1) 1.56 Belay Duguma *et al.* (2012).

In Amhara region West Gojjam zone average value of NSC for local and different blood level was much different. As the researcher stated local cows and crossbreed of 25, 50 and 75% blood level recorded 1.67±0.61 and 1.71±0.40, 1.51±0.34 and 1.66±0.41 respectively, and overall 1.63±0.44 service times per conception. On the other hand, NSC of 1.28, 1.54, 1.59, 1.54 and 1.52 were recorded for Metekel ranch, North Gondar, Burie district and Andassa livestock research center and Assella Town, respectively.

2.3.3. Age at first calving (AFC)

Age at first calving is the period between birth and first calving and influences both the productive and reproductive life of the female, directly through its effect on her lifetime

calf crop and milk production and indirectly through its influence on the cost invested for up-bringing. The overall mean of age at first calving based on different genetic make-up (blood level) of HF and Borana crossbred was obtained as 34.6, 33.7, 33.3 and 33.96 months in 50% (F1), 75% (F2), 87.5% (F3) and ≥93.75% (F4), respectively (Zelalem Abera *et al.,* 2015).

2.3.4. Days open (DO)

It is the interval between date of calving and date of successful conception. It is one of the best indicator variables, which is most commonly used to measure fertility performance in dairy cattle. Days open directly affect CI, which plays a vital role in the achievement of dairy farms. Days open is the part of the calving interval that can be shortened by improved herd management. Long days open and consequently, prolonged CI may affect the overall economic revenues of the dairy herd.

The average day open period of Frisian cattle is 4.65 months (Mengistu D *et al.,* 2016) which is lower than the cross of Frisian with Zebu cattle which have 5.19 months (Belay *et al.,* 2012). In west Gojjam zone the days open was recorded for local breeds 9.82±1.44, whereas for crossbreeds of 25, 50 and 75% of blood level were 3.76±1.40, 3.66±1.80 and 3.45±1.20 months respectively. In Andassa breeding ranch DO of Fogera breed shows 9.33±0.11. On the other hand, for highland and lowland Zebu breed DO were 7.17 and 8.33 months respectively.

2.3.5. Calving interval (CI)

Calving interval is the time between two consecutive parturitions, and preferably should be in the range of 12 to 13 months. Calving interval has a great economic importance on the life time milk production and productive life of dairy animals, which ultimately affects the economics of the owners. It is known that the extended calving intervals detrimentally affect the longevity as a productive life, since the cow with longer calving interval has fewer lactation numbers throughout the same age of herd life compared with cows with shorter calving intervals Ayeneshet B *et al.* (2018). The calving interval of Fresian cow is 13.77 months which have low interval than Horo cow which is 26.28 (Mengistu D *et al.,* 2016).

In modern dairies, the general practice is to breed cow early and cross breeding of zebu with Fresian, with the aim of establishing calving interval of 12 to 13 months, which is considered optimum; hence, the calving interval is considered as an important index of reproductive and productive performance. As the researcher explored CI highly differs between 25, 50 75 percent levels of cross breeds which were 22.15±4.22, 17.52±4.36, and 15.70±3.21 months for 25, 50 and 75%, respectively.

On the other hand, due to the factors of nutrition, season, milk yield, parity, suckling and uterine involution; one year interval is not to do so for the country production system, accordingly cross breed dairy cattle calving interval on central highlands shows 25.95 months.

Table 1. Age at First Service (AFS), Age at First Calving (AFC), Calving Interval (CI), Days Open, and Number of Service per Conception (NSPC) of dairy cattle in Ethiopia

Breeds	AFS (months)	AFC (months)	CI (months)	DO (months)	NSPC	Sources
Friesian	32.71	42.13	13.77	4.65	1.3	(Mengistu D *et al*., 2016).
Friesian x Zebu (F1)	24.8	35.3	21.36	5.19	1.56	(Alemselam Birhanu *et al*., 2015).
¾ Friesian x ¼ Boran	31.4	40.95	13.2	4.3	1.42	(Mengistu D *et al*., 2016)
7/8Friesian x1/8Boran	29.88	40.16	13.5	4.53	1.37	(Mengistu D *et al*., 2016)
Pure HFx Pure boran (F1)	25.16	34.6	----	----	----	(Zelalem *et al*., 2015)
PureHFxF1breed (F2)	23.8	33.7	----	----	----	(Zelalem Abera *et al*., 2015)
PureHFxF2breed (F3)	23.7	33.36	----	----	----	(Zelalem Abera *et al*., 2015)
Pure HfxF3 breed (f4)	24.34	33.96	----	----	----	(Zelalem Abera *et al*., 2015)

2.4. Productive Performance of Crossbred Dairy Cattle in Ethiopia

The lactation performance of dairy cattle is usually measured by determining the total milk yield per lactation or per year, average daily milk yield, lactation length. Generally, the reproductive performance and lactation performance of dairy cattle are closely associated with each other. Breeding failure has a clear negative influence on milk production and farm income and determines the future sustainability of a dairy farming operation. Milk production level and lactation persistency are crucial factors determining the appropriate calving interval.

2.4.1. Lactation length (LL)

Lactation length refers to the time of period from when a cow starts to secrete milk after parturition to the time of drying off. Lactation length is an important production trait as it influences the total milk yield. In the majority of improved dairy farms, a lactation length of 305 days usually accepted as a benchmark.

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 (example; breed).

The lactation periods of dairy cattle differ in various places for example Debre Birhan, Sebeta, Shambu, Melkasa, Welenchiti, Gonder, Bahir Dar Zuria lactation periods were 9.7, 10, 10.53, 10.;8, 11.4, 9.17 and 10 months respectively Belay M *et al.* (2021). Mostly cows give milk for ten months lactation period and two months rest in drying off but in Ethiopian case lactation periods were in between minimum of 8.7 months which is recorded in Debre Markos and the maximum reaches 12 months in Kombolcha (Alemu Menale, 2019).

In general the mean of lactation length of indigenous Horo and PureHFxF1borenabreed (F2) dairy cow is 9.15 and 11.6 month, respectively. The lactation length of indigenous dairy cattle is lower than pure exotic and cross; hence, the cross breeding is important practices of modern dairies to improve lactation performance of indigenous dairy cow Wondimagegn Tadesse (2021)

2.4.2. Daily milk yield (DMY)

Daily milk yield is a very important production efficiency trait, which is a combination of milk yield and lactation length (Ayeneshet Bernabas *et al.*, 2018). Cows with high milk yield per day of lactation length (MY/DLL) are cost-effective producers and have extra lactation milk yield. In the estimates of MY/DLL, milk yield on average basis of the lactation length were calculated without taking into account the initial low production, peak yield and the declining in production in the last phase of the lactation (Ayeneshet Bernabas *et al.*, 2018).

The milk yield of each cow depends on month of calving, feed availability and milking experience (Kuma Berhanu, 2012) and also on type of breed, production system and their management (Alemu Menale, 2019). The highest milk was recorded in the first four months of lactation periods and after that it declines; in the months May to September milk yield increases due to high supply of feed (Kuma Berhanu, 2012) and in higher cities produce more than lower cities due to the availability of input facilities (Alemu Menale, 2019).

Local cows have a low genetic potential for milk production and it tickles as a major limitation for supply chain; for this reason selection of breed and appropriate management is needed to make them productive (Kuma Berhanu, 2012). For Ethiopian indigenous cattle the average milk yield reaches 1.5 to 2 liters/day in 150-180 lactation days (Kassa Awoke, 2019) and also reported their productivity is lower around 0.5 to 2 liter/day in 160 to 200 lactation days. The overall mean of daily milk yield of indigenous dairy Zebu cross with Frisian (F1) cow were reported by Belay *et al*. (2012) as 8.52L/day which is higher than Horro breed 1.36L/day.

Table 2. Value of milk yield per day (MY/D), milk yield per lactation (MY/L) and lactation length (LL) of dairy cattle in Ethiopia

Breeds	MY/D/Cow	MY/Lactation	LL months	Sources
Zebu x HF	8.52L	2333.63L	9.13	(Belay *et al*., 2012)
Pure HFxPureboran (F1)	----	2520L	10.7	(Zelalem Abera *et al*., 2015)
PureHFxF1breed (F2)	----	3467L	11.6	(Zelalem Abera *et al*., 2015)
PureHFxF2breed (F3)	----	3579L	12.6	(Zelalem Abera *et al*., 2015)
Pure HfxF3 breed (f4)	----	3554L	11.8	(Zelalem Abera *et al*., 2015)

2.5. Constraints and opportunities of Dairy cattle Production

2.5.1. Constraints of dairy cattle production

The constraints of dairy cattle production differ with in the three production systems and among different locations (Kassa Awoke, 2019). A major constraint altogether production system is the dearth of animal feeding. Land shortage for establishing improved forage, genetic limitation, limited access and highk cost of concentrated feed, availability and high cost of dairy heifers/cows, no operational breeding strategy and policy, low coverage of veterinary service provision, lack of coaching and capacity development opportunities, weak linkages between research, extension providers and technology users, inadequate extension and training service, milk market related constraints, reproductive problems, lack of research and knowledge exchange system, socio-economic challenges and inadequate access to credit and financing to the dairy farmer (FAO, 2019).

Similarly, feed shortage and land scarcity, diseases, poor access to marketplace, restricted market information, lack of improved breed, inadequate artificial insemination (AI) and infrastructure were reported as the primary constraints of dairy cattle production by (Gemechu Teshome and Amene Tesfaye, 2017). According to a study by (Musa Ahmedin, and Yesihak Yusuf, 2020) around West Hararghe, there are different challenges faced in dairy production. These include shortage of feed, shortage of water, inadequate access to veterinary drugs and services, lack of improved dairy animals, and inadequate extension. High feed cost, land shortage, space limitations, feed quality, and availability also as

inadequate extension and veterinary services were the most dairy production system constraints in both Arsi urban and peri-urban areas.

As indicated by Gebresellasie Lidetu (2019) high feed cost, land shortage and space limitation, feed quality, availability, and cost problems as well as inadequate extension and veterinary services are the major dairy production system constraints in the Urban and Peri-Urban areas of central Highlands of Ethiopia. Urban dairy farmers encountered a challenge due to the increased feed prices (Lombebo WA and Wosoro ES, 2019).

High feed cost was the primary constraint in the urban dairy production system of Holetta, Bishoftu, Sululta, Assela, and per-urban Sululta, Bishoftu, Holetta, and Assela. Inadequate supply of quality feed and low productivity of the indigenous cattle breeds are the most factor limiting dairy products within the region Galmessa Ulfina *et al*. (2013). Shortage of quality feed supply is remain as major problem of dairy production in Ethiopia (Ayeneshet B *et al.*, 2018; Musa Ahmedin, and Yesihak Yusuf, 2020).

The low production can be due to a spread of factors including lack of proper supplementary feeding of the cows, the poor nutritive value of pastures and forages offered to the animals, and lack of dairy husbandry training to boost productivity. Furthermore, insufficient artificial insemination service, shortage of semen, and shortage of AI professionals have been recognized as factors leading to poor breed improvement in most parts of Ethiopia Mebrate Getabelew *et al.* (2019). The major production problems listed by Misganaw D *et al.* (2017) includes absence of milk processing plants and equipment's, lack of skills, inadequate manufacture space, changeable marketing scheme, shortage of water, poor genetic potential of dairy cows for milk production.

2.5.2. Opportunities for dairy production

High demand for milk consumption, the existence of the research institutions, income generation and employment creation as well as service providers were mentioned as the main opportunities for dairy production by dairy producers in different areas of the present study. Azege *et al.* (2013) also mentioned that the large and diverse dairy animals genetic resources adapted to the wide and various agro-ecologies, establishment of several structures and service centers such as veterinary health and AI centers, high demand for consumption of dairy products, huge human population with long-standing tradition of

consumption of dairy products, high rate of urbanization and income growth, availability of trained manpower, research institutions and technologies shows that Ethiopia has ample opportunities for dairy development. A study by Solomon (2014) also revealed that because of the rapid urbanization, extensive population growth and change in the living standard of the people in Mekelle city, dairying gives the opportunity for dairy producers to generate income as it is highly demanded product. The same author further mentioned other opportunities for milk producers in the same area concerning to accessing adequate land and credit for dairy cooperatives, animal health service, AI service and extension and training services. In Wolaita Sodo area, high milk demand was the main opportunity to dairy production as stated by Asrat *et al.* (2016) which was consistent with the present results. The authors added that dairying provides the opportunity for smallholder farmers to use land, labor and feed resources and generate regular income.

CHAPTER 3. MATERAILS AND METHODS

3.1. Description of the Study Area

The study was carried out in and around Debre Tabor Town, which is located in the South Gondar Zone of the Amhara Regional State. The town is 546 kilometers from Addis Ababa and 103 km from the regional capital, Bahir Dar. The district is situated at 11°51′N latitude and 38°1′E longitude. The altitude is 2,706 metres above sea level, and the yearly rainfall ranges from 1100 to 1359 millimetres. The district's annual average lowest and maximum temperatures range from 10°C to 25°C. The city has a significant potential for livestock production, particularly milk and cattle fattening. The major local livestock resources are total number of cattle (26477), among them crossbred cattle are (16000), local cattle are (10477), total cows are (8289) (crossbred cows are (5083), local cows are (3206), Sheep (9302), goats (3965), poultry (59733), equine (3535) and beehives (1810). The major crops grown in the area are wheat, barley, Teff, bean, and pea (Debre Tabor town, 2022) (Figure 1) Map of Debre Tabor town is presented.

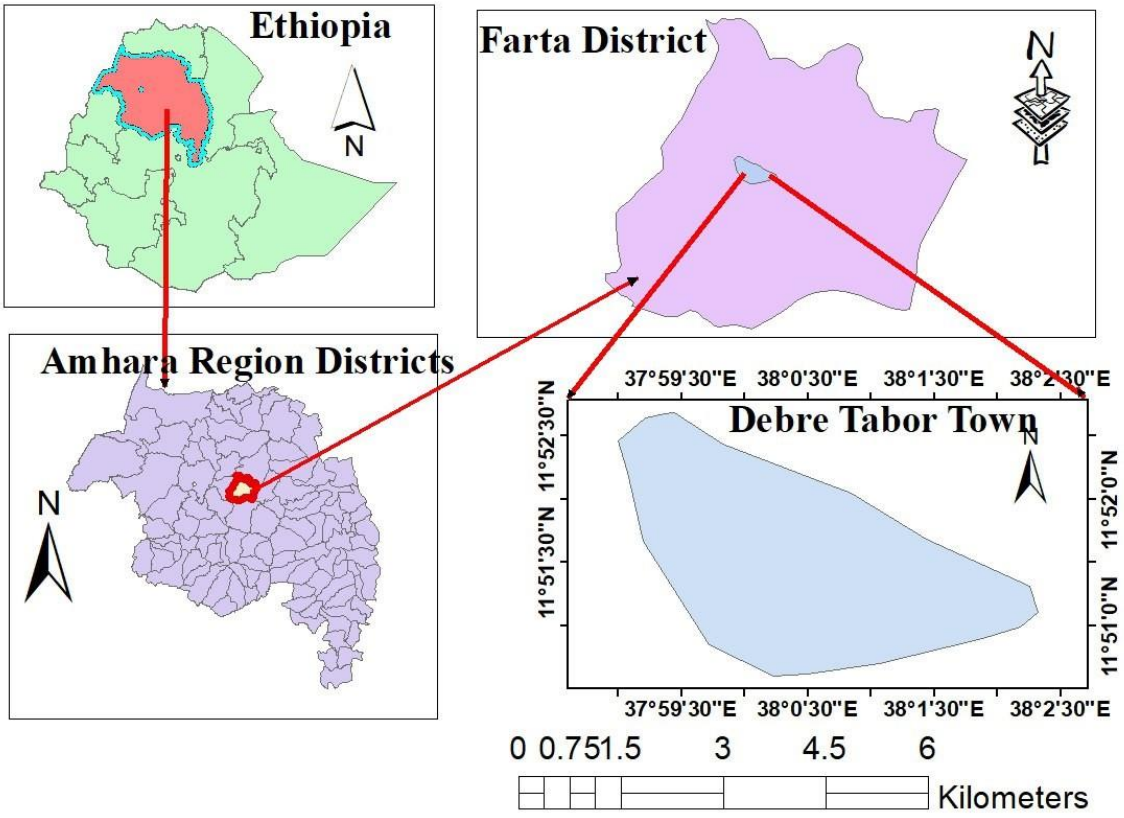


Figure 1: Map of study area

3.2. Sample Size and Sampling Techniques

A two-stage purposive and random sampling technique was implemented to select research units. The first sampling stage was purposive and the second sampling stage was random sampling. After taking preliminary survey on production potential, 11 Kebeles (9 from urban and 2 from peri-urban) were selected purposively based on their potential in dairy cattle production (Figure 2). Secondly the sample households were selected using simple random sampling techniques from each urban and peri-urban area.

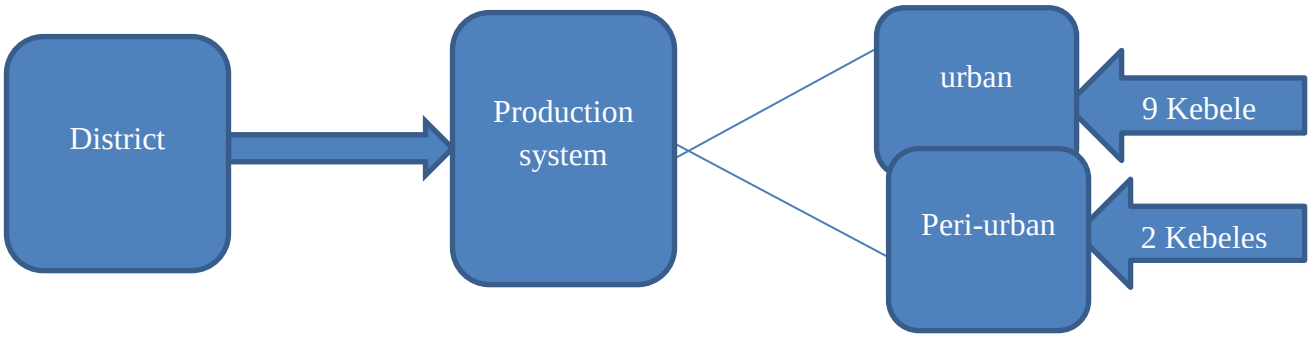


Figure 2. Sampling technique in the study area

According to records from the Debre Tabor administrative town Livestock & Fisheries Office, about 1600 households have crossbred dairy cows. The total sample size of the study is determined by using sample size determination formula (Yamane, 1967).

$n= N/1+N (e)^2$

Where, n = sample size, N = population size, e = margin of error (7%).

The total crossbreed dairy cattle producers in the district were 1600 and 7% precision will be used. n= 1600/1+1600 (0.07)2=180

3.3. Sources of Data

The study used both primary and secondary data sources. The primary data were collected from respondents through semi-structured questionnaires, focus group discussions and monitoring activities. The Secondary data were obtained from published research findings, farm record data's, reports of zonal and district agriculture and livestock offices, and other non-governmental offices.

3.4. Methods of Data Collection

The study had two parts. The first part is the survey, on which the husbandry practice of crossbred dairy cows, constraints and opportunities of dairy cattle production that was identified and assessed. The second part was monitoring on which quantitative data on

milk production of crossbred (Zebu ×exotic blood) dairy cows were followed and collected. A cross-sectional survey was undertaken on 180 randomly selected smallholder dairy farmers from urban and per-urban areas. Structured questionnaire was designed to collect socioeconomic and cattle production system characteristics, general household information, husbandry practice, constraints and opportunities dairy cattle.

Socioeconomic: Information was collected on sex, age, level of education of farmers (household head), livestock herd size and composition and functions of livestock in the areas.

Cattle production system characteristics: Information was collected on objectives of cattle keeping, cattle herd size and composition.

Dairy cattle husbandry practice: Information was collected on dairy cattle feed and feeding, cattle housing and record keeping, cattle breeding practices, weaning and culling system and common dairy cattle disease.

Estimated reproductive and productive performances of cattle: Information was collected on reproductive traits such as age at service, number of service per conception, age at first calving, days open and calving intervals and on estimated productive performance was average daily milk yield (at early, mid and last period of lactation) and lactation length. The questionnaires were pre-tested before the actual data collection start to verify that all of the study's objectives were met and respondents understand and answer the questions correctly. Focus group discussions with farmers were held to acquire a deeper understanding of dairy production constraints and opportunities. Secondary data was collected from the district livestock and fisheries office documents and other related articles.

3.4.1. Household survey

A semi-structured and pre-tested questionnaire was used to interview a total of 180 dairy cattle owners. The data was majorly collect through the questionnaires; general household information and herd composition, husbandry practice, constraints and opportunities of dairy cattle.

3.4.2. Focus group discussion

A Focus Group Discussion (FGD) is a qualitative research method and data collection approach in which a small group of people discuss a certain topic or issue in depth, guided by a trained, external moderator. A focus group discussion was held to validate and

triangulate the data acquired through the survey. The FGD discussants consisted of 5-8 people (kebele DAs and dairy farmers) and 5 FGD was performed. The checklist served as the basis for the debate, which was led by researchers.

3.4.3. Monitoring for milk production performances

The milk yield of crossbred dairy cows was assessed in two production systems: urban and peri-urban. The study population consists of 40 lactation crossbreed dairy cows that were randomly selected; from these samples, 20 lactating crossbreed cows were from urban and 20 lactating crossbreed cows were from peri-urban production systems. Lactating crossbred dairy cows (Zebu × pure exotic HF) with genotype of 25%, 50%, 75%>75%, and in number of 9, 10, 11, and 10 were selected. The crossbred dairy cows genotype level were identified using owner information, documented datasheets, and in consultation with animal inseminator professionals. The lactating cows in the research were considered for parities 1, 2, 3, 4, and 5 and their number were 10, 9, 5, 9, and 7, respectively. Individual cow milk yields were monitored for nine months (from March to November) by trained enumerators from the community who completed secondary education with the assistance of me. A total of 40 lactating cows were classified according to lactation stage (1st = 1-3 months, 4-6 months, 2nd and 3rd = 7-9 months) and parity (1, 2, 3, 4, and 5). Because of the small quantity, cows with parities greater than 5 are included and treated as such. Hand milking was used to milk cows.

Hand milking was practiced to milk cows. Daily milk yield (morning and evening) was measured by using calibrated plastic Jogs measuring cylinder for a period of two days/week (Wednesday and Saturday) for a period of 9 (nine) months (March 2023 – November 2023). Samples were taken for monitoring in the study areas presented in (Table 3)

Table 3. Samples were taken for monitoring in the study areas

District	Name and number of Kebeles by production system		Farmers sampled Crossbred cow owners	Crossbred Dairy cows sampled
In and Debre tabor town	Urban	Debre Tabor town	14	20
	Peri-urban	H.abaregay	9	10
		Tsegur	5	10
Total	2	3	28	40

3.5. Statistical Analysis

The raw data collected during the formal survey were entered into Microsoft Excel (2010) for data organization. The entered data was then analyzed using descriptive statistics in the statistical package for social sciences (SPSS version 23) software. Means were used to construct minimum, maximum, and mean values, and the General Linear Model (GLM) of the Statistical Analysis System (SAS 9.0, version 2004) was used to analyze monitoring data and other quantitative variables to find statistical differences among sampling data. A critical probability of $P<0.05$ was utilized to assess variations in milk production throughout lactation stages, parity, genotype level, and production systems.

The following statistical model was applied during data analysis to analyze data on average daily milk yield (ADMY)

The model: Statement regarding blood level, parity, stage of lactation, and production system to determine the milk yield potential of dairy cattle. The following model was used:

$$Yijkl= \mu + S_i + B_j + P_k + L_l + (SB)_{ij} + (SP)_{ik} + (SL)_{il} + e_{ijkl}$$

Where, Y_{ijkl}=response variables (milk yield),

μ = overall mean

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

B_j = fixed effect of j^{th} genotypes (25%, 50%, 75% and >75%),

P_k =fixed effect of k^{th} parity (1, 2, 3, 4, and 5),

L_l =fixed effect of l^{th} stage of lactation (1^{st}, $2^{nd,}$ and 3^{rd})

$(SB)_{ij}$ = the interaction effect of the production system and genotype

$(SP)_{ik}$ = the interaction effect of the production system and parity

$(SL)_{il}$ = the interaction effect of the production system and stage of lactation

e_{ijkl} = random error

Index method was used to summarize rank-type data. The Index was computed with the principle of weighted average according to the following formula (Musa et al., 2006). Index = Rn*C1+Rn-1*C2….R1*Cn/∑ Rn*C1+ Rn-1*C2….R1 Where; Rn = Value given for the least ranked level. (Example if the least rank is 5th rank, then Rn=5, Rn-1=4 and … R1= 1) Cn = Counts of the least ranked level (in the above example, the count of the 5th rank = Cn, and the counts of the 1st rank = C1)

CHAPTER 4. RESULTS AND DISCUSSION

4.1. Household Characteristic

In the study areas, the majority of households were male (83.3%) while female respondents were 11.7%. In the current study, the highest percentages of household heads were male, which implies that higher proportions of males were involved in dairying than females (Table 4). The overall male respondents obtained in the present study is similar to Getaachew Fikru *et al.* (2022) who found that 83.3% in Selected Districts of North Shewa Zone, Oromia, Ethiopia. On the other hand, the result was higher than the findings of Hirpha Ketema and Amanuel Bekuma (2018) who reported that 72.5% of the respondents were male in Walmera District of Oromia Regional State.

The majority (26.7%) of respondents have completed primary school, followed by read and write (21.7%), illiterate (20%), secondary school (20%), and diploma or higher (11.7%). The findings, in general, show that dairy cattle owners in the studied areas are mostly literate. Higher education levels help farmers learn how to easily embrace new dairy technologies and improve dairy management. The respondents' educational background differed from that of Hirpha Ketema and Amanuel Bekuma (2018), who stated that over half of the respondents (46.1%) had attended elementary school (1-8 grade), whereas 31.4 percent were illiterate and unable to read and write. Only 9.8% of respondents had received secondary schooling. The majority of respondents were between the ages of 40 and 49, accounting for approximately 31.7%, with the second greatest proportion being between the ages of 50 and 59, accounting for 30.6%. Thus, the research area had a higher potential for economically engaged populations to participate in dairy cattle production. The respondents' ages were identical to those reported by Hirpha Ketema and Amanuel Bekuma (2018), who found that the biggest proportion of respondents were between the ages of 31 and 40, accounting for 39.2%, while the second highest proportion was between the ages of 41 and 50, accounting for 27.5%.The average family size in urban and peri urban of research site was 4.74±1.16 and 6.23±1.40 respectively. The overall average family size of research site was 5.48±1.48 the result was similar with Admasu Lakew *et al.* (2019) who reported that he overall average family size was 5.9 and Belay Duguma and Geert P.J. Janssens (2016) who reported that the mean family size of the respondents was 6.02±2.52. Larger family size might be an opportunity in the day-to-day labor of different

routine activities such as feeding, herding, cleaning, milking and milk processing on a dairy farm.

Table 4. Household characteristic

Variables		Study areas					
		Urban		Pri urban		Overall	
		(N=90)	Percent %	(N=90)	Percent %	(N=180)	Percent %
Sex of respondents	Male	85	94.4	74	82.2	159	83.3
	Female	5	5.6	16	17.8	21	11.7
	Overall	90	100	90	100	180	100
Educational level of respondents	Illiterate	15	11.9	21	38.9	36	20
	Red and write	27	21.4	12	22.2	39	21.7
	Primary school	42	33.3	6	11.1	48	26.7
	Secondary school	24	19	12	22.2	36	20
	Diploma and above	18	14.3	5.6	7.8	21	11.7
	Overall	90	100	90	100	180	100
age of respondent	20-29	0	0.0	4	4.4	4	2.2
	30-39	14	15.6	4	4.4	18	10.0
	40-49	35	38.9	22	24.4	57	31.7
	50-59	25	27.8	30	33.3	55	30.6
	60-70	9	10.0	13	14.4	22	12.2
	>70	7	7.8	17	18.9	24	13.3
	Overall	90	100	90	100	180	100
Family size	Mean ±SD		4.74±1.16		6.23±1.40		5.48±1.48

N, number of respondents

4.2. Livestock Composition and Herd Size

The average numbers of livestock owned are presented in (Table 5). The total number of local cattle per household (1.39±0.59) was higher in peri-urban than urban (1.20±0.45) in the study areas. In the study, the urban household owned higher numbers of crossbred dairy cows. This may be the management practice in urban is better than peri-urban. The mean heads (4.08) of cattle holding per household in the present study was lower than the mean 5.6 cattle holding in West Shewa Zone (Admasu Lakew *et al.,* 2019). The average crossbred dairy herd per household was 2.11 heads which is lower than 4.6 reported by Admasu Lakew *et al.* (2019). Local cows were mainly kept on peri-urban dairy farms (1.39±0.59), while in the urban production system mainly kept crossbred cows (2.11±0.74) and the result was comparable with the findings of Kiros Abebe (2019) who reported that local cows were mainly kept on peri-urban dairy farms, while in the other locations and production system mainly crossbred cows were kept.

Table 5. Livestock composition and herd size (Mean±SD).

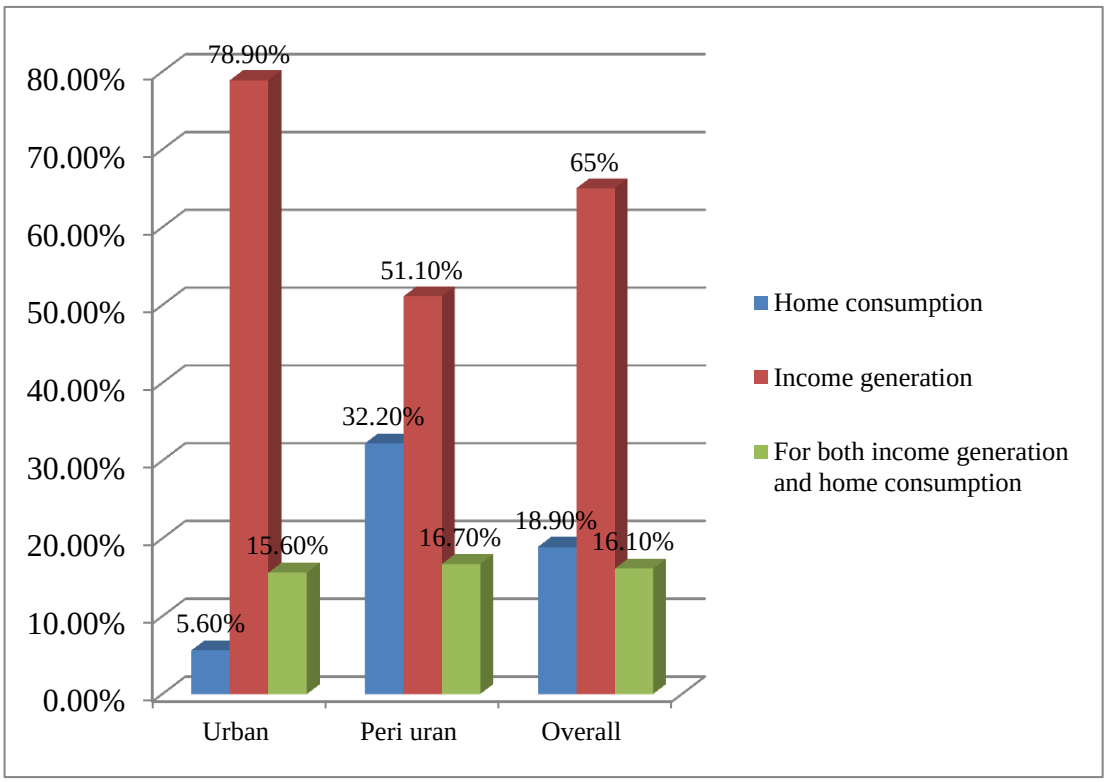
Variables	Study areas		
	Uran (N=90)	Peri-urban (N=90)	Overall (N=180)
	Mean±SD	Mean±SD	Mean±SD
Milking cows[a]	1.0±0	1.20±0.40	1.19±0.40
Milking cows[b]	1.49±0.50	1.01±0.12	1.26±0.44
Pregnant cows[a]	1.0	1.0±0	1.0±0
Pregnant cows[b]	1.20±0.40	1±0	1.10±0.30
Dry cows[a]	1.0±0	1.0±0	1.0±0
Dry cows[b]	1.0±0	1.0±0	1.0±0
Total cows[a]	1.20±0.45	1.39±0.59	1.38±0.58
Total cowsa[b]	2.11±0.74	1.45±0.54	1.78±0.73
Tatal dairy cow	2.18±0.80	2.51±0.86	2.34±0.85
Oxen[a]	1.0 ±0	1.45±0.51	1.40±0.5
Oxen[b]	1.0	1.76±0.43	1.71±0.47
Heifers[a]	1.0±0	1.0±0	1.0±0
Heifers[b]	1.08±0.28	1.0±0	1.04±0.2
Bulls[a]	-	1.0±0	1.0±0
Bulls[b]	1.0	1.0±0	1.0±0
Female calves[a]	1.0	1.0±0	1.0±0
Female calves[b]	1.23±0.51	1.16±0.38	1.20±0.47
Male calves[a]	1.0±0	1.0±0	1.0±0
Male calves[b]	1.14±0.36	1.0±0	1.08±0.27
Total cattle	3.66±1.52	4.52±1.46	4.08±1.56
Sheep	2.0±1.26	2.28±0.66	2.18±0.92
Goats	3.0	4.0±0	3.91±0.29
Chicken	3.80±2.34	1.69±0.46	2.15±1.42
Horses	1.0±0	1.0±0	1.0±0
Donkeys	1.0±0	1.35±0.49	1.27±0.46
Mules	1.0±0	2.0±0	1.62±0.51

N, number of respondents; SD, standard devation; a, local; b, crossbred

4.3. Purpose of Keeping Dairy Cattle

Figure 3 depicts farmers' reasons for maintaining dairy cattle in the research area. The majority of farmers' reasons for keeping dairy cattle (65%) are income generation, 18.9% are home consumption, and 16.1% are both income generation and home consumption. Dairy farmers stated that an increase in milk yield per household will boost their income and home consumption, resulting in better livelihoods. The findings of this study were consistent with those of Belay Duguma and Geert P.J. Janssens (2016), who found that the

majority of farmers (94.4%) claimed that milk production for income generation is the key motivation for keeping dairy cattle. The result of the study is in disagreement with the results of Aschalew Kebede and Asrat Guja (2023) who reported that the majority of the households' milk products were for market sale and household consumption (33.3%), for market sale (30%), and for household consumption only (26.7%)at Gidole Town, south Ethiopia. In the study area the reason of farmers keeping dairy cattle milk production in urban (78.9%) are income generation, (15.6%) are both income generation and home consumption (5.6%) are home consumption, whereas, and in peri-urban (51.1%) are income generation, (16.7%) are both income generation and for household consumption and, (32.2%) only home consumption.



N, number of respondents

Figure 3. Purpose of keeping dairy cattle (N=180)

4.4. Dairy Management Practices

4.4.1. Housing and record keeping practices

Almost all (90%) of dairy herd owners across the study areas housed their animal's in separate barns constructed purposefully for dairy cattle (Table 6). Similarly, Kilos Abebe *et el.* (2018) who reported that almost all dairy owners were used separate housing system for their dairy cattle in urban and peri-urban areas of Central Highlands of Ethiopia. Based

on the interview 80.0% of farmers from urban and 75.6% from peri-urban constructed dairy cattle barns with corrugated iron roofing material followed by plastic cover (20%) in urban and (24.4%) in per-urban respectively. These results were in agreement with the previous results of Admasu Lakew et al. (2019) who revealed that the majority of the respondents (89.4%) and (68.5%) in Urban and peri-urban areas constructed dairy cattle barns with corrugated iron roofing material for better durability, while the rest constructed with thatched grass and few are constructed with Plastic/Geo-membrane. As indicated in Table 10, in the study areas most (80.6%) dairy producers were not keeping records. Similarly, Belay Deguma (2020) who written farm records were not kept by 95% of the respondents, while very few (5%) indicated that they kept written record of daily milk yields in selected towns of Jimma zone, south-western Ethiopia. Based on the interview (78.9%) in urban and (82.2%) in peri-urban were not keeping record. In the study area the main reason raised for not keeping records was (91.7%) farmer's lack of awareness on the benefits of keeping records and the reaming (9.3%) no reason to record. In line with this result, Admasu Lakew et al. (2019) who reported that the main reason raised for not keeping records was farmer's lack of awareness on the benefits of keeping records

Table 6. Housing and record keeping practices

Variables			Study areas					
			Uran		Peri-urban		Overall	
			(N=90)	Percent%	N=90)	Percent%	N=180)	Percent%
Type of house		Separate house	90	100	72	80	162	90
		No separate house	0	0.0	18	20.0	18	10.0
		Overall	90	100	90	100	180	100
Construction materials of house	Roof	Corrugated iron	72	80.0	68	75.6	140	77.8
		Plastic cover	18	20.0	22	24.4	40	22.2
		Overall	90	100	90	100	180	100
	Wall	Stone and blocks	15	16.7	2	2.2	17	9.4
		Woods with mud	75	83.3	88	97.8	163	90.6
		Overall	90	100	90	100	180	100
	Floor types	Concrete	50	55.6	26	28.9	76	42.2
		Stone	40	44.4	35	38.9	75	41.7
		Earth	0	0.0	29	32.2	29	16.1
		Overall	90	100	90	100	180	100
Record system?	Yes		19	21.1	16	17.8	35	19.4
	No		71	78.9	74	82.2	145	80.6
	Overall		90	100	90	100	180	100
reasons for no record	lack of awareness		68	95.8	65	87.8	133	91.7
	no reason		3	4.2	9	12.2	12	8.3
	overall		71	100	74	100	145	100

N, number of respondents

4.4.2. Major source of dairy cattle feeds and feeding systems

As shown in (Table 7), in the study area the major feeding system is stall feeding (60%) followed by (25.5%) both grazing and stall feeding and the remaining 14.4% were grazing. The result of this study is in disagreement with previous findings of Amanuel Bekuma and Yohanis Addisu (2021) who reported that free grazing remains the major system of feeding (72.12) practiced as compared to tethering during wet grazing (27.8%) systems. In this result the feeding system in urban were (91.1%) stall feeding, (6.7%) both grazing and stall feeding, (2.2%) grazing and in peri-urban (28.9%) stall feeding, (44.4%) both grazing and stall feeding and (26.7%) grazing. The grazing feeding system in peri-

urban was higher than in urban this may be due to in peri-urban area land availability is higher than urban.

The results of these study show that agro-industrial byproduct was the major animal feed resources (36.7%) followed by hay (31.1%) in urban area. While hay was the major animal feed resource (35.6%) followed by agro-industrial byproduct (18.9%) in per-urban study area (Table 9). The finding of the present study with regard to identified feed resources was in agreement with previous work of Amanuel Bekuma and Yohanis Addisu (2021) who reported that different feed resources were identified and categorized into: private natural pasture, communal pastures grazing, hay, green feeds (fresh or succulent grasses and legumes), crop residue, road and river side, aftermath grazing and also non-conventional feed were identified.

Table 7. Types of dairy cattle feed and feeding systems

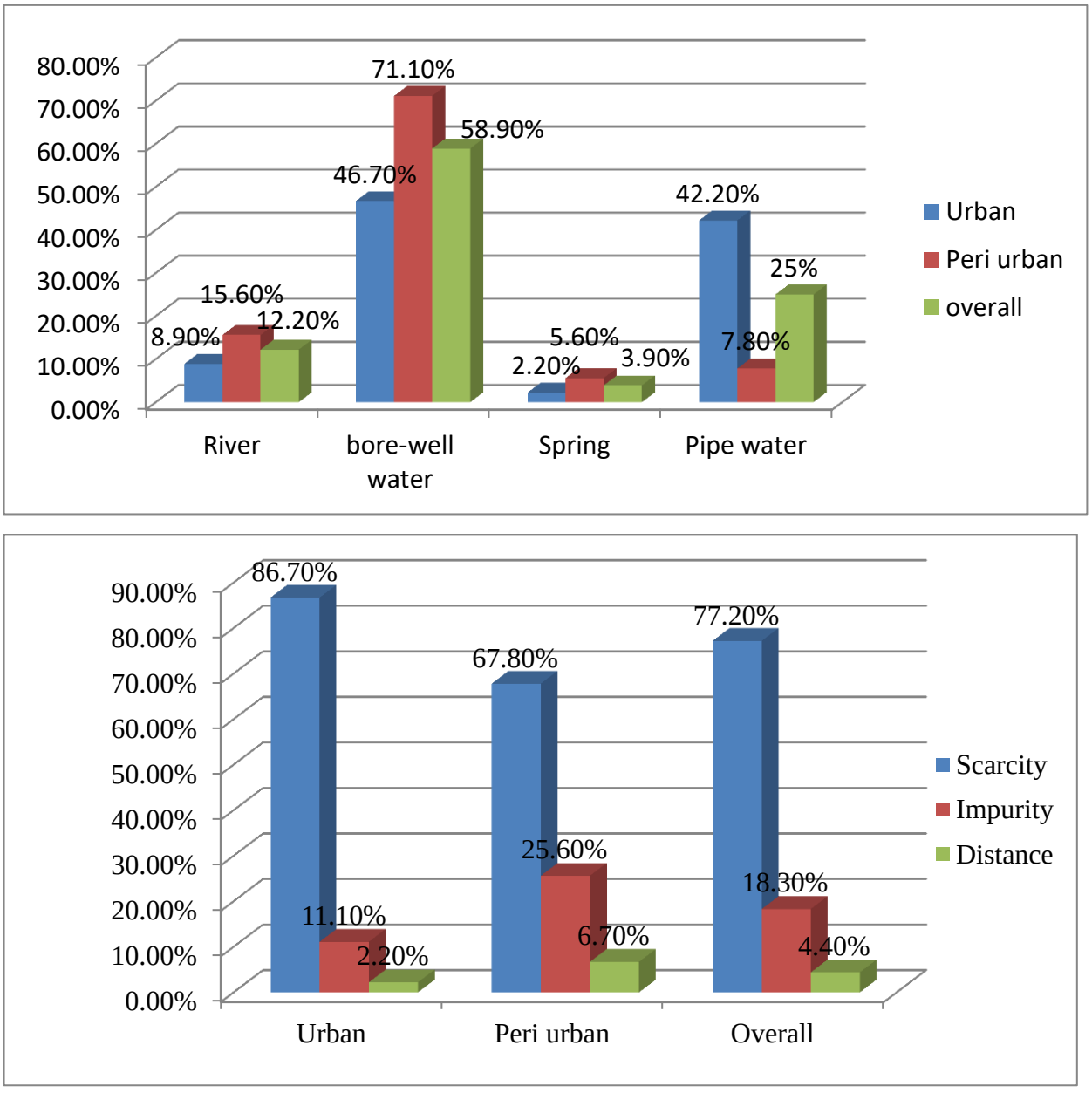
Variables		Study areas					
		Urban		Peri-urban		Overall	
		(N=90)	Percent%	(N=90)	Percent%	(N=180)	Percent%
Types of dairy cattle feeding systems	Grazing	2	2.2	24	26.7	26	14.4
	Stall feeding	82	91.1	26	28.9	108	60.0
	Both grazing and stall feeding	6	6.7	40	44.4	46	25.6
	Overall	90	100	90	100	180	100
Major types of dairy animal feed resource	Agroindustry byproduct	33	36.7	17	18.9	50	27.8
	Improved forage	3	3.3	7	7.8	10	5.6
	Crop residue	6	6.7	18	20.0	24	13.3
	Grazing	2	2.2	5	5.6	7	3.9
	Local brewery byproduct	18	20.0	11	12.2	29	16.1
	Hay	28	31.1	32	35.6	60	33.3
	Overall	90	100	90	100	180	100

N, number of respondents

4.4.3. Source of water and water related problems

The availability of water sources for dairy animals reported to vary across the study sites (Figure 4). The majority (58.9%) of the interviewed dairy farmers were dependent on bore-

well water followed by (25%) are pipe water, river (12.5%) and (3.9) are spring water. The result of this study was in disagreement with previous findings of Bereda *et al.* (2017) who reported that about half of the interviewed dairy farmers were dependent on tap water followed by river, spring and bore-well water in Sendafa, Chancho, Fiche and Degem. The majority of the respondents (72.2%) in the study area mentioned sacristy of water was as a major problem. This result was in agreement with the findings of Bereda *et al.* (2017) who reported that the majority of the respondents (50-91%) mentioned seasonality of water availability as a major constraint.

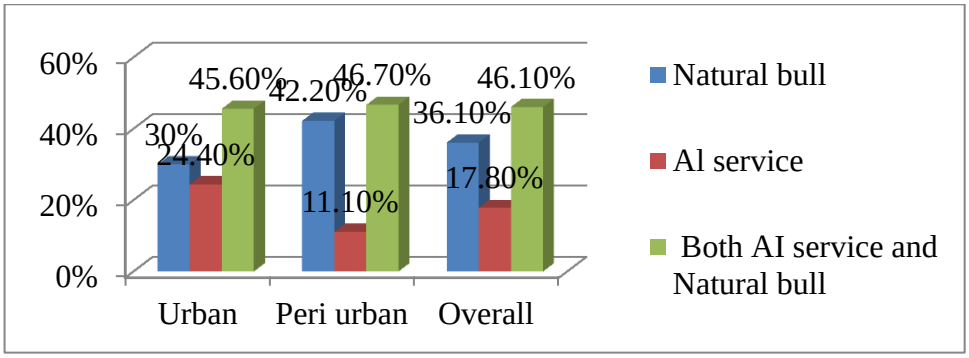


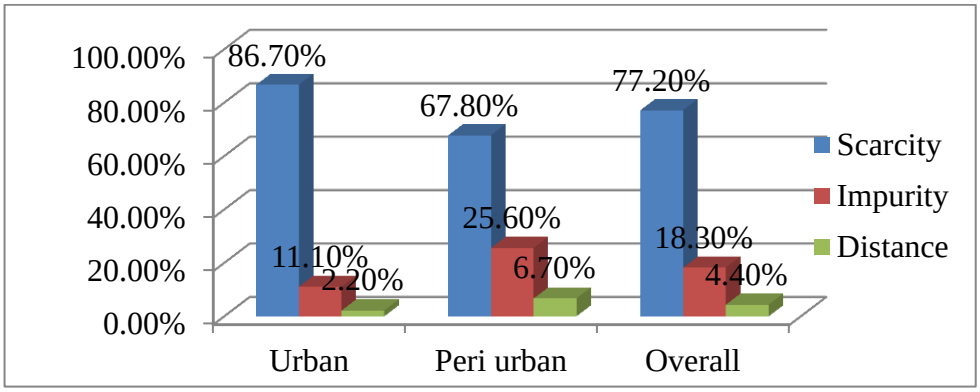
N, Number of respondents

Figure 4. Source of water and water related problems (N=180)

4.4.4. Breeding practice

In the present study, both natural mating and AI were practiced in the study area. Most of the farmers in the study area bred their dairy cows using both natural mating and AI (46.1%), natural mating (36.1%) and AI (17.8%) alone (Figure 5). The current result is in line with the findings of Hirpha Ketema and Amanuel Bekuma (2018) who reported most of the farmers in the study area bred their dairy cows using natural mating and AI (50%), natural mating (46.1%) and only AI (3.9%) Walmera District of Oromia Regional State. In contrast to this, Abadi *et al* (2017) reported 56.67% of the respondents use AI and the remaining. 43.33% of the respondents use natural mating in Adigrat Town. Almost all respondents (90.1%) of the study area reported that the major constraints of AI were lack of access of AI service, the rest (9.9%) were conception problem. This result was in line with the reports of Hirpha Ketema and Amanuel Bekuma (2018) who reported that most of the AI service provided by the government technician was not easily accessible for the farmers only 24.5% of the respondents had easy access to AI service and the rest did not have easy access to AI service.





N, number of respondents

Figure 5. Breeding system and major constraints of AI service of dairy cattle (N=180)

4.4.5. Weaning and culling practice

In the present study the majority (80%) of the dairy producers were practiced calf weaning in their farm (Table 8). This result agreed with previous similar studies conducted by Kiros Abebe *et al.* (2018) reported that in Bishoftu and Holetta areas all respondents were practiced calf weaning. In the present study the majority of dairy producers (84.4%) in urban and (89.1%) in per-urban were practiced partial weaning methods to wean their calves. In agreement with these results, about 90.8% dairy cattle producers, both in town and the surrounding of Boditti town practiced partial suckling prior to milking and colostrum is given to calves freely (Asrat *et al.,* 2013). In this study almost all of the respondents (88.9%) practiced culling of dairy cattle. In line with this result the study in North Shoa Zone, Ethiopia Admasu Lakew *et al.* (2019) reported that culling was practiced by the majority of the respondents in urban areas than peri-urban areas. In this study the reasons for culling were financial constraint (57.5%), low milk yield (17.5%), old age (14.4%) and infertility (10.6%). This result were agreed with report of Ayele Abebe (2012) in Fogera, Jeldu and Diga districts of the Nile Basin (Ethiopia) indicated that in case of emergencies both financial and agricultural the farmers tend to sell the growing herd first and breeding females were maintained in the herd for older age until, reproductive performance was nearly stopped.

Table 8. Weaning and culling practice

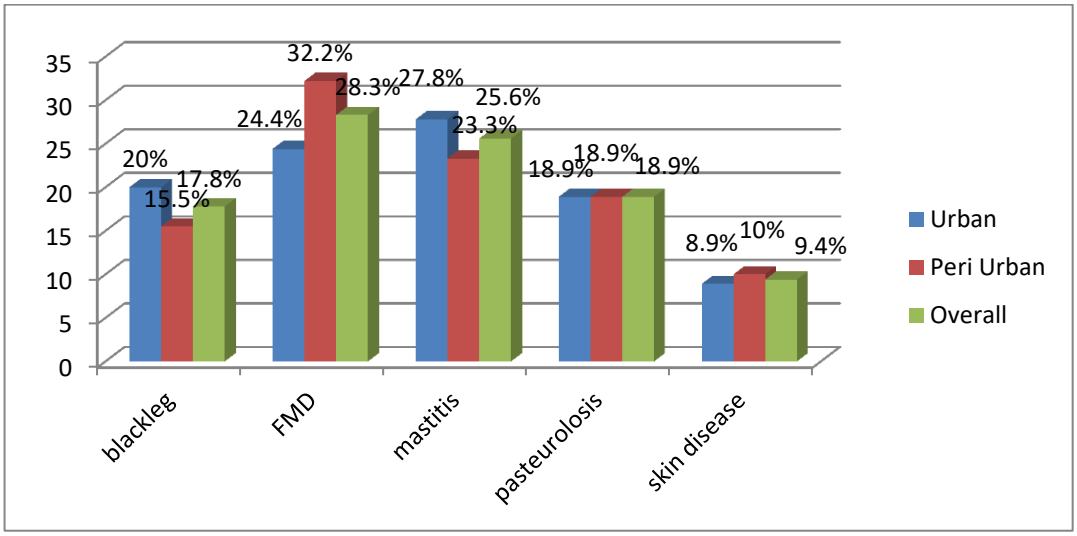
Variables		Study areas					
		Urban		Peri-urban		Overall	
		(N=90)	Percent%	(N=90)	Percent%	(N=180)	Percent%
Do you practice calf weaning?	Yes	79	87.8	65	72.2	144	80
	No	11	12.2	25	27.8	26	20
	Overall	90	100	90	100	180	100
Types of weaning	partial	67	84.4	57	89.1	124	86.7
	abrupt	12	15.2	7	10.9	19	13.3
	Overall	79	100	64	100	143	100
Do you practice culling	Yes	84	93.3	76	84.4	160	88.9
	No	6	6.7	14	15.6	20	11.1
	Overall	90	100	90	100	180	100
Reason of culling	Infertility	9	10.7	8	10.5	17	10.6
	Low milk yield	16	19.0	12	15.8	28	17.5
	Financial constraint	52	61.9	40	52.6	92	57.5
	Overall	84	100	76	100	160	100

N=number of respondents

4.4.6. Common disease of dairy cattle

The major diseases identified in the study area are presented in (Figure 6. The most important diseases affecting dairy cows in the study area were Foot and Mouth Disease (FMD) 28.3%, Mastitis (25.6%), pasteurolosis (18.9%), Blackleg (17.8%) and Lumpy skin disease (LSD) (9.4) were the most important disease in the study area. Mastitis was higher in urban and FMD was higher in peri urban this due to in urban the crossbred dairy cows have higher blood level which are more sus table to mastitis and FMD was higher in peri urban this is due to lack management as FMD is viral disease it require high management. The result was in disagreement with the findings of Amanuel Bekuma and Yohanis Addisu (2021) who reported that Trypanosomiasis (23.44%), Mastitis (19.8%) and Foot and mouth disease (FMD (17.7%) were among the frequently occurring dairy cow diseases and Abera Yetera et al. (2018) who reported that the most important diseases affecting dairy cows are trypanosomosis (Shillo), Anthrax (Abba (Lamootta),

Contagious Bovine Pleuroneumonia (CBPP) (Woraanitto) and Lumpy skin disease (Qadda).



N=number of respondents

Figure 6. Common Disease of Dairy Cattle (N=180)

4.5. Reproductive Performance of Crossbred Dairy Cattle

4.5.1. Age at first service

The overall average age at first service (AFS) of crossbred dairy heifers was 23.17±7.53 months. The average age at first service of crossbred dairy heifers in urban and peri-urban production system were 20.28±4.35 and 26.05±8.85 months respectively (Table 9). The age at first service were shorter in urban than peri-urban production systems. This may be due to in agreement with the findings of Beshada Taye and Asaminew Tassew (2023) who reported that the average differences in nutrition, and management practices among production systems. This result is age at first service of crossbred dairy heifers in urban for large, medium, and small scale production were 21.5±1.5, 22.1±1.2 and 23.9±1.5 months, and in peri-urban 22.2±2.4, 22.7±2.5 and 24.8±2.1 months, respectively in and around Sendafa town, Oromia Region, Ethiopia. The result of the study was higher than Dessalegn Genzebu (2017) who reported that the mean age at first service was 18.7±3.7 and 18.7±3.5 months (range of 13 to 26 months) old for crossbreed cattle reared by the farmers in Bishoftu and Akaki towen , respectively. The results, on the other hand, were lower than the results of Bayissa Amenu *et al.* (2017) who reported that overall average age at first service (AFS) for local and crossbred heifers in the study districts were 45.27 ± 0.47 and 32.11 ± 1.23 months, respectively in Gindeberet and Abuna Gindeberet Districts of West Shoa Zone, Oromia Region, Ethiopia.

4.5.2. Numbers of services per conception (NSPC)

The overall numbers of services per conception (NSPC) of crossbred dairy heifers was 1.70±0.85 months. The average numbers of services per conception of crossbred dairy cows in urban and peri-urban production system were 1.54±0.54 and 1.85±1.05 respectively (Table 9). This result is line with the results of Kirose Abebe *et al*. (2019) who reported that the longest average numbers of services per conception were 1.85±0.61 and 1.65±0.5 which were from peri-urban and urban of Bishoftu. This result is lower than the findings of Wondossen Ayalew *et al*. (2018) who reported that the average numbers of services per conception of this study was 2.18 Tropical Highlands, South Western.

4.5.3. Age at first calving (AFC)

Age at first calving is defined as the age at which heifers calve for the first time. The overall average age at first calving (AFC) of crossbred dairy heifers was 31.99±6.97 months. The average age at first calving of crossbred dairy heifers in urban and peri-urban production system were 29.33±4.39 and 34.65±8 months respectively (Table 9). This finding is in agreement with the results of Beshada Taye and Asaminew Tassew (2023) who reported that mean of age at first calving in the urban was 32.8±2.5 months and the average length of the first calving in peri-urban was 33.9±3.3 months. The results, on the other hand, were lower than the findings of Bayissa Amenu *et al.* (2017) who reported the overall average of age at first calving (AFC) for local and crossbred cows in the study areas were 57.08 ± 0.61 and 40.79 ± 1.23 months, respectively.

4.5.4. Days open (DO)

The overall number of day's open of crossbred dairy cows in the study area was 186.12±81 days. The average number of day's open of crossbred dairy cows in urban and peri-urban production system was 154.02±65.33 and 218.22±82.74 days, respectively (Table 9). This result is in line with the findings of Kefale Getahun et al. (2019) who reported that the result of DO is (197 days) in Holetta Agricultural Research Center. An increase in days open was observed in peri-urban areas. This could be due to the inconsistency of management related to a lack of supplementary feed, poor oestrus detection, insufficient AI services, a lack of regular follow up of breeder cows, and other technical issues). These findings were greater than the findings of Abera Fekata and Ulfina Galmessa Girgo (2022) who reported that the average number of days that local and cross breeds were available was 161±0.41 and 140±0.49, respectively in Waliso and Ilu Districts Oromia, Ethiopia.

4.5.5. Calving interval (CI)

The overall average daily milk yield of crossbred dairy cow in the study area was 9.64±3.01 liter, (Table 9). This result was higher than the report of Aschalew Kebede and Asrat Guja (2023) that the mean value of the daily milk yield of crossbred cows in the study area was 7.29±0.22 liter/day at Gidole Town, south Ethiopia and Desyibelew W et al. (2019) who reported as the overall mean milk yield was 7.40 ± 0.38 liters per cow. The total milk yield in urban and per urban dairy were 10.71±3.64 and 8.57±1.64 liter per day per cows, respectively. This result were less than the results of Dessalegn Genzebu (2017) who reported that the mean milk yield was 14.3±5.4 litter, 12.7±2.7 litter and 7.9±2.5 liters for the first, second and third stage of lactations, respectively with an overall average of 11.6±3.1 liters per day/cows in Bishoftu.

Table 9. Reproductive performance of dairy cattle

Variables	Study areas		
	Urban	Peri-urban	Overall
	N=90	N=90	N=180
	Mean±SD	Mean±SD	Mean±SD
Age at first service (months)	20.28±4.35	26.05±8.85	23.17±7.53
Number of service per conception	1.54±0.54	1.85±1.05	1.70±0.85
Age at first calving (months)	29.33±4.39	34.65±8	31.99±6.97
Days open (days)	154.02±65.33	218.22±82.74	186.12±81
Calving interval (months)	14.80±3.25	18.83±5.27	16.81±4.81

N, number of respondents; SD, standard deviation

4.6. Production Performance of Crossbreed Dairy Cattle

4.6.1. Daily milk yield

The overall average daily milk yield of crossbred dairy cow in the study area was 9.64±3.01 liter, respectively (Table 10). This result was higher than the report of Aschalew Kebede and Asrat Guja (2023) that the mean value of the daily milk yield of crossbred cows in the study area was 7.29±0.22 liter/day at Gidole Town, south Ethiopia and Desyibelew W *et al*. (2019) the overall mean milk yield was 7.40 ± 0.38 liters per cow. The total milk yield in urban and per urban dairy were 10.71±3.64 and 8.57±1.64 liter per day per cows respectively. This result were less than the results of Dessalegn Genzebu (2017) who reported that the mean milk yield was 14.3±5.4 litter, 12.7±2.7 litter and 7.9±2.5 liters for

the first, second and third stage of lactations, respectively with an overall average of 11.6±3.1 liters per day/cows in Bishoftu.

4.6.2. Lactation Length

The average lactation length of crossbreds cattle in the study area were 285.83±57.64 days, (Table 10). The lactation length was higher than the report of Desyibelew W *et al.* (2019) that the average lactation length in the study area was reported by the respondents as 7.49 ± 0.13 months (224.7days). The result was lower than the findings of Kefale Getahun (2020) who reported that the mean lactation length estimated by this study was (326.69 ± 2.03 days) and higher than the result of Aschalew Kebede and Asrat Guja (2023) who reported that the mean lactation length of crossbreed cows in the study area was 7.9±1.45 months (237±43.5days). The average lactation length of dairy cows in urban and peri-urban were 277.00±59.50 and 294.66±54.63 days respectively. The result was lower than the results of Beshada Taye and Asaminew Tassew (2023) who reported that the overall average lactation length in urban and peri-urban was 323.0±46.7and 319.0±45.6 days, respectively

Table 10. Average milk yield and lactation length

variables	study areas		
	Urban	Peri-urban	Overall
	N=90	N=90	N=180
	Mean±SD	Mean±SD	Mean±SD
Average daily milk yield(liter)	10.71±3.64	8.57±1.64	9.64±3.01
Lactation length	294.66±54.63	277.00±59.50	285.83±57.64

4.7. Monitoring Results

4.7.1. Effect of genotypes on milk yield

This result had significant (P< 0.01) effect of different genotypes on average daily milk yields in urban and per urban production. The mean daily milk yields of crossbred cows in the study area were different and it is increasing as genotype increases within the same genotype in different types of production system and stage of lactation. Accordingly, the average daily milk yield in urban production system for 25%, 50%, 75%, and >75% genotypes were 5.85±2.15, 9.55±3.32, 10.32±3.50 and 13.05±3.70 liters respectively. The average daily milk yields in per urban production system for 25%, 50%, 75%, and >75% genotypes were 4.14±1.29, 7.27±2.63, 7.74±3.19 and 9.95±3.56 liters respectively. The

total milk yield in the study area in all genotypes was 4.71± 1.79, 8.41±3.17, 9.38±3.57 and 11.50±3.90 liters respectively. The total milk yields of crossbred dairy cows in urban and per urban dairy production were 10.14±3.96 and 7.10±3.44 liters respectively. The total milk yields of crossbred dairy cows in in the study area were 8.62±4.0 liters respectively (Table 13). This result was lower than the findings of Beshada Taye and Asaminew Tassew (2023) who reported that the total milk yields for all genotypes in urban and per urban dairy production system were 10.1±1.7 and 10.1±1.9 liters per day per cows respectively and Nitsuh Walelign (2018) who reported that the average daily milk yield in the MAIE farm was 12.26 0.06 liters. This result was higher than the previous report by Bekuma A *et al.* (2022) who reported that the mean daily milk yield per cow for indigenous and crossbred cow was 1.18±0.52 and 5.83±0.28 liters, respectively in West Wollega Zone, Gimbi District, Ethiopia and Aschalew Kebede and Asrat Guja (2023) reported that the mean value of the daily milk yield of crossbred cows in the study area was 7.29±0.22 liter/day.

Table 11.Average daily milk yield in different genotype across different production system (Mean±SD) (N=40)

Genotypes	Number of records	Daily milk yield (Mean±SD)			P-value
		Urban	Peri-urban	Total	
25%	65	5.85 ± 2.15^{d}	4.14 ± 1.29^{d}	4.71 ± 1.79^{d}	0.0001
50%	78	9.55 ± 3.32^{c}	7.27 ± 2.63^{c}	8.41 ± 3.17^{c}	0.0001
75%	78	10.32 ± 3.50^{b}	7.74 ± 3.19^{b}	9.38 ± 3.57^{b}	0.0001
>75%	78	13.05 ± 3.70^{a}	9.95 ± 3.56^{a}	11.50 ± 3.90^{a}	0.0001
Overall	312	10.14 ± 3.96^{b}	7.10 ± 3.44^{c}	8.62 ± 4.00^{c}	0.0060

Means with the same letter of superscript in the same column and row did not differ significantly at (P≥0.05), N= Number of sampled dairy cows SD = Standard deviation. N= number of sampled dairy cows (20 dairy cows for each production system)

4.7.2. Effect of parity on milk yield

In this result parity had significant (P <0.05) effect on average daily milk yield in urban and peri-urban production system. In the present study, the average daily milk yield was increased from parity one to parity five in urban and per-urban production system. An overall daily milk yield in urban for parity one, parity two, parity three, parity four and parity five were 8.50±3.28, 9.54± .67, 11.37±3.91, 10.64±4.97 and 12.24±4.4 liters respectively and an overall daily milk yield in per-urban for parity one, parity two, parity three, parity four and parity five were 5.97±2.25, 5.98±2.72, 7.37±3.97, 8.24±4.27 and 8.28±3.72liters respectively. The total milk yield in the study area in all parity was 7.23±3.05, 7.95±3.20, 8.97±4.31, 9.57±4.74 and 9.98±4.41 liters respectively. In the study area daily milk yield was increased as parity increase (Table 14). The present result indicated that cows are produced more milk as they became matured enough (associated with growth in body size and secretory tissues of udder and adaptation to lactation stress). As a matter of fact as age increase animals will utilize the feed for maintenance, production and reproduction rather than for growth. Hence, the feed used for growth in heifers will be utilized for milk production in older animals. The result was agreed with the result of Kefale Getahun (2020) who reported that significantly (P<0.05) higher daily milk yield was observed in parity eight and lower yield was observed at parity one and Nitsuh Walelign (2018) who reported that parity also had shown significant effect (P <0.01) on lactation milk yield.

Table 12.Average daily milk yield against parity across different production system (Mean±SD) (N=40)

Parity	Number of records	Daily milk yield (Mean±SD)			P-value
		Urban	Peri-urban	Total	
1	73	8.50 ± 3.28^{e}	5.97 ± 2.25^{c}	7.23 ± 3.05^{e}	0.0001
2	72	9.54 ± 2.67^{d}	5.98 ± 2.72^{c}	7.95 ± 3.20^{d}	0.0001
3	67	11.37 ± 3.91^{b}	7.37 ± 3.97^{b}	8.97 ± 4.31^{c}	0.0001
4	66	10.64 ± 4.97^{c}	8.24 ± 4.27^{a}	9.57 ± 4.74^{b}	0.0001
5	70	12.24 ± 4.42^{a}	8.28 ± 3.72^{a}	9.98 ± 4.41^{a}	0.0001
Overall	348	10.14 ± 3.96^{c}	7.10 ± 3.44^{b}	8.62 ± 4.00^{c}	0.0394

Means with the same letter of superscript in the same column and row did not differ significantly at (P≥0.05), SD = Standard deviation. N= number of sampled dairy cows (20 dairy cows for each production system)

4.7.3. Effect of stage of lactation on milk yield

In this result stage of lactation had significant (P <0.05) effect on average daily milk yield in urban and peri-urban production system. In this result daily milk yield was decreased as from lactation stage 1st to 3rd. The average daily milk yield at 1st, 2nd, and 3rd lactation stages in urban was 13.37± 3.28, 10.37± 3.14 and 6.68±2.14 liters respectively and an overall daily milk yield in per-urban 9.72±3.59, 7.12±2.72, and 4.45±1.40 liters respectively The total milk yield in the study area in all lactation stage was 11.54 ±3.86, 8.75 ±3.33 and 5.57±2.11 liters respectively (Table15). In result was lower than the result of Megara Abera (2016) who reported that the average milk production for all crossbred with different exotic blood level lactation stage was 17.69 , 13.5 and 9.8 liters at early, mid and late stage of lactations. The result was comparable with the findings of Melku Muluye *et al.* (2017) who reported that the average milk production for all crossbred cows with exotic blood level was 9.0±3, 7.2±2 and 4.4±2 liters at early, mid and late stage of lactation and Desyibelew W *et al*. (2019) who reported that the overall mean milk yield per day per cow during early, mid and late stage of lactation was reported by the respondents as 9.74 ± 0.42 liters, 7.39±0.32 liters and 5.078 ± 0.25 liters per cow, respectively.

Table 13.Average daily milk yield in a different stage of lactation across different production system (Mean±SD) (N=40)

Stage of lactation	Number of records	Daily milk yield (Mean±SD)			P-value
		Urban	Peri-urban	Total	
1st	78	13.37± 3.28[a]	9.72 ± 3.59[a]	11.54 ±3.86[a]	0.0001
2nd	78	10.37 ±3.14[b]	7.12± 2.72[b]	8.75 ±3.33[b]	0.0001
3rd	70	6.68 ± 2.14[c]	4.45 ± 1.40[c]	5.57±2.11[c]	0.0001
Overall	226	10.14 ± 3.96[a]	7.10± 3.44[c]	8.62± 4.00[b]	0.0498

Means with the same letter of superscript in the same column and row did not differ significantly at (P≥0.05), N= Number of sampled dairy cows SD = Standard deviation. N= number of sampled dairy cows (20 dairy cows for each production system)

4.8. Constraints and Opportunities of Dairy Cattle Production

4.8.1. Constraints of dairy cattle production

According to the respondent's response high feed cost, feed quality and availability problem, disease prevalence, shortage of water, land scarcity and space limitation were the followed by, lack of market access, lack of finance and poor artificial insemination and bull service were the other ranked major problems in urban while feed quality and availability problem, high feed cost, disease prevalence, lack of market access, poor artificial insemination and bull service, lack of finance, shortage of water and land scarcity and space limitation were among the major constraints to dairy cattle production (Table 16). This result is in line with the previously reported by Sara Endale *et al.* (2022) shortage of feeds are noted as major constraints in animal production. (Minale Getachew and Yilkal Tadele (2015) also reported similar findings as the primary constraints to increased milk production under all dairy production systems are inadequate feed resources, poor pasture development and the increasing feed prices.

Also, it is in agreement with the result of Malede Birhan *et al.* (2015) finding most important constraints associated with milk production were land shortage, feed shortage, dkisease prevalence, poor government attention, poor veterinary service, lack of improved dairy breed, high cost of feed, water shortage, lack of improved forage pasture and poor transportation and Bernabas Ayeneshet *et al.* (2018) also indicated main production constraints as revealed by the farmers include shortage of quality feed supply, inadequate water supply, prevalence of diseases, marketing problem, poor Infrastructure of their locality and inadequate extension service.

4.8.2. Opportunities of dairy cattle production

The major opportunities to dairy cattle production in the study area are shown in Table 17. High demand for milk consumption, income generation and employment creation, availability of animal health services, market access followed by suitable climatic condition, supply of dairy cattle breed, availability of AI service and extension and training service in the urban while income generation and employment creation, high demand for milk consumption, availability of animal health services, suitable climatic condition, market access followed by supply of dairy cattle breed, market access, extension and training service, and availability of AI service in peri-urban were among the major opportunities ranked by the respondents.

This result is in line with the previously reported by Asrat A *et al*. (2016) that dairying provides the opportunity for smallholder farmers to use land, labor and feed resources and generate regular income. Therefore, market connection, improved breeds (access for AI), and improved management and veterinary and extension services are the major issues for smallholder dairy development in addition to provision of credit, adequate land and training and Abdurehman Musa and Yusuf Mummed Yesihak (2020) also reported similar findings as although many problems and constraints that may hinder the development of the dairy sector were identified in the area, the interviewed households were willing to continue expand and/or involve in dairying in the future. Because they understood that dairy farming supports livelihoods of society under low input production system, generates income and creates employment opportunity under market oriented production system.

Also, it is in agreement with the result of Tsegay Lijalem *et al.* (2015) finding despite of there were many problems and constraints that might be slow down the development of the dairy sector however, there were also suitable condition to improve dairy production and productivity for the future such as marketing accessibility, veterinary and artificial insemination service (AI) and infrastructure.

Table 14. Major constraints of dairy cattle production

Parameter	Urban											Peri-urban										
Dairy Production constraints	Rank											Rank										
	1th	2th	3th	4th	5th	6th	7th	8th	Score	Index	Rank	1th	2th	3th	4th	5th	6th	7th	8th	Score	Index	Rank
High feed costs	83	7	0	0	0	0	0	0	713	0.220	1	13	77	0	0	0	0	0	0	643	0.198	2
Land scarcity and space limitation	0	2	1	2	70	1	13	1	340	0.105	5	0	1	7	5	3	4	13	57	181	0.055	8
Feed quality and availability problems	5	70	13	0	2	0	0	0	616	0.190	2	66	0	18	0	6	0	0	0	660	0.203	1
Disease prevalence	0	10	68	2	6	1	3	0	521	0.160	3	6	1	2	68	10	2	1	0	455	0.140	3
Poor artificial insemination and bull service	0	0	0	4	0	2	8	76	118	0.036	8	0	0	0	6	68	14	2	0	348	0.107	5
Lack of market access	0	0	6	4	3	75	1	1	296	0.091	6	0	5	50	7	0	21	6	1	446	0.137	4
Shortage of water	2	1	0	76	5	2	0	4	433	0.134	4	0		2	3	0	46	14	25	218	0.067	7
Lack of finance	0	0	2	2	4	9	65	8	203	0.063	7	6	5	11	0	3	4	54	7	288	0.088	6
Total									3240	1										3239	1	

Table 15. Major opportunities of dairy cattle production

Parameter	Urban											Peri-urban										
Dairy Production opportunities	Rank											Rank										
	1th	2th	3th	4th	5th	6th	7th	8th	Score	Index	Rank	1th	2th	3th	4th	5th	6th	7th	8th	Score	Index	Rank
High demand for milk consumption	81	81	10	0	0	0	0	0	710	0.219	1	40	77	9	0	0	0	0	0	625	0.192	2
Income generation and employment creation	30	81	6	0	0	0	0	0	627	0.193	2	80	10	0	0	0	0	0	0	710	0.219	1
Availability of animal health services	6	1	38	45	0	0	0	0	508	0.157	3	3	44	37	6	0	0	0	0	437	0.152	3
Availability of AI service	0	0	0	5	39	7	0	39	241	0.074	7	0	0	0	8	38	3	0	41	202	0.074	8
Supply of dairy cattle breed	0	0	0	1	47	36	6	0	313	0.097	6	0	0	0	3	43	44	0	0	392	0.098	5
Market access	0	0	3	39	1	44	0	3	352	0.109	4	6	0	1	36	3	43	1	0	244	0.116	6
Extension and training	0	0	0	0	0	3	42	45	138	0.042	8	0	0	1	0	0	0	44	45	225	0.042	7
Suitable climate condition	0	0	42	0	3	0	42	3	351	0.108	5	0	0	35	6	0	0	45	4	405	0.103	4
Total									3240	1										3240	1	

CHAPTER 5. CONCLUSION AND RECOMMENDATIONS

5.1.CONCLUSION

The results of this study revealed that the educational levels of most respondents were completed primary school and they can read and write. Most dairy cattle owners participate in dairying activity to get income through selling milk and milk products. High feed cost, shortage of feed and disease prevalence was the main problems of dairy production in the area. The practice of Al service was more common in urban than per-urban. Financial constraint, low milk yield and infertility were the reason of culling dairy cows. Age at first service, number of services per conception, age at first calving, days open and calving interval were shorter in urban than per-urban dairy production systems. The average daily milk yield of crossbred dairy cows was increased as genotypes increase. The average daily milk yield was increased from parity one to parity five both in urban and per-urban production systems. The lactation length of crossbreed was higher in urban than in per-urban. It is concluded that the crossbred cows' reproductive performance is longer, and the milk yield also does not match to their milking potential.

5.2. RECOMMENDATIONS

Based on the findings of the present study it is recommended that:

- The crossbred dairy cows’ reproductive management like housing, feeding, breeding, culling and health care should be improved in order to reduce the age at first service, number of services per conception, age at first calving, days open and calving interval.
- The crossbred dairy cows' milk production is low compared to their milking potential and thus an improvement in overall husbandry practices is needed.

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7. APPENDIX

Appendix 1: Questionnaire

Questionnaire to study on assessment of husbandry practice, reproductive and productive performance of crossbred cattle that are kept in and around Debre Tabor towen , South Gondar Zone, Amhara region, Ethiopia.

Enumerator Name _____Date of interview _____/_____/_____

A. Survey site (Location)

Region: _____ Zone_____ District _____ Kebele _____

Type of production system_____

B. Socioeconomic and farming system characteristics of dairy owner (select and encircle the best answer or fill the blank space)

1. Name of farm owner: _____
2. Sex of farm owner 1 -Male 2. Female
3. Age of the respondent (years) 1. Under 20 2. 20-29 3. 30-39 4. 40-49 5. 50-59 6. 60-69 7. Above 70
4. Marital status 1. Married 2. Single 3.Widow 4.Divorced
5. Educational status of the household 1. Illiterate 2. Read and Write 3. Elementary school 4. High school 5. Diploma and above
6. Family size: _____
7. Land holdings (ha)
   For crop production_____ For grazing_____ For forage production_____
   For forest____ Others_____

C. Livestock type, number and herd composition

Livestock type		Composition	Average Number
Cattle	Milking cows	Local	
		Crosses	
	Pregnant cows	Local	
		Crosses	
	Non- Pregnant cows	Local	
		Crosses	
	Dry cows	Local	
		Crosses	
	Total cows	Local	
		Crosses	
	Oxen	Local	
		Crosses	
	Heifers	Local	
		Crosses	
	Bulls	Local	
		Crosses	
	Male calves	Local	
		Crosses	
	Female calves	Local	
		Crosses	
Total		Local	
		Crosses	
Sheep			
Goats			
Chicken			
Horses			
Donkeys			
Mules			

D. Dairy Production system

1. Is livestock important to you? 1. Yes 2.No
2. Among livestock species which one is more important for you? (list and rank it)

    1. cattle
    2. sheep
    3. goat
    4. poultry
    5. horses
    6. donkeys
    7. mules

3. If yes, please list the reasons of keeping livestock? (list and rank it)
    1. milk yield
    2. income source
    3. for draught power
    4. for saving
    5. manure
    6. for social function
4. Do you produce milk? 1. Yes 2. No
5. If yes, for what purpose do you produce milk? 1. Home consumption 2.market 3. for both 4. Others (specify):_____
6. What is your major livestock farming? 1. Cattle production 2. Small ruminant production 3.Poultry production 5.Honey production 5.Other:_____
7. How long have you been engaged dairy cattle production? _____ 1. 1-5years 2. 6-10 years 3. 11-15 years 4. >15years
8. Source of dairy animals 1. Ranch through Agriculture offices 2. Ranch through service cooperatives 3. Gift from family 4. Gift from NGOs 5. Purchased from local market 6. Given from relatives and/friends 7.Rearing (own source)
9. Currently how many crossbred dairy cows you have? 1. < 2 2. 2 - 4 3. 4 -6 4. >6 5. Others_____
10. . Why you keep dairy cattle? 1. To produce milk for home consumption 2. To produce milk to generate income 3. To produce milk for home consumption and to generate income 4. To use for gift 5. Others ___
11. How do you differentiate among the different dairy cows in your flock? 1. Color 2. Size 3. Milk quantity 4. Using ear tag 5. Local name 6. Others (specify) _____
12. . Who is mainly responsible for the dairy cattle? 1. Female head 2. Male head 3. Children 4. Other laborer 5. All family members 6. Other_____

E. housing system and **record keeping of dairy cattle (selects and encircles the best answer or fill the blank space)**

1. Is there separate house for dairy cattle? 1. Yes 2. No
2. If yes what is the housing type for dairy cattle? 1. Open sided house 2. Closed sided house 3.. No separate house 4. Others
3. If no separate house, how you keep them? 1. Together with other animals 2. Together with family 3. Freely in the compound 4. Others _____
4. How many times clean the dairy house per day? 1. Three times a day 2.Two times a day 3. Once a day 4. Others (specify) ____
5. Condition of Dairy house sanitation 1. Good 2. Fair or medium 3. Dirty 4. Difficult to judge
6. How do you dispose the cattle dung from the barn? 1. Draining system 2. Labor 3. both
7. Frequency of disposing manure from the barn 1. Once per day 2.Twice a day 3. Three times a day. 4. three times
8. What type of herding management do you have for your dairy cattle? 1. Indoor 2. Outdoor 3. Booth
9. What type of floor of barn use for your dairy cattle? 1. Concrete 2. Stone 3. Mud 4. other
10. What condition of your dairy cattle house? 1. Comfortable and dry 2. uncomfortable and dirty 3.medium
11. Is there recording system in the farm? 1. Yes 2. No
12. If yes, what type of record keep? List rank it)
    1. Feed record
    2. breed record
    3. production record
    4. health record
    5. financial record
13. If there is no record, why? 1. Lack of awareness 2. No reason.

G. Feed resources and Feeding system (select and encircle the best answer or fill the blank space)

1. What are the primary sources of feeds for your dairy cows in each month? Write in the table below. Specify each type of feed e.g. Teff straw, wheat straw, wheat bran, wheat short, Sesbania, oat, vetch, alfalfa, Napier grassetc.)

Source	Spring			Winter			Autumn			Summer		
	S	O	N	De	Ja	Fe	Ma	Ap	Ma	Jun	Jul	Aug
Communal pasture land												
Private pasture Land												
Hay												
Backyard forage												
Improved forage												
Crop residues												
Concentrate Feed												
Local brewery by products												
Road and aftermath grazing												
Others, Specify												

2. How do you feed the dairy animals?
    1. Based on only grazing

2. Based on only stall feeding (concentrate + hay and/or crop residue+ agro industrial byproducts + cut and carry + Local brewery)
3. based on grazing and stall feeding(hay/crop residue and cut and carry
4. Based on grazing and stall feeding (concentrate + hay and/or crop residue+ agro industrial byproducts + cut and carry +Local brewery)

3. If they graze for how long they stay in grazing (hours per day)? In wet season? _____
4. If they graze for how long they stay in grazing (hours per day)? In dry season?_____
5. Is there a problem of feed shortage for dairy cows? 1. Yes 2. No
6. If yes, when? 1. From January to June 2.from June to December 3. All the year
7. If yes, how do you cope up with feed shortage in your locality? 1. Change of feed resources based on availability and cost 2. Rent land and grow fodder 3. Reducing herd size 4.Using conserved forage (hay, silage) 5. Using non-conventional feed
8. What are the main problems in the area of improved forage use for milk cows? 1. Unawareness 2. Lack of seed 3. Lack of growing land 4. Poor adaptability 5. Shortage of improved forage in the area 6. Combination of them 7. Other
9. What the main problems in the area are of concentrate feed use for milk cows? 1. Unawareness 2. Lack of access 3. Costly 4. Combination 5. Shortage of supply
10. What are the main problems in the area of crop residue use for milk cows? 1. Shortage of production 2. low nutrient content 3. Utilization by other livestock type 4. Shortage due to Utilization for other purpose other than feed 5. Combination of them 6 .Costly 7. Others
11. Which cop residue is your dominant feed? 1. Teff straw 2. Barley straw 3. Rice straw 4. Maize stalk 5. Inset residue 6. Combination of them (specify) _____
12. What is the major source of feed to your livestock? 1. Agro industrial by product 2. Improved forage 3.crop residue 4. Grazing 5. Local brewery by product 6. Otherr----------
13. To which classes of cattle do you give relatively more in time of Sever feed shortage? 1. Milking cows 2. Milking and pregnant cows 3. Pregnant cows 4. feed than Dry cows 5. Draught oxen
14. How do you get feed (all kind of feeds) for your livestock? 1. Produce on farm 2. Purchase from outside 3. Produce and purchase 4. Other (specify)___

15. Do you conserve feeds to feed milk cows in times of feed shortage? 1. Yes 2. No
16. If yes, how do you conserve? 1. Hay making 2. Silage 3. other:_____
17. If no, why not? 1. Lack of knowledge 2. Lack of labor 3. other_____
18. Do you supplement your lactating animals? 1. Yes 2. No
19. If yes, mention the types of feeds that you supplement? 1. Mixed 2. Wheat bran 3. Bean bran 4. Nug seed cake 5 soybean meals 6. other
20. How do you provide supplementary feeds? 1. Separately 2. Group feeding 3. Others (specify) _____
21. How frequently do you provide supplementary feeds for your lactating animals? 1. Once a day 2. Twice a day 3. Three times a day 4. As available
22. Do you provide mineral supplement to your animals? 1. Yes 2. No
23. If yes, please list the type of supplement (including traditional ones) 1. Salt 2. other
24. How frequently do you provide salt? 1. Free access at any time 2. Daily 3. Every other day 4. Once per week 5. Others

H. Source of Water and Frequency of Watering

1. What is the source of water for your animals? 1. River 2. Tap water 3.Spring 4. Pipe water 5. Bore well 6. Other (specify) _____
2. How frequently do you provide water for your cattle? 1. Free access 2. Once per day 3.Twice per day 4. Three times a day 5. Every other day 6. Other (specify) _____
3. What is your water related problem? 1. Scarcity 2. Parasites 3.Impurities 4. Distance

F. Calf management and dairy cattle culling practices (select and encircle the best answer and fill the blank space)

1. Do you wean your calf? 1. Yes 2. No
2. If yes, at what age do you wean the calf (in months)? 1. 2month 2. 3month 3. 4 month 4. 5 month 5. other
3. If yes, which type of weaning do you exercise? 1. Partial weaning 2. Abrupt weaning 3. Other (specify)
4. Who weans the calf mostly? 1. The cow refusal 2. Owner 3.Refusal of the calf due to lack of milk 4. Others (specify)
5. If the owner does weaning, explain the reason? 1. To get more milk 2. Prepare the cow for mating 3. Give rest time for next calving 4. Combination of them_____ 5. Others (specify)_____

6. System of weaning exercised by the owner? 1. Isolation 2. Protection from sucking without isolation 3. Other (specify) _____
7. What method do you use for pre-weaning milk feeding? 1. Bucket feeding (for local, cross or both) 2. Partial suckling (for local, cross or both) 3.Other (for local, cross or both) (specify
8. Do you provide colostrum for your newborn calf? 1. Yes 2. No
9. If yes, for how long is the newborn calf supplied with milk (In days)? 1. 2days 2. 3 days 3. 4 days 4. 5 days 5. Other
10. If no, why? 1. Lack of awareness 2. To use for home consumption 3. Other
11. For how long newborn calves stay indoors until they start grazing? Specify in days 1. 30 days 2. 60 days 3. 90 days 4. 120days
12. Do you provide supplementary feed to newborn calf till they start grazing? 1. Yes 2. No
13. If yes, mention type of feed? 1 .milk 2. Milk replacement feed 3.other_____
14. If yes, mention form of feeding? 1. Group 2. Individual) 3. other _____
15. Do you practice culling? 1. Yes 2. No
16. If yes, what is the main reason of culling? 1. Disease 2. Old age 3. Infertility 4. Low milk yield 5.financial constraint 6. Feed shortage 7. Others (specify) _____
17. If you cull dairy cattle due to financial constraint, which is your priority for culling? 1. Milking cow 2. Bull 4. Heifer 5. Male calves 6. Female calves 7. Pregnant cow 8. Infertile/cows with low milk yield 9. Others (specify)

I. Breeding, reproductive and productive performances of dairy cattle (select and encircle the best answer or fill the blank space)

1. What are merits of crossbred cattle compared with local cattle (list and rank it).
    1. have less resistance to disease
    2. require more quality and quantity of feed
    3. require high dairy housing management
    4. require high disease management

2. What are demerit of crossbred cattle compared with local cattle (list and rank it)
    1. Provide high milk production
    2. Provide high meat production
    3. Have high growth rate and fertility

4. produce more calf through their life time

3. Which breed of dairy cows do you like to keep in the future? 1. Local 2. Crossbred
4. Why do you select it? 1. High milk production 2.high meat production 3. High growth rate 4. High fertility 5. produce more calf through their life time
5. Do you select superior females for breeding? 1. Yes 2. No
6. If yes, how do you select breeding cows? 1. Pedigree history 2. Physical appearances 3. Milk production 4. Growth rate 5. Age at first calving 6. Calving interval 7. Mothering ability 8. Others (specify) _____
7. Do you select superior males for breeding? 1. Yes 2. No
8. If yes, how do you select breeding males? 1. Pedigree history 2. Physical appearances 3. Growth rate 4. Service efficiency 5. Combination of the above (mention) 6. Others (specify)
9. Which breed sire mostly you use for natural mating? 1. Crossbred 2. Local 3. Both equally 4. Unknown
10. What are your criteria(s) to mate heifers? 1. Age 2. Size 3. Both age and size 4. Whenever they manifest estrus
11. What type of breeding practices do you use for dairy cows? 1. Natural (bull service) 2. Artificial insemination (AI) 3. Both
12. If you use AI, what is the source of it? 1. Government recruited technicians' 2. NGO's 3. Private 4. Others (specify) ____
13. Is there a problem of AI? 1. Yes 2. No
14. If yes, why? 1. No access 2. Unwillingness of AI technicians' 3. Shortage of liquid nitrogen and semen 4. Others (specify) _____
15. Do you have your own breeding bull? 1. Yes 2. No
16. If yes, breed type? 1. local 2.crossbreed
17. If yes, how does it give service? 1. Own herd only 2. Own and neighbor herd freely 3. Others (specify) ____
18. If no, where is your source for the bull? 1. Neighbor freely 2. Government 3. Rent from neighbor specify in birr_____ 4. Others (specify) _____
19. Is mating seasonal? 1. Yes 2. No
20. If yes, why? 1. Due to feed shortage in some months 2. Planned for heat period and time of calving 3. Other (specify) _____
21. If you're mating is natural as well as seasonal how cows and bulls are protected from mating out of the season? 1. Isolation 2. Others (specify) _____

22. What are the peaks mating months of the year? (Mention) 1.Spring 2. Winter 3. Autumn 4. Summer
23. Why you select? 1. High amount of feed source 2. Climatic favorability of season 3. other
24. How long (in years) a milk cow and bull stays in a herd for breeding in their lifetime? 1. Cow _____ 2.Bull_____
25. How do you detect a heifer or cow in heat? 1. Heat sign 2. Tether bull 3 other _____
26. If you are using heat signs, what are the most important heat signs you use to detect a cow in heat? (list and rank it)
    1. Mucus discharge from vulva
    2. Reading and swelling of vulva
    3. Shouting
    4. Reduce feed intake
    5. Mount other animals
    6. Stand to be mounted by other animals
    7. nervousness
27. What is the average age at first service (AFS) for crossbred dairy heifer? In months _____
28. If you see a cow in heat in the morning, when do you take the cow for service?_____ _____
29. If you see a cow in heat in the afternoon , when do you take the cow for service ?____
30. What is the average number of service per conception? time _____
31. What is the average age at first calving (AFC) for crossbred dairy heifer? months _____
32. What is the average lactation length for dairy cows (in months)?_____
33. What is the average calving interval (CI) for crossbred dairy cows? In months _____
34. How many days of days open (DO) (Interval between dates of calving to date of successful conception) for crossbred dairy cows? In days _____
35. What is the source of your replacement breeding cow? 1. Own herd 2. Another herd 3. Purchase 4. Other (specify) _____
36. What is the source of your replacement breeding bull? 1. Own herd 2. Another herd 3. Purchase 4. Other (specify) _____

37. How many calving are most likely to occur in the cow life time? in number _____

38. What is the frequency of milking of your cows? 1. Once in the morning 2. once in the evening 3 . Twice a day, morning and evening 4. Other (specify) _____

J. Dairy cattle reproductive health problems and Veterinary Services (select and encircle the best answer or fill the blank space)

1. Describe major disease you have experienced in your milk cattle during the last year (list and rank it).
   1. Local name of disease mastitis Symptom swelling of udder Month of occurrence____ ____
   2. Local name of diseases bloat Symptom bloating Month of occurrence_____
   3. Local name of diseases (FMD Symptom wounding of foot and mouth Month of occur rence_
   4. Local name of disease skin disease Symptom wounding of skin Month of occurrence_____
   5. Local name of disease black leg Symptom lameness of lag Month of occurrence_____
   6. Local name of disease pasteurolosis Symptom coughing Month of occurrence_____
2. What do you do when your animal is sick? 1. Keep of waiting 2. Culling 3. Consult veterinarian 4. Others(specify)_____
3. Do you have access to veterinary services? 1. Yes 2. No
4. Is there a problem with animal health services? 1. Yes 2. No
5. If yes, please mention? 1. Shortage of medication 2. lack of veterinarians service 3.other
6. Do you use any control measures for ecto-parasites of milk cows? 1. Yes 2. No
7. If yes, what are drugs? specify 1. ivermictine 2. Diazole 3. other
8. If yes, how to control? 1. Anthelmintic 2. Spraying 3. both 4. others
9. Frequency/year _____
10. Do you use any control measures internal parasites? 1. Yes 2. No
11. If yes, what are drugs? specify 1. albendazole 2. ivermictine 3. Diazole 4. other
12. If yes, how to control 1. Anthelmintic 2.Spraying 3. Both 4. others
13. Frequency/year_____
14. Is there a problem of calving difficulties? 1. Yes 2. No

15. If you say yes, how to solve the problem? 1. Take to veterinarian 2. Assisting by you 3. by using experienced persons
16. Is there retained fetal membrane 1. Yes 2. No
17. If you say yes, how to solve the problem? Problem? 1. Take to veterinarian 2. Assisting by yourself 3. By using experienced persons

K. What are the major constraints and opportunities of dairy production in your area?

1. What are dairy production constraints? (list and rank it)
    1. High feed costs
    2. Land scarcity and space limitation
    3. Feed quality and availability problems
    4. Disease prevalence
    5. Poor artificial insemination service
    6. Lack of market access to sell the milk thought the year
    7. Shortage of water
    8. Lack of finance

2. What are dairy production opportunities? (list and rank it)
    1. Availability of high demand for milk consumption
    2. Source of income generation and employment creation
    3. Availability of animal health services
    4. Availability of AI service
    5. supply of dairy cattle breed
    6. Availability of market access
    7. Provision of extension and training
    8. Availability suitable climate condition

Appendix 2: Checklist used for the monitoring data

Farmer Name:_____

Cow ID/name _____ Parity_____ Insemination history _____

Breed_____ Stage of lactation_____ Genotype-_____

Date	Milk yield (litter)		
	Morning	Afternoon	Total

Appendix 3: Photos

Photos taken during interviews

Photos taken during monitoring study

BIOGRAPHY

The author was born from his father Ato Getnwt Endalew and his mother W/ro Haymanotie Alamrew on November, 1992 in North Gojjam Zone, Mecha district, Ethiopia. He attended his elementary school education at Sibu and Wottet Abay Elementary School from 1998 to 2006 in Mekini kebele and Wottet Abay townrespectively. After completion of his Primary school, he was learned his high school and preparatory school education in Merawi Secondary and Preparatory School from 2007 to 2011.

After successfully passing the Ethiopian School Leaving Certificate Examination, he joined to Debre Markos University, in the field of Animal Science at the College of Agriculture up to June 2013 and he graduated with Bachelor of Science (BSc) Degree in animal science in June 2013. After graduation, in August 2013 to 2019 he was employed at Fogera agriculture office, Dangila agriculture office and Bahir Dar and Debre Tabor poly technic college. In 2019 academic year, the author joined the College of Graduate Studies of Bahir Dar University for his Master of Science (MSc) Degree in Animal Production.