Omo International Journal of Sciences

https://survey.amu.edu.et/ojs/index.php/OMOIJS

Research Article

Assessment of dairy cattle breeding practices and reproduction performances in Derashe district, Southern Ethiopia

Tezera Bogale[1,2], Esatu Bekele[1]*, Yisehak Kechero[1]

[1]Arba Minch University, College of Agricultural Sciences, Arba Minch, Ethiopia
[2]Wolayta Sodo University, Tarcha Campus, College of Agricultural sciences

Abstract

This study was conducted in Derashe District, Southern Ethiopia with the aim of assessing the breeding practices and the reproductive performance of crossbred and local cows in the district. Field observations, key informant discussion and structured questionnaire were used to generate data. The district was stratified in to three agro-ecologies namely highland (2301-2622 m.a.s.l), mid-altitude (1501-2300 m.a.s.l) and lowland (below1500 m.a.s.l) with a total of 149 respondents. The number of respondents was determined by using probability proportional to size-sampling technique. The overall average cattle herd size in the study areas was 9.5 of local cows and crossbreds. However, the average cattle herd size of crossbred and local cows was 9.5 heads per household. Age at first services, age at first calving, days open, calving intervals and number of services per conception of HF in the mid-altitude were 19.85±1.101months, 28.519±1.354 months, 141.111±6.435 days, 22.815±0.912 months and 1.781±0.102, respectively. Age at first services, age at first calving, days open, calving intervals and number of services per conception of Jersey crosses were 24.09±0.513 months, 33.09±0.5 month, 152.273±3.835 days, 24.455±0.312 months and 1.982±0.018, respectively. Age at first service, age at first calving, days open, calving intervals and number of services per conception rate of local cows were 39.414±0.552 months, 48.483±0.558 months, 170.624±0.882 days, 26.559±0.321 months and 2.009±0.005, respectively. The overall daily milk yield of HF crosses, Jersey crosses and local cows in the study areas was 8.344±0.576, 4.06±0.248, and 1.971±0.052 liters, respectively($P<0.05$). The mean lactation length of HF crosses, Jersey crosses and local cows was 8.62±0.233, 7.51±0.552 and 7.40±0.076 months, respectively ($P<0.05$). Poor extension and shortage of AI services were the major problems in the study area. The opportunities for improving dairying are suitable climatic condition, road access, AI services and increased demand of dairy products by increasing human population. Generally, dairy cattle production in the study district was subsistent type of production. Except for mid-altitude dairy producers, the highland and lowland farmers did not focus on dairy production. The local Zebu, Boran and unknown breed types are dominant cattle population in highland and lowland areas of the district which were associated with low productivity. In order to alleviate these problems, farmers should be halped to have awareness to use AI services.

Keywords: Agro-ecologies; Dairy cattle; Derashe district; Productive,;Reproductive

* Corresponding author: tessema4@gmail.com

https://doi.org/10.59122/134B722

Received October 20, 2024; Accepted November 30, 2024; Published December, 2024

1. Introduction

Ethiopia has the largest livestock population in Africa (Metaferia *et al.*, 2011). This Livestock sub-Sector contributes an estimated 16 % of the total Gross Domestic Product (GDP) and over 30 % of the agricultural GDP in Ethiopia although the sector ranks second in foreign exchanges of the country (Alazar, 2015). The total cattle population for the country is estimated at about 59.5 million. Out of this the female cattle constitute 55.5% and the remaining 44.5 % are male cattle. It is estimated that 98.20% of the total cattle in the country are local breeds. The remaining are hybrid and exotic breeds that account for about 1.62% and 0.18%, respectively (CSA, 2016/2017).

In Ethiopia, different types of dairy production systems are identified based on various criteria. It can broadly be categorized in to urban, peri-urban and rural milk production systems based on location (Redda, 2001), while based on market orientation, scale and production intensity, dairy cattle production system can categorize as traditional small holders, privatized state farms and urban and peri-urban system (Kumsa, 2002; Ahmed, 2004; Ketema, 2008).Even if it has the largest cattle population in Africa, reproductive and productive performances of cattle are very low in Ethiopia.

The per capita milk consumption of the country is estimated to be about 19.2 kg per year, which is far below the average per capita consumption of Africa and the world per capita which averages 37.2 kg/year and 100 kg/year, respectively (FAOSTAT, 2011). A recent report indicated that, the average lactation period per cow during the reference period at country level is estimated to be about *six* months, and average milk yield per cow per day is about 1.37 liters. The average lactation period is about *nine* months whereas the average daily milk yield is about 3.59 liters in the sedentary areas of the country (CSA, 2016/2017).

Furthermore, the annual rate of increase in milk yield (estimated to be 1.2%) lags behind the increment in human population (estimated to be about 2.7% per annum) (CSA, 2008) and this resulted in large supply–demand variance for fresh milk (MoARD, 2004). Azage (2003) estimated that if the current level of milk production would be maintained, then about 6 million tons of additional milk (4% increment in total milk production) is required per annum to feed the increasing human population and narrow the gap in milk supply and demand. Thus, the country has been spending foreign currency to import dairy products from abroad to meet domestic demand. For instance, the country spent about 3.1 million USD in 2001 for same purpose, and this number increased to 9.3 million USD in 2008 (Haile, 2009).

The level of foreign exchange earnings from livestock and livestock products are also much lower than would be expected, given the size of the livestock population (Gebremedhin *et al*., 2007). Therefore, dairy production in Ethiopia is anticipated to increase rapidly in response to the fast-growing demand for livestock products resulting from increasing human population, especially in urban areas, and rising consumer income, provided that appropriate interventions are made along the dairy value chain (Azage *et al*., 2013).

Ethiopia has a huge potential for dairy development in Africa. The large and diverse livestock genetic resources, the existence of diverse agro-ecologies suitable for dairy production, the increasing domestic demand for milk and milk products. However, dairy development has been hampered by multi-faceted, production system-specific constraints related to genotype, feed resources and feeding systems, access to services and inputs, low adoption of improved technologies, marketing and absence of clear policy support to the sector (Azage et al., 2013).In order to improve the low productivity of local cattle, selection as well as cross breeding of indigenous breed with high producing exotic breed has been considered as practical solution (Tadesse, 2010). Cross breeding work in Ethiopia was initiated to cross indigenous zebu with Holstein- Friesian or Jersey cattle to improve milk production in the early (1950s) Aynalem et al. (2011). Unfortunately, the activities were not based on clearly defined breeding policy with regard to the level of exotic inheritance and the breed types to be used (Aynalem et al,. 2011).

Although efforts were made to develop breeding program for various livestock species in the country, all were not materialized due to lack of commitment and consultation with various stakeholders (Aynalem et al., 2011). Success of dairy production in general and crossbreeding program in particular needs to be monitored regularly by assessing the reproductive and productive performance under the existing management systems. Reproduction and productivity of crossbred dairy cattle are believed to be higher than that of local zebu, but the performance status of different exotic blood level crossbred and local dairy cows in different farming system of Ethiopia highland both in production and reproductive traits are little understood, therefore, the present study is planned to undertake to assess production, breeding practice, breeds and reproductive performance of dairy cattle in the study area.

2. Materials and Methods

2.1. Description of study areas

The common agricultural practice of the district is mixed crop-livestock production system. The major growing crops in the study area are maize, sorghum, teff and wheat. Livestock

production system are characterized by minimal management of inputs in terms of production and breeding management, disease control and nutrition and are mainly traditional and subsistence oriented.

The study site was selected from the districts based on dairy cattle potential of both local and crosses, farmers' motivation and preferences to improve local cows through crossbreeding, farmers' long experience of keeping crossbred and local dairy cattle among the five districts of Segen area peoples' zone. Stratified sampling technique was applied to select agro-ecologies whereas the study farmers associations were selected using simple random sampling technique. Households having crosses of HF and Jersey cows and local cows were selected for the study following systematic random sampling technique. One hundred forty- nine (149) households were selected from the districts. The agro-ecological Zone of the district comprised of 17.27% (2301-2622 m.a.s.l) highlands, 35% (1501-2300 m.a.s.l) mid altitude and 48.0 % (Below 1500 m.a.s.l) lowlands. The proportionality of respondents across each agro-ecology was obtained by using probability proportional to sample size determination formula. The selected farmers are interviewed using a structured questionnaire which was pre-tested with 5 farmers in each agro-ecology.

The total sample size for household interview was determined (Eq. 1) using probability proportional to sample size-sampling technique of Cochran's (1977).

$$n = \frac{Z^2 * (p)(q)}{d^2} \quad \rightarrow n1 = \frac{No}{(1+\frac{N}{No)}} \tag{1}$$

Where no= desired sample size according to Cochran's (1977) when population greater than 10,000 n1 = finite population correction factors (Cochran's formula, 1977) population less than10, 000, Z = standard normal deviation (1.96 for 95% confidence level), P = 0.11 (proportion of population to be included in sample i.e., 11%), q= 1-0.11 i.e. (0.89), d = is degree of accuracy desired (0.05), 5% error term.

Based on the first formula, the total number of households were 149 from three agro-ecologies of the district i.e. (26 HH highland (17.27%), 52 HH mid-altitude (35%) and 71HH lowland (48.0%)).

2. Data and data collection tools

Data on socio-economic characteristics of the respondents, dairy cow holding of households, dairy cattle feeds and feeding, health care and common diseases, breeding practices and farmer's trait preferences, housing and routine farm managing activities were collected. Milk

production traits (average daily milk yield, lactation length and lactation milk yield) was collected.

Economically important reproductive traits age at first calving, calving interval, gestation length, number of services per conception and days open were considered for evaluating the reproductive performances of cows. Opportunities and constraints of dairy cattle husbandry was also assessed using structured questionnaire. The researcher's own observation, interview using structured questionnaire, focus group discussions and keeping records on performance parameters was also used for data gathering.

Besides performance records recalled indicative information was also incorporated. Researcher's own observation, questionnaire survey, records on reproductive and productive performances, focus group discussion with model or experienced farmers and communication with livestock production experts at different levels were used as data collection tools.

2.3. Data analysis

All the data was analyzed using Statistical Package for Social Sciences (SPSS) version 20. Statistical variations for categorical data were tested by means of cross tabs/Chi-square Tests. Significant differences were considered at $P < 0.05$ whereas the other numerical data were subjected to one way analysis of variance (one-way ANOVA).

Mean comparisons was carried out using Turkey's honestly significant difference test and levels of significance was also considered at $P<0.05$. The analyzed data was presented using table, figures, percentages, means, and standard error of means. The appropriate statistical model used for characterization of the dairy cattle production and feeding system is as follows (Eq. 2):

$$Y_{ijk} = \mu + \alpha_i + \Sigma_{ij} \quad (2)$$

Where *yijk* = total observation due to i^{th}, agro ecology effect μ = is overall mean

α_i = the i^{th} effect of location (agro-ecology), Σ_{ij} = random error

3. Results and Discussion

3.1. Purpose of keeping dairy cattle in the study area

The purposes of keeping dairy cattle in the study area were varied between agro-ecologies as presented in Table 1. Highland farmers preferred to keep dairy cattle to often male calves to assist draught power than milk productions, mid-altitude dairy cattle producers kept to produce milk for either household consumption or daily income from sale of raw milk. Moreover, male calves were grown for fattening whereas culling of heifers or cows were practiced due to lack of

space. Whereas lowland farmers kept cattle to produce milk for household consumption, source of income from sour butter milk and butter sale, income from sale of animals, to assist draught power and to use them as asset. On the other hand, income from sale of animals and manures used as bio gas were non-significant (P>0.05). The present study agrees with Asrat et al. (2016) in and around Wolaita Sodo town. The role of animal dung in study area was not that much used to the crop production system, especially at highland and lowland districts because of lack of awareness and lack of extension services.

Table 1. Purpose of keeping dairy cattle in the study area

Purpose of keeping	Agro-ecology (%)			Overall (n=149)	p-value
	Highland (n=26	Mid altitude (n=52)	Lowland (n=71)		
For milk consumption	0	100	100	82.6	***
Produce raw milk for daily income	0	61.5	0	21.5	***
Income from sour milk & butter	0	38.5	100	61.1	***
Growing male calves for ploughing	100	38.5	50.7	55	***
For asset	0	0		24.2	***
Income from sale of animals	100	100	100	100	NS
Manure for bio-gas	0	3.8	0	1.3	NS
Manure for fertilizer	0	78.8	0	27.5	***

n= number of the respondents, NS= not significant, ***=P<0.001 significant

3.2. Cattle herd size holding and composition in study area

Cattle holdings and herd structure in the three agro-ecologies are presented in Table 2. The overall average local cattle holding per household where 9.5 heads per household was varied between agro-ecologies, being highest in Lowland 19.18 followed by highland 7.04 and mid-altitude 2.27 heads per household, respectively. The overall average of unidentified blood level group of HF and Jersey crosses holding per household were 2.6 and 0.72, respectively. The current result agrees with the finding of Yayeh et al.(2014) for Debremarkos district where cattle heads per household reported was 10.60,Yohannes(2015 reported for Borena and Guji zones Shakiso, 9.8) heads per household and Philimon (2012) for East Shewa Zone which was 10.39 cattle heads per households. The current finding is much lower than Yabello area, which were 25.7. This is because in the present study area low number of cattle founded in mid-altitude and highland than lowland area. The highland and lowland agro-ecologies of the district were occupied by 100% of indigenous or local cows. In mid-altitude of the district 60.28% were cross breeds and 39.72% were local cows. This was due to the fact that mid-altitude was located around the district town and the dairy cattle producers had well organized awareness to dairy cattle production, feeding and solely used to AI services to improve their own local cows.

Table 2. Average cattle herd size and compositions in the study area

Types breeds	Agro-ecology			
	Highland (N=26)	Mid-altitude (N=52)	Lowland (N=71)	P-value
HF cross breed				
Milking cows	-	0.94	-	0.14
Pregnant cows	-	0.12	-	0.05
Dry cows	-	0.48	-	0.08
Heifers	-	0.31	-	0.09
Male calves	-	0.35	-	0.09
Female calves	-	0.40	-	0.07
Bulls/oxen	-	0	-	0
Total		2.6	-	0.52
Jersey cross breed				
Milking cows	-	0.25	-	0.07
Pregnant cows	-	0.14	-	0.07
Dry cows	-	0.04	-	0.02
Heifers	-	0.06	-	0.04
Male calves	-	0.23	-	0.07
Female calves	-	0	-	0
Bulls/oxen	-	0		0
Total		0.72		0.27
Local cows/zebu breed				
Pregnant cows	0.62^{b}	0.17^{c}	1.55^{a}	0.46
Dry cows	0.62^{b}	0.0^{c}	3.14^{a}	0.72
Heifers	0.88^{b}	0.02^{c}	2.89^{a}	0.66
Calves	1.73^{b}	0.81^{c}	3.66^{a}	0.77
Bulls/oxen	1.69^{b}	0.06^{c}	4.73^{a}	0.82
Total	7.04	2.27	19.18	4.04

Regarding herd composition, the overall average number of local cattle between agro-ecologies oxen/bulls (6.48 heads per household) was used for breeding and ploughing purposes, milking cows (5.92 heads per household), pregnant cows(2.34 heads per household), dry cows (3.76 heads per household), Heifers (3.79 heads per household) was used to stock replacement purposes and Calves (6.2 heads per household). The average number of HF crosses only in mid-altitude area was milking cows(0.94 heads per households), pregnant cows(0.12 heads per household), dry cows (0.48 heads per households), heifers(0.31 heads per household) , female calves(0.40 heads per household) were used for stock replacement while 0.35 male head calves per households were used for fattening purposes. The average number of Jersey crosses only in mid-altitude area was milking cows (0.25 heads per households), pregnant cows (0.14 heads per

household), dry cows (0.04 heads per households) and heifers (0.06 heads per household) and male calves (0.23 heads per households) were used for fattening purposes.

3.3 Breeding Practices

The overall breeding practices of dairy cattle production in study areas was 78.5% natural mating with local bulls and 21.5% Artificial insemination (AI). According to the respondents, the reason for the limited use of AI especially in highland, lowland and partial part of mid-altitude dairy cattle producers were lack of awareness, lack of provision of extension services and unavailability of road access. The majority of mid-altitude (61.5%) of the households used AI as a sole source of genetic improvement while 38.5% used solely local bulls. Whereas highland and lowland dairy cattle producers used 100% local bulls for breeding practices. The breeding practice was different in mid-altitude than highland and lowland areas. The present study agrees with Asrat et al. (2015) for Humbo Woreda, Wolaita Zone, Southern Ethiopia.

3.3.1. Criteria to select dairy cows in the study area

Selection criteria of dairy cows were differed between agro-ecologies of the study area. The most widely used selection criteria were milk yield, availability and fat content of the breed in the study area as presented in Figure 1. When agro-ecologies were compared, the mid-altitude dairy producers were better in the selection of dairy cows than highland and lowland areas.

3.3.2. Calf rearing practices

Calf rearing practices varied between agro- ecologies of the study area. Almost all highland farmers focused on calf rearing because of calves are grown to assist draught power. As a result, they feed colostrum and common milk freely up to lactation length. Among Mid-altitude dairy producers 61.53% have crossbred and feed colostrum averagely for one week because they focus on milk production for income sources while 38.47% have local cows and focus on calves and milk used for household consumption and they feed milk freely for the calves. Lowland farmers have large number of local cows, so they were focus on calves other than milk production and feed their calves colostrum freely. Overall, of the households were feed colostrum averagely for 6.3 days. The average weaning age of calves 7.19 months highland, 5.28-month mid-altitude and 7.40-month lowland, this figure showed that at mid-altitude area wean age of calves was lower than highland and lowland, because in mid- altitude area the households reared cross breed cows and they focus prior to milk production than calves, even though cross breed calves grow faster than local calves genetically. This result line with the

reported by Asaminew and Eyassu (2009) in Bahar Dar Zuria and Mecha areas and Asrat et al. (2015) for Humbo Woreda. All of the respondent supplement after birth the new born animals with soft green local grass between the range 15 and 20 days.

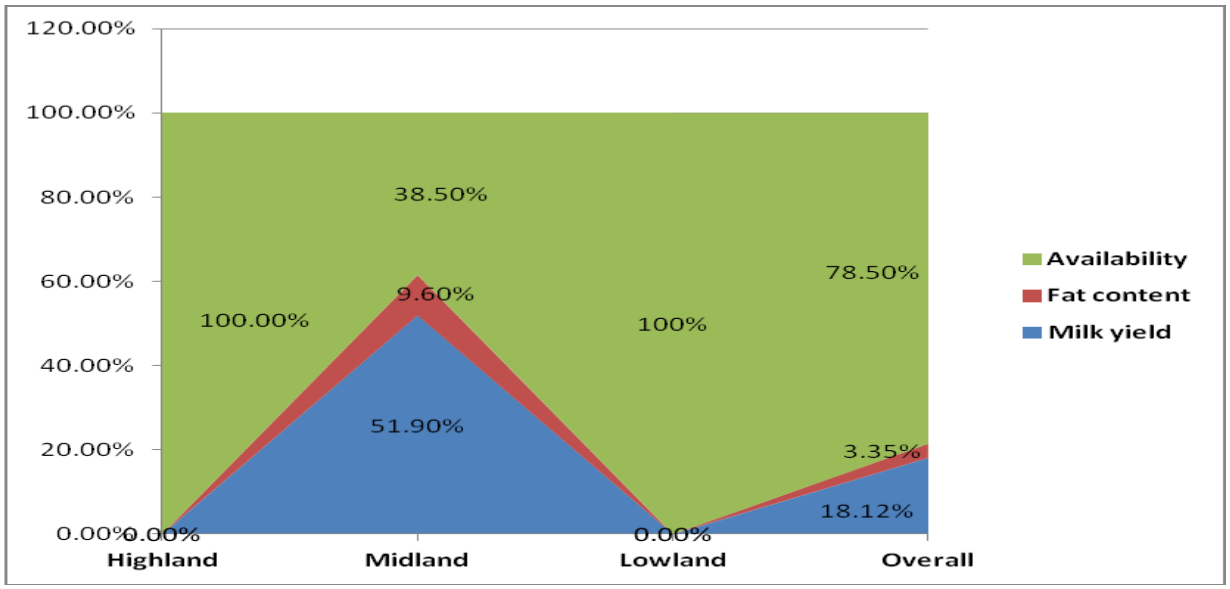

Figure 1. Selection criteria of dairy cows in the study area

3.3.3. Culling of dairy cattle in the study area

Culling of dairy animal in the study areas varied between agro-ecologies as presented in Table 3. The overall culling of animals in the study areas were based on production problems, feed shortage, disease (mastitis), space problems and to get financial requirement. The current finding agreed with reported by Philimon (2012) for Selected Woredas of east Shewa Zone, Oromia region. In comparison between agro-ecologies culling of dairy cows due to space problems was observed in more percentage in mid-altitude (town) area than highland and lowland areas. Production problems was higher in lowland area followed by highland than mid-altitude area.

Table 3. Culling of dairy in cattle in study area

Purpose of keeping	Agro-ecology (%)			Overall	p-value
	Highland (n=26)	Mid altitude (n=52)	Lowland (n=71)	(n=149)	
Production problems	15.4	0	54.9	28.9	***
Disease problems(mastitis)	0	11.5	0	4	**
Space problems	0	69.2	0	24.2	***
To get financial requirement	92.3	0	52.1	35.5	***
Feed shortage	67	79	7	61.35	***

N= number of the respondents, **=<0.01, significant, ***=p<0.001 significant

3.4 Features of dairy cattle production system in Derashe area: A focus group discussion

Focus group discussion was held in the study areas with 33 (29 male and 4 female) household headed. Highland (13 males only), mid-altitude 11 (7 males and 4 females) and lowland area (9 males only). According to the focus group discussion results, cows were not specialized for milk production at highland. Similarly lowland farmers were rearing the dairy cattle for multipurpose such as for milk consumption, calf rearing, income from sale of animals and milk products and for useas asset.

The feeding system of highland farmers in the study area was tethering on their own backyard, road sides and supplementing crop residues, enset and palatable trees/shrubs. The mid-altitude dairy cattle producers feeding systems were intensive/stall feeding or zero grazing by green and dry grass (standing hay), crop residues, enset and non-conventional feeds, like katikala, tella and cheka residues respectively, tethering and free grazing for a few times on private grazing land. In lowland area the feeding systems of dairy cattle producers were dominated by free grazing on natural pastures, supplementing crop residues only at morning time before free grazing. Tuber crop such as enset is also commonly used in the study area of highland and mid-altitude. Crop residues are commonly used as animal feeds sources in three agro- ecologies of the study area. There is little practice (tradition) of developing improved forages in the highland area like, elephant grass and Desho. Even though there was lack of industrial by- product feed sources in three agro-ecologies of the district. Because the study district was far from the sources. Generally dairy cattle production and management practices were poor and it should be requiring many training and extension services in the study area. The present study agrees with Misgana et al. (2015 in Selected Districts of East Wollega Zone, Ethiopia.

3.5 Reproductive and productive performance of dairy cows in study area

The mean (±SEM) age at first service (AFS), age at first calving (AFC), Days open (DO), calving interval (CI), and number of services per conception (NSPC) in three agro-ecologies of the study area is summarized in Table 3.

3.5.1 Age at first service (AFS)

The mean (±SEM) age at first service in the mid-altitude area was for Holstein Friesian (HF) and Jersey cross which were 19.85±1.1 and 24.09±0.51 months, respectively. The overall mean (±SEM) age at first service for local breeds were 39.41±0.55 months. Local breeds mean

of (AFS) was significantly varied between agro-ecologies (P<0.001) in highland, mid-altitude and lowland areas were 41.08±1.05,40.87±1.15 and 36.29±0.63 months, respectively. Lowland area mean age at first service of local breeds were lower than in highland and mid-altitude areas.

The current finding of mean AFS of HF cross in the study area was 19.85±1.1 months. This result is higher than the value reported by Nibret (2012) in and around Gondar town and Dessalegn et al. (2016) in Bishoftu and Akaki town with the values of 15.4 and 18.7±3.7 months, respectively on the same HF crossbred because of the better dairy cattle managements practices applied in in the study area. However, lower than the value reported by Embet and Zeleke (2007), Nuraddis et al. (2011), Belay et al. (2012), Hunduma (2012), and Kumar and and Alemshet (2014) in Dire-Dawa, in Gondar towns, Debre-Birhan, Jimma town, Asella, Eastern Zone of Tigray, in Mekele and in and around Adigrat town, respectively with the values of 25.6, 27.5, 24.30±8.01, 25.2±1.1and 25.5±0.21 months, respectively. The current results recorded for AFS of Jersey crossbred was 24.09±0.51 months. This result is similar to the value reported by Habitamu et al. (2010) in Wolaita Sodo with the value of 24.07 month. It is lower than the finding of Demissu et al. (2014) in and around Horro- Guduru who reported that 33.3±10.9 month. The current result of the mean AFS of local cows was 39.414±0.552 months. This finding is lower than the value reported by Debir (2016) in Sidama zone with the values of 44.1±5.9 months.

3.5.2 Age at First Calving (AFC)

The mean(±SEM) age at first calving in mid-altitude area of cross breed of HF and Jersey were 28.52±1.35 and 33.09±0.5months respectively. Overall mean(±se) number of age at first calving of local breeds were 48.48±0. 56months.The mean(±se) age of first calving of local breed in highland, mid-altitude and lowland were significantly varied between agro-ecologies(P<0.001) of 50.02±1.6, 50.09±1.13 and 45.32±0.64 months, respectively.The current finding of mean of HF crossbred of AFC was 28.519±1.354months.This result is higher than the value reported by Nuraddis et al.(2011) in Gondar town and Dessalegn et al. (2016) in Bishoftu and Akaki town with the values of 23.1 and 26.9±5.4 months respectively, but lower than the value reported by Embet and Zeleke (2007), Nibret (2012), Alemshet (2014) and Debir (2016) in Selale and Addis Ababa, in North Gondar Zone, Dire-Dawa, in and around Gondar town, in North Shewa Zone, Eastern Zone of Tigray, in and around Adigrat town and Sidama Zone , Southern Ethiopia respectively with the values of 30.14, 36.41±0.0.9, 36.2±1.03, 32.4, 39.83±0.18, 39.6±0.4, 34.8±0.21 and 39.3±3.25 months respectively. The current result of mean

of AFC of Jersey cross was 33.09±0. 5months.This result line with the value reported by Habitamu et al. (2010) in Wolaita Sodo with value of 34.5 months and lower than the value reported by Demissu et al. (2014) in and around Horro- Guduru, with the value of 42.2±11.45 months. The current finding of mean of AFC of local cows was 48.483±0.558 months. Debir (2016) in Sidama Zone Southern Ethiopia with the values of 59.90±0.83 and 51.9±5.9 months, respectively.

3.5.3 Days Open (DO)

The mean(±se) number of days open (DO) in mid-altitude(town) areas was of cross breeds of HF and Jersey were 141.11±6.44 and 152.27±3.84 days, respectively. Over all mean(±sem) number of days open of local cows were 170.62±0.88 days. The mean (±sem) number of days open of local cows were significantly varied between agro-ecologies (P<0.001) in highland, mid-altitude and lowland areas were 168.96±1.674, 169.78±1.78 and 173.13±1.01days, respectively. The current finding of mean of (DO) of HF crossbreds were 141.11±6.44 days. This result higher than the value reported by Hunduma (2012), Nibret et al. (2012) and Nuraj et al. (2014) in Asella town, in and around Gondar and in Gondar, Ethiopia with the values of 85.6±5.6, 87and 104.23±28.81 days respectively and lower than the value reported by Nuraddis et al. (2011) and Belay et al. (2012) in Gondar town and Jimma town with the value of 171 and 155 days respectively at the same HF crossbred. The day's open of local cows in current study was 170.624±0.882 days. This result higher than the value reported by Nuraj et al. (2014) in Gondar, Ethiopia with the value of 148.33±38.44 days.

3.5.4 Calving Intervals (CI)

The calving interval is a period between two consecutive parturitions. The mean(±se) number of months of calving interval in mid-altitude area of HF and jersey crosses were 22.82±0.91and 24.46±0.31 months respectively. The overall mean(±se) of calving interval of local cows were 26.54±0.32months. The mean(±se) of calving interval of local breeds were significantly varied between agro-ecologies(P<0.001) in highland, mid-altitude and lowland areas were 25.62±0.61, 28.61±0.65 and 25.39±0.37 months respectively. The current finding of mean CI of HF crossbred was 22.82±0.91 months. This result line with the value reported by Mulugeta and Belayneh (2013) in Chacha town and nearby selected kebeles, North Shoa Zone, Amhara Region, Ethiopia with the value of 22±4.4 month. However, it is lower than the value reported by Nuraddis et al. (2011), Hunduma (2012), Debir (2016), Dessalegn et al. (2016) and

Zereu and Lijalem (2016) in Gondar town, Asella town, Sidama zone and Bishoftu and Akaki town respectively with the value of 13.9, 12.42, 17.1±4.5 and13.0±2.1 months respectively. Even though it is lower than the finding of Alemshet (2014) in and around Adigrat town, North Ethiopia with the value of 26.5±0.32 month. The current finding of mean calving interval (CI) of local cows was 26.54±0.32 months. This result agreement with the value reported by Mulugeta and Belayneh (2013), Damitie et al. (2015) and Debir (2016) in Chacha town and nearby selected kebeles, North Shoa Zone, Lake Tana Watershed, North Western Amhara, Ethiopia and Sidama Zone, Southern Ethiopia respectively, with the value of 24.94±4.1, 25.5±0.52 and 23.6±4.4 months respectively. However, the current result is higher than the value reported by Zereu and Lijalem (2016) in Wolaita Zone, Southern Ethiopia with the value of 19.91±0.83 month. Number of Services Per Conception (NSPC)

The mean(±se) number of services per conception (NSC) of HF and Jersey cross breeds were 1.78±0.1 and 1.98±0.02respectively. The overall mean(±se) of number of services per conception of local breeds were 2.01±0.01. The mean(±se) of number of services per conception of local breeds was significantly varied between agro-ecologies($P<0.001$) in highland, mid-altitude and lowland areas were 2.03±0.01, 2.00±0.01 and 1.99±0.01 respectively. The current finding of mean NSPC of HF Crossbred was 1.781±0. 102.The current result agreement with Shiferaw et al. (2003), Yifat et al. (2009), Alemshet (2014) and Debir (2016) in Central Highland, Ethiopia, in and around Zeway, North Shoa Zone, in and around Adigrat and Sidama Zone, Southern Ethiopia, they were reported that 1.62, 1.67, 1.6, 1.73±0.04 and 1.8 respectively. But higher than the finding of Nuraddis et al. (2011), Hunduma (2012), Belay et al. (2012), Nibret et al. (2012) and Niraj et al. (2014) in Gondar town, Asella town, Jimma town, in and around Gondar town and in Gondar, Ethiopia respectively with they were reported that 1.29, 1.52±0.9, 1.56, 1.3 and 1.5±0.3 respectively. Mean of NSPC of Jersey cross in current study was 1.982±0. 018.The current result agreement with the finding of Gizaw et al. (2011) in Ethiopia, Habitamu et al. (2010) in Wolaita Sodo and Demissu et al. (2014) in and around Horro-Guduru, they were reported that 1.92, 1.79 and 1.8 respectively. The current mean of NSPC of local cows was 2.01±0.01. This result agrees with that reported by Niraj et al. (2014) in Gondar, Ethiopia and Debir (2016) in Sidama Zone, Southern Ethiopia with the value that 2.2±0.2 and 2.4, respectively.

Table 4. Mean(±SE) reproductive performance of HF and Jersey crosses and local cows in the study district

Independent variable	Agro-ecology (Mean ± SEM)			Overall	P-value
	Highland (n=26)	Midland (n=52)	Lowland (n=71)	(n=149)	
HF cross breed		19.85±1.10		19.85±1.10	
Age at first services					
Age at first calving		28.52±1.35		28.52±1.10	
Days open					
		141.11±6.43		141.11±6.43	
Calving intervals					
Number of services per conception		22.82±0.91		22.82±0.91	
		1.78±0.10		1.78±0.10	
Jersey cross breed					
Age at first services		24.09±0.51		24.09±0.51	
Age at first calving		33.09±0.51		33.09±0.51	
Days open		152.27±3.84		152.27±3.84	
Calving intervals		24.46±0.31		24.46±0.31	
Number of services per conception		1.98±0.02		1.98±0.02	
Local cows					
Age at first calving	50.04±1.06[a]	50.09±1.126[a]	45.32±0.64[b]	48.48±0.56	***
Days open	168.96±1.67	169.78±1.78[b]	173.13±1.01[a]	170.62±0.88	***
Calving intervals	25.62±0.61[b]	28.61±0.648[a]	25.39±0.37[b]	26.54±0.32	***
Number of services per conception	2.03±0.01[a]	2±0.010[a]	1.997±0.01[b]	2.01±0.01	***

n= number of respondents, se± standard error, HF= Holstein Friesian, ***= P<0.001 significant

3.6 Milk yield of cross breed and local cows in the study area

Milk yield is one of the most important outputs of dairy cattle production. According to breed type, management and season of the year in Table 5, the mean (±sem) daily milk yield of HF cross in mid-altitude area was 8.34±0.58 liters/day/cow and mean (±se) daily milk yield of Jersey cross breed in mid-altitude area was 5.07±0.25 liters/day. The overall mean (±se) of daily milk yield of local was 1.97±0.05 liters/day/cow. Mean (±SEM) daily milk yield of local cows were significantly varied between agro- ecologies (P<0.01) in highland, Mid-altitude and lowland areas were 1.93±0.1,2.31±0.1 and1.68±0.06 liters/day/cow, respectively. High daily milk yield was observed of local cows in mid-altitude and highland than the lowland area because better management practices in both agro-ecologies than lowland area. The mean daily milk yield (DMY) of HF crossbred was 8.34±0.58 liters/day.

The current result line with the finding of Belay et al. (2012) in Jimma town that reported 8.4 liters. Even though higher than the finding of Amasaib et al. (2008), Niraj et al. (2014) and Ketema (2014) in Sudan, Debremarkos, in Gondar and Kersa Malima Woreda,Oromiya, respectively with the values that reported 6.8, 7.3±4.65, 6.5 and 4.73±3.2 liters/day/cow, respectively. Although the current result is lower than the finding of Dessalegn et al. (2016) in Bishoftu and Akaki town 11.6±3.1 and 10.8±2.4 liters/day/cow, respectively. The overall mean daily milk yield (DMY) of local cows was 1.97±0.1liters. Current finding similar with the finding of Nuraj et al. (2014) in Gondar, Ethiopia and Zereu and Lijalem (2016) in Wolaita Zone, Southern Ethiopia, they reported that 1.97 and1.99±0.06 liters/day respectively. However, higher than Ketema (2014) in Kersa Malima Woreda, Oromiya with value that reported 1.15±0.39 liter.

Table 5. The average Mean± SE of daily milk yield of cross breed and local cows in the study district

Independent variable	Agro-ecology (Mean ± SEM)			Overall (n=149)	P-value
	Highland (n=26)	Midland (n=52)	Lowland (n=71)		
HF cross breed-Milk yield per day in liter		8.34±0.58		8.34±0.58	
Jersey cross breed-Milk yield per day in liter		5.07±0.25		5.07±0.25	
Local cows-Milk yield per dairy in liter	1.93 ± 0.10^{b}	2.308 ± 0.10^{a}	1.68 ± 0.10^{b}	1.97 ± 0.05^{b}	**

n= Number of respondents, SE± standard error, HF= Holstein Friesian, **= P<0.01significant

3.7 Lactation length of cross breed and local cows in the study area

The mean (±SE) number of lactation length of HF crosses, Jersey crosses and local cows were 8.62±0.23, 7.51±0.55 and 7.40±0.08 months respectively as presented in Table 6. The overall mean (±SE) of lactation length of local cows were non-significantly varied (P>0.05) across three ago-ecologies. The mean(±se) of lactation length of mid-altitude area HF cross breed was longer than both highland and lowland areas of local breeds because the mid-altitude dairy producers were rearing more cross breed and their most interest focuses on dairy production than the highland and lowland areas. The mean lactation length of HF cross was 8.62±0.23 months.

The current result is disagreed with the finding of Amasaib et al. (2008) in Sudan, Belay et al. (2012) in Jimma town, Ketema (2014) in Kersa Malima Woreda, Nuraj et al. (2014) in Gondar, Ethiopia and Dessalegn et al. (2016) in Bishoftu and Akaki town, where the value

reported by 12.5, 9.1, 10.1, 10.8 and 9.22±1.17 months respectively. The overall lactation length of local cows in current study area was 7.40±0.076 months. The current result agreement with the value reported by Niraj et al. (2014) in Gondar Ethiopia with the value of 6.8 month and lower than the value reported by Ketema (2014) in Kersa Malima Woreda, Zereu and Lijalem (2016) in Wolaita Zone, Southern Ethiopia, with the values of 9.8, 10.5 and 10.802±0.503 months respectively.

Table 6. Mean (±SEM) of lactation length (in months) of cross breed and local cows

Independent variable	Agro-ecology (Mean ± SEM)			Overall (n=149)	P-value
	Highland (n=26)	Midland (n=52)	Lowland (n=71)		
HF cross		8.62±0.22		8.62±0.23	
Jersey cross		7.51±0.55		7.51±0.55	
Local cows	7.5±0.17	7.35±0.18	7.38±0.097	7.40±0.08	0.1335

SEM=Standard error of means, HF=Holstein Friesian

Since dairy production and productivity was very low in highland and lowland areas due to large number of genetically poor local cows. In order to alleviate this problem, creating awareness for the farmers to use AI services to improve their own local cows. Extension services will give due attention for innovators and early adopter farmers.

4. Conclusions

Generally, dairy cattle production in Derashe district is a subsistence type of production system except mid-altitude (town) area. Indigenous local zebu cattle Boran and uncharacterized local breeds are dominate cattle population in highland and lowland areas with low milk production potential. Improving such low milk production potential of local cows via Artificial Insemination is challenged by many factors, such as lack of awareness among farmers, lack of extension services, lack of training and lack of infrastructures. Dairy cattle production in the study area constrained by provision of extension services, Genotypic problems, lack of AI services in highland and lowland. Despite of the many problems and constraints that might slow down or reduce the development of the dairy cattle production in the study area, there were also suitable condition to improve dairy cattle production and productivity for the future times. These are climatic condition/ agro-ecology, cereal crop production, road access, human population increment and AI services specially in mid-altitude (town) area.

Acknowledgements

The authors would like to express their gratitude to Arba Minch University for funding

the research project.

Conflict of Interest

The authors state that they do not have any conflicts of interest.

References

Alazar, S. (2015). Contribution of livestock sector in Ethiopian economy: A Review. Advances in Life Science and Technology, 29.

Alemshet, B. (2014). Evaluation of the reproductive performance of crossbred (HF × zebu) dairy cows and Artificial insemination service efficiency in and around Adigrat, North Ethiopia.

Amasaib, E. O., Abu Nikhaila, A. M., Fadel Elseed, A. N. M. A., & Mohamed, H. E. (2008). Effect of season of calving and parity on some productive traits in pure and crossbred cattle in Sudan. Research Journal in Dairy Science, 2 (1), 5–8.

Anderson, S. C., & Cockayne, S. (2003). Clinical chemistry: Concepts and Applications. McGraw-Hill Companies.

Asaminew Tassew, & Eyassu Seifu. (2009). Smallholder dairy production system and emergence of dairy cooperatives in Bahir Dar Zuria and Mecha districts, Northwestern Ethiopia.

Asrat, A., Feleke, A., & Ermias, B. (2016). Characterization of Dairy cattle production systems in and around Wolaita Zone Sodo Town, Southern Ethiopia. Scholarly Journal of Agricultural Science, 6 (3), 62–70.

Aynalem Haile, Azage Tegegne, Workneh Ayalew, Noah Kebede, & Tadelle Dessie. (2011). Breeding strategy to improve Ethiopian Boran cattle for meat and milk production. IPMS Working Paper No. 2656.

Azage, Tegegne. (2003). Financing market-oriented milk development—The case of Ada'a-Liben district milk and milk products marketing association, Ethiopia. Urban Agriculture Magazine, 9, 25–27.

Azage, Tegegne, Gebremedhin, B., Hoekstra, D., Belay, B., & Mekasha, Y. (2013). Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market oriented development. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 31. ILRI (International Livestock Research Institute).

Belay, D., Yisehak, K., & Janssens, G. P. J. (2012). Productive and reproductive performance of Zebu × Holiesten-Friesian dairy cows in Jimma town, Oromia Region, Ethiopia.

CSA (Central Statistical Agency). (2008). Report on livestock and livestock characteristics; vol. II, Agriculture sample survey 2008/09.

Central Statistical Agency (CSA). (2017). Agricultural sample survey. Report on livestock and livestock characteristics. The Federal Democratic Republic of Ethiopia, Central Statistical Agency (CSA). Private Peasant Holdings. Statistical Bulletin 570.

Cochran, W. G. (1997). Sampling techniques (3rd ed.). John Wiley and Sons.

Debir Legesse Belay. (2016). Assessment of reproductive performance of local and crossbred Dairy cattle in Sidama Zone, Southern Ethiopia. Journal of Natural Science Research, 6 (9).

Demissu, H., Fekadu, B., & Gemeda, D. (2013). Early growth and reproductive performance of Horro cattle and their F1 Jersey crosses in and around Horro-Guduru livestock production and Research center. Ethiopia Science, Technology and Arts Research Journal, 2 (3), 134–141.

Dessalegn, Genzebu, Berahn Tamir, & Gebreyohannes Berhane (2016). Study of reproductive and production performance of crossbred dairy cattle under smallholders' management system in Bisheftu and Akaki towns.

Emebet, Mordan. (2006). Reproductive performance of dairy cows under urban dairy production system in Dire-Dewa, Ethiopia.

FAOSTAT. (2009). FAO statistical yearbook. Food and Agriculture Organization of the United Nations.

Gebremedhin, B., Hoekstra, D., & Jemaneh, S. (2007). Heading towards commercialization? The case of live animal marketing in Ethiopia. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project Working Paper 5. ILRI (International Livestock Research Institute).

Habtamu Lema, Kelay, B., & Desie, S. (2010). Study on the reproductive performance of Jersey cows at Wolaita Sodo dairy farm, Southern Ethiopia. Ethiopian Veterinary Journal, 1.

Haile, G. (2009). The impact of global economic and financial crises on the Ethiopian dairy industry. UNIDO.

Hunduma, D. (2012). Reproductive performance of crossbred dairy cows under smallholder condition in Ethiopia. International Journal of Livestock Production, 3 (3), 25–28.

Ketema, S. (2008). Characterization of market oriented smallholder dairying and performance evaluation of dairy cooperatives in Tiyo Woreda, Arsi Zone of Oromia Regional State. [Unpublished Master Thesis). Hawassa University, Ethiopia.

Kumsa, T. (2002). Smallholder dairy in Ethiopia. Bako Agicultural Research Centre.

Metaferia, F., Cherenet, T., Gelan, A., Abnet, F., Tesfay, A., Ali, J. A., & Gulilat, W. (2011). A Review to improve estimation of livestock contribution to the National GDP. Ministry of Finance and Economic Development and Ministry of Agriculture.

MoARD. (2004). Market-oriented development master plan. MoARD.

Motlagh, M. K., Roohani, Z., Shahne, A. Z., & Moradi, M. (2013). Effects of age at calving, parity, year and season on reproductive performance of dairy cattle in Tehran and Qazvin Provinces, Iran. Research Opinions in Animal and Veterinary Sciences, 3 (10), 337–342.

Nibret, M. (2012). Study on reproductive performance of crossbred dairy cows under small holder conditions in and around Gondar, North Western Ethiopia. Journal of Reproductive and Infant Psychology, 3, 38–41.

Niraj, K., Alemayehu, E., Abreha, T., & Hailelule, A. Y. (2014). Productive performance of indigenous and Holstein-Friesian crossbred dairy cows in Gondar, Ethiopia. Veterinary World, 7 (3), 177–181.

Nuraddis, I., Ashebir, A., & Shiferaw, M. (2011). Assessment of reproductive performance of crossbred cattle (Holstein Friesian x Zebu) in Gondar town. Global Veterinarian, 6 (6), 561–566.

Philimon. (2012). Characterization of beef cattle production and marketing systems in three selected woredas of East Shewa zone (Unpublish Master Thesis). Jimma University, Etiopia.

Redda, T. (2001). Small scale milk marketing and processing in Ethiopia. In proceedings of south work shop on small holder dairy production and marketing, constraints and opportunities.

SPSS (Statistical Procedures for Social Sciences) (2009). SPSS User's guide version 20.0. SPSS Institute Inc.

Tadesse Guadu, & Mengistie Abebaw. (2016). Challenges opportunities and prospects of dairy

farming in Ethiopia: A review. World Journal of Dairy and Food Sciences, 11 (1), 101–140.

Yifat, D., Bahilibi, W., & Desie, S. (2012). Reproductive performance of Boran cows at Tatesa cattle breeding center. International Journal of Advanced Research in Biological Sciences, 6 (3), 101–105.

Yohannes Urgesa. (2015). Status of dairy cattle production in Borena and Guji Zone, Ethiopia. International Journal of Innovative Research and Development, 4 (13).

Zereu, G., & Lijalem, T. (2016). Production and reproduction performance of local Dairy cattle: in the case of rural community of Wolaita zone, Southern Ethiopia. Journal of Fisheries and Livestock Production, 4 (3), 2332–2608.