

## REPRODUCTIVE AND PRODUCTIVE PERFORMANCE OF DAIRY CATTLES IN BAKO TIBE DISTRICT WEST SHOWA OROMIA REGIONAL STATE, ETHIOPIA

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**ABSTRACT.** The study was conducted in the Bako Tibe district of West showa Zone, Ethiopia, to assess the reproductive and productive performance of Dairy cattle in the study area. Multi-stage sampling techniques were used to collect data on productive and reproductive performance. The collected data were analyzed using Statistical Package for Social Sciences version 20. All statistical significances were tested at  $p < 0.05$ . The overall mean of AFS, AFC, CI, DO, NSPC for both indigenous and cross breed dairy in study area were 41.25 month, 50.5, 24 month, 160.5 day, 1.78 and 20.95 month, 30, 16 month, 137 day, 1.7 respectively for both indigenous and cross breed dairy cattle respectively. The productive performance of dairy cattle in study area were Daily milk yield, lactation length, 1.26 litter, 6.58 month, and 5.9liter , 9.04 month for both indigenous and cross breed dairy cattle in study area. Generally, the reproductive and productive performance both indigenous and crossbreed dairy cattle is generally poor.

**Keywords:** *Bako tibe, Agro ecology, productive performance, reproductive performance*

### INTRODUCTION

Ethiopia possesses a large livestock population in Africa with nearly 63 million cattle, over 31 million sheep and 33 million goats, and 61 million chickens (1). Despite a high livestock population and existing favourable environmental conditions, the current livestock output of the country is still very low. This is associated with several complex and inter-related factors such as inadequate feed and nutrition, widespread diseases, poor genetic potential, market problems, the inefficiency of livestock development services concerning credit, extension, marketing, and infrastructure (2).

This sector is a corner stone of the economic and social life of the people. Livestock is an integral part of the agriculture and the contribution of live animals and their products to the agricultural economy accounts for 40%, excluding the values of draught power, manure and transport of people and products (3). The economic activity of Ethiopia mostly depends on agriculture especially in rural and semi-urban parts of the country and the contribution of livestock in this agricultural practice is unmeasurable. Livestock farming especially dairy production is a major activity in urban and rural parts of Ethiopia either for home consumption in the rural area mostly and for income generation (4).

Generally, the productive and reproductive performance of dairy cows in the country is low when compared to other African countries. The low performance of crossbred dairy

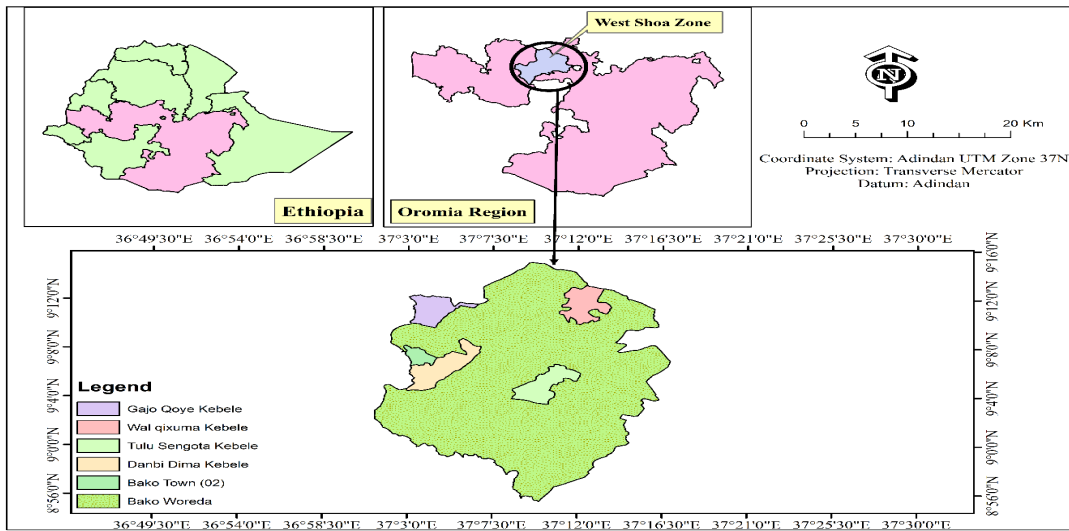
cows is due to different factors like low genetic makeup, feed cost, low quantity, and quality of feed, disease, lack of extension service (5). The productive and reproductive performance of cow-like daily milk yield, lactation length, lactation yield, age at first calving, calving interval, days open, number of services per conception is low. These performance traits are the most important factors in the dairy industry and profitability. The productive and reproductive performance of crossbred dairy cattle are believed to be higher than that of the local breed but the performance of different crossbred cattle having different exotic blood levels are different in the different farming systems of Ethiopian highland both in production and reproduction but not well studied. Different numbers of researches have been conducted in different parts of the countries to evaluate the performance of crossbred for different exotic blood level crossbred of dairy cows in the relatively controlled condition in urban and peri-urban dairy farming areas of the country (6).

The performance of dairy cows mostly depends on the breed's reproductive efficiency and reproductive performance is an outstanding and important trait in dairy cattle production (7). The knowledge of the reproductive and productive performance of dairy cattle is an important point for the success of sustained dairy production in Ethiopia and there is limited information on the productive and reproductive performance of dairy cattle in western showa zone particularly Bako tibe district. Therefore, the objective of this study is to assess the productive and reproductive performance of dairy cattle in Bako tibe district western showa zone Oromia regional start, Ethiopia.

## **MATERIAL AND METHODS**

### ***Description of The Study Area***

The study was conducted in Bako Tibe District, West Shewa Zone, and Oromia Regional State, Ethiopia (figure 1). The district is located 251 km west of Addis Ababa, Ethiopia. The district has 28 rural kebeles and four urban kebeles with a total of 32 kebeles. Out of the 32 kebeles, 14 are located in mid-altitude while the rest of 18 is located in the lowland area. The average elevation of the district is 1610 m.a.s.l and is located at 37.0575' longitude and 09.015' latitude. Geographically, it is categorized into three agro-ecologies, lowland (58%), mid-highland (37%), and a little bit highlands (5%) with an annual rainfall of 1200-1300mm and a temperature range of 13.8-27.8<sup>0</sup>C. The soil type of the district is red soil (55%), loam soil (25%), grey soil (15%), and clay soil (5%) with acidity (PH5.3-6) (8).



**Fig. 1.** Map of the study area

**Sampling Techniques**

In this study, multi-stage sampling techniques were used. In the first stage, the Bako Tibe district was selected purposely for its potential in dairy cattle production. In the second stage, the district was stratified based on agroecology into mid-land and lowland altitudes. In the third stage, five kebeles were selected purposively based on agro-ecology representation, dairy production potential, and accessibility out of 32 kebeles (two for mid-altitude and three representing lowland) from the district. The selected kebeles include from mid-altitude Gajokuye, Warketuma, and lowland-Danbidemi, Tulu sengota, and Bako 02. In the fourth stage, 138 representative household farmers (42 from mid-altitude and 96 from lowland) who owned at least one dairy cow were selected from identified lists of dairy producers using a simple random sampling technique, based on proportional to the population size of the selected kebeles. The sample size for collecting quantitative and qualitative data for this research was determined by using (9) formula.

$$n = \frac{N}{1 + N(e)^2}$$

Where, N= stands for the total number of the targeted population

e =stands for maximum variability or margin of error 8 % (0.08)

l=stands for the probability of the event occurring.

Therefore, 
$$n = \frac{1180}{1 + 1180(0.08)^2}$$

Thus, a total of 138 households were interviewed.

**Sources and Methods of Data Collection**

For the study both primary and secondary data were collected to attain the objective of the study. Primary data were collected by using structured semi structured questionnaire, focus group discussion and field observation. Semi structured questionnaires were prepared and translated into local language, and administered to collect relevant information for the study by trained enumerators who were indigenous to the community with close

supervision of researcher. Focus group discussions were held with clan or village leaders, district agricultural experts (extension agents), local dairy cow owners and elderly female and male member of the society who are known to have better knowledge on the dairy production status of the area. Secondary data were also collected from written and unpublished documents of agricultural office of each respective districts, books and journals.

### ***Data Analysis***

Data collected were coded and entered into Microsoft Excel spreadsheet 2007 and analysed using Statistical Package for Social Sciences (SPSS) version 20. The agro-ecologies were compared using the model indicated below. All statistical significances were tested at  $p < 0.05$ . The results were summarized using descriptive statics, tables, percentages, mean and standard error.

The following model was used to analyse productive and reproductive performance

$$Y_{fk} = \mu + df + e_{fk}$$

Where;  $Y_{fk}$  = the observed productive and reproductive performance;  $\mu$  = the overall mean;  $df$  = the effect of the  $f^{\text{th}}$  location (Agro ecology) (1. Midland, 2. Lowland) and  $e_{fk}$  = random residual error.

## **RESULT AND DISCUSSION**

### ***Age at First Service***

Age at first services (AFS) is the age at which heifers attain body condition and sexual maturity for accepting services for the first time and it is also considered as age at puberty. The average ages at first services for local and cross breed heifers in the study area were  $41.25 \pm 1.3$  and  $20.95 \pm 0.06$  months, respectively (Table 2). It was noted that local heifers in mid-altitude reached sexual maturity earlier and had significantly ( $p < 0.05$ ) lower age at first services ( $40.5 \pm 0.89$  months) than in low land areas ( $42 \pm 1.67$  months). This difference might be associated with management in terms of feeding and housing and climatic condition. However, there was no significant difference in AFS for crossbred cows ( $20.7 \pm 0.07$  vs.  $21.2 \pm 0.05$  months for midland and low land, respectively between the two agro-ecologies of the study area. This might be due to the same genetic makeup of the animals and farmers might have given similar better management practices.

The current value of average AFS observed for local cows is closer to the finding of (10) who reported that AFS for local cows was 41.62 months in the selected urban and peri-urban dairy production systems of West Shoa Zone, Oromia Regional State. The current values of AFS for crossbred cows were also less than with reported values b(11) where AFS was  $24.30 \pm 8.01$  months for crossbreed dairy cows in Jima Town. This may be due to lack of proper management practice like feed and feeding, health care and controlled breeding.

**Table 1. Kebeles and contact farmers covered in Bako district**

Agro-ecology	Selected Kebeles	Target population(N)			Sample household(n)		
		Male	Female	Total	Male	Female	Total
Midland	GajoKuyi	106	20	126	13	2	15
	Walqixuma	210	22	232	24	3	27
	Total	316	42	158	37	5	42
Lowland	Bako Town	300	150	450	35	18	53
	D/Dima	211	21	232	25	2	27
	Tulu Sengota	122	18	140	14	2	16
	Total	633	189	822	74	22	96
Total		949	231	1180	111	27	138

### Age at First Calving

The overall mean of age at first calving (AFC) of local and crossbred heifers in the study area were  $50.5 \pm 0.4$  and  $30 \pm 0.05$  months, respectively (Table 2). Agro-ecologically, the average AFC for local cows were  $49.5 \pm 0.09$  and  $51.5 \pm 0.69$  months in mid-altitude and lowland, respectively and there were significantly different ( $p < 0.05$ ) due to climatic conditions and better feeding and another management system in the midland area of agro-ecology. With, regarding the agro-ecology of the study area, AFC for cross-bred cows were  $29.5 \pm 0.02$  and  $30.5 \pm 0.07$  months for mid-latitude and low land areas, respectively and there were no significant differences between the two agro-ecology in the district (Table 2). The present findings of mean age at first calving for crossbred cows was lower than the findings (12) who reported  $36.4 \pm 1.7$  months in Oromia Rregional State of Arsi Zone in Assela town. The present findings in the mean age at first calving for local heifers was similar to the reported value(13) where AFC for local heifers was 50.59 months in the Dandi district. The existence of difference may be due to constraints like shortage of feed, lack AI technician and veterinary service.

**Table 2. Average mean of reproductive performance of dairy cattle**

Breed	Agro ecologies			P-value
	Mid land Mean±SE	Low land Mean±SE	Over all mean Mean±SE	
<b>Local Cow</b>				
AFS (Month)	$40.5 \pm 0.89$	$42 \pm 1.67$	$41.25 \pm 1.3$	0.04
AFC (Month)	$49.5 \pm 0.09$	$51.5 \pm 0.69$	$50.5 \pm 0.4$	0.02
CI (Month)	$20 \pm 0.10$	$28 \pm 0.07$	$24 \pm 0.09$	0.001
DO (day)	$160 \pm 0.08$	$161 \pm 1.5$	$160.5 \pm 0.08$	0.001
NSPC (times)	$1.66 \pm 0.14$	$1.9 \pm 0.09$	$1.78 \pm 0.11$	0.001
<b>Cross breed</b>				
AFS (Month)	$20.7 \pm 0.07$	$21.2 \pm 0.05$	$20.95 \pm 0.06$	0.09
AFC (Month)	$29.5 \pm 0.02$	$30.5 \pm 0.07$	$30 \pm 0.05$	0.07
CI (Month)	$14 \pm 0.35$	$18 \pm 0.08$	$16 \pm 0.38$	0.005
DO (day)	$135 \pm 0.02$	$140 \pm 0.73$	$137.5 \pm 0.09$	0.003
NSPC (times)	$1.6 \pm 0.06$	$1.7 \pm 0.06$	$1.7 \pm 0.06$	0.02

### ***Calving Interval***

The calving interval is the period between two consecutive parturitions and ideally, should be between 12 to 13 months. Calving interval (CI) is one of the major components of reproductive performance that influences dairy production in the areas. The overall average calving interval for local and crossbred cows in the study areas were  $24 \pm 0.09$  and  $16 \pm 0.38$  months, respectively (Table 2). Concerning agroecology, the average calving interval for local cows in the mid-altitude and lowland agroecology were  $20 \pm 0.10$ ,  $28 \pm 0.07$ , respectively, and was significantly different between agroecology. In the case of crossbred cows, the mean CI were  $14 \pm 0.35$  and  $18 \pm 0.08$  for mid-latitude and low land agroecology, respectively.

The current finding of CI for locally bred in the study areas was closer to report t of (14) who reported 24.94 months for the indigenous breed in the North Shoa Zone of Oromia Regional State.

### ***Days Open***

The average days open (DO) for local and crossbred cows in the study area were presented in Table 13. Days open is the period between calving and conception in cows. The average days open for local and crossbred cows were  $160.5 \pm 0.08$  and  $137.5 \pm 0.09$  days, respectively (Table 13). The average days open for local and cross-bred cows was significantly ( $P < 0.05$ ) different between the two agro-ecologies in the district.

The current findings in average days open observed for local and crossbred cows was lower than with the finding of (15) who reported mean days open of 340.3 and 155 days for local and crossbred cows, respectively in selected urban and peri-urban dairy production systems of West Shoa Zone, Oromia Regional State. The current figure for crossbred cows was also lower than the values reported by (16) where days open was 155 days for crossbred dairy cows in Jima Town Oromia Regional State. The reason for lower days open in the study areas might be an indication of better management practices in terms of nutrition, supplementary feed, and better condition to overcome heat detection in the current study areas.

### ***Number of Services Preconception (NSPC)***

The average NSPC for local and crossbred cows in study areas were presented in Table 2. The number of services per conception (NSPC) is the number of services (natural or artificial) required for successful conception. The average numbers of services per conception for local and crossbred cows in study areas were  $1.78 \pm 0.11$  and  $1.7 \pm 0.06$ , respectively. The average number of services per conception for local and crossbred was significantly ( $P < 0.05$ ) different between the two agro-ecologies where it was higher in the low land areas for both local and crossbred cows than in mid-altitude agroecology. This might be due to more environmental impact in low land agroecology than mid-altitude.

The overall mean NSPC for both local and crossbred cows in the present study were in line with the result of (17) where NSPC were 1.7 and 1.8 for local and cross breed cows, respectively in the highlands of Ethiopia.

## ***Productive Performance of Dairy Cattle***

### ***Daily Milk Yield***

The overall mean daily milk yield for local and crossbred cows in study areas were  $1.26 \pm 0.06$  and  $5.9 \pm 0.17$  liters/cow/day, respectively. There is a significant difference ( $P < 0.05$ ) between the two agro-ecologies and bred of the study area (Table 3). These variations could be attributed to differences in feeding and other management practices. The present finding for local and crossbred cows in the study area were similar to the findings of (19) who reported an average milk yield of 1.0 liter for local Arsi cows and 5.8 liters for crossbred cows in the East Shoa Zone, Oromia Regional State. The current finding in milk yield of local cows was lower than the result of (18) who reported 3.4 liters of milk yielding Noth Shoa Zone, Oromia ReginalState, Ethiopia. But, the milk yield of crossbred cows in the current study was slightly higher than the report of(20) where it was 5.5 liters in the above-mentioned places.

### ***Lactation Length***

The average lactation length (12 months) for local and crossbred dairy cows in study areas were presented in Table 14. The overall mean lactation length for local and crossbred cows was found to be  $6.58 \pm 0.09$  and  $9.04 \pm 0.31$  months, respectively. Agro ecologically, the average lactation lengths for local cows were  $7.08 \pm 0.0$  and  $6.09 \pm 0.08$  months in mid-altitude and lowland areas, respectively. As well, the average lactation length for cross-bred cows in mid-attitude and lowland areas was  $9.03 \pm 0.05$  vs.  $9.06 \pm 0.16$  months, respectively. The result of current study is lower than the report of (21) who reported that the lactation length of indigenous dairy cattle was 8.21 month in sidama Zone ,southern Ethiopia.

***Table 3. Average daily milk yield per cow and lactation length***

Cattle breed	Mid land Mean $\pm$ SE	Low land Mean $\pm$ SE	Overall mean $\pm$ SE	P-value
<b>Local cows</b>				
Daily milk yield per cow(liters)	$1.40 \pm 0.06$	$1.12 \pm .06$	$1.26 \pm 0.06$	0.007
Lactation lengt(Month)	$7.08 \pm 0.01$	$6.09 \pm 0.08$	$6.58 \pm 0.09$	0.001
<b>Crossbreed cows</b>				
Daily milk yield(liters)	$6.67 \pm .106$	$5.07 \pm .23$	$5.9 \pm 0.17$	0.001
Lactation length (Month)	$9.03 \pm 0.05$	$9.06 \pm .16$	$9.04 \pm 0.31$	0.07

*Note:-Mean  $\pm$ SE= Mean and standard Error, P-value ( $P < 0.05$ ) =significant, P-value ( $P > 0.05$ )= Not significant*

## CONCLUSION

In general, the reproductive and reproductive performance of both indigenous and crossbreed in the study area is poor. This poor performance of both crossbreed and local breed require the planned technical and institutional intervention for support service, for appropriate breeding program, improved veterinary and AI technician and improved forage production. Improvement of improved forage production and expansion to decrease feed shortage is encouraged.

### Conflicts of interest

The authors declare no conflicts of interest

### Data availability statement

The data will be provided upon the request of the corresponding author

### Declaration of funding

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## REFERENCES

- [1] FAO, IFAD, UNICEF, WFP and WHO. (2019): The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. Rome, FAO. Licence: CC BY-NC-SA 3.0 IGO
- [2] Ahmedin A, Yesihak., (2020): Milk production performance, challenges and opportunities Dairy cattle production in west Hararghe, Oromia regional state, Ethiopia. *Open Journal of Animal Sciences*, Vol.10
- [3] Alame, A. and Lema Z. (2015): Contribution of Livestock Sector in Ethiopian Economy : A Review. *Advances in Life Sciences and Technology*, 29, 79–91
- [4] Kumar, N. and Tkui, K., (2014): Reproductive performance of crossbred Dairy cow in Mekelle, Ethiopia. College of Veterinary Medicine, Mekelle University, Ethiopia Scientific Journal of Animal Science, 3(2) 35-40.
- [5] Getachew Y, Lemma A, Fesseha H (2020): Assessment on reproductive performance of crossbred dairy cows selected as recipient for embryo transfer in urban set up bishoftu, Central Ethiopia. *Int J Vet Sci Res* 6(1): 080-086. DOI: <https://dx.doi.org/10.17352/ijvsr.000058>.
- [6] Shiferaw Y, Tenhagen BA, Bekana., (2005): Reproductive disorders of cross breeds dairy cows managed under different production systems in central high lands of Ethiopia. *J of Trop Anim Helth and production*; 37(5):427–441
- [7] Naceur, M., Bouallegue M., Frouja S., Ressaissi Y., Kaur Brar S. and Ben Hamouda M., (2012): Effects of Environmental Factors on Milk Yield, Lactation Length and Dry Period in Tunisian Holstein Cows, Milk Production -An Up-to-Date Overview of Animal Nutrition, Management and Health, Prof. Narongsak Chaiyabutr (Ed.), ISBN: 978-953-51- 0765-1, InTech, DOI: 10.5772/50803.
- [8] Bako Agricultural Office

- [9] Belay, D.Yisehak K. & Janssens G. (2012): Productive and Reproductive Performance of Zebu X Holstein-Friesian Crossbred Dairy Cows in Jimma Town, Oromia, Ethiopia. *Global Vet.* 8.(67)
- [10] Hunduma, D. (2012): Reproductive performance of crossbred dairy cows under smallholder condition in Ethiopia. *Int. J. Livest. Prod.*, 3(3): 25-28
- [11] Belay, D., Azage, T. and Hegde, B.P. (2012): Smallholder Livestock Production System in Dandi District, Oromia Regional State, Central Ethiopia. *Global Veterinaria* 8(5): 472-479.
- [12] Mulugeta, A. and Belayeneh A. (2013): Reproductive and lactation performances of dairy cows in Chacha Town and nearby selected kebeles, North Shoa Zone, Amhara Region, Ethiopia, *World Journal of Agricultural Sciences* ,1(1), pp. 008-017. Available online at <http://wsrjournals.org/journal/wjas> ISSN 2329-9312 ©2013 World Science Research Journals.
- [13] Belay, D., Yisehak, K. and Janssen, G. (2012): Productive and reproductive performance of zebu x Holstein-Friesian crossbred dairy cows in Jimma town, Oromia, Ethiopia. *Global veterinarian* 8(1): 67- 72.
- [14] Tadesse, M. Thiengetham, A. Pinyopummin, and S. Prasanpanich, (2010): Productive and reproductive performance of Holstein Friesian dairy cows in Ethiopia. *Livestock research for rural development*. Volume 22, (2) article no. 34.
- [15] Belete, A. Fekadu B. and Berhanu, G. (2010): Cattle milk and meat production and marketing systems and opportunities for market-orientation in Fogera woreda, Amhara region, Ethiopia. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 19. ILRI (International Livestock Research Institute), Nairobi, Kenya. 65 pp.
- [16] Lemma, F. Fekadu, B. and Hegede, B. (2005): Rural smallholders Milk and dairy products production, utilization and Marketing systems in East Shoa Zone of Oromia. In: *Proceedings of the 12th Annual conference of the Ethiopian Society of Animal Production (ESAP)* held in Addis Ababa, Ethiopia, August 12-14, 2004. ESAP, Addis Ababa, Ethiopia
- [17] Belete, A. Fekadu B. and Berhanu, G. (2010): Cattle milk and meat production and marketing systems and opportunities for market-orientation in Fogera woreda, Amhara region, Ethiopia. IPMS
- [18] Abera, Y., Urge, M., & Nurfeta, A. (2018): Productive and reproductive performance of local dairy cows in selected districts of Sidama Zone, Southern. 9(May), 88–94. <https://doi.org/10.5897/IJLP2018.0447>