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Analysis of Lifetime Traits for Crossbred Dairy Cattle in the Central Highland of Ethiopia

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Abstract: The objective of this study was to analyze the lifetime performance of crossbred dairy cattle in the Central highland of Ethiopia. Birth year records of 502 cows maintained at Holetta Agricultural Research Centre from 1974 through 2015 were used to estimate longevity traits. The fixed effects considered were genetic groups, season of birth, and birth year groups. Least squares mean analyses were performed using general linear model procedure of SAS software, version 9.4. The overall means for total life (TL), herd life (HL), productive life (PL), lifetime milk yield (LTMY), lifetime milk yield per day of total life (LTMYTL), lifetime milk yield per day of herd life (LTMYHL), lifetime milk yield per day of productive day (LTMYPL) and calf crop (LTC) were 3294.6±54.16 days, 2046.2±47.19 days, 1367.8±37.7 days, 9314.14±314.2 kg, 2.71±0.06 kg, 4.45±0.08 kg, 6.56±0.10 kg and 4.5±0.10, respectively. Both genetic group and birth year were found to be the factors that significantly influenced ($p <$ at least 0.05) all studied traits. The study revealed that the first generation 50%, and 75% Friesian x Boran crossbred dairy cows performed better in most of the lifetime traits than Borana and later generations (F_2 and F_3) which implies that segregation effect can be minimized through upgrading. The result may show that about 438.40 days were wasted without production during calf and heifer growth period compared with an ideal situation (24 to 27 months considered as the cow starts production). In addition, cows spent 90.76 days per calving without milk production unnecessarily. The higher gap between TL and HL and between HL and PL could show that more milk and calf production can be obtained through selection and enhancing heifer rearing and cow management. In conclusion, the first generation 50% and 75% Friesian x Boran crossbred dairy cows had performed better in lifetime traits than Boran and later generations (F_2 and F_3). This could be associated with a reduction in adaptation potential of up-graded generation and reduction in hybrid vigor and recombination losses in inter se generation. Enhancing the farm husbandry practices and optimizing breeding programs that encompass the lifetime traits are essential to reduce the effect of environmental factors, reduce segregation and further genetic improvement.

Keywords: *Borana, Herd life, Productive life, Milk yield*

Introduction

In Ethiopia, crossbreeding has brought substantial change in the production and reproductive performances of dairy cattle. Several research reports revealed that crossbred cattle produce 5 times more daily milk yield and attain the age at first calving much earlier than indigenous counterparts (Aynalem *et al.*, 2011; Kefena *et al.*, 2016; Yohannes *et al.*, 2017).

Lifetime traits are some of the economically important traits in dairy production and are a reflection of both the productive and reproductive efficiency of farm animals (Pelt, 2017). The longevity of dairy cows is a complex trait with low heritability and is affected by several factors (Ferris *et al.*, 2014; Grandi *et al.*, 2016; Vries and Marcondes, 2020). Longevity of a dairy cow is also determined by the culling practices of the farm and it might be different due to the differences in the production system (Vries and Marcondes, 2020). Animal could be culled due to disease, lower production, conformation problems and other economic reasons (Vries and Marcondes, 2020).

The economic output of dairy cattle depends on its lifetime performance rather than single lactation performance. Improvement in the longevity of cows can result in higher lifetime milk production which leads to efficient economic output (Ambhore *et al.*, 2017). In addition, higher longevity could help to reduce the cost of replacement, enhance the proportion of cows found in high production age, and avail data and productive cows for selection (Martens and Bange, 2013; Horvath *et al.*, 2017; Mirhabibi *et al.*, 2018). Holetta Agricultural Research Centre has been working on genetic improvement of dairy cattle including lifetime traits for the last 50 years (Kefena *et al.*, 2011). However, there is limited information on the lifetime performance of crossbred dairy cattle in recent years regarding the status of longevity traits on this farm. Therefore, this study was aimed to analyze the lifetime performance of crossbred dairy cattle at Holetta Research Center, central Ethiopia.

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Materials and Methods

Description of the Study Area

For this study data recorded on lifetime performance was obtained from Holetta Agricultural Research Centre's dairy farm. Holetta is located between 3°24´N to 14°53´N latitude and 33°00´E to 48°00´E longitude and 35 km west of Addis Ababa. The area has an altitude of 2400 meters above sea level and receives 1100 mm average annual rainfall. The area has an annual mean minimum and maximum temperature of 6°C and 24°C, respectively. There are two rainfall patterns in the area. The short rainy period includes months from March to May and the long rainy period extends from June to September (Yohannes *et al.*, 2017).

Data Source and Animal Management

Data for this study were obtained from a database of Holetta Agricultural Research Centre (HARC). Records of 502 cows born on the farm from 1974 to 2015 were included in the study. Records on production and reproduction performance records were considered to calculate measures of lifetime traits, lifetime milk yield, lifetime milk production and lifetime calf crop production. The animals were managed based on breed group, stage of pregnancy, lactation stage, sex and age. Almost similar feeding and other management practices were provided for all animals within each category. Animals were allowed to graze on pasture land from early morning 8.00 AM to 4.00 PM. A concentrate diet composed of wheat middling, wheat bran, noug (*Guizocia abyssinica*) cake and salt was supplemented when they return from grazing. About 4, 1-1.5, and 0.25-1 kg of concentrate mixed were supplemented per day for milking cows, heifers, and calves, respectively. Calves were reared by bucket feeding of milk and offered roughage feed starting from two weeks of age. The total amount of whole milk provided to each calf until weaning age (98 days) was 260 kg. Milking was carried out by hand in the morning and evening times until the year 2001. Since 2002, milking machines replaced hand milking. Vaccination against major diseases, deworming against internal parasites and acaricidal spray to control external parasites were given on regular schedules according to the disease control calendar set by the animal health research division of HARC.

Mating Design

The Borena cows used as a dam breed for crossbreeding were purchased from the Borena area in southern Ethiopia. Mating was undertaken throughout the year using artificial insemination (AI) obtained from the National Artificial Insemination Center (NAIC) and worldwide sire (WWS). Natural mating was also practiced when cows came into repeat heat with AI and to generate pure Boran following heat. The estrous cycle of breeding cows was detected by a teaser bull. Borena dams were mated with Friesian sire semen to produce F_1 (Table 1). The F_1 was either inter se mated or backcrossed with 75% FB or Friesian semen to produce 62.5% and 75% generation, respectively. The later generations F_2 (50% F_1 dam x 50% F_1 sire), F_3 (F_2 dam x F_2 sire), and 75%FB second generations were produced by inter se mating.

Table 1. Number of observations by genotypes included in the study

Dam genotype	Sire genotype	Progeny produced	N
BO	BO	Boran	18
BO	F	50%F_1	283
F_1BOF	F_1BOF	50%F_2	52
F_2BOF	F_2BOF	50%F_3	38
F_1BOF	BOFF	62.5%F	17
F_1BOF	F	75% F_1	85
BOFF	BOFF	75% F_2	9

BO= Boran; F= Friesian, 50%F_1= First generation 50% Friesian inheritance; 50%F_2= Second generation50% Friesian inheritance; 50%F_3= Third generation 50% Friesian inheritance; 62.5%F= 62.5 % Friesian inheritance; 75% F_1= First generation 75% Friesian inheritance; 75%F_2= Second generation 75% Friesian inheritance; N= Number of observations.

Traits Considered in the Study

Total life or longevity (TL): Total life is the period from birth to disposal of the cow from the herd. It was calculated as the period between the date of birth and the date of disposal of the animal.

Herd life (HL): Herd life is the period between the first calving and disposal of the cow from the herd. It was calculated as the total number of days from the date of first calving to disposal.

Productive life (PL): Productive life is the number of days in milk during the entire lifetime of the cow or the total length of days in lactation. These were calculated as the sum of the number of days in milk in different lactations completed in the herd.

Lifetime milk yield (LTMY): Total amount of milk yield produced during the entire lifespan of the cow in the herd.

Lifetime milk yield per day of total life (LTMYTL): Lifetime milk yield per day of total life was obtained by dividing lifetime milk yield by the total lifespan of cows.

Lifetime milk yield per day of herd life (LTMYHL): Lifetime milk yield per day of herd life was calculated as lifetime milk yield divided by herd life.

Lifetime milk yield per day of productive life (LTMYPL): Lifetime milk yield per day of productive life was estimated as lifetime milk yield divided by productive life.

Calf crop production (LTC): Corresponds to total calves produced until disposal of the cow.

Data Management and Analysis

Long-term data collected and stored in the database of Holetta Agricultural Research Centre was used to evaluate the lifetime traits. Data of cows disposed of (dead and culled) from 1974 to 2015 were used for this analysis. Incomplete records such as cows that did not have a birth date and parity data were excluded from the data. In addition, records of abortions were considered incomplete lactation and excluded. Cows that completed at least the first two lactations with a minimum lifetime milk yield of 1,000 kg and above 100 days of lactation lengths were included in the final dataset.

The least-squares mean analyses of fixed effects were performed using the general linear model (GLM) procedures of Statistical Analysis System (SAS, version 9.4). The fixed effects fitted in the model include genetic group (Boran, 50%F_1, 50%F_2, 50%F_3, 62.5%F, 75% F_1, and 75% FB), birth year (grouped into seven periods based on the similarity within year groups and each group represents six-years,1974-1979, 1980-1985, 1986-1991, 1992-1997, 1998-2003, 2004-2009 and 2010-2015), and birth season; grouped into three classes based on the pattern of meteorological information as a dry season (October to February), short rainy season (March to May), and a long rainy season (June to September).

The traits considered in the model include total life, herd life, productive life, lifetime milk yield, milk production per day of total life, milk yield per day of herd life, milk yield per day of productive life and calf crop. The following model was used for data analysis:

$$Y_{jkl} = \mu + G_j + P_k + S_l + e_{jkl.}$$

Where, Y_{jkl} = Lifetime traits (Total life, Herd life, Productive life, Lifetime milk yield, Milk production per day of total life, Milk yield per day of herd life, Milk yield per day of productive life, and lifetime calf crop), μ = overall mean; Gj = the effect of jth genetic group (j= Borana, 50%F_1, 50%F_2, 50%F_3, 62.5%F, 75% F_1, and 75% F_2); P_k = fixed effect of k^{th} year of birth (k= 1974- 2015)); S_l = fixed effect of l^{th} season of birth (Dry season, Short rainy season and long rainy season) and e_{jkl} = random error associated with $_{jkl}{}^{th}$ observation and assumed to be normally and independently distributed.

Results and Discussion

Total Life (TL) and Lifetime Milk Yield (LTMY)

The least-square means and standard error of TL and LTMY are summarized in Table 2 and Table 3, respectively. The overall mean and standard error of TL of crossbred dairy cows and Borana cows was 3294.6±54.16 days (9.03years). The current value is higher than the report of Gebeyehu (2014), Direba *et al.* (2015), Vinothraj *et al.* (2016) and Ikeda *et al.* (2019) who found 7.9 years for HF, 7.3 years for Pure Jersey, 7.3 years for Jersey x Red Sindh and 6.26 years for Nelore cows in tropical countries, respectively. Contrary to our result, Chhaya (2013) for HF x Deoni crosses (11.3 years) and Kefena *et al.* (2013) for Fresian and Jersey crosses with Boran (11 years) reported higher longevity in India and Ethiopia, respectively. The difference with the literature may be due to the variation of environment, genotype, culling practices of the farm and number of observations considered. Genotypes and year of birth had a significant effect ($p < 0.0001$) on TL (Table 2). Even though Borana was less productive than crossbred cows, they stay a significantly longer period in the herd than crossbred cows. This is mainly attributed to the fact that Borana is more adaptive to the prevailing environment and there was less culling pressure on this breed compared to crossbreed generations as the farm keeps Borana to use as a dam breed for crossbreeding. Fifty percent crossbred (3814.17±68.90) and 75% crossbred (3607.21 ±132.24) had higher TL than other generations (2871.72±160.84 to 3253.37±133.71) which could indicate that the farm keep the first and upgraded generations for long period as the milk yielding potential of these generations was better than the others. The difference of later mating generation may be due to gene complementary effect and loss of segregation in inter se generations. Likewise, the variation between years of birth implies the inconsistent management across the study period and an increase in culling intensity on low-performing cows from the herd in the recent years than in the earlier year.

The overall least square mean and standard error of LTMY was found to be 9314.14±314kg (2.71±0.06 kg per day of total life) (Table 3). The value obtained in the present study was comparable with some other estimates for crossbred dairy cattle in the tropics (Chhaya, 2013; Kefena *et al.,* 2013; Ambhore *et al.,* 2017). However, it is higher than the value reported for Pure Jersey cattle (7216.34 ± 189.83kg) in Ethiopia (Direba *et al.,* 2015) and Jersey x Red Sindhi Crossbred Cows (4411.14 ± 194kg) in India (Vinothraj *et al.,* 2016). Milk yield performance of 50% F_1 (11196±466.63) and 75% first-generation (8610±519.77) were much better than pure Borana cows (1730±433.67) and other inter se generations (5145±623.56 to 6537±653.04). Lifetime milk yield performance of 62.5% FB crosses (9454±1153.49) was better than 75% FB crosses (8610±519.77). This might be due to better adaptation of 62.5% FB crosses to the low input tropical production systems. The result indicates that the LTMY performance of crossbreds in Ethiopia was much better than the indigenous breed (Boran) and comparable to studies in tropical countries. The difference might be due to the type of breeds involved in crossbreeding, level of gene inheritance, environmental effects and culling intensity practiced by the farms.

Table 2. Least-square means (LSM) and standard error (SE) of total life, productive life and herd life

Factors	N	TL (days) LSM±SE	HL (days) LSM±SE	PL (days) LSM±SE
Overall	502	3294.6±54.16	2046.2±47.19	1367.8±37.7
Breed group:		***	***	***
Borana	18	4071.57±230.13[a]	2156.95±227.13[abc]	290.52±173.78[d]
50%F_1	283	3814.17±68.90[a]	2536.37±67.99[a]	1851.76±52.02[a]
50%F_2	52	3253.37±133.71[bc]	1736.83±131.97[bc]	1190.10±100.97[bc]
50%F_3	38	2871.72±160.84[c]	1319.95±158.75[c]	909±121.46[cd]
62.5%F	17	3253.08±254.83[abc]	1642.92±251.51[bc]	1093.72±192.44[bc]
75%F_1	85	3607.21±132.24[ab]	2263.28±130.52[ab]	1609.29±99.86[ab]
75%F_2	9	3032.77±318.67[abc]	1730.77±314.53[abc]	1218.61±240.65[abc]
Birth season:		*NS*	*NS*	*NS*
Dry	192	3425.96±97.48	1962.73±96.21	1218.91±73.61
Short rain	172	3497.76±97.86	1982.03±96.59	1180.51±73.90
Main rain	138	3320.80±98.98	1792.56±97.69	1098.99±74.748
Birth year group:		***	***	***
1974-1979	25	4116.22±203.73[ab]	2220.45±201.08[ab]	1514.04±153.85[a]
1980-1985	50	4646.29±145.61[a]	2507.31±143.72[a]	1607.10±109.96[a]
1986-1991	52	3961.14±137.96[b]	2441.09±136.16[a]	1688.35±104.18[a]
1992-1997	36	3404.39±174.90[bc]	2141.10±172.63[ab]	1464.91±132.07[a]
1998-2003	124	2955.91±118.16[cd]	1743.27±116.62[b]	983.82±89.23[b]
2004-2009	99	2639.72±131.98[d]	1329.44±130.26[c]	531.32±99.66[c]
2010-2015	116	2180.21±126.94[e]	1004.41±125.28[c]	373.41±95.86[c]
CV		28.24	44.88	51.37

****= P<0.0001; Means with the same letter and in the same column for each effect are not significantly different; N= Number of observations; TL= Total life; PL= Productive life; HL= Herd life; LSM= Least-squares mean; SE= Standard error of mean; NS= Not significant.*

Herd Life (HL) and Milk Yield per day of Herd Life (LTMYHL)

The overall mean HL of crossbred dairy cows in the present study was 2046.2±47.19 days (5.6 years) indicating that animals spent a longer time (1248.40 days or 3.42 years) before starting production. By assuming 27 months of average age at first calving, our present result reveals that about 438.40 productive days were lost without milk production during the calf and heifer growth period. Our estimate is closer to 5.83 years reported for Holstein Friesian dairy cows in Ethiopia (Haile and Yoseph, 2016). However, it is higher than the reported averages of Kern *et al.* (2014), Gebeyehu (2014) and Direba *et al.* (2015) for Holstein Friesian and Jersey breeds in Brazil and Ethiopia, respectively. The value of the present stud was lower than the study of Teodoro and Madalena (2005) and Kefena *et al.* (2013) on Jersey crosses in Brazil and Ethiopia, respectively. The difference in estimates of the present study with some other literature could be due to the difference in genotype and environment. The observed variation can also be due to culling practice as some farms cull cows at early parities to provide a chance for new generations. Genotype and year of birth significantly ($p < 0.0001$) affected HL. Cows born during 1980-1985 (2507.31±143.72) had the highest HL and a decreasing trend was detected following this year group. This could be associated with the change in the culling practice of the farm.

The overall least square mean and standard error of LTMYHL of crossbred dairy cows in the present study was 4.45±0.08 kg (Table 3). The present finding is almost comparable to the 4.77 kg estimated for Jersey cattle in India (Dinesh *et al.*, 2014). However, lower estimates of LTMYHL were reported for crossbred dairy cows (Kefena *et al*, 2013; Vinothraj *et al.,* 2016). Lifetime milk yield per day of herd life was significantly varied between genotype and birth years ($p < 0.0001$). First-generation 50% FB (4.85±0.12) and 75%FB (5.66±0.23) cows produce substantially higher LTMYHL than Borana (1.14±0.39) and other inter se generations (2.94 to 4.00 kg). Year of birth had a marked effect ($P<0.0001$) on LTMYHL but season of birth did not affect it ($p > 0.05$). The observed variation between year and genetic group could reflect the management difference across years and inconsistent genetic improvement activities.

Productive Life (PL) and Milk Yield per day of Productive Life (LTMYPL)

The average PL of the herd was 1367.8±37.7 days (3.7 years) which indicates that cows spent 41.52% of their entire life and 66.85% of HL in milk production (Table 2). The result may infer that cows spent 90.76 days per calving and 408.40 days from HL without milk production after excluding 60 days rest period for late pregnancy or preparation for the next lactation. The present finding is in agreement with Gebeyehu (2005), who reported a PL of 3.57 years for Holeisten x Borana crossbred cows in Ethiopia. Singh *et al.* (2011) and Haile and Yoseph (2016) also calculated 3.25 years and 3 years for the Sahiwal and Holstein Friesian dairy cows in India and Ethiopia, respectively. There was a declining trend in PL of cows over the study period which might show that the farm reduce attention to lifetime traits in recent years.

The overall least square mean and standard error of LTMYPL of crossbred dairy cows in the present study was 6.56±0.10kg (Table 3). The present value was similar to 6.46±0.13 reported for the Jersey breed in India (Dinesh *et al.,* 2014). However, it is higher than the estimate of some other studies in the tropics (Chhaya, 2013; Kefena *et al.,* 2013; Vinothraj *et al.,* 2016). On the contrary, it is lower than the value (9.71±0.14kg) reported for Holstein Friesian x Sahiwal cows in India (Singh *et al.,* 2018). Milk yield per day of productive life was noticeably varied between genotypes ($p < 0.0001$). Fifty percent F_1 (4.85±0.12 kg) and 75 percent F_1 (5.66±0.23 kg) crosses outperform Borana breed (1.14±0.39 kg) and inter se generations (2.94 to 3.67 kg) by a wide margin. This implies that upgrading may help to reduce the effect of segregations on inter se generation and the need for an appropriate breeding program to maintain the desirable breed level.

Table 3. Least square means (LSM) and standard error (SE) of lifetime milk production traits

Effect	N	LTMY(kg) LSM±SE	LTC(n) LSM±SE	LTMYTL(kg) LSM±SE	LTMYPL(kg) LSM±SE	LTMYHL(kg) LSM±SE
Overall	502	9314.14±314.28	4.5±0.10	2.71±0.06	6.56±0.10	4.45±0.08
Breed group:		***	***	***	***	***
Pure Boran	18	1730±433.67^{d}	4.34 ±0.51^{abc}	0.64±0.29^{d}	3.15±0.41^{d}	1.14±0.39^{d}
50%F_1	283	11196±466.63^{a}	5.63±0.15^{a}	3.18±0.09^{ab}	6.62±0.12^{b}	4.85±0.12^{b}
50%F_2	52	6537±653.04^{bc}	3.68±0.29^{bc}	1.72±0.17^{c}	4.74±0.24^{c}	3.16±0.23^{c}
50%F_3	38	5145±623.56^{cd}	2.93±0.35^{c}	1.29±0.20^{cd}	4.22±0.29^{cd}	2.94±0.28^{c}
62.5%F	17	9454±1153.49^{ab}	3.44±0.57^{bc}	2.03±0.32^{c}	5.70±0.46^{c}	4.00±0.44^{bc}
75% F_1	85	8610±519.77^{abc}	4.36±0.29^{b}	3.41±0.17^{a}	8.11±0.23^{a}	5.66±0.23^{a}
75% F_2	9	5361±1474.72^{cd}	3.75±0.71^{abc}	1.98±0.41^{bcd}	5.87±0.57^{bc}	3.67±0.55^{bc}
Birth season:		*NS*	*NS*	*NS*	*NS*	*NS*
Dry	192	10327.9 ±584.55	4.09±0.22	2.15±0.12	5.54±0.17	3.73±0.16
Short rain	172	9097.6 ±478.52	4.10±0.22	2.04±0.12	5.60±0.17	3.58±0.16
Main rain	138	8173.6 ±524.03	3.87±0.22	1.92±0.12	5.32±0.17	3.59±0.17
Birth year group:		***	***	***	***	***
1974-1979	25	9327±1487.77^{bc}	4.03±0.45^{abc}	1.9±0.26^{bc}	4.36±0.36^{cd}	3.26±0.35^{bc}
1980-1985	50	8295±765.22^{bc}	5.08±0.32^{a}	1.42±0.18^{c}	4.00±0.26^{d}	2.78±0.25^{c}
1986-1991	52	9695±791.57^{bc}	5.03±0.31^{a}	2.37±0.17^{ab}	5.27±0.25^{bc}	3.85±0.24^{b}
1992-1997	36	12613 ±2018.32^{a}	4.88±0.38^{ab}	2.98±0.22^{a}	6.74±0.31^{a}	4.98±0.30^{a}
1998-2003	124	10667±752.94^{ab}	3.75±0.26^{b}	2.19±0.15^{b}	5.80±0.22^{ab}	3.70±0.20^{b}
2004-2009	99	8711±561.09^{bc}	2.85±0.29^{c}	1.64±0.16^{c}	5.89±0.23^{ab}	3.21±0.23^{bc}
2010-2015	116	7624±436.2^{c}	2.53±0.28^{c}	1.75±0.16^{bc}	6.37±0.23^{a}	3.65±0.22^{bc}
CV		66.55	46.09	44.06	25.13	0.36

**** =P<0.0001; Means with the same letter and in the same column for each effect are not significantly different; N= Number of observations, LTMY= Lifetime milk yield; LTC= Lifetime calves crop; LTMYTL= Lifetime milk yield per total life; LTMYPL= Lifetime milk yield per productive life; LTMYHL= Lifetime milk yield per herd life; LSM= Least-squares mean; SE= Standard error of mean, NS= Not significant, N= Number of calve crops.*

Lifetime Calves Crop (LTC)

The overall least square mean and standard error of the LTC of crossbred dairy cows and the Borana breed in the present study was 4.5±0.10 (Table 3). The result is comparable with the value reported for Sahiwal cows (4.19±0.20) and Holstein x Boran crossbred cows (4.19±0.20) in India (Singh *et al.,* 2011). But it is higher than the estimate of Gebeyehu *et al.* (2014) for Holstein Friesian (3.55±0.12) and Direba *et al.* (2015) for Pure Jersey cattle (3.22±0.0) in Ethiopia. Our result is inconsistent with the value estimated for the Holstein x Gir cross (5.480±0.764) in Brazil (Teodoro and Madalena, 2005) and 5.7 ± 0.2 found by Kefena *et al.* (2013) for Holstein x Borana cross in Ethiopia. The difference with some literature may be due to breed level, a difference of the environment used to maintain the cows and the sample size used for analysis. Calf crop was significantly influenced by genotype. The highest calves crop was recorded by F_1 50% crossbred (5.63±0.15) followed by F_1 75% (4.36±0.29) and Borana (4.34±0.51). The lower LTC observed in the inter se generations has resulted from a high rate of culling due to the low milk production potential of this group. In addition, the higher gap between TL and HL and between HL and PL could show that more calves-can be obtained through selection and enhancing heifer rearing and cow management.

Conclusion

The study revealed that the first generation 50% and 75% Friesian x Boran crossbred dairy cows had performed better in lifetime traits than Boran and later generations (F_2 and F_3). There was a declining trend in the lifetime performance as the level of Friesian gene inheritances increased from 50 % to 75% and inter se generations. This could be associated with a reduction in adaptation potential of up-graded generation and reduction in hybrid vigor and recombination losses in inter se generation. The inconsistent trends observed on most lifetime traits over the study year indicate the fluctuation in farm management such as feeding and health. The higher gap between TL and HL and between HL and PL could show that more production and calf can be obtained through selection and enhancing heifer rearing and cow's management. In general, the lifetime performance of most crossbred genotypes was good. However, enhancing the farm husbandry practices and optimizing breeding programs that encompass the lifetime traits are essential to reduce the effect of environmental factors, reduce segregation and further genetic improvement.

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Conflict of Interests

The authors declare that they have no competing interests.

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