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Milk yield performance of crossbred dairy cows in Ethiopia: A review

B Nibo *

Department of Agricultural Research, Ethiopian Institute of Agricultural Research, Addis Ababa, P.O.Box 2003, Ethiopia

*Corresponding author. E-mail: bnibo1984@gmail.com

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ABSTRACT

Crossbreeding had been initiated and put into practice in various parts of Ethiopia for a very long time to improve milk yield performance. This review was conducted to review and generating compiled information on milk production Daily Milk Yield (DMY), Lactation Length (LL) and lactation milk yield of cross breed dairy cattle in Ethiopia. Review results of milk production performances in Ethiopia varied greatly from one genotype to another. The on station lactation milk yield, lactation length and daily milk yield were ranged from 1293.01 ± 23.70 to 2957.46 ± 72.98 liters, 298.68 ± 5.17 to 374.05 ± 7.24 days, 4.18 ± 5 to 8.70 ± 0.17 liters, respectively, whereas the on-farm review results were ranged from 631.69 ± 222.98 to 2705.43 liters, 241.65 ± 26.22 to 310.91 ± 41.83 days and 7.30 ± 0.16 to 9.91 liters, respectively. Among the genotypes, the 50% F1 and 75% Holstein Friesian first generations were considered suitable for milk production parameters. The on station development of 50% F2, F3, and 75% second generations showed low milk production. Regardless of blood level and genotype difference, the performance of on farm crossbred cows was almost similar to on station experimental cows. Crossbred cows were affected by non-genetic factors like year, season, and parity, depending on the breed and study location. In general, crossbred cows have good milk yield performances compared to indigenous (local) breeds. However, crossbred animals could not exploit their maximum potentials because animals are subjected to different environmental effects.
Keywords: Crossbred, Genotype, Milk performance, Lactation length, Environmental effects

INTRODUCTION

Ethiopia is one of the developing countries in Africa known with a huge livestock population. The estimated total cattle population for the country is about 70 million constituting of male (44%) and female (56%). Out of the total cattle population in the country, the proportion of indigenous breeds are 97.4% and the remaining hybrid and exotic breeds are about 2.3% and 0.31%, respectively (CSA, 2020/2021). But, dairy industry is not developed as that of east African countries for example Kenya, Tanzania and Uganda (Hunduma, 2013).

The overall productivity and adaptive efficiency of cattle depends largely on their milk production performance in a given environment. Reproduction is an indicator of milk production efficiency and the rate of genetic progress in both selection and crossbreeding programs particularly in dairy production systems.

The milk production traits are crucial factors, contributing for the profitability of dairy production (Fikre, et al. 2007). The common determinant traits for milk production performance of breeding animal are Daily Milk Yield (DMY), Lactation Length (LL) and Lactation Milk Yield (LMY) of breeding animal. However, the ultimate goal in dairy production is to undertake economically efficient milk production, which is influenced by the reproductive efficiency of the cows. In the long term crossbreeding program, different genotypes were produced in the country. The present review was focused on reviewing and generating compiled information on milk yield traits of crossbred dairy cattle in Ethiopia.

LITERATURE REVIEW

Milk Production Traits

The milk production performance of dairy cattle is usually measured by determining the average Daily Milk Yield (DMY), Lactation Length (LL), Lactation Milk Yield (LMY) or per year, lactation persistency, and milk composition (Arbel, et al. 2001; Zewudu, et al. 2013).

Milk production is affected by genetic and environmental factors. Among the environmental factors, the quantity and quality of available feed resources are the major ones. Profitability of a dairy enterprise depends on obtaining as high level of milk production as possible with available feeds, relative to the maintenance cost of the animals. According to Dessalegn, et al., said that poor management of dairy cattle was the most probable factors affected the standard expected of milk production performance of cross breed cattle. Efficient heat detection and timely insemination, better health management, genetic improvement of crossbreeding, supplementing of good quality feed resources are required for optimal milk production performance (Kefale, 2018; Haile, et al., 2009; Melku, 2016; Tadesse B, 2014).

RESULTS AND DISCUSSION

Lactation Milk Yield (LMY)

Most genetic improvement programs of developing countries have focused on improving production performance of dairy cattle particularly; increasing production of milk yield is the ultimate goal of dairy sectors (Table 1) (Million, et al., 2003; Sena, et al., 2014; Gebregziabher, et al., 2014).

Table 1: Lactation milk yield of crossbred dairy cows with different genetic group in Ethiopia.

No.	breed/genotype	LMY (L)	Study sites	Source
1	50% F1 Friesian	2203.23 ± 38.13	On station	Kefale, 2018
2	50% F2 Friesian	1697.09 ± 71.82	On station	Kefale, 2018
3	50% F3 Friesian	1522.67 ± 90.07	On station	Kefale, 2018
4	50% HF	2019 ± 26	On station	Haile et al., 2009a
5	50% HF × Local	631.69 ± 222.98	On farm	Melku, 2016
6	50% HF × Barca	2316 ± 98	On station	Million and Tadelle 2003
7	50% F1 Friesian	2369.95 ± 26.04	On station	Tadesse, 2014
8	50% F2 Friesian	1681.24 ± 47.66	On station	Tadesse, 2014
9	50% F3 Friesian	1542.38 ± 59.57	On station	Tadesse, 2014
10	50% HF × Borena	2088±118	On station	Million and Tadelle 2003
11	50% HF × Borena	2031 ± 20.9	On station	Gebregziabher et al., 2013
12	50% HF × Borena (F1)	2355 ± 71	On station	Demeke et al., 2004
13	50% HF × Borena (F2)	1928 ± 108	On station	Demeke et al., 2004
14	50% HF × Horro	1836 ± 31.6	On station	Gebregziabher et al., 2013
15	50% Jersey × Borena	1788 ± 26.5	On station	Gebregziabher et al., 2013
16	50% Jersey × Borena (F1)	2092 ± 75	On station	Demeke et al., 2004

17	50% Jersey × Borena (F2)	1613 ± 107	On station	Demeke et al., 2004
18	50% Jersey × Horro	1621 ± 33.1	On station	Gebregziabher et al., 2013
19	75% F1 Friesian	2957.46 ± 72.98	On station	Kefale, 2018
20	75% F2 Friesian	2027.16 ± 152.15	On station	Kefale, 2018
21	75% Friesian	2480.4 ± 7	On station	Kefena et al., 2006
22	75% HF	2182 ± 4	On station	Haile et al., 2009a
23	75% HF × Local	762.71 ± 147.42	On farm	Melku, 2016
24	75% HF × Barca	2373 ± 105	On station	Million and Tadelle 2003
25	75% Jersey	1673.94 ± 4	On station	Kefena et al., 2006
26	75% HF × Borena	2336 ± 96	On station	Million and Tadelle 2003
27	75% HF × Borena	2528 ± 141	On station	Demeke et al., 2004
28	75%HF × Borena	2240 ± 35.9	On station	Gebregziabher et al., 2013
29	75% HF × Borena	2292.36 ± 102.55	On station	Tadesse, 2014
30	75% HF × Horro	2184 ± 72.8	On station	Gebregziabher et al., 2013
31	75% Jersey × Borena	1956 ± 133	On station	Demeke et al., 2004
32	75% Jersey × Borena	1832 ± 56.0	On station	Gebregziabher et al., 2013
33	75% Jersey × Horro	1724 ± 73.9	On station	Gebregziabher et al., 2013
34	87.5% HF × Barca	2189 ± 183	On station	Million and Tadelle 2003
35	87.5% HF × Borena	1915 ± 163	On station	Million and Tadelle 2003
36	F1 Friesian	1908.06 ± 11	On station	Kefena et al., 2006
37	F1 Jersey	1725.46 ± 7	On station	Kefena et al., 2006
38	F2 Friesian	1622 ± 5	On station	Kefena et al., 2006
39	F2 Jersey	1380 ± 5	On station	Kefena et al., 2006
40	Friesian × Borena	1907.6 ± 15.1	On station	Gebregziabher et al., 2014
41	Holistian × fogera	2705.43	On farm	Sena et al., 2014

42	Jersey × Borena	1684.1 ± 17.6	On station	Gebregziabher et al., 2014
43	Jersey × GH	2364.70 ± 85.06	On farm	Wondossen et al., 2018
44	Jersey × Horro	1293.01 ± 23.70	On station	Sisay, 2015
45	Zebu × HF	2042.11	On farm	Belay et al.,2012

Note: LMY: Lactation Milk Yield; HF: Holstein Friesian; F1: 1st filial generation; F2: 2nd filial generation; F3: 3rd filial generation; Fg: 1st generation for 75% crosses; Sg: 2nd generation for 75% crosses.

Lactation Length

Lactation length refers to the time of period from when a cow starts to secrete milk after parturition to the time of drying off (Table 2). A lactation period of 305 days is recommended to take advantage of 60 days dry period (Gebregziabher, et al., 2013; Demeke, et al., 2004; Wondossen, et al., 2018).

Table 2: Lactation length of crossbred dairy cows with different genetic group in Ethiopia.

No.	Breed/genotype	LL (days)	Study sites	Source
1	50% F1 Friesian	343.62 ± 3.56	On station	Kefale, 2018
2	50% F2 Friesian	319.42 ± 6.68	On station	Kefale, 2018
3	50% F3 Friesian	319.25 ± 8.37	On station	Kefale, 2018
4	50% HF	337 ± 3	On station	Haile et al., 2009a
5	50% HF × Local	310.91 ± 41.83	On farm	Melku, 2016
6	50% HF × Barca	326 ± 11	On station	Million and Tadelle 2003
7	50% F1 Friesian	332.54 ± 2.82	On station	Tadesse, 2014
8	50% F2 Friesian	298.68 ± 5.17	On station	Tadesse, 2014
9	50% F3 Friesian	299.90 ± 6.46	On station	Tadesse, 2014
10	50% HF × Borena	328 ± 13	On station	Million and Tadelle 2003
11	50% HF × Borena	337.2 ± 3.6	On station	Gebregziabher et al., 2013
12	50% HF × Borena (F1)	348 ± 6	On station	Demeke et al., 2004
13	50% HF × Borena (F2)	308 ± 9	On station	Demeke et al., 2004
14	50% HF × Horro	321.0 ± 5.5	On station	Gebregziabher et al., 2013
15	50% Jersey × Borena	315.3 ± 0.6	On station	Gebregziabher et al., 2013
16	50% Jersey × Borena (F1)	343 ± 6	On station	Demeke et al., 2004

17	50% Jersey × Borena (F2)	304 ± 9	On station	Demeke et al., 2004
18	50% Jersey × Horro	303.8 ± 5.8	On station	Gebregziabher et al., 2013
19	75% F1 Friesian	374.05 ± 7.24	On station	Kefale, 2018
20	75% F2 Friesian	303.12 ± 15.73	On station	Kefale, 2018
21	75% Friesian	356.43 ± 6	On station	Kefena et al., 2006
22	75% HF	351 ± 6	On station	Haile et al., 2009a
23	75% HF × Local	303.42 ± 46.25	On farm	Melku, 2016
24	75% HF × Barca	360 ± 12	On station	Million and Tadelle 2003
25	75% Jersey	341 ± 4	On station	Kefena et al., 2006
26	75% HF × Borena	358 ± 11	On station	Million and Tadelle 2003
27	75% HF × Borena	331 ± 12	On station	Demeke et al., 2004
28	75% HF × Borena	343.2 ± 6.3	On station	Gebregziabher et al., 2013
29	75% HF × Borena	331.02 ± 11.12	On station	Tadesse, 2014
30	75% HF × Horro	360.7 ± 12.7	On station	Gebregziabher et al., 2013
31	75% Jersey × Borena	337 ± 11	On station	Demeke et al., 2004
32	75% Jersey × Borena	302.8 ± 9.8	On station	Gebregziabher et al., 2013
33	75% Jersey × Horro	329.0 ± 12.9	On station	Gebregziabher et al., 2013
34	87.5% HF × Barca	351 ± 22	On station	Million and Tadelle 2003
35	87.5% HF × Borena	341 ± 20	On station	Million and Tadelle 2003
36	93.75% HF	328.3 ± 5.50	On station	Wubshet, 2018
37	F1 Friesian	340.64 ± 10	On station	Kefena et al., 2006
38	F1 Jersey	333.37 ± 7	On station	Kefena et al., 2006
39	F2 Friesian	337 ± 5	On station	Kefena et al., 2006
40	F2 Jersey	330 ± 5	On station	Kefena et al., 2006
41	HF × Fogera	273	On farm	Sena et al., 2014

42	Jersey × GH	270	On farm	Wondossen et al., 2018
43	Zebu × HF	241.65 ± 26.22	On farm	Belay et al., 2012

Note: LL: lactation length; HF: Holstein Friesian; F1: 1st filial generation; F2: 2nd filial generation; F3: 3rd filial generation; Fg: 1st generation for 75% crosses; Sg: 2nd generation for 75% crosses.

Daily Milk Yield (DMY)

Systematic incline or decline in daily milk yield can be used as a tool for early warning for management decisions and predicting production capacity of cows (Table 3) (Sisay, 2015; Belay, et al., 2012; Kefena, et al., 2006; Wubshet, 2018).

Table 3: Daily milk yield of crossbred dairy cows with different genetic group in Ethiopia.

No.	Breed/ genotype	DMY (L)	Study sites	Source
1	50% F1 Friesian	6.69 ± 0.08	On station	Kefale, 2018
2	50% F2 Friesian	5.66 ± 0.16	On station	Kefale, 2018
3	50% F3 Friesian	5.02 ± 0.19	On station	Kefale, 2018
4	50% HF	6.0 ± 0.1	On station	Haile et al., 2009a
5	50% HF × Local	7.34 ± 2.61	On farm	Melku, 2016
6	50% HF × Barca	7.21 ± 0.26	On station	Million and Tadelle 2003
7	50% F1 Friesian	7.14 ± 0.06	On station	Tadesse, 2014
8	50% F2 Friesian	5.70 ± 0.12	On station	Tadesse, 2014
9	50% F3 Friesian	5.05 ± 0.15	On station	Tadesse, 2014
10	50% HF × Borena	6.36 ± 0.30	On station	Million and Tadelle 2003
11	50% HF × Borena	6.4 ± 0.06	On station	Gebregziabhere et al., 2013
12	50% HF × Borena (F1)	7.1 ± 0.17	On station	Demeke et al., 2004
13	50% HF × Borena (F2)	5.4 ± 0.24	On station	Demeke et al., 2004
14	50% HF × Horro	5.7 ± 0.10	On station	Gebregziabhere et al., 2013
15	50% Jersey × Borena	5.6 ± 0.08	On station	Gebregziabher et al., 2013
16	50% Jersey × Borena (F1)	6.2 ± 0.17	On station	Demeke et al., 2004
17	50% Jersey × Borena (F2)	4.5 + 0.24	On station	Demeke et al., 2004
18	50% Jersey × Horro	4.9 ± 0.10	On station	Gebregziabher et al., 2013

19	75% F1 Friesian	8.70 ± 0.17	On station	Kefale, 2018
20	75% F2 Friesian	6.72 ± 0.37	On station	Kefale, 2018
21	75% Friesian	6.95 ± 6	On station	Kefena et al., 2006
22	75% HF	6.3 ± 0.1	On station	Haile et al., 2009a
23	75% HF × Local	8.78 ± 1.69	On farm	Melku, 2016
24	75% HF × Barca	7.15 ± 0.28	On station	Million and Tadelle 2003
25	75% Jersey	4.9 ± 4	On station	Kefena et al., 2006
26	75% HF × Borena	6.92 ± 0.25	On station	Million and Tadelle 2003
27	75% HF × Borena	7.2 ± 0.32	On station	Demeke et al., 2004
28	75% HF × Borena	7.0 ± 0.11	On station	Gebregziabhere et al., 2013
29	75% HF × Borena	6.91 ± 0.25	On station	Tadesse, 2014
30	75% HF × Horro	6.8 ± 0.23	On station	Gebregziabhere et al., 2013
31	75% Jersey × Borena	6.1 ± 0.31	On station	Demeke et al., 2004
32	75% Jersey × Borena	5.7 ± 0.17	On station	Gebregziabher et al., 2013
33	75% Jersey × Horro	5.5 ± 0.23	On station	Gebregziabher et al., 2013
34	87.5% HF × Barca	6.28 ± 0.52	On station	Million and Tadelle 2003
35	87.5% HF × Borena	5.98 ± 0.50	On station	Million and Tadelle 2003
36	F1 Friesian	5.6 ± 8	On station	Kefena et al., 2006
37	F1 Jersey	5.17 ± 7	On station	Kefena et al., 2006
38	F2 Friesian	4.81 ± 5	On station	Kefena et al., 2006
39	F2 Jersey	4.18 ± 5	On station	Kefena et al., 2006
40	Friesian × Borena	5.88 ± 0.05	On station	Gebregziabhere et al., 2014
41	HF × Fogera	9.91	On farm	Sena et al., 2014
42	Jersey × Borena	5.21 ± 0.05	On station	Gebregziabher et al., 2014
43	Jersey × GH	7. 30 ± 0.16	On farm	Wondossen et al., 2018

44	Zebu X HF	8.45 ± 1.23	On farm	Belay et al.,2012

Note: DMY: Daily Milk Yield; HF: Holstein Friesian; F1: 1st filial generation; F2: 2nd filial generation; F3: 3rd filial generation; Fg: 1st generation for 75% crosses; Sg: 2nd generation for 75% crosses.

CONCLUSION

Many literature results in Ethiopia agreed, crossbred dairy cows produced better milk yield performances than indigenous breeds because of the advantage of heterosis. However, their milk yield performance had lower than pure exotic parents. Most crossbred dairy cows milk yield trait performances were influenced by year, season, and parity and lactation numbers. In the long term experiment on station condition, 50% F1 crossbred genotypes were relatively performed well and indexed in milk production traits. The second and third generations in all genotypes were poor in both milk yield performances due to heterosis reduction. The 75% of first generations were higher milk producers than all other genotypes. Therefore, 50% F1 and 75% first generation crosses as dairy cows were the best options to the producers under the current dairy production conditions in Ethiopia, as extreme performance differences were not seen as an on-station and on farm evaluated crossbred dairy cows. Regarding milk yield performances, index selection should be applied by including all economic important milk yield traits.

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