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Early Growth and Reproductive Performance of Crossbred Dairy Cattle in Ethiopia: A Review

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ABSTRACT

The economy of livestock production largely depends upon the early growth and reproductive efficiency of the animals. This review was conducted to generate the database about the early growth and reproductive traits of crossbred cattle such as birth weight (BW), age at first service (AFS) and age at first calving (AFC) under Ethiopian conditions. The effort was made to collect and discuss all the published materials in the required areas in order to provide piece of information pertaining to early growth and reproductive traits of crossbred dairy cattle. In order to achieve the best early growth and reproductive performance in dairy animals, it is concluded that management system improvement, including effective heat detection and timely insemination, better health management, genetic improvement of crossbreeding and supplementation of good quality and quantity feed resources, is necessary.

Key words: Early, Growth traits, Reproductive trait.

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 44% males and 56% females and the proportion of indigenous breed is 97.4% hybrid and exotic breeds are about 2.3% and 0.31%, respectively (CSA, 2020/2021). The dairy industry in Ethiopia is still not well developed compared to east African countries like Kenya, Tanzania and Uganda (Hunduma, 2013).

Cattle's total productivity and adaptation efficiency are heavily reliant on their reproductive success in a particular environment. Reproduction is an indication of reproductive efficiency and the pace of genetic advancement in both selection and crossbreeding programs, notably in dairy production systems.

Reproductive characteristics are critical variables in dairy production profitability (Fikre *et al*., 2007). Female reproductive performance is one of the most significant factors in cattle production. AFS and AFC can be used to evaluate reproductive performance. According to Tadesse (2014), a cow's reproductive efficacy impacts its lifetime production. The first calving signifies the beginning of a cow's productive life and is directly tied to generation interval. Therefore, the objective of this review was focused on reviewing and generating compiled information on early growth and reproductive performance of crossbred dairy cattle in Ethiopia.

Growth performance of crossbred dairy cattle

Birth weight

The birth weight performance of crossbred dairy cattle was evaluated by researchers under different agroclimatic conditions as well as managemental systems. The birth weight reported weights Jersey (J) × Horro (HO) at BARC (Bako Agricultural Research center) and Holstein Friesian (HF) × Fogera (FO) crossbred cattle at ALRC (Andassa Livestock Research Center), 19.1 kg and 23.5 kg (Habtamu Abera *et al*., 2012; Addisu Bitew *et al*., 2010), respectively. It is also assessed with different genotypes utilising data obtained from ranch and research centre since evaluating performance on farm data is challenging due to a lack of record keeping and unknown blood level/genotype of handled/reared animals.

The research conducted at Metekel Cattle Breeding Improvement Ranch for 50, 75 and 87.5% HF × Fogera was 24.58±0.10, 26.56±0.26 and 26.45±0.73 kg, respectively (Belay Zeleke, 2014). Based on the reports on Aynalem Haile *et al*. (2011) the performance of birth weight for 50, 62.5, 75, 87.5% HF × Boran crossbred were 26±0.15, 29.2±0.36, 31.1±0.28 and 31.4±0.27 kg, respectively. In both Boran and Fogera crosses, the performance of the herd increase as blood level increases. The birth weight performances of different crossbred dairy cattle are presented in Table 1.

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Table 1: Birth weight for crossbred dairy cattle with different genetic group in Ethiopia.

No	Breed genotype	BW (Kg)	Study sites	Source
1	50% HF × BO	24.36±0.14	Abernosa ranch	Ababu *et al.*, 2006
2	50% HF × FO	24.58±0.10	MCBIR /on-station	Belay, 2014
3	50% HF × A	21.5±0.5	ALF/on-station	Abdinasir and Eskil, 2001
4	50% HF × Ba (F1)	25.5±0.4	On-station	Sendros *et al.*, 2003
5	50% HF × Ba(F2)	28.2±0.6	On-station	Sendros *et al.*, 2003
6	50% HF × BO	28.2±0.65	HARC/on-station	Gizachew *et al.*, 2003
7	50% HF × BO	26±0.15	On-station	Aynalem *et al.*, 2011
8	50% HF × BO(F1)	25.7±0.3	On-station	Sendros *et al.*, 2003
9	50% HF × BO(F2)	27.9±0.4	On-station	Sendros *et al.*, 2003
10	50% HF × BO/F1	25.38±0.26	HARC/on-station	Berhanu, 2008
11	50% HF × BO/F2	27.84±0.25	HARC/on-station	Berhanu, 2008
12	50% HF × BO/F2	27.84±0.25	HARC/on-station	Berhanu, 2008
13	50% HF × HO(F1)	22.9±0.4	On-station	Sendros *et al.*, 2003
14	50% HF × HO(F2)	26.1±0.6	On-station	Sendros *et al.*, 2003
15	50% HF × BO F1	25.08±0.14	On-station	Fikadu, 2020
16	50% HF × BO F2	28.53±0.21	On-station	Fikadu, 2020
17	50% HF × BO F3	26.83±0.29	On-station	Fikadu, 2020
18	50% HF × Z	24.6±0.5	ALF/on-station	Abdinasir and Eskil, 2001
19	50% J × Ba(F1)	21.6±0.5	On-station	Sendros *et al.*, 2003
20	50% J × Ba(F2)	23.3±0.5	On-station	Sendros *et al.*, 2003
21	50% J × BO	23±0.74	HARC/on-station	Gizachew *et al.*, 2003
22	50% J × BO(F1)	21.5±0.3	On-station	Sendros *et al.*, 2003
23	50% J × BO(F2)	22.8±0.4	On-station	Sendros *et al.*, 2003
24	50% J × BO/F1	20.91±0.44	HARC/on-station	Berhanu, 2008
25	50% J × BO/F2	22.07±0.33	HARC/on-station	Berhanu, 2008
26	50% J × HO(F1)	19.9±0.4	On-station	Sendros *et al.*, 2003
27	50% J × HO(F2)	22±0.6	On-station	Sendros *et al.*, 2003
28	50%HF × BO	24.83±2.33	HARC/on-station	Yohannes, 2017
29	62.5% HF × BO	28.9±0.7	On-station	Sendros *et al.*, 2003
30	62.5% HF × BO	28.6±0.94	HARC/on-station	Gizachew *al.*, 2003
31	62.5% HF × BO	29.2±0.36	On-station	Aynalem *et al.*, 2011
32	62.5% J × BO	21.9±0.9	On-station	Sendros *et al.*, 2003
33	62.5% J × BO	20.7±1.13	HARC/on-station	Gizachew *et al.*, 2003
34	75% HF × Ba(F1)	29.3±0.6	On-station	Sendros *et al.*, 2003
35	75% HF × BO	31.1±0.28	On-station	Aynalem *et al.*, 2011
36	75% HF × BO(F1)	29.7±0.4	On-station	Sendros *et al.*, 2003
37	75% HF × BO(F2)	28.6±1.2	On-station	Sendros *et al.*, 2003
38	75% HF × BO F2	31.31±0.33	On-station	Fikadu, 2020
39	75% HF × FO	26.56±0.26	MCBIR /on-station	Belay, 2014
40	75% HF × HO(F1)	28.4±0.5	On-station	Sendros *et al.*, 2003
41	75% HF × Z	25.7±0.8	ALF/on-station	Abdinasir and Eskil, 2001
42	75% J × Ba(F1)	21.3±0.6	On-station	Sendros *et al.*, 2003
43	75% J × BO	22.13±0.37	HARC/on-station	Berhanu, 2008
44	75% J × BO(F1)	21.1±0.5	On-station	Sendros *et al.*, 2003
45	75% J × HO(F1)	21±0.5	On-station	Sendros *et al.*, 2003
46	75%HF × A	24.6±0.6	ALF/on-station	Abdinasir and Eskil, 2001
47	75%HF × BO	31.74±0.29	HARC/on-station	Berhanu, 2008
48	87.5% HF × BO	31.4±0.27	On-station	Aynalem *et al.*, 2011
49	87.5% HF × FO	26.45±0.73	MCBIR /on-station	Belay, 2014

Table 1: Continue...

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50	HF × FO	24.92±0.37	MCBIR	Addisu and Hegede, 2003
51	HF × FO	23.5	ALRC /on-station	Addisu *et al.,* 2010
52	HF × HO	22.13±0.14	BARC/on-station	Habtamu *et al.*, 2012
53	J × HO	19.1±0.19	BARC/on-station	Habtamu *et al.*, 2012
54	J × HO	18.2±2.03	On-farm &on-station	Demissu, 2013

BW, Birth weigh; ALRC, Andassa Livestock Research Center; BARC, Bako Agricultural Research center; HARC, Holetta Agricultural Research center; MCBIR, Metekele cattle breeding and improvement Center; ALF, Assela Livestock Farm; Kg, Kilo gram; HF, Holstein Friesian; HF×BO, Holstein Friesian cross with Boran; HF×Ba, Holstein Friesian cross with Barka; HF×HO, Holstein Friesian cross with Horro; J×BO; Jersey cross with Boran; J×HO, Jersey cross with Horro; JxBa; Jersey cross with Barka; HO, Horro; BO, Boran; Ba, Barka; F1, First Generation Crossbred; F2, Second Generation Crossbred.

Table 2: Age at first service of crossbred dairy cows with different genetic group in Ethiopia.

Breed/genotype	AFS (months)	Study sites	Source
50% F1 Friesian	27.0±0.45	On station	Getahun *et al.*, 2019
50% F2 Friesian	34.8±0. 82	On station	Getahun *et al.*, 2019
50% F3 Friesian	33.0±1.02	On station	Getahun *et al.*, 2019
50% HF	27±0.7	On station	Haile *et al.*, 2009
50% HF × Local	28.80±5.48	On farm	Melku, 2016
75% F1 Friesian	31.3±0.81	On station	Getahun *et al.*, 2019
75% F2 Friesian	30.2±1.58	On station	Getahun *et al.*, 2019
75% HF	28±0.9	On station	Haile *et al.*, 2009
75% HF × Local	25.20±4.88	On farm	Melku, 2016
87.5% HF	28±1.2	On station	Haile *et al.*, 2009
93.75% HF	30.5±0.60	On station	Wubshet, 2018
HF × Borena	30.47±0.85	On station	Wassie *et al.*, 2015
HF × Borena	31.33±0.44	On station	Mengistu *et al.*, 2016
HF × Fogera	36.8±0.8	On station	Gebeyehu *et al.*, 2005
HF × Fogera	18.96	On farm	Sena *et al.*, 2014
HF × Arsi	33.62±0.71	On station	Wassie *et al.*, 2015
HF × Borena	40.9±0.33	On station	Berhanu *et al.*, 2011
HF × Borena	26.4±0.8	On station	Yohannes *et al.*, 2017
Horro-Jersey F1	33.3±10.90	On farm	Hunduma, 2013
Jersey × Horro	31.32±1.0	On station	Sisay, 2015

Reproductive performance traits

The lifetime productivity of a cow is influenced by its reproductive performance traits. Dessalegn *et al*. (2016) summarized that poor management of dairy cattle was the most probable factor adversely affecting the reproductive 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 reproduction performance.

Age at first service (AFS)

Age at first service (AFS) is the age at which heifers attain optimum body condition and sexual maturity for accepting service for the first time. The higher age at first service resulted from the low level of management and poor feeding of calves and heifers at the earlier stages, which consequently had reduced growth rate and delayed puberty (Dessalegn *et al*., 2016) (Table 2).

Age at first calving (AFC)

Age at first calving is the age at which heifers calve for the first time. First calving also marks the beginning of

Table 3: Age at first calving of crossbred dairy cows with different genetic group in Ethiopia.

Breed/genotype	AFC (months)	Study sites	Source
50% F1 Friesian	37.0±0.47	On station	Getahun *et al*, 2019
50% F2 Friesian	44.6±0.87	On station	Getahun *et al*, 2019
50% F3 Friesian	44.5±1.08	On station	Getahun *et al*, 2019
50% HF	39±0.6	On station	Haile *et al*., 2009
50% HF × Local	39.72±6.04	On farm	Melku, 2016
50% F1 Friesian	39.61	On station	Tadesse, 2014
50% F2 Friesian	46.25	On station	Tadesse, 2014
50% F3 Friesian	47.23	On station	Tadesse, 2014
50% Friesian × Arsi (F1)	29.2±1.4	On station	Negussie *et al*. 1998
50% HF × local (F1)	43.77±4.2	On station	Million *et al*., 2006
50% HF × local (F2)	35.91±1.3	On station	Million *et al*., 2006
50% HF × local (F3)	41.91±1.8	On station	Million *et al*., 2006
50% Jersey × Arsi (F1)	28.5±1.3	On station	Negussie *et al*. 1998
50% Jersey × Borena (F1)	46.91±3.8	On station	Million *et al*., 2006
50% Jersey × Borena (F2)	34.25±4.6	On station	Million *et al.*, 2006
50% Jersey × local (F1)	45.32±2.7	On station	Million *et al*., 2006
75% F1 Friesian	42.4±0.85	On station	Getahun *et al*, 2019
75% F2 Friesian	39.9±1.66	On station	Getahun *et al*, 2019
75% Friesian	41.29±9	On station	Kefena *et al*., 2006
75% HF	40±0.9	On station	Haile *et al*., 2009
75% HF × Local	36.36±4.56	On farm	Melku, 2016
75% Jersey	42.52±5	On station	Kefena *et al*., 2006
75% HF × Borena	46.46	On station	Tadesse, 2014
75% HF × local (F1)	45.60±2.6	On station	Million *et al*., 2006
75% HF × local (F2)	40.77±1.2	On station	Million *et al*., 2006
87.5% HF	39±1.3	On station	Haile *et al*., 2009
93.75% HF	39.76±0.67	On station	Wubsh *et al*., 2018
F1 Friesian	42.35±9	On station	Kefena *et al*., 2006
F1 Jersey	39.50±8	On station	Kefena *et al*., 2006
F2 Friesian	48.56±5	On station	Kefena *et al*., 2006
F2 Jersey	44.07±5	On station	Kefena *et al*., 2006
HF × Arsi	42.84±0.84	On station	Wassie *et al*., 2015
HF × Borena	39.49±0.83	On station	Wassie *et al*., 2015
HF × Borena	41.08±0.44	On station	Mengistu *et al*., 2016
HF × Fogera	29.52	On farm	Sena *et al*., 2014
HF × Local	38.8±0.5	On station	Negussie *et al*. 1999
HF × (Jersey × Arsi)	35.2±0.9	On station	Negussie *et al*. 1999
Jersey × GH	48.57±1.89	On farm	Wondossen *et al*., 2018
Jersey × Horro	42.2±11.45	On farm	Hunduma, 2013
Jersey × Horro	42.02±1.1	On station	Sisay, 2015

a cow's productive life. Age at first calving is closely related to generation interval and, therefore, influences response to selection (Abdel Rahman and Alemam, 2008) (Table 3).

CONCLUSION

It is concluded that by improving the management system such as efficient heat detection and timely insemination, better health management, genetic improvement of crossbreeding and supplementing of good quality and quantity of feed resources are required for optimal early growth and reproductive performance. It is possible to improve the growth and reproductive performances of the crossbred dairy cattle in the country. On station and on farm production system should developed and implement complete records including identity, performance, health care and production recording schemes. Selection and culling criteria should be defined on the bases of growth and reproductive performance of cows.

Conflict of interest

The authors declare that no conflict of interest concerning the research review or authorship of this research review article.

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