

Full Length Research Paper

Study of productive and reproductive performance of cross breed dairy cattle under smallholders management system in Bishoftu and Akaki Towns

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Accepted 07 October, 2015

The objective of this study was to assess the productive and reproductive performance of cross breed dairy cattle under smallholder farmers' level in Bishoftu and Akaki districts. The districts were purposively selected based on their potentiality of cross breeds dairy cattle population. A cross-sectional survey and structured questionnaire were used to collect data from 130 households. The data were analyzed using the Statistical Package for the Social Sciences to study the magnitude and direction of variation in months age at first services (AFS), age at first calving (AFC), calving interval (CI), lactation milk yield (LMY) and lactation length (LL) due to management factors. Calving interval (CI) was only significantly ($p < 0.001$) different between the woredas. The mean of AFS, AFC, CI, DMY, TLMY and LL were estimated to be (18.7±3.7 and 18.7±3.5 months), (26.9±5.4 and 27.0±3.7 months), (13.0±2.1 and 13.8±1.9 months), (11.6±3.1 and 10.8±2.4 liters per day/cows), (3208.56±108.81 and 3031.56±46.32 litres) and (276.6±35.1 and 280.7±19.3 days), respectively in Bishoftu and Akaki Towns. Poor management was the most probable factors affected the standard expected of reproductive and production performance of cross breed cattle in the study areas. Efficient heat detection and timely insemination, better health management, genetic improvement of crossbreeding, supplementing of good quality feed resources are required for optimal reproduction and production performance.

Key words: Cross breed, dairy cattle, productive, reproductive.

INTRODUCTION

Livestock production plays important role to human health and poverty alleviation in Ethiopia. The cattle production gives multi-purpose role where cattle provide milk, meat, fertilizer, fuel, draft power and also as a means of economic uplift from the sale of milk and milk products. The sector contributes 15 to 17% of gross domestic product (GDP) and 35 to 49% of agricultural GDP and 37 to 87% of the household incomes (Behnke and Metaferia, 2011).

Ethiopia has the largest livestock production in Africa; CSA (2014) stated that the total cattle population of the country in 2013 was estimated to be about 55.03 million. Out of this total cattle population, the female cattle constitute about 55.38% and the remaining 44.62% were male cattle, from this 6,675,466 and 10,731,656 were dairy and milking cows, respectively. The large cattle population; the favorable climate for improved, high yielding cattle breeds; and the relatively animal disease free environment make Ethiopia to hold a substantial potential for dairy development (Zelalem, 2012). Despite its potential for dairy development, productivity of cross

breed dairy cattle in general is low and the direct contribution it makes to the national economy is limited.

Like most developing countries, Ethiopia's increasing human population, urbanization trends and rising household incomes are leading to a substantial increase in the demand for livestock products, particularly milk and meat. In order to meet the growing demand for milk in Ethiopia, milk production has to grow at least at a rate of 4 percent per annum (Azage et al., 2001). Ethiopia has given the priority on the development of dairying at farmer's level to increase the supply of milk from smallholder dairy farms. Reproductive performance is one of the major factors, other than milk production, that affects productivity of a dairy herd. Reproductive performance is a biologically crucial phenomenon, which determines the efficiency of animal production. The production of milk and replacement stock is not possible unless the cow reproduces. The reproductive and production performance of the herd or animal is a key indicator of sustainability of a dairy farming system. The important parameters that determine cattle reproductive and productive efficiency are age at first service, age at first calving, birth weight, total milk yield, average milk yield per day, calving to first service interval and calving interval (Dematawawa and Beger 1998).

Currently, a large number of smallholder dairy farms are operating in the study areas. However, information on productive and reproductive performance of cross breed dairy cows in the study area was limited. Most of the research conducted for cross breed dairy cows has been under controlled conditions at research centers and government-owned institutions and thus has limited application to different production systems in Africa (Matthewman 1993). Moreover, the area is well communicated and the farmers are responsive make the research suitable in the study areas. The present study was therefore undertaken to investigate the productive and reproductive performances of crossbreed dairy cattle in Bishoftu and Akaki under smallholder management system.

MATERIALS AND METHODS

Study areas

The study was conducted in smallholder dairy farms found in Bishoftu and Akaki Towns. Bishoftu is located in 45 km along South East of Addis Ababa. The area is located at 9°N latitude and 40°E longitude at altitude of 1850 masl with annual rain fall of 866 mm of which 84% is in the long rainy season June to September (NMSA 2010). The annual average temperature ranges from 12.3oC to 27.7oC with an overall average of 18.7oC. The soil and climate are similar to those in many highland areas in Ethiopia. It is an important town where most governmental institutions, national and international

research centers are located. Cattle, small ruminant, poultry and equines are the major livestock species kept with fast growing smallholder dairy production (IPMS 2005).

Akaki district is located 25km away from Addis Ababa at 9°-10°24' North latitude and 37°56'-40° 35' East longitude with an altitude range of 1500-3100 meter above sea level. Its annual temperature ranges from 15°C-27°C. The mean annual rainfall of the district is 800-900 mm and the short rain occurs during February, March and April and the long rain extends from June up to August (Unpublished data of 2010/11). The report also shows that all of the domestic animals raised in the District, cattle population takes the first rank with 91,040, followed by 39,055 goats, 39,048 sheep, 22,676 donkeys, 6,136 horses, and 2,015 mules.

Method of data collection and sources

Sampling method

Bishoftu and Akaki were selected based on their crossbred dairy cattle population, ease of access, feeds and feeding systems and other characteristics of herd management. Smallholder farmers were selected from the list using a stratified random sampling procedure based on the information of city agricultural desk. Sample size was determined using the formula given by Arsham (2007) for survey studies:

$$N=0.25/SE^2$$

Where, N = sample size

SE= Standard error of the population.

Accordingly, a total of 156 smallholder farmers were selected at 4% standard error by random sampling method.

Questionnaires survey method

Structured questionnaire was prepared and used to collect information from crossbred dairy cow owners under smallholder condition in one visit interview and reproductive performance of their crossbred dairy cows were studied. The questionnaires were checked for clarity of the questions prior the interview. Prior the interview, respondents were briefed to the objective of the study. Following that, the actual questions and questionnaires were presented. Accordingly, information about the reproductive and production performance of cross breed dairy cattle >50% blood levels (age at first calving, age at first service, calving interval and calf crops, daily milk yield, total lactation yield, lactation length, and dry period) were collected.

Data analysis

The data were entered and organized in the excel spread sheet and then they were analyzed using descriptive

statistics (SPSS, version 20). Descriptive statistics was used to display the result such as mean and standard deviation. ANOVA comparison was performed using significance level at ($p < 0.05$)

RESULT AND DISCUSSION

Reproductive and production performance of dairy cattle

This section describes the reproductive and production performances of dairy cattle. The performance of the breed in the two districts was compared to assess their suitability in different management practices. Reproductive traits considered were age at first calving, calving interval, calf crops and number of service per conception while the production performance included were daily milk yield, total lactation yield, lactation length, and dry period.

Reproductive performance of dairy cattle

Age at first service

Age at first service (AFS) is the age at which heifers attain body condition and sexual maturity for accepting service for the first time. The respondents reported that the mean (minimum 13 months and maximum 26 months) age at first serviced were 18.7 ± 3.7 and 18.7 ± 3.5 months old for cross breed cattle reared by the farmers in Bishoftu and Akaki, respectively (table 1). There were not significant differences ($p < 0.05$) in age at first services (AFS) of the cross breed in the two woredas. The mean estimated AFS observed in this study was shorter than findings of Belay et al (2012) where the AFS cross breed dairy cows were 24.30 ± 8.01 in Jima Town and 27.5 months of AFS cross breed dairy cows reported by Zewdie (2010) in the highlands and central rift valley of Ethiopia. The largest age recorded in these areas could have 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.

Age at first calving

Age at first calving is the age at which heifers calve for the first time. The means \pm SD (minimum 18 months and maximum 36 months) of age at first calving (AFC) were 26.9 ± 5.4 and 27.0 ± 3.7 months for cross breed cattle in Bishoftu and Akaki, respectively (Table 1). Age at first calving was not different significantly between the two Woredas ($P < 0.05$). In the present study the average age at first calving is lower than AFC of 31.9 ± 0.22 months, which is reported by Yifat et al (2009) for cross breed in Zway. Moreover; the mean result of the age at first

calving in the present study was lower than that of Hunduma (2012) in Assela, Kumar and Tkui (2014) in Mekelle and Nibret (2012) in Gonder who reported 34.8 ± 4 , 36.4 ± 1.7 and 32.4 months, respectively for crossbred cows. The high age at first calving observed here may be related to environmental conditions and husbandry practices which may affect on the cattle growth. These may retard growth rate, delay puberty, reduced fertility and conception, thus, the high age at first calving of the imported breed. Hence, there should be concerted efforts to improve the feeding and nutrient profile of feeds offered to the animals, housing, disease prevention and management especially during harsh climatic conditions in order to improve on age at first calving.

Calving interval

The calving interval is the period between two consecutive parturitions, and ideally should be 12 to 13 months. Calving interval (CI) is one of the major components of reproductive performance that influences livestock production system. The means \pm SD (minimum 12 months and maximum 21 months) for CI were 13.0 ± 2.1 and 13.8 ± 1.9 months for cross breed cattle at Bishoftu and Akaki, respectively. There is a statistically significant ($P < 0.05$) difference in the mean length of calving interval in the two areas. Presented results are in concordance to the previous findings of Hunduma (2012), with 372.8 ± 5.9 days (12.4 months) in Assela own. However, the mean calving interval observed in this study is shorter than 17.8 months who reported by Emebet and Zeleke (2007) in Dire-Dawa and in line with 13.6 months reported by Yifat et al (2009) in Zway for cross breed dairy cows. The high calving interval reported here may be related to poor management practices and other environmental stress that could affect the animals return to oestrus, heat detection, serving and conception at Bishoftu and Akaki Towns.

Production performance of dairy cattle

Lactation yield was not measured in the survey, but based on farmers' knowledge about their production both per cow and per day.

Daily milk yield

The milk productions at different stage of lactation of cross breed dairy cows are presented in Table 1. The mean milk yield was 14.3 ± 5.4 litter, 12.7 ± 2.7 litter, and 7.9 ± 2.5 litters for the first, second and third stage of lactations, respectively with an overall average of 11.6 ± 3.1 litters per day/cows in Bishoftu. The mean milk yield was 14.5 ± 3 litter, 10.6 ± 2.67 litter, and 7.1 ± 2.0 litters for the first, second and third stage of lactations, respectively with an overall average of 10.8 ± 2.4 litters per

Table 1. Reproductive performance of crossbreed dairy cows.

Parameters	Bishoftu			Akaki			P
	Min.	Max.	Mean±SD	Min.	Max.	Mean±SD	
AAS (in months)	12	28	18.7±3.7	14	25	18.7±3.5	0.93
AFC (in months)	18	36	27.0±3.7	18	36	26.9±5.4	0.96
CI (in months)	12	24	13.0±2.1	12	18	13.8±1.9	0.02*

AFS = Age at First Service, AFC = Age at First Calving, CI = Calving Interval, SD = Standard Deviation * = shows significant difference ($p < 0.05$).

Table 2. Productive performance of crossbreed dairy cows.

Production parameters	Under three stage of lactation						P-value
	Bishoftu (Mean±SD)			Akaki (Mean±SD)			
	1 st stage	2 nd stage	3 rd stage	1 st stage	2 nd stage	3 rd stage	
DMY(liter)	14.3±5.4	12.7±2.7 ^b	7.9±2.5	14.5±3	10.6±2.6 ^b	7.1±2.0	-
	11.6±3.1			10.8±2.4			0.06
TMY/L/cow (liter)	3208.56±108.81			3031.56±46.32			-
LL (Days)	276.6±35.1			280.7±19.3			0.41

DMY= Daily milk yield; TMY/L= Total milk yield per lactation; LL= Lactation length; SD= Standard deviation; b = shows statistical significant difference ($p < 0.05$)

day/cows in Akaki. The milk production was significantly decreased in third than first and second stage of lactation. The result of this study is greater than Addis et al (2015) was reported 7.012±2.73, 5.55±2.83 and 3.50±1.64 litters for the 1st, 2nd and 3rd stages of lactation, respectively with an overall average yield of 5.35±1.23 liters per day. However, the result of this study is slightly greater than Adebabay (2009) who reported 10.96, 9.12 and 5.04 litters for first, second and third stages of lactation respectively.

Total lactation milk yield

Table 2 shows that the total mean lactation milk yields (TLMY) of cross breed dairy cow was found to be 3208.56±108.81 liters and 3031.56±46.32 litres, respectively. The mean lactation milk yield found in these study areas, were lower than 3025, 5807.83±78 liter litters reported by Dennis (2010) in Kenya and Naceur et al (2012) in Tunisia, respectively. The lower value obtained here could have been influenced by environment and poor management practices.

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. A lactation period of 305 days is recommended to take advantage of 60 days dry period. The mean±SD

lactation length of cross breed cows in the present study was found to be 276.6±35.1 days, 280.7±19.3 days, respectively (Table 2). The effect of study sites on lactation length was not significant ($P > 0.05$). The estimated lactation length was comparable to the ideal lactation length of 305 days as defined by Foley et al. (1972).

The lactation length of the present study is shorter than with the result of Mulugeta and Belayneh (2013) where the lactation period for crossbred dairy cows were 333.9 days in North Showa and with the findings of Ketema (2014) who reported the average lactation period of cross breed cow was 303 days in Kersa Woreda. Zewdie (2010) reported that the average lactation period of crossbred dairy cows in Debre-Birhan, Jima and Sebeta were 291.0±21.2, 288.5±21.2, and 300.0±21.2 days, respectively. The result is almost similar with the present finding. Level of management achievable in Ethiopia is unfavorable to higher exotic inheritance levels than 50% Holstein Friesian inheritance (Aynalem et al 2009).

CONCLUSION AND RECOMMENDATION

The smallholder dairy productions are important, where they help to safeguard the large difference between milk demand and supply around the towns. It is concluded that the results obtained for AFS, AFC, CI, LL and LMY were below the standard expected from commercial dairy herd. Management differences (Proper feeding, housing,

AI services/breeding, watering and health care) are the major influences to decrease the productive and production performance of cross breed cattle in the study areas. In order to improve the relatively low average daily milk yield, the extended AFC and CI, and the short LL and milk production associated with these, efficient heat detection and timely insemination, better health management, genetic improvement of crossbreeding, supplementing of good quality feed resources are necessary.

ACKNOWLEDGMENTS

The authors are grateful to the Addis Ababa University and the Mizan-Tepi University for financial support and smallholder farmers, development agents and experts of the study sites for their cooperation to undertake the study.

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