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Assessment of Reproductive Performance of Local and Crossbred Dairy Cattle in Sidama Zone, Southern Ethiopia

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Abstract
This study was conducted to assess the reproductive performance of local and crossbred dairy cows and factors affecting their performance in Bensa and Arbegona districts of Sidama zone, Southern Region. A total of 120 dairy owners were randomly selected and interviewed to obtain information on the reproductive performance of dairy cows. The average age at first service for indigenous female and male cattle was (44.1±5.9) and (42.2±4.4) months, respectively. The average age at first calving was 51.9±5.9 months, calving interval was 23.6±4.4 months, number of services per conception was 2.4 and reproductive lifespan of breeding female and male was 11.12±1.5 and 7.52±0.97 years, respectively. The average age at first service for crossbred female and male was 30.3±4.4 and 27.3±3.98 months, respectively. Age at first calving was 39.3±3.25 months, number of services per conception was 1.8 and calving interval was 17.1±4.5 months. The major problems for dairy cattle productively in the study area were shortages of feed, diseases, repeat breeding and poor veterinary service. In conclusion, the present study indicated that the reproductive performance of dairy cow in the study area was low, thus it calls attention to improve management system to improve the reproductive performance of dairy cows.
Keywords: reproduction; dairy cattle; agro ecology, Sidama Zone

Introduction

The reproductive performance of the breeding female is probably the single most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity of dairy cattle (Kiwuwa *et al*., 1983). The author indicated that the size of the calf crop is important for herd replacement and the production of milk depends on heavily on the cow reproductive activity. Livestock productivity in Ethiopia is said to be poor due to a number of reasons among which is the low genetic capacity of the indigenous cattle. Feed shortage, disease prevalence, low level of management, lack of proper breeding management such as lack of accurate heat detection and timely insemination might have contributed considerably to long days open, late age at first calving, long calving interval, short lactation length and low milk production influence on productive and reproductive performance of cattle (Masama *et al.,*2003).

The heritability of reproductive trait is low, so that environmental factors, including management conditions, play a significant role in the variability of the traits (Olori *et al.,* 2002). Reproductive performance traits like age at first service (AFS), Age at first calving, number of services per conception (NSC), days open (DO) and calving interval (CI) are the basis for a profitable dairy farming (Mukasa-Mugerewa, 1989). However, information is limited about the productive performance of dairy cows in smallholder dairy farms in the tropics, particularly in Ethiopia (Lobago *et al*., 2007). Thus, this study was conducted to assess the reproductive performance of indigenous and crossbred dairy cows and thereby to identify factors contributing for poor reproductive performance of indigenous and crossbred dairy cows under smallholder farm condition.

Materials and Methods

Description of the study area

The study was carried out in highland and midland agro-ecologies of Sidama Zone, Southern Nations Nationalities and Peoples' Region (SNNPR). Geographically, Sidama zone is situated between the coordinates of $5^0$45' and $6^0$45' N latitude and $38^0$39' and $38^0$29' E longitude with altitude ranging from 1100 to 3500 masl. Rainfall pattern of the zone is bimodal type with small rainfall during the months of February to April followed by the main rainy season from July to September. Total area coverage of the zone is about 10,000 km^2 and it has a diverse agro ecology classified as 30% *Dega* (highland), 60% *Woinadega* (mid land) and 10% *Kolla* (lowlands).

Sampling procedure

A random probability sampling procedure was employed to select sample *kebeles* and households to generate the data. A total of 120 households that own dairy cattle were randomly selected from the two agro-ecologies. A structured questionnaire were used to collect the required information focused on the reproduction performance parameters such as age at first service, age at first calving, calving interval, reproductive lifespan and major constraints of dairy cattle production and reproduction in the sample area.

Data analysis

Data collected was coded and processed in Microsoft Excel and Statistical Package for Social Science (SPSS). Quantitative data from survey was analyzed using descriptive statistics such as percentage, average, frequency and standard deviation and the qualitative data were assessed using non-parametric tests mainly chi square/$\chi 2$. The variation between groups was considered significant when the P value was less than 0.05.

Constraints of cattle reproductive performances were ranked using index following Kosgey, (2004). The ranking was expressed as an Index = the sum of (4 times first order + 3 times second order +2 times third order + 1 times fourth order) given for an individual variables divided by the sum of (4 times first order + 3 times second order +2 times third order + 1 times fourth order) for all variables.

Results and Discussion

Based on the primary data collected during the household survey, the result and discussion part of this study gave more emphasis on age at the first service, age at first calving, calving interval, number of service for conception, reproductive lifespan of breeding cows and bulls and major constraints of dairy cattle productivity.

Age at first service

The average ages at fist service (AFS) was not significant different across highland and midland agro-ecologies (Table 1). The overall AFS for native cattle in the present study were longer than-42.1 for Sheko breed, Takele (2005). AFS of native heifers was longer than those of the crossbred cattle in the current study. Similar result was also reported by Gebeyehu *et al.* (2005) 36.8±0.8 and Demissu *et al.* (2013) 33.3±10.9 who reported that AFS of native cattle was longer than those of Holstein Friesian and Jersey heifers reared in Ethiopia. This difference may be due to different feed management and genetic makeup of the animal. The management factor especially nutrition determines pre-pubertal growth rates and reproductive development (Masama *et al* ., 2003). Delay in the attainment of sexual maturity leads to economic loss, due to an additional, non-lactating, unproductive period of the heifer/cow over several months (Mukasa-Mugerwa, 1989). However, the zebu cattle usually have higher AFS when compared to the Taurus cattle of the crossbreds, the trait also varies across the breeds and between animals within a breed. Better managed and well fed heifers grew faster, served earlier and resulted in more milk and calves produced during the lifetime of the animal.

Age at first calving

The present study also indicated that age at first calving (AFC) of native cattle was longer than the finding reported by Kumar (2014) 39.4±1.7 Tigray, Gebriel (1983) 33.8 months in Arsi breed and Mulugeta (2013) 40.9±6.6 months. However, it was comparable with the result of Belay *et al.* (2012) 50.59±6.94 and Menale *et al.* (2011) 50.8± 0.36. On the other hand, AFC of the crossbred as observed in the current study was shorter than finding reported by Demissu (2013) 42.2±11.45 for Jeresy x Horro crossbred and Belay *et al.,* (2012) 36for HF x Zebu cattle at Jimma, south west Ethiopia. The variation in AFC between genotype probably due to genetic difference and farmers tend to provide better management and nutrition to the crossbreds when compared to those of the native cattle. The observations are in line with those of Masama *et al.* (2003) who reported that management and nutrition status of the cows influences their pre-pubertal growth rates and later their productive and reproductive status.

Calving interval (CI)

The calving is a period between two consecutive parturitions and should ideally be in the regions of 12 to 13 months. However, the average calving interval of the current study was found to be 23.6±4.4 and 17.1±4.5 months for local and crossbred cattle, respectively. On the other hand, crossbred cows CI was shorter than local cows (Table 1). This could be due to breed difference and management. Factors contributing for long CI are age of cows, breed of cows, calving season and forage availability in any particular year have to be considered as other impact factors (Yifat *et al*., 2012). The overall average CI in local cattle obtained in the present study was longer than the values from the previous findings (18 months) for Kerryu cattle (Shiferaw, 2014). The average estimated CI of local cattle in the present study is in accordance with 24.94±4 months reported in North Shoa Zone, Amhara Region (Mulugeta, 2013). It is more, profitable to have one calf yearly in cattle. If the calving interval is more, the total number of calving in cow lifetime will be decreased and total life production of milk decrease.

Number of service per conception (NSPC*)*

The results of average NSPC in the native cattle was higher than those of the crossbred in the study area (Table 1). The current result of NSPC of native cattle was higher than that reported by (Demissu *et al.,* 2013; Kumar *et al.,* 2014) 2.1 and 2.2 respectively, but it was lower than the report of Hyleyesus (2006). Similarly, NSPC of the current result of crossbred cattle was higher than the report highlighted by Belay *et al.* (2012) 1.56 and Nibret

(2012) 1.3. The present study was in accordance with the report of Negussie, (1992) who in his report indicated that high numbers of services per conception are correlated with the problems associated with poor semen quality, poor semen handling practices and poor insemination practices. Other factors influencing NSPC can be both due to genetic and management factors viz. season; that is related to availability of feed, placenta expulsion time, lactation length, milk yield and parity (Shiferaw *et al.,* 2003; Gebrekidan *et al.,* 2012).

Reproductive lifespan of breeding female and male

The results in Table 1 indicated that the overall average reproductive lifespan of local cow in the current study was in line with the report of (Jeregna, 2007) 11.23 and (Dejene, 2014) 11.5 years. However, aveage reproductive lifespan of local breeding male was longer than Sheko breeding male (6.5 years) (Mukassa-Mugerwa *etal*., 1991), But it was lower than Dejene (2014) (8.77) for Borana bull and Jeregna, (2007) 10.2 years in Danno district. According Mukasa-Mugerwa *et al*.(1989) the overall mean of Ethiopian local cow reproductive lifetime was 11 to 13 years. The difference in reproductive lifespan of cattle among the study could be management, breed age at first puberty and calving. The lifetime productivity of a cow is influenced by age at puberty, age at first calving and calving interval (Ensminger, 1969), genetic makeup and the health status of the cow (Goshu, 2005) and management and feeding standards (Abdulai, 2005).

Table 1 Reproductive and productive performance of dairy cattle

parameters	Cattle type	Agro-ecologies		
		Highland	Midland	**Total**
AFS (Months)	Local	$43.9\pm5.2A^{a}$	$44.2\pm6.3A^{a}$	44.1±5.9
	Crossbred	29.14 ± 4.4^{Bb}	30.9 ± 4.4^{Bb}	30.3±4.4
AFC (Month)	Local	51.8 ± 4.5^{Aa}	$52.0.\pm6.5^{Aa}$	51.9±5.9
	Crossbred	38.5 ± 2.4^{Bb}	39.7 ± 3.5^{Bb}	39.3±3.2
Calving interval	local	23.8±4.4	24.3±4.5	23.6±4.4
	crossbred	17.2±4.76	18.2±4.84	17.1±4.5
Number of service per conception	local	2.3	2.6	2.4
	crossbred	1.7	2.2	1.8
Reproductive life time of cow	Local	$11.6\pm1.4A^{a}$	$10.8\pm1.5B^{b}$	11.12±1.5
Reproductive life time of bull	Local	7.9±0.94	7.1±0.86	7.52±0.97

Where AFSF= age at first service female, AFSM= age first service male, AFC= age at first calving, $P<0.05^{a, b}$, values across column.

Farmers' awareness on time of insemination

Knowledge of estrus behavior and the estrus to ovulation interval is essential for estimating the best time for artificially inseminate cattle. The result as presented in Table 2 indicates that there is lack of awareness among the respondents regarding the appropriate time of insemination that most of the respondents were unaware of the AM/PM approach of inseminating their cattle. Dairy farmers' prefer to call an inseminator or take the cow to the insemination site early or lately at their possible time. This indices that lack of awareness on time of insemination may be a reason for the poor success of AI in the study area. The mis-timing of AI as observed in the study is the defects of poor extension services rendered to the beneficiaries of such program and lack of awareness related to estrus detection. Accordance with the findings of Nuraddis *et al.,* (2014) increasing numbers of services per conception are the results of problems associated with poor semen quality, poor semen handling practices, discontinuation of incentives to AI technician, season of breeding, management factors in relation to estrus detection, timing of insemination and skill of pregnancy diagnoses and poor insemination practices. A Study conducted by Miah *et al.,* (2004) indicates that improper timing of AI services can lead to reduction in conception rate.

Table 2 Awareness of AI beneficiaries on time of insemination during heat period (n=60)

Time of insemination	Cows and heifers showing heat in the morning (%)	Cows and heifers shown heat in the afternoon (%)
After noon of that day	38.3	48.7
Morning of that day	45.7	-
Morning of the next day	6.7	33.3
After noon of the next day	4.7	9.7
Based on the availability of the AIT	4.6	8.3
Overall	100	100

Distance of Artificial Insemination (AI) source

The result in Table 3 indicates that due to long distance of AI service more farmers were not using AI in the study area. However, respondents living in short distance of AI center have the opportunity to use the AI service.

Long distance happening in many areas and the reason is AI technicians are unable to get transport facilities like motor bicycles. This implies that distance to AI source tend to affect the efficiency of mating. Long distance traveling may impose stress on cows/heifers, resulting in low conception rates. Report from Desta (2002) and Abdinasir (2000) stated that a wide use of AI service in areas with good infrastructure for AI close to cities but very low application far from cities. AI is a time dependent activity, in which during this long journey/waiting time, heat period is passed away before the service have been given (Lemma, 2010). This finding regarding shortage of AI technicians and distance of the AI centers are in line with the findings of Tsegaye *et al.* (2015).

Table 3 AI distance of sample respondents (n=120)

AI distance in Km	User of AI		Non-user of AI		Total	
	No.	%	No.	%	No.	%
0.1 to 2	32	82	7	17.9	39	32.5
2.1 to 4	21	53.8	18	46.1	39	32.5
Above 4	10	23.8	32	76.2	42	35.0

Constraints of dairy cattle productivity

The findings indicate that in both agro-ecologies shortage of feed, repeat breeder, diseases and shortage of veterinary are the major problems affecting livestock productivity (Table 4). The current result revealed that, feed shortage was the primary constraints that hinder cattle productivities in both agro-ecologies. Seid (2014) also indicated that feed shortage was the number one constraints in Burji woreda of SNNPR. In Dandi district of Oromia region the major constraints of livestock production reported were feed shortage, animal health and lack of capital (Belay *et al*., 2012). Age at first calving was reported to be influenced by onset of puberty, which itself is affected by environment, breed type, season and herd effects (Mukassa-Mugerwa, 1989). The result of the focus group discussion highlighted that calving interval affected by the combined effect of feeding disease and breeding management. Similar report also indicated by Tsehay (1999) poor nutrition increases the susceptibility of dairy cows to health problem and physiological stress that results in lower production, much longer calving intervals as well as problems in fertility.

Repeat breeders are those cows that require three or more services to conceive (Casagrande and Goes, 1977; Enkhia *et al.*, 1983). The result in Table 4 indicates that repeat breeding was the second constraints both in highland and midland agro-ecologies of the study area. The cause of repeat breeding in the current study could be by time of insemination, semen quality and quantity, efficiency of AI technician, malnutrition, reproductive tract infections and poor management. Repeat breeder is a substailtial problem in cattle breeding leading to large economic loss for the dairy producer due to more inseminations, increased calving interval and increased culling rates (Dakriuf, 1978). The incidence of repeat breeding, 21.9% in India (Kaikini *et al.,* 1983) and 16.6 to 58.8% in Nigeria (Nuru and Dennis, 1976) had reported. In Ethiopia, Bitew and Prasad (2011) reported that 3% prevalence in local and crossbred cows in western Ethiopia, while Abreham *et al*. (2010) found 6.2% in crossbred dairy cows in central Ethiopia. In Addis Ababa Abattoir Enterprise, 235 female cattle that came for slaughtering, the most prevalent reason of culling, which accounted for 39.1%, were reproductive problems of which 28% were repeat breeding (Gebrekidan *et al.,* 2009).

Disease was the 3nd problems for cattle production and reproduction in study site (Table 4). Disease constraints of the current study was inconsistant with the report of (Yohannes, 2007) and (Shitahun, 2009). But, this result is in line with the report of Seid (2014) animla health problem mentioned as a 3rd constraint. The most significant diseases indicated by respondants in study area were liver flucke (fasciolosis), pasturolosis, mastites, lumpyskin, blackleg, pneumonia, pasteurellosis and tick. Aanimal health constraints of the present study was in line with the report of (Mulugeta , 2013).

The result in Table 4 indicates that veterinary service shortage ranked as fourth problem in both agro-ecologies. Due to the high cost of medicine, few farmers take their animals to the veterinary service. Similarly, Kumare (2014) reported that the high cost for the medicine and low productivity of the animal discourages farmers in Mekele. During focus group discussion farmers reported that the main problem of access to animal health services are long distance to animal health centers, high cost of private medicine and lack of timely availability of veterinary supplies. According to Azage *et al*. (2013), the main problems of access to animal health services in rural areas are distance from animal health centers, lack of skilled animal health technicians, lack of laboratory services, and lack of timely availability of veterinary supplies.

Table 4 Major constraints of dairy cattle productivity

Constraints	Highland (n=60)					Midland(60)				
	1st	2nd	3rd	4th	Index	1st	2nd	3rd	4th	Index
Feed shortage	73.3	26.7	0	0	0.37	50	26.7	15	8.3	0.33
Repeat breeder	26.7	73.3	0	0	0.33	40	50	10	0	0.32
Disease	0	0	88.7	11.3	0.19	10	10	35	45	0.19
Veterinary service shortage	0	0	11.3	88.7	0.11	0	13.3	40	46.7	0.16

Index=the sum of (4 times first order + 3 times second order +2 times third order + 1 times fourth order) for individual variables divided by the sum of (4 times first order + 3 times second order +2 times third order + 1 times fourth order) for all variables.

Summary and Conclusion

Results of the present study revealed that the reproductive performance of local and crossbred cows in highland and midland agro-ecologies found to be low. However, the traits of reproductive performance of this result showed significant difference among local and crossbred cows. Improvement can achieved though appropriate selection of breeds for crossbreeding program based on their performance. From the result, it can be concluded that the cause of poor reproductive performance in dairy cattle are late age at first service, late age at first calving, long calving interval, high number of service per conception, lack of awareness on time of insemination and long distance of AI service. Moreover, feed shortage, repeat breeding, disease and shortage of veterinary service are the major constraints of cattle productivity in the study area. In conclusion, considering dairy animal traits and production constraints are instrumental in improving reproductive performance of dairy animals.

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