



Reproductive Performance of Cross Breed Dairy Cows in Hawassa Town at Farm Level

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Abstract

A study was conducted to assess reproductive performances of 400 crossbred (287 Holstein Friesian x Zebu and 113 jersey crosses) dairy cows kept in medium and large scale dairy production systems. The 28 farms were selected purposively for ease access and with regard of interests of owners. A cross-sectional survey was carried out and data collection questionnaire format was developed and used from December, 2014 to April, 2015 in Hawassa town. The farms were categorized in to strata based on herd size; into small scale, medium scale and large scale production systems holding <5, 6-30 and >30 dairy cattle, respectively. Nevertheless; all data obtained belongs to medium and large scale production systems to achieve the scope of this study. The mean values for reproductive parameters of; age at first service (AFS) was 23.7 ± 0.130 months, age at first calving (AFC) was 33.2 ± 0.13 months, calving to first service interval (CFSI) was 62.7 ± 0.7 days, number of services per conception (NSPC) was 1.61 ± 0.031 , days open (DO) was 92 ± 0.8 , calving intervals (CI) was 381.3 ± 0.94 days and gestation length (GL) was 280.8 ± 0.29 days. Parity status had statistically significant effect ($p < 0.01$) on CFSI, NSPC, DO and CI. While breed had statistically significant effect ($p < 0.05$) on CFSI only. In contrast, production scales had no significant effect ($P > 0.05$) on any of the parameters. It could be concluded from the study that reproductive performances of cross bred dairy cows in Hawassa town at 28 selected farms were good as compared to many reports from different parts of the country. Nevertheless; this does not mean it is necessarily satisfactory as there were obviously herd managerial problems in certain farms. This in turn could have resulted in variations of reproductive parameters in advance, especially those parameters with great associations to the farm management; like age at first service, age at first calving, days open and calving to conception intervals. The ongoing activities to improve and expand reproductive performances of medium and large production scale systems should be encouraged and farms' owners should be well informed about good management of their herds especially on; general farm hygiene, how to follow up estrous detection, feed formulations, timing of insemination and regular vaccination programmes.

Keywords: Crossbred, dairy farm, reproductive parameters, parity status.

1. Introduction

Although the indigenous Zebu cattle are more adapted to the local tropical environment, their capacity for milk production is usually low. On the other hand, *Bos taurus* (European type) is the predominantly specialized dairy breed of the temperate countries. These breeds have high milk yield potentials but lack heat tolerance and disease resistance [1]. One way of improving tropical cattle regarding milk production is through crossbreeding with *Bos taurus* dairy breeds. The F₁ crosses can produce up to three times more milk, and have longer lactation and shorter calving intervals than the local breeds [2].

Even if Ethiopia has a large cattle population, the reproductive performance and the productivity of the indigenous cattle breed are low. And also, dairy industry is not developed as that of other east African countries such as Kenya, Uganda and Tanzania [3]. Cross breeding is an acceptable procedure in order to enhance production of milk and meat, particularly at commercial farms [4,5]. Eventually, mainly crosses of zebu with Holstein-Friesian cattle have been used for milk production for decades [6].

Reproductive performance is often a major determinant of biological and economic efficiency of livestock production in the tropics. Production of milk also depends heavily on it [6]. Among the reproductive traits, age at first service (AFS), age at first calving (AFC), number of services per conception (NSC), days open (DO), calving interval (CI), gestation length (GL), calving rate, non-returning and returning rate of service are the basis for profitable dairy farming [7, 8].

Among the major reproductive problems that have direct impact on reproductive performance of dairy cows are abortion, dystocia, retained fetal membrane (RFM), pyometra, metritis, prolapses (uterine and vaginal), anoestrus and repeat breeder [9, 10]. These results in considerable economic loss to the dairy industry due to slower uterine involution, reduced reproductive rate, prolonged inter-conception and calving interval, negative

effect on fertility, increased cost of medication, drop in milk production, reduced calf crop and early depreciation of potentially useful cows [10].

In dairy industry the reproductive goals that we need to follow are 12 months of calving interval, 85 days open, 1.6 services per conception rate and 85% of cows observed in estrus and recorded by 60 days fresh [11]. Estrous period of receptivity may last for 6-30 hours and occur every 21 days on average. Heat detection is the key to enhance reproductive performance and it is most important problem, which has faced the dairy industry as it is essential for successful application of artificial insemination (AI) or natural service (NS) on dairy animals [12].

It should also be noted that non-genetic factors such as age of dam, sex of the calf, gestation length, parity, and cow weight influenced birth weight in cattle, which is useful in selection criterion for increased production and reproductive efficiency of dairy cattle and they had significant effect on reproductive traits [13].

A number of research works and different results have been obtained on reproductive performances of indigenous and crossbred cows in and around Hawassa town, mostly at house hold and small holders' dairy farm level including urban and peri-urban dairy areas. For this reason; this study of reproductive performances of the crossbred dairy cows focuses on medium and large scale farms to fulfill the gap of information for livestock owners, veterinarians and researchers and provides comparative results with previous works for further development of strategies and enables them easy evaluation of performances to attain better improvement through possible interventions. Therefore, objectives of this study are;

☛ To assess various parameters of reproductive performances of medium and large scale crossbred dairy cattle (HF and jersey crosses with zebu) found in Hawassa town at different selected farms.

☞ To study factors that influence reproductive performances of medium and large scale crossbred dairy cattle found in Hawassa town.

☞ To obtain mean values of reproductive performance traits for the study animals.

2. Materials and Methods

Study area

The study was carried out from December, 2014 to April, 2015 in Hawassa town. Hawassa town, the capital of Sidama zone and SNNPRS, is located about 275 kms south of Addis Ababa. Geographically, it lies between 4°27' and 8°30' N latitude and 34°2' and 39°1' E longitude. It is located at an altitude of 1500-2000 meters above sea level and the area receives a mean annual rainfall of 800-1000 mm with average temperature ranging from 20.1-25°C [14].

Study design

Cross-sectional survey was carried out across the selected farms and data collection questionnaire format was developed and used. The farms were selected purposively for ease access, having crossbred dairy cows and with regard of interests of owners. The farms were categorized in to strata based on herd size into small scale, medium scale and large scale production systems holding <5, 6-30 and >30 dairy cattle, respectively; according to Mureda and Mekuriaw [15]. From 28 selected farms, 400 crossbred dairy cows (287 HF cross and 113 jerseys cross) were selected using simple random technique and proportionally, in this study.

Study animal and data collection

The selected farms were visited once (more than one time in a certain cases to complete some incomplete reproductive performances) and data on individual cow's or heifer's reproductive performance and on general farm management was recorded by interviewing and/ or from

individual record sheet. Nevertheless; all data obtained belongs to medium and large scale production systems to achieve the scope of this study. In both production systems cattle were kept intensively. The data obtained from the reproductive, breeding and management histories of 400 cows was used to asses age at first service (AFS), age at first calving (AFC), calving to first service interval (CFSI), number of services per conception (NSPC), calving to conception interval (CCI), calving interval (CI), calf mortality rate, gestation length and any reproductive health problems/disorders encountered in the farms.

Data processing and analysis procedures

After data collection, all raw data were critically edited, coded and inserted in to Microsoft excel spread sheet of 2010. Descriptive statistics used to summarize the mean values for all mentioned parameters of reproduction with their corresponding standard errors. The effects of breed and production scale on reproductive performance parameters were analyzed using independent t- test, while effects of parity status were analyzed using the ANOVA. In all cases, the SPSS version 16 was used.

3. Results

Here under the tables1, 2, 3, 4, 5, and 6 are; mean values of reproductive traits, effect of production scales on reproductive performance, the effect of parity status on reproductive traits, the effect of breed on reproductive performance, summary of farm managerial parameters and summary on reproductive health problems and calf mortality with their corresponding values, respectively.

Table.1.Mean values of reproductive traits of crossbred dairy cows in Hawassa town, Ethiopia.

Reproductive parameters	Minimum	Maximum	Mean (\pm SE)
AFS, months	18	30	23.7 (.130)
AFC , months	27	39	33.2 (.130)
CFSI, days	40	120	62.7 (.7)
NSPC	1	4	1.61(.03)
DO, days	60	150	91.6 (.8)
CI, days	340	480	381.3 (.9)
GL, days	270	296	280.8 (.3)

Table 2. Effect of production scales on reproductive performance parameters of crossbred dairy

Parameters	Production scale	N	Mean (\pm SE)	p-value
AFS months overall	medium scale	224	23.9(.17)	.487
	large scale	176	23.4(0.2)	
	400	23.7(0.13)		
AFC Months Overall	medium scale	224	33.5(0.17)	.824
	large scale	176	32.97(0.2)	
	400	33.24(0.13)		
CFSI Days Overall	medium scale	224	62.54(0.9)	.830
	large scale	176	62.94(1.02)	
	400	62.71(0.7)		

DO days overall	medium scale	224	92.8(1.03)	.900
	large scale	176	90.20(1.20)	
	400	91.6(0.8)		
CI days overall	medium scale	224	381.83(1.23)	.538
	large scale	176	380.65(1.47)	
	400	381.31(0.94)		
GL days overall	medium scale	224	280.87	.645
	large scale	176	280.61	
	400	280.75		

N=number of observations, AFS (age at first service), AFC (age at first calving), CFSI (calving to first service interval), NSPC (number of services per conception), DO (days open), CI (calving interval), GL (gestation length).

Table 3a. The effect of parity status on reproductive traits of crossbred dairy cows Mean values with their corresponding standard errors in the paranthesis

Parity status	AFS (age at first service)	AFC (age at first calving)	CFSI ** (calving to first interval)	NSPC* * (number of services per conception)	N
1	21.86±0.66	31.55±0.63	65.55±2.34	1.59±0.12	22
2	23.48 ± 0.254	33.11 ± 0.260	65.86 ± 1.23	1.82 ± 0.062	105
3	24.25 ± 0.223	33.76 ± 0.22	67.65 ± 1.170	1.61 ± 0.06	102
4	24.09 ± 0.24	33.69 ± 0.24	63.19 ± 1.14	1.59 ± 0.07	105
5	23.06 ± 0.4	32.49 ± 0.38	49.76 ± 1.31	1.27 ± 0.08	51
6	23.20 ± 0.73	32.47 ± 0.74	43.67 ± 1.79	1.40 ± 0.13	15
Total	23.68 ± 0.13	33.24 ± 0.13	62.71 ± 0.66	1.61 ± 0.03	400

Table.3b. The effect of parity status on reproductive traits of crossbred dairy cows in Hawassa town, Ethiopia

Parity status	DO***	CI***	GL*	N
1	95.45±2.52	388.64±3.04	281.45±1.13	22
2	96.44 ± 1.42	386.32 ± 1.79	282.47 ± 0.59	105
3	96.82 ± 1.28	387.31 ± 1.5	280.25 ± 0.6	102
	91.64 ± 1.34	381.71 ± 1.5	280.59 ± 0.58	105
5	76.67 ± 2	363.41 ± 2.49	278.90 ± 0.67	51
6	68.00 ± 2.43	352.67 ± 4.62	278.53 ± 0.92	15
Total	91.63 ± .78	381.31 ± .94	280.75 ± 0.29	400

*** = p-value less than 0.01, ** = p-value (greater than 0.01 but less than 0.05) * = p-value greater than 0.05 (insignificant), no star symbol= no relation with parity

N=number of observations, AFS (age at first service), AFC (age at first calving), CFSI (calving to first service interval), NSPC (number of services per conception), DO (days open), CI (calving interval), GL (gestation length).

Table. 4. The effect of breed on reproductive performance of crossbred dairy cows in Hawassa town at selected farms, Ethiopia

Parameters	Breed	N	Mean (\pm SE)	p-value
AFS months	HF cross jersey cross	287	23.21 (.15)	.377
		113	24.88 (.24)	
AFC Months	HF cross jersey cross	287	32.76 (.15)	.388
		113	34.46 (.24)	
CFSI Days	HF cross Jersey cross	287	61.61 (.75)	.003
		113	65.50 (1.33)	
NSPC	HF cross Jersey cross	287	1.59 (.036)	.828
		113	1.66 (.061)	
DO, days	HF cross jersey cross	287	90.55 (.91)	.202
		113	94.39 (1.50)	
CI, days	HF cross	287	378.90 (1.09)	.700
	Jersey cross	113	387.43 (1.76)	
GL, days	HF cross jersey cross	287	280.45 (.33)	.121
		113	281.53 (.58)	

Table: 5. Summary on farm managemental parameters of 28 farms and 400 crossbred dairy cows

No.	General management parameters of the farms	Number of farms	Percent	Number of cows included in the study	Percent
1.	Feeds given Roughages and concentrates only Salts added	18	63.3	228	57
		10	36.7	172	43
2.	Attention given To milk production only To milk production and reproduction	19	67.9	232	58
		9	32.1	168	42
3.	Vaccination Regular On disease outbreak only	18	63.3	314	78.5
		10	36.7	86	21.5

specialized dairy production, Habtamu *et al.* [20]; for jersey cows at Wolaita sodo dairy farms, Ethiopia and by Hunduma [7]; on reproductive performance of crossbred dairy cows under small holder conditions in Ethiopia, respectively.

However, the result of this study showed longer period in contrast to reports of 15.4 months forwarded by Nibret [21] on reproductive performances of crossbred dairy cows under small holder conditions in and around Gondar, Ethiopia. This might be due to managerial differences and environmental effects on sexual maturity of the heifers. None of the variables had statistically significant ($p>0.05$) result on age at first service in the findings of this study and has general agreement with findings of Nuraddis *et al.* [22] who reported that production scale had no significant effect on this trait.

However, the insignificant effect of scale of production system on AFC was not in agreement with previous report by Mureda and Mekuria [15], in that significantly longer AFC was reported in cattle managed in the medium scale dairy production system as compared to small and large scales dairy production system. The insignificant effect of scale of production systems on AFC in this might be due to nearly similar managerial operations throughout the farms. Generally, relatively AFC of this study seemed better than many other reports from different observations. This might be due to better farm managerial supervisions by the owners as there is the fact that the dairy sector has got increased business emphasis nowadays.

Age at first calving of this study was about 33.24 months as indicated in table 1, which is shorter from the result of previous studies of 36.2, 36.6 and 37 months reported by Emebet [19]; for crosses of Friesian and Jersey sire breed with Zebu dams in the Arsi region, Belay *et al.* [17] and Demissu [23], on production and reproduction performances of zebu crossed with HF in Jimma town, and on assessment of peri-urban dairy production system and evaluation of quality of cow's raw milk on crossbred dairy cows, Wollega

zone, Ethiopia, respectively. Nevertheless; there is closeness of the result with a previous report of 33.3 and 34 months by Demissu *et al.* [6], and Habtamu *et al.* [20], on reproductive performance of jersey cows at Wolaita sodo dairy farms, southern Ethiopia and for horro-jersey crosses, respectively. And also, Emebet [19], reported mean AFC of 33.8 months with a range of 31.3 to 35.7 months for crosses of Friesian and jersey sire breed with zebu dams in the Arsi region, Ethiopia.

However, the result of this study revealed longer AFC than the result reported by Nibret [21], of 32.4 months for reproductive performances of crossbred dairy cows under small holder conditions in and around Gondar, North western Ethiopia. In contrast to this finding of insignificant effect ($p<0.05$ from table 4) of breed on AFC was reported by Demissu [23]; the mean age at first calving (AFC) for local cows was shorter than for cross breed significantly ($P<0.05$) and Meseret *et al.* [12], reported significant effect of breed on age at first calving with longest AFC for jersey crosses followed by HF crosses and local boran breeds from the study on reproductive performance of crossbred dairy cows in Hawassa city, Ethiopia.

In this study, mean value of calving to first service intervals was about 62.71 days, from table 1. This result was strongly different from the report of 165 days forwarded by Nuraddis *et al.* [22], from assessment of reproductive performance of crossbred dairy cattle (HF x zebu) in

Gondar town. The result of this study is in a general agreement with reports of Mureda and Mekuriaw [15]; indicated that the CFSI and CCI were the longest for the first and beyond 6th parities as compared to 2nd, 3rd and 4th parities. Parity groups had also significant effect ($p<0.05$) on CFSI as summarized under table 3a, in contrast to the above report in which parity groups were insignificant. Anyhow, in terms of production scale, effect on this trait was insignificant ($p>0.05$) holding agreement with the above reports (table 2).

However, the previous report by Demissu *et al.* [6]; on early growth and reproductive performances of horro cattle and their F1 jersey crosses in and around horro production and research center, and Tadesse *et al.* [1]; reported on productive and reproductive performance of Holstein Friesian dairy cows in Ethiopia with mean of CFSI, DO and CI significantly ($p < 0.05$) declined from 1st to 3rd parity. Cows in the first parity had significantly ($P < 0.05$) longest CFSI, DO and CI than others holds similar agreement with this study having highly significant effect ($p < 0.01$) between parity groups as summarized under table 3). The significant effect of parity status on the first service to conception interval could be dependent on the ability to conceive and maintain pregnancy after a given service and the continuation of ovarian cycles and the correct detection of estrus in those cows that do not conceive to initial services.

The mean value of this study for number of services per conception was about 1.61, from table 1. This report revealed higher NSPC than the report of 1.4 and 1.52 by Nibret [21] and Hunduma [7], from studies on crossbred dairy cows under small holders' conditions in and around Gondar, and reproductive performance of crossbred dairy cows under small holder conditions in Ethiopia, respectively. A similar report to this result was 1.6 forwarded by Belay *et al.* [17], from study on zebu with HF crossbred dairy cows in Jimma town, Ethiopia.

However, this study showed lower NSPC than that of 1.8, reported by Habtamu *et al.* [20], from study on reproductive performance of jersey cows at Wolaita sodo dairy farms, Ethiopia. As summarized under table 3a, the result is in agreement with the result of Yifat *et al.* [24] and Goshu *et al.* [25] who found significant effect ($P < 0.05$) of parity on NSPC for Friesian cows in Ethiopia. Additionally, Melaku *et al.* [26]; on pre-weaning performance of fogera calves and Almaz (2012); on genetic parameter estimation of growth and reproduction traits of fogera cattle at Metekel ranch, found significance of parity on number of services per conception. This significance of parity might be due the capacity of mature enough

cows to have well performing reproductive organs and hence would require lower number of services per conception.

Besides the significant effect of cow's parity; proper and accurate heat detection may be indispensable to determine the onset of true standing and gives a better clue on when to inseminate. Here is the fact that, cows usually seeks out the male and 'stands' for him to mate her. The uterine, cervical and vaginal glands secrete increased amounts of mucus; the vaginal epithelium and endometrium become hyperaemic and congested; the cervix is relaxed. Ovulation occurs during this phase of the cycle in all domestic species with the exception of the cow, where it occurs about 12 hours after the end of estrus. Ovulation is also a spontaneous process in all domestic species with the exception of the cat, rabbit and camel, in which it is induced by the act of coitus [28]. Based on the above facts, it could be possible to early observe and detect whether the animal is on heat or not. However, there may be one challenging problem among the dairy cattle in which some cows could be in silent heat (silent ovulation) with showing no considerable behavioral changes.

Days open is influenced by the length of time for the uterus to completely involute, resumption of normal ovarian cycle, occurrence of silent ovulation, accuracy of heat detection, management, semen quality and skill of inseminator or efficiency of bull [26, 29]. The mean value of days open for this study was around 91.6 days as indicated under table 1, which is greater than that of 87 and 86 days reported by Nibret [21] and Hunduma [7], from their studies on crossbred dairy cows under small holders' conditions in and around Gondar and in Ethiopia, respectively.

Reasonably, it is closely similar to the mean value of 93 days reported by Sena *et al.* [5], on study of productive and reproductive performances of crossbred dairy cows in Debretabor town, Ethiopia. However, this result is shorter than that of 156 and 340 days reported by Belay *et al.* [17];

from study on zebu with HF crossbred dairy cows in Jimma town, and Yifat *et al.* [30], on reproductive performance of boran cows at Tatesa cattle breeding center. Parity had significant effect in this trait ($p < 0.01$, table 3b); this might be due to the difference in energy demand among different parity groups which signifies that the younger cows tend to have longer days open (calving to conception interval) than fully matured dams. This in turn could signify the capacity of cows to withstand the stresses of previous pregnancy and maintenance of the next pregnancy.

Calving interval is an important factor in measuring the breeding efficiency and directly correlates with the economics of milk production. Reproduction in dairy cows with regular and shorter calving interval (365-420 days) is a key feature for the rapid multiplication of the breeding stocks [23]. In this study calving intervals was found to be around 381.3 days as summarized under table 1, and revealed lower calving interval than the reports of 402, 450 and 630 days by Nibret [21], Habtamu *et al.* [20] and Belay *et al.* [17], from studies on reproductive performance of; crossbred dairy cows under small holders' conditions in and around Gondar, and jersey cows at Wolaita sodo dairy farms and zebu with HF crossbred dairy cows in Jimma town, Ethiopia, respectively. There were also considerable difference with reports of Mureda, and Mekuriaw [15]; with the result of mean calving interval (CI) across all production systems was 17.8 months.

However, the result of this study revealed longer calving interval of 373 days than reports of Hunduma [7], from study on reproductive performance of crossbred dairy cows under small holder conditions in Ethiopia. Nevertheless, based on the facts reported by Gebeyehu *et al.* [31], indicating that calving interval of 360 to 405 days are considered as standard values and the finding of this study might be said be within standard level.

During the study, some of the farm owners, especially those with attention to milk production only; as summarized under table 5, claimed that at certain occasions they do not allow their cows to breed even if they are in heat. This could also directly affect the length of days open and calving intervals. According to Joe *et al.* [32], perhaps cows breed between 40 to 60 days post-partum interval as short as 330 days and this should be avoided for optimum milk production. This idea could show that it is not advisable to breed as early 40-60 days after previous calving as the successive pregnancy period affects the former lactation period, if it is regardless of reproduction. Although production scale and breed had insignificant effect on CI (under table 2), there was strongly significant ($p < 0.01$) effect by parity status, from table 3b. This finding is not in agreement with findings of Habib *et al.* [33]; on reproductive performance of red Chittagong cattle in nucleus herd at Bangiladish University, who found that there was no significant association between different parity groups. Significant effect might be due to difference in cow's efficiency to conceive back withstanding all the stresses of the previous pregnancy and calving. This could be appreciated among the cows with less than two parity status having longer calving intervals than others having the parity status more than three from this study. This also might be due to previous pregnancy stress and variations in energy demand among different parity groups tending to be higher among young cattle for their full length maturity, milk production and maintenance and this in turn could delay the onset of postpartum heat period.

In this study, the mean value for gestation length was found to be 381 days, as summarized under table 1. This result revealed slightly longer gestation length than of 277 and 277.7 days reported by Nibret (2012); for reproductive performances of crossbred dairy cows under small holder conditions in and around Gondar, and Yifat *et al.* [30], on reproductive performance of

boran cows at Tatesa cattle breeding Center. None of the above mentioned variables had significant outcome on this trait (table 2, 3 and 4) and this holds general agreement with reports of many authors from different parts of the country. This might be due the fact that gestation length is relatively consistent trait and hardly affected by the type of cow breed and other environmental and managerial factors of farms.

In practice, the most widely used indication of pregnancy is frequent checking of animals about 21 days after insemination or breeding for visual signs of estrus, or by the use of various aids indicating estrus [34, 35]. However, as summarized under table 5, among 28 farms; 12 farms detect their cows for estrous signs only one time a day, 13 farms two times a day and the remaining 3 farms detect irregularly. This study revealed that estrous detection across the farm is not satisfactory and could be a reason for conception problem rate.

The reproductive health problems obtained in this study were abortion, dystocia, retained fetal membranes, prolapses (uterine and vaginal) and repeat breeding, as summarized under table 6. However, the findings were at a limited prevalence and among the problems dystocia showed more occurrence in cows which calved at age around 28 months. This might be due to lack of full length maturity of the dams resulting in disproportional pelvic width with fetal size. Repeat breeding also got one emphasis in this study, as this can invariably result in problem of conception rate. Repeat breeding was relatively most prevalent (7.5%) as summarized under table 6; might be due to ovarian problems most probably, ovarian cyst.

5. Conclusions and Recommendations

It could be concluded from this study that; production scale had significant effect on none of the above parameters ($p>0.05$) and this might be

due to both medium and large scales were operated intensively, while parity had significant effect ($p<0.05$) on calving to first service interval, number of services per conception, days open and calving intervals. Based on the findings of this study, HF crosses had moderately better reproductive performance than jersey crosses with mean, minimum and maximum values; however, there were no statistical significance except on calving to first service interval ($p<0.05$) with shorter days in HF crosses. Even if there were no clear cut standard values to determine the degree of reproductive efficiency, relatively this study revealed better reproductive performances of cross bred dairy cows as compared to many reports from different parts of the country. Nevertheless; this does not mean it is necessarily satisfactory as there were obviously herd managerial problems in certain farms, particularly on heat detection, regular vaccination, culling programmes, irregular usage of artificial insemination and feed formulations. In addition to the above constraints, few of the farm owners were careless for close supervision of the general farm hygiene and breeding systems. This in turn could have resulted in variations of reproductive parameters in advance, like age at first service, age at first calving, day's open and calving intervals. Moreover, some attentions given by the farm owners to their dairy cows also affect some reproductive parameters. This signifies that non-genetic factors and attentions given to each dairy farm also affect the reproductive parameters.

Based on the above conclusions the following recommendations are forwarded;

☞ The ongoing activities to improve and expand reproductive performances of medium and large production scale systems should be encouraged.

☞ The farms' owners should be well informed about good management of their herds especially on; general farm hygiene, how to follow up estrous detection, feed formulations, timing of insemination and regular vaccination programmes.

☞ Whenever possible, there must be standard values for reproductive parameters of dairy cows; for better evaluation of their performances, at country level.

6. References

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