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EFFECT OF NON-GENETIC FACTORS ON THE PRODUCTIVE AND REPRODUCTIVE TRAITS OF FRIESIAN CROSSBRED DAIRY COWS

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The present investigation was undertaken to study certain factors affecting the productive and reproductive performances of crossbred dairy cows maintained at fifteen dairy farms in Chittagong metropolitan area, Bangladesh over from the years 1992 to 2005. The data consisted of phenotypic values of five dairy traits such as age at first calving(AFC), post partum heat period (PPHP), calving interval (CI), lactation length (LL) and lactation milk yield (LMY) of 480 different crossbreds of Friesian cows were studied. The analyses of variance indicated that the effect of the farm was significant ($P \leq 0.05$) for all traits, whereas none of the traits influence by the season of birth. The calving years were significant ($P \leq 0.05$) for CI, LL and LMY. Least-squares means illustrated that the effect of lactation number on PPHP, LL and LMY was significant ($P \leq 0.05$).). It can be concluded that satisfactory management and appropriate genetic improvement strategies would result in improving performance of crossbred dairy cows.

Key words: Calving year, farm, lactation number, and season of birth.

The cattle of Bangladesh are mainly an indigenous, Zebu type (Bos indicus) and their daily average milk production is 0.5 to 2.5 liters (Khan et al., 2005 and Hossain et al., 2002). Whereas, crossbred cattle namely cross of Holstein-Friesian, Jersey, Sahiwal and Red-Sindhi with indigenous cattle produces 5 to 10 liters milk per day (Hossain et al., 2002; Majid et al., 1998).

Crossbred cows usually exceed the average performance level of potential pure-breeds and thus play an important role in livestock improvement. They have enough economic importance in terms of total production potentialities. Therefore, Bangladesh is conducting dairy cattle genetic improvement programme since 1970 using both tropical and temperate breeds through straight-breeding and crossbreeding. Certainly no unique achievement for production potentialities of crossbred cattle due to diversity of management systems and indiscriminate of breeding policy.

Productive and reproductive efficiency of cows directly affect the profitability and also act as indicators in selecting animal. Existing cattle have wide variation in terms of production as well as reproduction performances. A number of studies involving comparisons of productive and reproductive performances have been conducted (Das et al., 2009; Khan et al., 2005 and Hossain et al., 2002), but there are very few studies on factors affecting the economic dairy traits (Rehman et al., 2008; Fadlemoula et al., 2007 and Sattar et al., 2005) were found.

In Bangladesh, very scanty work has been reported so far on factors influencing the productive and reproductive performances in crossbred dairy cows. Therefore, this study was an attempt to know the effect of different factors such as farm, season of birth, year of birth and lactations on economically important dairy traits in crossbred dairy cows of Bangladesh.

MATERIALS & METHODS

A herd health database of 15 dairy farms in Chittagong metropolitan area has been developed by Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh. The farmers under herd health programme keep individual cow record in an organised way and this data were used for this current study. The study was conducted in five metro thanas (administrative sub-unit) namely Bakolia, Bandar, Kotwali, Patenga and Panchlaish of Chittagong district. The experimental data were collected from the record sheets of the above 15 farms. A database consisting of 480 crossbred of Friesian cows were used in this study. All records relating to animal born from 1992 to 2005 years were considered.

Productive and reproductive performance of the crossbred dairy cows

The data on productive and reproductive performance of individual animal involves the description of genetic make-up, season and year of birth. Season of birth were defined as three seasons namely summer (March to June), rainy (July to October) and winter (November to February). Reproductive data consists of age at first calving, post partum heat periods and intervals between calving. These three reproductive traits were recorded on days required for those events. Number of lactation, length of milk production period in days and how much milk is produced in liters were recorded.

Statistical analysis

From the collected data the mean and standard errors (SE) for the studied traits e.g., age at first calving (AFC), post partum heat period (PPH), calving interval (CI), lactation length (LL) and lactation milk yield (LMY) were estimated using the PROC MIXED of SAS (SAS, 2000) and the differences in means were tested by using the least significance differences (LSD) test (Steel et al., 1997).

Table-1. Mean ± SE values of traits under different farms in Chittagong area

Traits	Farms														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AFC (days)	1093.68^{b} ±14.11	1112.18^{ab} ±21.13	1115.72^{ab} ±19.62	1134..93^{a} ±16.99	1114.04^{ab} ±17.56	1136.09^{a} ±16.71	1133.32^{a} ±17.61	1114.72^{ab} ±23.30	1109.20^{ab} ±35.63	837.31^{c} ±45.37	1126..56^{ab} ±30.85	1181.98^{b} ±28.69	1080.19^{ab} ±37.89	1083.94^{ab} ±45.46	1136.81^{a} ±41.02
PPHP (days)	96.88^{a} ±2.02	91.88^{a} ±3.03	95.93^{a} ±2.82	96.95^{ab} ±2.44	95.64^{a} ±2.52	95.93^{a} ±2.40	95.99^{a} ±2.53	94.75^{a} ±3.34	98.22^{ab} ±5.11	104.82^{ab} ±6.51	105.82^{a} ±4.43	96.79^{ab} ±4.11	104.08^{ab} ±5.44	95.53^{ab} ±6.52	98.77^{ab} ±5.89
CI (days)	437.61^{b} ±7.40	435.78^{b} ±11.08	439.39^{b} ±10.29	447.51^{b} ±8.91	438.06^{b} ±9.21	441.16^{b} ±8.76	432.69^{b} ±9.23	433.24^{b} ±12.22	430.69^{b} ±18.69	474.02^{ab} ±23.80	459.97^{b} ±16.18	459.97^{b} ±16.18	459.35^{b} ±19.88	516.87^{a} ±23.85	466.30^{ab} ±21.52
LL (days)	259.29^{acd} ±5.53	269.27^{abcd} ±8.29	262.18^{acd} ±7.70	264.38^{abcd} ±6.67	269.20^{abcd} ±6.89	261.70^{abc} ±6.59	277.83^{b} ±6.91	262.40^{acd} ±9.14	257.33^{acd} ±13.98	242.42^{ac} ±17.80	240.19^{c} ±12.10	284.15^{d} ±11.25	258.31^{abcd} ±14.86	263.08^{abcd} ±17.83	265.27^{abcd} ±16.09
LMY (kg)	1315.95^{acd} ±67.88	1273.54^{acd} ±101.66	1428.41^{a} ±94.40	1445.91^{a} ±81.76	1378.23^{acd} ±84.49	1317.55^{a} ±80.39	1215.32^{ac} ±84.71	1310.44^{a} ±112.11	1035.14^{d} ±171.43	983.14^{ac} ±218.28	940.00^{c} ±148.45	1160.67^{a} ±138.02	1735.48^{b} ±182.30	1134.47^{a} ±218.72	1260.02^{ab} ±197.34

Means with different superscripts in the same row differ significantly ($p \leq 0.05$). (AFC= Age at first calving, PPHP=Post partum heat period, CI= Calving interval, LL=Lactation Length and LMY=Lactation milk yield)

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RESULTS AND DISCUSSIONS

The overall mean of all traits for crossbred dairy cows in different farms , seasons of birth, years of birth and lactations are shown in the Table 1 to Table 4, respectively.

In the present study, a significant ($P \leq 0.05$) variation in the AFC has been observed in different farms (Table 1). This might be due to husbandry, health care and nutritional variations between the farms. Oyedipe et al. (1982) reported that under improve management and health care and optimal nutrition status; seasonal stress can be minimized to obtain first calving at

about 3.5 years. Age at first calving differ widely in different years of birth. In a report, Rehman et al. (2008) found that age at first calving was affected by herd, year and season of birth. However, in the present study, it has been observed that the season of birth had no significant effect on AFC (Table 3). In agreement with the present finding, Dhara et al. (2006) and Sattar et al. (2005) also found non-significant difference for age at first calving in different seasons of birth. This seasonal variations in the age at first calving might be related to the fact that difference in availability of feeds and seasonal stress.

Table-2. Mean±SE values of traits for different seasons of birth

Traits	Seasons		
	Summer	Rainy	Winter
AFC (days)	1095.45±14.41	1099.01±14.31	1107.67±14.51
PPHP (days)	97.59±2.07	98.83±2.05	97.18±2.08
CI (days)	443.16±7.56	455.75±7.50	451.42±7.61
LL (days)	260.60±5.65	263.15±5.61	263.65±5.69
LMY (Kg)	1239.46± 69.33	1286.03±68.83	1261.36±69.81

AFC= Age at first calving, PPHP=Post partum heat period, CI= Calving interval, LL=Lactation Length and LMY=Lactation milk yield)

Table-3. Mean±SE values of traits for different years of birth

Traits	Years													
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AFC (days)	1054.45 ±97.93	1119.63 ±51.79	1051.42 ±68.58	1067.32 ±43.77	1085.75 ±27.35	1112.92 ±25.31	1106.95 ±22.40	1101.99 ±19.63	1099.12 ±18.33	1111.63 ±19.37	1121.13 ±19.79	1109.99 ±21.68	1126.29 ±24.17	1141.39 ±26.96
PPHP (days)	112.82 ±14.05	90.80 ±7.43	103.46 ±9.84	94.47 ±6.28	97.31 ±3.92	97.32 ±3.63	99.06 ±3.21	92.51 ±2.82	94.86 ±2.63	95.68 ±2.78	97.01 ±2.84	98.77 ±3.11	99.63 ±3.47	96.44 ±3.87
CI (days)	440.03^{ac} ±51.37	488.42^{a} ±27.17	452.65^{ab} ±35.97	402.09^{b} ±22.96	447.94^{ab} ±14.35	477.95^{b} ±13.28	453.99^{ab} ±11.75	454.85^{ab} ±10.30	450.43^{ac} ±9.61	441.74^{b} ±10.16	449.70^{ab} ±10.38	445.14^{ab} ±11.37	448.88^{ab} ±12.68	447.74^{ab} ±14.14
LL (days)	341.39^{a} ±38.41	245.62^{ab} ±20.32	298.66^{ab} ±26.90	266.23^{ab} ±17.17	264.59^{ab} ±10.73	249.34^{b} ±9.92	255.85^{b} ±8.79	260.01^{b} ±7.70	256.27^{b} ±7.19	247.57^{b} ±7.59	248.07^{b} ±7.76	249.28^{b} ±8.51	247.57^{b} ±9.48	244.08^{b} ±10.57
LMY (Kg)	1464.56^{ab} ±471.15	956.19^{b} ±249.19	1655.99^{a} ±329.95	1054.20^{b} ±210.60	1255.49^{b} ±131.60	1155.12^{b} ±121.78	1303.79^{b} ±107.81	1389.67^{b} ±94.49	1383.28^{b} ±88.18	1350.83^{b} ±93.18	1207.15^{b} ±95.20	1134.29^{b} ±104.33	1134.83^{b} ±116.30	1226.59^{b} ±129.69

Means with different superscripts in the same row differ significantly ($p \leq 0.05$). (AFC= Age at first calving, PPHP=Post partum heat period, CI= Calving interval, LL=Lactation Length and LMY=Lactation milk yield)

In the present study, PPHP has found to be significantly ($P \leq 0.05$) influenced by different farms. Though, there is no published information on the farm based difference in PPHP but this trend of variation may explain the fact that there were measurable differences in the management of the farms. Season of birth has found non-significant effect on PPHP. The average PPHP for different years of birth have a somewhat wider range but statistically non-significant ($P>0.05$). This result explains that PPHP may not be affected by year of birth. In this study PPHP was varied significantly ($P \leq 0.05$) with different lactations (Table 4). However, on contrary, in earlier report on Holstein-Friesian cows by Sattar et al. (2005) revealed that effect of parity on this parameter was statistically non-significant. This variation in the results may relate to the fact that crossbreds of temperate breeds in tropics may show variation in their reproductive performances.

Farms had a significant effect on calving interval in this study (Table 1). The highest (516.87 ± 23.85days) calving interval was observed in farm 14 and lowest (430.69 ±18.69days) was observed in farm 9. Rehman et al. (2008) found significant herd differences for this trait. Variations in calving interval of different farms might be due to genetic, environmental, feeding and managemental effects. In case of different seasons of birth lowest calving interval (443.16±7.56 days) was recorded in summer. In the previous studies Sattar et al. (2005) and Tekerli and Gundogan (2005) also reported lower interval for summer. CI in current study significantly ($P \leq 0.05$) differs with years of birth. Tekerli and Gundogan (2005) reported the effect of year factor was significant ($P \leq 0.05$) for calving interval. The lactation wise analyses revealed that the mean calving interval for most of the lactations were almost similar and non-significant ($P>0.05$). This finding agrees with the reports of Sattar et al. (2005) and Tekerli and Gundogan (2005); they found statistically non-significant effect of parity on this trait.

Variations in lactation length for different farms in current study were statistically significant ($P \leq 0.05$). It may be argued for this finding that most of the farms owner practices different trend for keeping a cow in lactation. The mean lactation length of crossbreds in this studies for summer, rainy and winter season were almost similar. This finding is inconsistent with the report of Fadlelmoula et al. (2007); they found influence of season on lactation length. This variation might be related to the fact that they conducted their study in the tropical Sudan and this study was conducted in subtropical Bangladesh. In this study year wise lactation length was almost similar except first three years of birth, which was significantly ($P \leq 0.05$) differed with other years of birth. It may be due to practicing milk a cow for more days by the farmers in their early years of farming. A highest least squares mean lactation length (292.64±20.68 days) was recorded in 10th lactation (Table 4). Rehman et al. (2008) reported that lactation length decreased with age; which is inconsistent with the present finding. It might be related to the fact that farmers under present study milk their cows more before culling.

Average milk yield per lactation in farms under this study were varied significantly ($P \leq 0.05$). Rehman et al. (2008) observed that total milk per lactation affected by the differences of herd. In current study it found that those calves born in rainy season yield more milk in their lactating life. Seasonal difference for lactation milk yield was supported by the report of Rehman et al. (2008). Total lactation milk yield for different years of birth varied significantly ($P \leq 0.05$) for current study. Tekerli and Gundogan (2005) observed significant influence of year factor on lactation milk yield.

Table-4. Mean±SE values of traits for different lactations

Traits	Lactations									
	1	2	3	4	5	6	7	8	9	10
PPHP (days)	99.16^{ab} ±7.69	95.86^{ab} ±3.17	95.82^{ab} ±2.75	99.51^{ab} ±2.84	99.62^{ab} ±3.27	97.82^{ab} ±3.39	101.49^{ab} ±4.17	108.51^{a} ±5.57	90.40^{b} ±6.39	90.49^{b} ±7.56
CI (days)	450.26 ±28.09	451.33 ±11.60	454.22 ±10.04	451.23 ±10.39	446.61 ±11.95	446.94 ±12.38	435.02 ±15.23	479.38 ±20.36	439.72 ±23.36	-
LL (days)	265.19^{abcd} ±21.01	271.11^{abcd} ±8.68	272.03^{ac} ±7.51	256.67^{bd} ±7.77	260.20^{abcd} ±8.94	255.65^{abcd} ±9.26	261.13^{abcd} ±11.39	254.79^{abcd} ±15.23	235.26^{ab} ±17.47	292.64^{cd} ±20.68
LMY (Kg)	1098.91^{abc} ±257.68	1377.89^{b} ±106.43	1328.88^{c} ±92.11	1136.71^{b} ±95.30	1191.75^{abc} ±109.61	1303.42^{abc} ±113.58	1276.28^{abc} ±139.67	1244.92^{abc} ±186.76	1101.14^{abc} ±214.28	1262.93^{abc} ±253.61

Means with different superscripts in the same row differ significantly ($p \leq 0.05$). (AFC= Age at first calving, PPHP=Postpartum heat period, CI= Calving interval, LL=Lactation Length and LMY=Lactation milk yield)

The parity numbers have significant effect on LMY for current study population. Fadlelmoula et al. (2007) and Sattar et al. (2005) in their study found significant influence of parity on lactation milk yield.

CONCLUSION

All the traits showed wider range of phenotypic values in different farms. The effect of season of birth on all the traits under study was found to be non-significant. However, all traits varied significantly with the differences of years of birth and also with the number of lactations. This study suggests that in future larger data sets would beneficial for increases the accuracy of the estimation. Finally, it can be concluded that satisfactory management and appropriate genetic improvement strategies would result in improving performance. More research is needed on factors that influence the performance of local genotypes and other crossbreds' cattle for establishing a well planed breeding and management policy.

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