Research Article

Productive and Reproductive Performance of Different Crossbred Dairy Cattle at Kishoreganj, Bangladesh

Mustasim Famous[1]*, Asim Chakrabartty Aditya[2], Shahabuddin Ahmed[3] and Sabuj Sutradhar[2]

[1]Department of Livestock Production and Management, Khulna Agricultural University, Khulna, Bangladesh; [2]Department of Genetics and Animal Breeding, Sylhet Agricultural University, Sylhet, Bangladesh; [3]Department of Animal Nutrition, Khulna Agricultural University, Khulna, Bangladesh.

Abstract | The study was conducted at Kishoreganj, Bangladesh to evaluate the productive and reproductive performance of Sahiwal × Local (SL× L), Friesian × Local (F×L), Sindhi× Local (S×L) crossbred during the period of July 2019 to January 2020. A total of 162 crossbred dairy cows under 3 genotypes were studied on the basis of productive and reproductive performances. The average age of puberty of L×F, L×SL and L×S crossbred cattle were 23.7, 26.5 and 29.5 months, respectively. The average age at first fertile service for L×F, L×SL and L×S crossbreds' cattle were 24.2, 27.0 and 31.0 months, respectively. The highest gestation length was 285 days and it was for L×S crossbred cattle. The lowest gestation length was 273 days and it was for L×F crossbred cattle. The highest lactation length was observed in case of L×F crossbred (300 days) and lowest was found in case of L×S crossbred (220 days). The highest number of services per conception was 1.66 and it was for L×SL crossbred cattle. The lowest number of services per conception was 1.61 and it was for L×F crossbred cattle. The average post-partum heat period of L×F, L×SL and L×S crossbreds were 114, 125 and 127days, respectively. The highest Post-Partum Heat Period (PPHP) was 127 days found in case of L×S crossbred cows. The lowest PPHP was found in case of L×F crossbred cows (114 days). The overall productive and reproductive performance of different crossbred were varied. Judging from the overall analysis of the results, it may be concluded that production and reproduction performances of Holstein crossbred are superior to other dairy crossbred in Kishoreganj, Bangladesh.

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***Correspondence** | Mustasim Famous, Department of Livestock Production and Management, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100, Bangladesh; **Email:** mustasimfamous1995@gmail.com
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Introduction

Bangladesh is an agriculture based densely populated country where 51.88% of people are engaged in agricultural sector (BBS, 2018). Livestock plays a crucial role in the livelihood of a large portion of the population. The magnitude of the contribution of the livestock sub-sector to the GDP is 1.66 percent where it generates 13 percent of the total foreign exchange earnings and provides full-time employment to about 20 percent of the rural population (BOS, 2016). Bangladesh has a high density of cattle population. The total livestock population of Bangladesh is 412.24 million among them cattle are 24.39 million in 2019-20 year. (DLS, 2020). Besides this large population they do not conform to any particular

breed or type and are broadly known as Indigenous/ Local cattle. Along with Indigenous, some imported improved breeds and their crosses with Indigenous/ Local (not exceeding 10%) constitutes the national herd. About 92 percent of the dairy cattle is non descriptive indigenous and only 8 percent is reported to be crossbred (BBS, 2006). These Indigenous cattle are of multipurpose in providing milk, draught, meat and dung as fuel and organic fertilizer. The number of milking cows in Bangladesh is 10 million and it represents 47 % of the total cows (Banglapedia, 2015). There is a great shortage of milk and meat production in Bangladesh. The yearly milk and meat production in Bangladesh is 7.27 and 6.15 million tons but the national demand is about 14.69 and 7.05 million tons respectively (BBS, 2017). Productive traits directly affect the profitability of the farm. These traits depend largely on the genetic potential of the dam and sire. Profitable breeding could be improved by keeping lactation length, dry period and service period between optimal limits (Alpan, 1994; Cilek and Tekin, 2005). Producing more milk annually is a primary measure of efficiency because maximum production of dairy cows has typically occurred with optimal management conditions (Kellogg et al., 2001). Because of the low milk production of local breeds, exotic breeds are adopted to increase milk production in commercial herds where intensive systems were followed. The revenues of milk production depend on the reproductive efficiency of the herds (Ahmed et al., 2000). Days open and no. of services per conception (NSPC) of the cows have been studied by several investigators due to the economic importance associated with the reproductive efficiency and fertility in dairy cattle. They are important in determining calving interval and influencing milk production (Ali et al., 2003; Riecka and Candrak, 2011). Long calving interval may be the main reproductive disorder of high yielding dairy cattle. Mainly, that is due to either low conception rate (40-50%) and/or high early embryonic mortality (Rossi et al., 2008). The poor reproductive performance of high yielding cows may affect the overall economic performance of the herd especially under high ambient temperature (Jainudeen and Hafez, 2000). The cattle resources of Bangladesh are mostly of the indigenous type (*Bos indicus*) with a substantial number of Sindhi, Sahiwal and Holstein-Friesian crossbreds. Indigenous cattle experience late maturity, short lactation length, long calving interval and poor production of milk and draught power but are more disease resistant and capable of thriving in harsh conditions (Majid et al., 1992). Exotic breeds often lack resistance to local diseases and climatic conditions, produce poorly and lack persistency without considerable high-quality feed and management. In the developing world, indiscriminate use of exotic animal genetic resources and poorly designed breeding schemes are the major reasons for the loss of animal genetic resources. The loss of locally adapted breeds will have long-term negative implications and, in most instances, will reduce food security rather than ensure it. Locally adapted breeds will continue to be valuable in our countries because these countries cannot afford the inputs that are required to sustain breeds that have been developed in low stress, high input production systems (Al-Amin et al., 2007).

One way of improving tropical cattle regarding milk production is through cross breding with *Bos taurus* dairy breeds. This has been widely used in order to combine the high milk yield potential of exotic breeds with the adaptability of the local ones. The first crossbred generation (F_1), usually from native females mated with exotic males, has been a success in most cases. The F_1 crosses can produce up to three times more milk and have longer lactation and shorter calving intervals than the local breeds (Kiwuwa et al., 1983). However, back crossing to the European breeds gave rather disappointing results; i.e. milk yield increased only slightly or even declined and fertility deteriorated. This is in addition to the lack of adaptation to tropical conditions (Syrstad, 1989). Crossbred cows are more productive in good nutrition and proper management. Therefore, programs have been taken to improve the genetic potential as well as productivity of non-descript indigenous cows through crossbreeding since 1970 (Bhuiyan, 2006). Rapid improvement in dairy productivity for food security and livelihood leading to poverty reduction is needed in Bangladesh. Therefore, the need for planning to intensify dairy productivity is a crying need of time. In order to maximize overall productivity, the herd must have appropriate combination of genetically high potential breeds along with good feeding and management system. This study was therefore, undertaken to evaluate the consequence of dam genotype on productive and reproductive performance of crossbred milch cows to know the productive and reproductive performance of dairy cattle in Kishoreganj district of Bangladesh.

Materials and Methods

The study was carried out on the different crossbred cattle in Kishoreganj district from the month of July 2019 to January 2020. The information dealing with the productive and reproductive performances of crossbred milking cows were collected from farm record sheet and from the owner by direct questionnaires. 17 dairy farms were visited for this purpose. Questionnaires for respective cow's information were prepared in properly designed forms. After preparing the questionnaires, preliminary sorting and checking of data were done and then were prepared for analysis. The questionnaire, made on crossbred dairy cows, contains a detail description of the cows that includes 4 productive (Milk yield per day, Peak milk yield per day, Lactation length, Dry period) and 9 reproductive parameters named Birth weight, Age at puberty, Age at first fertile service, Age at first calving, Gestation length, Post-Partum Heat Period (PPHP), Number of services per conception, Days Open (DO), Calving Interval (CI) were measured.

Results and Discussion

In total, 162 crossbred dairy cows of 3 different genotypes were studied on the basis of productive and reproductive performance.

Productive traits

Milk yield per day: The average milk yield per day for L×F, L×SL and L×S crossbred cattle were 13.9, 6.3 and 5.3 liter, respectively (shown in Table 1). The highest milk yield per day was recorded 13.9 liter found in case of L×F crossbred cattle. The lowest milk yield per day was 5.3 liter, found in case of L×S crossbred cows. Miazi et al. (2007) found that the average milk yield of Sahiwal × Local, Friesian × Local were 4.9±0.95 and 6.0± 1.06 L/day, respectively. Islam et al. (1999) also observed that the average milk yield of the Sahiwal × Local, Friesian × Local cows were 2.1±0.69, 4.7±1.01 and 6.2±3.16 liter/day, respectively. Their findings are slightly lower to the present study. The significant effect of genetic group on dairy milk yield is also found by Khan and Khatun (1998) and Nahar et al. (1992). Sarder et al. (1997) observed that the average milk yield (L/day) for Holstein Friesian cross, Sahiwal cross, Sindhi cross, Jersey cross and Local cows were 7.2 ± 2.6, 5.8 ± 2.2, 6.4 ± 2.76,6.9 ± 2.7 and 4 ± 1.5 liter, respectively. These results are not similar with this finding. The result of the present study has a partial agreement with the work of Hasan (1995) who found that the average milk production of crossbred dairy cows was 11.09 L/day. Similarly, Kabir et al. (2009) reported that the average daily milk yield of Local × Friesian graded animals was 12.03 ± 3.73 L/day while Nahar et al. (1992) found 7.5 ± 0.1 L/d. Although the milk production of crossbred cows of this study has partial agreement with the findings of above author. This result indicates that crossbred dairy cows perform their best under our climatic condition. The daily milk yield variation possibly occurred due to following factors-genetic, biological phenomenon, hormonal influences, feeding system, quality and quantity of feed, irresponsible care taker and severe intensive sun light and overall management.

Peak milk yield per day: The peak milk yield per day for L×F, L×SL and L×S crossbred cattle were 14.4, 6.4 and 5.4 liter, respectively. The highest peak milk yield per day was 14.4 liter found in case of L×F. The lowest peak milk yield per day was 5.4 liter found in case of L×S crossbred cows. Environment has great influence on genetic group of dams on peak milk yield per day. Breed management and environmental factors are major causes for the variation of peak milk yield per day.

Lactation length: The Average lactation length of L×F, L×SL and L×S crossbred cows were 277, 266 and 246 days, respectively (Table 1). The highest lactation length was observed in case of L×F crossbred (277 days) and lowest was found in case of L×S crossbred (246 days). Miazi et al. (2007) found that the average lactation length of Sahiwal ×Local and Friesian × Local were 270 ± 15 and 234.0 ± 24.0 days, respectively and these results have difference with the present study. Hasan (1995) found that average lactation lengths of Local × Sahiwal, Friesian × Local dairy cows were 256.3 ± 24.37 and 263.0 ± 30.68 days, respectively. These results are lower from our study. Disease occurrence, managemental system, feeding, housing and nutritional supplement has great influence upon lactation length.

Dry period: The average dry period of L×F, L×SL and L×S crossbred cattle were 87, 96 and 116 days, respectively (Table 1). The highest dry period was found in case of L×S crossbred cattle (116 days). The lowest dry period was found in case of L×F crossbred cattle (87 days). Nahar et al. (1987) found that the average dry period of Sindhi cross and Sahiwal were

145.9 and 127.2 days, respectively. These results are not similar to our findings.

Table 1: *Comparative productive performance of different crossbred dairy cattle.*

Traits	L × F (Mean ± SD) N=112	L × SL (Mean ± SD) N=24	L × S (Mean ± SD) N=26
Milk yield/day (L)	13.9 ± 0.73	6.3 ± 1.01	5.3 ± 0.31
Peak milk yield/day (L)	14.35 ± 0.52	6.4 ± 0.91	5.4 ± 0.69
Lactation length (D)	277±5	266± 5	246 ±5
Dry period (D)	87 ±9	96 ±13	116 ±14

SD: Standard Deviation.

Reproductive traits

Birth weight (kg): The average birth weight of L×F, L×SL and L×S crossbred dairy cows were 23.1, 20 and 19.1 kg, respectively (Table 2). The birth weight of L×F crossbred dam was heavier (23.1kg) than those other group. The lower birth weight of calf was 19.1 kg, found in case of L×S. The result of the present study has close agreement with the work of Kabir and Islam (2009) who found that the average birth weight of Friesian cross was 24.1±1.73 kg and for Sahiwal cross was 23.16 ± 2.13 kg. According to Hasan (1995) the average birth weight of SL × Pabna was 21.26 ± 2.89 kg. This result is almost similar to this present study. Similarly, Khan (1990) reported that the average birth weight of calves for Sindhi cross was 17.8 ± 0.18 kg, which is slightly lower than the present study.

Age at puberty: The average age of puberty of L × F, L × SL and L×S crossbred cattle were 23.7, 26.5 and 29.5 months, respectively (Table 2). The higher age was 29.5 month found in case of L×S crossbred. The lower age was 23.7 months found in case of L × F crossbred cattle. Kabir et al. (2009) found the differences between crossbred and indigenous cows were significant ($P < 0.01$). The age at puberty of Local, Shahiwal × Local and Holstein × Local are 25.92 ± 1.08, 18.0 ± 00 and 21.6 ± 2.40 months, respectively and these results are slightly lower than our study. Rahman et al. (1998) found that the age of puberty of Friesian × Local cows were 19 ± 2.3 months. Majid et al. (1995) reported that the age at puberty of L × F cattle ranged from 606.4 days (20.2m) to 770.31 days (25.68m) and these results are slightly lower than our study. In the present study, L × F crossbred reached early age of puberty than other genetic groups of dams. I think this is due to higher nutritional status. The animals that are reared in abundance of green grass good management system those progenies get early puberty which is one of the main demands of dairy farmer from his herd. Environment proper care also play a vital role in getting puberty earlier. Finally, genetic makeup is the main factor influencing the trait.

Table 2: *Comparative reproductive performance of different crossbred dairy cattle.*

Reproductive traits	L × F (Mean ± SD) N=112	L × SL (Mean ± SD) N=24	L × S (Mean ± SD) N=26
Birth weight (Kg)	23.1 ± 1.21	20 ± 1.3	19.1±1.11
Age at puberty (M)	23.7 ±.9	26.5±95	29.5 ± 1.0
Age at first fertile service (M)	24.2 ± 1.1	27.0 ± 1	31± 1
Age at first calving (M)	33.3 ± 1.20	36.3 ± 1	40.3±1
Gestation length (D)	273 ± 5	279 ± 5	279 ±5
Postpartum heat period (D)	114 ± 5	125 ± 5	127 ±5
Days open (D)	135 ± 5	146 ± 5	145 ±5
Service /conception	1.61 ±0.5	1.64 ± 0.3	1.63 ±0.5
Calving interval (D)	410 ± 10	426 ± 10	426 ±10

SD: Standard Deviation.

Age at first fertile service: The average age at first fertile service for L×F, L×SL and L×S crossbreds' cattle were 24.2, 27.0 and 31.0 months, respectively (Table 2). The highest age at first fertile service was 31.0 months found in case of L×S. The lowest age of first fertile service is 24.2 months and it was for L×F. Majid et al. (1995) observed that the age of first fertile service of 50% L × 50% F and 50% SL × 50% L are 26.3 ± 2.5 and 28.6 ± 3.9 months, respectively which have close agreement to this present study. Sarder and Hossain (2001) reported that age at first fertile service was 30.3±7 months for the indigenous cows which has close agreement with the present study. Rahman et al. (1998) reported that average age of first service for Friesian cross was 47.3 ± 0.5 month, which is higher from our study.

Age at first calving: The average age at first calving of L×F, L×SL, L×S crossbred cattle were 33.3, 36.3 and 40.3 months, respectively (Table 2). The highest age at first calving was 40.3 months found in case of L×S crossbred cattle. The lowest age at first calving was 33.3 months and it was for L×F crossbred cattle. Miazi et al. (2007) showed that the average age at first calving between Friesian × Local and Sahiwal × Local were 32.6 ± 2.32 and 28.0 ± 00 months, respectively and these results are slightly lower from our result. Asaduzzaman and Miah (2004) found that the age at first calving of Friesian ×Local and Sahiwal × Local were 36.3 ± 3.08 and 37.3 ± 3.01 months, respectively and the result of the present findings has close agreement with Asaduzzaman and Miah (2004).

Gestation length: The Average gestation length of L × F, L × SL and L × S crossbred cattle were 273, 279 and 279 days, respectively (shown in Table 2). The highest gestation length is 279 days and it is for L×S crossbred cattle. The lowest gestation length was 273 days and it was for L×F crossbred cattle. Rukonojjaman et al. (2009) found that the average gestation length of Friesian cross, Sahiwal cross and Sindhi cross were 275 ± 3.95, 276 ± 4.26 and 275 ± 4.41 month, respectively and the findings are almost similar to our findings. In another study, Hasan (1995) observed that the gestation length for Sindhi cross, Sahiwal cross and Holstein cross were 286, 282 and 284 days, respectively. Here the findings of Mr. Hasan are somewhat higher than our result. Asaduzzaman and Miah (2004) demonstrated the gestation length for Sahiwal × indigenous and Friesian × indigenous were 281.1 and 282.7 days, respectively and these findings are somewhat different from the present study. It is observed from the above discussion that crossbreds and indigenous cows have no significant effect on gestation length. Gestation length is a very important factor for dairy farm profitability. The farms, rearing animals which have lower gestation length is sure to obtain the profits.

Post-Partum Heat Period (PPHP): The average Post-partum Heat Period of L × F, L × SL and L × S crossbreds were 114, 125 and 127 days, respectively (Table 2). The highest PPHP was 127 days found in case of L × S crossbred cows. The lowest PPHP was found in case of L×F crossbred cows (114 days). Ali (1998) conducted an experiment and reported the PPHP of Crossbred and Local cows were 109.59 and 103.83 days, respectively. The result of the present experiment partially agrees with the findings of Ali (1998). Miazi et al. (2007) found that the average post-partum heat period of Sahiwal × Local and Friesian × Local cows were 95.0 ± 25.0, 90.0 ± 13.42 days respectively and these results are lower from our result.

Days open: The average days open of L×F, L×SL and L×S crossbred cattle were 135, 146 and 145 days, respectively (Table 2). The highest days open was 146 days found in case of L×SL crossbred cattle. The lowest days open was 135 days and it was for L×F crossbred cattle. This may be due to breed, sire, dam, nutrition, semen type, lactation length and frequency, poor heat detection and extension of postpartum waiting period etc. Khan and Majumder (2011) reported that calving to conception interval in Friesian cross, Sahiwal cross and local cows were 148 ± 8, 139 ± 8 and 116 ± 10 days, respectively. Here our findings are just reverse. This study shows that Friesian crosses has lower days open than the Sahiwal cross. The days open are also relatively lower in present investigation.

Service per conception: Average service per conception of L × F, L × SL and L × S crossbred cattle were 1.61, 1.64 and 1.63, respectively (Table 2). The highest number of services per conception was 1.63 and it was for L × SL crossbred cattle. The lowest number of services per conception was 1.61 and it was for L × F crossbred cattle. Mondal et al. (2005) found that average service per conceptions is 1.63 ± 0.64, 1.60 ± 0.65 and 1.60 ± 0.59 for Sahiwal cross, Sindhi cross and Friesian cross, respectively and these results are slightly higher from our result. The number of services per conception depends upon the stillness of the inseminator, semen quality, sperm motility and physical condition of the sire. Physically strong and disease-free sires have lower service per conception than the others. Artificial insemination has great influence upon the service per conception of crossbred animals.

Calving interval: Calving interval is the most important reproductive parameter that measures the overall reproductive performance of herd. The average calving interval of L × F, L × SL and L × S were 410, 426 and 426 months, respectively (shown in Table 2). The highest calving interval was found in case of L × SL and L × S crossbred (426 days). On other hand lowest calving interval was found in case of L × F crossbred (410 days). Mondal et al. (2005) found that the calving intervals were 445 ± 94.9, 451 ± 89.3 and 414 ± 51.4 days for Sahiwal cross, Sindhi cross, Friesian cross. These results are not similar to present study.

Conclusions and Recommendations

Four productive and nine reproductive traits were

studied. The birth weight of L × F crossbred was heavier (23.1 kg) than those other group and the lower birth weight of was found in case of L × S (19.1 kg). The highest milk yield per day was recorded 13.9 liter, found in case of L × F crossbred cattle as well as the highest peak milk yield per day was 14.4 liter. The higher age at puberty was 29.5 month found in case of L × S crossbred and the lower age was 23.5 months found in case of L × F crossbred cattle. The highest age at first fertile service was 31.0 months found in case of L × S and the lowest age of first fertile service was 24.2 months and it was for L×F. The highest age at first calving was 40.3 months found in case of L × S crossbred cattle and the lowest age at first calving was 33.3 months and it was for L × F crossbred cattle. The lowest gestation length was 273 days and it was for L × F crossbred cattle. The highest PPHP was found in case of L × S crossbred cows (127 days) and the lowest PPHP was found in case of L × F crossbred cows (114 days). The highest days open was 146 days found in case of L × SL crossbred cattle and the lowest days open was 135 days found in case of L × F crossbred cattle. The highest number of services per conception was in L × SL crossbred cattle (1.64) and the lowest number of services per conception was 1.61 was found in L × F crossbred cattle. The highest lactation length was observed in case of L × F crossbred (277 days) and lowest was found in case of L×SL crossbred (246 days). The highest dry period was found in case of L×S crossbred cattle (116 days) and the lowest dry period was found in case of L × F crossbred cattle (87 days). Judging from the overall analysis of the results, it may be concluded that production performance of Holstein crossbred is superior to other dairy crossbreds. More specifically L × F crossbred performs best. L × SL ranked second in performances While other crossbred performance is relatively lower performance.

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Novelty Statement

The study specifically emphasized the performance of different cross breed dairy cattle which were reared only at Kishoreganj district of Bangladesh.

Author's Contribution

All authors participated a significant role for the manuscript.

Conflict of Interest

The authors have declared no conflict of interest.

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