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Evaluation of productive and reproductive performances of crossbred and Deshi dairy genotypes in Bangladesh

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ABSTRACT

The research was conducted to evaluate productive and reproductive performances of crossbred and Deshi dairy genotypes and to find out possible scope of seed bull production through farmer participatory approach. The available dairy genotypes were Deshi (D), 50% Holstein Friesian (HF) - 50% D (50% HF), 62.5% HF-37.5% D (62.5% HF), 50% Sahiwal (SL)-50% D (50% SL) and H-SL-D. The results indicated that there were highly significant differences ($P<0.001$) in daily milk yield, peak daily milk yield, lactation length, dry period and moderate significant differences ($P<0.01$) in age at first heat, age at first service and had no significant effect ($P>0.05$) in age at first calving, calving interval, post-partum heat period and services per conception among available genotypes. The 75 % HF and H-SL-D genotypes produced significantly more daily milk yield (13.91±0.91 and 15.06±3.00 lit., respectively) compared to 50% HF, 62.5% HF genotypes (10.07±0.54 and 12.44±0.70lit., respectively), whereas Deshi cow gave 2.32±0.14 liters daily. The 75% HF had the highest peak daily milk yield (17.61±0.89 lit.) followed by H-SL-D, 62.5% HF, 50% HF, 50% SL and Deshi genotypes (16.71±3.11, 15.29±0.70, 12.51±0.53, 4.75±0.53, 3.60±0.22 lit., respectively). The 75% HF had the highest lactation length (306.09±11.41 days). But there were no significant differences found in lactation length among the 62.5% HF, H-SL-D and the 50% SL genotypes (283.85±16.24, 290.00±22.80 and 255.00±18.57 days, respectively), whereas Deshi cows had 242.73±8.89 days. Shortest dry period (54.90±3.05 days) found in 75% HF genotypes. The shortest average age at first heat was found in 75% HF (24.23±2.07months) cows followed by H-SL-D, 50% HF, 62.5% HF, Deshi and 50% SL cows (25.00±5.57, 25.29±1.58, 29.60±2.90, 32.00±0.65, and 33.00±1.34 months, respectively). The shorted length of age at first service was found in 75% HF (25.86±2.01 months) followed by 50% HF, 62.5% HF, Deshi and 50% SL cows having 26.10±1.55, 26.10±1.55, 32.31±0.73 and 33.17±1.42 months, respectively. The mean value for age at first calving of crossbred and Deshi cows were 37.6±1.20 and 41.13 ± 0.72 months, respectively. The shortest calving interval (13.14±0.36 months) was found in case of 62.5% HF cows followed by 75% HF, Deshi, 50% HF, H-SL-D and 50% SL cows (13.31±0.27, 13.47±0.19, 13.70±0.40, 13.89±1.09, 14.17±0.48 months, respectively). The shortest post-partum heat period was found in 75% HF (88.95±6.89 days) cows followed by 50% HF, 62.5% HF, Deshi, H-SL-D, 50% SL cows (93.72±5.66, 94.38±7.87, 108.08±7.16, 120.00±28.72, 134.63±16.27 days, respectively). The present study concludes that due to the level of performance of animals and farmers awareness and interest, herd book based farmer's participatory system may work here to produce proven sire to support small holder dairying in Bangladesh.

Key words: Dairy genotypes, farmer participatory approach, indigenous Seed Bulls, productive and reproductive performances, proven sire.

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INTRODUCTION

Livestock plays an important role in the economy of Bangladesh with a direct contribution of 2.67 % to the GDP and the growth rate of GDP in 2009-2010 for livestock was 3.98 %, according to Bangladesh Economic Review (2009-10). In order to increase milk production in the tropical region of the world, cattle crossbreeding programs have long been used as one of the main strategies and temperate breeds have been introduced in many developing countries (Cunningham et al., 1987). To meet an increasing demand for milk, the livestock sector in Bangladesh is undergoing rapid changes and intensive production expands by preferring a certain range of high-output dairy genotypes. The first choice of means for genetic improvement should be use of a superior tropical breed for upgrading. Improvement of indigenous zebu populations through upgrading with *Bos Taurus* breeds have to be carefully considered taking into account the perspective of not only well performing F_1 cows but also the establishment of a sustainable system in later generations. Rapid improvement in cattle productivity for food security and livelihood enhancement is needed in Bangladesh which can be achieved through intensification of dairy productivity in the country. But in order to maximize overall profitability, the herd must have appropriate combination of genetically high potential breeds along with better feeding, management and healthcare practices (Bhuiyan, 2008).The existing cattle breeding policy of the country is a two-tier system which kept provision of dairy development in the country using both i) high yielding variety (HYV) cattle which are crossbred e.g. ½ Holstein Friesian- ½ Local, and ii) important indigenous dairy cattle types / breeds e.g. Red Chittagong, Pabna, Munshigonj etc (Bhuiyan et al, 2007). The gap between demand and supply of quality seeds (semen, chicks, etc.) is considered as the major constraint in enhancing productivity. To overcome the problem, it is imperative to produce quality seeds through active participation of the farmers. Moreover, for the success of seed animal production program, higher selection pressure is needed which could be achieved through enhancing the size of breeding population. In Bangladesh condition, this could be achieved by seeking cooperation of the dairy cattle owners with defined breeding goal (s), opening herd book recording system, superior breeding animal selection, genetic evaluation system, production and exchange of breeding males (semen) and finally implementation of assortative/selective mating plan (Bhuiyan, 2008, 2006).

Bull production from farmer herds depend on Field Performance Recording (FPR) system. Data available from FPR will help to identify high-yield cows owned by farmers.

Selecting the best cows is one of the four important considerations in breeding for milk production. With a view to stated situation, the present study was planned to evaluate productive and reproductive performances of available different crossbred combinations and Deshi dairy genotypes and to find out possible scope of seed bull production through farmer participatory approach.

MATERIALS AND METHODS

Study area

The study was conducted at the peri-urban and rural farmers' herds in Mymensingh district within seven kilometers around the Artificial Insemination Centre, Bangladesh Agricultural University (BAU). Data were collected in a prescribed format designed according to the aim and objective of the present study. A total of 82 households were selected on the basis of availability of elite cows and heifers in their herds, which consisted of a total of 182 cows of both non-descript Deshi and crossbred genotypes having different grades of Holstein Friesian inheritance. Data used in this study were recorded during the period from April, 2010 to March, 2011.

Study parameters

Grade of a cow was ascertained by in-depth dialogue with the animal's owner so as to reveal her true pedigree. And the source of semen used to breed her mother was traced to know its paternal breed (or crossbred) status. Most of semen used by the farmers came from the breeding service providers of Directorate of Livestock Services

(DLS). Moreover, physical conformation, coat colour, size and level of production etc were also taken into consideration in her breed composition certainty process. Finally, the possible levels of inheritance of exotic genes of the cows were fixed. The production and reproduction performance traits of economic importance for dairy cattle considered in this present study were age at first heat, age at first service, age at first calving, daily milk yield, peak milk production, lactation length, dry period, post-partum heat period, services per conception and calving interval.

Then the average daily milk yield was calculated using the following equation (Mwacharo et al., 2002). Three consecutive previous post-partum heat periods of cow were recorded and average value was calculated. Three consecutive previous (preceding) calving intervals of cow were recorded and average value was calculated.

Data analysis

Analysis was performed by analysis of variance (ANOVA) method followed by Duncans' Multiple Range Test (DMRT) (only for separating the means of significant factors) under Statistical Package for Social Science (SPSS Statistics 17.0) program.

RESULTS AND DISCUSSION

In the present study, 82 households were included where Deshi, 50% Holstein Friesian-50% Deshi (50% HF), 62.5% Holstein Friesian-37.5% Deshi (62.5% HF), 75% Holstein Friesian-25% Deshi (75% HF) , 50% Sahiwal-50% Deshi (50% SL) and Holstein Friesian-Sahiwal-Deshi (H-SL-D) cows were 39, 43, 39, 43, 08, 10 in numbers, respectively. Trait wise distributions of number of observations available in this study are presented in Table 1 & 2. Figure 1 shows the percentage of available cow, heifer, male calf, female calf and bull with genotypes which were 51.26, 11.27, 15.77, 20.56 and 1.13, respectively. The percentage of overall homebred and purchased cows were 46, 54 respectively but in case of crossbred cows only 42% were homebred. From figure 2, it can be seen that the 5-6 year-old crossbreds appeared to be higher in number. But in case of longevity 75% HF cows were higher in number where 8 out of 43 cows were more than 10 years old. Figure 3 shows the average calving parity of existing cow genotypes. Maximum number (07) of calving parity was found in case of both 50% HF and 75% HF cows. Figure 4 shows that most of the farmers (78%) preferred Holstein-Friesian breed to inseminate their cows followed by Sahiwal, RCC and Deshi breed. The most of calves (31%) were born in January i.e. the calving rate was highest in winter season (December, January, February) followed by summer season (March, July, November, June, September, October, August, May and April) (Figure 5). About 89% of cows are fed straw in chopped form and then mixing these with green grass. Most of the cows (72%) are fed concentrate feed twice per day; and 20 % cows are feed concentrate thrice per day.

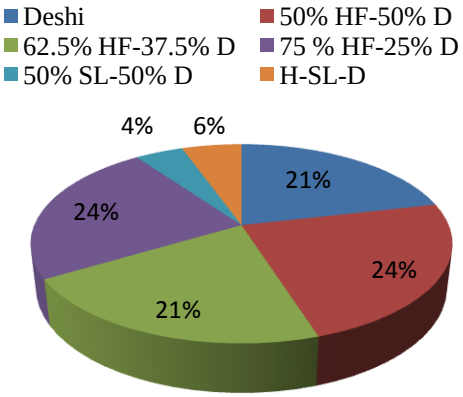

Figure 1
Availability of cow genotype in the study area

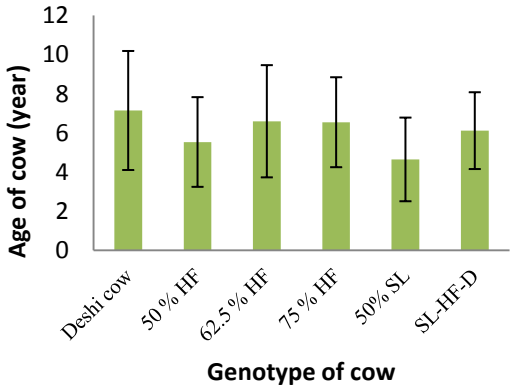

Figure 2
Average age of cows (mean±SD) in the study area.

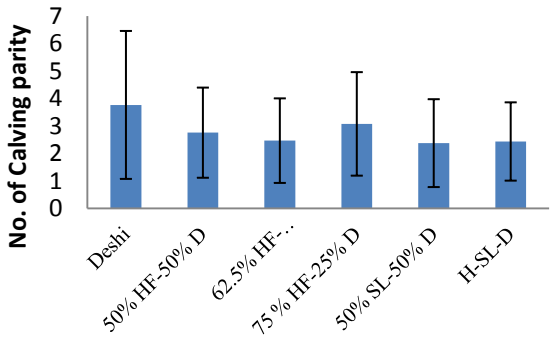

Figure 3
Average calving parity of cows (mean±SD) in the study area.

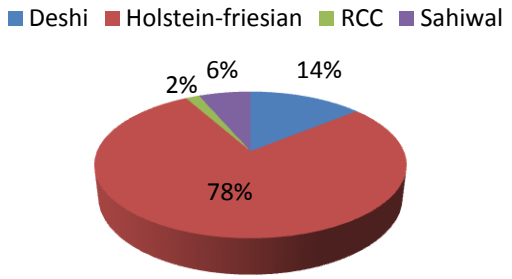

Figure 4
Percent preference of semen from bull by the farmers.

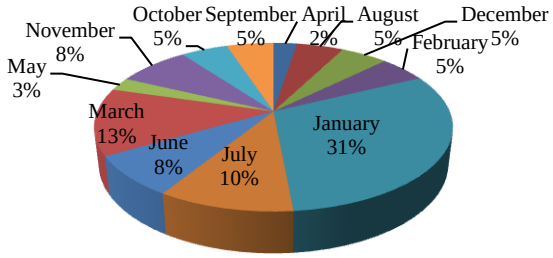

Figure 5
Percentage of calving in months of a year in the study area.

Amount of concentrate fed (kg/day) is presented in Table 1. A significant difference (P<0.001) was found on amount of concentrate feeding among the cow genotypes. Holstein-Friesian crossbred cows were fed on an average of 5.93±0.20 kg per day. Among the cows 75% HF were fed the highest amount (6.92 kg) of concentrate followed by H-SL-D, 62.5% HF, 50% HF, 50% SL and Deshi cows. On an average cows are fed green grass for 8.22 ± 3.97 months. In case of Holstein-Friesian crossbred it was 7.39 ± 3.98 months. Results showed that only 22.5 % farmers grow high yielding fodder for their cows. Majorities (68.0%) of the cows were artificially inseminated by using DLS produced semen and BAUAI Centre served 22.5% cows of the project area. Till 9.5% cow's especially Deshi cows were bred naturally. Due to the government policy other inseminators had no access to this studied area.

Daily milk yield of different genotypes of cows

The mean±SE (liter/day) for daily milk yield is presented in Table 1. The result revealed that there was a significant differences (P<0.001) among the different genotypes of cow for daily milk yield. H-SL-D had the highest daily milk production followed by 75% HF, 62.5% HF, 50% HF, 50% SL and Deshi cows. Daily milk yield of Deshi cow was 2.32±0.14 liters. Nearly similar result found 2.10±0.41, 2.38±0.73, 2.26±0.19, 2.36±0.2 and 2.28±2.15 liters from Kabir and Islam (2009), Rokonuzzaman et al. (2009), Faruk et al. (2007), Al-amin and Nahar, Ali et al. (2000) respectively. Alam et al. (2008) reported 1.63±0.72 liters, respectively; which are below the present study. Haque et al. (2002), Sultana et al. (2001) reported 2.50±0.30, 2.63±0.38, liters, respectively; which are above the present study. Molee et al. (2011) reported daily milk yield of < 80% HF crossbred was 11.84 liters, which nearly agrees with present study of 50% HF (10.07±0.54 liters), 62.5% HF (12.44±0.70 liters) and 75% HF (13.91±0.91 liters). These variations may be attributed to variation in quality and quantity of feed supplied and management level differences and the presence of higher proportion of selected elite cows that was considered in this study.

Peak daily milk yield

Peak daily milk yield (liter/day) of different genotypes of cow is presented in Table 1. Genotypes had highly significant (P<0.001) effect on this trait. The 75% HF had the highest peak daily milk yield followed by H-SL-D, 62.5% HF, 50% HF, 50% SL and Deshi cows.

Lactation length

Lactation length (day) of different genotypes of cow is presented in Table 1. There was a significant difference (P<0.001) among the cow genotypes on this trait. The 50% HF had longest lactation length (310.43 days) followed by 75% HF, H-SL-D, 62.5% HF, 50% SL and Deshi cows. The lactation length of Deshi cow is 242.73±8.89 days found in the present study which is similar to Sultana (241.18±10.53 days) in 1995. Haque et al. (2002) found 235.40±6.95 and 250.60±4.50 days, respectively; which are nearly similar to present study. Kabir and Islam (2009), Rokonuzzaman et al. (2009), Alam et al. (2008), Al-amin and Nahar (2007), Qureshi et al. (2002), Islam et al. (2002), Sultana et al. (2001), found 170.0±22.36, 227.8±32.50, 217.9, 225.50±6.10, 149.8, 230.62±30.68, 221.00±17.65, 220.21±21.69 days, respectively; which are below the present findings (242.73±8.89 days). Overall lactation length of HF crossbred cows from the present study was 300.19±8.06 days, which is nearly similar with 295.0±33.96, 287.47±10.20 days from Kabir and Islam (2009) and Sultana et al. (2001).

Dry period

Table 1 shows the dry period (days) of different genotypes of cows. A significant difference (P<0.001) was found in different cow genotypes on this trait. The observed shortest dry period (days) was found in 75% HF cows followed by 62.5% HF, 50% HF, H-SL-D, 50% SL and Deshi cows. Dry period of Deshi cows found in present study is 148.64±9.22 days. Qureshi et al. (2002) and Ali et al. (2000) found 152.6, and 141.38±21.61 days, respectively; which is nearly similar to present study. Rokonuzzaman et al. (2009) and Islam et al. (2002) found 197.4±52.28, 170.00±68.89 days in Deshi genotype, which is higher than the present study (148.64±9.22 days). This variation might be due to difference in genotypes and the management practices.

Age at first heat

Age at first heat (mean ± SE) of different cow genotypes is presented in the Table 2. A significant difference (P<0.01) was found among cow genotypes on this trait. The shortest average age at first heat was found in 75% HF (24.23±2.07months) cows followed by H-SL-D, 50% HF, 62.5% HF, Deshi and 50% SL cows25.00±5.57, 25.29±1.58, 29.60±2.90, 32.00±0.65, 33.00±1.34 months, respectively. The mean age at first heat of Deshi heifers of this present study (32.00±0.65 months) is higher value than the findings of Alam et al. (2008), Faruk et al. (2007), Qureshi et al. (2002), Sultana et al. (2001); and lower value from the reporting of Al-amin and Nahar (2007). From the present study, a significant difference (P<0.01) among the different grades of Holstein-Friesian heifers was observed.

Age at first service

Age at first service (months) is presented in the Table 2. There was a significant difference (P<0.01) among the cow genotypes on this trait. The shorted length of age at first heat was found in 75% HF (25.86±2.01 months) followed by 50% HF, 62.5% HF, Deshi and 50% SL cows having 26.10±1.55, 26.10±1.55, 32.31±0.73and 33.17±1.42 months, respectively. There is a difference between age at first heat and age at first service that indicates farmers' are intentionally escaping to serve at first at least for one estrous.

Age at first calving

Table 2 shows the age at first calving (months) of different cow genotypes. There is no significant difference (P>0.05) among the cows for this trait. The mean value for crossbred and Deshi cows were 37.6±1.20 and 41.13 ± 0.72 months, respectively. The present study reveals the age at first calving of Deshi cows is 41.13 ± 0.72 months which is nearly similar to the findings of 40.48±4.54 months from Rokonuzzaman et al. (2009); 40.03±3.54 months from Islam et al. (2002); 37.6±1.13, 36.85±2.87 months from the findings of Faruk et al. (2007) where Ali et al. (2000) reported lower value than the present study.

Table 1
The production and reproduction performance traits of cows (Mean±SE).

Genotype	Daily milk yield (liter/day)	Peak daily milk yield (liter/day)	Lactation length (day)	Dry period (days)	Concentrate feeding (kg/day)
Deshi	2.32^{a}±0.14	3.60^{a}±0.22	242.73^{a}±8.89	148.64^{d}±9.22	0.83^{a}±0.10
50% HF-50% D	10.07^{b}±0.54	12.51^{b}±0.53	310.43^{b}±14.77	92.95^{ab}±11.15	5.35^{b}±0.29
62.5% HF-37.5% D	12.44^{bc}±0.70	15.29^{bc}±0.70	283.85^{ab}±16.24	74.48^{ab}±8.31	5.51^{b}±0.36
75 % HF-25% D	13.91^{c}±0.91	17.61^{c}±0.89	306.09^{b}±11.41	54.90^{a}±3.05	6.92^{c}±0.36
50% SL-50% D	3.21^{a}±0.36	4.75^{a}±0.53	255.00^{ab}±18.57	140.00^{cd}±20.00	1.27^{a}±0.24
H-SL-D	15.06^{c}±3.00	16.71^{c}±3.11	290.00^{ab}±22.80	104.00^{bc}±27.13	6.11^{bc}±0.87
Holstein crossbred	12.29±0.46	15.20±0.47	300.19±8.06	71.56±4.54	5.93±0.20
Overall Mean ± S.E	9.50±0.53	10.18±3.79	282.50±6.24	96.66±5.22	4.76±0.22
Level of significance	***	***	***	***	***

In parenthesis observation numbers are given
NS= Non-significant , *** P< 0.001
Means with the same letter are not significantly different

Table 2
The production and reproduction performance traits of cows (Mean±SE).

Genotype	Age at first heat	Age at first service	Age at first calving (months)	Calving interval (months)	Post-partum heat period (day)	Services per conception
Deshi	32.00^{ab}±0.65	32.31^{ab}±0.73	41.13 ± 0.72	13.47±0.19	108.08^{b}±7.16	1.21±0.06
50% HF-50% D	25.29^{a}±1.58	26.10^{a}±1.55	36.43 ± 1.83	13.70±0.40	93.72^{a}±5.66	1.54±0.14
62.5% HF-37.5% D	29.60^{ab}±2.90	31.60^{ab}±2.80	41.00 ± 2.82	13.14±0.36	94.38^{a}±7.87	1.34±0.10
75 % HF-25% D	24.23^{a}±2.07	25.86^{a}±2.01	36.63 ± 2.29	13.31±0.27	88.95^{a}±6.89	1.40±0.10
50% SL-50% D	33.00^{b}±1.34	33.17^{b}±1.42	41.40 ± 1.47	14.17±0.48	134.63^{b}±16.27	1.38±0.18
H-SL-D	25.00^{a}±5.57	26.14 ^{a}±0.93	35.00 ± 5.69	13.89±1.09	120.00^{ab}±28.72	1.70±0.21
Holstein crossbred	26.27±1.37	29.56 ^{a}±2.46	37.6±1.20	13.41±0.19	95.64±4.10	1.44±0.06
Overall Mean ± S.E	28.14±0.85	29.24±0.82	38.87 ± 0.86	13.43±0.14	98.65±3.57	1.37±0.05
Level of significance	**	**	NS	NS	NS	NS

In parenthesis observation numbers are given
NS= Non-significant, ** P<0.0l
Means with the same letter are not significantly different

Calving interval

Calving interval (months) of the studied cows are presented in Table 2. There was no significant difference (P>0.05) among the genotypes of cows. But the shortest calving interval (13.14±0.36 months) was found in case of 62.5% HF cows followed by 75% HF, Deshi, 50% HF, H-SL-D and 50% SL cows, respectively. Calving interval of Deshi cow was 13.47±0.19 months (404 days). Al-amin and Nahar (2007), Qureshi et al. (2002), Islam et al. (2002) reported calving interval 415.00±5.00, 418, 418.78±36.74 days of Deshi cows respectively, which are more or less similar to present study. Kabir and Islam (2009), Alam et al. (2008), Faruk et al. (2007), Haque et al. (2002), Sultana et al. (2001) and Ali et al. (2000) found calving interval to be 464.0±34.35 days, 494.8 days, 15.4±0.75 months, 15.50±0.20 months, 472.67±30.87 days, 539.40±128.10 days, respectively; which are above the present study.

Mohamed-Khair et al. (2007) reported calving interval of 50%, 62.5%, 75% of zebu x Friesian cows were 394.60±16.33, 382.40±17.52 and 367.85±21.38 days, respectively; which are below the present study of 50% HF (13.70±0.40 months or 411 days), 62.5% HF (13.14±0.36 months or 394.2 days), 75 % HF (13.31±0.27 months or 399.3 days). Qureshi et al. (2002) found 390 days calving interval from 50 to 75% HF crossbred cows, which is nearly similar to the present study.

Post-partum heat period

Post-partum heat period (days) is presented in Table 2. No significant difference (P>0.084) is found for cow genotypes on this trait. The shortest post-partum heat period was found in 75% HF (88.95±6.89 days) cows followed by 50% HF, 62.5% HF, Deshi, H-SL-D, 50% SL cows, respectively. Islam et al. (2002) found PPHP of Deshi cows was 108.46±36.32 days, which is similar to present study (108.08±7.16 days). Ali et al. (2000) and Faruk et al. (2007) also found nearly similar result (103.83±18.54 and 102.0±8.77 days, respectively). Sarder et al. (1997) found slightly higher value (116±41 days) compared to present observation. The variation may be caused by various genetic, environmental, daily milk yields, physiologic and metabolic factors such as breed, nutritional status, lactation length, suckling frequency and milk production.

Services per conception

Number of services per conception is presented in Table 2. There is no significant differences (P>0.05) among the cow genotypes. The lowest number of services per conception found in Deshi cows (1.21±0.06) followed by 62.5% HF, 50% SL, 75% HF, 50% HF and H-SL-D cows, respectively. Rokonuzzaman et al. (2009), Kabir and Islam (2009), Alam et al. (2008), Faruk et al. (2007), Al-amin and Nahar (2007), Qureshi et al. (2002), Haque et al. (2002), Islam et al. (2002), Sultana et al. (2001), Ali et al. (2000) found 1.92±0.91, 2.0±0.70, 1.3, 1.32±0.13, 1.8±0.14, 2.0, 1.30±0.10, 1.41±0.56, 1.69±0.55, 1.98±0.58 numbers of services per conception, respectively; the present study (1.21±0.06) is nearly similar with Alam et al. (2008), Faruk et al. (2007), Qureshi et al. (2002), Haque et al. (2002). These variations may be due to inaccurate insemination techniques, improper heat detection, using low quality semen for artificial insemination and poor fertility of cows.

CONCLUSION

The present study concludes that the performance of available selected dairy genotypes both Deshi and crossbreds were favorable for the production of meritorious and clean young seed bulls.

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