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Selection of Black Bengal buck based on fertility and field progeny performance

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Abstract

This study was aimed for selection of Black Bengal bucks based on their fertility and the performance of their progeny in field condition. Data on buck were collected from a nucleus breeding flock and on progeny at field level. The traits considered were birth weight, weight at every 3-m interval up to 12 m of age. Average daily gain (g/day) on 90 progeny produced from 10 bucks and semen parameters on these bucks were collected. Heritability estimates obtained for birth weight, 3, 6, 9 and 12-m weights and average daily gain of progeny were found to be 0.41±0.08, 0.49±0.07, 0.46±0.08, 0.48±0.28, 0.50±0.09 and 0.49±0.06, respectively. The high heritability estimates of body weights indicated that there is a good opportunity for genetic improvement of this trait in a selection scheme. Heritability estimates obtained for semen volume, sperm concentration, sperm motility, sperm livability and normal sperm were 0.11±0.04, 0.25±0.07, 0.13±0.08, 0.12±0.08 and 0.06±0.03, respectively. The highest non return rate was observed in bucks of 32, 52 and 57 (66.67±6.75%). The lowest was found in buck 48 (41.67±5.65%). Among 10 bucks, first 3 top buck IDs were 52, 57 and 54 on the basis of BV at birth weight. Selection index of bucks for all traits was calculated and bucks were ranked accordingly. The highest selection index of three bucks ID were 52, 7 and 4 (1009.39, 934.595 and 865.808, respectively). It can be concluded that these top ranking three bucks can be selected and conserved for production and preservation of frozen semen for long term use.

Key words: Black Bengal, breeding buck, fertility, progeny performance

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Introduction

Goats are socio-economically important in developing countries, ensuring food and providing income to small households (Sahlu and Goetsch 2005). More than 90% of the goat population is in developing countries where goat meat and meat products are considered as one of the most important sources of income (Fahmy and Shrestha, 2000). In the livestock sector Black Bengal goat is the only recognized breed amongst the domestic species available in Bangladesh. Black Bengal goat is a dwarf breed and famous for high fertility, prolificacy, superior chevon quality, best quality skin, early sexual maturity, resistance against common diseases, seasonality, low kidding interval and very good adaptability (Husain 1993). For the better propagation of the species of goat, there should have good breeding buck. However,, there is severe shortfall of stud bucks all over the country, especially in the rural areas, where more than 80% goats are being reared by the farmers. Same bucks have been used generation after generation which has created greater chance of increasing inbreeding hence lower reproductive performances along with disseminating of various venereal and infectious diseases (Hussain 2007). More than 70% farmers faced severe shortage of breeding bucks for serving their does in the above district which ultimately represent the overall situation of the country (Khandoker et al. 2011). In order to improve the genetic make-up of goats it is important to study the reproductive efficiency as this will enhance proper selection of proven bucks. Among the reproductive traits, semen quality plays a major role in determining fertility and reproductive efficiency of livestock production (Moussa 1997). The quality of semen in relation to fertility is determined by the volume of ejaculate, sperm concentration, sperm motility and percentage of live and normal spermatozoa.

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On the other hand, about 10-15% of the total variations in the male fertility on the basis of non-return rate (NRR) are due to sperm motility (Christensen et al. 1999). Heritability estimates of traits are important because the estimates will determine if genetic selection is possible and the speed at which progress can be made through selection. Ranking seed stock animals on their selection index value sorts them based on their progeny's expected profitability for the targeted production system. In view of all these situations, present study was undertaken to evaluate the Black Bengal bucks based on the growth performance of their progeny in field condition, to evaluate the semen quality and the fertility level of bucks in respect of NRR. Along with that, to estimate heritability for growth performances of progeny and semen parameters of bucks, to predict breeding values of bucks for progeny growth performance and to calculate the selection index for evaluation of breeding bucks.

Materials and Methods

The data used in the present study were collected during the period from 2006 to 2010. Black Bengal progeny were reared in Dimla (Nilphamari) at farmer's house with a joint work with Mennonite Central Committee (MCC). Black Bengal breeding bucks were reared at the artificial insemination Center under the Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh. A total of 90 Black Bengal progeny of 10 Black Bengal bucks were used in this study.

All breeding bucks used for frozen semen production were managed and raised under confinement as an intensive system and the does were reared semi-intensively. Semen was collected by artificial vagina method. The volume (ml), sperm concentration (billion/ml), mass motility (%), percentage of live and percentage of normal sperm were recorded. With the help of graduated collection vial the volume of semen was measured directly. Mass motility of sperm and sperm concentration were determined by hemacytometer method according to Herman and Madden (1963).

Semen with motility of more than 60% was diluted with freezing extenders egg yolk citrate diluter and loaded in 0.5 ml straws and ends of the straws were sealed with polyvinyl chloride powder. The straws were placed in the refrigerator at 4-5°C for 3 hours. The motility of the equilibrated sperm was checked and only samples with more than 60-70% were used for freezing. After equilibration the straws were placed horizontally on a rack and transferred to the freezer to be frozen in vapor 15-20 cm above the liquid nitrogen. After 30 minutes, the frozen straws were transferred into the canister within the liquid nitrogen containers at -196°C until use for artificial insemination. After 24 hours, straws were retrieved from the LN containers using forceps and thawed in water bath at 37°C for 10 seconds. The straws were wiped and cut near the cotton plug end. A drop of thawed semen was placed on a previously warmed (37°C) slide and the post-thaw motility was estimated under microscope. Artificial insemination with frozen semen was performed by the AI technicians of Monga Mitigation project of MCC in the area of Dimla Upazila of Nilphamari district. Each insemination dose contains 100 million motile spermatozoa in a 0.5 ml straw and double insemination was performed after 24 hours and within 48 hours of heat detection.

NRR means the proportion of does not seen to come back into estrus within a specified period after breeding and thus considered to be pregnant. So, the NRR can be defined as the number of does which are not represented for subsequent insemination within a specified period such as 25 days. The NRR of all breeding bucks was recorded as the percentage. All the recorded data of progeny growth performance and semen parameters of individual buck were analyzed for mean with standard error using SPSS 11.5. Duncan's test was also performed to identify the significant differences between the mean values. Heritability was estimated with Residual Maximum Likelihood (REML) procedure fitting and animal model using VCF 5 soft ware (Groeneveld et al. 1998).

The percentages of NRR of all breeding bucks were calculated by using SPSS 11.5. Breeding value of animals for the traits was estimated using Best Linear Unbiased Prediction (BLUP) method. In a selection index, each item of phenotypic information is normally expressed as a deviation from a contemporary group mean. This accounts for environmental differences between contemporary groups. A simple example of an index follows the following form:

$$Index = h_1^2 b_1 x_1 + h_2^2 b_2 x_2$$

where, h^2's are heritability of traits; b's are weighting factors; x's are a single type of phenotypic performance or records; for example, weaning weight or type of birth and rearing.

Deep frozen semen from 10 Black Bengal breeding bucks was used as sire line in the present study. In this study, bucks were ranked according to the predicted breeding values calculated using their progeny growth performance; the semen characteristics, NRR and finally the selection index of bucks.

Results

Means with standard errors of progeny growth performance of individual Black Bengal breeding bucks and their average daily gain (ADG) up to 6-m are presented in Table 1. Variation in body weights of the progeny of selected 10 bucks were found significant at birth to 6-m of age. Birth weight of the progeny of different bucks varied significantly ($p<0.01$). At birth, the highest body weight (1.54±0.12) was observed of the progeny of buck number 52 where the lowest (0.98±0.06) was found of the progeny of buck number 3. Body weights of the progeny of different bucks varied significantly ($p<0.05$) at 3 and 6-m of age and the highest weight was also observed of the progeny of buck number 52. At 9 and 12-m of age, average body weight of the progeny differed non-significantly in most of the cases where the highest weight observed of the progeny of buck number 52 and 7 respectively. It was found that birth weights of the progeny of buck number 48, 57, 7 and 4 were higher compared to others. The ADG of the progeny of individual breeding buck differed significantly ($p<0.05$). It was observed that the highest body weight (51.48±8.96 g/day) attained by the progeny of buck number 52 and the lowest value (33.05±3.09 g/day) were observed in buck number 3.

Means values of progeny growth performance in both sexes are compared and their mean values of ADG up to 6-m are presented in Table 2. Variation in body weights of the progeny of selected 10 bucks were found significant at birth to 6-m of age. Birth weight of the progeny of different bucks varied significantly ($p<0.01$). At birth, the highest body weight (1.54±0.12) was observed of the progeny of buck number 52 where the lowest (0.98±0.06) was found of the progeny of buck number 3. Body weights of the progeny of different bucks varied significantly ($p<0.05$) at 3 and 6-m of age and the highest weight was also observed of the progeny of buck number 52. At 9 and 12-m of age, average body weight of the progeny differed non-significantly in most of the cases where the highest weight observed of the progeny of buck number 52 and 7 respectively. From this table it is found that birth weights of the progeny of buck number 48, 57, 7 and 4 is higher compared to others.

Table 1. Progeny growth performance of individual Black Bengal breeding bucks (means with standard errors)

Factors	Progeny body weights (kg) and ADG(g/d)					
Buck No.	Birth	3-m	6-m	9-m	12-m	ADG(0-6 m)
3	0.98^{d}±0.06 (17)	4.67^{b}±0.39 (13)	7.06^{bc}±0.63 (11)	10.57^{abc}±0.88 (9)	14.59^{ab}±1.16 (9)	33.05^{b}±3.09 (11)
4	1.18^{cd}±0.08 (10)	6.00^{ab} ±0.44 (10)	9.02^{abc}±0.66(10)	12.17^{abc} ±0.88(9)	15.41^{abc} ±1.16(9)	43.65^{bc}±3.35 (10)
7	1.07^{cd}±0.11 (5)	5.66^{ab}±0.69(4)	10.05^{ab}±1.04 (4)	13.88^{ab}±1.32 (4)	18.66^{a}±1.74 (4)	49.76^{a}±6.18 (4)
11	1.06^{cd}±0.09 (8)	5.39^{ab}±0.57 (6)	8.82^{abc}±0.93 (5)	10.97^{abc}±1.18 (5)	13.43^{ab}±1.56 (5)	42.17^{ab}±6.59 (5)
32	0.99^{d} ±0.07 (12)	4.78^{b}±0.40 (12)	7.05^{bc}±0.63 (11)	9.72^{c}±0.83 (10)	13.14^{ab}±1.16 (9)	33.73^{b}±3.69 (11)
48	1.17^{cd} ±0.08 (10)	6.68^{a}±0.57 (6)	8.84^{abc}±0.85(6)	11.24^{abc}±1.07 (6)	12.92^{b}±1.56 (5)	41.62^{ab}±4.14 (6)
52	1.54^{a}±0.12 (4)	6.74^{a}±0.69 (4)	10.81^{a}±1.19 (3)	14.32^{a}±1.52 (3)	15.71^{ab}±2.01 (3)	51.48^{a}±8.96 (3)
54	1.29^{abc}±0.11 (5)	5.19^{ab}±0.69 (4)	7.30^{bc}±1.19 (3)	10.10^{bc}±1.86 (2)	12.53^{b}±2.47 (2)	32.68^{b}±3.42 (3)
57	1.46^{ab} ±0.09 (6)	5.97^{ab}± 0.62 (5)	8.22^{abc}±0.93 (5)	9.66^{c}±1.18 (5)	11.28^{b}±1.56 (5)	37.56^{ab}±3.64 (5)
61	1.20^{bcd} ±0.07 (13)	4.89^{ab}±0.46 (9)	6.88^{c}±1.04 (4)	8.97^{c}±1.32 (4)	12.11^{b}±2.47 (2)	31.48^{b}±0.87 (4)
Sig. level	**	*	*	NS	NS	*

*Means with different superscripts in the same column differed significantly; *(p<0.05); ** (p<0.01); NS, non-significant*

Table 2. Progeny growth performance of individual Black Bengal breeding bucks according to sex (means with standard errors)

Factors	Body weights (kg) and ADG(g/d) of progeny						
Buck No.	Sex	Birth	3-m	6-m	9-m	12 -m	ADG (0-6-m)
3	M	1.00±0.06 (10)	4.57±0.34 (7)	7.85±.63 (5)	12.96^{a}±0.76 (4)	17.19±1.72 (4)	36.49±3.30 (5)
	F	0.94±0.09 (7)	4.79±0.87 (6)	6.41±0.97 (6)	8.87^{b}±1.18 (5)	12.51±1.90 (5)	30.18±4.91 (6)
	Sig	NS	NS	NS	*	NS	NS
4	M	1.09±.09 (5)	5.69±.82 (5)	9.31±1.26 (5)	14.31^{a}±1.13 (4)	18.61^{a}±1.76 (4)	45.62±6.65 (5)
	F	1.27±.04 (5)	6.30±.28 (5)	8.74±.42 (5)	10.46^{b}±0.68 (5)	12.85^{b}±1.02 (5)	41.68±2.04 (5)
	Sig	NS	NS	NS	*	*	NS
7	M	1.07±.09(5)	5.66±.69(4)	10.05 ±1.17 (4)	13.87±1.56 (4)	18.67±1.59 (4)	49.76±6.15 (4)
11	M	0.93±.08 (2)	5.12±0 (1)	10.20±0 (1)	14.38±0(1)	19.62^{a}±0.08 (1)	51.11±0 (1)
	F	1.10±0.13 (6)	5.45±0.79 (5)	8.48±1.21(4)	10.11±1.0 (4)	11.88^{b}±1.95 (4)	39.93±8.01 (4)
	Sig	NS	NS	NS	NS	*	NS
32	M	0.97±.13 (6)	4.89±0.99 (6)	7.78±1.0 (6)	10.9±1.61 (6)	15.45^{a}±1.46 (5)	37.87±4.93 (6)
	F	1.0±.11 (6)	4.67±0.47 (6)	6.18±0.92 (5)	7.94±1.18 (4)	10.25^{b}±0.57 (4)	28.77±5.22 (5)
	Sig	NS	NS	NS	NS	*	NS
48	M	1.19±0.13 (6)	6.09±0.42 (4)	8.7±1.06 (4)	11.22±0.75 (4)	12.97±1.03 (3)	41.32±5.82 (4)
	F	1.14±0.23 (4)	8.05±.95 (2)	9.13±1.33 (2)	11.27±1.27 (2)	12.85±0.85 (2)	42.19±7.30 (2)
	Sig	NS	NS	NS	NS	NS	NS
52	M	1.55±0 (1)	7.54±0 (1)	13.88±0 (1)	18.12±0 (1)	19.60±0 (1)	68.50±0 (1)
	F	1.54±0.01 (3)	6.40±.23 (3)	9.27±0.87 (2)	12.42±0.92 (2)	13.77±0.73 (2)	42.97±4.91 (2)
	Sig	NS	NS	NS	NS	NS	NS
54	M	1.54±0 (1)	6.06±0 (1)	8.56±0 (1)	10.10±0 (1)	13.20±0 (1)	39.22±0 (1)
	F	1.37±.08 (2)	4.9±0.35 (3)	6.67±0.39 (2)	10.10±.0 (1)	11.86±.0 (1)	29.42±1.75 (2)
	Sig	NS	NS	NS	-	-	NS
57	M	1.37±.09 (2)	5.31±0 (1)	7.94±0 (1)	9.98±0 (1)	10.40±0 (1)	37.00±0 (1)
	F	1.51±.08 (4)	6.14±.73 (4)	8.29±0.84 (4)	9.58±0.79 (4)	11.50±0.59 (4)	37.70±4.70 (4)
	Sig	NS	NS	NS	NS	NS	NS
61	M	1.24±0.11 (6)	4.84±0.38 (1)	6.88±0.27 (4)	8.99±0.31 (4)	12.11±0.51 (2)	31.48±0.86 (4)
	F	1.17±.06 (7)	4.95±.44 (4)	-	-	-	-
	Sig	NS	NS	-	-	-	-

*Means with different superscripts in the same column differed significantly; *(p<0.05); ** (p<0.01); NS, non-significant*

Table 3. Semen characteristics of individual Black Bengal breeding bucks (means with standard errors)

Buck No.	Semen characteristics				
	Semen volume (ml)	Sperm concentration (10^9 cells/ml)	Mass motility (%)	Sperm livability (%)	Normal spermatozoa (%)
3	0.42^{bcd}±0.02	2.34^{de}±0.09	77.09^{bcd}±1.24	83.77^{bcd}±1.21	87.86^{abcd}±1.26
4	0.43^{bcd}±0.03	2.53^{bc}±0.06	75.52^{de}±1.23	82.56^{cde}±1.10	86.55^{cd}±1.10
7	0.39^{cd}±0.03	2.11^{f}±0.09	68.77^{f}±1.57	80.38^{ef}±2.16	86.95^{bcd}±1.26
11	0.49^{ab}±0.04	2.69^{a}±0.08	78.67^{abc}±0.67	87.79^{a}±1.15	90.59^{a}±1.18
32	0.53^{a}±0.03	2.62^{ab}±0.04	80.82^{a}±0.52	86.84^{ab}±0.65	90.29^{a}±0.52
48	0.37^{d}±0.02	2.22^{ef}±0.05	73.31^{e}±0.83	78.64^{f}±0.92	85.53^{d}±1.01
52	0.50^{ab}±0.02	2.39^{cd}±0.04	79.13^{abc}±0.61	85.45^{abc}±0.82	89.98^{a}±0.59
54	0.48^{ab}±0.02	2.35^{de}±0.03	77.00^{bcd}±0.78	81.76^{de}±0.79	88.02^{abcd}±0.83
57	0.45^{abc}±0.02	2.44^{cd}±0.03	79.56^{ab}±0.75	87.17^{a}±0.91	89.49^{ab}±0.71
61	0.46^{abc}±0.01	2.37^{cde}±0.03	76.67^{cd}±0.68	85.20^{abc}±0.92	89.26^{abc}±0.72
Sig	**	**	**	**	**

*Means with different superscripts in the same column differed significantly (**, p<0.01)*

Table 4: Heritability (h^2) of body weights and ADG of progeny and different semen parameters of bucks

Growth performance		Semen characteristics	
Age	h^2±SE	Characters	h^2±SE
Birth	0.41±0.08	Semen volume	0.11±04
3-m	0.49 ±0.07	Sperm concentration	0.25±0.07
6-m	0.46±0.08	Mass motility	0.13±0.08
9-m	0.48±0.28	Sperm livability	0.12±0.08
12-m	0.50±0.09	Normal spermatozoa	0.06±0.03
ADG (0-6 m)	0.49±0.06	-	-

The ADG of the progeny of individual breeding buck differed significantly ($p<0.05$). The highest body weight (51.48±8.96 g/day) attained by the progeny of buck number 52 and the lowest value (33.05±3.09 g/day) were observed in buck number 3. Progeny growth performance in both sexes are compared and their mean values of ADG up to 6-m are presented in Table 2.

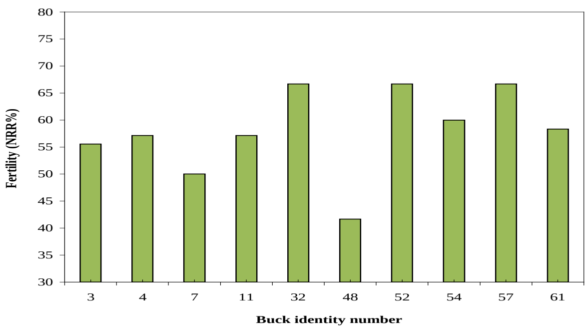

Figure 1. *NRR % of different bucks*

No significant variation was found in body weight between male and female progeny at 3 and 6 m of age. Body weight of the male and female progeny of buck number 3 and 4 differed significantly ($p<0.05$) at 9-m of age and the same result was observed in the progeny of buck number 4, 11 and 32 at 12-m of age. There have little variation in body weight between male and female progeny of buck number 48, 52, 54 and 57 at 9 and 12-m of age and it was observed that male progeny of most of the bucks weighted heavier than the female progeny at 12-m of age. The ADG of male progeny of all bucks was found higher than that of female progeny and it varied non-significantly. The highest ADG (68.50±0 g/day) was obtained by the male progeny of buck number 52 where as the lowest (28.77±5.22 g/day) was recorded in the female progeny of buck number 32.

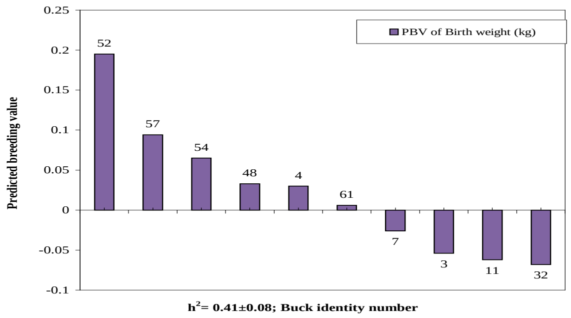

Figure 2(a). *Predicted breeding values of bucks based on progeny birth weight*

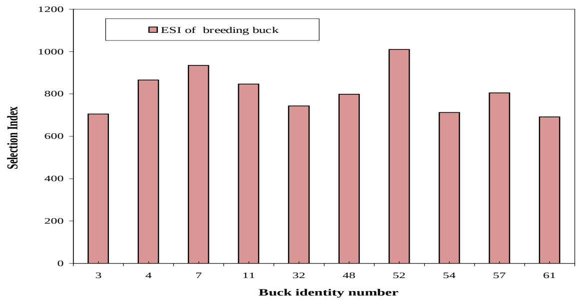

***Figure 2** (b). Predicted breeding values of bucks based on progeny body weight after 6-m of age*

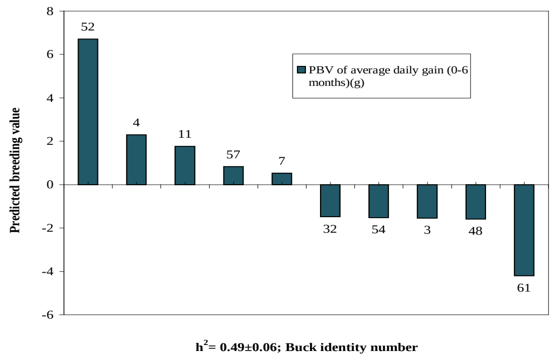

***Figure 2** (c). Predicted breeding values of bucks based on ADG (g) (0-6-m)*

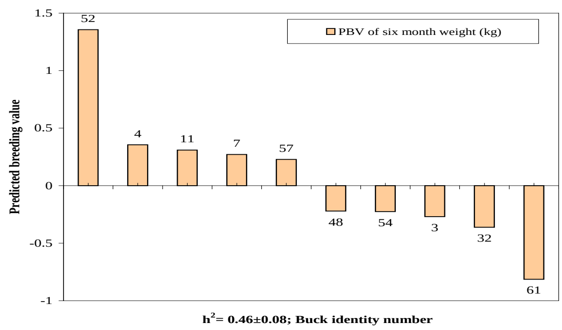

Figure 2 (d). *Selection Index of different bucks*

In order to predict the fertility of respective bucks, different parameters of semen - semen volume, sperm concentration and percentage of mass motility, sperm livability and normal spermatozoa is summarized in Table 3. Variation of semen volume among different bucks was found highly significant ($p<0.01$) where the highest volume (0.53±0.03 ml) obtained from buck number 32 and the lowest (0.37±0.02 ml) from buck number 48. Significant ($p<0.05$) variation of semen production was also found between buck number 7 and 54 but the remaining bucks differed non-significantly in terms of semen production. Differences of sperm concentration (10^9 cells/ml) among different bucks were found highly significant ($p<0.01$). The highest sperm concentration (2.69±0.08) was found in the semen of buck number 11 and the lowest (2.11±0.09) was in buck number 7. Sperm concentration of buck number 4 and 32 found significantly ($p<0.01$) higher than that of the remaining bucks. In case of mass motility of the spermatozoa of different bucks, it was found significant ($p<0.01$) variation. The highest per cent of mass motility (80.82±0.52) was observed in the sperm of buck number 32 where as the lowest per cent (68.77±1.57) was found in buck number 7. Mass motility of the sperm of buck number 3, 11, 52, 54 and 57 significantly higher than that of buck number 4, 48 and 61. Sperm livability (%) differed significantly among different bucks. Buck number 11, 32, 52, 57 and 61 produced significantly higher per cent of live sperm than that of buck no 4, 7, 48 and 54. The highest per cent of live- sperm was produced from buck number 11 where as the lowest from buck number 48.Highly significant ($p<0.01$) variation was found among the percent of normal spermatozoa produced from different bucks. The highest (90.59±1.18) per cent of normal spermatozoa was found in the semen of buck number 11 and lowest (85.53±1.01) from buck number 48.

Heritability (h^2) estimates ranged from 0.41±0.08 to 0.50±0.09 showed good findings in heritability for growth traits. For all semen parameters, the values of heritability were very low and ranged from 0.06±0.03 to 0.25±0.07. Estimates of heritability with standard errors of body weights at different ages of Black Bengal progeny and semen parameters of breeding bucks are given in Table 4.

The NRR was estimated to evaluate the fertility of the respective bucks. NRR of buck number 32, 52 and 57 was the highest and value was 66.67±6.75 % where as the lowest 41.67±5.65% of NRR observed in the buck number 48. NRR of other bucks were found almost similar. The NRR to first insemination is presented in Figure 1. The heritability of body weights at different ages of Black Bengal progeny and semen parameters of breeding bucks is shown in Table 4.

Bucks of the present study were ranked according to their PBV estimated from progeny's growth performance as presented in Figures 2 (a, b, c). Predicted breeding value of the bucks for their progeny's birth weight ranged from -0.068 to 0.195. According to the predicted breeding value of 10 bucks, best one was buck number 52, followed by buck number 57, 54 and 48 for birth weight (Figure 2: a).

Predicted breeding value of bucks for body weight at 6-m of age of their progeny varied according to different bucks. According to the PBV of bucks for body weight at 6-m of age of their progeny buck number 52 ranked the highest in order, followed by buck number 4, 11 and 7. Buck number 61 ranked the lowest (Figure 2: b).

The Predicted breeding value (PBV) of bucks for ADG of their progeny ranged from -4.196 to +6.71. The highest breeding value of ADG was found in the progeny of buck number 52, followed by buck number 4, 11, 57 and 7. The lowest breeding value of ADG was found from the progeny of buck number 61, followed by buck number 48, 3, 54 and 32 (Figure 2: c).

Estimated selection index of the bucks for their progeny's birth weight, progeny ADG (0-6 m), different semen parameters and NRR of bucks ranged from 1009.39 to 691.59. According to the estimated selection index of 10 bucks, best one was buck number 52, followed by buck number 7, 4 and 11 in order of merit for all traits (Figure 2: d).

Discussion

Average birth weight of the progeny of selected bucks varied significantly from 0.99±0.07 to 1.54±0.12 kg and this results were in agreement with the findings of Saadullah (1988) who reported that the highest average birth weight was found in the South East Asian region (1.55±.07kg) and the lowest in near and Middle East (1.2kg). Rahman (2007), Alam (2006), and Amin et al. (2001) observed the birth weight of Black Bengal kids was 1.21±0.12, 1.18 and 1.03 kg respectively that are almost similar to the present observation. From the Table it is found that average body weight at 3-m of age is above 5.0 kg in most of the cases where as Rahman (2007) reported 4.25±0.25 at the same age. Haque (2004) conducted an experiment on Black Bengal goat and reported that over all body weight at 6-m of age was 8300±378.5 g where as from the present study it is found that body weight of the progeny at 6-m of age ranged from 6.88±1.04 to 10.81±1.19 kg. Mean values of the progeny body weight at 9-m of age varied from 8.97±1.32 to 14.32±1.52 kg that supports the findings of

Growth and subsequent production and reproduction traits are closely related to birth weight (Siddiqui et al. 1981). Average body weight of the progeny of all selected bucks was different and it might be due to both genetic and environmental factors. The ADG of the progeny of buck no 52 was the highest and there found a wide variation among the progeny of different bucks. A high plane of nutrition has a significant effect on growth rate (Devendra 1988). Weight of dam affects the weight gain of the kids very much and more obviously during the second and third month (Romagosa 1975). The male kids of most of the bucks were heavier than females from birth to 12-m of age, and the differences between the two sexes were significant only at 9 and 12-m of age among the kids of the buck no 3, 4, 11 and buck no 32. Sex had a significant effect on growth after weaning until mature age. The result was in agreement with the reports of Husain et al. (1996) and Akhter et al. (2000). In this study, male kids were heavier in most of the cases and grew faster from weaning to onward, implying that sex effects are more pronounced with age after weaning. These effects have been attributed to hormonal differences between sexes and their resultant effects on growth (Bell et al. 1970).

The average ejaculate volumes of different bucks are presented in Table 3. The highest volume was observed as 0.53±0.03 ml and the lowest was 0.37±0.02 ml. Variation of semen volume among different bucks was found highly significant ($p<0.01$). Das et al. (2006) reported that the average ejaculate volume to be 0.16 to 0.51 ml. The highest average coincides with the present study but the lowest volume is much lower. Singh et al. (l985) conducted an experiment with 12 ejaculates collected from 2 Black Bengal bucks and average ejaculate volume was 0.46 ml which also falls within the range of present findings. Afroz (2005) also observed the average ejaculate volume of Black Bengal buck was 0.43 to 0.45 ml that supports the present finding. But the observation of Khan (1999) does not match with the present study where they found average ejaculate volume ranged from 0.30-0.41 ml and 0.27 ml, respectively which is much lower. Buck no 32, 52, 11 and 54 produced comparatively higher volume of semen compared to others. This might be due to higher body weight, better nutrition and good genetic potentiality.

Sperm concentration of the observed buck ranged from (2.69±0.08) to (2.11±0.09) $\times 10^9$ cell/ml and found significant variation among bucks. Sperm concentration of the present study match with the findings of Biswas (2001), who reported that the sperm concentration of black Bengal buck was (2.39 to 2.65) $\times 10^9$/ml. Afroz (2005) observed sperm concentration of black Bengal buck was (2.43 to 2.85)$\times 10^9$/ml that also supports the present findings. Sperm concentration of buck no 11, 32, 4 and 52 was higher as compared to other bucks and this might be due to their better genetic potentiality.

Mass motility of sperm of selected bucks varied significantly where the highest (80.82±0.52) per cent of motile sperm found in the buck no 32. Mass motility of the sperm of buck no 52, 57 and 11 is near to the highest per cent. Das *et al.* (2006) reported that sperm motility to be 70.00±5.54 to 82.80±3.43% which coincides with the present study. Afroz (2005) observed the average sperm motility was 76.00±1.45 to 78.00±1.11% that supports the present study while Khan (1999) reported 85.78±1.40% of mass motility of Black Bengal sperm which is higher than the present observation. Estimation of motility is important to semen quality and it can be used as selection criteria of breeding bucks. Live spermatozoa of fresh semen varied from 78.64±0.92 to 87.79±1.15% which differed significantly among the bucks. This result is in agreement with the finding of Hossain (2007) who found 84.99±0.38 to 85.62±0.57% live spermatozoa in Black Bengal buck semen.

The average normal spermatozoa of buck semen ranged from 85.53±1.01 to 90.59±1.18% which is in agreement with the result of Singh et al. (1985) and Afroz (2005) who reported 91.07% and 89.72±0.35 to 91.16±0.36% normal sperm, respectively in Black Bengal buck semen. It is generally known that higher per cent of normal spermatozoa in buck semen attributes better fertility of the respective buck. The variation observed among the bucks in this respect might be due to age of the bucks, season, nutrition, and rhythm of collection (Salhab et al. 2003).

The estimated NNR of bucks as a measure of their fertility ranged from 41.67 to 66.67 showed in figure1. The result was in agreement with Nordstoga et al. (2010), who observed 64.3% NNR of Norwegian goats. In fertility studies of livestock there is a tendency to focus more on the female side with less emphasis on the male side. However, male fertility is as important as that of the female (Syrstad 1981). The NRR of bucks depends on the holistic semen characteristics of bucks, breeding soundness of bucks and appropriateness of time and site of semen deposition.

The genetic gain associated with the production performance in progeny comes through bucks because of their favorable reproductive differential and higher selection intensity. Therefore, the success of any breeding strategy depends on the identification of genetically superior bucks and their maximum utilization.

Breeding values of bucks for birth weight were ranged from -0.068 to 0.195. Van et al. (1993) reported an annual increase in birth weight of 0.023 kg per year in the Elsenburg Dormer stud, whilst increases in birth weight could be undesirable because, if they are excessive, they may result in negative consequences such as difficulties in lambing, and resultant parturient deaths. The mean annual breeding values of pre-weaning weight in the Ile de France breed increased from -0.3636 to 0.1203 kg between 1990 and 2007. Wide range of breeding values was found for birth weight so that selection of bucks for the next generation would lead to higher genetic improvement in Black Bengal bucks in this flock.

According to the PBV of bucks for progeny body weights after 6-m of age were ranked between -0.8139 to 1.3558 (Figure 2:b). El-Arian et al. (2008) showed that averaged breeding values for weaning weight increased at a rate of 0.3445 ± 0.02 kg per annum in the Ile de France breed, which translated a commendable increase of 1.21% per annum.

Breeding values of bucks for ADG were ranged from -0.4.196 to +6.711 showed in the Figure. Growth is influenced by the genes of the individual, environment provided by the dam, and other environmental effects (Albuquerque and Meyer, 2001). Growth between given ages vary from breed to breed and individual to individual and within a breed primarily due to the genetic differences (Mukundan et al. 1982). The potential genetic change is economically important for some characteristics of domestic animals such as growth which depends to a large degree of magnitude on the genetic variance. The growth potential of the kids is one of the most important traits in a genetic improvement scheme.

In this study, it was tried to rank the breeding bucks according to estimated selection index taken into the progeny birth weight, progeny average daily gain, semen parameters and NRR of bucks. Selection index of bucks for different traits ranged from 1009.39 to 691.595. Among 10 bucks, best one was buck number 52, followed by buck number 7, 4 and 11 in order for considering of multi traits.

Conclusion

In connection to fertility, semen quality and NRR are the important criteria for buck evaluation. Selection of superior bucks can aid in high quality progeny production. Buck evaluation is generally aimed at selecting first few top ranking bucks, although it depends on the selection intensity in the breeding program. The highest selection indexes of three bucks ID were 52, 7 and 4. It can be concluded that these top ranking three bucks can be selected and conserved for production and preservation of frozen semen for long term use.

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