

Morphometry and fertility performance of bucks used for breeding programme in Bangladesh

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Abstract

Context: Phenotypic characteristics of buck is a basic tools in animal husbandry due to selection criteria and economical profit.

Objectives: The present research was conducted to evaluate the phenotypic traits of 60 bucks at Private Exotic Buck Breeding Centres in Rajshahi city with its adjacent area and Goat improvement Farm, Rajabarihat, Rajshahi, Bangladesh.

Material and Methods: The experiment was conducted at private and government buck breeding centres of Rajshahi, Bangladesh during January, 2009 to October, 2010 to evaluate the phenotypic traits of 60 bucks, namely Jamunapari (n=9), Sirohi (n=15), Beetal (n=13), Crossbred (n=13) and Black Bengal (n=10) in relation to genotype and age. The data collected from the owners using pre-tested questionnaires analyzed with variance (ANOVA) and DMRT test.

Results: The average value of phenotypic traits of buck as body weight, height at wither, height at rump, body length, heart girth, age at puberty, scrotal circumference, testicular length, scrotal diameter, paired testicular volume, libido (scale:1-4), servicing performance (scale:1-3), time required servicing, ejaculate time, services per day (times), conception rate (CR) and non return rate(NRR) at 60 days were 48.41±2.0 kg, 86.13±1.7 cm, 86.57±2.7cm, 108.1±2.1cm, 84.81±1.2 cm, 6.35±0.20 month, 26.12±0.42 cm, 14.73±0.28 cm, 8.30±0.13, 415.5± 19.38 gm, 3.51±0.60, 2.65± 0.21, 2.53±0.14 minutes, 10.88±0.57 seconds, 2.36±0.27, 82.25±1.5% and 86.53± 0.81%, respectively. Genotype had significant effect (P<0.05) on all the phenotypic traits of buck except on libido and servicing performance. The overall phenotypic performance was better in >2 years aged group of buck.

Conclusion: The Private exotic buck breeding centre plays a vital role for improving of Black Bengal goat as well as Beetal, Sirohi and Jammunapari cross-bred goat that are suitable genotypes for meat and milk production in Rajshahi of Bangladesh.

Key words: Black Bengal, Jamunapari, Sirohi, Beetal, Buck, Phenotypic characteristics.

Introduction

Goat is numerically and economically important and promising animal resources in the developing countries especially in Asia and Africa (Husain, 1999). It is an important source of income for the poor people. Goats are raised by poor farmers and distressed women with little capital investment (FAO, 1999). Goats are used primarily for meat production. According to latest estimate made by DLS annual slaughter rate of goat is 38% against 16% for cattle. The meat production from goat was 72810 MT against total meat production. Goats rank first position in terms of total livestock population in Bangladesh (FAO, 2008). For rearing goats, a minimum investment of money is often required, even without specific arrangement of housing. Goat graze on barren and road-side land with grass and least home made supplies such as rice gruel, boiled rice, vegetables peels etc. In addition goats fed on jackfruit leaves, which often are available in most of the rearing areas. The higher demands for meat and especially for skin in the local as well as foreign markets focused the goat enterprise extremely prominent to the vulnerable group of people and the existing socio-economic condition of the country. Goat also have important role in generating employment, income, capital storage and improving household nutrition (Devendra, 1992; Husain, 1999).

Black Bengal goat in Bangladesh is famous for its high prolificacy, superior chevon, best quality skin and very good adaptability. Although they are reported to be slower growth, low milk production and higher kid mortality (Devendra and Burns, 1983). In many situations, milk-producing ability of Black Bengal is very poor, which is some times not even sufficient to meet the minimum requirement of suckling of kids (Husain, 1993). Goat has been recently recognized as a tool of poverty alleviation. Many of the rural landless and marginal farmer's

possess 1-5 goats/family (Hossain *et al.*, 2004). In some areas goats contribute up to 41% of the total income of the farm (Hossain, 1993). In developing countries, it has been suggested that breed selection are screening producer may be used for genetic improve of local breed (Bradford and Mayer, 1986). In livestock sector goat will be the prominent tool to produce quantity and quality products but for this, genetic improvement is needed.

Crossbred goats require low capital investment, less feed than cattle & buffalo, less expensive housing, suitable for rearing in urban area and can be handle easily any family member even by children and produce on an average 1 liter milk sufficient to meet the family requirement. This goat may be poor man cow more accurately family cow. The male goats can easily be used for mutton production. Chevon (Meat of goat) is highly accepted meat by all communities of people in Bangladesh and also the most expensive meat in the country. So rearing of crossbred goats will ensure production of quality food as well as income generation of poor people especially in the urban areas thus strengthening their food security. This is why crossbred goats are becoming popular in the urban areas in the country and even rural areas of the western part of the country. A preliminary study made under the research project "Mapping genes for economic traits of goats" run in the Department of Animal Breeding and Genetics, Bangladesh Agricultural University reveals that crossbred goats reared in the city of Rajshahi have more litter size and birth weight as well as growth rate as compared to pure Black Bengal goats. In addition, these crossbred goats produce on average 1.0 liter milk whereas Black Bengal goat does not produce any milk after suckling of kid (Faruque *et al.*, 2009; Hossain, 2011).

Rajshahi is an adjacent area of Indian border where there are available verities of high quality goat breed. A few buck keepers of boarder areas were interested to collect the exotic buck like

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Jamunapari, Sihohi and Beetal, Rajshahi etc. and they started servicing with Bengal goat. In the mean time the progenies of exotic were found better performance. So, the groups of people were interested to rear the crossbred goat for their meat and milk production. In addition, during Monsha Puja festival in our country, the buck keepers sell their buck with high prize. Now it is a profitable business for buck keeper and it is extended adjacent Rajshahi area as well as to all over the country. But there is no scientific information on the exotic buck breeding centres raised at Rajshahi area in Bangladesh. So the present research has been taken to evaluate the phenotypic characteristics of different genotypes of buck with their age used at private and government buck breeding centres at Rajshahi of Bangladesh.

Materials and Methods

The experiment was conducted at Private Exotic Buck Breeding Centres at Rajshahi city and adjacent area, Goat improvement Farm, Rajabarihat, Rajshahi, Bangladesh during January, 2009 to October, 2010 to evaluate the phenotypic traits of 60 bucks.

Selection of Experiment Animals

A total 50 exotic bucks of different genotypes from twelve Private Buck Breeding Centres at Rajshahi which was recently established and 10 Buck from Government of Buck Breeding Centre of Goat Improvement Farm, Rajabarihat, Rajshahi has been selected for natural services of oestrus goats to crossing the Local or Black Bengal goat. The different exotic genotypes of buck were available at said breeding centres such as Jamunapari, Beetal, Sirohi, Crossbred and Black Bengal. Each Private Buck Breeding Centres has the buck ranging from 3 to 6. Generally, each exotic buck gives service about 2-4 doe per day.

Management of Bucks

The owner's of buck breeding centre they kept their buck in low cost house. The buck keeper supplied the food approximately, 1-1.5 kg concentrate feed like Anchor bran and chick pea and also provided jackfruit leaves etc. Always buck tied with a rope in a bamboo pool. The deworming and vaccination were not regularly practices.

Data collection

To collect information in accordance with objectives of the study and a survey schedule has been developed. The genotypes of buck were divided into 4 groups according to their genetic composition such as Group-I: Jamunapari (n=9), Group-II: Beetal (n=13); Group-III: Sirohi (n=15); Group-IV: Crossbred (J×S×B×BB) (n=13). The age of the animals was determined by dentition as described by counting the number of permanent incisors that have erupted on the lower jaw of the mouth. Age also recorded from birth register of buck breeding centres. Age of buck were classified into three groups which as follows, Group-I: <1.5 yrs (n=29); Group-2: 1.5 to <2 yrs (n=20); and Group-III: > 2yrs (n=11).

Plate-1: Private and Government Buck Breeding Centre (BBC) at Rajshahi of Bangladesh



Snap-1: Beetal buck at Hasan's BBC, Rajshahi



Snap-2: Sirohi buck at Raihan's BBC, Rajshahi



Snap-3: Jamunapari bucks at Nasirima's BBC



Snap-4: Black Bengal bucks at Rajshahi Govt. goat improvement farm, Rajshahi



Snap-5: Jamunapari × Sirohi × Black Bengal cross buck at Atik's BBC, Baneshor, Rajshahi.

Snap-6: Sirohi × Black Bengal cross breed of buck at Mokbul's BBC, Rajshahi.

Phenotypic Parameters of Buck

The phenotypic characteristics of buck were recorded as follows:

Height at withers (HW): Distance from point of withers to toe region or the distance from the surface of a platform to the withers.

Rump Height (RH): The vertical distance from the top of the pelvic girdle to the ground (cm).

Total Body length (TBL) measurements: TBL was measured as the distance from the external occipital protuberance to the tip of the tail.

Heart girth (HG) represented the circumference of the chest or with the aid of a measuring tape around the chest, just behind the front legs

Age at puberty (AP) was measure the age when the buckling started ejaculated fertile semen or capable to servicing of doe properly and able to produce kid from doe after serving.

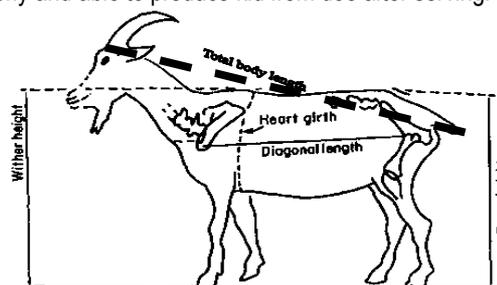


Fig. 1: Figure of goat in different locations for measurements.

Scrotal measurements: The Scrotal Circumference (cm) is the most accurate indicator of testicle size; measurements were taken at the largest diameter of the scrotum with a flexible tape placed around the scrotum after both testicles have been positioned beside each other in the scrotum.

Scrotal Diameter (SD): Scrotal diameter (SD) measured by following formula:

SD=Scrotal circumference (SC)cm \times 1/ π =SC (cm) \times 7/22= SC (cm) \times 0.32(where pie=22/7)

Testicular length (TT): Testicular or Scrotal length was measured with a vernier caliper as the distance between the tip of the scrotal sack and its neck.

Testicular volume: The testicular volume can be estimated by the following formula: PVT (cm³) = 0.0396 (Average TL) (SC)² where, PVT= Paired Testicular Volume, TL= Testicular length, SC= Scrotal Circumference.

Libido: Libido was assessed at weekly intervals for four weeks by reaction time in seconds. Briefly, reaction time was recorded, measured as the amount of time between first contact with the teaser buck and the first false mount with the penis erected (expressed in seconds). The libido of buck were divided into two group according to their sexual desire and it was valued 0 to 4 where 1= poor that is sexual power was very low, 2=quietly sexual interest and having serving power; 3=rapidly sexual interest and serving performance is rapid and quick and 4=sexual interest vigorously, uncontrollable and very good and rapid servicing status.

Time required for successful servicing: The time required for successful servicing of buck to the doe and calculated into minute.

Ejaculate time: Ejaculate time was recorded the interval the period in second when introduce the penis into the vagina and trusting to ejaculate.

The servicing performance was recorded as three scales 1-3. Scale- 1: poor sexual activity and servicing; Scale-2: sexual activity very sound and rapid; Scale-3: Very good sexual performance.

Conception rate (CR): The data were calculated for the first service conception rate. The conception rate (CR) was calculated, in this study using the following formula:

$$C.R = \frac{\text{Number of animals conceived}}{\text{Number of animals inseminated and examined}} \times 100$$

Non return rate (NRR): The non-return rate (NRR) at 60-days after service was subsequently calculated from a total of 777 first natural services. The non-return rate (NRR) was calculated in this study, by using the following formula:

$$NR \% = \frac{\text{Total no. of animals inseminated} - \text{Animal returning to service}}{\text{Total number of animals inseminate}} \times 100$$

Statistical Analysis

Table 1. Phenotypic traits of buck in different genotypes at Private and Government BBC in Rajshahi

| Parameters | Breeds | | | | | |
|--------------------------------------|--------------------------------|--------------------------------|--------------------------------|--|--------------------------------|-------------------|
| | Jamunapari n=9 | Beetal n=13 | Sirohi n=15 | S \times J \times BB crossbred n=13 | Black Bengal n=10 | Average n=60 |
| Body weight (kg) at above 1 year | 53.85 \pm 2.2 ^a | 60.20 \pm 3.1 ^a | 55.09 \pm 3.5 ^a | 42.71 \pm 2.9 ^b | 26.05 \pm 2.6 ^c | 48.41 \pm 2.0 |
| Height at wither (cm) | 91.71 \pm 2.6 ^a | 96.07 \pm 1.8 ^a | 91.00 \pm 2.6 ^{ab} | 84.93 \pm 1.9 ^b | 62.34 \pm 2.2 ^c | 86.13 \pm 1.7 |
| Height at rump (cm) | 94.11 \pm 2.6 ^{ab} | 100.90 \pm 4.0 ^a | 89.52 \pm 2.9 ^{bc} | 84.04 \pm 1.8 ^c | 60.04 \pm 2.1 ^d | 86.57 \pm 2.7 |
| Total body length (cm) | 116.4 \pm 3.3 ^a | 114.8 \pm 3.8 ^a | 116.4 \pm 3.4 ^a | 103.2 \pm 3.8 ^b | 85.7 \pm 2.6 ^c | 108.1 \pm 2.1 |
| Heart girth (cm) | 89.44 \pm 1.8 ^a | 90.43 \pm 1.6 ^a | 88.88 \pm 2.1 ^a | 82.36 \pm 2.3 ^b | 70.39 \pm 2.1 ^c | 84.81 \pm 1.2 |
| Age of puberty (m) | 5.44 \pm .20 ^c | 5.03 \pm .13 ^c | 5.83 \pm .20 ^{bc} | 6.15 \pm .20 ^b | 9.5 \pm .20 ^a | 6.35 \pm .20 |
| Scrotal circumference (cm) | 28.08 \pm .51 ^{ab} | 29.31 \pm .85 ^a | 26.31 \pm .55 ^{bc} | 24.56 \pm .45 ^c | 21.93 \pm .73 ^d | 26.12 \pm .42 |
| Testicular length(cm) | 15.87 \pm .56 ^{ab} | 16.17 \pm .60 ^a | 15.08 \pm .42 ^{ab} | 14.50 \pm .31 ^b | 11.60 \pm .40 ^c | 14.73 \pm .28 |
| Scrotal diameter(cm) | 8.93 \pm .16 ^{ab} | 9.32 \pm .27 ^a | 8.36 \pm .17 ^{bc} | 7.81 \pm .14 ^c | 6.97 \pm .23 ^d | 8.30 \pm .13 |
| Paired testicular volume (gm) | 499.7 \pm 30.6 ^{ab} | 563.6 \pm 41.41 ^a | 420.6 \pm 26.9 ^{bc} | 348.5 \pm 15.39 ^c | 226.6 \pm 21.54 ^d | 415.5 \pm 19.38 |
| Libido (scale: 1-4) | 3.55 \pm .17 | 3.69 \pm .13 | 3.26 \pm .15 | 3.53 \pm .16 | 3.60 \pm .22 | 3.51 \pm .60 |
| Servicing performance (scale:1-3) | 2.56 \pm .18 | 2.77 \pm .12 | 2.53 \pm .13 | 2.62 \pm .14 | 2.80 \pm .13 | 2.65 \pm .21 |
| Time required for servicing (minute) | 3.44 \pm .44 ^a | 2.37 \pm .33 ^b | 2.73 \pm .33 ^{ab} | 2.15 \pm .15 ^b | 2.10 \pm 0.1 ^b | 2.53 \pm .14 |
| Ejaculate time (second) | 13.22 \pm 1.4 ^a | 10.46 \pm 1.0 ^a | 13.27 \pm 1.6 ^a | 10.46 \pm 1.0 ^a | 6.30 \pm 0.6 ^b | 10.88 \pm .57 |
| Services per day (times) | 2.33 \pm .16 ^b | 2.23 \pm .12 ^b | 2.26 \pm .11 ^b | 2.15 \pm .10 ^b | 3.00 \pm 0.0 ^a | 2.36 \pm .27 |
| Conception rate (CR) | 81.11 \pm 4.8 ^b | 78.45 \pm 2.1 ^b | 81.00 \pm 3.5 ^b | 76.92 \pm 2.3 ^b | 97.00 \pm 1.5 ^a | 82.25 \pm 1.5 |

The raw data has been sorted and computed and statistically analyzed to calculate the effect of genotype and age on phenotypic traits of exotic and local bucks of different breeds at Private Buck breeding centres and Goat improvement farm, Rajbarihat, Rajshahi. The obtained information was loaded and stored on to the SPSS spread sheet. Then data was analyzed using SPSS programme. Data were subjected to analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT). Interpretations were derived from the data categorized into phenotypic traits of breeding bucks and reproductive and productive performance of doe under the study area (Steel & Torrie, 1980).

Results

The present study was carried out to evaluate the phenotypic traits of 60 (sixty) bucks in relation to their genotypes and age. Effect of genotypes on phenotypic traits in buck of private and government breeding centre are shown in Table-1. Genotype had significant effect ($P < 0.05$) on all the phenotypic traits of buck except on libido and servicing performance (Table-1). The highest values of body weight, height at withers, height at rump, total body length, heart girth, age at puberty, scrotal circumference, testicular length, scrotal diameter, paired testicular volume, servicing performance, time required for servicing and ejaculate time in Beetal, Sirohi and Jamunapari exotic breed than the Black Bengal and crossbred buck (Table-1). The higher values of age of puberty, libido, services per day, conception rate and non return rate at 60 days were in Black Bengal buck than others genotypes.

[Three age groups of phenotypic characteristics were recorded in private and government buck breeding centre at Rajshahi is presented in Table-2. It was found that higher values of body weight, height at weight, height at withers, height at rump, total body length, heart girth and non return rate at 60 days in the age group of <1.5 yrs and lower in >2 years of age group. The age of puberty, libido, time required for servicing, services per days, conception rates were higher in age groups of >2 years. The scrotal circumference, scrotal diameter, paired testicular volume and servicing performance were higher in age group of 1.5 to <2 yrs. Age had no significant effect ($P > 0.05$) on all the phenotypic characteristics except in ejaculate time ($P < 0.05$).

Non return rate (NRR) at 60 days 85.11± 2.31^b 84.13± 1.61^b 86.13± 1.69^b 84.76± 1.49^b 93.30±.74^a 86.53±.81

J= Jamunapari, S=Sirohi, BB= Black Bengal; Values are Mean±SE; n= Number of observation; SE= Standard Error of mean; Figures in the same column with different superscripts are significantly different (P<0.05; Duncan's test).

Table 2. Effect of age group of different genotypes of buck on phenotypic traits at Private and Government BBC in Rajshahi

| Parameters | Age Groups | | |
|--------------------------------------|------------------------|---------------------------|--------------------------|
| | <1.5 yrs n=29 | 1.5 to < 2 yrs n=20 | > 2 yrs n=11 |
| Body weight (kg) at above 1 year | 49.61±2.7 | 47.27±3.6 | 47.32±5.8 |
| Height at wither (cm) | 87.90±2.1 | 85.71±3.1 | 82.24±5.3 |
| Height at rump(cm) | 87.98±2.1 | 87.08±3.7 | 81.92±7.9 |
| Total body length(cm) | 109.24±2.7 | 106.46±4.1 | 108.09±5.1 |
| Heart girth(cm) | 85.73±1.7 | 83.88±2.2 | 84.04±3.7 |
| Age of puberty (month) | 6.03±.22 | 6.40±.36 | 7.09±.68 |
| Scrotal circumference (cm) | 26.04±5.0 | 26.25±.93 | 26.09±1.0 |
| Testicular length(cm) | 14.85±.35 | 14.70±.58 | 14.48±.71 |
| Scrotal diameter(cm) | 8.28±.16 | 8.34±.29 | 8.29±.32 |
| Paired testicular volume (gm) | 408.16±21.8 | 429.34±41.8 | 409.97±49.7 |
| Libido (scale: 1-4) | 3.48±.20 | 3.70±.11 | 3.55±.16 |
| Servicing performance (scale:1-3) | 2.59±.20 | 2.75±.20 | 2.64±.15 |
| Time required for servicing (minute) | 2.64±.22 | 2.19± 0.18 | 2.84± 0.32 |
| Ejaculate time (second) | 12.83±.83 ^a | 8.10± 0.76 ^b | 10.82± 1.00 ^a |
| Services per day (times) | 2.28±.02 | 2.40± 0.11 | 2.55± 0.16 |
| Conception rate (CR) | 79.37±1.6 | 79.50±1.8 | 80.54±3.0 |
| Non return rate (NRR) at 60 days | 86.75±1.1 | 86.30±1.5 | 86.36±2.0 |

Values are Mean±SE; n= Number of observation; SE= Standard Error of mean; Figures in the same column with different superscripts are significantly different (P<0.05; Duncan's test).

Discussion

Phenotypic characteristics of buck are a very important characteristic in animal husbandry due to selection criteria and economical profit. Salako (2006) reported that various body measurements and calculated indices from body measurements are important indicators of breed characteristics and production type of animals. In these sense, when compared the rump height and wither height it is seen that rump height is higher 2 cm higher than wither height. Heart height, rump height and body length are not affected by animal condition (Heinrichs *et al.*, 1992; Olfaz *et al.*, 2005) and fattening status (condition score) reflects body lipid content more than body weight (Nsoso *et al.*, 2003). Chenoweth (1997) suggested the use of scrotal size and testicular measurements to select for improved sperm production in breeding males. Hence, advantages would accrue from selecting bucks of higher-than-average scrotal circumference, even if it were unrelated to the fertility of the buck themselves. Land *et al.* (1982) reported that within each breed, body weight was significantly (P<0.05) higher in bucks aged >3 years than those between 1 and 3 years and <1 year. A similar trend was observed for the testicular measurements in all the breeds. This is expected as there is a linear relationship between body weight, testicular measurements and age. Thus, as body weight and age increased, SC, SL and TWT also increased. Adedeji and Gbadamosi (1999) reported the SC and SL of 22.6 cm and 13.6 cm respectively at 2 years of age and body weight of 26kg for Red Sokoto bucks. These values are similar to those of crossbred buck of 24.56±0.45 cm, 14.50±0.31cm and 42.71±2.9 kg for SC, SL and body weight, respectively at approximately 2 years of age reported in the present study.

Alam *et al.* (2007) reported body length, height at withers and heart girth of 87.9±1.9 cm, 54.1±0.7 cm and 67.4±1.1 respectively at 2 years of age for Black Bengal goat. These results are more or less similar to the findings of present study. Banerjee (2004) reported that the phenotypic traits of average body weight (60kg), body length (77cm) and heart girth (79 cm) in Jamunapari adult male and corresponding values 50-60kg, 86 cm and 86 cm in adult male of Beetal breed. He also shown that average body weight, body length and chest girth values were 50kg, 80cm, 80 cm in Sirohi goat and corresponding values 32kg, 63 cm and 72 cm respectively. Faruque and Khondoker (2007) studied the height at withers of BBW, BBC, BBH, JAM and CRW were 51, 49, 48, 85 and 65 cm respectively. They also recorded the birth weight was 0.98 to 1.1 kg. Amin *et al.* (2000) demonstrated the live weight, height at wither, body length and heart girth were 16.7 kg, 47.8 cm, 64.6 cm and 56.6 cm, respectively in selected random yearling weathers of Black Bengal goat. The overall body length, heart girth and wither height found in this study were almost similar as reported by Singh *et al.* (1979) and Husain (1993). Results obtained in the present study on body weight (BW) and other conformational traits (HW, HG, RH and BL) are concurrent with those obtained by other researchers (Mazumder and Muzumder 1983; Ruvuna *et al.*, 1988; Bhattacharya 1989). The present results some cases are similar and a few results are differing from these study. The variation of results may be due to genetic potentially, environmental and managerial factor as well as data taken error. On the basis of the information obtained from the present study it could be concluded that; The phenotypic traits viz. body weight, height at wither, height at rump, total body length, heart girth, scrotal circumference, testicular length, scrotal diameter and paired testicular volume had excellent in buck of Beetal>Jamunapari>Sirohi>crossbred>Black Bengal as well as the excellent fertility status such as servicing performance, ejaculate time, services per day, conception rate and non return rate at 60 days were better in Black Bengal Goat than the other breeds. Additionally, the middle age groups (1.5 to <2 yrs) had better phenotypic performances where libido, conception rate and non return rate was good at >2 yrs of buck groups. Finally, the Black Bengal goat is am famous breed in Bangladesh due to meat quality, skin quality, prolificacy, fecundity, fertility, survivability in respect of our environmental condition, acceptability to people, rearing ability, per unit price, total biomass, grazing habit and overall maintenance cost. The cross breed goat has shown the good result in this study for particular area and a short period. On other hand, many parameters have not been studied for example prevalence diseases. It concluded that, Black Bengal is pure breed famous goat that why it never be cross with other exotic breed.

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