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Improvement of Reproductive Performances of Black Bengal Goat Through Selection under Field Condition

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Abstract: Present study was undertaken to ascertain the improvement of reproductive performances through selective breeding. Reproductive data of 339 Black Bengal goats comprising of 2 genetic groups namely selective mating group and random mating group was recorded during the year 2004-05 and 2005-06. The study was conducted in 3 adopted villages namely Hatikanda, Ganguria and Panchpota villages in the Nadia district of West Bengal state of India under All India Coordinated Research Project on goat improvement, Black Bengal Field Unit. It was observed that effect of years, villages or genetic groups on age at first mating, age at first kidding, service per conception, weight at first mating, gestation period, service period and kidding interval was nonsignificant while effect of selection was significant ($p<0.05$) on weight at first kidding. The does of the selective group came on heat, served and kidded early during the year 2005-06 in comparison to the previous year. The kidding interval as well as service period was also decreased among the goats of selective group and service required per conception was also less. The body weight at first kidding of Black Bengal does of selective group was higher than random mating group during 2005-06. The reproductive efficiency was improving through selective breeding of Black Bengal goat under field condition. Indication of the result of present study was justifying the selection process as well as effectiveness for conservation of Black Bengal goat in their home tract.

Key words: Black Bengal goat, reproductive performances, selective breeding

INTRODUCTION

Goat plays a vital role in the economy of poor dwellers living in diverse climatic condition of India. In rural area goat keeping generates employment at the rate of 4.2% per annum. Black Bengal is a famous breed known for high prolificacy, superior chevon quality, best quality skin, early sexual maturity, low kidding interval and very good adaptability. The home tract of the breed is throughout West Bengal although it is distributed in the adjoining part of Jharkhand, Orrisa, Bihar and Tripura states of India and also available in Bangladesh. Wilson (1989) and Kiwuwa (1992) suggested that selection should improve reproduction and growth while conserving the characteristics that adapt tropical goats to their environment. Selective breeding using superior buck expected to improve the productive efficiency of Black Bengal goats without much alteration in the prevailing production system. Selective breeding was an important tool for conservation of the well adapted genetic resources and thus avoid fore coming extinction of the breed. Reproductive efficiency is always considered to be the most vital factor ensuring increase in productivity to a certain environmental condition (Hossain *et al*., 2004).

The objectives of the present study were to evaluate the reproductive performances of Black Bengal goat and to study the effect of selective breeding programme followed in the present study.

MATERIALS AND METHODS

The study was conducted under All India Coordinated Research Project on goat improvement [AICRP (G)], Black Bengal Field Unit. The field area of the project is Hatikanda, Ganguria and Panchpota villages in the Nadia district of West Bengal state of India. The reproductive data of 339 goats were available out of which 227 were collected during 2004-05 and 112 during 2005-06. The data were collected from April 2004-March 2006.

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Agro-climatic condition: The field area is situated at latitude of 23.5°N and longitude of 89°E and an altitude of 9.75 m above the mean sea level located close to the tropic of cancer. Being close to the tropics the recorded temperature is as high as 38°C in summer with the minimum ranging between 10 and 11°C in mid winter. The annual rainfall is fairly high ranging between 1000 and 2000 mm. Average relative humidity ranges from 45.25-90.50% through out the year.

Genetic group: There were 2 genetic groups of Black Bengal Goat under this study. The reproductive performances of the offspring produced after mating with selected bucks are called as selected group while offspring of random mating are called as unselected group or random mating group. The selection of buck was made on the basis of their physical characters (growth, biometry and semen characteristics) at the beginning of the study. A member of the twin family was preferred over singlet or triplet. Afterwards, the bucks which gave better progeny performance were kept for further breeding programme and the inferior bucks determined by progeny performance were replaced by superior bucks selected on the basis of same characters described earlier. This process was continued. This genetic programme was started with a total of 600 does, 200 in each of villages. Out of 200 does in each village 100 were mated with selected superior bucks at the ratio of 20:1 while rests were mated randomly. In the present study reproductive performances of a total of 170 does born by selective mating and 169 does born by random mating in the 3 villages were analyzed.

Management: All the animals utilized for the present study were reared in the farmers' house. The animals were fed mainly on grazing and allowing tree leaves during the rainy days. Little amount of concentrate (within the range of 50 g) were offered at the last stage of pregnancy and few days after birth. All the does were kept on floor made of soil/mud. The goat houses were sheded with paddy straw or corrugate sheet.

Health Care: All the animals were dewormed four times in a year. Deworming was done on the basis of faecal examination. Vaccination against PPR, Goat pox and FMD was done in every year. Regular grooming of the animals had been practiced by the goat farmers. Other health care and treatment was done whenever needed.

Reproductive characters: The reproductive traits studied under present study were age at first mating, weight at first mating, age at first kidding, service per conception, weight at first kidding, gestation period, service period, kidding interval (estimated as per Ahmed, 1992) and kidding rate.

Statistical methodology: The effect of the different years, villages and genetic groups on the variability of different important reproductive traits was estimated by analysis of variance. The formulae used for statistical analysis were:

$$Y_{ijkl}=\mu+Ai+Bj+C_k+e_{ijkl}$$

Where,

Y_{ijkl} = lth animal of the ith year under jth village of kth genetic group.
μ = Overall mean.
Ai = Effect of Year (I = 1-2).
Bj = Effect of Village (j = 1-3).
C_k = Effect of Genetic group (k = 1-2).
e_{ijkl} = Random error on observation distributed NID (0, σ2e).

From the above model, it was calculated:

- $CF = (GT)^2/N$
- SS_A (Between years) = ΣAi^2-CF
- SS_B (Between villages) = ΣBj^2-CF
- SS_C (Between genetic groups) = ΣCk^2-CF
- SS_T (Total) = $\Sigma Yijkl^2$-CF
- SSe (error)= $SS_T - SS_A - SS_B - SS_C$

The critical difference test (CD test) was carried out for the traits, which showed significant differences. This is done to compare between the means of sub-classes by applying the following formula.

$$|B_1 - B_2| > t_{1/2\alpha\,(N-5)} X\ vMSe\ (1/N_1 + 1/N_2)$$

RESULTS AND DISCUSSION

Age at first service: Age at first service is considered to be an important economic reproductive trait for profitable goat production. Age at first service of the doe of different villages and different genetic group was presented in Table 1. There was no significant effect of villages or genetic groups in different years. The does of selective group came on heat and served early which reflects the effect of selective breeding as an efficient tool for conservation and improvement of Black Bengal goat. The present study was in agreement with the findings of Misra and Sinha (2001) and Hossain *et al.* (2004). The result of the present study was not in agreement with Akhtar *et al.* (2006) which may be due to the fact that they

selected the animals only on the basis of live weight. From the overall result it was evident that the Black Bengal doe came on heat earlier and served earlier during the year 2005- 06 than the previous year which might be associated with the improvement of the total stock due to the process of breeding taken in the present study.

Weight at first service: Body weight of Black Bengal does at service during different years, villages and genetic groups were within the range of 9.84-11.12 kg (Table 1). The effect of years, villages and genetic groups was not significant. The result of the present study is almost in agreement with Akhtar *et al.* (2006) though the work was carried out in different areas. Ray *et al.* (1990) observed lower weight at first service which might be due to smaller population size.

Age at first kidding: The average age at first kidding of Black Bengal goat was 436 and 433 days during 2004-05 and 2005-06, respectively (Table 1). In West Bengal Das and Ghosh (1993) reported age at first kidding 394.25 days with a range of 352 -450 days. Ray *et al.* (1990) recorded that the age at first kidding in Black Bengal Goat was lowest in winter (441.67 days) followed by summer (445.15 days) and monsoon (453 days). In another study at Bangladesh Hossain *et al.* (2004) reported average age at first kidding 401 days which was almost similar to the present study. Average age at first kidding under intensive semi intensive system of management was 285 days and 405 days, respectively observed by Chowdhury *et al.* (2002). However Mishra and Sinha (2001) and Rao *et al.* (2002) observed at first kidding to be 501.7 days and 472.3 days accordingly in field condition. It was evident from earlier reports that at first kidding were lower during 1970s and 1980s but it increases after 1990s in field condition. This increase might be associated with indiscriminate breeding practices in field condition. There was no significant effect of years, villages and selection but it was observed that age at first kidding of the does of selective group was lower than overall during the year 2005-2006 indicating the effectiveness of selection process. Early kidding reduces replacement costs, increases animal and economic turn over rates and may lead to more rapid genetic improvement (Wilson and Durkin, 1983).

Service per conception: The number of services required per conception of Black Bengal does was decreased in the year 2005-06 than 2004-05 (Table 1). Black Bengal goats produce viable ova and sperm and thus services required per conception are lower. Akhtar *et al.* (2006) observed higher number of service per conception which might be due to difference in selection process. Hossain *et al.* (2004) observed higher number of services per conception under farm condition. Service per conception was not affected by feeding level and parity suggested by Chowdhury *et al.* (2002).

Weight at first kidding: Weight at first kidding is an important economic reproductive trait and it was observed 14.09 kg during 2004-05 and to 14.4 kg in 2005-06 (Table 1). Singh *et al.* (1987) reported weight at first kidding 15.4 kg which was similar to the present findings while Ray *et al.* (1990) observed lower body weight at first kidding (10.08 kg) which might be due to lesser number of observations. The effect of selection was significant ($p<0.05$) but the effect of year and villages were non significant. The body weight at first kidding of Black Bengal does of selective group was significantly higher than random mating group during 2005-06 and this significant improvement of body weight might be associated with the increased number of twins and triplets at birth as evident in this study (Table 2 and 3) or may be due to improvement of birth weight of kid born.

Gestation period: The overall gestation period of Black Bengal goat was found to be 145 days and 146 days during 2004-05 and 2005-06, respectively (Table 1) without any significant effect of years, villages or genetic group. Average gestation period of the present study was almost similar with the findings of Ghosh *et al.* (1994) and Choudhury *et al.* (2002) who observed the average gestation period of Black Bengal goat 145 days and 146 days though their work was carried out under different system of management. Ahmed (1992) observed 150 days gestation length which might be due to effect of parity, seasons or different agro climatic location.

Service period: In selective mating group the service period for 2004-05 and 2005-06 was found to be 60 days and 56 days, respectively. While in random mating group the service period for 2004-05 and 2005-06 was found to be 61 days and 67 days, respectively (Table 1). The increase in service period in random mating group from 2004-05 -2005-06 might be due to small sample size in 2005-06 though the increase is nonsignificant. On the other hand in selective group though there is smaller ample size, the service period was decreased nonsignificantly in 2005-06 from 2004-05 indicating genetic improvement through selection. The effect of years, villages or genetic groups was not significant ($p>0.05$). Similar result (60 days) was observed by Mishra and Sinha (2001). The shorter service period in the present study in comparison to other workers of recent times indicate the improvement of reproductive efficiency.

Table 1: Least Square Mean and SE of the reproductive traits of Black Bengal Goats

			Villages			Mating type	
Reproductive traits	Year	Overall	Hatikanda	Ganguria	Panchpota	Random	Selective
Age at first service (days)	2004-05	238 ±1.6 (227)	231 ±2.9 (48)	239 ±3.0 (92)	243 ±2.2 (87)	240 ±2.4 (111)	236 ±2.1 (116)
	2005-06	234±2.89 (112)	233±6.5 (32)	232±2.7 (38)	237±5.1 (42)	235±4.0 (58)	233±4.2 (54)
Weight at first service (Kg)	2004-05	10.06±0.09(227)	10.16±0.17(48)	10.14±0.18(92)	9.89±0.13 (87)	9.84±0.14 (111)	10.28±0.12(116)
	2005-06	10.5±0.17 (112)	10.66±0.38 (32)	10.34±0.15 (38)	10.49±0.29 (42)	11.12±0.23 (58)	9.88±0.24 (54)
Age at first kidding (days)	2004-05	417±2.8 (227)	410±2.8 (48)	415±2.9 (92)	427±2.2 (87)	418±2.3 (111)	417±2.0 (116)
	2005-06	419±1.5 (112)	431±6.3 (32)	405±2.6 (38)	421±4.9 (42)	429±3.9 (58)	409±4.0 (54)
Service per conception (no.)	2004-05	1.14±0.03 (227)	1.09±0.05 (48)	1.05±0.05 (92)	1.27±0.04 (87)	1.13±0.04 (111)	1.15±0.04 (116)
	2005-06	1.07±0.05 (112)	1.0±0.11 (32)	1.13±0.05 (38)	1.08±0.09 (42)	1.09±0.07 (58)	1.05±0.07 (54)
Weight at first kidding (kg)	2004-05	14.09±0.14(227)	14.78±0.26(48)	15.0±0.24 (92)	12.49±0.2 (87)	14.62±0.21^{b} (111)	13.56±0.19^{c}(116)
	2005-06	14.4±0.26 (112)	14.1±0.58 (32)	15.45±0.24 (38)	14.26±0.45 (42)	13.27±0.36^{a} (58)	15.94±0.37^{d}(54)
Gestation period(days)	2004-05	145±0.86 (227)	146±1.57 (48)	146±1.65 (92)	144±1.21 (87)	144±1.14 (111)	147±1.28 (116)
	2005-06	146±1.56 (112)	147±3.52 (32)	145±1.45 (38)	145±2.75 (42)	146±2.17 (58)	145±2.25 (54)
Service period (days)	2004-05	60±0.76 (227)	58±1.39 (48)	62±1.46 (92)	61±1.07 (87)	61±1.14 (111)	60±1.01 (116)
	2005-06	61±0.14 (112)	67±3.11 (32)	57±1.28 (38)	60±2.43 (42)	67±1.92 (58)	56±1.98 (54)
Kidding interval(days)	2004-05	205±1.1 (227)	204±2.02 (48)	208±2.12 (92)	205±1.55 (87)	204±1.65 (111)	206±1.47 (116)
	2005-06	207±2.0 (112)	214±4.51 (32)	202±1.86 (38)	205±3.52 (42)	213±2.73 (58)	201±2.88 (54)

Values bearing same superscript or no superscript within a row or column do not differ significantly; Data in parentheses are the numbers in each sub-class

Table 2: Kidding rate (No. of kid born and percentage) of Black Bengal goat under different Genetic groups

	2004-05			2005-06		
Kidding pattern	Random mating	Selective mating	Overall	Random mating	Selective mating	Overall
Singlet	29 (4.4%)	80 (12.2%)	109 (16.7%)	42 (5.2%)	69 (8.5%)	111 (13.7%)
Twin	174 (26.6%)	252 (38.5%)	426 (65.1%)	178 (22%)	354 (43.8%)	532 (65.8%)
Triplet and above	33 (5 %)	86 (13.1%)	119 (18.2%)	60 (7.4%)	106 (13.1%)	166 (20.5%)
Average litter size	1.81			1.89		

Table 3: Kidding rate (No. of kid born and percentage) of Black Bengal goat of different Villages

	2004-05			2005-06		
Kidding pattern	Hatikanda	Ganguria	Panchpota	Hatikanda	Ganguria	Panchpota
Singlet	29(4.4%)	42 (6.4 %)	38(5.8%)	44(5.4%)	52(6.4%)	15(1.9%)
Twin	138(21.1%)	130(19.9%)	158(24.2%)	180(22.2%)	192(23.7%)	160(19.8%)
Triplet and above	59(9 %)	33(5%)	27(4.1%)	89(11%)	41(5.1%)	36(4.4%)

Kidding interval: Average kidding interval of Black Bengal goat was represented in Table 1. Similar trend in results were also observed by Ray *et al.* (1990) and Rao *et al.* (2002). Lower kidding interval than previous workers (Singh and Mukherjee, 1998) probably due to proper health care and additional mineral supplementation during pregnancy which may lead to early involution of uterus and thus early onset of oestrus. Effect of years, villages or genetic group was not statistically significant but it was observed that kidding interval of the does produced through selective breeding is less than that of previous year or overall kidding interval.

Kidding rate: From the result (Table 2 and 3) it was evident that overall number of single kid borne during 2005-06 was decreased than 2004-05 where as the number of twin, triplet and above was remarkably increased during 2005-06 than previous year. The twin percentage in selective mating group was much higher than random mating group in both the years and it was also found to be increased in 2005-06 than previous year with in the selective mating group indicating the effectiveness of selection. Singh *et al.* (1987) recorded more singlet than twin or triplet which can not be compared the present study because their observation was very less. However, Biswas and Choudhury (2006) observed with in the range of 60% twin in 3 agro climatic condition of West Bengal which was nearer to the present finding but they observed almost 30-35% singlet. Average litter size was also increased from 1.81 (2004-05)-1.89 (2005-06). Average litter size observed by Biswas and Choudhury (2006) was 1.766 which was lower than present result indicating effectiveness of selection process. Average litter size for Black Bengal goat reported to be 1.6 by Hossain *et al.* (2004) and 2.15 by Amin *et al.* (2001) along with present result confirmed the reputation of Black Bengal goat for high fecundity.

CONCLUSION

It had been observed from the present study that the reproductive performances were improving though it was

not statistically significant. It was also reported that almost all reproductive traits under present study were improved in the year 2005-06 in comparison to previous year. Improvement of reproductive performances in selective mating group than random mating group recorded in the present study was justifying the method of buck selection as well as process of selective breeding for Black Bengal goat under field condition. Indication of the result was ensuring the effectiveness for conservation of Black Bengal goat in their home tract but the process will be continued for a considerable period of time.

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