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Growth performance of yearling F_1 progeny of different crossbred beef cattle

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Abstract

Bangladesh has a great demand of beef but it has been facing demand and supply mismatches due to insufficient production and supply of beef, low carcass yield of native cattle and recent no-cattle export policy of a long bordered neighboring country. Thus, the present work was undertaken with an objective to develop market beef cattle of average >150 Kg carcass weight by 24 months with an average FCR of <6.50 under on farm feeding and management condition. Aiming at developing breeding bulls the native dams of BCB-1 (BLRI Cattle Breed 1) were inseminated with the imported frozen semen of Brahman, Simmental, Charolais and Limousin. The crossbred progeny of different assorted F_1 genotypes were being selected and their production and breeding performance were evaluated and compared with BCB-1. All pregnant (> 6 months of gestation period) cows were in pre-natal care, and all calves were raised in a single plane of nutrition and management. All crossbred progeny performed better than BCB-1 in terms of live weights and average daily gains. Among the crossbreds, Charolais×BCB-1 had the highest ($p<0.001$) birth weight (27.5±1.52 kg) followed by Brahman×BCB-1 (24.1±1.23), Simmental×BCB-1 (21.9±1.78), Limousin×BCB-1 (19.8±1.39) and BCB-1×BCB-1 (18.4±1.09), and the genotypes differences were highly significant ($p<0.001$). In average growth curve, Simmental cross grew faster followed by Charolais, Limousin, Brahman crosses and purebred BCB-1. The genotype×environment interaction was only observed in birth weight. Purebred BCB-1 had the lowest daily DM intake and showed the lowest FCR in all ages compare to other crosses. Calf scour and alopecia occurred in all genotypes. In this breeding program, calf mortality was found as 5.26%. Simmental×BCB-1 is performing as the best among the five genotypes in terms of growth up to 12 month of age.

Key words: growth performance, crossbred, beef cattle, F_1 progeny

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Introduction

Livestock sector is producing only 30.18% of national requirements of meat. The per capita intake of meat is only 8.6 kg in Bangladesh against 42.1 kg and 32.2 kg for world and developing countries, respectively (Huque, 2012). To meet this gap, meat production of the country must be increased many folds. On the other hand, beef is a very popular meat item to the Bangladeshi consumers. But beef price is increasing tremendously especially in the last 12 years. Bangladesh has been facing demand and supply mismatches of beef due to insufficient production and supply, low carcass yield of native cattle and recent no-cattle export policy of a long bordered neighboring country. According to last Agricultural Census 2008, Bangladesh had very high density of cattle which was about 188 head/km^2 (Huque and Khan, 2017). Bangladesh has little opportunity to increase cattle population instead of increasing productivity.

Thus, Bangladesh has taken an opportunity for boosting its bovine industry through on-going program like cattle fattening and crossbreeding for dairy and beef cattle production. Our country has only native cattle which grow at a slower rate than most of the temperate fast growing beef breeds. Study showed that cattle in a feedlot system showed the value of feed conversion ratio (FCR) ranges from 5.93 to 10.10 whereas, a BCB-1 bull of 250 kg live weight gained 1200g/day and showed 5.13 to 6.73 FCR (Huque, 2011) which indicates that BCB-1 may has lower body weight at mature age compared to most temperate beef breeds but still they are more promising for beef production as FCR is an important economic parameter for commercial beef production. But, in order to support the increasing demand of beef we need to produce fast growing beef cattle within an economic FCR. Following the consequence DLS (Department of Livestock Services) has taken a breeding program for beef production. Imported frozen semen of

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American Brahman bulls has been inseminating in native cattle of Bangladesh to produce crossbred beef cattle. But before starting this program, no research has been done to compare the performances of Brahman crossbred with other crossbred exotic beef genotypes and native in the existing environment and similar feeding management system.

On the other hand, the dam line, which used in Brahman crossbred production, was not from similar breed which caused difficulties in evaluation of heterosis effect. In the recent studies of BLRI and DLS reported that Brahman crossbred bulls showed the higher FCR (12.1) compared to native BCB-1 (9.5) or Red Chittagong Cattle (9.9) (Roy *et al*., 2013; Rashid *et al.,* 2014). Considering the facts, the present work was undertaken to evaluate comparative performance of different crossbred beef genotypes. Here, three exotic beef breed i.e. Simmental, Charolais and Limousin alone with American Brahman was used as sire line on a single dam line BCB-1for the production of crossbred progeny. Simmental, Charolais, Limousin and American Brahman are worldwide recognized beef cattle breed and BCB-1 is a native cattle developed through selective breeding of native cattle named 'Pabna' evolved through admixture of Hariana, Tharparker and Sahiwal genetic materials (Bhuiyan *et al.,* 2007). The coat color and body size of BCB-1 bulls are attractive which have a great market value as a meat type cattle. Thus, the objective of the present work was to develop market beef cattle of average >150 Kg carcass weight by 24 months at an average FCR of <6.50 under similar feeding management conditions.

Materials and Methods

Selection of BCB-1 dams and collection of exotic beef breeds semen

A total number of 40 BCB-1 cows and heifers were selected based on their body weight, individual and pedigree performance and reproductive health for artificial insemination (AI) using exotic beef breeds semen to produce crossbred beef progeny. Frozen semen of purebred Simmental (Black and red), Charolais (white and red) and Limousin (light to darker red) were imported from Australia. In addition, 20 doses of frozen semen of purebred American Brahman sires were collected from DLS for this study. The production performances of the selected exotic beef breeds were reviewed and documented from secondary data sources.

Artificial insemination (AI) and production of crossbred beef progeny

Artificial Insemination was performed following the natural estrus of the selected BCB-1 dams. Before insemination all selected animals were checked for brucellosis and ovarian condition. Forty BCB-1 dams were divided into 4 groups, thus 10 BCB-1 dams were allowed for crossing with one beef breed. Four exotic beef breeds (Simmental, Charolais, Limousin and Brahman were considered as treatment groups and BCB-1 was considered as control group for comparison of the production performances of their progeny. Under this study control BCB-1 were collected from BCB-1 herd of BLRI which produced by natural services in the farm.

Table 1. Number of progeny produced from different genotypes

Genotype of calves	Sex		Total
	Male	Female	
BCB-1×BCB-1	5	5	10
Limousin×BCB-1	5	2	7
Simmental×BCB-1	2	5	7
Charolais×BCB-1	3	2	5
Brahman×BCB-1	4	3	7
Total	19	17	36

After 2 months of AI, pregnancy was tested by rectal palpation to ascertain the conception. Artificial insemination was performed following standard procedure for the production of crossbred progeny. Not more than 2 AI services were allowed for single conception and subsequent calculation of service per conception. Table 1 showed the number of crossbred and purebred progeny produced and studied under this breeding program. A total number of 26 crossbred progeny of four genotypes were produced and out of that 14 were males and 12 were female calves. A total number of 10 purebred BCB-1 progeny were considered for this study as control.

Performance recording of F_1 progeny

Birth weight, weaning weight, yearling weight, ADG at different stages, calf mortality and disease incidence were recorded throughout the year. The year consists of 3 seasons named as summer (March to June), rainy (July to October) and winter (November to February). From birth to 1 year of age every 15 days interval and after that every 1 month interval body weight of F_1 progeny were recorded.

Table 2. The milk feeding schedule of produced calves from birth to weaning

Calf age (Days)	Milk supplied percentage (%) of Body Wt. (Kg)
Birth to 30	10
31 to 45	8
46 to 60	6
61 to 75	4
75 to 90	2
91 to 97	Gradual decreases from 2 % to 0 % (Weaning)

Feeding and management system for crossbred beef progeny

All pregnant (> 6 months of gestation period) dams were kept in pre-natal care, and all calves were raised in a same plane of nutrition and management. Total milk and feed intake, FCR, disease incidence and calf mortality of BCB-1 and other genotypes were recorded. Calves were supplied whole milk according to body weight described in Table 2. The concentrate was supplied 50% of their DM requirement and rest of DM requirement was fulfilled by roughage (green grass or silage). The proximate composition of the supplied feed was stated in Table 3.

Table 3. Chemical composition of feed supplied to the calves

Feed	% DM	% CP	% Ash
Concentrate	88-89	16-18	10-11
German Grass	15-16	14-16	10-12
Napier Grass	14-16	9-10	-

Statistical analysis

The progeny performance data used in the present study was from five different genotypes and sample sizes were unbalanced due to insemination of dam following natural estrus. Hence, it fulfilled the characteristics of a non-orthogonal factorial design and all recorded data were analyzed by General Linear Model (GLM) procedure of SPSS (17.0). Calves were arranged based on genotypes and season. Duncan's multiple range test (DMRT) by Kramer (1957 was used for mean comparisons.

Results and Discussion

Live weight and growth rate

All crossbred progeny performed better than BCB-1 in terms of live weights. Among the crossbreds, Charolais×BCB-1 had the highest birth weight (27.5±1.52 kg) followed by Brahman×BCB-1 (24.1±1.23 kg), Simmental×BCB-1 (21.9±1.78 kg), Limousin×BCB-1 (19.8±1.39 kg) and BCB-1×BCB-1 (18.4±1.09 kg) and the genotype differences were highly significant ($p<0.001$) (Table 5).

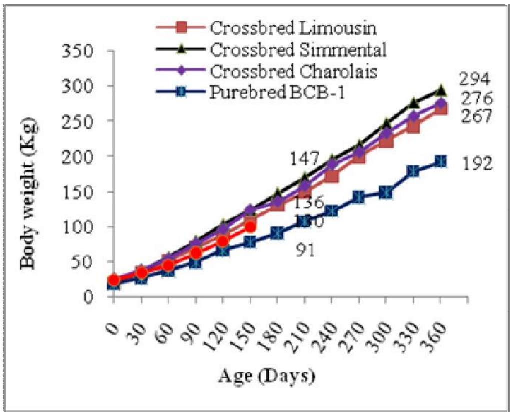

Figure 1. Cumulative growth curve of different crossbred genotypes

But the weaning, 6-month, 9-month and 12-month cumulative weights were the highest in Simmental×BCB-1 and the lowest in purebred BCB-1, and the genotype differences were also highly significant ($p<0.001$). Scholtz and Theunissen (2010) found the same or exceed weaning weights of different cross-bred beef genotypes in Sub-Saharan Africa which supported the findings of the present research work. Brahman calves were born in later and did not reach to yearling age during the study period. Maximum calves were born in rainy season and their birth weights differed significantly ($p<0.001$) among the seasons. The highest birth weight was observed in winter that may be due to birth of maximum heavier crossbred calves in this season (Table 5). Season had significant effect on birth ($p<0.001$) and weaning ($p<0.05$) weight. The genotype × environment interaction was only observed in birth weight (Table 5) and calves were adjusted gradually with the environment after birth.

Table 4. Effects of genotypes and seasons on live weights at different ages

Genotype	Body weights (kg) Mean±SEM				
	Birth wt	**3 month wt**	**6 month wt**	**9 month wt**	**12 month wt**
BCB-1×BCB-1	18.4±1.09 (10)	50.1±2.98 (10)	91.62±5.87 (8)	139.4±10.01	194.7 (1)
Limousin×BCB-1	19.8±1.39 (7)	72.8±3.80 (7)	134.2±5.98 (7)	196.9±7.71 (5)	270.2 (2)
Simmental×BCB-1	21.9±1.78 (7)	80.5±4.86 (7)	156.1±7.60 (7)	227.6±9.63 (7)	297.3 (1)
Charolais×BCB-1	27.5±1.52 (5)	79.4±4.75 (4)	138.1±8.39 (3)	199.2±17.34 (1)	279.9 (1)
Brahman×BCB-1	24.1±1.23 (7)	64.2±4.88 (5)	-	-	-
Sig.	***	***	***	***	-
Seasons					
Summer (March to June)	21.99±1.10 (10)	71.21±3.65 (7)	140.26±6.06 (6)	193.02±7.65	262.5 (5)
Rainy (July to October)	19.34±0.83 (18)	63.67±2.27 (18)	121.16±3.52 (18)	184.96±7.41	-
Winter (November to February)	27.40±1.35 (8)	70.88±3.68 (8)	85.86±13.85 (1)	-	-
Sig.	***	*	NS	NS	-
Genotype×Season					
Sig.	*	NS	NS	NS	-

***Highly significant ($p<0.001$); *Significant ($p<0.05$); NS Non significant, SEM= standard error mean, parenthesis indicates number of observation

All crossbred progeny performed better than BCB-1 in terms of ADGs (Table 6). In average daily gain, Simmental crossbred was found highest up to 9-month of age but in 9 to 12-month, Charolais crossbred performed the best (Table 6). Only daily gains at 3 to 6 months of age affected by the season ($p<0.05$). No genotype × environment interaction was found on ADGs at different stages of body weight. Figure 1 revealed the comparative growth performance of five different beef genotypes under the study. Average body weight of each genotype was calculated using body weight of male and female together. Here Simmental cross grew faster followed by Charolais, Limousin, Brahman and BCB-1 up to 1 year of age. Brahman calves born later and did not include for evaluation. Nogalski and Kijak (1998) reported the similar results as the present study. They found that crossbred bulls and heifers were heavier and had greater daily gains than the respective purebreds. These findings partially agreed with the results of Ozbeyaz *et al.* (1997) for both sexes they found no significant differences between breed types in terms of daily weight gain but Brangus crossbred males had gained about 39.6 kg more live weight than Limousin crossbred at the end of 510 days fattening period.

Table 5. Effects of genotypes and seasons on average daily body weight gains at different ages

Parameter	Average Daily Gain (kg)			
	Birth to Weaning	3 to 6 month	6 to 9 month	9 to12 month
Genotypes	Mean±SEM			
BCB-1×BCB-1	0.40±0.03 (10)	0.47±0.03 (8)	0.47±0.04 (3)	0.54(1)
Limousin×BCB-1	0.59±0.04 (7)	0.68±0.03 (7)	0.66±0.03 (5)	0.74(2)
Simmental×BCB-1	0.65±0.05 (7)	0.84±0.04 (7)	0.79±0.04 (7)	0.67(1)
Charolais×BCB-1	0.60±0.05 (4)	0.76±0.05 (3)	0.60±0.08 (1)	0.78(1)
Brahman×BCB-1	0.45±0.05 (5)	-	-	-
Sig.	***	***	**	-
Seasons				
Summer (March to June)	0.56±0.04 (7)	0.76±0.03 (6)	0.59±0.03 (6)	0.68 (5)
Rainy (July to October)	0.49±0.02 (18)	0.64±0.02 (18)	0.69±0.03 (10)	-
Winter (November to February)	0.48±0.04 (8)	0.40±0.07 (1)	-	-
Sig.	NS	*	NS	-
Genotype × Season				
Sig.	NS	NS	NS	-

*** Highly significant ($p<0.001$);** moderately significant ($p<0.01$);* significant ($p<0.05$), NS; non-significant; SEM; standard error mean, parenthesis indicates the number of observation.

Disease incidence and calf mortality

A number of calf diseases were identified under the present study (Table 7). Calf scour occurred in all beef genotypes. Most of the cases E. coli and Salmonella were the causal agents for calf scour. Moreover, dietary imbalance and parasitic infestation often lead to scouring. Calves under three month of age were more susceptible to scouring. Calf scour was found as the highest in Limousine cross and lowest in BCB-1 genotype. Alopecia occurred in all genotypes during winter season and recovered without any treatment. Coccidiosis mainly occurred in BCB-1 and Limousin cross. It may be due to a number of calves of BCB-1 and Limousin cross was borne during rainy season.

Table 6. Disease incidence crossbred and BCB-1 progeny

Genotype	Name of Diseases		
	Calf Scour (%)	**Fever (%)**	**Coccidiosis (%)**
BCB-1×BCB-1	8(1)	50(2)	57(4)
Limousin×BCB-1	31(4)	25(1)	43(3)
Simmental×BCB-1	23(3)	0(0)	0(0)
Charolais×BCB-1	15(2)	25(1)	0(0)
Brahman×BCB-1	23(3)	0(0)	0(0)
Total (%)	100(13)	100(4)	100(7)

* Within bracket the number of observation

It is difficult to remove the causal agent of calf scour and coccidiosis due to construction defect of the floor of calf shed. One calf of Brahman cross had skin disease. The endoparasitic infestations identified in BLRI cattle research farm were caused by ascaris, paramphystomum, strongylus and monizia. A total of 38 calves were born and out of that 2 were died due to coccidiosis and premature delivery (Table 8). Table 8 showed that Charolais cross was the highest mortality (16.6%) followed by Limousin cross (12.5%). Overall calf mortality was found 5.26 % in this study.

Table 7. Calf mortality of crossbred and BCB-1 progeny

Genotypes	Calf mortality			
	Total calf born	Calf died	Causes of death	% calf mortality
BCB-1×BCB-1	10	0	-	0
Limousin×BCB-1	8	1	Coccidiosis/ Diarrhea	12.5
Simmental×BCB-1	7	0	-	0
Charolais×BCB-1	6	1	Premature Birth	16.6
Brahman×BCB-1	7	0	-	0
Total	**38**	**2**	**Total**	**5.26**

Conclusion

Growth performance of crossbred Simmental, Charolais, Limousin, Brahman and purebred BCB-1 were studied to select suitable beef genotype for commercial beef production in Bangladesh. Among the five genotypes, crossbred Simmental performed as the best in terms of growth performance up to 12 months of age (yearling). Growth performance of all genotypes will be evaluated at 2 years of age for final selection of suitable beef genotype for the production of market beef cattle.

References

Bangladesh Bureau of Statistics (BBS) 2010. Census of Agriculture 2008, Structure of agricultural holdings and livestock population, Volume 1, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, The Govt. of Bangladesh.

Bhuiyan AKFH, MM Hussain and GK Deb (2007). Indigenous cattle genetic resources of Bangladesh and a way forward to their development. Bangladesh Journal of Progressive Science and Technology. 5: 105-112.

Huque KS (2011). Native animals are low productive-a clamor. BLRI Newsletter-a free updates on livestock research and production. 2 (1 & 2).

Huque KS (2012). Changes in and challenges of Bangladesh livestock. BLRI Newsletter. 3:1.

Huque KS and MYA Khan (2017). Socio-geographic distribution of livestock and poultry in Bangladesh- A review. Bangladesh Journal of Animal Science. 46(1):65-81.

Kramer CY (1957). Extension of Multiple Range Tests to Group Correlated Adjusted Means. Biometrics. 13(1): 13-18.

Nogalski Z and Z Kija (1998). The effect of crossing Black and White cattle with the Limousin breed on fattening capacity and slaughter value of the crossbreds. Roczniki Naukowe Zootechniki. 25(3): 23-34.

Ozbeyaz C, T Yagci and O Alpen (1997). Commercial crossbreeding of Jersey cows for beef production using Brangus, Limousin and Simmental sires. II. Fattening, slaughtering and carcass characteristics. Lalahan Hayvancilk Arastiring Enstitusu Dergisi, 37:1-22.

Rashid MM, AKFH Bhuiyan, MA Hoque and KS Huque (2014). Study on feeding concentrates on the growth performance of Brahman-Native crossbred bulls in Bangladesh. Proceedings of the 16th AAAP Animal Science Congress, Gadjah Mada University, Yogyakarta, Indonesia. Vol. II.: 10-14.

Roy BK, KS Huque, NR Sarker, SMJ Hossain, MS Rana and MN Munsi (2013). Study on growth and meat quality of native and Brahman crossbred bulls at different ages. Annual Research Review Workshop. BLRI, Savar, Dhaka. 33-34.

Scholtz M M and A Theunissen (2010). The use of indigenous cattle in terminal cross-breeding to improve beef cattle production in Sub-Saharan Africa. Animal Genetic Resources, 46: 33-39.