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Animal performance of indigenous Red Chittagong cattle in Bangladesh

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ABSTRACT. The study was carried out using body weights at several ages of Red Chittagong Cattle (RCC) performed on two management systems viz in-farm and in-field. There were a total of 208 animals whose body weights were recorded from 2005 to 2013. The overall average weight at birth (BW), 3-month (3MWT), 6-month (6MWT), 9-month (9MWT), 12-month (12MWT), 15-month (15MWT), 18-month (18MWT), 21-month (21MWT), 24-month (24MWT), 27-month (27MWT), 30-month (30MWT) and 33-month (33MWT) were 15.4 ± 0.15, 30.5 ± 0.75, 43.1 ± 1.03, 54.6 ± 1.77, 65.7 ± 2.34, 70.7 ± 2.72, 86.7 ± 4.33, 92.1 ± 3.71, 105.2 ± 4.43,114.5 ± 5.04,122.8 ± 4.71 and 101.8 ± 12.16 kg, respectively in farm condition while corresponding values field condition were 14.7 ± 0.24, 31.1 ± 0.53, 41.9 ± 0.78, 52.2 ± 0.98, 60.99 ± 1.12, 70.6 ± 1.66, 79.5 ± 2.04, 89.2 ± 2.61, 102.1 ± 4.01, 112.3 ± 3.81, 128.4 ± 5.63 and 100.7 ± 21.53 kg respectively. The effect of different non genetics factors such as management system, sex, parity of dam, season of birth and year of birth were estimated on body weight. Linear growth curves from birth to 33 months of age of RCC on two management systems showed an increasing trend in body weight from birth to 30 months of age with highest body weight attained at 30 months of age and afterwards showed a gradual declining trend. The results indicated that RCC has almost similar body weight and growth performance in farm and field conditions meaning their equal suitability in both management systems.

Keywords: Red Chittagong cattle, body weight, growth curve.

Desempenho animal de bovinos chittagong vermelhos indígenas em Bangladesh

RESUMO. O estudo foi realizado utilizando pesos corporais em várias idades de gado Red Chittagong (RCC) em dois sistemas de manejo viz in-fazenda e em campo. Havia um total de 208 animais com peso corporal registrados de 2005 a 2013. O peso médio global ao nascimento (PN), aos 3 meses (3MWT), 6 meses (TC6), 9 meses (9MWT), 12 meses (12MWT), 15 meses (15MWT), 18 meses (18MWT), 21 meses (21MWT), 24 meses (24MWT), 27 meses (27MWT), 30 meses (30MWT) e 33 meses (33MWT) foi de 15,4 ± 0,15, 0,75 ± 30,5, 43,1 ± 1,03, 54,6 ± 1,77, 65,7 ± 2,34, 70,7 ± 2,72, 86,7 ± 4,33, 92,1 ± 3,71, 105,2 ± 4,43, 114,5 ± 5,04, 122,8 ± 4,71 e 101,8 ± 12,16 kg, respectivamente, na condição fazenda, enquanto os valores correspondentes de condição de campo foram 14,7 ± 0,24, 31,1 ± 0,53, 41,9 ± 0,78, 52,2 ± 0,98, 60,99 ± 1,12, 70,6 ± 1,66, 79,5 ± 2,04, 89,2 ± 2,61, 102,1 ± 4,01, 112,3 ± 3,81, 5,63 ± 128,4 e 100,7 ± 21,53 kg, respectivamente. O efeito de diferentes fatores não genéticos, tais como: sistema de gestão, sexo, paridade da barragem, estação de nascimento e ano de nascimento foram estimados no peso corporal em vários anos. Curvas de crescimento linear desde o nascimento até 33 meses de idade da RCC em dois sistemas de manejo mostraram uma tendência de aumento no peso corporal desde o nascimento até 30 meses de idade, com maior peso corporal atingida aos 30 meses de idade, e depois mostraram uma tendência gradual de declínio. Os resultados indicaram que RCC tem peso corporal e crescimento quase iguais em condições de campo e fazenda, o que significa sua igual adequação em ambos os sistemas de gestão.

Palavras-chave: bovinos red chittagong, peso corporal, curva de crescimento.

Introduction

The Red Chittagong cattle (RCC) is a valuable Indigenous bovine genetic resource of Bangladesh with many attributes better than other available indigenous types. These cattle are readily distinguishable from others due to its distinct phenotypic features (Alam, Bhuiyan, Ali, & Mamun, 2007).

The positive features of RCC lie on its ability to withstand extreme tropical climates and to survive on low quality feed during periods of feed shortage. Furthermore, they are reputed to give birth every year, lower calf mortality can give birth of to 8-10 calves in life time, attain sexual maturity earlier, suitable for tillage operation and traction, swift in

their movement, hardworking in hot, humid and rainfall condition are considered unique characteristics of RCC (Jabbar & Green, 1982; Habib, Bhuiyan, Bhuiyan, & Khan, 2003). Growth is one of the most important characteristics of cattle and has been investigated for many years (Blasco & Gomes, 1993; Bathaei & Leroy, 1998). Changes in live weight with age are important aspects of beef production from cattle. Growth studies are very important for livestock production because growth is the foundation on which the other forms of production such as milk, meat and work rest and it provides scope for early selection of animal. This study was performed to evaluate the body weights of RCC at several ages both on-station and on-field and to compare their growth curves in the said management systems.

Material and methods

Animal and data

Long term research work conducted at the Department of Animal Breeding and Genetics, Bangladesh Agricultural University (BAU), Mymensingh aiming at conservation and improvement of RCC is being carried out since 2004 where data have been generated on Red Chittagong cattle maintained and performed on two management systems viz: (i) improved management system where RCCs were maintained at the Nucleus Herd at BAU, Mymensingh and (ii) low input management system where RCCs were maintained at farmers' houses in rural village of Char Jailkhana, Mymensingh Sadar in Mymensingh district. Data included a total of 208 animals of which 90 animals from 2005 to 2008 in station and 118 animals from 2009 to 2013 in field conditions. Traits considered in this study were birth weight (BW), 3- month body weight (3MWT), 6- month body weight (6MWT), 9- month body weight (9MWT), 12- month body weight (12MWT), 15- month body weight (15MWT), 18- month body weight (18MWT), 21- month body weight (21MWT), 24- month body weight (24MWT), 27- month body weight (27MWT), 30- month body weight (30MWT) and 33- month body weight (33MWT).

Animal management system

In the Nucleus Herd cattle were fed with urea, molasses and straw as basal diet supplemented with some concentrates and green grasses (Table 1, 2 and 3). Concentrate feeds were supplied twice daily in the morning and evening. Annual fodder maize and perennial fodder German and road side grasses were fed in fresh condition to the cattle and calves. In the on-field rural village level cattle were reared by traditional management system as grazing and cut and carry green/roadside grasses. Sometimes farmers supplied concentrate feed with straw to their animals especially to milking cows. In both management systems cattle were bred through Artificial Inseminators using semen of pure RCC bulls maintained at the BAU AI Centre. Other activities like records on pedigree, date of birth, birth weight, weighing at regular intervals, date and weight at weaning, date at first service, date of conception, pregnancy diagnosis, number of services per cow, date of calving, milk yield, date of abortion, date of death and sale or culling, and other management events were regularly carried as accurate as possible.

Table 1. Types of diet used for the RCC at the Nucleus Herd (*ex situ*)

Diet	Composition
1	Urea-molasses- rice straw (UMRS) + Green Grass + Concentrate
2	Molasses-rice straw (MRS) + Green Grass + Concentrate
3	Rice straw (RS) + Green Grass + Concentrate

Source: the author.

Table 2. Composition of UMRS and MRS.

Component	Amount	
	UMRS	MRS
Chopped straw (kg)	100	100
Molasses (kg)	20	20
Urea (kg)	03	-
Water (kg)	100	100

Source: the author.

Table 3. Composition of concentrate mixture with nutrients value

Ingredient	Amount (%)	
	Adult cows	Calves
Wheat bran	20	-
Rice polish	25	-
Mustard oil cake	15	20
Corn (crushed)	20	50
Soybean meal	10	20
Di-calcium phosphate (DCP)	05	05
Common salt	05	05
Vitamin premix	0.01	0.01
Estimated CP (g kg^{-1} DM)	180	195
Estimated energy (MJ ME/kg DM)	10.0	11.5

Source: the author.

Data analysis

The data recorded from this research were entered in Microsoft Excel Worksheet, organized and processed for further analysis. Mean with standard errors (SE) for different traits were estimated with the help of Statistical Analysis System (SAS 9.1.3). Analysis of variance procedure of the same statistical package was used in a preliminary statistical treatment to detect the effects of fixed effects of breed, sex and their interaction on body weight across the ages.

The following generalized linear model (GLM) was used:

$$Y_{ijklmn} = \mu + a_i + b_j + c_k + d_l + p_m + e_{ijklmn}$$

where μ is the general mean assumed to be fixed and unknown, normally distributed with mean 0 and variance δ^2, a_i is the fixed effect of production system (i=1,2); b_j is the fixed effect of sex (j=1,2); c_k = effect of year of birth (k= 2005 to 2013); d_l = effect of season of birth (l = 1,2,3,), p_m = effect of parity of dam (m=1 to 8) and e_{ijklmn} is the error term associated with the measurements and assumed to be normally and independently distributed $\sim(0,\sigma^2_e)$ where σ^2_e is the common variance.

Construction of growth curve

Linear growth curves from birth to 33-month of age in two management systems were constructed and compared to describe body weight changes of Red Chittagong cattle with age in two management systems.

Results and discussion

Growth performance of Red Chittagong cattle maintained on two management systems were analyzed and used for constructing growth curves. Means with standard errors (SE) of body weights of RCCs were calculated from birth to 33-month of age at 3-month interval. Table 4 shows the summary of effect of various factors on the body weight traits of RCC.

Table 4. Summary of effect of various factors on the body weights of RCC

Trait	Effect of				
	Management system	Sex	Year of birth	Season of birth	Parity of dam
Birth weight	**	***	NS	*	NS
3MWT	NS	NS	NS	NS	NS
6MWT	NS	NS	**	NS	NS
9MWT	NS	NS	*	**	NS
12MWT	*	NS	**	NS	NS
15MWT	NS	NS	NS	NS	NS
18MWT	NS	NS	*	NS	NS
21MWT	NS	NS	NS	NS	NS
24MWT	NS	NS	NS	NS	NS
27MWT	NS	NS	NS	NS	NS
30MWT	NS	NS	NS	NS	*
33MWT	NS	NS	***	*	*

*= Significant at 5% level of probability ($p < 0.05$),** = Significant at 1% level of probability ($p < 0.01$), *** = Significant at 0.1% level of probability ($p < 0.001$); NS = Not significant ($p > 0.05$). #3MWT= 3- month body weight; 6MWT= 6- month body weight; 9MWT= 9- month body weight; 12 MWT= 12- month body weight; 15 MWT= 15- month body weight; 18 MWT=18- month body weight; 21 MWT= 21- month body weight; 24 MWT= 24- month body weight; 27 MWT= 27- month body weight; 30 MWT= 30- month body weight; 33MWT= 33- month body weight.

Analysis of variance showed effect of management system on birth weight ($p < 0.01$) and 12-month body weight ($p < 0.05$) while no ($p > 0.05$) effects of the similar were found on 3MWT, 6MWT, 9MWT, 15MWT, 18MWT, 21MWT, 24MWT, 27MWT, 30MWT and 33MWT. There effect of sex on birth weight was significant ($p < 0.001$) while no ($p > 0.05$) effect of sex on body weight at the said several ages. Analysis of variance showed that there was ($p < 0.05$) effect of parity of dam on 30MWT and 33MWT. There was effect of season of birth on birth weight ($p < 0.05$), 9MWT ($p < 0.01$), and 33MWT ($p < 0.05$). Also, significant effect of year of birth on 6MWT ($p < 0.01$), 9MWT ($p < 0.05$), 12MWT ($p < 0.01$), 18MWT ($p < 0.05$) and 33MWT ($p < 0.001$) were observed.

Body weights of RCC according to different factors

Table 5 shows the mean body weight (birth to15-month) of RCC according to different factors. Management system had ($p < 0.01$) effect on birth weight of calves (Table 4). The average birth weight was 15.4±0.16 kg in station and 14.7±0.24 kg in field. Khan, Haque, Mian and Khatun (2000) observed the birth weight of Red Chittagong cattle (RCC) in farm and rural conditions as 17.3±0.76 and 16.0±1.52 kg. Sex of calves had ($p < 0.001$) effect on birth weight of RC calves (Table 4). Males (16.2±0.16 kg) had higher birth weight than females (13.9±0.159 kg). These differences in sex could be due to the greater rate of skeletal growth in utero of male calves compared to female calves. Season of birth had ($p < 0.05$) effect on birth weight of calves (Table 4) and is consistent with Meyer (1997). Acharya, Balaine and Mohan (1977) stated that the influence of month of calving on birth weight might be the result of differential availability of pastures to pregnant dams due to variable weather conditions and the direct effect of the latter on the comfort of the animal. Parity of dam and year of birth had no ($p > 0.05$) effect on birth weight (Table 4). This result agrees with the results of Habib, Bhuiyan and Amin (2009), Rabeya, Bhuiyan, Habib and Hossain (2009) and Munim, Hussain, Hoque and Khandokar (2006).

Management system, sex of calves, parity of dam, season of birth and year of birth showed ($p > 0.05$) effect on 3-month body weight (Table 4). This result agrees with the result of Afroz, Hoque and Bhuiyan (2011) who found non-significant ($p > 0.05$) effect of sex of calf, parity of dam, season of birth and year of birth on 3-month body weight but significant ($p < 0.05$) effect of sex of calf on birth weight was found by Rabeya et al. (2009). Management system, sex of calves, parity of dam and season of birth showed ($p > 0.05$) effect on 6-month body weight (Table 4). Non-significant ($p > 0.05$) effect of sex of calves, parity of

dam and season of birth were found by Afroz et al. (2011) on 6- month body weight but ($p < 0.05$) effect of sex of calf on 6- month body weight was found by Rabeya et al. (2009). Management system, sex of calves, parity of dam showed ($p > 0.05$) effect on 9-month body weight (Table 4). This result agrees with the result of Afroz et al. (2011) who found non-significant ($p > 0.05$) effect of sex of calves, parity of dam on 9-month body weight but ($p < 0.05$) effect of sex of calf on 9- month body weight was found by Rabeya et al. (2009). Management system showed significant effect ($p < 0.05$) on 12-month body weight (Table 4). The mean 12-month weight was higher (65.68±2.34kg) in station than in field (60.1±1.12 kg).

Year of birth had ($p < 0.01$) effect on 6-month body weight with a trend of 2009>2007>2010>2008 (Table 5). No ($p > 0.05$) effect of year of birth on 6-month body weight was found by Afroz et al. (2011). Year of birth had ($p < 0.05$) effect on 9-month body weight with a trend of 2007>2009>2010>2008 (Table 5). No ($p > 0.05$) effect of year of birth on 9-month body weight of RCC was also found by Afroz et al. (2011). Year of birth had ($p < 0.01$) effect on 12-month body weight with a trend of 2007>2009>2010>2008 (Table 5). No ($p > 0.05$) effect of year of birth on 12- month body weight was found by Afroz et al. (2011).

Season of birth had ($p < 0.01$) effect on 9-month body weight with a trend of winter>summer>rainy (Table 5). No ($p > 0.05$) effect of season of birth on 9-month body weight was found by Afroz et al. (2011).

Sex of calves, parity of dam, season of birth showed no ($p > 0.05$) effect on 12- month weight. This result agrees with the result of Afroz et al. (2011).

Management system, sex of calves, parity of dam, season of birth and year of birth showed no ($p > 0.05$) effect on 15- month body weight (Table 4). This result was consistent with the result of Afroz et al. (2011) who found no effect of sex of calves, parity of dam, season of birth and year of birth for 15-month body weight.

Year of birth had ($p < 0.05$) effect on 18-month body weight with a trend of 2009>2008>2007>2010 (Table 6). No ($p > 0.05$) effect of year of birth on 18-month body weight was found by Afroz et al. (2011).Management system, sex of calves, parity of dam and season of birth showed no ($p > 0.05$) effect on 18-month body weight (Table 4). This result was consistent with the result of Afroz et al. (2011) who found no effect of sex of calves, parity of dam and season of birth for 18-month body weight.

Management system, sex of calves, parity of dam, season of birth and year of birth showed no ($p > 0.05$) effect on 21-month body weight (Table 4). No ($p > 0.05$) effect of sex of calves, parity of dam, season of birth and year of birth on 21- month body weight was found by Afroz et al. (2011).

Management system, sex of calves, parity of dam, season of birth and year of birth showed no ($p > 0.05$) effect on 24-month body weight (Table 4). No ($p > 0.05$) effect of sex of calves, parity of dam, season of birth and year of birth on 24- month body weight was found by Afroz et al. (2011).

Management system, sex of calves, parity of dam, season of birth and year of birth showed no ($p > 0.05$) effect on 27-month body weight (Table 4). Management system, sex of calves, season of birth and year of birth showed no ($p > 0.05$) effect on 30-month body weight (Table 4). Parity of dam had ($p < 0.05$) effect on 30- month body weight with a trend of $2^{nd}>5^{th}>6^{th}>1^{st}>4^{th}>3^{rd}$ (Table 6).

Table 5. Mean ± SE of body weights of RCC according to different factors

Factor	Category	Mean ±SE					
		BWT	3MWT	6MWT	9MWT	12MWT	15MWT
Management system	On field	15.39±0.15	30.47±0.75	43.14±1.03	54.56±1.48	65.68±2.3	70.69±2.77
	On station	14.69±0.24	31.13±0.53)	41.95±0.78	52.19±0.98	60.99±1.1	70.65±1.66
Sex of calf	Male	16.22±0.16	31.07±0.64	41.88±0.86	53.11±1.17	63.02±1.48	70.57±1.99
	Female	13.92±0.16	30.66±0.58	42.96±0.92	52.98±1.18	62.06±1.64	70.74±2.02
Parity of dam	1st	14.94±0.34	31.12±1.13	41.36±1.16	49.52±2.04	59.37±2.59	65.25±2.86
	2nd	14.85±0.34	32.52±1.34	44.16±1.74	54.55±2.25	65.76±3.84	76.90±4.66
	3rd	14.29±0.34	29.45±1.08	43.59±2.06	56.07±2.67	65.48±3.94	71.91±5.86
	4th	15.34±0.40	32.03±1.04	44.52±1.28	56.47±1.65	66.28±2.30	72.76±2.32
	5th	15.86±0.40	30.57±1.2	42.20±1.46	52.19±2.46	63.76±3.01	73.96±4.19
	6th	15.78±0.42	28.78±1.31	39.61±2.26	50.86±3.17	58.54±3.13	69.80±6.81
Season of birth	Summer	14.92±0.25	31.14±0.83	42.6±1.10	53.09±1.46	62.02±2.03	71.55±2.80
	Rainy	14.93±0.27	30.31±0.88	40.86±1.19	50.46±1.38	59.33±2.24	67.41±2.23
	Winter	15.38±0.23	30.92±0.69	43.34±1.14	55.11±1.63	65.73±1.87	73.11±2.73
Year of birth	2007	14.86±0.36	29.55±1.02	42.38±2.54	57.62±2.54	70.43±4.29	78.07±4.34
	2008	14.95±0.53	29±1.32	40.21±1.58	49.26±1.81	60.1±2.64	69.52±3.25
	2009	15.47±0.48	33.10±1.29	46.38±2.02	55.69±2.75	65.04±3.68	79.87±6.73
	2010	15.56±0.46	30.17±1.37	41.86±2.04	53.15±2.0	64.05±0.44	72.00±2.30

Source: the author.

Table 6. Body weight (18- month to 33- month) of RCC according to different factors

Factor	Category	Mean ±SE					
		18MWT	21MWT	24MWT	27MWT	30MWT	33MWT
Management system	On field	86.68±4.33	92.09±3.72	105.20±4.43	114.51±5.05	122.81±4.71	101.75±12.17
	On station	79.46±2.04	89.23 ±2.61	102.06±4.01	112.25±3.82	128.36±5.63	100.70±21.53
Sex of calf	Male	81.13±3.05	89.02±2.40	105.20±5.68	116.40±6.17	127.40±7.34	88.20±35.21
	Female	82.07±2.39	91.25±2.73	102.55±3.30	111.55±3.47	123.48±4.23	103.87±10.96
Parity of dam	1st	74.47±3.38	82.27±4.95	93.57±6.96	104.23±6.76	119.12±7.16	84.54±19.89
	2nd	89.45±7.15	101.50±7.94	119.10±8.60	125.14±5.96	146.00±4.21	77.37±28.25
	3rd	89.08±8.78	87.75±11.13	104.75±11.83	105.33±11.53	109.50±9.13	131.33±11.86
	4th	80.41±2.47	92.15±3.17	99.90±5.17	112.25±8.70	113.66±6.48	119.80±6.60
	5th	91.38±8.2	96.90±4.87	110.12±4.7	124.87±6.00	144.00±7.81	148.50±3.50
	6th	77.35±7.15	89.77±7.40	96.33±3.82	117.50±9.13	129.67±5.48	136.50±5.50
Season of birth	Summer	82.17±3.85	92.06±4.28	102.41±5.71	114.11±6.45	120.30±7.63	78.66±19.68
	Rainy	75.46±2.34	82.76±3.45	94.84±5.06	100.63±4.26	114.85±6.87	75.28±25.73
	Winter	87.70±4.05	95.00±3.75	109.24±3.95	119.31±4.32	131.68±4.61	135.50±5.18
Year of birth	2007	84.71±4.07	91.71±4.24	104.14±5.75	107.57±5.31	120.70±6.78	129.07±7.72
	2008	84.92±5.43	93.85±5.43	105.73±6.72	114.31±7.95	122.33±7.79	131.62±4.91
	2009	97.73±9.27	102.5±8.38	114.45±6.68	112.8±5.05	134.42±4.26	143.25±3.3
	2010	81.38±3.20	92.57±4.40	103.09±6.23	115.18±5.31	130.83±4.8	140.60±5.95

Source: the author.

Management system and sex of calf showed no ($p > 0.05$) effect on 33-month body weight (Table 4). Parity of dam had significant ($p < 0.05$) effect on 33-month body weight (Table 4) with a trend of $5^{th}>6^{th}>3^{rd}>4^{th}>1^{st}>2^{nd}$ (Table 6). Season of birth had ($p < 0.05$) effect on 33- month body weight with a trend of winter>summer>rainy (Table 6). Year of birth had ($p < 0.001$) effect on 33-month body weight with a trend of 2009>2010>2008>2007 (Table 6).

Growth curves of Red Chittagong Cattle

The body weights (kg) of RCCs at several ages in two management systems are presented in Table 7 and the same in the form of growth curve have been plotted in Figure 1.

Table 7. Body weights (kg) of RCCs at several ages in two management systems

Age class	Mean ± SE	
	On-station	On-field
Birth	15.39±0.15	14.69±0.24
3M	30.47±0.75	31.13±0.53
6M	43.14±1.03	41.95±0.78
9M	54.55±1.77	52.19±0.98
12M	65.67±2.34	60.99±1.12
15M	70.69±2.72	70.65±1.66
18M	86.68±4.33	79.46±2.04
21M	92.09±3.71	89.23±2.61
24M	105.20±4.43	102.06±4.01
27M	114.51±5.04	112.25±3.81
30M	122.81±4.71	128.36±5.63
33M	101.75±12.16	100.70±21.53

Source: the author.

From the constructed curves (Figure 1) it is clear that there was an increasing trend in body weight from birth to 30-month of age. The RCCs showed their highest body weights at 30-month of age, after that the weight of animals showed a gradual decline in growth curve, no matter the management system is (on-field or on-farm). Traditional management system could not hamper their performance while the improved management could not cross their genetic level. The obtained results were in line with the results obtained in similar indigenous cattle elsewhere. However, the differences among estimates obtained by others and the present study could be partly explained by greater environmental changes in which the individuals were exposed during data collection, sample sizes used in estimation and genetic constitution of the population from which samples were picked up.

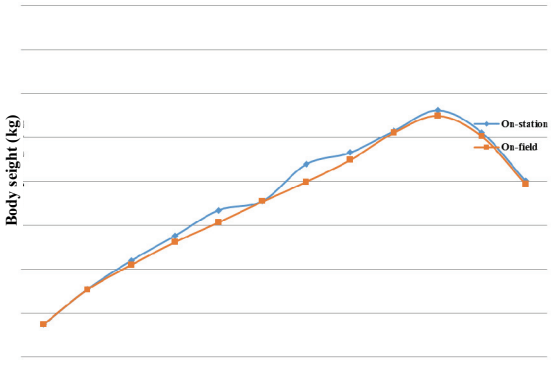

Figure 1. Growth curves of Red Chittagong cattle.
Source: the author.

Conclusion

In conclusion, it could be pointed out that in spite of little differences, RCC has almost similar body weight and growth performance in both management systems (on-station or improved management system and on-field or low input / traditional management system). So, it can be said that, RCC could be considered as an equally suitable breed for both management system and any attempt

in improving its performance through breeding may equally be accrued in both management systems.

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