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Lactation performance of Red Chittagong Cattle and effects of environmental factors

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Abstract

The present study was undertaken to estimate effects of environmental factors on milk production traits in Red Chittagong Cattle (RCC). A total of 103 milk yield records of 45 RCC cows obtained between 2005 and 2009 were analysed. Actual lactation yield, lactation length, daily milk yield and dry period were estimated as 500.7 ± 19.3 kg, 259.6 ± 6.2 days, 1.9 ± 0.1 kg and 162.4 ± 7.7 days, respectively. Age and season corrected lactation yield, 305 day milk yield and daily milk yield were estimated as 605.4 ± 22.9, 677.1 ± 19.4 and 2.2 ± 0.1 kg, respectively. Sex of calf and season of birth did not significantly ($P>0.05$) affect production, but lactation order significantly ($P<0.05$) affected production except lactation length. Year of birth had no effect ($P>0.05$) on the traits analysed except daily milk yield ($P<0.05$). Calving age significantly ($P<0.05$) affected lactation yield but did not other traits. Cows in 5th lactation produced highest total (604.3 ± 69.3 kg) and daily milk yield (2.17 ± 1.8 kg). Cows aged 6 – 7 years had best lactation yield (576.8 ± 60.5 kg). (*Bangl. vet*. 2010. Vol. 27, No. 1, 18 – 25)

Introduction

In the dairy industry, productive traits directly affect the profitability of the farm. These traits depend largely on the genetic potential of the dam and sire. Profitable breeding could be improved by keeping lactation length, dry period and service period between optimal limits (Alpan, 1994; Cilek and Tekin, 2005). In order to let an individual express its full genetic potential, it is necessary to optimize the environment. Some environmental factors can measured, such as age, year, season, milking frequency, but some cannot, such as disease. Although, data on performance of exotic and crossbred cows are available in Bangladesh, they are very limited in case of indigenous cattle. A comprehensive study on milk production traits of indigenous cattle is essential for improving the breeding efficiency and formulating breeding strategy. Red Chittagong Cattle (RCC) is a promising indigenous type with some unique features, and is found in Chittagong area. But they have been losing their unique features due to indiscriminate breeding with poor indigenous, exotic and crossbred cattle.

The present study was conducted to know the factors affecting milk production potential of RCC in intensive farm management conditions in Bangladesh.

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Materials and Methods

Data on milk production of RCC cows were collected from the nucleus herd of Bangladesh Agricultural University (BAU) Dairy Farm, Mymensingh from 2005 to 2009. To determine the effect of season, the months were grouped into summer (March - June), rainy season (July - October) and winter (November - February). Generally, the animals were maintained in face-out open sheds. Bulls, lactating cows and calves were kept in separate sheds. Pregnant cows were usually moved to the maternity barns about two months before calving. Artificial insemination (AI) was practiced. Animals were stall-fed throughout and were seldom grazed. Urea-molasses-straw or molasses-straw were provided twice a day *ad lib* throughout. Green forage including German grass, sorghum and maize fodder were provided at 5 kg/animal/day. Concentrate mixture (wheat bran, rice polish, corn powder, oil cake, soybean meal, di-calcium phosphate, salt and vitamin-mineral premix) was supplied each morning at 600g/lactating cow, 500g/pregnant cow and 400g/dry cow and heifer. Calves remained in separate pens except at milking time when they were allowed to suck from their dams, until weaning. Cows were usually culled for old age, failure to produce milk or reproductive incapability. Replacements were usually selected from calves born in the herd. Cattle were regularly vaccinated against Foot and Mouth Disease and Anthrax. Adult animals were treated time to time with albendadole (Endokill® - ACI Ltd., Helmex® - Renata Animal Health Ltd.), tetramizole & oxyclozanide (Tetranid® - Techno Drugs Ltd.; Levanid® - ACME Laboratories Ltd.) and ivermectin (Cevamec® - 1% - ACI Ltd.), while fenbendazole (Peraclear® - Techno Drugs Ltd.) was used for young calves. All anthelmintics were administered according to the results of faecal sample examination. Milk yield, lactation length and dry period were measured. The test day milk yields were standardized according to age at calving and season of calving as described by Van Vleck and Henderson (1961).

Data analysis and statistical model

Simple means and standard errors for the traits studied were estimated using SPSS 11.5 computer package program. For analysis of variance (ANOVA), LSD test using SPSS program was used. Duncan's multiple range test (DMRT) was used for multiple comparisons of each trait. The statistical model was as follows:

$$Y_{ijklmn} = \mu_i + A_{ij} + B_{ik} + C_{il} + D_{im} + E_{in} + \mathbf{e}_{ijklmn}$$

Where,

Y_{ijklmn} = Observed milk production i at lactation number j, calving age k, calving season l, calving year m and sex of calf born n,
μ_i = Population mean for trait i,
A_{ij} = Fixed effects of lactation number j for trait i (j = 1, 2, …, 6),
B_{ik} = Fixed effects of calving age k for trait i (k = <4, 4-5, 5-6, 6-7 and ≥7 years),
C_{il} = Fixed effects of calving season l for trait i (l = summer, rainy, winter),
D_{im} = Fixed effects of calving year m for trait i (m = 2005, 2006, …, 2009),

E_{in} = Fixed effects of sex of calf born n for trait i (n = male and female) and
e_{ijklmn} = Random sampling error

Results and Discussion

The least squares means along with their standard errors for different milk production traits and the effects of various environmental factors on the traits analysed are in Table 1.

Lactation length

The mean lactation length of RCC was 259.6 ± 6.2 days, which is consistent with the studies of Habib *et al.* (2003) for RCC (261.1 ± 14.5 days) at BAU dairy farm. Shorter lactations (211.5 ± 20.9 to 242.2 ± 8.3 days) were found by Alam *et al.* (2007); Munim *et al.* (2006); Khan *et al.* (1999) for RCC. Nondescript *Desi* cattle showed shorter lactation (221.3 ± 21.9 to 250.6 ± 69.8 days) as reported by Khan *et al.* (2001); Rahman *et al.* (2001); Hossain and Routledge (1982). Longer lactations were reported by Hossain and Routledge (1982) for Pabna cows (286.0 ± 67 days) and Munim *et al.* (2006) for local indigenous cattle (284.2 ± 18.4 days). Their findings were not consistent with our study.

Table 1. Least squares means (± SE) of milk production and their effects for various factors

Traits	Mean ± SE	Level of significance				
		Sex of calf born	Lactation order	Season of birth	Year of birth	Calving age
Lactation length (day)	259.6 ± 6.2(100)	NS	NS	NS	NS	NS
Lactation yield (kg)	500.7 ± 19.3(103)	NS	(P<0.05)	NS	NS	(P<0.05)
Daily milk yield (kg)	1.9 ± 0.1(103)	NS	(P<0.05)	NS	(P<0.05)	NS
Dry period (day)	162.4 ± 7.7(66)	NS	(P<0.05)	NS	NS	NS
Corrected lactation yield (kg)	605.4 ± 22.9(103)	-	-	-	-	-
Corrected 305-day milk yield (kg)	677.0 ± 19.4(103)	-	-	-	-	-
Corrected daily milk yield (kg)	2.2 ± 0.1(103)	-	-	-	-	-

Figures in parenthesis indicate number of observations, NS means non-significant at 5% level (P>0.05); - Indicates effect not included in the model

Table 2 shows that cow that gave birth to male calves had a tendency to longer lactation, although it was statistically insignificant (P>0.05). Analysis of variance showed non-significant (P>0.05) variations of lactation length by lactation order, season of calving and year of calving. The longest lactation was at 4th to 5th lactation and minimum at 6th lactation (not significant). The result is in agreement with the

results of Cilek (2009); Zafar *et al.* (2008); Erdem *et al.* (2007); Bilgic and Alic (2005); Pelister *et al*. (2000a); Wilson *et al.* (1987), but not with the results of Cilek (2009); Zambrano *et al.* (2006), who found significant effects ($P<0.05$; $P<0.001$) of lactation order and calving year on lactation duration. Age of cow did not significantly ($P>0.05$) affect lactation length (Table 1) is in accordance with the results of Cilek (2009) but not with those of Inci *et al.* (2007); Pelister *et al.* (2000a).

Lactation yield

The mean lactation yield was 500.7 ± 19.3 kg. The result is closely in accordance with the results of Alam *et al.* (2007) and Munim *et al.* (2006) who found 516.9 ± 35.9 and 528.8 ± 59.8 kg for RCC and Local × Sahiwal cross, respectively. But Munim *et al.* (2006); Habib *et al.* (2003) found better lactation yields of RCC as 570.5 ± 112.5 and 661.2 ± 39.8 kg, respectively. The lactation yield of RCC is better than that of nondescript *Desi* cows (213.0 ± 9 kg) reported by Hossain and Routledge (1982). In study by Hossain and Routledge (1982), lactation yields was 803.0 ± 290 kg for Pabna cows, higher than this study. The mean age-season corrected lactation yield and projected 305-day milk yield of RCC were 605.4 ± 22.9 and 677.0 ± 19.4 kg, respectively. There is no literature on RCC or other indigenous cows in Bangladesh for age-season corrected milk yield traits.

Analysis of variance revealed that milk yield is significantly ($P<0.05$) affected by lactation order and age at calving (Table 1). Milk yield reached a maximum at 5th lactation and then declined (Table 2). Wilson *et al.* (1987) found yields increased to a maximum at 3rd to 5th lactations and then diminished. Zafar *et al.* (2008) found lowest milk yield for the first lactation and highest in 6th lactation. Aslam *et al*. (2002) found highest milk yield in 4th parity. Their results are closely in line with the result of this study. Many studies have found significant effect of parity (lactation number) on production, especially between first and later parities. This indicates that cows starting lactation at early age are not mature. But the result of this study contradicts the results of Alam *et al.* (2007); Bilgic and Alic (2005); Habib *et al.* (2003) who found non-significant effect of lactation number on yields. The present result is in agreement with the results of Cilek *et al.* (2009); Acharya *et al.* (1977), who reported cows attained highest yield at 7-7.5 years of age. Lactation yield was not affected significantly ($P>0.05$) by sex of calf born, calving season and year (Table 1). The small variations of milk yield with season and year of calving might be due to seasonal influences as well as feed, temperature, humidity and management. This statement is supported by Cilek (2009); Zafar *et al*. (2008); Cilek and Tekin (2005); Erdem *et al.* (2007); Aslam *et al.* (2002); Wilson *et al*. (1987), who reported significant variation of milk yield with those factors. Bilgic and Alic (2005); Pelister *et al*. (2000b); Wilson *et al.* (1987) reported milk yield was not affected significantly by those factors, in accordance with the present finding.

Daily milk yield

The mean daily milk yield of RCC was 1.9 ± 0.1 kg, similar to the study of Khan *et al.* (1999) who found daily milk yield of RCC to be 1.8 ± 0.9 and 2.0 ± 0.7 kg for

RCC in rural and farm conditions, respectively. Khan *et al*. (2001) found daily milk yield of nondescript *Desi* cows to be 1.9 ± 0.3 kg, similar to this study, but the result is inconsistent with Munim *et al.* (2006); Habib *et al*. (2003) who found 2.5 ± 0.3 and 2.6 ± 0.1 kg, respectively, for RCC. The daily milk yield of RCC is better than that of nondescript *Desi* cows as reported by Bhuiyan and Faruque (1993); Husain and Mostafa (1985), who found daily milk yield as 1.6 ± 0.7 and 1.5 ± 0.2 kg (1.2 ± 0.1 kg for farming condition), respectively. The standardized age and season corrected daily milk yield of RCC was estimated as 2.2 ± 0.1 kg.

Daily milk yield differed significantly ($P<0.05$) with lactation order and calving year (Table 1). The daily milk yield in 5th lactation was significantly higher than in first lactation. This result is consistent with Munim *et al.* (2006) who found significant ($P<0.05$) effect of parity on daily milk yield. They reported higher average daily milk yield in 5th parity than 1st, 2nd, 3rd, and 6th parities. But the result differed from that of Habib *et al.* (2003) who found non-significant ($P>0.05$) effect of lactation number on daily milk yield. Daily milk yield did not differ significantly ($P>0.05$) with sex of calf born, season and age at calving.

Dry period

This is the period of cessation of milk production. This trait is important to the dairyman. The average dry period in this study was 162.4 ± 7.7 days, which is close to the result obtained by Alam *et al*. (1994) who found 178.3 days in nondescript *Desi* cows. In contrast, Ali *et al*. (2006) found 134.3 ± 37.3 days dry period for indigenous cow. Longer dry periods (222.0 ± 13.4 to 275.0 ± 13.6 days) were obtained by Hossain and Routledge (1982) for nondescript *Desi* cows and Pabna cows, respectively.

Table 2 shows that dry period in 6th parity was significantly ($P>0.05$) longer than in earlier parities. Cilek (2009); Zafar *et al.* (2008); Aslam *et al*. (2002) found lowest and highest dry period during 9th and 1st lactation, respectively. Erdem *et al.* (2007) and Inci *et al.* (2007) found non-significant effect of lactation number on dry period. Analysis of variance showed insignificant ($P>0.05$) difference of dry period with sex of calf born, season, year and age at calving (Table 1). This is in agreement with the results of Pelister *et al.* (2000a) for the effect of season of calving and Inci *et al.* (2007) for the effect of calving year, but Erdem *et al*. (2007); Zambrano *et al*. (2006); Bilgic and Alic (2005); Pelister *et al.* (2000a) found significant variations of dry period with calving year and age at calving. The variations in results by different authors might be due to different breed, feeding, management, or environment.

In conclusion, though milk productions of crossbred cows in Bangladesh are better than RCC, this study revealed better performance of RCC than other nondescript indigenous cattle of Bangladesh. Furthermore, the results clearly indicated that some non-genetic factors greatly affect milk production. No emphasis has been made for the improvement of RCC. Therefore, there is a need for a genetic improvement programme in RCC in order to make smallholder dairy farming more profitable in Bangladesh.

Table 2. Mean milk yield traits and environmental factors

Factors	Mean ± SE			
	Lactation length (days)	Lactation yield (kg)	Daily milk yield (kg)	Dry period (days)
Sex of calf born	**NS**	**NS**	**NS**	**NS**
Male	266.2 ± 8.2 (51)	518.9 ± 26.3 (53)	1.9^{a} ± 0.1 (53)	163.8 ± 1.5 (36)
Female	252.8 ± 9.4 (49)	481.4 ± 28.4 (50)	1.9^{a} ± 0.1 (50)	160.7 ± 10.0 (30)
Lactation order	**NS**	**P<0.05**	**P<0.05**	**P<0.05**
1	239.7 ± 14.4 (24)	422.3^{b} ± 39.5 (25)	1.7^{b} ±.1.0 (25)	168.9^{a} ± 18.4 (15)
2	269.0 ± 15.3 (21)	485.7^{ab} ± 35.0 (21)	1.79^{ab} ± 0.7 (21)	148.9^{a} ± 14.6 (13)
3	252.1 ± 9.0 (21)	509.2^{ab} ± 30.5 (21)	2.02^{ab} ± 0.9 (21)	161.0^{a} ± 11.8 (15)
4	276.6 ± 12.3 (16)	564.4^{ab} ± 52.6 (17)	1.97^{ab} ± 1.5 (17)	138.7^{a} ± 12.7 (14)
5	279.6 ± 20.3 (14)	604.3^{a} ± 69.3 (14)	2.17^{a} ± 1.8(14)	192.3^{a} ± 32.4 (7)
6	231.5 ± 8.9 (4)	413.8^{b} ± 41.2 (5)	1.62^{b} ± 1.9 (5)	273.5^{b} ± 46.5 (2)
Calving season	**NS**	**NS**	**NS**	**NS**
Summer	247.8 ± 9.8 (31)	492.3 ± 34.0 (33)	1.9 ± 1.0 (33)	181.9 ± 16.7 (15)
Rainy	256.9 ± 12.7 (31)	486.1 ± 31.8 (31)	1.9 ± 0.9 (31)	157.6 ± 13.0 (20)
Winter	271.5 ± 9.8 (38)	271.5 ± 9.8 (38)	1.8 ± 0.8 (39)	156.1 ± 11.5 (31)
Calving year	**NS**	**NS**	**P<0.05**	**NS**
2005	234.1^{a} ± 15.0 (12)	439.3^{b} ± 45.0 (12)	1.9^{ab} ± 1.4 (12)	160.6 ± 13.8 (11)
2006	275.2^{ab} ± 10.1 (25)	588.9^{a} ± 39.3 (25)	2.1^{a} ± 0.1 (25)	143.2 ± 13.3 (20)
2007	277.5^{b} ± 16.4 (23)	473.2^{ab} ± 30.0 (24)	1.7^{b} ± 0.7 (24)	163.0 ± 16.3 (18)
2008	259.8^{ab} ± 13.9 (21)	492.4^{ab} ± 48.1 (23)	1.8^{ab} ± 1.2 (23)	187.8 ± 16.5 (16)
2009	233.5^{a} ± 11.2 (19)	468.4^{ab} ± 47.7 (19)	1.9^{ab} ± 1.4 (19)	152.00 (1)
Age at calving	**NS**	**P<0.05**	**NS**	**NS**
<4 years	254.2 ± 12.4 (27)	460.79^{ab} ± 35.5 (27)	1.9^{ab} ± 0.9 (27)	162.4 ± 14.4 (18)
4-5	241.5 ± 14.5 (24)	417.37^{b} ± 31.0 (25)	1.7^{b} ± 0.7 (25)	154.0 ± 13.0 (18)
5-6	266.6 ± 8.9 (23)	555.99^{a} ± 28.9 (24)	2.1^{a} ± 0.9 (24)	155.4 ± 12.5 (15)
6-7	276.9 ± 16.8 (15)	576.82^{a} ± 60.5 (15)	2.1^{a} ± 1.6 (15)	162.9 ± 24.7 (9)
>7	274.5 ± 20.1 (11)	558.6^{a} ± 78.2 (12)	2.0^{ab} ± 0.2 (12)	204.7 ± 39.9 (6)

Figures in the parenthesis indicate number of observations, NS means non-significant at 5% level (P>0.05). Means with different superscripts within the same column differ significantly (P<0.05)

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