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Seasonal Index and Breeding Efficiency of Red Chittagong Cattle in Bangladesh

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Abstract

The study was aimed to observe reproductive pattern and efficiency of Red Chittagong Cattle (RCC) including reproductive history taken from two different herds; nucleus herd (on-station) and community herd (on-farm) in Mymensingh district of Bangladesh. A total of 184 calving parity records from 66 RCC cows that included 317 estrous, 164 conception and 178 calving history covering a period from 2005 to 2011 were considered for analyses. The highest frequencies of estrous, conception and calving occurred in May (13%, 15% and 14%, respectively), while the lowest in September for estrous (4%) and conception (4%) and April and June for calving (5%). The month of the year had significant ($p<0.001$ to $p<0.05$) effect on both estrous and calving but not for conception ($p>0.05$). There was no significant effect of season with estrous or conception or calving, but numerically highest incidence of estrous and conception in summer (36% and 38%, respectively) and calving in winter (36%) are noted. The seasonal indexes of calving in the on-station and on-farm herds were 0.73 and 0.78 respectively, with an overall mean of 0.68. The breeding or reproductive efficiency of the nucleus herd was estimated based on calving interval and age at first calving along with calving interval and the calculated results were 79 % and 82%, respectively for those two methods of estimation. The result obtained in this study indicates the reproductive behavior of RCC did not differ significantly by season, but varied with month of the year. In addition, reproductive efficiency of RCC in this study was slightly lower than that of expected.

1. Introduction

In livestock population, some are seasonal breeders which mean they come into heat in the specific season of year and subsequently give birth. But in domestic animals, though cows are not seasonal breeder but there is well established evidence of seasonal influence on reproductive pattern (Jockle, 1972; Randel, 1984). It is essential to know the seasonal pattern of reproduction in cows because it is directly related to produce calf crop and eventually harvesting milk yield throughout the years. It also helps breeders to easily maintain reproductive behaviours in cattle.

The breeding or reproductive efficiency of cow is another factor which determines the number

of calves produced during her life time. The target of a breeder is to achieve higher breeding efficiency so that total life time production is increased. The reproduction or breeding efficiency is determined by the combined effect of hereditary and environment. Several measures of breeding efficiency like number of services per conception, calving interval, and days from first breeding to conception are useful. The profitability of a dairy enterprise depends on herd life which in turn is largely affected by the breeding efficiency of cows of that herd. An average breeding efficiency of less than 100% by the formula of Wilcox et al (1957) indicates that one calf production does not occur at a regular interval of 365 days in the herd.

There is a paucity of information on the seasonality and efficiency of reproduction for indigenous cattle in Bangladesh. Thus this study has been conducted to obtain documented evidence on the seasonality of reproduction and to estimate reproductive efficiency of Red Chittagong Cattle (RCC) in Bangladesh.

2. Materials and Methods

Study area, topography and climates

The study was carried out at two different places; the on-station nucleus herd located about 4.5 km apart from Mymensingh city in Bangladesh lies between 24°30' and 25°10' North latitude and 90°15' and 91°15' East longitude and on-farm community herd located about 2.0 km apart in the North side from Mymensingh city lies between 24°77' and 24°78' North latitude and 90°39' and 90°41' East longitudes. It has a pronounced tropical monsoon-type climate with warm temperatures throughout the year, with a hot and rainy summer and a dry winter with relatively little variation from month to month. January tends to be the coolest month with temperatures averaging near 26°C and April/May the warmest with temperatures from 33 to 36°C (The climate is one of the wettest in the world. Most places in the plain land receive more than 1,525 mm of rain a year. Most rains occur during the monsoon (June-September) and little in winter (November-February). There are three prominent seasons: the dry summer/pre-monsoon/hot season from March to June, monsoon/wet summer/rainy season from July to October and winter/dry season from November to February.

Feeding and managements of animal herds

The feeding and management of RCC at on-station (nucleus herd) was solely intensive where animals were stall fed throughout the year. The animals were provided three different kinds of feeds such as concentrate, green grass and straw where straw was the basal diet added with urea and/molasses. Animals were grazed at seldom due to lack of facility. Urea-molasses-rice straw (UMRS) or sometimes only molasses-rice straw (MRS) were provided twice a day *ad libitum* throughout the year. Green forages and roadside grasses were provided with limited amount due to scarcity. Concentrate mixture (corn, wheat bran, rice police, mustard oil cake, soybean meal) was supplied once a day in the morning at the rate of 600 g/lactating cow, 500 g/pregnant cow, 400 g/dry cow and heifers.

The feeding and management system of RCC at on-farm (community farmer's house) were not similar as in nucleus herd. Farmers seldom used straw for their animals. Road side, land boundary or fellow land green grasses were the main sources of feed. During dry and cropping seasons cut-and-carry green grasses were used to feed their animals. Farmers used to escape their animals for grazing in an around 6 to 8 hours a day. Farmers used to offer drinking water for their animals with some bran (wheat or rice) and salt regularly according to their ability especially to lactating cows.

After freshening, cows were hand milked once a day except test days when morning and evening milking were allowed to count total daily milk yield for recording exclusive of that drawn by the calves until production declined below 250 g per day. The calves were allowed to suckle their dam for few hours after milking and again few hours before evening and it continued up to 3-4 months. Afterwards, calves were allowed to suckle once a day after milking until weaning. Due to low yields and short lactation duration, cows were actually milked until they spontaneously became dry; hence forced drying due to advanced pregnancy seldom occurred. In the farmer's house, calves were allowed to remain present with their dam after milking till evening.

Heat was detected by the signs of behavioral estrous and observed daily for every cow. Cows were bred usually by artificial insemination (AI) at the first estrous both for lactating cows and heifers (subject to confirmation).

Regular vaccination (against Foot and Mouth Disease (FMD) and Anthrax) and deworming were performed in both the herds.

Traits evaluated and data analyses

Data comprised the events of estrous, conception and calving over a period of 7 years (2005 to 2011) were classified into three seasons (summer, rainy and winter) and twelve months (January to December). From a total of 317 estrous, 164 conceptions and 178 calving records from 66 cows, the frequency distributions according to months and seasons of year for two herds and analysis of variances were calculated by simple statistical method of SPSS 11.5 computer package.

Seasonality of calving index was calculated as given by Oseni *et al* (2003) with the following equation: Seasonality of calving index = 1– ratio of number of calvings in month with fewest calvings and number of calvings in month with most calvings.

The breeding efficiency (BE) is a measure of deviation of reproductive performance from a specified level, calculated by the method described by Wilcox *et al* (1957) and Tomar (1965) with the following formulae based on age at first calving and calving interval:

$$\text{BE}\left(\begin{matrix}\text{based on calving interval as described by Wilcox} \\ et\ al., 1957\end{matrix}\right) = \frac{(\text{N} - 1)365}{\text{D}} \text{x } 100$$

$$\text{BE (based on age at first calving and calving interval as described by Tomar, (1965)} = \frac{(\text{N} - 1) \text{ x } 365 + 945}{\text{AFC} + \text{D}} \text{x } 100$$

Where, N is the total number of offspring produced in a certain age, AFC is the age at first calving in days, D is the total number of days from the first to the last calving, 365 is the expected days of calving interval and 945 is the expected days at first calving.

3. Results and Discussion

Seasonal pattern of reproduction and index

Table 1 illustrated the history of animals showing estrous, conception and calving in different months of a year from 2006 to 2011 and the overall seasonality index of calving for RCC.Monthly distribution of 317 estrous in Table 1 showed that month of year had highly significant effect ($p<0.001$) on showing estrous. The highest frequency of estrous was in May (12.9±1.9%), while the lowest in September (4.1±1.1%). Habib (2011) in his recent study with the different herd reported insignificant results ($p>0.05$) where the highest frequency of showing estrous in the same month. Ghosh *et al* (1992) in another study with another population of cows in Bangladesh found the highest frequency of estrous in February (25.79%). Although month of the year (overall) had significant ($p<0.001$) effect in showing estrous, but season had no significant effect ($p>0.05$) in this herd (Table 2). However, insignificantly slightly higher frequency of estrous was shown in summer followed by winter and rainy season (Table 2). Winter season was found to influence ($p>0.05$) most estrous to occur in another population of RCC in Bangladesh (Habib, 2011).

Table 1: Frequency of reproductive pattern in different months of the year (mean±SE)

Month	**Estrous (%)**			**Conception (%)**			**Calving (%)**		
	On-station	On-farm	Overall	On-station	On-farm	Overall	On-station	On-farm	Overall
Jan	07.6±2.1	13.2±2.7	10.4±1.7	07.3±2.9	10.9±3.5	09.1±2.3	06.9±2.8	10.9±3.3	08.9±2.2
Feb	14.6±2.8	07.5±2.1	11.0±1.8	15.9±4.1	06.1±2.7	10.9±2.4	10.5±3.3	07.6±2.8	08.9±2.2
Mar	06.9±2.0	05.7±1.8	06.3±1.4	06.1±2.7	04.9±2.4	05.5±1.8	09.3±3.2	14.1±3.7	11.8±2.4
Apr	10.1±2.4	06.3±1.9	08.2±1.5	09.8±3.3	08.5±3.1	09.1±2.3	03.5±1.9	06.4±2.4	04.5±1.6
May	11.4±2.5	14.5±2.8	12.9±1.9	12.2±3.6	17.1±4.2	14.6±2.8	12.8±3.6	15.2±3.8	14.0±2.6
Jun	05.7±1.8	11.3±2.5	08.5±1.6	07.3±2.9	09.8±3.3	08.5±2.2	03.5±1.9	05.4±2.4	04.5±1.6
Jul	13.9±2.8	09.4±2.3	11.7±1.8	09.8±3.3	09.8±3.3	09.8±2.3	05.8±2.5	05.4±2.4	05.6±1.7
Aug	04.4±1.6	09.4±2.3	06.9±1.4	09.8±3.3	07.3±2.9	08.5±2.2	10.5±3.3	11.9±3.4	11.2±2.4
Sep	05.1±1.7	03.1±1.4	04.1±1.1	06.1±2.7	01.2±1.2	03.7±1.5	06.9±2.8	05.4±2.4	06.2±1.8
Oct	07.6±2.1	07.5±2.1	07.6±1.5	06.1±2.7	08.5±3.1	07.3±2.0	06.9±2.8	05.4±2.4	06.2±1.8
Nov	08.2±2.2	06.3±1.9	07.3±1.5	04.9±2.4	09.8±3.3	07.3±2.0	11.6±3.5	09.8±3.1	10.7±2.3
Dec	04.4±1.6	05.7±1.8	05.1±1.2	04.9±2.4	06.1±2.7	05.5±1.8	11.6±3.5	03.3±1.9	07.3±1.9
N	158	159	317	82	82	164	86	92	178
Sig.	*	*	***	NS	NS	NS	NS	*	*
SI							0.73	0.78	0.68

N= number of observations; Sig. = Significance level (p<0.05; *** p<0.001; NS p>0.05); SI= seasonal index*

Monthly distribution of 164 conceptions is given in Table 1. Month of the year had no significant effect (p>0.05) for conception, but slightly higher conception was noted in May (14.6±2.8) and the fewest conception frequency was shown in September (03.7±1.5). In general agreement, Habib (2011) reported the same month as cow conceived most and fewest with insignificant difference among months. Ghosh et al (1992) reported that the most important months for conception were October to March (9.00 to 19.43%), but it is not in agreement with the results of this study. Season had no significant influence on conception, although most favorable season for conception seen in this study was summer followed by winter and rainy (Table 2) which is not in line with Zakari *et al* (1981) who found the highest percentage of conception in rainy season. But the current results agree well with the earlier work in the same herd conducted by Habib (2011).

Table 2: Seasonal variations in reproductive pattern

Season	**Estrous (%)**			**Conception (%)**			**Calving (%)**		
	On-station	On-farm	Overall	On-station	On-farm	Overall	On-station	On-farm	Overall
Summer	33.3±3.8	39.1±3.9	36.3±2.7	34.9±5.3	40.7±5.5	37.8±3.8	29.4±4.9	40.9±5.1	35.4±3.6
Rainy	30.8±3.7	30.1±3.7	30.3±2.6	33.7±5.2	28.4±5.0	31.1±3.6	29.4±4.9	27.9±4.7	28.7±3.4
Winter	35.8±3.8	30.8±3.7	33.4±2.7	31.3±5.1	30.9±5.2	31.1±3.6	41.2±5.4	31.2±4.8	35.9±3.6
Sig.	NS	NS	NS	NS	NS	NS	NS	NS	NS

Sig. = Significance level; NS = Non-significant at 0.05 level (p>0.05)

Monthly distribution of 178 calving is also given in Table 1. The calving pattern indicated that month of the year differed significantly ($p<0.05$) for calving in RCC. It was the highest in May (14.0±2.6 %), and the lowest frequency (4.5±1.6%) was in April and June. The result is in agreement with earlier work of Habib (2011) for month most cows conceived, but differ for variation ($p>0.05$). On the other hand, Ghosh *et al* (1992) reported the highest frequency of calving in November (21.38%) in their study. Season had shown no significant ($p>0.05$) variation for calving frequency, although the most favorable season of calving was winter (Table 2). This result is coincided by the earlier reports of Habib (2011), Ghosh et al (1992), Hassan *et al* (2007), Khan *et al* (1997, 1997a) and Voh and Octchere (1989) in different population of cows.

Seasonality index of calving for RCC was calculated as 0.73 and 0.78 for on-station and on-farm herd with an overall index of 0.68 (Table 1). Hassan *et al* (2007) reported seasonality indexes to be 0.86, 0.77 and 0.60, respectively for buffaloes, crossbreds and Sahiwal cows in Pakistan. The result of this study indicated the seasonal index of calving for RCC to be less pronounced than buffaloes and crossbreds but more pronounced than Sahiwals when compared to their reports.

Breeding/reproductive efficiency

The overall breeding efficiency of the RCC nucleus herd found from this study was 79.4±3.7 % and 81.9±1.7%, respectively for the two methods (Table 3).

Table 3. Breeding efficiency estimated by the methods based on calving interval and age at first calving along with calving interval

Breeding efficiency	**N**	**Min.**	**Max.**	**Mean**	**SE**	**CV**
Based on calving interval	48	47.8%	96.0%	79.4%	3.7	15.9%
Based on calving interval & age at first calving	48	54.7%	102.0%	81.9%	1.7	14.6%

N= number of observations; Min= minimum value; Max= maximum value; SE= standard error and CV= coefficient of variation.

However, Kiwuwa *et al* (1983) on cows of various degrees of Friesian inheritance in Ethiopia and Hammoud *et al* (2010) on Friesian cows in Egypt found comparatively higher breeding efficiency (95% and 90.1%, respectively). In Ethiopia, Goshu (2005) studied the breeding efficiency of Friesian-Boran crossbred cows by the formula included the expected age at first calving (960 days) and desirable calving interval (396 days) and found the average breeding efficiency of the herd to be 66.3±0.5% which did not confirm the value near this study (81.9±1.7%). The coefficients of variation of breeding efficiency among cows are within normal range. Different biological factors like pubertal age, abortion rate, postpartum estrous, days open are directly associated with length of inter calving period and total life time calf

production which contribute overall breeding efficiency of a cow.

The abortion rate of 1.8% (3, out of 164 pregnancies) found from the history of the nucleus herd in this study is very low compared to Goshu (1999), Goshu (2005), and Goshu and Hegde (2003) reported between 17.5% to 29%. Thus, the estimated breeding efficiency below the expected level exists in the present study might be due to prolonged age at first calving and calving interval (caused by prolonged post partum estrous period and days open). The variation of magnitude among different workers might be resulted due to different breed, environment, sample size, management or different formula used for estimation by different workers.

4. Conclusion

From this study it is clear that reproductive behaviors occur round the year and no specific calving and breeding seasons are noted in RCC. However, the frequency of showing estrous and calving significantly varies in different months of the year. Thus, the reproductive management system should be maintained carefully in consideration with the month in which the most reproductive behaviors take place. In addition, the lower breeding efficiency in this study compared to expected level (100%) indicates the requirements for the better breeding management in the herd.

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