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## Assessment of performance and profitability of buffalo rearing in selected coastal areas of Bangladesh

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### Abstract

The current study was designed to assess the productive and reproductive performances of buffaloes, as well as the profitability of rearing buffaloes at the household farming level in two coastal districts (Bhola and Patuakhali) of Bangladesh. A total of 80 households (of those farmers who had a buffalo at least completed one lactation length) were surveyed directly using a pre-designed questionnaire during the period of April to September 2016. The average daily milk yield of indigenous buffalo was  $2.79 \pm 0.31$  litres, with an average lactation yield of  $714.69 \pm 129.32$  litres over  $256.30 \pm 14.37$  days of lactation. The average peak yield of buffalo was found to be  $4.33 \pm 0.46$  litres, with the 3<sup>rd</sup> and 4<sup>th</sup> months being the most likely to reach peak milk yield. Buffaloes had an average dry period of  $193 \pm 21.10$  days. The average age at first heat, age at first pregnancy, age at first calving, post-partum heat period, number of services per conception, inter-calving period, gestation period were  $38.79 \pm 4.07$  months,  $41.85 \pm 3.15$  months,  $49.84 \pm 3.28$  months,  $147.91 \pm 19.96$  days,  $2.23 \pm 0.19$  times,  $545.37 \pm 39.11$  days and  $313.47 \pm 8.77$  days, respectively, as recorded in this investigation. The annual production cost per buffalo was Tk. 5610.00, whereas the annual gross return per buffalo was Tk. 22890.00. The study revealed that buffalo farming is a profitable practice in the coastal areas of Bangladesh. The outcomes of this study may help farmers, researchers, and policymakers for the improvement of buffalo in the future.

**Keywords:** Buffalo, profitability, coastal belt, productivity, reproduction performance

### 1. Introduction

Buffalo (*Bubalus bubalis*) is an important species of livestock in the tropical and subtropical countries around the world, including Bangladesh, where it contributes significantly to people's livelihoods by providing high-quality animal protein (milk and meat), dung as fuel and organic fertilizer, mechanical or draft power, and hides and skins as raw materials for industry (Ghaffar *et al.*, 1991; Robinson *et al.*, 2011) [1, 2]. Bangladesh has around 1.47 million buffaloes (DLS, 2016) [3], which are mostly raised by small farm holders in the plain land, sugarcane belt, and coastal areas of the country (Faruque *et al.*, 1990) [4]. Buffalo contributes around 0.94% and 2.0% of total meat and milk production in Bangladesh, respectively (DLS, 2015) [5]. Farmers, particularly women, could enhance their livelihoods by raising buffaloes, and it could be a critical gateway for rural poverty alleviation (Kalash *et al.*, 2009; Sarkar *et al.*, 2013; Amin *et al.*, 2015) [6, 7, 8]. The people of the Southern coastal region of Bangladesh raise buffaloes in their households and also collectively by following the bathan (free-range) system. However, buffalo farming is not so beneficial for a variety of reasons, the major concern of which is the limited productivity of buffaloes. The indigenous buffaloes of Bangladesh can't be classified as any specific breed type and hence fall under the category of non-descriptive, and their production and reproduction performances are extremely poor. Primarily, productivity is mostly determined by four aspects of animal husbandry practices: such as breeding, feeding, health care, and management.

Productive and reproductive efficiency are major factors that determine buffalo farming profitability. There are numerous productive and reproductive issues in the field that cause buffaloes to lose reproductive function. Any interruption in the animal's normal reproductive function causes infertility or sterility, resulting in financial losses due to the lengthening of the dry period and the inter-calving interval, which affects calving and lactation over the animal's lifetime (Agarwal *et al.*, 2005) [9].

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Total losses in buffaloes because of reproductive difficulties accounted for 39% of total losses caused by various illness conditions (Khan *et al.*, 1995)<sup>[10]</sup>. There are several published reports on productive and reproductive performances of buffalo as well as the profitability of its rearing around the world (EI-Kirabi, 1995; Siddiquee *et al.*, 2010; Ranjana *et al.*, 2015)<sup>[11, 12, 13]</sup>, but there is very little information on this topic in Bangladesh, particularly in coastal areas. Such knowledge is invaluable in national planning schemes for buffalo improvement. Therefore, the current study was carried out to know the productive and reproductive performances of buffaloes, as well as to evaluate the profitability of rearing buffaloes in the household farming system in coastal regions of Bangladesh.

## 2. Materials and Methods

### 2.1. Study area and farmers' selection

The survey was conducted in four upazilas of two coastal districts in Bangladesh: Bauphal and Dashmina upazila of Patuakhali district, and Burhanuddin and Bhola Sadar upazila of Bhola district. These districts were selected purposively as the buffalo population was fairly distributed and large in number in that region. The information for this study was collected from 80 farmers, 20 from each selected upazila. The farmer was selected adopting PPRS (Proportional Probability Random Sampling) technique of Lahiri (Snedecor and Cochran, 1989)<sup>[14]</sup> on the basis of at least completion of one lactation length of buffalo at the time of the investigation. A total of 90 buffalo cows' data were recorded.

### 2.2. Collection of data and measurement of variables

The primary data was collected during the period of April to September 2016 by personal interview method using a questionnaire that was previously prepared and tested in the field. The respondents were interviewed individually and the data about animal productive performances (average daily milk yield, lactation length, total lactation production, peak milk yield, and dry period) and reproductive performances (age at first puberty, age at first pregnancy, age at first calving, post-partum heat period, number of services per conception, calving interval, and gestation length) were collected. Cost benefits of buffalo rearing were also investigated.

### 2.3. Statistical analysis of data

All obtained data were verified and cross-checked before being transferred to master sheets. The SPSS-v-16 computer package program was used to analyze the data.

## 3. Results and Discussion

### 3.1. Productive performances of buffalo cows

#### 3.1.1. Average daily milk yield

The average daily milk production of indigenous buffaloes in the study area was found 2.79±0.31 liters (Table 1). The findings of the current study were in accordance with those of Amin *et al.* (2015)<sup>[8]</sup>. Non-descript buffalo cows in the eastern part of India produce 1.56 to 4.12 liters of milk per day (Gupta *et al.*, 2014)<sup>[15]</sup>. However, Karim *et al.* (2013)<sup>[16]</sup> and Siddiki *et al.* (2015)<sup>[17]</sup> recorded higher values (3.32-3.33 liters/day) in their investigation than the current study. The present findings also disagree with those of Khan *et al.* (2014)<sup>[18]</sup> who found that Pakistan's Azikheli buffalo produced 7.19 liters of milk per day. Lower milk yield could be attributed to poor feeding management, low genetic potentiality, and the fact that buffaloes were not kept as the sole milk animal in the

investigated area. Management systems like smallholder and bathan farming could also be a contributing factor. The milk production of buffaloes raised in the household (semi-intensive system) was higher than that of buffaloes raised in the bathan (extensive system) (Uddin *et al.*, 2016)<sup>[19]</sup>.

#### 3.1.2. Lactation length

The present findings of lactation length (256.30±14.37 days) in the studied area were in line with those of Siddiquee *et al.* (2010)<sup>[12]</sup> and Rahman *et al.* (2016)<sup>[20]</sup>. According to EI-Kirabi (1995)<sup>[11]</sup>, the lactation length of Egypt buffalo ranges from 210 to 280 days. Indigenous buffaloes in the coastal area of Bangladesh had lactation period of 270 days (Faruque and Amin, 1994)<sup>[21]</sup>. The lower average lactation length of 227 days was noted by Huque and Shahjahan (2016)<sup>[22]</sup>. In contrast to our findings, the higher lactation period was reported by Hussen (1990)<sup>[23]</sup> in Tangail district of Bangladesh as 328.89 days and Islam *et al.* (2004)<sup>[24]</sup> in govt. buffalo farm as 311 to 330 days. This variation may be due to the differences in breed and management approaches as well as the start of milking following parturition. However, lactation length of 305 days is regarded as the ideal length for buffaloes.

#### 3.1.3. Lactation milk yield

The lactation milk yield in the studied area was 714.69±129.32 litres (Table 1). The lactation yield in the household farming or semi-intensive system was 712-799 litres (Faruque *et al.*, 1990; Uddin *et al.*, 2016)<sup>[4, 19]</sup> which were coincided with the present findings. Lactation yield of 730.9±153.65 liters was found by Hussen (1990)<sup>[23]</sup> in Tangail district of Bangladesh. Siddiquee *et al.* (2010)<sup>[12]</sup> reported that the average lactation yield was 995.5±120.2 liters in Companigonj sub-district of Bangladesh which is higher than the present findings. The findings of the present study were lower than that of Islam *et al.* (2004)<sup>[24]</sup>. This could be due to the genotypic factors and management.

#### 3.1.4. Peak yield

The average peak milk yield of buffalo in the current study was recorded as 4.33±0.46 litres (Table 1). The findings of the present study were in agreement with those of Siddiquee *et al.* (2010)<sup>[12]</sup>. Meena *et al.* (2016)<sup>[25]</sup> reported that the average peak yield of buffalo under field conditions was 8.56±0.85 litres/buffalo. The peak milk yield of 5.5 litres in local buffaloes was noted by Jainuddin (1988)<sup>[26]</sup>. The peak lactation was observed between the 3<sup>rd</sup> to 4<sup>th</sup> months of lactation with more than 60% yields within 5 months of lactation for the said regions which were consistent with the findings of Siddiquee *et al.* (2010)<sup>[12]</sup> and Khan *et al.* (2014)<sup>[18]</sup>.

**Table 1:** Productive traits of buffalo cows (No. of buffaloes=90)

Parameters	Performance (mean±SD)
Average daily milk yield (litres)	2.79±0.31
Lactation length (days)	256.30±14.37
Total Lactation production (litres)	714.69±129.32
Peak yield/day (litres)	4.33±0.46
Peak milk yield (month)	3 <sup>rd</sup> and 4 <sup>th</sup>
Dry period (days)	193±21.10

Data were presented as mean ± SD (standard deviation)

#### 3.1.5. Dry period

The present study showed that the dry period of buffalo was 193±21.10 days (Table 1). Ranjana *et al.* (2015)<sup>[13]</sup> reported

that the dry period of buffalo was  $156.4 \pm 39.6$  days. A higher value was observed by Thiruvenkadan *et al.* (2010)<sup>[27]</sup> and stated the dry period of  $250.5 \pm 15.9$  days in buffaloes. The Nili-Ravi and Murrah breeds of Pakistan were reported to have dry periods of 90 to 150 days and 60 to 200 days, respectively (Wahid, 1973)<sup>[28]</sup>.

### 3.2. Reproductive Performances of buffalo

#### 3.2.1. Age at first heat

The average age at first heat of indigenous buffaloes at the surveyed area was  $38.79 \pm 4.07$  months (Table 2) and this finding was agreed by Jainudeen (1988)<sup>[26]</sup> and Helmi (1989)<sup>[29]</sup> who reported that the age of puberty of buffaloes was delayed (3-4 yrs). Timsina *et al.* (2015)<sup>[30]</sup> reported that buffaloes attained their first heat at 34.2 months of age. The local buffaloes of Bhutan showed first estrus at an average age of 35.26 months (Wangdi *et al.*, 2014)<sup>[31]</sup>. However, it is late in comparison to other countries and this may be due to the limited supply of feed and nutrients to calves during their growth stage.

#### 3.2.2. Age at first pregnancy

In this study, the average age at first pregnancy was found to be  $41.85 \pm 3.15$  months (Table 2). The findings of this current investigation were comparable with those of Amin *et al.* (2015)<sup>[8]</sup> and Siddiki *et al.* (2015)<sup>[17]</sup>.

**Table 2:** Reproductive traits of buffaloes (No. of buffaloes=90)

Parameters	Performance (mean $\pm$ SD)
Age at first heat (months)	$38.79 \pm 4.07$
Age at first pregnancy (months)	$41.85 \pm 3.15$
Age at first calving (months)	$49.84 \pm 3.28$
Post-partum heat period (days)	$147.91 \pm 19.96$
Service per conception (number)	$2.23 \pm 0.19$
Calving interval (days)	$545.37 \pm 39.11$
Gestation length (days)	$313.47 \pm 8.77$

Data were presented as mean  $\pm$  SD (standard deviation)

#### 3.2.3. Age at first calving

The average age at first calving for buffalo raised by smallholder farmers in the study was  $49.84 \pm 3.28$  months (Table 2). The lowering in the age at first calving leads to an increase in lactation yield and helps dairy buffalo farmers to improve their economies. The findings of this investigation were in line with the findings of Bhatti *et al.* (2007)<sup>[32]</sup>, Karim *et al.* (2013)<sup>[16]</sup>, and Momin *et al.* (2016)<sup>[33]</sup>. Shashidhara *et al.* (1998)<sup>[34]</sup> stated that the age at first calving of 1301-1390 days was optimum for obtaining maximum lactation milk yield and lifetime milk yield in buffaloes.

#### 3.2.4. Post-partum heat period

The data pertaining to the post-partum heat period of buffalo was  $147.91 \pm 19.96$  days (Table 2). The outcomes of this study were in sequence to those of Karim *et al.* (2013)<sup>[16]</sup> and Momin *et al.* (2016)<sup>[33]</sup>. The average post-partum heat period in Murrah buffalo of India was estimated to be  $139.91 \pm 2.96$  days (Jamuna *et al.*, 2013)<sup>[35]</sup>. The possible cause of prolonged post-partum heat period may be the missing of several heat periods due to the unavailability of breeding bulls or artificial insemination in the study area. This could also be attributed to a lack of knowledge about how to detect heat

signs in buffaloes, as well as the nutritional and health status of buffaloes.

#### 3.2.5. Service per conception

The study revealed that the service per conception of buffalo was  $2.23 \pm 0.19$  times/buffalo (Table 2). The results of this investigation were in accordance with those of Wangdi *et al.* (2014)<sup>[31]</sup> in Bhutan and Khan *et al.* (2009)<sup>[36]</sup> in Murrah buffalo at an organized farm but greater than the findings of Islam *et al.* (2004)<sup>[24]</sup> and Momin *et al.* (2016)<sup>[33]</sup>. A higher rate of service per conception could be attributed to a failure to recognize heat, a post-partum problem in the buffalo, or poor post-partum management.

#### 3.2.6. Calving interval

The average inter-calving period of buffaloes in the selected area was  $545.37 \pm 39.11$  days (Table 2) which is coincided with the observations of Karim *et al.* (2013)<sup>[16]</sup> but higher than the findings of Amin *et al.* (2015)<sup>[8]</sup> and Siddiki *et al.* (2015)<sup>[17]</sup>. Khan *et al.* (2014)<sup>[18]</sup> reported that the calving interval of buffaloes ranged from 483 to 750 days. One calf every 15 months is considered profitable in buffaloes. The prolonged calving interval may be due to poor management and poor reproductive performance (silent estrous and seasonal breeder) of buffalo cows.

#### 3.2.7. Gestation length

The average gestation length of buffalo cows available in the studied region was  $313.47 \pm 8.77$  days (Table 2). The results of this study were consistent with those of Uddin *et al.* (2016)<sup>[19]</sup> but higher than those of Wangdi *et al.* (2014)<sup>[31]</sup>. The indigenous buffalo cows of Pirojpur district in Bangladesh were found to have an average gestation period of  $319.56 \pm 5.93$  days (Karim *et al.*, 2013)<sup>[16]</sup>. The average gestation period in Indian buffalo cows was  $308 \pm 9.6$  days (Joshi *et al.*, 1968)<sup>[37]</sup>. However, the variation in gestation length may be due to differences in the breeding months of buffaloes.

### 3.3. Cost-return of buffalo rearing

#### 3.3.1. Rearing cost of buffalo

The cost of feeding, breeding, housing, equipment, and health care of buffaloes have been presented in Table 3. The average cost of feed was higher than the average cost of housing and equipment, breeding, and health care on a yearly basis. Farmers in the study area generally use locally available feed resources and do not buy feed for their buffaloes, but at the time of scarcity, they purchase feed i.e., straw only. Besides, farmers usually bred their buffaloes naturally using their own or neighboring buffalo bulls, resulting in lower breeding costs. The major cost of healthcare is the cost of medicine and vaccine. The village farmers relied on local veterinary pharmacy for medicine. But, the farmers who live closer to the upazila headquarters usually receive medical care services from the upazila livestock office. However, the average rearing cost of one buffalo per year was Tk. 5610. Sarkar *et al.* (2013)<sup>[7]</sup> and Amin *et al.* (2015)<sup>[8]</sup> estimated that the total annual rearing cost of one buffalo in Bagerhat and Noakhali districts in Bangladesh was Tk. 6850.00 and Tk. 5070.00, respectively, which was more or less similar to the present findings.

**Table 3:** Cost and returns from buffalo rearing (yearly per buffalo)

Cost		Return	
Items	Amount (Tk.)	Items	Amount (Tk.)
Average feed cost	2570	Draught	10390
Average housing and equipment cost	1980	Milk sale	12500
Average breeding cost	260		
Average health care cost (Veterinary doctor, medicine and vaccine)	800		
Total Cost	5610	Total Return	22890
Net income= Total Cost- Total Return= Tk. 17280			

### 3.3.2. Income from buffalo rearing

The total (draught + milk) and net income per year per buffalo have been presented in Table 3. The annual net income from one buffalo was Tk. 17280. It indicates that the rearing of buffaloes in the selected areas was profitable. The findings of the current investigation were in line with those of Amin *et al.* (2015) [8] who reported that the annual net revenue from rearing one dual purpose buffalo was Tk. 13932. Also, Sarkar *et al.* (2013) [7] found that the annual net revenue from rearing one buffalo was Tk. 15630. Furthermore, Kalash *et al.* (2009) [6] reported that net annual income from rearing one buffalo was Rs. 16,064 per year indicating buffalo rearing was profitable in India which is also agreed with the current findings.

### 4. Conclusion

The findings revealed that the post-partum heat period and dry period were found to be high, which prolonged the inter-calving interval and also increased the unproductive period of buffaloes in the study area. The productive and reproductive performances of indigenous buffalo need to be improved in order to gain more profit from buffalo rearing. A prospective cohort study should be carried out to have precise information on the reproductive and productive characteristics of indigenous buffaloes of Bangladesh. Furthermore, the study would be helpful for the farmers, researchers, and policy-makers for the future improvement of buffaloes in the coastal area as well as in Bangladesh.

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### 6. Conflict of interest

The authors declare that they have no conflict of interest.

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