DAIRY BUFFALO PRODUCTION UNDER INTENSIVE SYSTEM IN SEMI ARID AREA OF BANGLADESH

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ABSTRACT

An attempt was made to know the management system of intensive buffalo farming and buffalo derived -problems under semi-arid area of Bangladesh. Direct interview with farmers, farm observation, community discussion and key informant interview (KII) had been followed over six months in Dinajpur district. It was observed that buffaloes were reared under two types of management system namely household yard intensive (HYI) and completely intensive (CI). In HYI system, farmers purchased heifer or pregnant buffalo from local market and sold mother with calf after one year. Buffaloes were kept shed at night and maintained feeding, showering and other activities in the household yard at day. Those were showered by once-two times/week in cool day, but most of them were showered in a day. On the other hand, in CI system, buffaloes were reared inside the shed all time and maintain feeding, showering and other activities in the shed. Buffaloes were showered twice in a day in winter period while three times in summer period. Average milk production for each buffalo was 5 to 8 liter/day. Major productive and reproductive traits e.g. lactation Length (day), average milk yield (L/day), dry period (day), age at first pregnancy (month) and age at first calving (month) were found better in CI system than that of HYI system and those were found highly significant ($P<0.001$). Significant difference were found on total solids, fat and protein content but no significance difference were observed on SNF, lactose and ash of buffalo milk between two farms. Insignificant difference ($P>0.05$) was found for the value of electric conductivity (ECms/cm) that showed both farms produced healthy milk (3.25±0.49 vs 3.09±0.89). Both systems showed as a profitable venture (BCR 1.33 vs 1.25). Problem matrix revealed that the top ranked order of problem were “inadequate knowledge on buffalo rearing”, “high price of feed” and “low milk price” mentioned as 1, 2 and 3. Shortage of feeds and fodder, high temperature and lack of cow boy were ranked as 4, 5 and 6. Limited breeder bull, lake of AI workers and inadequate quality semen and credit facilities mentioned as 7 ranked problem. It was concluded that ensuring training and marketing could help to improve intensive system of dairy buffalo that meet up the growing demand of milk in urban people. Simultaneously AI facilities with quality semen, HYV fodder cultivation and credit facilities should be promoted for sustainable dairy buffalo farming.

Keywords: *Bubalus bubalis*, buffalo, buffalo farming, feeding system, milk quality

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INTRODUCTION

The rural farming system of animal agriculture consisting buffaloes (*Bubalus bubalis*) and other livestock resources in Bangladesh. Buffalo is a less prioritized dairy species in Bangladesh though it has potential health beneficial due to quality of milk and meat. The buffalo meat is of good quality as compared to the cattle beef because of the low cholesterol. Buffalo meat contains 40% less cholesterol, 55% less calories, 11% more protein and 10% more mineral in comparison to bovine meat (Nanda and Nakao, 2003). Buffalo milk has 43% less cholesterol than cow's milk on the basis of per gram butterfat and having 58% and 40% more calcium and protein than cow's milk respectively. In addition to the significant cholesterol and calcium benefits of buffalo milk, is also a rich source of iron, phosphorus, vitamin A and of course protein (Bilal *et al*., 2006). Considering its composition, it may be advisable over cattle beef for the cholesterol sanative people (Bilal *et al.*, 2006). It has been never addressed in before by policy level in Bangladesh despite their important role in the national economy. The buffaloes are 14.71 million heads (DLS 2016) in Bangladesh. Though the trend of buffalo population (2.20%) in recent year is relatively higher than cattle (0.44%) but buffalo milk production is not contributed significantly to national production in Bangladesh (Islam, 2017). Total milk production of Bangladesh is about 7.27 million metric tons per year (MMT) against the requirement of 14.69 MMT (DLS 2016). To address the gap of demand and availability of milk, another dairy species e.g. buffalo should be prioritised along with cattle.

Several production system based on management practices and feeding system are found in Bangladesh. At the village level production is usually based on a small herd of mixed ages and sexes generally for milk and breeding purposes. In a semi-intensive production system, buffaloes are kept mainly for specific purposes, i.e., either for milk or for meat production. In an extensive production system, a larger herd is kept for both meat and meat production (usually for sale or slaughter). In the village production systems, buffaloes and cattle are kept within the shed at night, and spend the daytime household yards for feeding and resting, together with other animals. Many buffaloes rear in saline coastal region under extensive farming in *Char areas*. In river basin areas, buffaloes are reared under semi-intensive system. In this system, buffaloes are kept within the shed at night and spend daytime for grassing in the *Bathan.* Besides, a few number of intensive buffalo farming also been seen in some institutional herd as well as farmer level as business purpose where buffaloes are kept in shed whole time. Household intensive system are very scattered and mainly seen at Northern part of Bangladesh, e.g. Dinajpur, Rangpur which is reared mainly under the intensive irrigated agriculture system. The national strategies for the irrigated intensive agricultural system in developing countries should focus upon producing less expensive milk from dairy buffaloes that, efficiently, utilize the limited expensive produced feed resources (Soliman, 2007). Milk production has a comparative advantage in agricultural resource use, in terms of net costs per 100 grams animal protein under irrigated intensive agricultural system in developing countries (Soliman, 2007). The total milk yield per lactation and lactation period varied among the systems due to availability of feed resources, management systems and genotypes of buffaloes. The buffalo raised under household / semi-intensive system produced higher milk than those raised under bathan /extensive system which

results household farming is more attractive as it gives milk and meat both. The lactation yield in the household farming/ semi-intensive system and bathan farming /extensive system were 712 to 799 and 435 litres, respectively (Faruque *et al*., 1990; Uddin *et al*., 2016).

There is several research works in Bangladesh which is demonstrated about productive, reproductive and management system of dairy buffalo under extensive and semi- intensive system, but there is very few information about intensive system of buffalo farming. Moreover India, Pakistan, Trinidad, Italy and some other country have been started intensive system buffalo farming to increase the national milk production in the country. Farmers of Bangladesh believe that extensive system is essential for buffalo farming due to its feeding and wallowing behaviours. This study is therefore undertaken to know the different information regarding feeding, breeding, management practice and associated problems under intensive system of dairy buffalo farming; so that policy makers could be given attention for development of milking buffalo farming which would lead to improve milk production in Bangladesh.

MATERIAL AND METHODS

Location of study areas

Dinajpur district was selected for the study as a semi-arid aria. Moreover greater Dinajpur and Rajshahi district are second buffalo concentrate areas holding 5.1 to 10 buffalo for 1000 people (Huque and Khan, 2017). Birganj, Kaharol and Dinajpur sadar upazilla under Dinajpur district were selected for the study.

Climate of Study area

Dinajpur experiences a hot, wet and humid tropical climate. Under the Köppen climate classification, Dinajpur has a tropical wet and dry climate. The district has a distinct monsoonal season, with an annual average temperature of 25°C (77°F) and monthly means varying between 18°C (64°F) in January and 29°C (84°F) in August. Paddy, Maize, wheat and potato are main crops (Wikipedia 2017).

Farmer selection

Based on the information of Upazila Livestock Office of Birganj, Kaharol and Dinajpur Sadar buffalo farmers were considered for the study. Farmers were randomly selected based on management system and on the experience of dairy buffalo farming having at list one milking buffalo and one calf.

Preparation of questioner

Structure questionnaire was developed according to variable of the objectives. Variables like productive, reproductive, feeding and management practice with related problem for buffalo farming were considered. Data was collected using standard procedure. The questionnaire was pre-tested in the selected area. Some addition and subtraction had been made in the preliminary schedule on the basis on experienced gained in pre-tasting and finalized the questionnaire. The schedule contains were both open and closed-ended question.

Data collection

Qualitative and quantitative information were collected from household yard intensive and full intensive farm. Data were collected directly from 30 household yard intensive (HYI) farms and visited by the researcher through face to face

interviews. Moreover more than 60 milking buffalo farmers were discussed for validate the information of household yard intensive system (HYI). Discussion was also conducted with the cowboys (hired labours) who were taken care of buffalo farm to confirm and recheck the information.

Information is collected from two completely intensive (CI) system buffalo farms (who were rearing buffaloes since three decade) over six months period through direct interview with a prescribed format which was kept in record book. Researcher also kept communication with the farm owners by over mobile phone during study period. Based on record book, different information/ variables were collected from individual farm e.g. gestation period, calving interval, lactation period, dry period, milk production, breeding system and profitability. Feeding and management practices were documented based on questioner. Problem associated to buffalo farming were collected and rechecked with cowboys, Veterinary Field Assistant (VFA) and Upazilla Livestock Officer (ULO). The study therefore follows the mixed methodology mode of Greene *et al.* (1989) focusing mainly on triangulation which can investigate the same issue with the same unit of analysis (Mitchell, 1986).

Period of study

Farm visit, farm observation, secondary review, community discussion were held in the period of six moths which was from October 2016 to March 2017.

Milk sample collection and analysis

Milk sample were collected from both type of intensive farm of Dinajpur district. Just after milking milk samples were collected by ice box and frize at minus twenty degree centigrade (-20^{o}C) due to bring the sample to Dairy Science Laboratory, Bangladesh Agricultural University, Mymensingh. Milk samples were analysed after reaching normal temperature. The milk compositions (TS, SNF, Fat, Protein, Lactose, Ash, P^{H}, Density and conductivity) were analyzed by using Lactoscan milk analyzer (Milktronic Ltd., 600 Stara Zagora, Bulgaria) in the Dairy Science Laboratory, Bangladesh Agricultural University.

Determine of the problem matrix of dairy buffalo farming

In order to understand local perceptions of the problem of dairy buffalo farming, a simple proportional pilling tool was used with two different groups of informant consisting sixteen buffalo farmers. The informants were asked to think about related problem that might have influenced the reduction of dairy buffalo production. Ten factors were identified and then recognized first five factors using 16 small stones.

Data analysis

After collecting data from field, these were edited and coded. The data was then transfer to MS Excel for processing and summarizing. The tabular technique mainly used to analyze the data and derived meaningful finding by using simple statistical measures like mean, percentage and ratio. Statistical analyses were carried out through SPSS version 16 computer package and analysis of variance of treatment (three locations) means was done by ANOVA in case of productive, reproductive and milk quality. Duncan Multiple Range Test (DMRT) was used to the level of significance the treatment means.

RESULT AND DISCUSSION

Dairy buffalo model

Dairy buffalo farm were very scattered in the study areas. Eighty-eight percent (88%) farmers reared dairy buffaloes that were purchased pregnant or heifer buffalo for business purpose. All of them reared buffalo under household yard. After calving, farmers sold buffalo with calf when age of calf became for two-three months. Among them, a total of 12% farmers maintained full cycle; they reared milking buffaloes with calf for selling milk as a means of family income. Buffalo were reared in shed at night and whole day in household yard allocation with feeds. On the contrary, a few number of intensive dairy buffalo herds were shown in study areas that were reared buffalo all time in the shed. They were rearing buffaloes since two-three decades. Herd size was consisting with 6 to 22 buffaloes by maintaining stall feeding with cooling fan and showering, called as completely intensive (CI) system.

Housing system

Most of the house made by muddy, bamboo and straw. At night farmer kept animal in house. During day, they kept animal in household yard (HYI) where animal took rest and fed to straw, grass, water and small amount of concentrate feed under HYI system. But buffaloes were passed day-night in brick and tin made shed under completely intensive system (CI). Uddin *et al.* (2016) observed that dairy buffaloes were kept under semi-intensive system in the wet season and only 15% farmers provided shed having only roof but no concrete floor. Akbar *et al.* (2009) mentioned that most of the dairy buffalo were not housed in extensive system of bathan areas but buffaloes which were in the plain land sometime had an enclosure, only roof made by straw or tin without wall and floor was always muddy. Seventy four percent respondents reported that the average housing facilities were unavailable for buffalo rearing (Siddiki, 2017) which was not agreed to present study as in Dinajpur both type of farm provided houses for buffaloes. According to Siddiki, 2017, 100% of the farmers didn't care about the housing for buffalo rearing in Subornochar upozila, followed by Trishal, Bagha and Lalpur were 80%, 70% and 45%, respectively and differed significantly ($P<0.01$) between the locations.

Feeding system

The main diet for the buffalo was roughage such as natural grass, and paddy straw. The roughage could be fed either fresh as pasture or in a cut-and-carry-system. The roughage was often complemented with grains, concentrate and agro-industrial by-products such as of wheat bran, oil cake and broken rice etc. Concentrate feed, paddy straw, local grass and water were provided in the manger in a household yard in day time under HYI system. But in night only straw and water kept in the shed where passed whole. Forage was found as insufficient during the dry season and abundant during the rainy season.

Different types of feed base identified under intensive household yard (HYI) system. Average rice gruel ready feed, broken maize, maize flower, rice bran, wheat bran , broken rice after cook, mustard oil cack, molasses, paddy straw green grass cultivated/cut and carry and fresh water were 1.71, 0.03, 0.14, 0.16, 0.14, 1.53, 0.86, 0.19, 0.09, 10.69, 6.22 and 25 to 60 kg/day/buffalo provided respectively. All farmers provided paddy straw and half of them were provided green grass. A total of 75% farmers provide wheat bran, 62.5% farmers provide cack, 62.5% farmers provide

broken rice after cooking and 50% farmers provide broken maize to milking buffalo (Table 1). Under completely intensive system (CI), supply of feed resources depend on season and available of feeds and fodders Table 2. Buffaloes were given more grass (10 to 14 kg/day/each) for three-five months (March to July) during flash period and less grass (1 to 6 kg/day/each) for seven months (August to February) during lean period. During that time paddy straws were also given at the rate of 7.5 to 9 and 11 to 14 kg/day respectively depending on the season. Allocation of concentrate feeds were 5 to 7 kg/milking buffalo. Broken maize, wheat bran, broken rice, and oil cake mainly were used for concentrate mixture. Ahmed (2006) showed that common concentrates of wheat bran, rice polish, pea bran, khesary bran, matikalai bran, lentil, sesame oil cake, coconut oil cake and mustard oil cake were available round the year for dairy animal which support our findings. In the rainy and winter season some legumes, green grasses were grown sporadically in some areas of the country and next six months availability of green grass was very limited, during this time rice straw alone contributes 87% of roughage portion of the dairy feed (Tareque, 1991) (Table 3).

The dry matter intake (DMI) (kg/d) of milking buffaloes in different locations was varies from 13 to 15 (kg/d) (Siddiki, 2017) but in our study dry matter supply (DMI) (kg/d) of milking buffaloes in study area was near to similar as dry matter basis (kg/day).

Watering

All farmers (100%) provided fresh drinking water to buffalo in three times a day under HYI and CI system. Average water intake was 26 to 60 litter under HYI. But 45 litters and 60 litters were found in winter and summer period respectively under CI system. Drinking water is the most important water source of buffalo for body functions, e.g. maintaining body temperature, milk production and maintaining blood plasma volume. A restricted water intake leads to a decrease in dry matter intake and thus affects milk production and growth negatively (Buffalopedia, 2018).

Wallowing

Due to keep cool body temperature and control of insect, buffaloes showed wallowing behavior. In case of absence of water or mud hole, the buffaloes behave more likely to cattle. They need shade and shower. Very few numbers of buffaloes were allowed for wallowing at pond or river in summer season under HYI system. Wallowing was done in river/pond for 1 to 2 h during July to October in this system. Buffaloes were showered once/two times during a week in high cool period (December to January) and other time, most of the farmers' showered buffalo at home once time in a day for both HYI and CI system. When buffaloes enter the water, they defecate and/or urinate to maintain temperature (buffalopedia, 2018). According to farmer reaction, without showering, buffalo feed intake was reduced, skin disease, delay heat and early abortion might be occurred.

Breeding

A total of 96.3% buffalo cow received natural breeding under HYI system whereas, AI was covered only 3.7% in semi-arid areas of Bangladesh. Most of the farmers were facing problem to breed their buffaloes during heat. As of notification of farmers buffaloes were missing heat several times due to lack of breeding bull and far distance of bull station from farm. Moreover farmers bring the heated buffalo far way by small van/track which was very costly (BDT 25000 to

Table 1. Location of study areas.

Name of the upazilla	Location in Bangladesh	Human population density	Type of farm
Birganj	26°0′0″N 88°35′0″E	560/km^2 (1,500/sq mi)	Full Intensive and Intensive household yard
Dinajpur sadar	25°38′N 88°39′E	520/km^2 (1,300/sq mi)	Full Intensive
Kaharole	25.7917°N 88.6000°E	576/km^2 (1,490/sq mi)	Intensive household yard

Source: Wikipedia, 2017.

Table 2. Available feed-base and Feed supply (kg/day) for dairy buffalo under HYI system.

Name of feed-base	Amount Kg/day/buffalo	Percent of farmer provided feed items
Rice gruel	1.71	12.5
Ready feed	0.03	25
Broken maize	0.14	50
Maize flower	0.16	25
Rice bran(kg)	0.14	25
Wheat bran (kg)	1.53	75
Broken rice after cook (kg)	0.86	62.5
Mustard oil cake (kg)	0.19	62.5
Molasses	0.09	25
Straw (kg)	10.69	100
Green grass cultivated/cut and carry	6.22	50
Fresh water	25-60	100

30000). On the other hand natural breeding were followed in CI system as breeding bull were kept in this farm (Table 4).

The natural mating system was practiced by the most farmers though few number of breeding bull having in the herd (about 1%) both in household and bathan farming in Bangladesh (Uddin *et al*., 2016) which agreed to our present finding. Sawarkar *et al.* (2001) reported that, most of the farmers preferred natural service with the expectation that it would increase the conception rate. More than half of the farmers used natural service to their buffalo in heat at the right time, while 42% of farmers were unable to inseminate their animals in time due to various reasons (Uddin *et al*., 2016).

Milk production and quality

Average milk production for first, second and third stage were 6.80, 4.30 and 2.00 litter/day/ buffalo respectively under HYI system and it was 11,6.5 and 2.5 litter/day/ buffalo respectively for CI system (Table 5).

Table 6 showed that chemical quality of buffalo milk for household intensive (HYI) and completely intensive (CI) farm in study areas. Significant difference were found on total solids, fat and protein content but no significance difference were observed on SNF, lactose and ash of buffalo milk between two farms. Insignificant difference ($P>0.05$) was found for the value of electric conductivity (ECms/cm) that showed both farms produced healthy milk (3.25±0.49 vs 3.09±0.89). Milk quality of buffalo agreed with the result of Xiao-YanLing *et al*., 2013 who found that the average milk yield per lactation in 305 day, average milk fat, protein, lactose, total solid and non-fat solid of dairy buffalo were 1162 kg ,7.52%, 4.32%, 5.19%, 17.81%, and 10.11%, respectively in Mang city of China.

Milk man was milking from buffalo cow and purchased milk but price was not well (40 to 42 Tk/L) in HYI system. Milk sold to local market and sweetmeat shop. Some time Milk man didn't come to collect milk and farmer became looser. They gave money to farm owner quarterly or monthly basis. Buffalo farmers therefore depend on middle man for pricing of milk. But in completely intensive system, farmer was sold milk directly to sweetmeat shop (50 to 55 Tk/L) and took relatively better price than HYI system.

Productive and reproductive characters

Productive and reproductive characters of dairy buffalo were exposed in Table 7 under household intensive (HYI) and completely intensive (CI) system. Lactation Length (day), average milk yield (L/day), dry period (day), age at first pregnancy (month) and age at first calving (month) were found highly significant ($P<0.001$) between the system. Service per conception (number), service per conception and post Partum heat (month) period of dairy buffalo were found as significant ($P<0.05$) different between household intensive (HYI) and completely intensive (CI) system. But insignificant different were shown in case of weaning age (days) and gestation length between those system (month). The average dry period (day), weaning age (day), service per conception (Number), age at first pregnancy (month), age at first caving (month), calving interval (month), gestation period (month), postpartum heat period (month) were 172.67±22.73 and 97.22±6.18, 199.33±19.28 and 190.56±8.81, 2.00±0.58 and 1.33±0.50, 35.42±3.48 and 29.33±0.86, 45.60±3.60 and 39.33±0.86, 14.00±1.30 and 12.89±1.16, 10.01±0.17 and 10.00±0.00 and 4.23±0.89 and 3.44±0.72 for HYI and CI system, respectively

Table 3. Average feed allocation(kg/day/buffalo) base on fodder availability under CI system.

Month	Rice gruel (kg)	Brokenmaize	wheat bran	Broken rice	Mustard oil Cake	Molsses	Straw (kg)	Green grass from own
March-July (Five months)	6	1.25	2.25	1	0.75	0.3	8.75	13.5
August-February (Seven months)	6	1.25	3	2	0.75	0.3	13.25	5.5

Table 4. Breeding system and time of heat showed by buffalo cows.

Variables	Semi-arid (Dinajpur)
Type of breeding	
Natural breeding (% of buffalo)	96.3
Artificial insemination (AI) (% of buffalo)	3.7
Time of signing heat	
Early morning (% of buffalo)	11
Noon (% of buffalo)	3.2
Afternoon (% of buffalo)	5.7
Evening (% of buffalo)	12.4
Early night (% of buffalo)	47
Late night (% of buffalo)	20.7

Table 5. Average milk production (L/day).

Management system	First stage (L/day)	Second stage (L/day)	Third stage (L/day)
HYI	6.80	4.30	2.00
CI	11	6.5	2.5

Table 6. Chemical quality of buffalo milk under Household Intensive (HYI) and Completely Intensive (CI) system.

Parameter (%)	Household intensive	Completely intensive	Level of significance
Total solid	16.43±1.03	18.20±0.98	**
Fat	6.86±0.65	8.62±0.97	***
SNF	9.42±0.70	9.49±0.29	NS
Lactose	4.54±0.18	4.66±0.14	NS
Ash	0.67±0.05	0.70±0.03	NS
Protein	4.32±0.35	3.86±0.22	**
pH	6.20±0.42	6.09±.30	NS
Conductivity	3.25±0.49	3.09±0.89	NS

(Table 7). Similar findings were also reported by other authors (Karim *et al*., 2013; Faruque *et al*., 1990; Shabede *et al*., 2003) which were more or less similar to our findings.

The lactation yield in the household farming/ semi-intensive system and bathan farming /extensive system were 712 to 799 and 435 litres, respectively (Faruque *et al*., 1990; Uddin *et al*., 2016) which are much lower than the Nili-Ravi buffaloes reported by Mudgal (1989); Khan (1995); ICAR (2000) and also lower than present finding. Lactation yield of our finding also more than the finding of Hussen (1990); Faruque and Amin (1995). Lactation yield of indigenous buffaloes were low in Khulna region (280 litres, Faruque and Amin, 1995) and Tangail district (830 litres, Hussen, 1990). Cross breed buffaloes were reared in HYI and CI system in Dinajpur district which were migrated from India.

Calf management

Most of the farmers fed colostrums and milk to new born buffalo calf. After one month letter, wheat bran, cake and newly grown soft grass were fed to calf (50 to 60 gm/day). Calves were kept in separate dry and clean place in same room of mother at night and kept at day time in raise pit under tree shed. Timely feeding of colostrums to calves is essential and it should be fed within 2 to 3 h after birth and delay in feeding of colostrums lead to lowered effectiveness of the colostrums in terms of providing immunity to calves (Sharma and Mishra, 1987). Tiwari *et al*. (2007) found that the disease incidence in India Diarrhoea, pneumonia, parasitic infestation, dysentery was found as common diseases in study areas. Tiwari *et al*. (2007) also found those type of disease incidence in India in buffalo calves which reveals that the most common and frequent occurring disease in calves

Table 7. Productive and reproductive traits of dairy buffalo under Household Intensive (HYI) and Completely Intensive (CI) system.

Parameters	Household Intensive (HYI) system	Completely Intensive(CI) system	Level of significant
Lactation Length (day)	188.67±13.06	217.22±6.18	***
Lactation yield (L)	1028±256.68	2001±332.97	***
Average milk yield (L/day)	5.46±1.33	9.22±1.56	***
Dry period (day)	172.67±22.73	97.22±6.18	***
Weaning age (days)	199.33±19.28	190.56±8.81	NS
Service per conception (number)	2.00±0.58	1.33±0.50	*
Age at first pregnancy (month)	35.42±3.48	29.33±0.86	***
Age at first calving (month)	45.60±3.60	39.33±0.86	***
Calving interval (month)	14.00±1.30	12.89±1.16	*
Gestation length (month)	10.01±0.17	10.00±0.00	NS
Postpartum heat (month)	4.23±0.89	3.44±0.72	*

*** = Significance at 0.1% level of probability; * = Significance at 5% level of probability;
NS = Non significant; ± = Standard deviation

was diarrhoea which was reported by 82.2% of the dairy farms followed by endoparasite infestation (80%), ectoparasite infestation (78.9%), naval ill (66.7%) and pneumonia in calves (26.7%). Calf mortality was found as 8% and 7% respectively for HYI and CI system.

Primary health care

A total of 31% farmers used anthelmintics drug for internal parasite for buffalo but 23% farmers followed vaccination practice under HYI system. In CI system farmers were used for controlling both external and internal parasite. Vermic injection which introduced two times in a year (1 ml/40 kg body weight). Deworming drug was used for all type of internal parasite. Vaccine was used for HS and FMD under CI system

Economics of buffalo farming

Yearly expenditure, gross income and net income were BDT 140000, BDT 200000 and BDT 60000 respectively and yearly Benefit Cost Ratio (BCR) was found as 1.33 for in HYI system. On the contrary, yearly expenditure, gross income and net income were BDT 968810, BDT 1220525 and BDT 251715 respectively in CI system farm. Yearly Benefit Cost Ratio (BCR) was found as 1.25. Moreover total remaining assets were BDT 1060000 which represents of present value of buffalo herd of CI system (Table 8). Hasan *et al*., 2016 found that buffalo rearing in the coastal areas of Bangladesh was highly profitable that was crucial pathway for poverty alleviation. Rahman *et al*., 2008 stated that the benefit cost ratio was 1.31, indicating that buffalo rearing was profitable in Bangladesh which is agreed with the findings of Islam *et al*., 2017; Siddique *et al*., 2017 and also support to present study.

Problems associated with dairy buffalo production

According to farmer reaction ten bellow problems had been identified for milking buffalo production system resulted reason for decreasing buffalo population.

Shortage of feeds and fodder

Lack of feed and fodders at January to February as during this time there was no fellow land for grassing. The situation of pasture land was aggravated day by day because of crops were occupied most of the land in those areas. Maize was cultivated most of the land for grain production but they could not fed maize leaf to their animal due to lack of awareness.

High price of feed

High cost of concentrate feed of animal. Farmer could not provide balance feed due to high price of feeds.

Low milk price

Most of the farmers did not get good price of milk (30 to 40BDT). In some cases a few number of farmer get good price (BDT 50 to 52) where milkman collects milk from several farmers and sold to district level sweat meat shop.

High temperature

High temperature was a hindrance for buffalo rearing. Temperature was gradually increased and reducing water source. During high temperature; buffalo could not to take feed as required and abortion might be happen if not showering properly done during hot summer season.

Table 8. Cost -benefit of intensive buffalo farming (1USD = BDT83).

Herd composition and items		**Unit price**	**Yearly total cost**	**Yearly Gross income**	**Yearly net income**	**Net income Monthly**	**Remaining asset (Unit Price)**	**Total Remaining asset**
Milking buffaloes	8	Total milk production 45 L/ day, BDT 53/L	-	870525	-	80000	640000	-
Dry buffaloes	4	-	-	-		70000	280000	-
Heifer	1	-	-	-	-	65000	65000	-
Bull	1	-	-	-	-	75000	75000	-
calf	7	50000	-	350000	-	-	-	-
Concentrate feed	-	18	643860	-	-	-	-	-
Straw	-	3	229950	-	-	-	-	-
Labour	1	7500	90000	-	-	-	-	-
Other	-	-	5000	-	-	-	-	-
Total	-	-	968810	1220525	251715	20976	-	1060000
BCR	1.25							

Decrease of buffalo ploughing

One decade ago, land was cultivated by buffalo ploughing but now day it is done by power tiller.

Limited breeder bull

Few number of breeder bull was main hindrance to bred the buffalo. Farmer could not reach to bull station to breed the buffalo cow in time.

Lake of AI workers and inadequate quality semen

Artificial Insemination (AI) facilities were not available, even yet not popularized because of insufficient AI worker as well as unavailable of buffalo semen and low conception rate.

Lack of financial institutes

There was NGO office but did not provision to disburse credit to purchase buffalo.

Lack of cow boy

Now a day cow boy was not found as before. Labor did not wanted to work in buffalo farm as a cow boy due to opportunities of several jobs.

Inadequate knowledge for buffalo rearing

Government/ NGOs/ private sector did not provide still training or awareness program on Buffalo rearing.Problem matrix represented total score and percentage of score to assess dairy buffalo-derived problems illustrated in Table 9. The top three problems were found "inadequate knowledge for buffalo rearing/no training facilities on buffalo farming", ''high price of feed'' and "low milk price" which were ranked as 1, 2 and 3. Shortage of feeds and fodder, high temperature and lack of cow boy were ranked as 4, 5 and 6. Limited breeder bull, lake of AI workers and inadequate quality semen and lack of financial facilities as credit were ranked for 7. Decrease of buffalo ploughing shown as 8 (Table 9).

Table 9. Problem matrix for assessing dairy buffalo-derived problems.

Name of the problem	% of the score	Ranked order
Inadequate knowledge for buffalo rearing/no training facilities on buffalo farming	18	1
High price of feed	15	2
Low milk price	14	3
Shortage of feeds and fodder	11	4
High temperature	10	5
Lack of cow boy	9	6
Limited breeder bull	7	7
Lack of AI workers and inadequate quality semen	7	7
Lack of financial facilities as credit	7	7
Decrease of buffalo ploughing	4	8
-	100	-

CONCLUSION

Social and technological transformation can boost up the milk production from this species. Development of management practise along genetic improvement and policy intervention could be enhanced the productivity of buffalo and it would be contribute significantly in national economy.

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