Mechanization of dairy farming in Bangladesh

Ashish Kumar Das, Chayan Kumer Saha* and Md. Monjurul Alam

(Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh)

Abstract: The mechanization status of dairy farming in Bangladesh is not mentionable. In every steps of the farming operation, indigenous systems have been practiced in most of the farms. This study has been conducted to assess mechanization status in dairy farming. The selected areas of this study were Bangladesh Agricultural University (BAU) dairy farm, Mymensingh, Rural Development Academy (RDA) dairy farm, Bogra and four small, four medium and two large farms in Sirajganj district. Most mechanized RDA dairy farm and rest of the non-mechanized farms were selected for this study. The field survey was conducted by interviewing identified sample respondents with pre-determined interview schedules to cover all selected locations. Most of the farms have no specific designed farm building with specific space per animal, feeding alley, manger, gutter and drainage system, ventilation system. Even the manure management system in study area was very poor. A biogas plant can utilize manure properly. Milking machine and chopper machine were only found in BAU and RDA dairy farms. Spacing per animal for dairy cow was 3.65 m2, for pregnant cow was 9.30 m2, for dry cow or heifer was 1.37 m2, and for calf was 1.31 m2 respectively. Mangers in a pen barn were about 0.5-1.25 m wide and 0.5-1 m depth which varies for dairy cow, heifer, calf, and bull individually. All farms in study areas found natural ventilation system. Concentrates require per day for dairy cow, dry cow, heifer, bull calf, cow calf and mature bull were 3.4, 2.2, 1.2, 0.5, 1.01 and 5.2 kg respectively. The amount of maize for bull is 2.4 kg, for dairy cow is 1.4 kg and lowest amount for bull calf is 140 g per head. Due to lack of knowledge and unfamiliarity farmers do not accept machinery like milking machine, chopper machine etc. Installation of partial mechanization can contribute to convert indigenous into modernization with gross productivity of dairy farming systems in Bangladesh.

Keywords: mechanization, dairy farm, waste disposal, ventilation, manger, gutter

Citation: Das, A. K., C. K. Saha, and M. M. Alam. 2016. Mechanization of dairy farming in Bangladesh. Agricultural Engineering International: CIGR Journal, 18(3):51-62.

1 Introduction

Bangladesh is an agricultural based country. About 80% people of Bangladesh are directly and indirectly depend on agriculture. The economy of Bangladesh is mainly based on agriculture. Livestock plays an important role in the national economy of Bangladesh with a direct contribution around 3% to the agricultural GDP and providing 15% of total employment in the economy (GOB, 2013). The dairy farms in Bangladesh are broadly belonging to the private ownership. Many unemployed educated youths have invested in livestock and taken up programme on rearing cows, beef cattle for milk and meat production in rural and urban areas. In addition increasing urbanization, availability of disposal incomes and changing food consumption pattern has enlarged the demand for various livestock origin foods including dairy products (Sharma 2007; Kumar et al. 2011).). The increasing demand was expect to push up intensification in smallholder livestock (Wright et al. 2012). The scope for mechanization of a dairy farm includes farm building design and modernization, proper maintenance, milking, collecting and mixing feeds as well as in producing fodder crops and proper utilization of farm spaces. Some important aspects of dairy housing design include cubicles, feed barriers, cow movement, and waste handling (Kelly et al, 1993). Milking system is the important part of modern dairy farm. Mechanized milking system of a modern dairy farm requires large numbers of high yielding dairy cow, efficient milking machine and skilled operators that reduce the drudgery of manual milking and milking time. Mechanization is also demanded for waste disposal (cow dung, urine, feed

Received date: 2016-07-10 **Accepted date:** 2016-08-01

***Corresponding author: Chayan Kumer Saha,** Professor, Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh. Mobile:+8801715626517, Email: cksahabau@yahoo.com, cksaha@bau.edu.bd

residue etc.) and to make the farm environment friendly for the animals and workers. A mechanized dairy farm and an effective waste disposal system are recommended for efficient dairy farming (Rahman, 2004). In a word, mechanization is needed for a dairy farm to make it profitable. Mechanization in dairy farming may contribute in increasing dairy milk production. Therefore, assessment of mechanization status of dairy farming in Bangladesh is an urgent need of the time. So, this research is designed to analysis and evaluates the mechanization status of dairy farming in Bangladesh.

2 Materials and methods

The study period was February 18 to March 21, 2015. The selected areas of this study were Bangladesh Agricultural University (BAU) dairy farm, Mymensingh, Rural Development Academy (RDA) dairy farm, Bogra and four small, four medium and two large farms in Sirajganj district (Figure 1). In this study BAU and RDA dairy farms were considered as mechanized and modernized farms, where modern farming systems have been practiced. Other farms, where indigenous farming systems have been practiced considered as non-mechanized farms.

Figure 1 Study areas showing in the map.

(a) BAU, Mymensingh, (b) RDA, Bogra, and (c) Baghabari, Sirajganj.

The field survey was conducted by interviewing identified sample respondents with pre-determined interview schedules to cover all selected locations. All information about characteristics of different farming system; housing system; design of manger, gutter, and feed alley; machinery and equipments used in a dairy farm; light and ventilation system; water supply system; milking system & operation; feeding system; feed quantity, amount; waste disposal and management system were assessed according to the interview schedule and personal observation.

3 Results

The status of mechanization of dairy farming in Bangladesh is not good. Most of the dairy farms follow traditional and indigenous procedure in every operation

of farming. None of them use any milking machines except RDA dairy farm. The researcher observed, only RDA dairy farm uses milking machine. Other small, medium and large private farms do not use any type of mechanization. They always feel comfortable in manual milking. Among the farms, only RDA dairy farm was well mechanized. In every operation of farming system there have some differentiates among small, medium, and large dairy farms. Characteristics of different farming systems are discussed in Table 1.

Table 1 Characteristics of different farming systems

Attributes	Smallholder < 10 cows	10–20 cows	20–50 cows	Large dairy > 50 cows
Labor	Only family	Mostly family	Paid labor	Permanent paid labor
Genetic value of cattle	Generally low, mostly local breed	Variable due to Some crossbreeding	Variable, more crossbreeding	Variable, maximum crossbreeding
Feed resources	Little or no concentrates or cropland	Crop residues, some concentrates and some grass,forage	Crop residues,more concentrates and green fodder	Available feed of concentrates and crop residues, silage, forage
Animal health resource	Minimum	Mostly in an emergency	More access to regular animal health resources	More access to regular health resources
Education about Animal husbandry	Little	Slightly higher	Variable	Variable
Reproductive management	Poor	Average	Good	Good
Access to financing	Low	Some access	Good	Good

3.1 Mechanization status in dairy farming

Most of the dairy farms in Bangladesh are not mechanized. The commercial farms in rural area yet follow indigenous farming practice. There are lots of scopes to install partial mechanization such as milking system, housing system, chopping system, feeding system, ventilation system, waste management system etc. The differentiate scenario of mechanization status of different farms in selected study areas are discussed in Table 2.

Table 2 The mechanization status of different dairy farms in selected study areas

	Characteristics	RDA Dairy Farm	BAU Dairy Farm	Others
1.	Housing System	Concrete Structured	Concrete Structured	Thatched House
2.	Animal Spacing	Specified	Specified	Not Specified
3.	Alley, Manger, Gutter, Drainage	Standard Design	Standard Design	Not Specifically Designed
4.	Feeding Arrangements	Feed trough	Feed trough	Ring Feeders, Feed lots
5.	Ventilation System	Natural	Natural	Natural
6.	Water Supply	Submersible Pump	Vertical Turbine Pump	Hand Tube-well, Motor
7.	Chopper Machine	Using	Using	Not using
8.	Milking Machine	Present and active	Present but useless	Not using
9.	Transportation Trolly/ wagon	Using	Using	Not using
10.	Waste management System	Liquid/slurry, Daily Spread, Anaerobic digestion	Liquid/slurry, Pasture, Daily Spread, Burned for fuel, Dry lot	Pasture, Burned for fuel, Dry lot
11.	Biogas plant	Present	Not present	Not present
12.	Own Artificial Insemination	Present	Not present	Not present
13.	Bio-security	Satisfactory	Satisfactory	Not satisfactory
14.	Silo Pit	Present	Present	Absent
15.	Milk Packaging System	Present	Present	Absent

3.2 Housing system

In Bangladesh maximum farms have free stall system. BAU and RDA dairy farm have concrete structured sheds (Figure 2). They give natural safety from storm, rain and sunlight. It is important to design the cubicle considering to cow comfort. Lying times of cattle are related with cubicle length. Neat and cleaned farm shed is essential to safe cattle from diseases. Space per animal is very important to provide the cattle comfortable. Space per animal is varied on the basis on species, size, age, spacing etc. Space allowance is an important factor for rearing animal. It has a good contribution for meat and milk production. Also spacing for pregnant cows is important for their comfortable movement. Spacing per animal found (Table 3 and Table 4) in BAU and RDA for dairy cow 2.39 m^2 and 3.65 m^2, for pregnant cow 9.30 m^2, for dry cow or heifer 1.37 m^2, and for calf 1.31 m^2 respectively. There are no specific spaces per animal in small, medium and large private commercial and non-mechanized farms (Figure 3). Cattle stay there as a group. Sometimes milking cows, heifers and calves are kept separately. But there are no specific floor spaces for individual cattle. A modern dairy farm should have specific spacing per animal for their better growth and to avoid animal densifications. Although too much spacing cows can't feel comfort due to cleanliness, we are still not providing the optimum space allowance for cows to maximize their comfort.

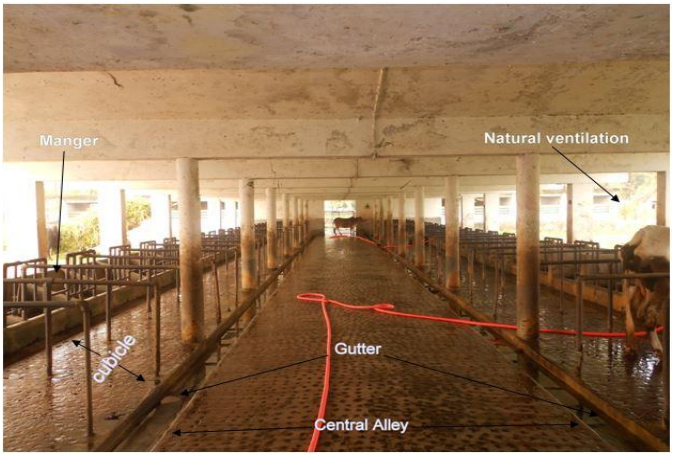

Figure 2 Photographic view of a modern dairy shed

Table 3 Different types of houses and space per animal at BAU dairy farm

Types of houses	Types of pen.	Age	Space per animal		
			Length, m	Width, m	Area, m^2
Calf Housing	Individual	Up to 1 year	1.22	1.07	1.31
Heifers or dry cow	Group	1 year to pregnant			1.53
Dairy cow	Individual	Up to milking	1.88	1.27	2.39
Pregnant cow	Individual	The pregnant cow of 6 months up to milking	3.05	3.05	9.30

Table 4 Different types of houses and space per animal at RDA dairy farm

Name of Houses	Types of pen.	Types of houses	Space per animal		
			Length, m	Width, m	Area, m^2
Dry cow shed	Individual	Face in	2.49	1.42	3.54
Dairy cow shed - 1	Individual	Face out	2.49	1.42	3.54
Heifer shed	Group				1.37
Dairy cow shed - 2	Individual	Face out	2.57	1.42	3.65
Bull Shed	Individual	One way facing	3.96	3.05	12.08

Figure 3 Photographic view of an indigenous dairy shed

3.3 Design of alleys, mangers, gutter and drainage

Feed alleys, mangers, gutters and drainage are very important of dairy houses. A modern mechanized dairy farm should have perfectly designed alleys, mangers and drainage. The efficiency of a farm is partially depends on it. A well structured farm has a specific designed alley, manger, gutter, and drainage system. The small, medium and large farms non-mechanized farms have no designed alley, manger, gutter, and drainage system. Alley is essential for movement in the farm for supplying feeding and cleaning purpose. Proper designed manger provides the comfortable feeding of animal and properly designed gutter and drainage provides waste disposal easily to make the environment healthy for animal.

3.3.1 Alleys

Two types of alleys have been seen in concrete structured farm shed. In face in shed, cattle are faced with each other. Here a central passage goes through the shed which is used for serving feed and movement of workers. In face out cattle are placed opposite and don't faced with each other. This system has two types of alleys, one central alley for movement and the other feed alley used to serving feed to manger. The central walking area within a barn found (Table 5 and Table 6) width of 1.5 to 1.8 m exclusive of gutter when cows are in face out position, and 1.2 to 1.5 m when cows are in face in position. The feed alley in case of a face out system is 1.2 m wide and the central walk has shown a slope of 1 inch from the centre towards the two gutter running parallels to each other, thus formed a crown at the centre.

Table 5 Dimension of alleys, mangers, gutter and drainage in BAU dairy farm

Types of house	Feeding alley	Mangers			Gutter		Drainage	
	Width, m	Width, m	Height of alley side, m	Height of standing side, m	Wide, m	Depth, m	Width, m	Depth, m
Heifer dry cow and dairy cow sheds	1.25	1	0.60	0.20	0.30	0.15	0.15	0.08
Calf housing	1.07	Small size			0.15	0.05	0.30	0.08

Table 6 Dimension of alleys, mangers, and gutter in RDA dairy farm

Types of house	Feeding alley	Mangers			Gutter		Central alley/ Grazing ground	
	Width, m	Width, m	Height of alley Side, m	Height of standing side, m	Wide, m	Depth, m	Length, m	Width, m
Dry cow shed	1.25	0.75	1	0.65	0.30	0.15	18.25	1.22
Dairy cow shed - 1	1.25	0.50	1	0.65	0.40	0.15	17	1.83
Heifer shed	1	0.60	1	0.70	0.30	0.15	10	3
Dairy cow shed - 2	-	0.70	1	0.65	0.30	0.15	18.25	1.5

3.3.2 Mangers

The manger should have perfect height which can provide comfort for different animals. Here most of the farms use feed trough or ring type manger in Bangladesh. Mangers in a pen barn are about 0.5-1.25 m wide and 0.5-1m depth which are varied for dairy cow, heifer, calf,

and bull individually (Table 5 and Table 6). Standing space require per cow is about 0.75 m.

3.3.3 Gutter

Gutter is designed to dispose animal urine, bathing water with manure wash away. A well mechanized farm should have proper designed gutter. Most of the farms found 0.15 m to 0.30 m wide and 0.15 m (Table 5 and Table 6) depth gutter. This is enough space for disposing liquid slurry. Minimum slope of 2.54 cm in 5.5 m is desirable for drainage.

3.3.4 Drainage

There is nothing more annoying and time-consuming than trying to make water run "Up hill". This happens much too often where floors, mangers, gutters and yards are paved without allowing proper slope. Manger needs periodic washing and drains must be provided, at least at each end. Water bowls occasionally overflow due to valve failures. This also requires drains for easy water removal. Cattle stalls should have a slight slope towards the gutters. Floors and alleys should also have some slope for draining when washed. Paved yards should slope away from buildings, doors and gates. When building feeding platforms for feed bunks, as much as 1 in 12 slopes is allowed to insure adequate drainage. As a general rule 1 in 100 of slopes is recommended. However, no two situations are exactly alike and specific requirements for any certain area must be carefully worked out.

3.4 Dairy farm machinery and equipment

For a better position in this competitive market it has no alternative to mechanization. There are lots of opportunities of partial mechanization in the dairy farms. Most of the dairy farms in Bangladesh are not well mechanized. Farmers are not familiar with dairy machinery such as milking machine, chopper machine etc. To them indigenous manual farming operation is more preferable instead of using any machine. Lack of technical skill and knowledge about mechanization is also a reason to avoid them. Among the study areas only the RDA dairy farm has good mechanization. Milking machine (Figure 4) and chopping machine are used here. About 80% milking operation are conducted by milking machine here. An imported motor operated electrical milking machine is used here.

Figure 4 Milking machine used in RDA dairy farm

In BAU dairy farm there is a milking parlor but it is useless due to lack of proper maintenance. In other non-modernized dairy farms, they do not use any milking machine. In these farms, farmers feel comfortable in manual milking operation. Milking machine can save time, increase milk production and protect cow's udder from mastitis and infection. Chopper machine is also used in BAU and RDA dairy farms for chopping straw, maize grass, Napier grass, jumbo grass, germen grass, *para* grass etc. In non-mechanized farms farmers don't use any chopper machine. They use sickle for cutting straw, grass. Spade, khurpi are used to collect manure. Scarcity of electricity, lack of skill labor, ignorance about machine, cost due to operation and maintenance are the main reasons to avoid mechanization.

3.5 Ventilation system

Ventilation system is essential to keep the farm area comfortable by supplying adequate air. It also protects animal from various diseases. Correct building design is critical to ensure adequate ventilation. This is extremely important to maintain air quality. To ensure adequate ventilation, it is important that the building is designed to,

- Remove excess heat
- Remove excess water vapour
- Remove microorganisms, dust and gases
- Provide a uniform distribution of air
- Provide correct air speed for stock

Natural ventilation is the least troublesome, most efficient and least expensive system for providing an optimum environment within a building. All farms in study areas have natural ventilation system (Figure. 2 and Figure 3). But some electrical ceiling and table fans are used during summer season to protect the animals from hot environment. They also help to keep the floor dry after bathing. So, adequate ventilation keeps the farm house cool and it is comfortable for animal living. Moreover natural ventilation can save money and electricity consumption.

3.6 Water supply

In BAU dairy farm a deep tube well is used to supply water for entire farm activities. Water is used for washing, bathing, cleaning, and feeding purposes. The washed water is being used for applying irrigation to the attached field for cereal and fodder crop production. A portable hose pipe is used in most of the farm for bathing. The information of the pump is given below:

Pump Type: Vertical turbine deep tube well; Discharge: 360 gal/min; Motor: 60 hp;

Pressure: 39- 40 kg/cm^2 (In spring season), 40-44 kg/cm^2 (In other seasons)

In RDA dairy farm a D.C submersible pump is used for water supply. The information of the

Pump is given below:

Borehole: Depth-28 m; Housing pipe-12 m; Dia-36 cm; Strainer- 12 m; Dia- 1 m; Bail Plug-3 m; Diameter-36 cm; Pump capacity-52000 L/h; Prime mover-3.6 KW. Beside that hand Tube- wells are also used for water supply. Hand tube-well and motor for lifting water have been used in different small, medium and large commercial dairy farms.

3.7 Feeding system

In rural area cattle have access in grazing as there are a lot of grazing lands. In RDA and BAU farms different types of grass such as Napier grass, Para grass, German grass, Jumbo grass, and maize grass are supplied according to the season. They have highly nutritive value and essential for milking cows. Different types of concentrated feed are necessary for animal growth and development. The concentrates have been given twice a day, mostly in morning and in afternoon. Amount of feed of each animal varies according to their age, weight, species, and conditions either pregnant or milking etc. The ingredients of concentrated feed are almost same in all farms at the study area. But quality is varied according to supply and price. It was found that about 10 kg green grasses require a dairy cow per day. Different concentrates are used to fulfill the nutritional demand of cattle. The amounts of concentrates vary according to the age. In this study, it was found that concentrates require per day (Table 7) for dairy cow, dry cow, heifer, bull calf,

cow calf and mature bull were 3.4, 2.2, 1.2, 0.5, 1.01 and 5.2 kg respectively. The most consumed ingredient is maize; all types of cattle take maize in maximum amount. The amount of maize for bull is 2.4 kg, for dairy cow is 1.4 kg and lowest amount for bull calf is 140 g per head. Vitamin mineral pro-mix is the lowest amount ingredient in all ingredients. It requires maximum 6 g per bull and minimum 1 g per bull calf per day.

Table 7 Amount of concentrate feeds per animal per day

Feeds	Dairy cow	Dry Cow	Heifer	Bull Calf	Cow calf	Bull
Maize, g	1430	920	570	140	440	2430
Wheat bran, g	348	230	100	78	130	430
Rice bran, g	700	462	180	67	130	790
Soybean, g	415	270	50	78	100	210
Mustard oil cake, g	350	230	167	78	150	710
Molasses, g	130	92	100	6	30	430
Salt, g	35	20	12	3	10	50
DCP Powder, g	70	47	27	10	20	110
Vitamin Mineral Pro-mix, g	3.50	2.30	1.5	1	1.3	6
Total Amount, g	3481.5	2273.3	1207.5	461	1011.3	5166

3.8 Waste disposal and management system

Waste management is essential practice for a dairy farm. Waste in stable contains mainly animal droppings dung, urine and left over animal feeds. Regular removal of waste is very much essential to keep the animal healthy because waste is a health hazard due to following reasons.

- From the aesthetics point of view, waste it is a nuisance.
- It undergoes pure faction and produces foul smell, which has an effect on the animal health.
- Organic portion of waste ferments and favors fly breeding. Flies play an important role in disease transmission.
- Rate and vermin's are attracted by the garfage (waste from food).
- It acts as a source of various diseases of animal and human.

As, the waste has several health effects, waste management is very much necessary. In a dairy farm a large amount of waste is accumulated daily. Traditional waste management is very difficult and expensive. But mechanizing waste management is easier, completed in short time and relatively economic. There is a lot of scope of mechanization in waste disposal system. Proper waste management is very important for a dairy farm. The dairy waste from dairy farming can be utilized by supplying plant nutrients for organic crop production. On the basis of proper waste management system environmental hazard can be minimized. Most of the farms have no proper waste management system. A modern dairy farm should have proper waste management facilities. In BAU dairy farm waste materials in a dairy shed are usually collected manually and then remaining are washed away with water flow by using a hosepipe. The washed wastes from the sheds were send into a sump and irrigate them directly into land without any treatment. There are increasing incidences of dairy waste running off land in wet weather and causing pollution of surface water. Everyday there produces about 1000 kg cow dung, 600 L urine and 14 kg feed wastes. But there is no scope to utilize these dairy wastes such as biogas plant, bio compost making facilities etc. Cow dung is stored in a roofed house in an open place beside the farm. This stored dung is sold out. People use it as fuel and manure. Roofed solid manure storage, storage tank, or pond for liquid wastes can be constructed with metal, concrete, or wood. Below ground tanks can be loaded using slatted floors, push-off ramps, gravity pipes, gutters, or plumps. Tanks can also be constructed of recast concrete panels that are bolded tougher. The waste material can easily be

collected with scraper. Drainage facilities are very much important for washing with water flow, but the drainage system of this farm is not satisfactory, so the drainage system should be improved. In RDA dairy farm wastes are properly managed. Here dairy solid manure is collected and also washed away during bathing of cattle and deposited in filtration tank through the gutter and drainage line. A pump is used to collect liquid and solid manure from tank to a digester at a specific time in a day. There are two biogas plants; each is in 130 m^3 capacity. For being biogas plant here dairy waste is fully utilized. In small, medium and large non-mechanized farms, there are no specific waste management systems; here dung is mostly used as fuel. There has no specific idea or plan to build a biogas plant for utilization of wastage to make the environment hazard free and sustainable.

4 Discussion

Most of the housing system of dairy farming in Bangladesh is not well structured. Almost all farms are thatched houses, which are constructed with corrugated iron sheet bamboo and wood. Floors are brick soling. Sometimes mortared floor are shown with thatched house. Hossain et al., (2004) observed that 63% farmers provided closed house and 63% farmers used paved floor. Loose housing with deep straw bedding for dairy cows became popular in the fifties (Larsson, 1955; Hörning, 2000) and the cubicle system was introduced in the early 1960s (Albright and Arave, 1997; Hörning, 2000). Careful attention to the design of stalls is essential to maximize their health, productivity and longevity. Proper designed stall can provide cattle to comfort ability when lying down, and standing. It must allow the cow to perform its' natural movements when getting up and lying down so as to reduce the chance of the cow injuring herself. Inadequate design of stalls can reduce stall occupancy in free-stall housing, and lead to injury, disturbed rest, and consequently lower production in tie-stall housing. Wander (1976) and Cermak (1987) found that lying times get longer when the total cubicle length is changed from 2.10 m to 2.50 m. The cubicle divisions should be wide enough to allow the cow to lie down easily, and should not be positioned so that the cow rubs her legs or neck against them when resting or when moving from standing to lying.

Spacing of surveyed mechanized farms in Bangladesh is satisfactory. Sastry (1980) designed small Indian dairy farm spacing for dairy cow 3.72 m^2, for buffalo 4.18 m^2, and for older calf 2.23 m^2 in the shed. Muprhy (1989) found cow stall platform sizes under 545 kg weight cattle, width should be 1.22 m and length should be 1.68 m. Murphy (1989) suggested calf housing should be 1.22 m × 2.44 m for calf hutch (plus 1.22 m × 1.83 m outdoor run), 1.22 m × 2.13 m for bedded pens, and 0.61 m×1.22 m. For bedded pen size should be 2.32-2.79 m^2/head. 16-25 months aged heifer house should be 3.72 m^2/animal of resting area 4.65 m^2/animal paved outside lot.

The comfort of a stall will depend greatly on the type and quality of the flooring in the stall. Under no circumstances should dairy cattle be expected to lie on bare concrete. A large survey of several hundred dairy herds in Norway (Valde et al., 1997) found that simply providing a rubber mat or some litter bedding reduced the incidence of mastitis by 14% compared to cows kept on concrete floors. However, a few inches of straw or sawdust are probably inadequate to ensure the comfort of the animals. Optimal flooring should provide adequate thermal insulation, an appropriate degree of softness, appropriate degree of friction, a low risk of abrasion and should be easy to maintain and clean (Nilsson, 1992).

The appropriate size of manger is required for comfortable feeding. Sastry (1980) found for a small Indian dairy farm 0.60 m height and 0.60 m wide manger. Murphy (1989) found 40 cm to 45 cm width and 28-40 cm depth in European farm gutter system. This is comparatively large space in our country condition. The big farm house should have lots of animal, that way there require a large space for disposing waste.

The aim of the ventilation system must be to provide a continuous stream of fresh air to every housed animal at all times of the day or night. Inadequate ventilation system can contribute greenhouse gas emissions varied in different seasons. Based on improper ventilation gas emission can vary in different period of day. Saha et al. (2014) found the average NH_3 and CH_4 emissions between 6 a.m. and 6 p.m. were 66% and 33% higher than the average NH_3 and CH_4 emissions between 6 p.m. and 6 a.m., respectively for all seasons from a naturally ventilated dairy building.

Clean water is required for feeding, bathing and cleaning farm house to make the farm diseases and insects free. Milking cows need 35 to 45 gal/head-day (4½ to 5 lb water/lb milk production); Dry cows need 20-30 gal/head-day; Heifers need 10-15 gal/head-day; Calves 6-10 gal/head-day (Muprhy, 1989). Peak water consumption is shortly after feeding. So the source of water supply is the major consideration for farming systems.

Feeding systems for cattle producing milk for cheese were highlighted and machine and labor costs were for different machinery involved in feeding dairy herds (Colzani, 1990). Most feeding systems aim to maximize the intake of good quality forage while balancing the nutritional requirements of the stock with concentrates or other feeds. Feeding is directly related to emit CH_4 and N_2O from enteric fermentation and manure of ruminative animal. Improving the nutritive value of the feed given to grazing animals by balancing the diet with concentrates, or by breeding improved pasture plants, may reduce CH_4 emission. The proportion of concentrate within the diet is negatively correlated with CH_4 emissions (Yan et al. 2000; Lovett et al. 2005). A reduction in feed intake leads to an increased risk of disease for the cow.

Livestock waste water, which is a mixture of manure and washing water, is taken from livestock houses after solid/liquid separation (Su et al. 2003). IPCC (1996) estimated that using two animal manure systems produced 38% and 53% of manure by both liquid and solid storage and dry lot respectively in Asia and the Far East. Anaerobic wastewater treatment systems produce less GHG than lagoon systems (Su et al. 2003). Only biogas plant can interrupt to spread out hazardous methane and nitrous oxide gas into environment to keep it friendly for living. Previous systems analyses of biogas production have shown that manure can be the best substrate from a greenhouse gas perspective and can even give 'negative' emissions if the biogas replaces fossil fuel and account is taken of the decreased methane losses from the stored manure (Börjesson & Berglund, 2007). Anaerobic digester has the potentiality to be an efficient means of emphatically decreasing greenhouse gas emissions in a number of areas of the animal production life cycle, but there is also a risk of greenhouse gas emissions increasing if there are high losses of methane or nitrogen. So it is essential to increase technical knowledge of biogas production. In Asia and the Far East, cattle manure is used about 50% for fuel, with the remainder being managed in dry systems (IPCC, 1996). In pasture area dung is deposited on grassy grazing land. CH_4 and N_2O emits from cow dung which is mainly responsible for global warming. GHG emissions from cows' excreta were lower for housing systems with straw litter than for slurry-based systems. A change toward straw-based systems would therefore be desirable because of reduced GHG emission and also of a potentially beneficial effect on animal welfare (Tuyttens, 2005).

5 Conclusions

The mechanization of dairy farming especially in commercial farms requires for better farm management and production. Mechanization can save time, money and reduce drudgery. In Bangladeshi condition, people always neglect mechanization, because they are not familiar with dairy machinery. It seems to them complicated. So, they feel better with their traditional and indigenous farming practices. People should be educated about their local resources and the importance of dairy production by utilizing available resources. Lack of husbandry

knowledge and education is also a reason of improper farming practices. Specific design of farm house, feeding system, and waste disposal system can improve productivity and providing living friendly farm for their better health and environment.

Acknowledgements

It is a great pleasure to express our deep sense of gratitude and profound regard to the authorities of Bangladesh Agricultural University (BAU) and Rural Development Academy (RDA) dairy farm for providing co-operation during the study.

References

Albright, J. L., and C.W. Arave. 1997. The behavior of cattle. CAB International, Wallingford, UK.

Börjesson, P., and M. Berglund. 2007. Environmental systems analysis of biogas systems –Part II: The environmental impact of replacing various reference systems. *Biomass and Bioenergy*, 31(5): 326-344.

Cernak, J. 1987. The design of cubicles for British Friesian dairy cows with reference to body weight and dimensions, spatial behavior and upper leg lameness. In cattle housing systems, lameness and behavior, 119-129. (ed. Wierenga, H. K. & Peterse D. J.) Martinus Nijhoff Publishers.

Colzani, G. 1990. Mechanization of cattle feeding. Istituto Sperimentale per la MeCcanizzazion Agricole, Rome, Italy. *Maquinas-Tractores-Agricolas*, 6(1): 23-52.

GOB, (Government of the People's Republic of Bangladesh). 2013. *Economic Review 2013*. Ministry of Planning. Government of the People's Republic of Bangladesh.

Hörning, B. 2000. Alternative Haltungssysteme für Rinder und Schweine (Alternative housing systems for cattle and swine). Ministry of Agriculture, Bonn, Germany, *Berichte über Landwirtschaft*, 78: 193-247.

Hossain, Z. M. A., S. M. J. Hossain, M. M. Rashid, N. Sultana, and M. H. Ali. 2004. Study on the present management condition of private dairy farm at Rangpur Sadar Thana in Bangladesh. *Journal of Biological Sciences*, 4(2): 185-188.

IPCC, 1996. In: Houghton, J. T., L. G. Meira Filho, B. Lim, K. Tréanton, I. Mamaty, Y. Bonduki, D. J. Griggs, and B. A. Callander, (Eds.). *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2: Greenhouse Gas Inventory Workbook (Chapter 4)*.

Kelly, M., J. Bishop, G. A. F. Tilley, C. Nias, R. Stewart, E. Collins (ed.), and C. Boon. 1993. Recent development in the design of dairy cow housing. Building Design Unit, Scottish Agriculture College, Auchincruive, Ayr, UK. *Livestock Environment IV*. Proceeding of a conference held in Coventry, UK, 6-9 July 1993.

Kumar, A., D. C. Rai, and Khyali Ram Choudhary. 2011. Prospects and opportunities for exports of dairy products from India. *Indian Journal of Animal Sciences*, 81(2):86-91.

Larsson, K.-E. 1955. Lösdrift för mjölkkor ur driftsekonomisk synpunkt. Vilka tekniska förutsättningar finns för lösdrift i Sverige? *Lantmannen*, 39: 1105-1108.

Lovett, D. K., L. J. Stack, S. Lovell, J. Callan, B. Flynn, M. Hawkins, and F. P. O'Mara. 2005. Manipulating enteric methane emissions and animal performance of late-lactation dairy cows through concentrate supplementation at pasture. *Journal of Dairy Science*, 88(8):2836–2842.

Muprhy, J. P. 1989. Dairy facility design. Conference paper. Kansas Agricultural Experiment Station contribution; no. 90-140-S. Report of progress (Kansas Agricultural Experiment Station); 580.

Nilsson, C. 1992. Walking and lying surfaces in livestock houses. In C. a. P. D. Phillips (Eds), *Farm Animals and the Environment* (pp. 93-110). Wallingford: CABI.

Rahman, M. M. 2004. An Appraisal of the Present Status and Scope for Mechanization of the BAU Dairy Farm. An M.S. Thesis, Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Saha, C. K., C. Ammon, W. Berg, M. Fiedler, C. Loebsin, P. Sanftleben, R. Brunsch, and T. Amon. 2014. Seasonal and diel variations of ammonia and methane emissions from a naturally ventilated dairy building and the associated factors influencing emissions. *Science of the Total Environment*, 2014,s 468–469(2):53-62.

Sastry, N. S. R. 1980. Housing cows at small dairy farms. *Indian Farming*, 30(5): 22-32

Sharma, V. P. 2007. Globalisation and Indian Diary Sector. Dairy India 2007. Dairy India Yearbook, New Delhi. 55-60.

Su, J. J., B. Y. Liu, and Y. C. Chang. 2003. Emission of greenhouse gas from livestock waste and waste water treatment in Taiwan. *Agriculture, Ecosystems and Environment*, 95(1):253-263.

Tuyttens, F. A. M. 2005. The importance of straw for pig and cattle welfare: a review. *Applied Animal Behaviour Science*, 92(3):261-282.

Valde, J. P., D. W. Hird, M. C. Thurmond and O. Osteras. 1997. Comparison of ketosis, clinical mastitis, somatic cell count, and reproductive performance between free stall and tie stall barns in Norwegian dairy herds with automatic feeding. *Acta Veterinaria Scandinavica*, 38(2):181-92.

Wander, J. F. 1976. Haltungsund verfahrenstechnisch orientierte Verhaltensforschung. *Züchtuvgskunde*, 48(6): 447-459.

Wright, I. A., S. Tarawali, M. Blummel, B. Gerard, N. Teufel, and M. Herrero. 2012. Integrating crops and livestock in subtropical agricultural systems. *Journal of the Science of Food and Agriculture*, 92(5): 1010-1015.

Yan, T., R. E. Agnew, F. J. Gordon, M. G. Porter. 2000. Prediction of methane energy output in dairy and beef cattle offered grass silage based diets. *Livestock Production Science*, 64(2–3):253-263.