

## A STUDY ON TRADITIONAL WHEAT STORAGE FACILITIES IN FLOOD PRONE AREAS UNDER BHOLA DISTRICT

M K Hasan\*<sup>1</sup>, T Islam<sup>2</sup> and K K Saha<sup>3</sup>

<sup>1</sup>Assistant Engineer, Engineering Section, Sylhet Agricultural University, Sylhet-3100, Bangladesh

<sup>2</sup>Department of Agricultural Construction & Environmental Engineering, Sylhet Agricultural University, Sylhet-3100, Bangladesh

<sup>3</sup>Department of Farm Power and Machinery, Sylhet Agricultural University, Sylhet-3100, Bangladesh

### Abstract

The study was conducted at two flood prone upazillas under Bhola district. Farmers were selected from five villages and they were classified as small, medium and large based on their own land. Generally the farmers used traditional storage structures such as dole, motka/jala, steel drum, gunny and plastic bags. The status of average production, consumption, sale, farm use, labor payment, storage volume, cost, durability and losses of different storage structures for wheat and seeds were reviewed and identified. Steel drum, motka/jala, gunny and plastic bags were found more economical for the farmers considering the capital cost, expected life and storage loss. It was found that about 71% farmers were affected by the flood and average 12% stored grains were damaged by the flood in 2009. Around 61% farmers expressed their interest on co-operative storage system at the time of flood to store food grains with pay. The place and type of storage structures were identified based on the opinion of farmers. From the study it is suggested that, to construct storage structures at a safe and easily accessible place, the type of structures should be pucca one and should be elevated from the ground level.

**Keywords:** Wheat storage, storage facilities, storage loss and flood prone areas

### Introduction

Bangladesh is an agrarian country. Agricultural commodities have to undergo a series of operations such as harvesting, threshing, winnowing, grading, bagging/packing, transportation and storage before they reach to the consumers. There are significant losses at all these stages. The most important step in case of the cereals like wheat is the storage of the grain produce. Losses during storage are mainly due to attack by storage insect-pests, loss of moisture in grain, fungus infection, rodent attack and spillage. Since a huge amount of wheat product is lost during the storage of grain, various precautions need to be taken to prevent these losses. In Bangladesh, most of farm product is stored by farmers for their own consumption. Farmers store grain in bulk, using different types of storage structures made from locally available materials. Storage structure design and its construction also play a vital role in reducing the losses during storage. The major construction materials for storage structures in rural areas are mud, bamboo, stones and plant materials. They are neither rodent-proof nor secure from fungal and insect attack. The most of the causes for damage of food crops during storage are due to insects, microorganisms, rodents and unfavourable conditions for storage. In a storage system the structure, temperature and moisture content of the stored materials play a vital role. For optimum storage condition, temperature and moisture content must be controlled. Otherwise severe deterioration may occur in both quality and quantity of stored grains. To prevent these undesirable agents causing damage and to preserve the grains for a long term with appropriate storage structure different researches concerning grain storage were being carried on throughout the world.

The role of storage structure is very important for storing food grain. In this country grains are stored in most house hold traditional storage structures like dole, berh, gola, kuthi, motka/jala, plastic bags, gunny bags, steel drum, and plastic drum etc. Several studies have been conducted for improving these storage structures as well as minimizing the storage loss.

Average losses and deterioration of grains (wheat, rice and paddy) in silo/godown storages were estimated to be 1.5% and for warehouse storage to be 2.8% (Mandal, 1984). Storage of wheat in dole, dole with seeds dried at monthly interval, dole with 0.12 mm thick polythene bag-inside, dole with seeds mixed with biskathali leaves, dole with coatings of coaltar, hessian bag, kerosene tin with air tight lid, earthen pitcher with coating of coaltar, and 0.12

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\*Corresponding author: M K Hasan, Assistant Engineer, Engineering Section, Sylhet Agricultural University, Sylhet-3100, Bangladesh, email: engrkamrul.bd@gmail.com

mm thick polythene bag were found to be efficient and the seeds maintained over 80% germination at the end of storage (Ahmed, 1990). About 90% of the harvested grain is contributed by traditional agriculture and traditional seeds storage facilities, storage that these are common in various regions for storage of various crops with a tendency of using locally available materials (Aziz and Mallya, 1994). Storage loss in our country is relatively high due to improper storage structures, lack of knowledge about storage to the farmers and traders and improper management during storage period. Storage cost and grain loss in the metal containers are low (Rabbani, 1976).

The other important factors are moisture content and temperature of storage grains which limit the distribution and grow of insects, mites and storage fungi that contaminate and destroy stored grain. Good storage means keeping moisture content lower. In high altitude regions, the losses were mainly caused by rodents, where as in lower areas, the losses were due to high moisture content of the stored grain (Manandhar and Rijk, 1980). Low temperature is effective for low moisture content in preventing damage by storage fungi. So for keeping good condition of stored grain we have to maintain optimum temperature. In common grain storage, fungi grow most rapidly at 30 to 32°C and their growth rate decreases as temperature decreases. The average grain temperature remains less than the average ambient temperature and the mean relative humidity of grain mass also remains less than the average ambient humidity when stored in metal container (BRRI, 1983).

The lands of Bangladesh are fixed but crop production is gradually increasing day by day due to the introduction of high yielding varieties (HYV), increasing cropping intensity, better cultural practices and introduction of modern post-harvest technologies. This increased production requires more storage facilities. In Bangladesh most of the farmers of rural areas store food grains in their house hold traditional storage structures like dole, motka/jhar, steel drum, gunny bags and plastic bags etc. These structures are not so durable and poor in providing optimum storage conditions. The grains stored in these structures are susceptible to damage by natural calamities like heavy rainfall, flood, cyclone and attack of microorganisms, insects and rodents which cause a considerable damage and loss in every year. These storage losses are playing a vital role in post-harvest losses. Therefore, it is the burning issue to improve the storage system for the rural areas especially in the flood prone areas of Bangladesh. Storage systems for those particular flood prone areas are more significant and the time of flood stored food grains are damaged to certain extent. In Bangladesh co-operative or common storage facilities are almost absent. To reduce the storage loss, co-operative storage structures are essential to provide more facilities for the farmers to store grains at the time of natural disaster. Storage facilities in the flood or cyclone prone area are also very important with respect to ensuring food security among the affected areas. The farmers store food grains not only for their own consumption throughout the year but also ensure secured supply of food for their families during the period of natural disaster. Due to traditional storage system, flood causes a considerable amount of losses to the stored food grain in the flood prone areas in our country. So the storage system in private and Government levels are to be improved for ensuring food security especially in the flood prone areas.

For storage of grains, various factors are considered, which mostly are biological and economic in nature. For proper preservation or storage of grains there should have a clear idea and conception about those factors. Some important factors are: i) chemical change, ii) micro-organisms and enzymes, iii) respiration and heating, iv) moisture content for safe storage, v) moisture content for safe storage, vi) mites and insects, vii) drying, viii) moisture migration and accumulation, ix) molds, x) insects, pests and rodents, xi) thermal properties of grain, xii) thermal properties of the structures, xiii) exclusion of air, xiv) antiseptics of fumigants, xv) assessment of grain quality, xvi) foreign matter, and xvii) bulk density.

No study on these aspects in those affected areas still reported. So it deserves a careful and effective investigation. The present study, therefore, will provide to identify the problems and prospects of storage. It will also reveals a path of finding suitable locations for constructing storage structure and management of storage so that the people of flood prone areas can store and de-store food grains on their needs, emergency distribution, and price speculation. The specific objectives of the study were : i) to identify the existing grain storage facilities and losses in selected areas, ii) to study the problems and prospects of grain storage at farmers level, and iii) to suggest need based storage systems in the flood affected areas.

## Materials and Methods

Primary data were collected through farm survey with the help of pre-tested questionnaires. The questionnaire was used for collecting data from farmers. Data were collected during October to November, 2009. The following steps were followed during data collection:

### Selection of the study area

As per aim of the study, Bhola Sadar and Burhan Uddin upazillas of Bhola district were selected as the study area. Some community storage structures, private storage for wheat were visited. The information required for the study was collected as available in the selected area. The villages of upazillas are almost easily accessible. The data were taken through interviewing farmers who are very much related with grain storage. Five unions namely Char Shibpur, Uttar Dighaldi, Daksin Dighaldi, Kutba and Bara Manika were selected. Based on ownership of land, the farmers were classified into three categories. These are: small farmers having land up to 1.00 hectare; medium farmers having land with 1.0 to 3.00 hectares and large farmers having land exceeding 3.00 hectares.

### Collection and analysis of data

At the beginning of the interview, the aims and objectives of the study were explained to each farmer. Then the questions were asked in a very simple manner with explanation of questions where necessary and the replies were recorded in the questionnaire. In achieving the objectives of the study the collected data were classified, tabulated and analyzed. Lists of tables were prepared in accordance with the aim and objectives of the study. Simple statistical techniques were followed for analyzing the data.

### Existing grain storage facilities

Storage practices employed in Bangladesh can be divided into three categories. These are storage by farmers, storage by small commercial farms and storage by the government. The traditional and conventional storage structures used by the farmers are dole, motka/jala, steel drum, gunny and plastic bags. These structures are not so durable and susceptible to damage by natural disasters and attack of microorganisms, insects and rodents are causing considerable damage and loss in every year. The traditional storage structures have a number of limitations. The woven bamboo containers, like dole, berh, dhari, etc. have open surfaces, which cause serious losses by rodents and insects and also favour the growth of microorganisms, as it cannot control the moisture contents and temperature.

### Storage by small commercial farms

The small commercial farms store food grains for commercial purposes. They buy food grain (paddy, wheat, potato, etc) when these are available in the market just after the production season and store these food grains in own or rental godown and sell them when price is higher in off season.



Fig. 1. Government godown



Fig. 2. Affected area by flood



Fig. 3. Dole



Fig. 4. Motka



Fig. 5. Jar & Kerosene Tin



Fig. 6. Steel drum



Fig. 7. Gunny bag



### Storage by government cooperatives and community

The government agencies store food grains in silos, CSDs (Central Storage Depot) and LSDs (Local Storage Depot). In this case storage quality is maintained and the loss of storage is minimum. These public storages are not providing facilities to the common people for storing food grains. Mia (1994) showed that the Government has a system of storing food grains through LSDs and CSDs only 16% of the total production. In the study area, there is only one LSD godown at the upazilla level. Cooperative or common storage is very much important in remote and flood prone areas. In the study areas, there are no co-operative or common storage structures.

### Results and Discussion

Farmers produce different types of cereal crops in the study area. The main grain crops are paddy, wheat and potato. Production volume of wheat and potato are low in comparison to paddy for all categories of farms. Farmers made acquisition of crop from net production, beginning stock and purchase of crop.

#### Total acquisition of wheat

Total acquisitions of wheat from different sources of farms are shown in Table 1. It was found that average acquisition of wheat of small, medium and large farms were 186.6, 466.5 and 783.72 kg, respectively of which 149.28, 373.2 and 634.44 kg were average net production; 0, 93.3 and 149.28 kg were beginning stock, respectively. Average purchase of the farms was nil.

**Table 1. Total acquisition of wheat from different sources by farm size in the study areas**

Farm Category	Average net production (kg)	Beginning stock (kg)	Average purchase (kg)	Average acquisition from all sources (kg)
Small farm	149.28	0	37.32	186.6
Medium farm	373.20	93.3	0	466.5
Large farm	634.44	149.28	0	783.72

#### Disposal and storage of grain crop

Farmers have to expend a portion of produced crop in farm use and labor payment. They also have to sale a part meeting up immediate emergency needs. Then farmers store food grains for family consumption, seeds for the next sowing season and facing family needs and natural disaster.

#### Disposal and storage of wheat

Table 2 shows the disposal pattern of wheat by farm size in the study areas. About 74.64, 186.6 and 261.24 kg of average acquisition were consumed by small, medium and large farms, respectively. Amount of wheat sold for labor payment by small, medium and large farms were 0, 37.32 and 74.64 kg of average acquisition, respectively. Average farm uses were 37.32, 37.32 and 293.92 kg and average sales were 37.32, 37.32 and 111.96 kg for small, medium and large farms, respectively. Table 2 also reveals the average storage of wheat by farm size in the study areas. Average storage for small, medium and large farms were 37.32, 74.64 and 149.28 kg of average acquisition, respectively.

**Table 2. Annual composition and storage of wheat in the study areas**

Farm category	Average acquisition (kg)	Average composition				Storage (kg)
		Family (kg)	Farm use (kg)	Sale (kg)	Labour payment (kg)	
Small farm	186.60	74.64	37.32	37.32	0	37.32
Medium farm	373.90	186.60	37.32	37.32	37.32	74.64
Large farm	822.58	261.24	223.92	111.96	74.64	149.28

#### Existing grain storage structure

The study areas are located in the flood prone regions of the Bhola Sadar & Bhurhan Uddin upazilas. Farmers of the study areas used traditional grain storage structures like dole, motka, jala, steel drum and gunny bag etc.

**Grain storage structures used by the farmers****Table 3. Traditional wheat storage structures of sampled farm in the study areas**

Farm category	No. of farm	Dole (bamboo made)		Motka/ Jhala (clay made)		Steel drum		Gunny bag	
		No. of farm used	% of farms used	No. of farm used	% of farms used	No. of farm used	% of farms used	No. of farm used	% of farms used
Small	12	5	42	8	67	6	50	6	50
Medium	28	12	43	15	54	8	29	11	39
Large	10	4	40	7	70	4	40	3	30

All farmers stored their produced wheat in dole, motka/jhala, steel drum and gunny bag. Wheat is stored in different traditional storage structures. The acquisition of traditional wheat storage structures of sampled farmers at Bhola Sadar & Burhan Uddin upazilas is given in Table 3. Number of used dole were to be 5, 12 and 4, motka/jhala 8, 15 and 7; steel drum 6, 8 and 4; gunny bag 6, 11 and 3 for small, medium and large farmers respectively out of farm 12, 28 and 10 numbers, respectively. Table 3 also reveals that dole, motka/jhala, steel drum, and gunny bag used by the farmers were 42, 67, 50 and 50 percent for small farm; 43, 54, 29, and 39 percent, for medium farms; and 40, 70, 40 and 30 percent, respectively for large farms.

**Grain storage cost and loss**

Storage cost and losses are very important in case of studying grain storage. As the study areas lie on flood prone and remote regions, storage systems practiced were mostly traditional. For this reason, both storage cost and losses of grain were comparatively high.

**Storage cost and loss of wheat in different storage structures**

Farmers stored wheat in dole, motka/jhala, steel drum and gunny bag. Table 4 reveals the loss of storage in steel drum, motka/jhala was lower than loss of storage in dole.

**Table 4. Storage cost and loss of wheat in different storage structures**

Storage structure	Capacity (kg)	Capital cost (Tk.)	Expected life (Year)	Cost per 40 kg (Tk)	Rate of loss (%)
Dole	1119.60	700	5	5.00	4.20
Motka/Jala	150.00	500	10	13.50	1.25
Steel drum	150.00	600	10	16	1.25
Gunny bag	74.64	50	3	9	2.50

**Storage cost, loss and germination rate of stored seeds by farm category**

Farmers store paddy, wheat and potato as seed for the next sowing season. They take special care from harvesting to storage for seed preparation. So, the cost is comparatively high but loss is low. Table 5 shows the storage cost, loss and germination rate of wheat in different structures for an average period of 8-9 months in the study area by farm category.

**Table 5. Storage cost, loss and germination rate of wheat seed storage by farm category**

Farm category	Storage structure	Cost of storage per 40 kg (Tk.)	Loss of storage (%)	Germination rate (%)
Small	Motka/Jala	13.5	1.25	82
Medium	Steel drum	16	1.25	81
Large	Steel drum	16	1.25	85

**Storage of food grains as affected by flood**

The study areas of Bhola Sadar and Burhan Uddin upazillas are flood prone regions. Among the 5 unions, 3 are more affected than the other ones. In every year a large part of these unions have been suffering from flood damage. Table 6 shows the number of affected farm and damage of stored crop. It reveals that larger farms are less affected by flood and crop damage.

**Table 6. Farms affected by flood and damaged of stored grain**

Farm category	Number of farm	Number of farm affected by flood	% of farm	Damage of stored crop (%)
Small	12	10	84	14
Medium	28	22	79	12
Large	10	5	50	10

### Appreciation of common storage and co-operative storage

The study areas are flood affected zones and flood causes considerable damages in most of the farm almost every year. There is no common or co-operative storage structure. But the respondent of the sample farms and traders expressed their interest about common or cooperative storage. Table 7 gives the appreciation of common and co-operative storage by farm sizes.

**Table 7. Appreciation of common and cooperative storage in terms of farm category**

Farm category	Number of farmer	Interested for commercial structure	% of farmer	Interested for co-operative storage	% of Farmers
Small	14	4	33	8	67
Medium	28	12	43	16	57
Large	10	4	40	6	60

### Appreciation of training on storage and government help (Loan, grant etc)

The farmers of Bangladesh are not aware about the importance of storage and its management. Financial conditions of the farmers are not also good. They need support in various forms for production and storage of produced crops especially food grain crops. This type of help is very much deserving in the flood prone area of the country. Table 8 shows the appreciation of farmers.

**Table 8. Appreciation of training on storage and government help**

Farm category	Number of farmers	Number of farmers interested for training	% of farm Interested	Number of farmers interested to get government help (Loan and grant etc.)	% of farm Interested
Small	12	11	92	10	84
Medium	28	27	96	25	89
Large	10	10	100	7	70

### Need based storage system

The study was conducted to identify the need based storage system for ensuring food security in remote and flood prone areas of Bangladesh. The main river side areas of the country are affected more or less in every year by flood. During flood, houses including storage structure of farmers are damaged to certain extent and they fall in a position of food insecurity. In the study areas of Bhola Sadar and Burhan Uddin upazillas, average 71% farmers are affected by flood and average 12% stored grains are damaged in the flood of 2009. For ensuring security and good maintenance of storage quality the structure should be pucca building with storage capacity of minimum 60 metric tons. Such a structure can provide storage of wheat produce in the area (for about 150 farmers) and the structure could be accommodated in 5 decimals of land.

The farmers of the study area stored their paddy in indoor type traditional storage structures like dole, steel drum, motka/jhala, gunny bags and plastic bags. The tendency of using dole and motka/jhala is high but these structures are not so durable and storage losses are comparatively high due to various factors. During flood, the houses and storage structures and stored grains of farm people are damaged partially or fully. For this reason, there is no alternative other than improved storage structure construction in safe place. Farmers of the study areas have lack of knowledge on storage and they need government help (like loan, training etc.) due to lack of affordability. Government has storage system i.e. LSDs in upazilla level. General farmers and traders have no access to this system. There is no government storage system at the union or village level. Some of the considerations in building a storage structure to reduce storage losses are: i) the storage structure should be elevated from the ground and away from moist places in the house, ii) if possible, the structure should be airtight, even at loading ports, iii) surrounding area of the structure should be clean to minimize insect breeding, iv) rodent proof materials should be used for construction of rural storages, v) the structure should be plastered with an impervious clay layer to avoid termite attack, or attack by other insect, and vi) in the flood/cyclone prone areas the number of flood cum cyclone shelter including co-operative storage system for food grain should be increased. Various research and development organizations in Bangladesh have identified some proven, age-old structures from certain areas of the country and, based on these, some improvised storage structures have been developed and recommended for use at farmers' level.

### References

- Ahmed M. 1990. Effect of cultural condition and storage environment on the quality and field performance of wheat seed. PhD Thesis, Department of Agronomy, Bangladesh Agricultural University, Mymensingh.
- Aziz A A and Mallya J I. 1994. Traditional seed storage facilities in Tanzania and their effect on seed quality. In Abstracts from 2<sup>nd</sup> SADC seminar on Seed Research and Certification. 17-20 May, Tanzania.

- BRRRI (Bangladesh Rice Research Institute), 1983. Annual report for 1982. Rice post harvest technology Division, Joydebpur, Gazipur. p.201.
- Manandhar R B and Rijk A G. 1980. On farm grain storage on Nepal. , AMA. J. Agril. Mech. 11(4):69-74.
- Mandal G, Samajpati J N and Rashid M A. 1984. Studies on grain storage structures in Mymensingh district, Bangladesh. AMA. J. Agril. Mech.. 15(4):50-54.
- Mia M I A and Haq A F M F. 1994. Storage of food grains in the selected flood prone and flood free areas of Bangladesh: A farm level study. Bangladesh J. Rural. Dev. Studies. 4(1&2).
- Rabbani M G. 1976. Comparative study and development of low cost grain storage structure for domestic use in Bangladesh, Undergraduate Project Report, Department of Agricultural Engineering and Basic Engineering, Bangladesh Agricultural University, Mymensingh.