ISSN 0258-7122 (Print), 2408-8293 (Online)
Bangladesh J. Agril. Res. 42(2): 289-299, June 2017

# FINANCIAL PROFITABILITY OF IMPROVED WHEAT SEED STORAGE AT HOUSEHOLD LEVEL IN SOME SELECTED AREAS OF BANGLADESH

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## Abstract

Small and marginal farmers have little access to improved seed from institutional sources and are thus largely excluded from the benefits of new varieties. The production and storage of improved varieties seeds at the household (HH) level can overcome this problem. The study assessed the wheat seed storage systems used at HH level, with a particular emphasis on how the farmers are financially benefited by doing the seed storage business. The study analyzed data collected at random from Cereal Systems Initiative for South Asia in Bangladesh (CSISA-BD) project supported 210 farmers spread over three wheat growing Hubs namely Mymensingh, Faridpur and Rangpur. The study revealed that wheat growing farmers used different types of storage containers and showed the highest level of preference (score 7.2) on plastic/metal drum lining with polythene bag due to lower cost of storage, longevity, and seed quality maintenance. Wheat farmers retained on an average 95.7 kg of improved seed at household level. Majority of the retained seeds at HH level (64%) are being marketed and sold to neighbouring farmers, local markets, and dealers. Wheat seed storage at household level was a profitable business to most of the respondent farmers. They earned a reasonable net income (Tk.420-Tk.1471) from seed storage. The farmers who stored seed in *plastic sac+poly bag* received the highest net income (Tk.1471) due to less storage cost, and higher seed price. Respondent farmers did not face any critical problem during seed storage.

Keywords: Wheat, seed storage, storage system, protection measure, profitability.

## Introduction

Wheat is one of the important cereal crops after rice in Bangladesh. It has versatile uses and a very good substitute of rice. The per capita wheat consumption increased to 26.09 gram/day in 2010 from 12.08 gram/day in 2005 at the national level (HIES, 2010). Rice self-sufficiency in Bangladesh is always fraught with uncertainty as the country suffers from different natural calamities. Therefore, to keep pace with the future demand of the growing population, the

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current production and productivity of wheat must be raised for maintaining the country's food security without substantial and unaffordable imports.

The area and production of wheat continuously fluctuated over the years due to various reasons. Its production got a new momentum in the mid '90s and continued up to 1999. During this period, the area, production and yield of wheat registered highly significant positive growth rates due to introduction of modern seed-water-fertilizer technologies (Miah *et al*., 2015). Unfortunately, the area production and yield of wheat registered highly significant negative growth rates during 2000-2007 (Fig 1).

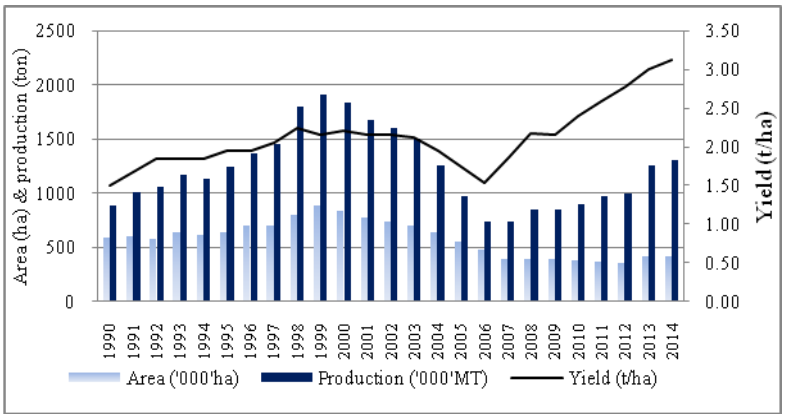


**Fig 1. Area, production and yield of wheat in Bangladesh, 1990-2014**

Source: BBS, 2011& 2013; www.indexmundi.com (for year 2014).

Many wheat growers started shifting their wheat lands to *Boro* rice during this period (2000-07) because of stable and higher yield, higher return, and for food security (Hussain and Iqbal, 2011). Besides, vast wheat areas were also replaced by maize in this period (Miah *et al.*, 2013). Considering these depressing situations, Bangladesh Government gave due emphasis to increase wheat production throughout the country as a source of sustaining food security. The scientists of Wheat Research Centre (WRC) have developed a number of improved wheat varieties for farm level use. However, due to the initiatives of BARI and CIMMYT and the higher adoption of high yielding varieties at farm level, the area, production and yield of wheat further got momentum from 2007 and started increasing at the rate of 0.94, 7.77, and 6.84% respectively during 2007-2014 (Fig. 1).

Seed security is the key to the attainment of household food security among resource poor farmers in developing countries (Wambugu *et al.*, 2009). In 2015, Bangladesh Agricultural Development Corporation (BADC) produced 27,208 tons of wheat seed which was 48.4% of the total seed requirement (Maswood, 2014; Nuruzzaman, 2015). Food insecure, marginal, and landless farmers have little access to the improved seeds from BADC and are thus largely excluded

from the benefits of any new variety (Page and Jafry, 2007). But, the production and storage of improved varieties of seed at the household level has successfully overcome this problem.

Over the past three years (2011-13), CIMMYT under the CSISA-BD project activities has facilitated the dissemination of the new wheat varieties through seed production and storage trainings, as well as, on-farm trials and demonstrations among small and marginal wheat farmers. Additional supporting activities (e.g. farmer field days, market linkage workshops) were also conducted with the aim of encouraging farmers to store seeds of these new varieties at their level for own use and earning income by selling surplus portion. This 'bottom-up' seed dissemination has enabled hundreds of trained wheat farmers to gain profit from producing and selling high quality seed to neighbours, wheat farmers, relatives, and traders. Therefore, it is now essential to assess the financial gain accrued by the farmers through wheat seed storage and evaluate the knowledge learned in order to inform scale-out efforts designed to reach farmers in other areas.

**Objectives**

1. To identify and delineate the prevailing systems used in storing wheat seed at the household level in the study areas.
2. To estimate the financial profitability of wheat seed storage at the household level for different storage devices.
3. To explore the problems and prospects encountered with respect to wheat seed storage at the household level and provide some policy recommendations.

**Materials and Method**

**Method of data collection and period of study:** Data for the present study were gathered from both primary and secondary sources. Primary data were collected from selected farmers with the aid of a pre-tested interview schedule during February-April, 2015. CSISA-BD project personnel in respective district assisted researchers and enumerators in collecting the required primary data. Secondary data were collected from different published sources, such as Bangladesh Bureau of Statistics (BBS), journal articles, and internet services.

**Sampling procedure and sample size:** The improved wheat seed storage and distribution activities of the CSISA-BD project were launched in the three hubs namely Mymensingh, Faridpur and Rangpur. Therefore, the above mentioned hubs were purposively selected for this study. Secondly, Trisal, Mymensingh Sadar, and Iswargonj Upazilas under Mymensingh hub, Nagorkanda, Kashiani, and Faridpur Sadar Upazilas under Faridpur hub, and Pirgonj, Nilphamari Sadar, Lalmonirhat Sadar, and Rajarhat Upazila under Rangpur hub were also purposively selected for this study. Before selecting sample respondents, a

complete list of improved wheat seed storing farmers was prepared with the help of CSISA-BD project personnel working under respective hubs. Finally, a total of 210 small and marginal (having land size 0.50-2.49 acres) project supported wheat farmers[2] taking 70 farmers from each hub were randomly selected from the list for interview.

**Analytical technique:** The collected data were edited and tabulated for analysis. Descriptive statistics were mostly used in analysing collected data and information. The cost of storage included the annual cost of container and protection measures. Due to very small number of samples, protection cost was not considered to calculate net income from storage. The annual cost of a container was calculated by estimating depreciation cost applying straight-line method for one year. In this study, the salvage value of storage container was reported to be zero.

Again, the gross income of storage was estimated by multiplying the quantity stored (kg/farm) with increased price (Tk/kg) of seed due to storage. Increased price is the difference between two prices that prevailed during seed selling and seed storing.

## Results and Discussion

### Distribution Pattern of Wheat Grain and Seed

In 2013-2014, sample farmers in the study areas produced on an average 894 kg of wheat of which 11.52% was retained for seed and the rest wheat grains were sold and consumed at household level. The purposes of retaining seed were to ensure quality seed for own use, getting higher price, timely sowing of seed, higher yield, meet up the costs of cultivation and inputs of wheat or the next crop (Miah *et al.*, 2015). They sold 64% of seed to others and used 32% seed for their own cultivation. A small percentage (4%) of seed was also consumed in the case of unsold or time of need (Table 1).

Respondent farmers sold seed to neighbouring farmers, other farmers at local market, and local fertilizer/pesticides dealers[3]. Data in Table 2 show that 60% seeds were sold to the neighbouring farmers, 31% to other farmers at local markets, and 9% to local fertilizer & pesticides dealers. Farmers received higher price (Tk.40/kg) when they could sell seed to dealers and received the lowest price (Tk.31.1/kg) when they sold it to local markets. Again, most respondent farmers could sell their new variety seed to the neighbouring farmers at higher price (Tk.34.3/kg). Neighbouring farmers and local dealers usually pay higher

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[2] Supported farmers were those wheat farmers who took supports like seed storage training, storage device, and improved wheat seed from CSISA-BD project.

[3] Some local fertilizer/pesticides dealers in the study areas collect seed of improved variety wheat from known farmers and sell them at higher price.

price for improved variety seed only because of better confidence about seed quality.

**Table 1. Wheat grain and seed use pattern at household level during *rabi* season, 2013-2014**

| Particulars | Mymensingh (*n=70)* | Faridpur *(n=70)* | Rangpur *(n=70)* | All area *(n=210)* |
|---|---|---|---|---|
| 1. Average wheat area (ha/HH) | 0.247 | 0.268 | 0.178 | 0.246 |
| 2. Average production (kg/HH) | 1007 | 1028 | 648 | 894 |
| 3. Yield (ton/ha) | 4.08 | 3.84 | 3.64 | 3.63 |
| 4. Use of grain (kg/HH) | 891 (100) | 906 (100) | 577 (100) | 791 (100) |
| a. Sale | 763 (86) | 646 (71) | 528 (92) | 646 (82) |
| b. Consumption | 128 (14) | 260 (29) | 49 (8) | 145 (18) |
| 5. Use of seed (kg/HH) | 116 (100) | 122 (100) | 71 (100) | 103 (100) |
| a. Own use | 44 (38) | 33 (27) | 21 (30) | 33 (32) |
| b. Sale | 68 (58) | 83 (68) | 48 (67) | 66 (64) |
| c. Consumption | 3 (3) | 6 (5) | 2 (3) | 4 (4) |
| d. Gifted to others | 1 (1) | -- | -- | -- |

Note: Figures in the parentheses indicate the percent of total production. HH= Household.

**Table 2. Distribution pattern of sold seed and price received in 2013-2014**

| Study area | Farmer | | Local market | | Local dealer | | Total quantity sold (kg/HH) |
|---|---|---|---|---|---|---|---|
| | Quantity sold (kg/HH) | Price (Tk/kg) | Quantity sold (kg/HH) | Price (Tk/kg) | Quantity sold (kg/HH) | Price (Tk/kg) | |
| Mymensingh | 46.2 (68) | 41.3 | 4.6 (7) | 39.1 | 17.4 (25) | 40.0 | 68.2 (100) |
| Faridpur | 40.9 (49) | 28.4 | 41.9 (51) | 27.6 | -- | -- | 82.8 (100) |
| Rangpur | 32.4 (68) | 35.7 | 14.3 (30) | 32.8 | 1.2 (2) | 40.0 | 47.9 (100) |
| All area | 39.8 (60) | 34.3 | 20.3 (31) | 31.1 | 6.2 (9) | 40.0 | 66.3 (100) |

Note: Figures in the parentheses indicate the percentages of total quantity. HH= Household.

## Preference of Storage Systems

The respondent farmers were asked to give preference scores that ranged from 1 to 8 considering seed quality maintenance (color and luster), cost, availability, longevity, and usability. The average score on preference ranking was found to be the highest for *metal/plastic drum* (7.2) due to cost effectiveness and getting better quality seed. The next best preferred devices were *metal/plastic drum+poly bag* (7.1), *plastic sac+poly bag* (6.0), and *jute sac+poly bag* (5.2). The lowest preference was reported to be on using *jute sac* and *plastic sac* alone (Table 3). The most crucial causes of dissatisfaction (low preference) were the possibility of damaging the container by rats and inclusion of air in the container. Some wheat farmers also mentioned that the use of jute or plastic sac needed 2/3 times checking of seed in a season, possibility of insect-pest infestation, and quality deterioration of seed.

**Table 3. Average score on preference ranking for different storage devices**

| Study area | Types of storage devices | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Jute sac | Plastic sac | Poly bag | Plastic sac + poly bag | Jute sac + poly bag | Metal/plastic drum | Drum + poly bag | Earthen pot |
| Mymensingh | 1.3 | 2.7 | 3.6 | 5.3 | 5.6 | 7.1 | 7.5 | 2.8 |
| Faridpur | 1.1 | 2.6 | 3.7 | 6.4 | 4.6 | 7.2 | 6.9 | 3.5 |
| Rangpur | 1.1 | 2.6 | 3.7 | 6.1 | 5.3 | 7.3 | 6.8 | 3.0 |
| All area | 1.1 | 2.6 | 3.7 | 6.0 | 5.2 | 7.2 | 7.1 | 3.1 |

**Note:** Score ranged from 1.0 to 8.0. Scores 1 and 8 mean the lowest and highest choice/preference, respectively.

## Quantity of Wheat Seed Stored

Quality character of wheat seed is influenced by various factors such as germination rate, moisture content, color and seed-borne fungal prevalence during storage (Malaker *et al.,* 2008). Type of storage container is one of the important factors that determine the quality of seed to a great extent. Respondent farmers stored wheat seed using different types of containers with different techniques. At least eight types of different storage containers were reported to use by the sample farmers. Among these devices, plastic/metal drum, jute sac, and plastic sac along with poly bag were highly used by the wheat farmers. Table 4 revealed that the highest percentage of farmers (44%) stored on an average 98.2 kg of wheat seed using *plastic/metal drum+poly bag* followed by stored 99 kg of wheat seed using *jute sac+poly bag*. The highest amount of wheat seed was stored per household through *plastic sac + poly bag*, although the number of users was low compared to other devices. However, the average storage quantity and duration were 95.7 kg/HH and 31.4 weeks, respectively.

**Table 4. Quantity of wheat seed stored and storage duration using different storage devices**

| Storage device | % of HH | Quantity stored (kg/HH) | Storage duration (week) | Storage loss (kg) |
|---|---|---|---|---|
| 1. Plastic/metal drum+ poly bag | 44 (92) | 98.2 | 30.8 | 2.0 (1) |
| 2. Jute sac + poly bag | 42 (89) | 99.0 | 32.0 | 3.0 (3) |
| 3. Plastic sac + poly bag | 7 (15) | 118.3 | 30.7 | -- |
| 4. Plastic sac | 0.5 (1) | 80.0 | 28.0 | -- |
| 5. Jute sac | 0.5 (1) | 40.0 | 28.0 | 5.0 (1) |
| 6. Poly bag | 0.5 (1) | 35.0 | 31.0 | |
| 7. Earthen pot | 5 (10) | 40.6 | 32.2 | -- |
| 8. Other device | 2 (4) | 50.0 | 31.8 | |
| Average | -- | 95.7 | 31.4 | -- |

Note: Other device includes jar cane, biscuit tin, and soybean oil container. Figures in the parentheses indicate number of respondent farmer. HH= Household.

### Type of Protection Measures Adopted

In the case of air tight container and appropriate moisture content of seed, no protection measure is needed for getting quality seed. However, the wheat farmers of Mymensingh and Faridpur took some protection measures against insects. Among different protection measures, the dust/powder of *Neem* leaves was highly used by the farmers (17.1%) as protection measure in the study areas. Usually, no cost was involved with this traditional measure. However, the average costs incurred for other less used protection measures ranged from Tk.15 to Tk. 72 per household (Table 5).

**Table 5. Farmers' responses on protective measures taken against pests during storage**

| Protective measures | % respondents opined | | | | Average cost | |
|---|---|---|---|---|---|---|
| | Mymensingh (*n=70)* | Faridpur *(n=70)* | Rangpur *(n=70)* | All area *(n=210)* | Tk/HH | Tk/kg |
| 1. *Neem* leaf powder | 35.7 | 15.7 | -- | 17.1 | -- | -- |
| 2. *Biskatali* leaf powder | 4.3 | -- | -- | 1.4 | -- | -- |
| 3. White powder | 4.3 | 1.4 | -- | 1.9 | 57.9 | 0.61 |
| 4. Phostoxine | 2.9 | 1.4 | -- | 1.4 | 62.5 | 0.65 |
| 5. Naphthalene | -- | 7.1 | -- | 2.4 | 15.3 | 0.16 |
| 6. Insecticides | 2.9 | -- | -- | 1.0 | 16.7 | 0.17 |
| 7. Others* | 2.9 | 18.5 | -- | 7.2 | -- | |

Note: Others included sand, ash, rice bran, tobacco powder

### Profitability of Seed Storage at Household level

Wheat seed storage at household level was opined to be a profitable business to most of the respondent farmers. On an average, supported and non-supported farmers stored about 97.2 kg and 90.5 kg of seed per season, respectively. The range of increased seed prices due to storage was found to be Tk.10.9 to Tk. 12.7 for supported farmers, whereas it was Tk. 9.4 to Tk. 17.1 for non-supported farmers. The higher increased price received by supported farmers might be due to improved variety and reliability of seed producers. On an average, supported and non-supported farmers earned gross income of Tk. 1223 and Tk. 1157, respectively.

The average annual cost of storage device or container was more or less same for both categories of farmers. The highest cost incurred for *jute sac+poly bag* (Tk.32.9) and the lowest cost was for *earthen pot* (Tk.23.0) might be due to the low longevity and low price of the devices respectively. Again, the cost of storage device per kilogram of seed was estimated the lowest for plastic/metal drum for both categories of farmers. The unit price of plastic or metal drum was

reported to be high in the study areas and many respondent farmers had no capacity to purchase it. However, the annual cost for *plastic or metal drum* was low which was about Tk.26 per year. This lower price was attributed to higher longevity of the device (Table 6).

The wheat seed storing farmers earned, on an average, gross income of Tk. 1233. The average net return was Tk.1204. The farmers who stored seed in *plastic sac+poly bag* system received the highest net income (Tk.1471/HH) followed by the method storing seed in *plastic/metal drum* due to storing higher quantities, less storage cost, and higher price. Storing wheat seed in earthen pot generated the lowest net return for the farmers. The farmers who stored seed in poly bag or jute sac also received lower net return.

The average net returns received by supported and non-supported farmers were Tk.1194 and Tk. 1127, respectively. The non-supported farmers who stored seed in *plastic/metal drum* received the highest net income (Tk.1817/year) due to store higher quantities, less storage cost, and higher price of seed. Again, the supported farmers who stored seed in *plastic sac+poly bag* received the highest net income (Tk.1471/year) due to store higher quantities of seed (Table 6).

**Table 6. Profitability of wheat seed storage under different storage devices in 2014**

| Storage device | N | Quantity stored (kg/farm) | Price before storage (Tk/kg) | Increased price due to storage (Tk/kg) | Gross income from seed sold (Tk/farm) | Cost of storage device | | Net income (Tk/farm) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Tk/year | Tk/kg | |
| ***A. Supported farmer*** | ***206*** | ***97.2*** | ***21.7*** | ***12.58*** | ***1223*** | ***28.3*** | ***0.32*** | ***1194*** |
| 1. Plastic sac + poly bag | 15 | 118.3 | 21.1 | 12.7 | 1502 | 31.1 | 0.26 | 1471 |
| 2. Jute sac + poly bag | 89 | 99.0 | 22.3 | 11.1 | 1099 | 32.9 | 0.33 | 1066 |
| 3. Plastic/metal drum | 92 | 98.2 | 21.3 | 14.6 | 1429 | 26.3 | 0.27 | 1403 |
| 4. Earthen pot | 10 | 40.6 | 21.1 | 10.9 | 443 | 23.0 | 0.57 | 420 |
| ***A. Non-supported farmer*** | ***61*** | ***90.5*** | ***20.7*** | ***12.78*** | ***1157*** | ***29.6*** | 0.33 | ***1127*** |
| 1. Plastic sac + poly bag | 10 | 57.5 | 21.1 | 13.9 | 799 | 31.1 | 0.54 | 768 |
| 2. Jute sac + poly bag | 23 | 72.4 | 20.6 | 9.4 | 681 | 32.9 | 0.45 | 648 |
| 3. Plastic/metal drum | 26 | 122.9 | 20.5 | 15.0 | 1843 | 26.5 | 0.22 | 1817 |
| 4. Earthen pot | 2 | 42.5 | 21.2 | 17.1 | 727 | 23.0 | 0.54 | 704 |

Note: Others included kerosene tin, edible oil jerkin, biscuit tin, etc.

Due to very small number of sample, protection cost was not considered in calculating net income

The income earned from seed storage was spent for different purposes. The net income was mostly spent for land preparation (45%), buying inputs for wheat cultivation (18%), purchase of food items (16%), other expenses (14%), and spent for education (Table 7).

**Table 7. Pattern of farmers' seed storage income utilization on different items in 2014**

| Expenditure head | Average amount spent (Tk.) | | | |
|---|---|---|---|---|
| | Mymensingh | Faridpur | Rangpur | All area |
| 1. Met up land preparation cost | 1376 (40) | 1399 (57) | 852 (38) | 1209 (45) |
| 2. Purchase food items | 733 (21) | 190 (8) | 363 (16) | 418 (16) |
| 3. Purchase fertilizers | 269 (8) | 236 (10) | 210 (9) | 238 (9) |
| 4. Expenses for education | 256 (7) | 286 (12) | 25 (1) | 189 (7) |
| 5. Purchase agricultural instrument | -- | 7 (0) | 588 (26) | 199 (7) |
| 6. Settle irrigation cost | 110 (3) | 84 (3) | -- | 64 (2) |
| 7. Other expenses | 694 (20) | 265 (11) | 197 (9) | 377 (14) |

Note: Figures in the parentheses indicate percent of total income

## Problems of Seed Storage

Both supported and non-supported farmers faced different problems to some extent during seed storage. About 17% households did not have plastic tripals for drying wheat seed. Some respondent farmers faced problem with scavenging poultry and birds during seed drying (5.2%). However, some of the supported farmers were found to use old variety (6.3%), not rouging their wheat plot (7.0%), use traditional device in seed storage (4.8%), and placing seed container on ground (Table 8). These are some factors of good storage of seed. Most wheat farmers dried wheat grain properly before retaining it as seed. Some farmers dried seed on tripal which were made of plastic or cement bags. Some farmers dried seed on ground (covered with cowdung solution). They had little access to *Pacca Chatal* for drying seed.

**Table 8. Problems faced by sample wheat storage households in the study areas**

*(% of responses)*

| Problem faced | Supported farmer *(n=210)* | Non-supported *(n=60)* | All category *(n=270)* |
|---|---|---|---|
| Lack of tripal for drying | 14.3 | 26.7 | 17.0 |
| Attack of poultry and birds | 5.2 | 5.0 | 5.2 |
| Using old wheat variety | 4.8 | 11.7 | 6.3 |
| Practice no roughing | 6.7 | 8.3 | 7.0 |
| Use traditional storage container | 4.3 | 6.7 | 4.8 |
| Placing seed container on ground | 1.4 | 1.7 | 1.5 |

## Conclusions and Recommendations

### Conclusions

The study assessed the wheat seed storage systems used at household level, with a particular emphasis on how the farmers are financially benefited by doing the seed storage business. On average, wheat production was about 900kg/HH; and out of the three study areas trend in production was better in Faridpur area probably due to better soil fertility. The bulk of the total outputs at farm level (82%) are being marketed. In the case of stored seed, nearly 64% are often sold out by the households. The wheat farmers in the study areas use nine types of storage containers and show the highest level of preference on plastic/metal drum and plastic/metal drum along with poly bags due to cost effectiveness and better quality seed. They sell most of their seeds to neighbouring farmers, local markets, and dealers. Wheat seed storage at household level is a profitable business to most of the sample farmers. They can earn a reasonable net income (Tk.1127-Tk.1194/HH) from seed storage. The farmers who stored seed in plastic/metal drum receive the highest net income due to higher storage capacity, less storage cost, and higher seed price. Respondent farmers did not face any critical problem during seed storage.

### Recommendations

Based on the above findings, the following recommendations are made.

(i) Most marginal farmers do not have capability to buy plastic/metal drum. Therefore, interested small and marginal wheat farmers should be provided plastic/metal drum with subsidized price.

(ii) Present study strongly recommends that the existing training and seed dissemination program should be extended to other new and promising areas for fostering wheat cultivation as well as improving farmers' income in Bangladesh.

**Acknowledgements:** We wish to record our gratitude to Dr. Rafiqul Islam Mondal, Director General, Bangladesh Agricultural Research Institute (BARI), and Dr. M.A. Matin, CSO, Agricultural Economics Division of BARI for allowing us to conduct this study. We are thankful to Dr. Dinabandhu Pandit, Cropping System Agronomist, Mymensingh Hub, Dr. Mohi Uddin, Cropping System Agronomist, Faridpur Hub, and Md. Anarul Haque, Extension Agronomist, Rangpur Hub for their invaluable cooperation during conducting questionnaire survey. We also wish to acknowledge the financial support of CIMMYT to conduct the study.

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