



Potato Producers' Attitudes Towards Cold Storage in Selected Areas of Bogura District

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ABSTRACT

Potato is an important vegetable for its commercial and nutritional value in the world as well as Bangladesh. The study was undertaken to examine producers' attitudes towards cold storage and also to identify factors influencing the attitudes. Primary data were collected from purposively selected 50 potato producers from Shibgonj and Sadar upazila of Bogura district. The primary data were collected through direct face to face interview method with the help of pretested structured questionnaires during the month of November, 2018. Five-point Likert scale had been used to collect data for measuring the producers' attitudes towards cold storage. Multiple regression model was used to examine the factors influencing potato producers' attitudes towards cold storage. By using the data from Likert scale, total score value for individual potato producer was calculated and it was found that most of the potato producers (68 per cent) showed their disfavored attitudes towards cold storage and only 26 per cent showed their favored attitudes in the study area. Average score value for the individual statements were also estimated and found that most of the score values were less than three, which means that most of the cases potato producers had showed their disfavored attitudes towards cold storage in the study area. The multiple regression model identified that age, farm size and status of storing potato in cold storage had significant influences on the potato producers' attitudes towards cold storage. Cold storage authority should take care all types of producers more with a congenial environment to improve the attitudes of the potato producers. Since, this study has been conducted in a small scale; the findings should be used carefully. This type of study can be conducted in a large-scale basis including traders who store potato in a cold storage to get insights into attitudes and for making generalization of the findings.

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Introduction

Bangladesh is predominantly an agrarian country. Most of the people in rural areas are directly or indirectly depend on agriculture. Agriculture is the single largest producing sector of the economy and contributes about 13.02% to the total Gross Domestic Product (GDP) of the country and also accommodates around 40.6% of labour force (BBS, 2019). Potato is now one of the staple foods in Bangladesh. Potato is the single most popular vegetable-tuber crop grown in more than 100 countries of the world (Hussain, 2016). In Bangladesh the cultivation of potato was started in the late 19th century (Siddique and Hussain, 1988). Potato is a staple food in the developed countries as well, which accounts for 37% of the total production in the world (FAO and CIP, 1995). Considering the trend of population growth and consequently the increased demand for food in Bangladesh and dwindling cultivable land area, the potato is likely to play a vital role in the future.

Potato is a popular and important vegetable in Bangladesh. Potato is one of the main commercial crops grown all over the country. In Bangladesh, potato is mainly consumed as a vegetable. Adequate supply of potato stabilizes the vegetable market all-round the year (Moazzem and Fujita, 2004). The government has been trying to diversify food habits and encourage potato consumption to reduce pressure on rice. So, potato is becoming an important food for food security in Bangladesh. In Southeast Asia the potato is an important vegetable in diet diversification and an anchor in intensive cool-weather horticulture systems.

Bangladesh is the third largest potato producer in Asia and is among the top 10 of the potato producing countries (FAOSTAT, 2019) of the world. It ranks third in area acreage after rice and wheat and is cultivated in almost all agro-ecological regions of Bangladesh.

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In addition, potato ranks second after rice in production in Bangladesh. The land and climatic condition of Bangladesh with abundant water and humid temperature is ideally congenial to the cultivation of potato. The area, production and yield of potato have increased significantly during the last three decades in Bangladesh. However, due to lack of adequate cold storage facilities, huge amount of potato is wasted every year. BBS (2015) estimated about 25-45 per cent loss and damage of perishable produces (vegetables and fruits) because of acute shortage of small cold storage to preserve in Bangladesh (BBS, 2015). Due to inadequacy of post-harvest cold storage facilities, the farmers suffer a huge loss and damage of perishable produces, and become victims of exploitation by middlemen and local wholesalers at both producers and consumers end. According to feasibility study by PKSF (2017), demands for cold storage is growing among farmers, fisheries and rural small businesses for short term preservation of perishable agro-products near wholesale rural markets but there is hardly initiative for small scale cold storage.

On a global scale, Food and Agriculture Organization (FAO, 2001) has estimated 30-40 per cent loss of all vegetables and fruits due to perishability and absence of proper post-harvest storage, processing plants and transportation facilities. The purpose of storing potato in cold storage is to maintain tubers edible condition and to provide uniform supply of potato to the market during off-season. Cold storage plays an important role in increasing production of potato by supplying quality seed potato in time also. Cold storage helps in the price stabilization of perishable commodities by removing the gluts occurring in the production season (Kohls and Uhl, 1980).

A few studies (Ahmad, 1979; Elias and Hossain, 1981; Sabur, 1986; Islam, 1987; Siraj *et al.*, 1992; Fuglie *et al.*, 1997; Hajong, 2011; Minten *et al.*, 2014) have been conducted to measure mainly marketing system of potato, production of potato, storage and utilization of potato, marketed surplus, and economic and technical analysis of different types of post-harvest technology for storing potatoes. This study is little bit different in the sense that it was conducted to measure potato producer's attitudes towards cold storage. Because, measurement of attitude occupies a central role in the theories of consumer behavior and research regarding this field (Ajzen, 2008). On the other hand, price of agricultural products fluctuates more than industrial products. In agriculture, mainly supply determines the price of the agricultural commodities. Agricultural commodities are perishable in nature. Since, agricultural commodities are necessary types; most of them are inelastic in demand (Tomek and Robinson, 2003).

So, if the stable supply of agricultural commodities in the market cannot be maintained properly then there will be a chance of being higher price fluctuation. Instable prices can affect the income of producers greatly. A sharp price decline during and immediately after harvest of potato, deprives the potato farmers from getting a remunerative market price for their produce. If the farmers fail to sell their produce at an incentive price they are likely to discontinue its production which may adversely affect the economy. Sometimes, it is seen in print and electronic media that farmers are not getting enough prices by storing potato in cold storage. In this perspective, an attempt has been made to examine the potato producer's attitudes towards cold storage and also to examine the factors influencing potato producer's attitudes.

Materials and Methods

The study was conducted in selected areas of Bogura district. Bogura district is the leading zone in respect of cold storage plants installed and potato production in Bangladesh. Thirty five cold storages were located in Bogura district. Fifty farmers who cultivated potato in the study area were selected purposively from Shibgonj and Sadar upazila of Bogura district. Purposive sampling technique was followed classifying the potato growers according to their cultivated holdings into small (0.05-2.49 acres), medium (2.50- 7.49 acres) and large (7.50 acres and above). Thirty nine small farmers, 8 medium farmers and 3 large farmers were selected which comprised the sample of potato growers. The study was based on primary data which were collected from potato growers interviewed at their village homes in 2018. The collected data were checked and cross-checked for ensuring their reliability and adequacy and thereby to make them meaningful for the present study. All the collected data were summarized and scrutinized carefully and transferred in MS excel sheet.

Likert scale was used to assess the potato producers' attitude on cold storage. To apply the Likert scale a series of items were compiled that expressed a wide range of attitudes, from extremely positive to extremely negative. Each item calls for checking one of five fixed alternative expressions such as "strongly agree", "agree", "neutral", "disagree", and "strongly disagree". In this five-point continuum, weights of 5,4,3,2,1 and 1,2,3,4,5 are assigned. The direction of weighting being determined by the favorableness or un-favorableness of the scale items used in the frame. After that a total score for each respondent is calculated by summing the value of each item that checked. Then the researchers determined a basis for the selection of items for the final scale by applying item analysis. With item analysis each item is subjected to a measurement of its ability to

separate the highs from the lows. This is called the discriminative power (DP) of the item (Nachmias and Nachmias, 1992).

$$DP = Q_1 - Q_2$$

where, Q_1 = range above the upper quartile, and Q_2 = range below the lower quartile.

The DP value was computed for each of the scale items and those with the largest DP values are the items that best determinate among individuals expressing deferring attitudes toward the measured attitudes. In calculating the DP, summation of the scored items for each respondent was made and placed the scores in an array, from lowest to highest. Then, the range was compared above the upper quartile (Q_1) with that below the lower quartile (Q_2), and the DP value is calculated as the difference between the weighted means of the scores above Q_1 and of those that fall below Q_2 . Potato producers' expression was checked for 20 scale items. The 5 scale items were excluded from the items on the basis of Discriminative Power (DP) which were the smallest values. Then finally the 15 scale items were used for the analysis. Here (Table 1) 20 statements (scale items) those were included in the interview schedule to check the response from potato producing farmers for measuring attitudes. Item 12, 13, 14, 18 and, 20 are unfavorable items and rest of them (15 items) are favorable items.

From the Table 2, it is seen that weighted total and weighted mean for the high (25%) were 58 and 4.83 respectively. For low (25%) weighted total and weighted mean were 52 and 4.43 respectively. After calculation it was depicted that DP value was 0.49. In this way, DP values for the rest of the 19 statements were calculated. Statements were arranged according to the descending order of DP values in Table 3. For selecting the scale items those were used to measure the potato producers' attitudes on cold storage, DP value was computed for each of the 20 scale items, and those items with the largest DP values were selected. These are the items that best discriminate among individuals expressing different attitudes toward the measured attitudes. All the DP values are shown in Table 3 where the statements are arranged in descending order of DP values. From the 20 statements; five statements (statement 2, 4, 11, 19, and 14) were excluded for the analysis as they kept the DP values lowest level.

Multiple regression model was used to examine the factors (socio-economic profile of the producers) influencing the potato producers' attitudes on cold storage. Producers' attitudes (total score value) was used as dependent variable and six independent variables (age, level of education, potato production, farm size, annual income, and status of storing potato in a cold storage by the producer) were included in the model. For examining the factors influencing the attitudes in other studies; age, level of education, annual income, farm size and other variables has been used by many authors (Oluwasusi, 2014; Patidar and Patidar, 2015; Khushi *et al.*, 2018).

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + u_i$$

where, Y_i = Producers' attitudes on cold storage (score value; total score for finally selected 15 statements); X_1 = age of the potato producer (years); X_2 = level of education (total number of academic years that a respondent received by getting formal education. A score of 1 was assigned for each class passed by the respondent, 0 was assigned for no education); X_3 = production of potato (kg); X_4 = farm size (acres; size of farm was measured by the land owned plus the land rented-in minus the land rented-out); X_5 = annual income (used as dummy variables with a reference income group; annual income of the potato producer was collected by the four income categories (<Tk.100000, Tk. 100000 -Tk. 150000, Tk. 150000 - Tk. 200000, and > Tk. 200000) was used as dummy variable because of grouped data.

The dummy variables are $D_1 = 1$, if income level Tk. (100000 –150000); $D_1 = 0$, otherwise; $D_2 = 1$, if income level Tk. (150000 - 200000); $D_2 = 0$, otherwise; $D_3 = 1$, if income level >Tk. 200000; $D_3 = 0$, otherwise; Reference income is <Tk.100000; X_6 = Status of storing potato in a cold storage by the producer (used as a dummy variable, $D_4 = 1$, if storing potato in a cold storage regularly; $D_4 = 0$, otherwise). So, the final multiple regression model will be:

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 D_1 + \beta_6 D_2 + \beta_7 D_3 + \beta_8 D_4 + u_i$$

where, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ and β_8 are the regression coefficients; α = intercept; u_i = regression error.

Table 1. Statements for measuring potato producers' attitudes towards cold storage

Sl. no.	Statements
1.	Potato is a perishable product, so it is better to store potato in cold storage.
2.	If I store potato in a cold storage then I will get more profit by selling it off season at higher price.
3.	Storing potato in a cold storage is very easy task.
4.	Cold storage is more suitable for potato storage.
5.	Potato cold storage is easily accessible, so I use cold storage.
6.	We get better price of potato throughout the year because of cold storage.
7.	Even, if storage cost increases, I will store potato.
8.	I am satisfied with potato storing in cold storage.
9.	We need more cold storage.
10.	I am satisfied with the storage facilities.
11.	In future, potato storage will be more profitable.
12.	I don't like to store potato in cold storage, because it is very expensive.
13.	Cold storage owner is getting more profit; I am not benefitted from cold storage.
14.	Traders who store potato in cold storage, they are getting more profit. I am not benefitted.
15.	I always get enough space for storing my potato in a cold storage.
16.	Quality of cold storage is very good.
17.	I like to store potato in a cold storage though I could not get chance sometimes.
18.	There some complexities to store potato in cold storage. So, I don't like to store potato in cold storage.
19.	Large amount of potato is encouraged to store in a cold storage.
20.	Sometimes, potatoes are found rotted condition from cold storage, so, I don't like to store potato in cold storage.

Table 2. Calculating DP value for the first scale item (statement) "Potato is a perishable product, so it is better to store potato in cold storage"

Group	Number in a group	Score					Weighted total	Weighted mean	DP (Q1- Q2)
		5	4	3	2	1			
High 25% (Q1)	12	10	2	0	0	0	58	4.83	0.49
Low 25% (Q2)	12	4	8	0	0	0	52	4.33	

Weighted total = Summation (Score × Number who checked that score); Weighted mean = weighted total/number in group; DP = difference between the weighted mean of Q₁ and Q₂

Table 3. Selected 20 statements according to higher DP value for measuring the attitudes of potato producers' towards cold storage

Statement No.	Items	DP value	Ranked by DP Value
3	Storing potato in a cold storage is very easy task.	1.41	1
17	I like to store potato in a cold storage though I could not get chance sometimes.	1.33	2
8	I am satisfied with potato storing in cold storage.	1.16	3
15	I always get enough space for storing my potato in a cold storage.	1.16	4
16	Quality of cold storage is very good.	0.91	5
6	We get better price of potato throughout the year because of cold storage.	0.83	6
10	I am satisfied with the storage facilities.	0.83	7
12	I don't like to store potato in cold storage, because it is very expensive.	0.75	8
18	There some complexities to store potato in cold storage. So, I don't like to store potato in cold storage.	0.66	9
13	Cold storage owner is getting more profit; I am not benefitted from cold storage.	0.50	10
1	Potato is a perishable product, so it is better to store potato in cold storage.	0.49	11
5	Potato cold storage is easily accessible, so I use cold storage.	0.41	12
9	We need more cold storage.	0.41	13
7	Even, if storage cost increases, I will store potato.	0.33	14
20	Sometimes, potatoes are found rotted condition from cold storage, so, I don't like to store potato in cold storage.	0.33	15
2	If I store potato in a cold storage then I will get more profit by selling it off season at higher price.	0.25	16
4	Cold storage is more suitable for potato storage.	0.25	17
11	In future, potato storage will be more profitable.	0.25	18
19	Large amount of potato is encouraged to store in a cold storage.	0.25	19
14	Traders who store potato in cold storage, they are getting more profit. I am not benefitted.	-0.16	20

Lowest rank value indicates highest DP value

Results and Discussion

Potato producers' attitudes towards cold storage

Attitudes may be defined as the predisposition or a tendency to respond positively or negatively towards a certain idea, object, person or situation. Attitude is the psychological path of evaluating a specific object with favor or disfavor (Eagly and Chaiken, 2007). Attitude influences an individual's choice of action, and responses to challenges, incentives, and rewards (together called stimuli) (Business dictionary, 2017).

Favorableness and un-favorableness of potato producers towards cold storage

From the calculation of the total score value of individual potato producers regarding their attitudes on cold storage, attitudes of favorableness and un-favorableness on cold storage is presented in Table 4. The potato producers were categorized into three types; i) favored attitudes towards cold storage (score value: greater than 45), ii) neutral attitudes towards cold storage (score value: equal to 45) and iii) disfavored attitudes towards cold storage (score value: less than 45). Here, highest value of individual score can be 75 and lowest can be 15 because the total number of item (statement) is 15. Score values for sampled individual potato producers were estimated from the data developed by five-point Likert scale. By using this score values, potato producers' attitudes on cold storage were categorized on the basis of the criteria mentioned above presented in Table 4. It was found from the table that most of the sampled potato producers (68 percent) were in the group of disfavored attitudes towards cold storage and 26 percent of the sampled potato producers were in the group of favored attitudes towards cold storage in the study areas. Though, very few cases (only six percent) were in neutral attitudes. This finding indicated that most of the potato producers revealed their disfavored attitudes towards cold storage in the study areas.

Average score value on individual statements towards cold storage

Average score value for each 15 items were calculated to observe the extent of potato producers' attitudes on individual items and also to compare among them.

From this result, there will be a scope for the policy maker to take initiatives on specific items to improve the situation. Here the weighted average has been used to measure the attitudes on individual scale items where the maximum weighted average will be 5.00 and minimum will be 1.00 (since it is five-point scale). The higher weighted average value (greater than 3.00) of any statement measures the extent of favorableness attitudes towards the cold storage and lower weighted score value (less than 3.00) of statement measures the extent of unfavorable attitudes. The average values for the statements 'Storing potato in a cold storage is very easy task', 'Sometimes, I did not get enough space for storing my potato in a cold storage', 'I don't like to store potato in cold storage, because it is very expensive', 'Sometimes, potatoes are found rotted condition from cold storage so, I don't like to store potato in cold storage' are 2.95, 2.60, 2.90, and 2.90 respectively. This indicates the unfavorable attitudes of potato producers on cold storage regarding those four issues. On the other hand, the average values on some aspects such as 'I am satisfied with potato storing in cold storage', 'Quality of cold storage is very good', 'There are some complexities to store potato in cold storage so, I don't like to store potato in cold storage' are 3.65, 3.45 and 3.20, respectively. This signifies that the attitudes of potato producers were favored towards cold storage on these aspects but the extent of favourableness is not high since the values are not near to 5.00 even not higher than 4.00 (Table 5).

Table 5 shows that most of the individual statements (8 out of 15) have weighted score values lower than three that means most of the cases potato producers had showed their un-favorable attitudes towards cold storage in the study area. For five statements, the score value was greater than 3 (though the values are not closed to 5) that means potato producers showed their favorable attitudes towards cold storage on the aspects of those five statements. It can be concluded from this section that overall attitudes of the potato producers towards cold storage was un-favorable though in some cases were favorable attitudes but the extent of favorableness was very low.

Table 4. Percentage of favorableness and un-favorableness towards cold storage of potato producers on the basis of individual score value

Score value	Attitudes	No. of potato producer	Percentage
Greater than 45	Favored towards cold storage	13	26
Equal to 45	Neutral on cold storage	3	6
Less than 45	Disfavored towards cold storage	34	68

Table 5. Attitudes of Potato producers towards cold storage on individual scale items

Sl. no.	Scale items (statements)	Average score value
1	Storing potato in a cold storage is very easy task.	2.95
2	I want to store potato in a cold storage but I could not get chance.	3.00
3	I am satisfied with potato storing in cold storage.	3.65
4	Sometimes, I did not get enough space for storing my potato in a cold storage.	2.60
5	Quality of cold storage is very good.	3.45
6	We get better price of potato throughout the year because of cold storage.	2.70
7	I am satisfied with the storage facilities.	3.15
8	I don't like to store potato in cold storage, because it is very expensive.	2.90
9	There are some complexities to store potato in cold storage. So, I don't like to store potato in cold storage.	3.20
10	Cold storage owner is getting more profit; I am not benefitted from cold storage.	2.90
11	Potato is a perishable product, so it is better to store potato in cold storage.	3.05
12	Potato cold storage is easily accessible, so I use cold storage.	2.65
13	We need more cold storage.	2.90
14	Even, if storage cost increases, I will store potato.	3.00
15	Sometimes, potatoes are found rotted condition from cold storage, so, I don't like to store potato in cold storage.	2.90

Empirical results of factors influencing potato producer's attitudes towards cold storage

A multiple regression analysis was applied to examine the factors influencing potato producers' attitudes towards cold storage in the study areas. While applying multiple regression analysis, it was checked if there were exist any multicollinearity among the independent variables. In this regard, Variance Inflating Factor (VIF) was applied to check the multicollinearity between the independent variables. The results of VIF are shown in Table 6. Table shows that VIF value of the variables are less than 10. According to Gujarati (2003) if VIF exceeds 10, that variable is said to be highly correlated. So, there was no problem of multicollinearity problem found in this model because VIF values are less than 10 even less than 3. There were three variables (age, farm size, and status of storing potato in cold storage) out of six independent variables in the model found significant in explaining the variation of potato producers' attitudes towards cold storage. That means there was a significant influence of these three variables (factors) to the attitudes of potato producers towards cold storage in the study areas. Other three variables (level of education, production of potato, and annual income)

could not find significant influence on the potato producers' attitudes towards cold storage. The results showed that age of the potato producers had negative significant effect (-0.12) on the attitudes towards cold storage. It revealed that young producers had more favorable attitudes towards cold storage than the aged producers. Farm size of the potato producers had significant positive relationship with their attitudes towards cold storage. And the coefficient value was 1.01. The coefficient is statistically significant because significance level is 0.036 (less than 5%) and t-value is greater than 2.00. Regression coefficient (1.01) indicates that if the farm size increases 1 acre then producers' attitudes towards cold storage increases 1.01 unit. It revealed that large farm holders had more favorable attitudes towards cold storage than the small farm holders. So, it can be concluded that large potato producers had more positive attitudes towards cold storage. Status of storing potato in cold storage found positive and significant influence on the attitudes of potato producers towards cold storage. The producers who stored potato in cold storage regularly influenced on the potato producers' attitudes 3.78 units more than the producers who did not store potato in cold storage regularly (Table 6).

Table 6. Factors influencing potato producers' attitudes on cold storage

Independent variable	Coefficients	t-value	Significance	VIF
Constant	48.32	14.01	.000	
Age (years)	-0.12*	-2.02	.050	1.146
Level of education (years of schooling)	-0.08	-0.56	.577	1.142
Production of potato (kg)	0.00	-1.82	.076	2.202
Farm size (acres)	1.01*	2.16	.036	2.649
Annual income (Tk.) (reference income <Tk.100000)				
Tk. (100000 –150000)	-2.05	-1.19	.240	1.600
Tk. (150000 - 200000)	-0.88	-0.51	.614	1.762
>Tk. 200000	-0.38	-0.17	.865	1.874
Status of storing potato in cold storage	3.78*	2.87	.006	1.152
R-square	0.30			

*indicates significant; Dependent variable: Score value of attitudes for individual producers; Source: Authors' own estimation

Level of education of the potato producers found insignificant negative regression coefficient value which was -0.08. The coefficient is statistically insignificant because t-value is less than 2.00; significance level is more than 0.05. That means educated potato producers have more un-favorableness towards cold storage though statistically it is not proved since it is insignificant. Amount of potato production also does not have any influence on the attitudes of potato producers on cold storage. Annual income was used as dummy variables with a reference income but none of the cases found significant influence on the difference of producers' attitudes with the reference income.

Conclusion

This study examined the potato producers' attitudes towards cold storage in Bogura district. Most of the potato producers' attitudes were not favored towards cold storage. Item wise analysis also indicated that most of the cases, producers were not favored towards cold storage. Producers agreed that storing potato in cold storage is not easy task, they don't get enough space always, storing potato in cold storage is expensive, not easily accessible, and sometimes potato found not in a good condition, and cold storage authority earns more profit. These are established from the average score of the individual statements. Analysis showed that large farm holders had more favorable condition towards cold storage than the small farm holders. So, cold storage authority should think about these issues. They should create more congenial environment with the all type of potato producers because, they are the important stakeholders in connection with potato cold storage industry in Bangladesh.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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