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ADOPTION OF SELECTED WHEAT PRODUCTION TECHNOLOGIES IN TWO NORTHERN DISTRICTS OF BANGLADESH

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Abstract

The study was conducted in two major wheat growing areas of Bangladesh to determine the adoption level and factors affecting the adoption of wheat production practices in the study areas during 2011. Descriptive statistics along with multiple regression technique was used to achieve the objectives. The results revealed that most of the farmers (60.91%) in the study areas were cultivating Shatabdi variety of wheat. Adoption level of seed rate, TSP and MoP application were found to be very low. On the other hand, production practices like time of wheat sowing and number of irrigation were highly adopted by the farmers. Most of the farmers (69.09%) applied TSP below the recommended dose while 81.82% of the farmers applied MoP over the recommended dose. The study also revealed a positive and significant relationship between adoption and the variables like education, experience and extension contact. Lack of proper information and technical knowledge were the major problems that hinder the adoption of wheat production technologies in the study areas. Adoption gaps are needed to be eliminated to enhance the productivity as well as net return of wheat cultivation.

Keywords: Adoption, Production Technology, Northern Bangladesh

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Introduction

Agriculture is the backbone of the economy of Bangladesh. Climate of Bangladesh is strongly favorable for different crop production. However, most of the farmers of the country still follow the traditional crop production technologies (Pandit *et al*., 2007). Therefore, they receive lower yield and cannot meet the food demand of the country. Thus, the technology adoption by the farmers is an essential pre-requisite for economic prosperity in developing country likes Bangladesh. Adoption may be defined as the integration of an innovation into farmers' normal farming activities over an extended period of time (Feder *et al*., 1985). Increasing population pressures, traditional farming systems and small farm holding are not enough to support growing number of people in household. Whereas, the one who adopts improved crop production packages can produce ample food for as many as thousands of people. Successful adoption of improved agricultural technologies could stimulate overall economic growth through inter sectoral linkages while conserving natural resources (Sanchez *et al*., 2009). Past studies (Dixon *et al*., 2006; Wanyama *et al.,* 2010) showed that adoption of improved production practices may help the farmers to get higher amount of yield and had impact on household food security and income.

An important objective of rural development is to increase agricultural productivity with a view to enhancing farmer's income and standard of living. Improved practices provide the main venue for increasing productivity in the country's agriculture (Edna *et al*., 2009). Rural development can be promoted through stimulating the adoption of improved production practices. Bangladesh Agricultural Research Institute has developed improved production practices for various crops. However, this study only considered the wheat crop as it is one of the most important cereal crops in Bangladesh. It is grown on about 3,764,24 hectares of land with an average production of 9,01,490 MT (BBS, 2010). At present, high-yielding varieties occupy 98% of the area (Hossain, 1984). Still every year Bangladesh needs to import large amount of wheat grains to meat up local demand of about 3.5 million ton (Baksh *et al*., 2009). Several studies at home and abroad (Hossain and Bruce, 1992; Kamruzzaman *et al*., 2001; Iqbal Muhammad *et al*., 2002; Walford, 2002; Lee David, 2005; Gardebroek, 2006; Serra *et al*., 2008; Baksh *et al*., 2009; Singh and Chahal, 2009) have been conducted on the adoption of different agricultural technology and crop variety. However, very few of them considered the adoption level of production practices of wheat in Bangladesh. Keeping all these factors in

consideration the study was undertaken with the following specific objectives.

Specific objectives

i. To determine the level of adoption of improved wheat production practices
ii. To find out the factors affecting the adoption decision and
iii. To identify the problems that limits the acceptability of improved wheat production practices.

Materials and Methods

Two major wheat growing districts of Bangladesh namely Dinajpur and Thakurgaon were purposively selected for the study. A total of 110 sample taking 55 from each district were selected for the study by using random sampling technique. The study was mainly based on primary data collected through face to face interview during the month of February to April, 2011. Collected data were then summarized, tabulated and analyzed to fulfill the objectives of the study.

Analytical technique

Mostly descriptive statistics like average percentage were used to achieve the objectives of the study. Adoption level of wheat production practices were evaluated against the recommended doses given in Krishi Projukti Hatboi (2006) published by Bangladesh Agricultural Research Institute.

Calculation of adoption level

The level of adoption was measured by computing adoption scores for recommended technologies. Scores given to each technology that varied from 1 to 0 according to the adoption of the suggested technology. A respondent farmer could get a score of "1" for adopting the technology. On the other hand, farmer could receive a score of "0" for not adopting the technology. The mean score became the index of level adoption of the recommended technologies. On the basis of the score that earned by the farmers were categorized as high, medium, low and very low level of adoption respectively.

Multiple regression analysis

To find out the factors responsible for adoption of wheat production practices a multiple regression analysis was conducted considering pooled adoption scores of a farmer as dependent variable. Following type of multiple regression model was used for this study;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + u_i$$

Where,

Y = Pooled adoption score
X_1 = Education (Year of schooling)
X_2 = Age of the respondent (years)
X_3 = Experience is farming (years)
X_4 = Farm size (ha)
X_5 = Household size (Actual number of members of the household)
X_6 = Extension contact (score)
u_i = Error term

Results and Discussion

Socio-economic profile of the respondents

It is revealed from Table 1 that average age of respondents was more or less similar in both the study areas. About 83% of the respondents were literate in the study areas. Most of them (39.09%) had secondary level of education. Average family size was found to be 5.78 which was higher than the national average. Average farm size of Thakurgaon (1.59 ha) was found higher compared to Dinajpur district (1.47 ha). Farmers of Dinajpur were more experienced in wheat farming than that of Thakurgaon. Average experience in wheat farming was found to be 13.74 years in all areas.

Table 1. Profile of the respondents

Items	Dinajpur *(n = 55)*	Thakurgaon *(n = 55)*	All areas *(n = 110)*
Demographic Characteristics			
Average age of respondents (yrs)	41 (12.7)	40 (10.4)	40 (11.5)
Level of education (%)	-	-	-
Illiterate	10.91	21.82	16.36
Primary	34.55	21.82	28.18
Up to SSC	34.55	43.64	39.09
HSC	16.36	9.09	12.73
Above HSC	3.64	3.64	3.64
Average Family size (No/family)	5.80 (2)	5.76 (2.5)	5.78 (2.2)
Land use (ha)	-	-	-
Own cultivated land	1.18 (1.1)	1.32 (1.9)	1.25 (1.6)
Average farm size	1.47 (1.1)	1.59 (1.9)	1.53 (1.5)
Wheat cultivated area	0.39 (0.3)	0.44 (0.6)	0.42 (0.5)
Experience in wheat cultivation (yrs)	14.65 (6.3)	12.96 (5.7)	13.81 (6)

Note: Figures in the parentheses indicates standard deviation

Farmers growing different varieties

Majority 60.91% of the farmers in both of the study areas were grown Shatabdi variety followed by Prodip (34.55%). More than 67% of the farmers in Thakurgaon grown Shatabdi variety while it was about 54.55% in Dinajpur district (Table 2).

Table 2. Distribution of farmers according to prevailing wheat varieties in the study area

Variety name	Dinajpur *(n = 55)*	Thakurgaon *(n = 55)*	Both areas *(n = 110)*
Prodip	45.45	23.63	34.55
Shatabdi	54.55	67.27	60.91
Showrab	-	9.09	4.55

Seed rate

It was found that majority (87%) of the respondents' exceded the recommended amount of seed (120 kg ha^{-1}). None of the farmers applied the seed lower than the recommended dose. Only 12.73% of the respondents were using recommended quantity of seed. The mean score of adoption was found only 0.13 which indicates very low level of adoption in both the areas (Table 3).

Table 3. Seed rate of wheat used by the sample farmers in the study areas

Location	Recommended rate	Above recommended rate	Below recommended rate	Mean	Adoption level*
Dinajpur *(n = 55)*	7 (12.73)	48 (87.27)	-	0.13	Very low
Thakurgaon *(n = 55)*	7 (12.73)	48 (87.27)	-	0.13	Very low
All areas *(n = 110)*	14 (12.73)	96 (87.27)	-	0.13	Very low

Note: Figures in parentheses indicates percentage of total
*Adoption level was categorized for mean score ≤ 0.25 as very low, between 0.26 to 0.50 as low, between 0.51 to 0.75 as medium and between 0.76 to 1.00 as high

Time of sowing

It is evident from Table 4 that most of the farmers were sowing wheat crop during the recommended period (2nd week of Nov. to 1st week of Dec.). More than 85% of the farmers sowing wheat crop during the recommended period while about 14% of the farmers sowing wheat after the recommended period. Mean score of adoption was found 0.85 which indicated high level of adoption.

Table 4. Time of wheat crop sowing in the study areas

Location	During recommended period	After recommended period	Mean	Adoption level*
Dinajpur *(n = 55)*	47 (85.45)	8 (14.55)	0.85	High
Thakurgaon *(n = 55)*	47 (85.45)	8 (14.55)	0.85	High
All areas *(n = 110)*	94 (85.45)	16 (14.55)	0.85	High

Note: Figures in parentheses indicates percentage of total
*Adoption level was categorized for mean score ≤ 0.25 as very low, Between 0.26 to 0.50 as low, between 0.51 to 0.75 as medium and between 0.76 to 1.00 as high

Seed treatment

It is revealed from the Table 5 that almost all the farmers did not treat the seed before sowing wheat. More than 96% of the farmers did not treat wheat seed before sowing in Thakurgaon while it was 91% in Dinajpur district. Therefore, there exists a scope for filling the gap in the adoption of this technology. It will not only protect the crop from primary diseases infestation but will also augment the productivity of wheat in the study areas.

Table 5. Percentage of farmers adopting seed treatment

Items	Dinajpur *(n = 55)*	Thakurgaon *(n = 55)*	All areas *(n = 110)*
Yes	9.09	3.64	6.36
No	90.91	96.36	93.64

Fertilizer application

Urea

It is evident from Table 6 that 39.09% of the farmers used recommended dose of urea (180-220 kg ha^{-1}). About 32% of the farmers used urea over the recommended level and 29% farmers used urea lower than the recommended dose. Overall adoption score of urea was found 0.39, which indicated low level of adoption.

Table 6. Application of urea by the sample farmers

Locations	Recommended dose	Above recommended dose	Below recommended dose	Mean	Adoption level*
Dinajpur *(n = 55)*	21 (38.18)	20 (36.36)	14 (25.45)	0.38	Low
Thakurgaon *(n = 55)*	22 (40.00)	15 (27.27)	18 (32.73)	0.40	Low
All areas *(n = 110)*	43 (39.09)	35 (31.82)	32 (29.09)	0.39	Low

Note: Figures in parentheses indicates percentage of total
*Adoption level was categorized for mean score ≤ 0.25 as very low, between 0.26 to 0.50 as low, between 0.51 to 0.75 as medium and between 0.76 to 1.00 as high

TSP

Most of the farmers (69.09%) used TSP lower than the recommended dose (140-180 kg ha^{-1}). Only 20.91% of the farmers used recommended dose of TSP. Overall adoption score of TSP application was found 0.21. It indicated very low level of adoption.

Table 7. Application of TSP by the sample farmers

Location	Recommended dose	Above recommended dose	Below recommended dose	Mean	Adoption level*
Dinajpur *(n = 55)*	11 (20.00)	4 (7.27)	40 (72.73)	0.20	Very low
Thakurgaon *(n = 55)*	12 (21.82)	7 (12.73)	36 (65.45)	0.22	Very low
All areas *(n = 110)*	23 (20.91)	11 (10.00)	76 (69.09)	0.21	Very low

Note: Figures in parentheses indicates percentage of total
*Adoption level was categorized for mean score ≤ 0.25 as very low, between 0.26 to 0.50 as low, between 0.51 to 0.75 as medium and between 0.76 to 1.00 as high

MoP

About 86% of the farmers of Thakurgaon applied MoP more than the recommended dose (40-50 kg ha^{-1}) whereas more than 78% of the farmers of Dinajpur used MoP more than the recommended dose. On an average, about 82% of the farmers applied MoP more than the recommended dose. Only 13.64% of the farmers applied recommended dose of MoP. As a result adoption level of MoP application found to be very low in the study areas with an adoption score of only 0.14 (Table 8).

Table 8. Application of MoP by the sample farmers

Location	Recommended dose	Above recommended dose	Below recommended dose	Mean	Adoption level*
Dinajpur *(n = 55)*	8 (14.55)	43 (78.18)	4 (7.27)	0.15	Very low
Thakurgaon *(n = 55)*	7 (12.73)	47 (85.45)	1 (1.82)	0.13	Very low
All areas *(n = 110)*	15 (13.64)	90 (81.82)	5 (4.55)	0.14	Very low

Note: Figures in parentheses indicates percentage of total
*Adoption level was categorized for mean score ≤ 0.25 as very low, between 0.26 to 0.50 as low, between 0.51 to 0.75 as medium and between 0.76 to 1.00 as high

Top dressing of urea

Almost 85% of the farmers applied top dressing of urea within the recommended period (at the time of first irrigation). Only 15% of the farmers applied urea after the recommended period. Overall adoption score was found to be 0.85, which indicated high level of adoption (Table 9).

Table 9. Time of top dressing of Urea in the study areas

Location	During recommended period	After recommended period	Mean	Adoption level*
Dinajpur *(n = 55)*	48 (87.27)	7 (12.73)	0.87	High
Thakurgaon *(n = 55)*	45 (81.82)	10 (18.18)	0.82	High
All areas *(n = 110)*	93 (84.55)	17 (15.45)	0.85	High

Note: Figures in parentheses indicates percentage of total
*Adoption level was categorized for mean score ≤ 0.25 as very low, between 0.26 to 0.50 as low, between 0.51 to 0.75 as medium and between 0.76 to 1.00 as high

Number of irrigation

The recommended number of irrigation to wheat crop is 2-3 times depending on the type of soil (Krishi Projukti Hatboi, 2006). The present study had found that 83.64% of the farmers applied recommended number of irrigation while about 16% of the farmers applied less than the recommended number of irrigation. Overall adoption level of irrigation number was found to be high in the study areas.

Table 10. Number of irrigations applied by the sample farmers

Location	Recommended	Above recommended	Below recommended	Mean	Adoption level*
Dinajpur *(n = 55)*	44 (80.00)	1 (1.82)	10 (18.18)	0.80	High
Thakurgaon *(n = 55)*	48 (87.27)	-	7 (12.73)	0.87	High
All areas *(n = 110)*	92 (83.64)	1 (0.91)	17 (15.45)	0.84	High

Note: Figures in parentheses indicates percentage of total
*Adoption level was categorized for mean score ≤ 0.25 as very low, between 0.26 to 0.50 as low, between 0.51 to 0.75 as medium and between 0.76 to 1.00 as high

Factors affecting the adoptions

Results of the regression analysis showed that 51% of variation in adoption could be explained by the independent variables included in the model. The co-efficient of education, experience and extension contact were significant and positively related with the adoption of wheat production practices. Coefficient of education implies that respondent with higher education adopted more. This agrees with the findings of Mittal Surabhi and Praduman Kumar (2000). Similarly, Coefficient of extension contact suggests that the more the extension contact with the farmers, the more information on the improved wheat production practices reach to the farmers. Hence, farmers are likely to adopt more. This echoes with the findings of Nnadi and Akwiwu (2005) and Singh *et al*. (2000). Coefficient of farmer's age was negative and significant at 10% level of significance. If age of farmers' increases by 1 year, keeping other factors constant, adoption would be decreased by 0.19 units. It implies that younger farmers were more interested to adopt new production technologies.

Table 11. Factors affecting the adoption of wheat production practices

Variable	Co-efficient	Standard error	t-value
Constant	1.96***	0.280	6.99
Education	0.166**	0.069	2.38
Age	-0.193*	0.127	-1.82
Experience	0.024*	0.015	1.58
Farm size	-0.021	0.048	-0.431
Household size	-0.010	0.032	-0.317
Extension contact	0.521***	0.049	10.51
Adjusted R^2	0.51		
F-value	21.73***		
Observations	110		

Note: *, ** and *** indicates significant at 10%, 5% and 1% level of significance

Problems of adoption

Table 12 shows the seriousness of problems that hinder adoption of wheat production practices. Almost 90% of the farmers indicated inadequate information media as a problem of adoption in the study areas. Mean score of this problem was 2.07, which indicated that it is a serious problem. In this context, extension communication can play a vital role. Lack of technical knowledge was also a serious problem that hinders the adoption of wheat production practices. Low level of income, lack of access to credit facilities and fear & suspicion were identified as less serious problem since the mean score were 1.97, 1.86 and 0.43 respectively.

Table 12. Problems of adoption in the study areas

Problems	VS	S	MS	LS	NS	Mean	Remarks*
Inadequate medium as a source of information	27 (24.55)	18 (16.36)	12 (10.91)	42 (38.18)	12 (10.91)	2.07	Serious
Lack of technical knowledge	14 (12.73)	37 (33.64)	16 (14.55)	33 (30.00)	9 (8.18)	2.11	Serious
Low level of income	11 (10.00)	29 (26.36)	34 (30.90)	18 (16.36)	17 (15.45)	1.97	Less Serious
Lack of access to credit facilities	9 (8.18)	36 (32.73)	18 (16.36)	25 (22.73)	20 (18.18)	1.86	Less serious
Fear & suspicion	1 (0.91)	5 (4.55)	5 (4.55)	18 (16.36)	79 (71.82)	0.43	Less serious

Note: Figures in parentheses indicates percentage of total
VS = Very serious, S= Serious, MS = Moderate serious, LS = Less serious, NS = Not serious
*The midpoint of this frequency table is 2. As a decision rule, any mean score that is ≤ 2 = less serious and that >2 = serious

Conclusion and Recommendations

Findings of the study suggested that remarkable gaps existed in the application of various technologies in wheat cultivation. Adoption level of seed rate, Urea, TSP, MoP was found to be very low whereas the adoption of sowing time and number of irrigation was found to be high. Different factors like education, age and extension contact had positive and significant effect on the adoption of wheat production practices. Inadequate medium of information, lack of technical knowledge impede the adoption of wheat production practices in the study areas. If the adoption gaps of some of the recommended technologies are properly eliminated, farmers could receive maximum return. Regular visit by extension agencies to disseminate modern production technologies, training to improve technical knowledge, credit with low interest can play a vital role in this regards. Besides, more research must be done to define appropriate wheat research priorities in the country.

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