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MODERN TECHNOLOGY ADOPTION BY THE RICE FARMERS IN THE SOUTH-WEST REGION OF BANGLADESH

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Abstract

Modern technology adoption usually leads to an increase in agricultural productivity. The rate of this technology adoption might vary depending on diverse agro-economic and socio-political factors. This study attempts to scrutinize the pattern and level of technology adoption by the rice farmers in the south-west region of Bangladesh. Descriptive and inferential analytical techniques are applied using cross-sectional data collected from randomly selected 120 rice-producing farmers in the south-west region of Bangladesh using a pre-tested interview questionnaire. The surveyed farmers have more than 23 years of farming experience on average. Study findings indicate that around 87 percent of the farming households have adopted modern technologies in terms of improved seed, irrigation management, and chemical fertilizer use in the study area. The ratio decreases to around 60 percent if the adoption of harvesting technology is considered. The farmers are lagging far behind to adopt mechanization in the land preparation phase in terms of tractor use. The technology adopter farmers observe that their intensity of technology adoption has increased over the time period. The study findings exhibit that the intensity of technology adoption is higher for the farmers who have better credit access and have engagement in the farmers' group compared to others. Moreover, farmers who have received farm management training adopt modern technology more intensively than other farmers. This study identifies the backwardness of harvesting and land preparation phases in terms of technology adoption. It also finds that socio-economic circumstances and institutional issues trigger technology adoption decisions.

Keywords: Agriculture, technology, adoption, rice farmer, Bangladesh

Introduction

Adoption of modern technology can be the major driving force for enhancing farm productivity and attaining sustainable agricultural growth, especially in an agrarian country like Bangladesh. Agriculture is the foundation and one of the foremost motivating forces of the economy of Bangladesh. Though the country is moving towards an industry lead and service-oriented economy, still, agriculture is the primary source of income, livelihood, and food security for rural people in Bangladesh (Ahmed et al., 2015; Jolliffe et al., 2013). The

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agriculture sector is contributing about 13 percent of the total GDP of Bangladesh and employs around 41 percent labor force (BBS, 2021; BBS, 2018).

Rice is the main staple food of the 168.22 million population in Bangladesh (BBS, 2020). Around 80 percent of people in the country consume rice three times a day (Hossain et al., 2006; Islam, 2018; Rahman et al., 2009). The population of Bangladesh is increasing at an annual growth rate of 1.37 percent (BBS, 2020). Consequently, food consumption demand is increasing in the country day by day in association with the increased population. Simultaneously, cultivable land is decreasing because of rapid urbanization, industrialization, and the transformation of human activities (Ahmed, 2013).

Therefore, the adoption of modern farming technology especially in rice production can be an important option for ensuring better access to food by increasing crop productivity and reducing food prices (Ahmed et al., 2021; Asfaw et al., 2012; Chandio and Yuansheng, 2018; Ghimire et al., 2015; Hossain et al., 2006; Islam, 2018; Mariano et al., 2012). Probable modern farming technologies in Bangladesh include high-yielding varieties, shock tolerant variety, farming practices, improved seed varieties, chemical fertilizer, irrigation apparatus, agricultural production, processing tools, improved management practices, farmer's cooperation, and so on (Ahmed et al., 2021; Asfaw et al., 2012; Atibioke et al., 2012; Chandio and Yuansheng, 2018; Ghimire et al., 2015).

In recent years, rice production has tripled due to the introduction of high-yielding verity (HYV) seeds, the use of balanced fertilizer, pest and weed control procedures, modern irrigation facilities, and mechanical cultivation (Ahmed et al., 2021; Rahman, 2017). But the fact is that the innovation in agriculture and adoption of new farming technologies are very slow in developing countries like Bangladesh (Bandiera and Rasul, 2006; Pierpaoli et al., 2013). Smallholder farmers are far behind in adopting modern technologies, and the majority of them rely on traditional methods of production (Muzari et al., 2012; Mwangi and Kariuki, 2015). Most of the rice is grown in Bangladesh under rain-fed conditions and irrigation in Aus, Aman, and Boro seasons using little fertilizers, inadequate disease and pest control, and use of limited machinery (Hazell, 2010; Muzari et al., 2012).

The official statistics of the Food Planning and Monitoring Unit of Bangladesh stated that improved rice varieties played a significant role in increasing rice production in Bangladesh. Annual rice production has increased from 9.93 million tons to around 34.94 million tons from the year 1972-73 to 2016-17 which ensured supplying food for around 160 million people (FPMU, 2017). Islam (2018) found that from 2012 to 2015 the use of improved rice varieties increased significantly in Bangladesh, especially during the Boro season. Similarly, Pingali (2012) pointed out that modern rice variety adoption in South Asia is lower among the smallholder farmers particularly in the rainy season because of insecure land ownership and tenancy system, as well as defective input and output markets. Ahmed et al. (2016) also found that rice farmers used retained seeds from their own production and through the farmer-to-farmer exchange in the Aus and Aman seasons, but in the Boro season, most of the farmers use improved seeds through purchasing from markets. According to Ahmed et al. (2016), in the south-west region of Bangladesh predominantly 59 percent of rice farmers used shallow tube-well as the method of irrigation even in the Boro season. Moreover, about 5 percent of the farmers hardly use irrigation in their rice fields, especially in the Boro season (Ahmed et al., 2016).

Adoption of good management practices is also important for sustainable agriculture (Farid et al., 2015; Mariano et al., 2012). Moreover, the adoption of crop rotation can reduce the probability of pest attack and disease infestation as well as facilitate weed control (Farooq et al., 2011; Kirkegaard et al., 2008). Furthermore, Nazu et al. (2021) mentioned that the adoption of improved crop and soil management practices may lead to increase crop yield. Likewise, technology adoption is also necessary for smallholder farmers to secure their crops from economic and natural risks caused by disasters. Shock-resistant improved seed varieties can protect crops from natural shocks, pests, and disease attacks. The use of modern irrigation technologies such as shallow tube wells, deep tube wells, and lift pumps help to protect crops from drought (Janvry and Sadoulet, 2010). Jain (2017) mentioned that farmers' access to information technology (ICT) reduces the

economic risk by providing different communication services like the internet, mobile phone, television, and market knowledge.

Therefore, modern rice farming technology adoption provides the opportunity to increase rice yield, which will also ensure the food security of rice farming communities (Ahmed et al., 2021; Mariano et al., 2012). Many studies have been conducted focusing on the adoption of modern farming technologies in rice cultivation including in Bangladesh (Ahmed and Garnett, 2010; Asfaw et al., 2012; Biswas et al., 2021; Chandio and Yuansheng, 2018; Ghimire et al., 2015; Hossain, 2012; Hossain et al., 2006; Islam, 2018; Islam et al., 2016; Kabir et al., 2020; Khan et al., 2010; Khatun and Haider, 2016). Very few studies were carried out focusing on south-west coastal Bangladesh. Moreover, most of them cover the cause of improved technology adoption as well as analyze the impact of technology adoption. But before analyzing the impact of improved technology adoption having a clear understanding of the present status and level of adoption of technologies is essential.

Hence, this research aims to find out the degree and frequency of modern agricultural technology adoption by the farmer in the south-west region of Bangladesh. Historically this region is characterized by agrarianism. The south-west region covers about 32 percent of the total area of Bangladesh (BBS, 2021) of which 1.7 million hectares are cropland (Saleque et al., 2010). Approximately 10 percent of the total population lives in the south-west coastal area (Nicholls et al., 2018). Most of the people depend on different sub-sectors of agriculture for their income and livelihood in this area. Rice is grown in around 95 percent of total cropland in the south-west region (Kabir et al., 2020). About 60-70 percent of the cropland of the south-west region is affected by various degrees of salinity and other climate-induced hazards such as monsoon flooding, drought, waterlogging, cyclones, tidal flooding, and so on (Ahmed et al., 2019; Ghose, 2014; Haider and Hossain, 2013; Mondal, 2010; Shelley et al., 2016; SRDI, 2010). Consequently, rice can be grown only in the dry (Boro) season in this region. Therefore, the adoption of improved rice cultivation technology is essential in this area to increase food production.

Materials and Methods

Sampling and data source

A cross-sectional household survey was conducted to collect primary data for this study. A total of 120 rice farmers were selected randomly from 8 villages in Khulna, Bagerhat, Satkhira, and Jashore districts. A multistage random sampling procedure was applied to select the study area and the survey respondents. The study area was selected randomly, and survey respondents were selected applying the systematic random sampling technique. Secondary data was collected from the Bangladesh Bureau of Statistics (BBS), peer-reviewed journal articles, books, reports, websites, and other published and unpublished materials.

Analytical framework

Descriptive and inferential analytical techniques were applied to see the differences between adopter and non-adopter categories. Descriptive statistical analysis such as mean, standard deviation, and other tools have been used to quantify the variables. Besides this, to identify the variations, sample means were compared by performing a t-test.

Data and variable definition

The study collected socio-economic characteristics of farmers, technology adoption information, and farm economics data from rice farmers to address the objective. Improved rice seed varieties, irrigation management, use of chemical fertilizer, use of pest and disease control, and use of farm mechanized tillage and harvesting technologies have been considered as modern farming technologies following Ahmed et al. (2021); Hailu et al. (2014); Khatun and Haider (2016). This study also assumed a respondent as an adopter of modern technology if s/he applied at least 4 out of above mentioned 5 technologies (i. improved rice

seed varieties, ii. irrigation management, iii. use of chemical fertilizer, iv. use of pest and disease control, v. use of farm mechanized tillage and harvesting technologies). Otherwise, the respondent farmer is considered as a non-adopter of modern technology. Following the definition of BBS, sample farmers are classified into four farm size categories, such as (i) marginal farmers (operating less than 0.05 acre of land); (ii) small farmers (operating 0.05 to 2.49 acres); (iii) medium farmers (operating 2.5 to 7.49 acres); and (iv) large farmers (operating 7.50 acres and more), by quoting classification according to Bangladesh Bureau of Statistics (BBS, 2021). The description of the variables that are used in this study is presented in Table 1 with the unit of measurement.

Table 1. Description of the variables used in this study

Variable Name	Definition and unit of measurement	Literature Support
Demographic information		
Age of household head	Number of years	Ghimire et al., 2015; Islam, 2018; Kabir et al., 2020; Kassie et al., 2011; Ruzzante et al., 2021
Sex of household head	1=Male, 0=Female	Ghimire et al., 2015; Ruzzante et al., 2021
Education level	Years of schooling of household head	Ghimire et al., 2015; Islam, 2018; Kassie et al., 2011; Ruzzante et al., 2021
Household size	Number of family members	Ghimire et al., 2015; Islam, 2018; Kassie et al., 2011; Ruzzante et al., 2021
Household characteristics		
Farming experience	Number of years	Challa and Tilahun, 2014; Kabir et al., 2020; Ruzzante et al., 2021
Farm size	Amount of cropland holding by household (Acre)	Ghimire et al., 2015; Islam, 2018; Kabir et al., 2020; Kassie et al., 2011; Ruzzante et al., 2021
Land ownership	1 if the cropland is owned by the household; 0 otherwise	Ghimire et al., 2015; Hailu et al., 2014; Kassie et al., 2011; Ruzzante et al., 2021
Access to credit	1 if the household has access to credit; 0 otherwise	Ghimire et al., 2015; Islam, 2018; Kassie et al., 2011; Ruzzante et al., 2021
Access to information Service	Code: 1=TV, 2=Radio, 3=Mobile phone, 4=Newspaper, 0=Others	Akudugu et al., 2012
Access to training	1 if farmers get training; 0 otherwise	Challa and Tilahun, 2014; Ghimire et al., 2015
Membership in farmers' group	1 if farmers participate in farmers' group; 0 otherwise	Hailu et al., 2014; Kassie et al., 2011; Ruzzante et al., 2021

Variable Name	Definition and unit of measurement	Literature Support
Access to off-farm activities	1 if the farmer is engaged in off-farm activities; 0 otherwise	Ghimire et al., 2015; Kassie et al., 2011; Ruzzante et al., 2021
Farm economics information		
Plot size	Size of largest plot considered as sample (acre)	Khatun and Haider, 2016; Minten et al., 2007
Seed used	Amount of seed used (Kg per acre)	Dhehibi, 2016; Minten et al., 2007
Chemical fertilizer used	Amount of fertilizer used (Kg per acre)	Dhehibi, 2016; Minten et al., 2007
Pesticide used	Amount of pesticide used (Kg per acre)	Khatun and Haider, 2016
Irrigation	Number of irrigations used per acre	Dhehibi, 2016
Labors employed	Number of labors used per acre	Dhehibi, 2016

Results and Discussion

Demographic Profile

The survey findings presented in the Table 2 state that all the respondent farmers are male. Surveyed farmers are on average 46 years old. On average they have completed seven years of education ranging from 0 to 12 years of education. Both the adopter and non-adopter farmers completed a similar level of education. The average family size among the respondents in the study was 5.11, which is more than the national average of 4.4 (BBS, 2021). Survey findings summarized that 28 households live in joint families, and the rest 72 percent live in nuclear families, which indicates the limited scope of supplying family labor to the farming activities. Additionally, it is observed that there were on average 1 to 3 earning members in the household.

Table 2. Demographic information of the respondent

Particulars	Bagerhat (N=30)	Jashore (N=30)	Khulna (N=30)	Satkhira (N=30)	Overall (N=120)
Age of farmers	44.90	47.70	43.37	47.43	45.85
Year of Schooling	7.40	6.07	6.93	5.63	6.51
Family Size	5.13	5.00	5.17	5.13	5.11
Number of earning member	1.40	1.37	1.37	1.53	1.42
% of farmers have access to credit	70	60	50	53	58
Average amount of credit taken (Tk.)	12,476	9,389	10,000	8,750	10,300

Survey findings presented in Table 2 also denoted that about 58 percent of farmers have access to credit. Among the farmers who have credit access, around 96 percent adopted modern farming technologies in their rice farms. Farmers of Bagerhat avail better access to credit. On average 70, 60, 50, and 53 percent of farmers have reported access to credit respectively from Bagerhat, Jashore, Khulna, and Satkhira. Farmers

received on average Tk. 10,300 credit. Farmers of Bagerhat received credits of Tk. 12,476, farmers of Khulna received Tk. 10,000, farmers of Jashore received Tk. 9,389, and Tk. 8,750 was taken by farmers of Satkhira district. The study found that technology-adopting farmers received significantly higher credit than non-adopters. Farmers who have adopted modern technology, received a credit of on average Tk. 10,500, and non-adopter received credit on average of Tk. 6,000. The mean difference of credit taken is Tk. 4,500 which is significant at the 10 percent level ($p<0.10$).

The study findings also stated that all the surveyed farming households have access to information from different sources. Among them 44 percent receive farming-related information from television, 14 percent get it using mobile phones, and the rest of the farmers receive it from radio, newspapers, and other sources. But only 58 percent of farmers claimed that they have access to government extension services.

Engagement in farming activities

Study findings stated in Table 3 expressed that all the surveyed households are smallholder farmers having on an average 1.07 acres of cultivable land. The average landholding varies from 0.33 to 2.31 acres per household. Farmers of Bagerhat hold on an average more land than other districts. Farmers hold on an average of 1.14, 1.13, 1.01, and 0.99 acres of cultivable land in Bagerhat, Khulna, Jashore, and Satkhira districts respectively.

Table 3. Farmer's participation in the farming activities

Particulars	Adoption status	Bagerhat (N=30)	Jashore (N=30)	Khulna (N=30)	Satkhira (N=30)	Overall (N=120)
Cultivable land holding by household (acre)	Adopter	1.22	1.00	1.22	0.99	1.12
	Non-Adopter	0.98	1.02	0.98	1.00	0.99
	All	1.14	1.01	1.13	0.99	1.07
Amount of land cultivated rice (acre)	Adopter	0.83	0.70	0.85	0.67	0.77
	Non-Adopter	0.64	0.83	0.69	0.73	0.73
	All	0.77	0.75	0.79	0.70	0.75
% of farmers cultivate rice in own land	Adopter	70.00	44.40	26.30	66.70	51.40
	Non-Adopter	70.00	58.30	63.60	46.70	58.30
	All	70.00	50.00	40.00	56.70	54.20
Years of farming experience	Adopter	22.35	25.60	23.50	24.00	23.86
	Non-Adopter	21.85	24.80	21.82	22.63	22.77
	All	22.10	25.20	22.66	23.32	23.32
% of farmers received training	Adopter	80.00	77.80	63.20	93.30	77.80
	Non-Adopter	60.00	66.70	54.50	46.70	56.30
	All	73.30	73.30	60.00	70.00	69.20
% of farmers engaged in any farmers' group	Adopter	45.00	27.80	63.20	26.70	41.70
	Non-Adopter	10.00	25.00	18.20	26.70	20.80
	All	33.30	26.70	46.70	26.70	33.30

Around 54 percent of farmers cultivate rice on their owned land. The summary data indicated that the adopter farmers owned on average less than non-adopter farmers. Among the technology adopter farmers, on average 51 percent cultivated rice on their land. On the other hand, among the non-adopter farmers, 59 percent of farmers own land where they grow rice. Land ownership in the Bagerhat district is higher than in other districts. Survey findings indicate that land ownership in the study area is 70, 40, 50, and 58 percent respectively in Bagerhat, Khulna, Jashore, and Satkhira districts. The surveyed farmers have an average of around 23 years of farming experience. Both adopter and non-adopter farmers have similar farming experiences. Farmers of the Bagerhat district have comparatively lower farming experience (22 years) whereas the farmer from the Jashore district has higher farming experience (25 years).

The study found that around 70 percent of the farmers received training in farm management from diverse sources. Among the technology adopter on average 78 percent of farmers receive training on improved farm management. Out of them, around 67 percent of farmers adopted improved rice cultivation technologies on their farms. It was also reported that only 33 percent of the farmers are engaged with farmers' groups for on average 3.5 years. The study found that the rate of technology adoption is higher among the farmers who are engaged in any farmers' group. It is observed that, out of the farmers who have group membership, around 75 percent of farmers adopted improved technologies. Moreover, among the surveyed districts, farmers of Khulna district have more engagement in farmer groups, i.e., on average 46 percent of farmers are members of a farmer group. It was observed that on average only one person from each household was engaged in farming activities and worked for an average of 17 days in a month. Similar engagement in the farming activities was observed in all the four sampled districts.

Patterns of technology adoption

Study findings indicated that around 87 percent of the farming households have adopted modern technologies in terms of improved seed, irrigation management, and chemical fertilizer use. But if the adoption of farm mechanization like the use of a tractor for land preparation and the mechanized harvester is considered, the adoption rate decreased to around 60 percent. Among the survey districts, more farmers in the Bagerhat district adopted modern farming technologies. It was reported that 67, 63, 60, and 50 percent of farmers adopted modern farming technologies respectively from Bagerhat, Khulna, Jashore, and Satkhira districts. Technology-wise adoption information is stated in Figure 1.

Descriptive statistics also indicated that almost all the farmers adopted improved seed varieties, chemical fertilizers, and pest and disease management technologies on their farms. But the study identifies the backwardness of the adoption of modern technologies in the harvesting and land preparation phases.

Figure 2 demonstrated that, out of five selected modern technologies, farmers adopted on average 3.61 technologies. Farmers of Bagerhat and Satkhira districts adopted on average 3.73 and 3.37 numbers of technologies respectively. On the other hand, in Khulna and Jashore districts farmers adopted on average 3.67 numbers of technology. Survey findings also expressed that, around 51 percent of farmers adopted improved rice cultivation technologies to their own land, whereas 49 percent of farmers applied improved technologies to hired land.

The study findings also exhibit that the technology adopter farmers observe that their intensity of technology adoption has increased over time. Around 38 percent of respondents perceived that their intensity of technology adoption has remained the same over time. On the other hand, around 62 percent of farmers perceived that their intensity of technology adoption has increased over time. Furthermore, the study findings stated that the intensity of technology adoption is higher among the farmers who have better credit access and have engagement in the farmers' group, as well as those who have received farm management training compared to others.

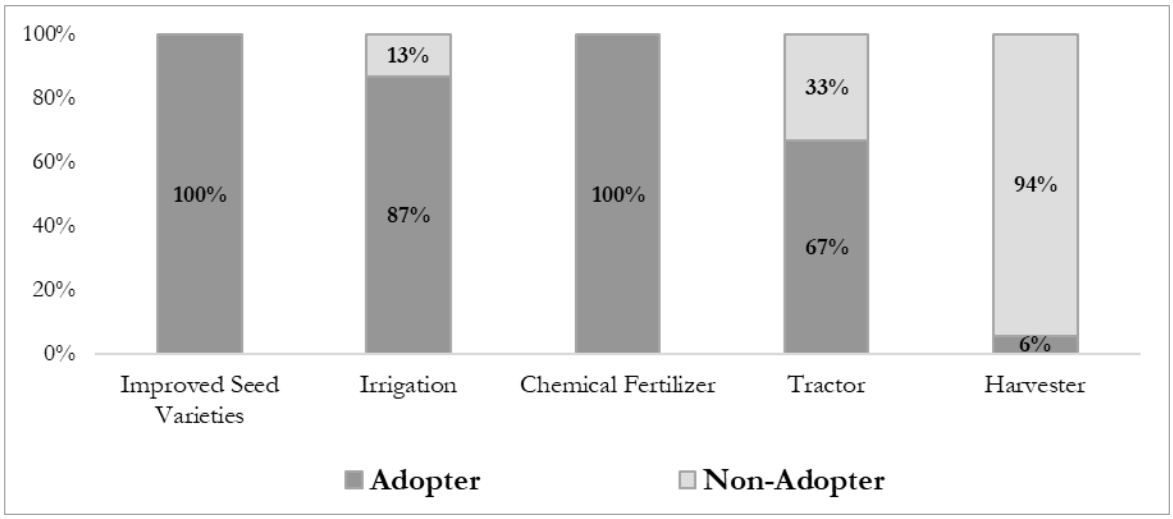

Figure 1. Patterns of modern technology adoption by the rice farmers.

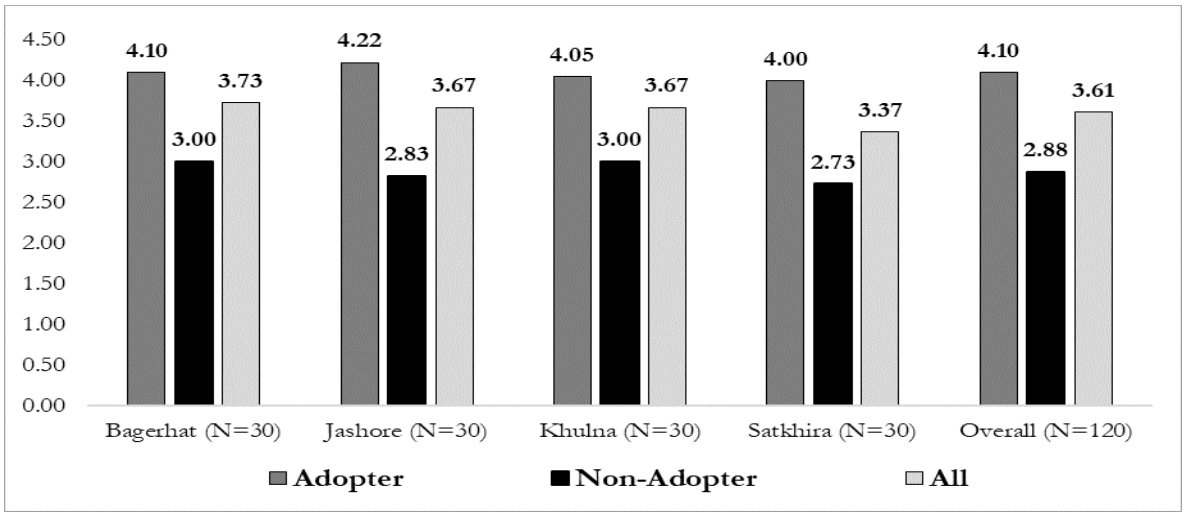

Figure 2: Intensity of technology adoption by rice farmers.

The summary results presented in Table 4 implied that farmers used on average 7.20 kilograms of rice seed per acre of land. Farmers of Khulna and Satkhira districts used on average 7.58 kilograms of rice seed per acre during the Boro season. On the other hand, farmers of the Bagerhat and Jashore district used on average 6.82 kilograms of rice seed per acre. Survey results indicated that farmers use on average 31 numbers of hired labor and 17 family labor per acre to cultivate rice.

The two-sample t-test results presented in Table 5 denote that, farmers who have access to credit adopted on average 4.06 numbers of modern technologies, whereas those who do not have access to credit adopted 2.98 technologies, and the mean difference is 1.08 which is statistically significant at a 1 percent level ($p<0.01$). Similarly, farmers who have received training demonstrated 9 percent more adoption than other

Table 4. Input use by the rice farmers

Inputs	Unit	Technology Adopter (N=72)	Non-Adopter (N=48)	Overall (N=120)
Seed use	Kg/acre	7.28 (2.24)	7.07 (1.86)	7.20 (2.09)
Irrigation use	Hrs/acre	89.27 (42.19)	67.68 (53.41)	80.63 (47.98)
Chemical fertilizer use	Kg/acre	236.11 (50.84)	241.48 (46.12)	238.26 (48.88)
Harvester use	No./acre	0.10 (0.30)	0 (0)	0.06 (0.24)
Pesticide use	Kg/acre	1.25 (0.51)	1.17 (0.40)	1.21 (0.47)
Hired labor use	No./acre	32.74 (8.41)	28.28 (12.75)	30.96 (10.55)
Family labor use	No./acre	16.62 (10.46)	17.80 (13.27)	17.10 (11.63)

Note: Figures in the parentheses indicate standard deviations

farmers and the mean difference of adoption is 0.29, which is statistically significant at a 5 percent level ($p<0.05$). Likewise, farmers who have membership in any farmer groups adopted on average 3.83 numbers of technology, and those who do not have membership in farmer groups adopted 3.50 technologies, and the mean difference is 0.33, which is statistically significant at a 5 percent level ($p<0.05$). On the other hand, the inferential analysis indicated that there is no significant difference in technology adaptation among farmers with different levels of education.

Table 5. Two-sample t-test results

Group	N	Mean	Mean Difference	t-Value	p-Value	df
Access to credit						
Yes	70	4.06	1.08***	13.87	0.000	118
No	50	2.98				
Received farm management training						
Yes	83	3.70	0.29**	2.23	0.028	118
No	37	3.41				
Membership in farmer groups						
Yes	40	3.83	0.33**	2.53	0.013	118
No	80	3.50				
Education level						
Completed 8-12 class	59	3.58	0.05	0.50	0.612	118
Completed 1-7 class	61	3.63				

Note: df = Degree of Freedom; *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Comparison of cost and revenue on adopter and non-adopter farmers

The descriptive analysis given in Table 3 indicated that on average a farmer cultivated rice on 0.75 acres of land. Adopter farmers cultivated more land than non-adopter farmers, i.e., an adopter farmer cultivated rice on average 0.77 acres of land, whereas a non-adopter farmer cultivated rice on 0.73 acres of land. Compared to other districts, farmers of the Khulna district cultivated rice on more land. Farmers of Khulna, Bagerhat, Jashore, and Satkhira districts cultivated rice in 0.79, 0.77, 0.75, and 0.70 acres of land respectively.

It was found that labor cost is the lion's share i.e., 52 percent of total production cost. The chemical fertilizer cost stands for the second-highest cost item covering 15 percent of the total cost. Cost comparison between modern technology adopters and non-adopters indicated that the adaptor farmers had to pay 13 percent more production costs than non-adopters. Table 6 describes the cost and revenue received by farmers from rice cultivation.

Table 6. Revenue and costs of rice cultivation

Particulars	Unit	Technology Adopter (N=72)	Non-Adopter (N=48)	Overall (N=120)
Land lease cost (per season)	BDT/acre	5,240 (5,767)	4,019 (4,972)	4,752 (5,475)
Seed cost	BDT/acre	2,190 (587)	2,145 (508)	2,172 (555)
Irrigation cost	BDT/acre	5,474 (1,713)	4,242 (3,090)	4,981 (2,427)
Chemical fertilizer cost	BDT/acre	6,898 (1,590)	7,073 (1,415)	6,968 (1,519)
Harvester use cost	BDT/acre	476 (1,500)	0 (0)	285 (1,182)
Tillage (tractor) cost	BDT/acre	2,140 (770)	379 (817)	1,436 (1,170)
Pesticide cost	BDT/acre	1,712 (635)	1,590 (484)	1,663 (581)
Hired labor cost	BDT/acre	16,372 (4,207)	14,141 (6,377)	15,480 (5,275)
Total input cost	BDT/acre	40,502 (8511)	33,590 (8452)	37,737 (9110)
Yield	MT/acre	3.19 (0.30)	2.93 (0.31)	3.08 (0.33)
Total Revenue	BDT/acre	56,681 (6,323)	51,910 (7,159)	54,772 (7,043)

Note: Figures in the parentheses indicate standard deviations

The inferential analysis indicated that the mean difference in rice yield between technology adopters and non-adopter is 0.26 metric tons per acre which is statistically significant at a 1 percent level ($p<0.01$). Similarly, farmers who adopted modern farming technologies got nine percent higher revenue which is also statistically significant at a 1 percent level ($p<0.01$).

Conclusion

Adoption of modern farming technology is the key to increasing farm production, which may lead to ensuring food supply for the growing population. But the adoption of technology is not satisfactory in the study area. The study observed satisfactory adoption of improved seeds and the use of chemical fertilizer. But the study observed a very lower adoption of mechanization like tractors and harvesters.

The study also overserved better adoption of modern rice farming technologies among those farmers who are members of any farmer groups, have access to credit, and receive farm management training. Technology adopters received significantly higher yield (8.80 percent more yield) and revenue (9.20 percent

more) than non-adopters. Adoption of farm mechanization in rice cultivation may be a better option to substitute labor (labor cost is 41 of total production) which may lead to better revenue earning for the farmers.

The study observed a lack of access to information as well as access to government extension services, which are also essential for ensuring the effective use of modern farm technologies. The policy should be taken to increase access to farming information to increase awareness of the benefits of adopting modern technologies in farming activities. Finally, though there is the differentiation of intensity of technology adoption, the input used, cost, and revenue, the study finds that rice cultivation is profitable in the south-west coastal region.

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