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Farmers' Attitudes Towards Cultivating Hybrid Rice in Bangladesh

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ABSTRACT

Considered to be one of the viable options to sustain growth in rice production, hybrid rice was introduced during the 1998-1999 boro season in Bangladesh. Its performance, however, simultaneously created hope and despair amongst the farmers. Understanding farmers' attitudes towards this crop variety is therefore critical if hybrid rice is to be promoted further in Bangaldesh and beyond. The study was conducted to: i) assess attitudes of the farmers towards hybrid rice; ii) develop an item-wise analysis of attitudes towards hybrid rice; iii) explore the relationships between selected farmers' characteristics and their attitudes towards hybrid rice. The study was conducted in five regions of Bangladesh. A concurrent embedded design using a cross sectional survey was employed. The population of this study consisted of rice growers of the boro season. A multistage stratified random sampling design was employed in selecting the sample of 425 farmers. Data were collected through face–to–face interviews using a pre-tested and back translated questionnaire. Findings confirmed that a majority of non-adopters (67.1%) and de-adopters (68.0%) showed neutral attitudes while the majority of continuing adopters (58.9%) developed favorable attitudes towards cultivating hybrid rice. The results of this study raise important considerations for extension workers, research leaders, seed traders and policy makers to refine the policy guidelines for the discovery, development and delivery of hybrid rice in Bangladesh.

Key words: Attitude; Hybrid rice; Farmer; Survey; Bangladesh

INTRODUCTION

Bangladesh is primarily an agrarian economy with a high population density, where food security remains a major concern. Agriculture, having contributed 23.5 percent of the country's gross domestic product (GDP) during 2009/10, plays a great role in the creation of rural employment and generation of income in Bangladesh and is therefore considered a lifeline of the Bangladesh economy. Rice is the mainstay of Bangladesh's agriculture. It contributes more than 80 per cent of the total food supply. More than 95 per cent of the population consumes rice in Bangladesh. Even though Bangladesh has made significant progress in agriculture, especially with respect to rice production and yields, the demand for rice still outstrips domestic production and the country remains a net importer of rice (FPMU 2008). There is a pressing need, however, to further improve rice production to meet the demands of the growing population, which increases at the rate of 1.32 per cent per annum (BER, 2010, as cited in among the various options available to increase the rice yields, hybrid rice technology is the most feasible and readily adoptable, as has been amply demonstrated in China. Hybrid rice could play an important role in food security, especially in poor countries in the tropics, where the population is soaring and agricultural areas are shrinking . In particular, hybrid rice varieties have shown 15-20 per cent higher yield potentials than inbred rice varieties and have demonstrated their ability to perform better under adverse conditions of drought and salinity. It is also reported that hybrid rice not only has a distinct yield advantage over inbred varieties but also is more responsive to fertilizers and can adapt to varying environments. Above all, as the 'father of hybrid rice', Professor Longping Yuan, pointed out, Bangladesh can be self sufficient by cultivating hybrid rice . In the hope of achieving these outcomes, hybrid rice was introduced in the 1998-1999 boro season in Bangladesh, but without a clear deployment strategy (Hossain, Janaiah, & Husain, 2003) and its cultivation continues today.

The promotion of hybrid rice is a challenging and time-consuming task , which has been reflected in the adoption process over the last decade in Bangladesh. By the 2008-09 crop year, only about 8 per cent of the rice

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area was planted with different rice hybrids . On average, farmers brought 37.84 per cent of their potential rice farming area under cultivation of hybrid rice over the period of 2001-2011 in the sample areas. There is an enormous potential for improving the level of adoption of hybrid rice in Bangladesh but empirical studies have identified that it is going through some difficulties at the farmers' level. It is thus important to understand the farmers' attitudes to this innovation for further development and delivery.

According to attitude/behavior theories, one's attitude towards an object influences one's behavior related to that object. In this regard, factors associated with the farmer's beliefs and attitudes towards the technology represent one of the major constraints identified . In an earlier study, indicated amongst other factors that 'lack of favorable attitudes towards the technology' are the major cause behind non-adoption. Likewise, also identified 'farmers' attitudes towards technology' as a high priority issue for initiating further research.

The ultimate target for sustaining growth in rice production through hybrid rice is belied in practice. The field performance of this technology over a decade gives rise to a deep concern for its future. Understanding farmers' attitudes in terms of beliefs, feelings, and tendencies to action towards this technology is critical to successful promotion. These attitudes have not, hitherto, been assessed.

The purpose of this study was to study growers' attitudes towards hybrid rice. The specific objectives guiding the study were to, assess attitudes of the farmers towards hybrid rice, develop an item-wise analysis of attitudes towards hybrid rice and to explore the relationships between selected farmers' characteristics (age, educational qualification, family size, farm size, annual family income, training experience, organizational participation, communication exposure, assessment of current promotional activities, perception of rice and extent of adoption) and their attitudes towards hybrid rice.

METHODOLOGY

Research Site

The land use pattern of Bangladesh is influenced by agro-ecology, soil physiographic and climatic factors (BBS, 2011). Considering the variations of all these factors the total land area of Bangladesh has been classified into nine regions of which at least five have been approved through the gazetted notification of the Government of Bangladesh for evaluation and registration of every single variety of hybrid rice (GOB, 2003). Therefore five regions were taken into account for this study in order to select the sample.

Sampling Design

A concurrent embedded design using a cross sectional survey was employed . The population of this study consisted of rice growers of the boro season who were responsible for farming decisions. A multistage stratified random sampling design as proposed by was employed in selecting the sample. In order to maintain the level of precision (sampling error) at (±5) percent, the level of confidence at 95 per cent and the degree of variability at 50 per cent, 425 farmers were selected following sample size recommendations as proposed by , and . Farmers in three categories were sampled: namely, non-adopters (79), de-adopters (122) and continuing adopters (224) of hybrid rice. Data were collected through face–to–face interviews with the sampled farmers using a pre-tested and back translated questionnaire.

Through prior consultation, the authors designed an 8-page questionnaire comprising 183 items in a series of 21 questions sequencing from general to specific. The questionnaire was formatted with both open and closed question items in order to accommodate both quantitative and qualitative responses. The first citing investigator spent 120 working days travelling to different places of the selected research sites between March 2 and June 30, 2012, in order to gather data.

Measurement of Growers' Attitudes Towards Cultivating Hybrid Rice

In order to assess the attitudes of the respondents towards hybrid rice a mix of 15-attitudinal statements, both positive and negative, were framed to represent their opinions, motivations, orientations, feelings, evaluations, judgments and values as proposed by . A Likert-type scale was used to rank individual item statements as followed by scores ranged from one to five, where the most favorable positive attitude was represented by the value of five and the most unfavorable attitude by the value of one. The respondents selected from the following options: 5 = Strongly Agree; 4 = Agree; 3= Undecided; 2 = Disagree; 1 = Strongly Disagree for the positive statement, while for the negative statement, the scale was reversed. An attitudinal score for the sample of farmers was computed by summing up individual item scores obtained against each response for all items. Thus the attitudinal score of a sampled farmer could range from 15 to 75, where 0 indicated an unfavorable attitude and 75 indicated a favorable attitude towards hybrid rice. In addition,

average scores with standard deviations were also computed for individual item statements to show their relative position along the continuum of the scale. Internal reliability of the attitudinal scale was calculated using Cronbach's alpha, which was found to be 0.70. stated that in the case of attitude measurement, a reliability coefficient of above 0.70 is desirable, but lower coefficients are tolerated.

Statistical analysis

The authors reviewed each survey instrument for missing information (e.g. name of block, upazila and district), ineligible writing, and incomplete sentences and responses. Based on the outputs of the questionnaire survey, various statistical data analyses including analyses of frequencies, percentages, range of scores, means, and standard deviations of the variables were performed. The groups of non-adopters, de-adopters and continuing adopters were compared using Analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

Assessing Attitudes of the Farmers Towards Hybrid Rice

The total attitudinal score of non-adopters, de-adopters and continuing adopters ranged from 27 to 61, 32 to 62, and 25 to 62 respectively with an average of 44.91, 45.45 and 50.58 and standard deviations of 7.04, 6.95, and 6.31. Based on the scores attained by rating the 16 attitudinal item-statements, each group of farmers was further categorized into three (Table 1).

As shown in Table 1, the computed F value is 33.85 with 2 degrees of freedom at the 0.001 level of probability, implying that there is a significant difference between non-adopters, de-adopters and continuing adopters with regard to the attitudes of respondents towards cultivating hybrid rice.

Table 1 also indicates that the majority of non-adopters (67.1%) and de-adopters (68.0%) showed neutral attitudes towards cultivating hybrid rice. Higher risk perceptions perhaps discouraged the majority of non-adopters and de-adopters from forming favourable attitudes towards hybrid rice. The majority of continuing adopters (58.9%), however, showed favorable attitudes which may explain why they have continued to cultivate hybrid rice from the beginning.

Table 1: An Overall Distribution of the Farmers' Attitude Towards Hybrid Rice

Category	Non-adopters	De-adopters	Continuing adopters	Total
Unfavorable attitude	10	15	10	35
(score bet^{w} 25-37)	(12.7)	(12.3)	(4.5)	(8.2)
Neutral attitude	53	83	82	218
(score bet^{w} 38-50)	(67.1)	(68.0)	(36.6)	(51.3)
Favorable attitude	16	24	132	172
(score bet^{w} 51-62)	(20.3)	(19.7)	(58.9)	(40.5)
Total	79	122	224	425
	(100)	(100)	(100)	(100)
Computed statistics:				
Minimum	27	32	25	25
Maximum	61	62	62	62
Mean	44.91	45.45	50.58	48.05
SD	7.04	6.95	6.31	7.14
F statistic	33.85***			

Note. *P< 05. **P< 01. *** P<0.001. Figure in parentheses indicates percentage of the respondents.

An Item-Wise Analysis of Attitudes Towards Hybrid Rice

Besides calculating the overall attitudinal score for the non-adopters, de-adopters and continuing adopters, this researcher counted the frequency of the respondents along the continuum of the scale against individual item-statements, with mean and standard deviations (Table 2).

As shown in Table 2, for the statement, 'I feel motivated to cultivate hybrid rice', a majority of non-adopters (50.6%) disagreed to strongly disagreed while the opposite was true for de-adopters, where 54.9% agreed or strongly agreed with the statement. A high proportion of continuing adopters (79.0%) strongly agreed. The highest mean value for this statement was 4.6, with a standard deviation of 0.96, as rated by continuing adopters.

Table 2: Item-wise Analysis of Attitudes of Non-adopters (n=79), De-adopters (n=122) and Continuing Adopters (n = 224)

Category	Extent of opinion					Sample statistics	
	SA	A	U	DA	SDA	Mean	SD
I feel motivated to cultivate hybrid rice.							
Non-adopters	6 (7.6)	32 (40.5)	1 (1.3)	12 (15.2)	28 (35.4)	2.7	1.49
De-adopters	24 (19.7)	43 (35.2)	1 (0.8)	31 (25.4)	23 (18.9)	3.11	1.47
Continuing adopters	177 (79.0)	30 (13.4)	1 (0.4)	7 (3.1)	9 (4.0)	4.6	0.96
Cultivation procedure of hybrid rice is as simple as other conventional inbreeds.							
Non-adopters	16 (20.3)	38 (48.1)	5 (6.3)	18 (22.8)	2 (2.5)	3.61	1.13
De-adopters	28 (23.0)	60 (49.2)	0 (0.0)	33 (27.0)	1 (0.8)	3.66	1.13
Continuing adopters	82 (36.6)	100 (44.6)	0 (0.0)	40 (17.9)	2 (0.9)	3.98	1.08
Hybrid rice requires intensive crop management.							
Non-adopters	75 (94.9)	4 (5.1)	0 (0.0)	0 (0.0)	0 (0.0)	4.95	0.22
De-adopters	110 (90.2)	10 (8.2)	0 (0.0)	2 (1.6)	0 (0.0)	4.86	0.47
Continuing adopters	205 (91.5)	16 (7.1)	0 (0.0)	3 (1.3)	0 (0.0)	4.89	0.43

Hybrid rice provides high profit with high investment.							
Non-adopters	67 (84.8)	10 (12.7)	2 (2.5)	0 (0.0)	0 (0.0)	4.82	0.45
De-adopters	100 (82)	16 (13.1)	2 (1.6)	3 (2.5)	1 (0.8)	4.73	0.69
Continuing adopters	198 (88.4)	16 (7.1)	2 (0.9)	5 (2.2)	3 (1.3)	4.79	0.69
All types of farmers can take advantage of hybrid rice technology.							
Non-adopters	25 (31.6)	27 (34.2)	2 (2.5)	15 (19.0)	10 (12.7)	3.53	1.43
De-adopters	41 (33.6)	43 (35.2)	1 (0.8)	24 (19.7)	13 (10.7)	3.61	1.40
Continuing adopters	81 (36.2)	84 (37.2)	5 (2.2)	34 (15.2)	20 (8.9)	3.77	1.32
Hybrid rice produces significantly higher yield over conventional inbreeds like BRRI dhan 28 and BRRI dhan 29.							
Non-adopters	73 (92.4)	3 (3.8)	0 (0.0)	3 (3.8)	0 (0.0)	4.85	0.60
De-adopters	111 (91.0)	10 (8.2)	0 (0.0)	1 (0.8)	0 (0.0)	4.89	0.38
Continuing adopters	213 (95.1)	4 (1.8)	0 (0.0)	7 (3.1)	0 (0.0)	4.89	0.54
Hybrid rice does not show significantly higher yield over the popular inbreeds (BRRI Dhan 28 and BRRI Dhan 29) with same management practices.							
Non-adopters	53 (67.1)	6 (7.6)	0 (0.0)	5 (6.3)	15 (19.0)	3.97	1.63
De-adopters	91 (74.6)	7 (5.7)	1 (0.8)	4 (3.3)	19 (15.6)	4.20	1.50
Continuing adopters	104 (46.4)	24 (10.7)	0 (0.0)	21 (9.4)	75 (33.5)	3.27	1.83
Cultivation of hybrid rice is expensive.							
Non-adopters	71 (89.9)	7 (8.9)	0 (0.0)	1 (1.3)	0 (0.0)	4.87	0.44
De-adopters	102 (83.6)	17 (13.9)	1 (0.8)	2 (1.6)	0 (0.0)	4.80	0.53
Continuing adopters	182 (81.2)	36 (16.1)	0 (0.0)	6 (2.7)	0 (0.0)	4.76	0.59
Hybrid rice can be cultivated at diverse ecological settings.							
Non-adopters	36 (45.6)	34 (43.0)	2 (2.5)	6 (7.6)	1 (1.3)	4.24	0.92
De-adopters	61 (50.0)	51 (41.8)	3 (2.5)	7 (5.7)	0 (0.0)	4.36	0.79
Continuing adopters	102 (45.5)	79 (35.3)	2 (0.9)	41 (18.3)	0 (0.0)	4.08	1.09
Cultivation of hybrid rice is financially risky.							
Non-adopters	58 (73.4)	13 (16.5)	0 (0.0)	8 (10.1)	0 (0.0)	4.53	0.93
De-adopters	85 (69.7)	23 (18.9)	0 (0.0)	14 (11.5)	0 (0.0)	4.45	0.98
Continuing adopters	138 (61.6)	38 (17.0)	1 (0.4)	45 (20.1)	2 (0.9)	4.18	1.22
Farmers are no more interested to extend acreage under hybrid rice cultivation.							
Non-adopters	24 (30.4)	12 (15.2)	1 (1.3)	4 (5.1)	38 (48.1)	2.75	1.82
De-adopters	41 (33.6)	12 (9.8)	4 (3.3)	12 (9.8)	53 (43.4)	2.80	1.81
Continuing adopters	32 (14.3)	37 (16.5)	3 (1.3)	31 (13.8)	121 (54.0)	2.23	1.57
Hybrid rice secures high profit with less investment.							
Non-adopters	1 (1.3)	0 (0.0)	1 (1.3)	2 (2.5)	75 (94.9)	1.10	0.52
De-adopters	1 (0.8)	1 (0.8)	0 (0.0)	0 (0.0)	120 (98.4)	1.06	0.45
Continuing adopters	4 (1.8)	2 (0.9)	0 (0.0)	6 (2.7)	212 (94.6)	1.13	0.62
Through seed production program, hybrid rice will create employment opportunities in rural settings.							
Non-adopters	9 (11.4)	55 (69.6)	14 (17.7)	1 (1.3)	0 (0.0)	3.91	0.58
De-adopters	14 (11.5)	98 (80.3)	10 (8.2)	0 (0.0)	0 (0.0)	4.03	0.44
Continuing adopters	38 (17.0)	170 (75.9)	13 (5.8)	3 (1.3)	0 (0.0)	4.08	0.53
Cultivating hybrid rice can improve the farmers' socio-economic status.							
Non-adopters	13 (16.5)	35 (44.3)	7 (8.9)	22 (27.8)	2 (2.5)	3.44	1.14
De-adopters	16 (13.1)	57 (46.7)	6 (4.9)	37 (30.3)	6 (4.9)	3.33	1.18
Continuing adopters	100 (44.6)	91 (40.6)	11 (4.9)	21 (9.4)	1 (0.4)	4.20	0.94
Hybrid rice technology is an effective tool to ensure up coming food security.							
Non-adopters	23 (29.1)	33 (41.8)	7 (8.9)	15 (19.0)	1 (1.3)	3.78	1.11
De-adopters	40 (32.8)	46 (37.7)	7 (5.7)	29 (23.8)	0 (0.0)	3.80	1.14
Continuing adopters	129 (57.6)	69 (30.8)	11 (4.9)	15 (6.7)	0 (0.0)	4.39	0.86

Note. SA for Strongly Agree =5, A for Agree=4, UD for undecided=3, DA for disagree=2 and SDA for strongly disagree=1. Figures in parentheses indicate percentages of the respondents.

The statement, 'the cultivation procedure of hybrid rice is as simple as other conventional inbreeds', was endorsed by the majority of non-adopters (68.4%), de-adopters (72.2%), and continuing adopters (81.2%) with agreement to strong agreement (Table 2). The minor difference farmers reported was in planting a single seedling in the case of hybrid rice whereas three to five seedlings are required for inbreds. Continuing adopters are more comfortable with cultivating procedure of hybrid rice.

Table 2 shows that the statement 'hybrid rice requires intensive crop management' has been rated as 'strongly agree' by a great majority of non-adopters (94.9%), de-adopters (91.5%) and continuing adopters (91.5%). reported a similar finding as time-tuning of key farm operations such as seeding, transplantations, weeding, fertilizer application, plant protection, irrigation, harvesting and threshing is very important for the exploitation of available yield potential of hybrids. The highest mean value as rated by the non-adopters was 4.95 with a SD of 0.22.

A great majority of non-adopters (84.8%), de-adopters (82.0%) and continuing adopters (88.4%) strongly agreed that hybrid rice provides a high profit with high investment (Table 2). Growers are satisfied with the level of production of hybrid rice but they are concerned about the requirement of investment. Farmers often could not afford the cost required to take advantage of its production potential. The perception of non-adopters

($\bar{x}$=4.79; SD=0.69)

Against the statement, 'all types of farmers can take advantage of hybrid rice technology', 65.8 per cent of non-adopters, 68.8% of de-adopters and 73.4 per cent of continuing adopters checked 'agree' to 'strongly agree'. Although the total input cost was about 23 per cent higher for hybrids than for inbreds , still the poor farmers do not hesitate to cultivate hybrid rice in the hope of getting higher yields. The highest mean value ($\bar{x}$=3.77) for this statement was found in the ratings of continuing adopters, with a standard deviation of 1.32 (Table 2).

An overwhelming majority of non-adopters (92.4%), de-adopters (91.0%) and continuing adopters (95.1%) strongly agreed with the statement 'Hybrid rice produces

significantly higher yields over conventional inbreeds like BRRI dhan 28 and BRRI dhan 29'. reported that, on average, the yield gain of hybrids over HYVs was 15 per cent. Respondents from all three categories were clearly quite convinced about this.

Table 2 also shows that a majority of non-adopters (67.1%) and de-adopters (74.6%) strongly agreed with the statement, 'hybrid rice does not show significantly higher yields over the popular inbreeds (BRRI dhan 28 and 29) with the same management practices'. A different scenario, however, is found in the case of continuing adopters. Although the highest proportion (46.4%) of continuing adopters strongly agreed with the statement, 33.5 per cent of them strongly disagreed. The highest mean value regarding this statement was obtained from de-adopters ($\bar{x}$=4.2; SD=1.5)

(Table 2). Still the overall judgement of the farmers is in favour of the statement. The findings of the above two consecutive statements clearly suggests that hybrid rice is more productive than conventional inbreeds, but not with the same management practices that apply to inbreeds. Therefore the key to maximize the output yield of hybrid rice is better management practices. The more appropriate the management practices are, the better the chance of a higher yield.

Table 2 indicates that a great majority of non-adopters (89.9%), de-adopters (83.6%) and continuing adopters (81.2%) strongly agreed with the statement that 'cultivation of hybrid rice is expensive'. In fact it has been found that the total cost of inputs is about 23 per cent higher for hybrids than for HYVs in Bangladesh. Similarly in India, hybrid rice cultivation was found to be 19 per cent costlier than inbred varieties (Janaiah & Hossain, 2000 as cited in .

Table 2 also indicates that a great majority of non-adopters (88.6%), de-adopters (91.8%) and continuing adopters (80.8%) agreed with the statement, 'hybrid rice can be cultivated at diverse ecological settings'. Although farmers endorse the statement, they prefer cultivating hybrid rice at low lands, which are naturally fertile. The perceptions of de-adopters ($\bar{x}$=4.36; SD=0.79) and non-adopters ($\bar{x}$=4.24; SD=0.92) concerning this statement are slightly higher compared to continuing adopters ($\bar{x}$=4.08; SD=1.09).

A great majority of non-adopters (73.4%), de-adopters (69.7%) and continuing adopters (61.6%) strongly agreed that cultivation of hybrid rice is financially risky. Farmers claimed that cultivation of hybrid rice is no more profitable than the conventional inbreeds because of higher input costs and lower market prices. They were seriously concerned about whether they could recoup the money they would spend for cultivating hybrid rice. Some farmers argued that they cultivate hybrid rice because the land they have is in the lower basin, which is suitable for cultivating hybrid rice instead of inbreeds. The statement obtained the highest mean value, however, from non-adopters ($\bar{x}$=4.53; SD=0.93).

Table 2 indicates that the highest proportion of non-adopters (48.1%), de-adopters (43.4%) and continuing adopters (54.0%) strongly disagreed with the statement, 'farmers are no more interested to extend acreage under hybrid rice cultivation' while the second highest proportion of non-adopters (30.4%), de-adopters (33.6 %) and continuing adopters (14.3%) strongly agreed with the statement. This disparity of response is mainly caused by the year-wise performance of hybrid rice. Although hybrid rice has higher yield potential, it is not stabilized: rather, it fluctuates. If the production performance goes up in a certain year, acreage under hybrid rice cultivation increases in the following year. If it goes down, acreage under hybrid rice cultivation severely decreases in the next. Hence, it has been found in this study that the adoption rate of hybrid rice has been growing in a tortuous fashion since its inception. However, the highest mean value ($\bar{x}$=4.08) for this statement was found in case of de-adopters.

Almost all the non-adopters (94.9%), de-adopters (98.4%) and continuing adopters (94.6%) strongly disagreed with the statement, 'hybrid rice secures high profit with less investment'. This finding therefore corroborates the fact that hybrid rice entails high investment in order to secure higher profit. The mean value for this statement is almost identical to all three groups of respondents (non-adopters,$\bar{x}$ =1.1; SD=0.52: de-adopters$\bar{x}$ =1.06; SD=0.45: continuing adopters, $\bar{x}$=1.13; SD=0.62) as shown in Table 2.

A large majority of non-adopters (69.6%), de-adopters (80.3%) and continuing adopters (75.9%)) agreed with the statement, 'through seed production programs, hybrid rice would create employment opportunities in rural settings'. Although all three categories of farmers (non-adopters, $\bar{x}$ =3.91; SD=0.58: - deadopters,$\bar{x}$ =4.03; SD=0.44: continuing adopters, $\bar{x}$ =4.08; SD=0.53)

were optimistic about this statement, the adoption of hybrid rice is at a rudimentary stage, covering about 8 per cent of the rice area. If the production level became

stabilized, cultivation of hybrid rice should expand over time. Expansion of acreage might necessitate large-scale production and supply of hybrid seed. Already it is identified by that, production of hybrid rice and hybrid rice seed generated a lot of rural employment in the country, The majority of non-adopters (60.8%), de-adopters (59.8%) and a vast majority of continuing adopters (85.2%) agreed to strongly agreed that by 'cultivating hybrid rice they could improve their socio-economic status'. A farmer from Nilphamary district reported on the performance of hybrid rice, "hybrid rice is the best productive rice ever found in Bangladesh". However, the highest mean value was obtained from continuing adopters ($\bar{x}$=4.2; SD=0.94).

Almost an equal proportion of non-adopters (70.9%) and de-adopters (70.5%) and a great majority of continuing adopters agreed to strongly agree that 'hybrid rice technology is an effective tool to ensure upcoming food security'. Continuing adopters are more optimistic about the potential of hybrid rice to feed the growing population. This finding is simply based on the farmers' perception of production potential of hybrid rice, ignoring its susceptibility to crop damage, consumption troubles and lower market prices. Famers believe that these problems will be sorted in the near future.

Relationships between farmers' characteristics and their attitudes towards hybrid rice

Studies have shown that farmers' personal characteristics have some influence on their perception of innovations and their decision to adopt or reject such innovations . In this study, the data showed a significant positive relationship (Table 3) between training experience, communication exposure of the farmers and their attitudes towards hybrid rice, while there was a significant negative relationship between farmers' perception of risk and their attitudes towards hybrid rice. The above statement can be interpreted as showing that training experience and communication relationships with available sources and channels helps develop favorable attitudes. On the other hand, higher perceptions of risk lead to unfavorable attitudes and vice versa. The participation of farmers in training courses about different aspects of hybrid rice cultivation (namely, identifying quality seeds, optimum number of seedlings per hill, desired age of seedlings, planting time and space, judicious use of agrochemicals and optimum time of harvesting) helps develop their operational and production skills. As a result, farmers face a lower risk in cultivating hybrid rice and gained higher yields. In addition, farmers maintaining good working relationships with official sources and channels can be properly guided through recommended procedures that result in higher yields. The most alarming aspect of hybrid rice cultivation for farmers, however, is the risk associated with cultivation procedures, crop management, yields, investment, profits, risk, adaptability, and the prospect and potential of hybrid rice that farmers observe and experience. Perceptions of differential cultivation procedures, intensive crop management, high investment, less profit, and

Table 3: Co-efficient of correlation (r) between farmers' characteristics and their attitudes rowards hybrid rice

Dependent variable	Independent variable	'r' value
Attitude towards hybrid rice	Age	0.04^{NS}
	Educational qualification	0.01^{NS}
	Family size	0.05^{NS}
	Farm size	-0.04^{NS}
	Annual family income	0.03^{NS}
	Training experience	0.10^{*}
	Organizational participation	0.05^{NS}
	Communication exposure	0.14^{**}
	Assessment of current promotional activities	0.05^{NS}
	Risk perception	-0.463^{***}
	Extent of adoption	0.078^{NS}

Note. NS Non-significant, *P< 05. **P< 01. *** P<0.001.

lower prospects of hybrid rice may direct farmers towards forming negative attitudes. On the other hand, age, educational qualification, family size, farm size, annual family income, organizational participation, communication exposure, assessment of current promotional activities, and extent of adoption had no significant relationship to attitudes.

CONCLUSION

In this research it was found that the majority of non-adopters (67.1%) and de-adopters (68.0%) showed neutral attitudes towards cultivating hybrid rice while the majority of continuing adopters (58.9%) showed favorable attitudes in this regard. A significant difference was found between non-adopters, de-adopters and continuing adopters in terms of their attitudes towards hybrid rice. The data also showed a significant positive relationship between training experience and communication exposure and their attitudes towards hybrid rice, but a significant negative relationship between farmers' perceptions of risk and their attitudes. The findings of this study raise important considerations for extension workers, research leaders, seed traders and policy makers. These findings point to a need to refine working procedures and policy guidelines in the following areas:

In order to facilitate broad adoption, grassroots level workers of concerned organizations (such as BRRI, DAE, BADC, seed companies, and NGOS) should initially

target those farmers who maintain good communication relationships with official information sources and channels.

Information about production technology and potential benefits of hybrid rice should be circulated through a wide range of extension methods, including mass media (such as television, radio, newspapers, and leaflets), group extension events (such as group discussion meetings and field days) and individual extension events (such as farm and home visits) to build awareness and encourage favorable attitudes towards hybrid rice. In addition, rigorous monitoring and supervision of extension agents is crucial at the grass-roots level to guide farmers to follow the recommended procedures and make them aware of potential hazards that could arise in cultivating hybrid rice.

Production skills should be strengthened through training on production and protection technologies of hybrid rice, which might be used as a platform for promotion of hybrid, rice cultivation.

Complementary inputs and irrigation equipment should be offered at subsidized rates: this would be conductive to minimizing the production cost. Taking action to ratify rationalized and regulated market prices is also an urgent issue to be addressed for increasing the area under cultivation of hybrid rice.

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