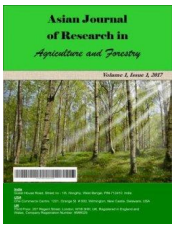

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Adoption of BRRI dhan49 by the Farmers of Bogura Sadar Upazila in Bangladesh

Md. Atiqur Rahman[1], Razeul Islam[1], Maliha Rahman Falguni[2], Saleh Ahmed Shahriar[3*], Md. Arifur Rahman[4] and Md. Marufur Rahman[5]

[1]Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.
[2]Department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.
[3]Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.
[4]Bangladesh Agricultural Development Corporation, Bangladesh.
[5]Institute of Research and Training on Applied Science, Dhaka, Bangladesh.

Authors' contributions

This work was carried out in collaboration with all authors. Authors MAR, RI, MRF and SAS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MAR and MMR managed the analyses of the study and literature searches. Author MRF supervised the manuscript. Author SAS edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The research examined the status of adoption of BRRI dhan49 and explored the contribution of the selected characteristics of the cultivators to their adoption of BRRI dhan49. The methodology of this study is an integration of quantitative and qualitative methods based on data collection. Data were collected from 116 BRRI dhan49 cultivators from January 21 to February 20, 2017. Descriptive statistics and multiple regressions were used for analysis. Most of the farmers (78.4%) belong to medium adoption followed by high adoption (11.2%) by the rice cultivators. Among the influential variables, the level of education, annual family income, extension media contact, rice cultivation knowledge and attitude towards BRRI dhan49 were significant contributors and provided

**Corresponding author: E-mail: shahriar777.ss@gmail.com;*

53.8% contribution on adoption of BRRI dhan49. It was also found that 3.4%, 16.3%, 38.8%, 33.7% and 7.8% farmers were innovators, early adopters, early majority, late majority and laggards, respectively. It can be concluded that the composite adoption of BRRI dhan49 production technologies is moderate and needs further advancement. Based on the findings, it is recommended that respective authorities should implement and popularize farm-based projects on a massive scale for the adoption of BRRI dhan49.

Keywords: Technologies; rice cultivation; adopters; adoption.

1. INTRODUCTION

Bangladesh has a long history of rice cultivation. Rice is grown throughout the country except in the southeastern hilly territories. Rice is the staple food for about 156 million people of the country. During the year 2015-2016, Rice ranked first position by production among all the cereals in Bangladesh [1]. Therefore, the modern varieties of rice have given its contribution to increase the yield per unit area of rice. Among the modern varieties, BRRI dhan49, benefit to expand rice production in a sustainable manner for the food and nutritional security of this exceptionally populated country [2,3]. The rice cropping pattern of Bangladesh has changed-areas once occupied by the rainfed Aus gradually shifted to Boro cultivation. As a result, the contribution from each season also changed-Aman rice previously contributed a major portion of total rice, but Boro is now the major contributor to total rice production in the country, despite Aman coverage area is greater [4,5]. Aus, Aman, and Boro rice were recently reported to account for 7%, 38%, and 55%, respectively, of the total rice production in Bangladesh [6,7]. Bangladesh has made notable progress in sustaining respectable growth in rice production, and this growth in production has originated mostly from the shift from low-yielding traditional to high-yielding modern varieties when irrigation facilities were developed [8,9]. Another factor contributing to the increase in total rice production by modern rice varieties such as BRRI dhan49 is the key to change in the rural economy [10,11]. Although Bangladesh has an agrarian economy, about 89% of total farm-holdings are below 2.49 acres in size. However, socioeconomic factors, such as the predominance of small and marginal farmers and tenancy cultivation in agrarian structure, did not impede the adoption of modern rice varieties in Bangladesh [12,13,14]. Major constraints to the adoption of modern rice varieties were, in fact, logistic factors. Bogura locale is considered as surplus rice generation zone of the country, where BRRI Dhan49 was a noteworthy endeavour. Bogura sadar upazila range, in this manner, considered a most reasonable area to concentrate the marvels of selection of BRRI Dhan49 innovations by the rice cultivators [15,16,17]. Contemplates on individual, gathering and society uncovered that acknowledgement of modem innovations is restrictive upon many variables. Some of these are social, individual, practical and situational components [18,19,20]. While directing any review on the reception of modem advancements, these elements should be considered. An extremely couple of past research work attempted to discover the above certainties. The focal point of the research work was to explore the trends of adoption of BRRI dhan49 by the farmers. This is why the following objectives were structured out in order to provide an appropriate track to the research work: to assess the extent of adoption of BRRI dhan49 by the farmers and to estimate the level of contribution of the selected characteristics of farmers in adoption of BRRI dhan49 and categorize the adopters of BRRI dhan49;

2. MATERIALS AND METHODS

2.1 Measurement of the Dependent Variable

Adoption of BRRI dhan49 was measured by computing Adoption Quotient (AQ). It was calculated by asking the farmers i) cultivated area of BRRI dhan49 ii) potential area for cultivation of BRRI dhan49 iii) years of BRRI dhan49 cultivation. Adoption of BRRI dhan49 was measured by Adoption Quotient as the following formula:

$$\text{Adoption Quotient (}\mathbf{AQ}\text{)} = \frac{\sum c/p}{Y} \times 100$$

Where,

c = cultivated area
P = Potential area
y = Years of BRRI dhan49 cultivation

Using the above formula, adoption of BRRI dhan49 production technologies score of a

respondent could range from 0-100, while 0 indicating no adoption and 100 indicating highest adoption. Based on the information cited by the farmers, they were classified into three categories (Mean ± Standard Deviation) namely „low", „medium" and „high" adoption of BRRI dhan49.

2.2 Measurement of Adopter Categories

Before measuring the adopter categories, the researcher calculated the Adoption Period Score (APS) of BRRI dhan49 by asking the question to the farmers "How many times did you take after hearing about the BRRI dhan49 qualities to cultivate in your land?". The adopter categorization on the basis of APS diving the bell-shaped curve into five areas by using its two parameters (mean and standard deviation).

Innovator = ($\bar{x}$ - 2σ)

Early adopter = ($\bar{x}$ -2σ) to ($\bar{x}$ -σ)

Early majority = (x - σ) to ($\bar{x}$)

Late majority = ($\bar{x}$) to ($\bar{x}$ + σ)

Laggards & non-adopters = ($\bar{x}$ + σ) to ($\bar{x}$ +2σ)

2.3 Statistical Analysis

Regression analysis was used to identify the linear combination between independent variables used collectively to predict the dependent variables. Regression analysis helps us understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. Ordinary Least Squares (OLS) is used most extensively for estimation of regression functions. In short, the method chooses a regression where the sum of residuals, ΣUi is as small as possible. The factors that contribute to the adoption of BRRI dhan49 are analyzed using a regression model. The overall quality of fit of the model has been tested by ANOVA specifically F and R^2 test. The data were analyzed in accordance with the objectives of the proposed research work. The factors that contribute to the constraints faced by the farmers in vegetable production are analyzed using a regression model, multiple regression analysis (B) was used. Throughout the study, five (0.05) percent and one (0.01) percent level of significance was used as the basis for rejecting any null hypothesis. If the computed value of (B) was equal to or greater than the designated level of significance (*p*), the null hypothesis was rejected and it was concluded that there was a significant contribution between the concerned variable. Whenever the computed value of (B) was found to be smaller at the designated level of significance (*p*), the null hypothesis could not be rejected. Hence, it was concluded that there was no contribution to the concerned variables.

The model used for this analysis can be explained as follows:

$$Y = a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6 + b7x7 + b8x8 + b9x9 + e;$$

Where Y= is the adoption of BRRI dhan49;

Of the independent variables, x1 is the rice cultivators age, x2 is level of education, x3 is effective farm size, x4 is annual family income, x5 is organizational participation, x6 is cosmopoliteness, x7 is extension media contact, x8 is rice cultivation knowledge and x9 is attitude towards BRRI dhan49. On the other hand, b1, b2, b3, b4, b5, b6, b7, b8and b9 are regression coefficients of the corresponding independent variables, and e is random error, which is normally and independently distributed with zero mean and constant variance.

3. RESULTS AND DISCUSSION

3.1 Characteristics of the Farmers

The behavior of an individual is determined to a large extent by one"s personal characteristics. There were various characteristics of the farmers that might have a consequence of the adoption of BRRI dhan49. But in this study, nine characteristics of them were selected as independent variables, which included their age, level of education, effective farm size, annual family income, organizational participation, cosmopoliteness, extension media contact, rice cultivation knowledge and attitude towards BRRI dhan49 that might be greatly influenced the adoption of BRRI dhan49 of farmers. The age of the farmers has been varied from 28-74 years with a mean and standard deviation of 47.31 and 10.17, respectively. The middle-aged farmers comprised the highest proportion (53.4%) followed by old aged category (34.5%) and the lowest proportion was made by the young aged category (12.1%). The middle and young aged farmers were generally more involved in farm activities than the young. The level of educational scores of the farmers ranged from 0-17 with a mean and standard deviation of 7.62 and 4.05,

respectively. Based on the educational scores, the farmers were classified into five categories. Farmers under secondary education category constitute the highest proportion (47.4%) followed by primary education (22.4%). On the other hand, the lowest 5.2% can‟t read and sign category followed by can sign only category (6.9%) and 18.1% respondents were above secondary category. An educated farmer is likely to be more responsive to the modern facts, ideas, and information of BRRI dhan49. The effective farm size of the farmers ranged from 0.08-2.62 ha with a mean and standard deviation of 0.96 and 0.54 respectively. Based on their farm size, the farmers were classified into five categories following the categorization. The small farm holder constitutes the highest proportion (63.8%) followed by medium farm holder (33.6%). The findings of the study reveal that majority of the farmers were small to medium sized farm holder. The average farm size of the farmers of the study area (0.96ha) was higher than that of national average (0.60 ha) of Bangladesh (BBS, 2014). The score of annual income of the rice cultivators ranged from 62-230 thousand (BDT) with a mean and standard deviation of 223.58 and 81.08, respectively. On the basis of annual income, the rice cultivators were classified into three categories namely „low‟, „medium‟ and „high‟ annual family income. The rice cultivators having medium annual income constitute the highest proportion (69.0%), while the lowest proportion in low income (12.9%) followed by high income (18.1%). Majority (87.1%) rice cultivators have medium to high annual family income. Organizational participation score of the rice cultivators ranged from 4-16 with a mean and standard deviation of 10.12 and 2.22, respectively. Based on organizational participation score, the rice cultivators were classified into three categories namely less, medium and high participation. The highest proportion (78.4%) of the rice cultivators had medium organizational participation, while 7.8% and 13.8% had less and high organizational participation respectively. Cosmopolites score of the rice cultivators ranged from 8-22 with a mean and standard deviation of 17.12 and 2.22, respectively. The highest proportion (87.9%) of the rice cultivators had medium cosmopoliteness, while 7.8% had low cosmopoliteness and the lowest 4.3% had high cosmopoliteness. It might be logical because the respondents of the study area were sincere in their income generating activities. The observed score of agricultural extension contact of the farmers ranged from 10-30 against a possible range of 0-40. The average score of the farmers was 22.89 with a standard deviation of 3.17. The highest proportion (79.3%) of the farmers had medium extension media contact as compared to 11.2% of them having low extension media contact and 9.5% fell in high extension media contact. It might be concluded that majority of the farmers had medium extension contact. Finding revealed that 11.2% of the farmers had low extension contact which demands to strengthen and to improve the communication strategy. Low extension contact might be the reason that some respondent may think that they have enough knowledge about farming activities. Rice cultivation knowledge scores of the farmers ranged from 10-28 against a possible score of 0-30. The average score and standard deviation were 22.84 and 3.49, respectively. 79.3% of the farmers had medium rice cultivation knowledge, 14.7% had low knowledge and 6.0% had high rice cultivation knowledge. Rice cultivation knowledge of the farmers is definitely affected by the education of the farmers because education helps to enhance the eagerness to be acquainted with new variety or technology. Attitude towards BRRI dhan49 of the farmers ranged from 1-3. The average and standard deviation were 2.46 and 0.65 respectively. The observed data showed that most of the farmers (78.4%) had a moderately favorable attitude towards rice cultivation while 10.3% and 11.2% of them had a poorly favorable attitude and highly favorable attitude, respectively. The attitude of the respondents expressed their perception of rice cultivation. It helped the researcher to judge or measure the acceptance/rejection of rice cultivation in the rural area. Adoption of BRRI dhan49 by the rice cultivators is the dependent variable of this study and it was measured by computing scores according to the extent of adoption. Adoption of rice cultivation by the rice cultivators scored varied from 34.58-68.04 with the mean and standard deviation of 44.48 and 5.32 respectively. On the basis of adoption scores, the rice cultivators were classified into three categories namely low, medium and high adoption of BRRI dhan49. The highest 78.4% rice cultivators belongs to the group of medium adoption and the lowest percentage 10.3% in low adoption followed by high adoption (11.2%) by the rice cultivators in adoption of BRRI dhan49. Among the cultivators, most of the rice cultivators (89.7%) have medium to high adoption in BRRI dhan49.

Table 1. List of characteristics and its component for farmers

Characteristics	Categories	Range	Number	Percent	Mean	STD
Age	Young aged	28-74	14	12.1	47.31	10.17
	Middle aged		62	53.4		
	Old aged		40	34.5		
Level of education	Can"t read and sign	0-17	6	5.2	7.62	4.05
	Can sign only		8	6.9		
	Primary education		26	22.4		
	Secondary education		55	47.4		
	Above secondary		21	18.1		
Effective farm size	Landless	0.08-2.62	-	-	0.96	0.54
	Marginal		3	2.6		
	Small		74	63.8		
	Medium		39	33.6		
	Large		-	-		
Annual family income	Low income	62-230	15	12.9	223.58	81.08
	Medium income		80	69.0		
	High income		21	18.1		
Organizational participation	Less participation	4-16	9	7.8	10.12	2.22
	Medium participation		91	78.4		
	High participation		16	13.4		
Cosmopoliteness	Low cosmopoliteness	8-22	9	7.8	17.12	2.22
	Medium cosmopoliteness		102	87.9		
	High Cosmopoliteness		5	4.3		
Extension media contact	Low contact	10-30	13	11.2	22.89	3.17
	Medium contact		92	79.3		
	High contact		11	9.5		
Rice cultivation knowledge	Low knowledge	10-28	17	14.7	22.84	3.49
	Medium knowledge		92	79.3		
	High knowledge		7	6.0		
Attitude towards BRRI dhan49	Poorly favorable attitude	1-3	12	10.3	2.46	0.65
	Moderately favorable attitude		91	78.4		
	Highly favorable attitude		13	11.2		
Adoption of BRRI dhan49	Low adoption	34.58-68.04	12	10.3	44.48	5.32
	Medium Adoption		91	78.4		
	High adoption		13	11.2		

Table 2. Multiple regression coefficients of contributing factors related to the farmers" adoption of BRRI dhan49

Dependent variable	Independent variables	B	P	R^2	Adj. R^2	F	P
Farmers" adoption of BRRI dhan49	Age	0.059	0.203	0.538	0.507	20.75	0.000**
	Level of education	0.296	0.037*				
	Effective farm size	0.584	0.702				
	Annual family income	2.041	0.034*				
	Organizational participation	0.151	0.573				
	Cosmopoliteness	-0.138	0.507				
	Extension media contact	0.447	0.020*				
	Rice cultivation knowledge	0.398	0.003**				
	Attitude towards BRRI dhan49	3.383	0.000**				

***Significant at p < 0.01; *Significant at p < 0.05*

3.2 Factors Related to the Adoption of BRRI dhan49

In order to estimate the adoption of BRRI dhan49 by the rice cultivators from the independent variables, multiple regression analysis was used which is shown in the Table 2.

Table 2 shows that there is a significant contribution of respondents" level of education, annual family income, extension media contact, rice cultivation knowledge and attitude towards BRRI dhan49. Of these, rice cultivation knowledge and attitude towards BRRI dhan49 were the most important contributing factors (significant at the 1% level of significance). Level of education, annual family income and extension media contact (significant at the 5% level of significance) while coefficients of other selected variables have less contribution on adoption of BRRI dhan49. The value of R^2 is a measure of how of the variability in the dependent variable is accounted for by the independent variables. So, the value R^2 0.538 means that independent variables account for 53% of the variation in adoption of BRRI dhan49. The adjusted R^2 indicates the loss of predictive power or shrinkage. Therefore, the adjusted value (0.507) tells us how much variance in Y (adoption of BRRI dhan49) would be accounted if the model has been derived of the populations from which the sample was taken. The F ratio is 20.75 which is highly significance (p<.001). This ratio indicates that the regression model significantly improved the ability to predict the outcome variable. The b-values indicate the individual contribution of each predictor to the model. Almost all predictors have positive b-values indicates if scores/ values of predictors (e.g. level of education) increases so do the extent of adoption of BRRI dhan49 production technologies. However, each predictor may explain some of the variances in respondents" adoption of BRRI dhan49 conditions simply by chance. In summary, the models suggest that the respective authority should consider farmers" level of education, annual family income, extension media contact, rice cultivation knowledge and attitude towards BRRI dhan49.

4. CONCLUSIONS

The present study concluded that the composite adoption of BRRI dhan49 is adequate and needs further advancement for maintaining. Level of education of the farmers showed the most important contributing factor in the adoption of BRRI dhan49. This means that high literacy and educational level among the farmers might have influenced high BRRI dhan49. Annual family income, extension media contact, rice cultivation knowledge, of the farmers had a significant contribution in adoption of BRRI dhan49.

Farmer"s attitude towards BRRI dhan49 had a significant contribution in adoption of BRRI dhan49. It is, therefore, concluded that extension workers should vocation adequately with the farm people through various teaching methods and correctly envisaging those characteristics of the farmers which have some bearing on these activities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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