International Journal of Tropical Agriculture
Volume 39, Number (4) • 2021 : pp. 423-430
ISSN: 0254-8755

FARMERS' PREFERENCE ANALYSIS OF SELECTED RICE VARIETIES AT MIRZAGANJ UPAZILA OF PATUAKHALI DISTRICT

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Abstract: Farmers, the ultimate users of any rice variety consider some prominent traits before final adoption of the same. The purposes of this study were to assess the farmers' preference of two selected rice varieties, viz. BRRI dhan44 and Maulata and to explore relationships of 10 independent variables with the farmers' preference of rice varieties. Data were collected from a sample of 125 farmers selected by proportionate random sampling procedure from Mirzaganj upazila of Patuakhali district during October to November 2017 using pretested interview schedule.Preference of rice varieties were measured based on farmers' perceived eight attributes namely high grain yield, tall plant, more panicle per hill, suitable to submergence situation, tolerance to insects, high market price, coarse grain and eating quality. Mean preference of rice varieties indicate that 47.20 percent of the farmers had medium preference of rice varieties compared to 33.60 percent having low preference and 12.00 percent negative preference whereas only 7.2 percent had high preference. There was no significant difference among the mean preference of selected rice varieties. Pearson correlation test indicates that education and training participation of the farmers had positive significant relationship with their mean preference score while age, farm size, farming experience, farm size, annual family income, rice cultivated area, social participation and innovativeness were not significantly related.

Keywords: Adoption, farmer, preference, rice

INTRODUCTION

Rice (*Oryza sativa* L) is the dominant staple food among the major cereal and non-cereal crops in Bangladesh that occupies 75.01% of the total cropped area along with 90.0% of the total food grains [1]. In fact, 'Rice security' is synonymous to 'Food security' in Bangladesh as in many other rice growing countries [2].But current per unit yield of rice in Bangladesh is much less than those in Korea, China, Japan and many other countries [3]. The reasons of present poor yield of rice are inappropriate uses of rice varieties might be due to improper preference in respect of inaccurate knowledge and perception and constraints to the farmers. Farmers' preferences, needs and other expected characteristics of variety are very important for increased adoption rates by farmers [4],[5]. Acceptability and adoption of a new technology depend on biophysical and economic profitability, adequate knowledge of a number of factors including how users perceive the underlying problem, their attitude, beliefs, and practices related to the intervening solutions offered to them by the technological innovation [6],[7],[8]. Wale and Yallew [9] argued that the lack of fitness of variety attributes to farmers' needs and circumstances is the major factor hampering technology adoption. Environmental

Article History: Received: 23 November 2021; Revised: 29 November 2021; Accepted: 2 December 2021

adaptability and yield stability are important attributes for farmers' choice of crop varieties [10]. An understanding of this preference will enable researchers generate appropriate sustainable technologies and enhance user acceptability of the same. Farmers' perception of innovation attributes rather than inherent innovation qualities is often more important in their adoption decisions [11], [12]. There are ample studies regarding the adoption of modern agricultural practices by incorporating farm and farmers' characteristics. But very few studies have considered farmers' perceived understanding and satisfaction about the attributes or characteristics of technologies [6], [13], [14], [15], [16]. Innovation non-adoption is a complex function of several constantly changing factors like personal, social, or environmental [12]. To improve farmers' preference of rice varieties for sustainable rice production and long-term conservation of natural resources, it is necessary to undertake an in-depth study incorporating physical, personal, economic, situational, social and psychological factors to identify their contribution for higher preference of rice varieties of the farmers. Therefore, considered worthwhile to conduct a systematic study on Farmers' preference analysis of rice varieties in Patuakhali district to determine and describe the farmers' preference of selected rice varieties; and explore relationships of each of the selected characteristics of the farmers with their preference of rice varieties.

METHODOLOGY

Mirzaganj upazila was the locale of this study (Figure 1&2), located in between 22°13' and 22°29' north latitudes and in between 90°08' and 90°19' east longitudes. It is bounded by Bakerganj upazila on the north, Borguna Sadar upazila on the south, Patuakhali Sadar and Dumki upazilas on the east, Betagi upazila on the west. Main source of income is agriculture (62.5%) along with the dominant of transplanted aman rice. The other crops are potato, pulses, groundnut, and vegetables [17]. Farmers having at least 33.0

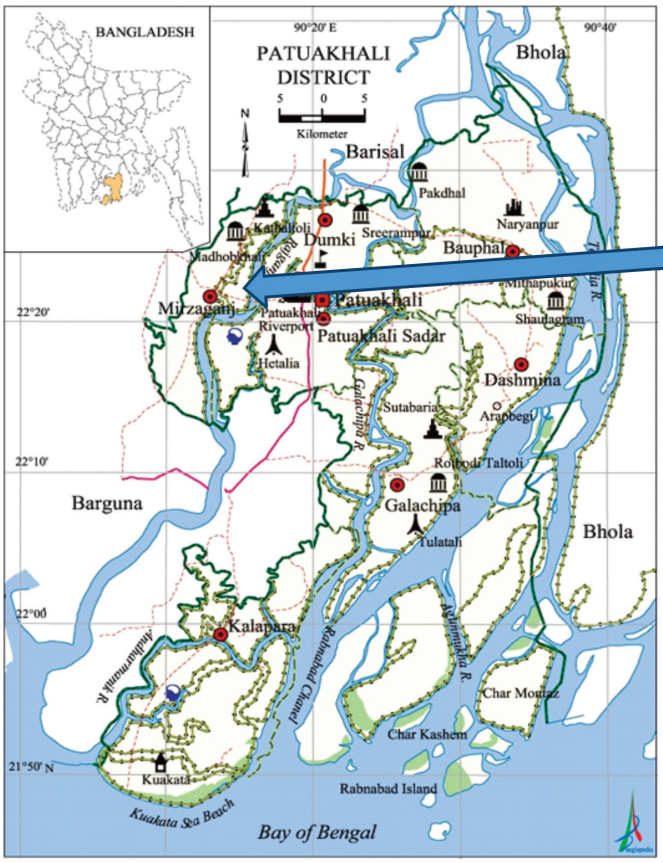

Figure 1: Map of Patuakhali district including its upazilas (Bangladesh-inset)

Figure 2: Map of Mirzaganj upazila showing the study unions

decimals T. aman rice cultivated area along with minimum one-year cultivation experience of these selected varieties constituted the population of this study. The selected varieties were BRRI dhan44 and Maulata (modern and local variety, respectively) due to their comparatively higher coverage.

Mirzaganj upazila was randomly selected as the locale of the study from 8 upazilas of Patuakhali district and two unions, viz. Madhabkhali and Amragachia were selected following same technique. One village was selected from each of two unions by using same technique. An up to date list of rice growers in these two selected villages were collected from the respective Sub-Assistant Agriculture Officers (SAAO). Total number of rice growers in these villages was 500 out of which 125 (40.0%) were selected as the sample of the study following proportionate random sampling technique. Farmers' preference of rice varieties was the dependent variable and 10 selected characteristics of the farmers were considered as independent variables of this study. The selected characteristics included: age, education, family size, farming experience, farm size, rice cultivated area, annual family income, training participation, social participation and innovativeness. Preference of rice varieties was measured as the degree of appropriateness of rice varieties in respect of some selected attributes as perceived or judged by the respondent farmers. Computation of farmers' preference of rice varieties comprised of four steps, viz. selection of rice varieties; selection of attributes of rice varieties; measurement of attribute of rice varieties; and measurement of attribute score of a rice variety. At first, two rice varieties including each of one modern and local were selected by considering comparatively maximum coverage in the study area. An interview schedule was prepared based on available literature on attributes of innovation [6], [18], [19], [20], [21], [22], [23] discussion with the SAAOs and pretest among 15 non-sampled farmers in the study area. Thus, a total of eight attributes were selected, viz. high grain yield, high plant height, more panicle per hill, suitable to submergence situation, tolerance to insects, high market price, coarse grain and eating quality. Attribute score of a variety was the respondent's perceived magnitude of an attribute [21],[24]. Farmers received response on each selected attribute of rice variety were rated as positive and negative aspects. Positive rating assigned for an attribute of a rice variety by a respondent indicates existence of his acceptable or desired trait and vice-versa for negative score. Participatory variety selection and other participatory approaches are preferred to create efficiency by shortening the duration of diffusion of varieties, technology or practices accepted at the farm level [4],[25],[26]. The preference score of a variety measures the perceived realization of eight selected attributes by a respondent farmer. Considering the perceived score of eight attributes by each respondent farmers against each variety, preference score was measured with slight modification of the formula used in preference analysis in participatory variety selection [22].

$$\text{Preference score of a variety} = \frac{\text{Sum of positive aspect ratings of attributes} - \text{Sum of negative aspect ratings of attributes}}{\text{Total ratings of attributes}}$$

Preference score of a farmer for particular variety was determined by deducting the sum of negative ratings of attribute from the sum of positive ratings of attribute divided by total number of ratings. Thus, maximum possible preference score of a respondent farmer for a particular variety '1'implied perfect preference based on eight selected attributes and minimum possible score was '-1' indicated very worse preference based on eight selected attributes. Therefore, possible score of a variety could also range from '-1' to '1', where '-1' indicating absence of perceived eight attributes and '1' indicating presence of perceived eight attributes as perceived by farmers. Based on overall mean preference score of eight attributes of selected varieties, preference score of variety was divided into five categories, viz. negative preference (<0.00), no preference (0.00), low preference (0.01-0.33), medium preference (0.34-0.66) and high preference (>0.66).

All the collected data were compiled, coded, and entered into the computer for analysis and interpretation using Statistical Packages for Social Sciences (SPSS) software. Hasan et al. [27]

used a similar method for analyzing the data. The statistical measures such as, number, percentile, mean and range, were used for describing the variables of the study. Relationships between preference of rice varieties and selected characteristics of respondents was measured though Pearson correlation of coefficient.

RESULTS AND DISCUSSIONS

Farmers' Socio-demography

The distribution of the socio-demographic characteristics of the respondents has been shown in Table 1. The age category reveal that overwhelming majority of the respondents (97.6%) was in young and middle aged categories. Almost all (95.2%) respondents had primary or secondary level education which is appreciable. Most of the respondents (67.2%) had medium family size with medium farming experience (60.0%). Most of the respondents (55.2%) possessed medium farm size where large proportion of the respondents (60.0%) had medium rice cultivated area. The average income (BDT 51940) of the respondents were much lower than the national average (BDT148518) (BBS, 2018). Results presented in Table 1 indicate that the highest proportion of the farmers (75.2%) had medium social participation. Overwhelming majority of the respondents (85.6%) had low or medium training participation. Results presented in Table 1 also reveal that about three-fifths of the respondents (59.2%) had low innovativeness.

Table 1: Salient features of the selected characteristics of the respondent farmers

Characteristics (Unit of measurement)	*Range*		*Categories*	*Respondents (n=125)*		*Mean*	*SD*
	Possible	*Observed*		*No.*	*%*		
Age (years)	Unknown	27-54	Young (up to 35)	74	59.2	35.54	5.60
			Middle (36 to 45)	48	38.4		
			Old (above 45)	3	2.4		
Educational level (Schooling year)	Unknown	4-14	Primary (up to 5)	18	14.4	7.74	2.16
			Secondary (6 to 10)	101	80.8		
			Above Secondary (>10)	6	4.8		
Family size (No. of members)	Unknown	4-9	Small (up to 5)	26	20.8	6.49	1.22
			Medium (6-8)	84	67.2		
			Large (above 8)	15	12.0		
Farming experience (Years)	Unknown	3-20	Low (≤5.79)	26	20.8	10.02	4.23
			Medium (5.80-14.23)	75	60.0		
			High (>14.23)	24	19.2		
Farm size (Hectare)	Unknown	0.41-1.09	Small (up to 0.43)	26	20.8	0.62	0.18
			Medium (0.44-0.81)	69	55.2		
			Large (above 0.81)	30	24.0		
Rice cultivated area (Hectare)	Unknown	0.41-1.01	Small (up to 0.42)	32	25.6	0.55	0.13
			Medium (0.43-0.68)	75	60.0		
			Large (above 0.68)	18	14.4		
Annual family income (BDT)	Unknown	24700-117000	Low (≤54.30)	83	66.4	51940	21260
			Medium (54.31-84.90)	33	26.4		
			High (>84.90)	9	7.2		
Training participation (Day)	Unknown	0-92day	Low (up to 30.66)	50	40.0	35.33	20.70
			Medium (30.67-61.33)	57	45.6		
			High (above 61.33)	18	14.4		
Social participation (Score)	0-20	1.0-8.0	Low (up to 2.80)	13	10.4	3.84	1.04
			Medium (2.81-4.88)	94	75.2		
			High (above 4.88	18	14.4		
Innovativeness (Score)	0-20	0-12	No (0)	30	24.0	3.63	2.97
			Low (1- 6.60)	74	59.2		
			Medium (above 6.60)	21	16.8		

Preference of BRRI dhan44

Preference of BRRI dhan44 was measured in respect of its 8 selected attributes perceived by the farmers. It is observed that, respondents' preference of BRRI dhan44 ranged from -0.25 to 0.75, the mean was 0.32 and the standard deviation of 0.31.

Table 2: Distribution of the respondents according to their preference of BRRI dhan44

Preference categories (scores)	*Farmers*		*Mean*	*SD*
	Number	*Percent*		
Negative preference (<0)	12	9.6	0.32	0.31
No preference (0)	21	16.8		
Low preference (0.01-0.33)	33	26.4		
Medium preference (0.34-0.67)	36	28.8		
High preference (>0.67)	23	18.4		
Total	125	100.0		

Little or less than one-thirds of respondents (28.8%) had medium preference followed by (26.4%) low preference and (9.6%) negative preference of BRRI dhan44. Only 18.4 percen trespondent had high preference (Table 2). Therefore, it reveals that more than half (52.8%) of the respondents had negative to low preference in case of BRRI dhan44 in the study area. Improved rice varieties have higher yields but they need a lot of fertilizer to grow. Sometime these varieties are susceptible to many insects and diseases. In order to control these, the farmer has to apply more pesticides which is beyond the means of many farmers.

Preference of *Maulata*

Preference of Maulata was also measured in respect its 8 selected attributes perceived by the farmers. It is observed that the respondents' preference of *Maulata* ranged from -0.25 to 0.75, the mean was 0.30 and the standard deviation of 0.28.

One-thirds of the respondents (33.6%) had 'low' preference of *Maulata* followed by (30.4%) medium, 14.4 percent 'no' and 9.6 percent showed 'negative' whereas only 12.0 percent had 'high' preference (Table 3). It means that

Table 3: Distribution of the respondents according to their preference of *Maulata*

Preference categories (scores)	*Farmers*		*Mean*	*SD*
	Number	*Percent*		
Negative preference(<0)	12	9.6	0.30	0.28
No preference (0)	18	14.4		
Low preference (0.01-0.33)	42	33.6		
Medium preference (0.34-0.67)	38	30.4		
High preference (>0.67)	15	12.0		
Total	125	100.0		

more than half (57.6%) of the respondents had 'negative' to 'low' preference in case of *Maulata* in the study area. Although the local variety is tolerant to diseases and insects, farmer's loss their interest in cultivating it as the yield of this variety is not satisfactory.

Mean Preference of Rice Varieties

Mean preference of rice varieties were measured in respect of farmers' perceived 8 attributes of selected rice varieties. It is observed that, respondents' preference of rice varieties ranged from -0.25 to 0.75, the mean was 0.31 and the standard deviation of 0.28.

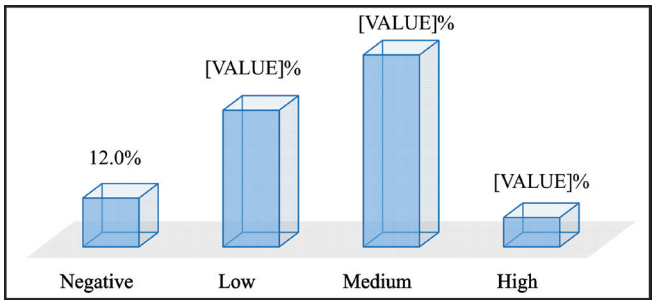

Figure 3: Distribution of the respondents according to their mean preference of rice varieties

About half of the respondents (47.2%) had medium preference of rice varieties followed by 33.6 percent low and 12.0 percent negative preference of rice varieties. Only 7.2 percent had high preference. The findings reveal that almost all (92.8%) of the respondents had negative to medium preference of rice varieties in the study area. This is due to the fact that this is a remote area, farmers training and social participation are not up to the mark. That's why they are not

aware of the benefits of improved varieties. But higher preference of rice varieties is essential for higher adoption as well as for optimum rice yield.

Comparisons of Preference of BRRI dhan44 and *Maulata*

Mean preference of BRRI dhan44 and *Maulata* variety was tested using paired t-test. It is observed that mean difference between BRRI dhan44 and *Maulata* was not significant (Table 4) which indicates that BRRI dhan44 was not much superior than that of *Maulata* in respect to selected attributes even though mean preference was little bit higher.

Table 4: Mean difference of preference of BRRI dhan44 and *Maulata*

Variety	*Mean*	*SD*	*t-value*
Preference of BRRI dhan44	0.3240	0.30623	1.168NS
Preference of Maulata	0.3020	0.28273	

NS = Not significant

Relationship between the Selected Characteristics of the Respondents and Their Preference of Rice Varieties

The relationship between education of the respondents and their preference of rice varieties found positively significant at 0.01% level of probability (r value 0.236**) (Table 5). It means that the higher is the level of education of the respondents, the higher is the increase of the preference of rice varieties. Hasan et al. [28] and Hoque et al. [29] found similar findings in their studies. Education makes people conscious and competent to various analytical ability. To recapitulate it can be said that educationally qualified farmers are more exposed about modern technologies. The relationship between training participation of the respondents and their preference of rice varieties was found positive and significant at 0.05% level of probability (r value 0.215*)(Table 5). This indicates that the higher level of training participation of the respondents, the greater their preference of rice varieties, i.e., respondents maintaining medium to high level of training participation, had higher preference of rice varieties due to the scope of orientation to different technologies. Here, more than four-fifths of the farmers (85.6%) had low to medium training participation even though training participation showed positive and significant relationship on farmers' preference of rice varieties. High preference might play significant role to speed up adoption rate of modern practices. Though Shah et al. [30] found no relationship between training participation of the respondents and their adoption of hybrid rice varieties.

Table 5: Relationship between the selected characteristics of the respondents and their preference of selected rice varieties

Selected characteristics	*Coefficient of correlation (r)*		
	Preference of Maulata	*Preference of BRRI dhan44*	*Mean preference*
1. Age	-0.092 NS	-0.075 NS	-.089 NS
2. Education	0.174 NS	0.264**	0.236**
3. Family size	0.037 NS	0.091 NS	0.070 NS
4. Farming experience	0.043 NS	0.178*	0.121 NS
5. Farm size	0.122 NS	0.130 NS	0.135 NS
6. Rice cultivated area	0.166 NS	0.145 NS	0.166 NS
7. Annual family income	-0.076 NS	-0.013 NS	-0.047 NS
8. Training participation	0.173 NS	0.226*	0.215*
9. Social participation	0.148 NS	0.166 NS	0.168 NS
10. Innovativeness	0.042 NS	0.161 NS	0.111 NS

* = significant at 5% level of significance, ** = significant at 1% level of significance, NS = Not significant

The respondents' age, family size, farming experience, farm size, rice cultivated area, annual family income, social participation, innovativeness had no undeniable association with their preference of selected rice varieties. Khalil et al. [31] also found similar findings which exposing that preference of selected rice varieties and the above characteristics of the respondents are independent to each other.

CONCLUSIONS

Majority of the respondents were young aged (59.2%), having primary or secondary level of education (95.2%), medium family size (67.2%), medium farm size (55.2%), medium farming experience (60.0%) with medium rice cultivated

area (60.00%), medium social participation (75.2%), low or medium training participation (85.6%) with an average annual income of BDT51940. Highest proportion (59.2%) of them had low innovativeness. In the study area, more than half of the respondents had negative to low preference in case of BRRI dhan44 (52.8%) and for Maulata (57.6%). About half (47.2%) of the farmers had medium preference of rice varieties compared to 33.6 percent having low preference and 12.0 percent negative preference whereas only 7.2 percent had high preference. Though mean preference was little bit higher in case of BRRI dhan44 but there was no significant difference between BRRI dhan44 and Maulata. Education and training participation of the farmers was found positively significant while age, farm size, farming experience, farm size, annual family income, rice cultivated area, social participation and innovativeness were not significantly related.

References

[1] BBS, Yearbook of agricultural statistics in Bangladesh, Dhaka: Ministry of Planning, Government of the People's Republic of Bangladesh, 2018.

[2] Brolley, M. 2015. Rice security is food security for much of the world. *Rice Today*. International Rice Research Institute (IRRI), DAPO Box 7777, Metro Manila, Philippines. PP. 30-32.

[3] BARC. 2012. *Fertilizer Recommendation Guide.* Dhaka: Bangladesh Agricultural Research Council.

[4] Dorward, P., P. Craufurd., K. Marfo., W. Dogbe., and R. Bam. 2007. Improving participatory varietal selection processes: participatory varietal selection and the role of informal seed diffusion mechanisms for upland rice in Ghana, *Euphytica,* 155: 315-327.

[5] Joshi, K. and J. Witcombe. 2002. Participatory varietal selection in rice in Nepal in favorable agricultural environments: a comparison of two methods assessed by varietal adoption, *Euphytica,* 127:445-458.

[6] Flett, R., F. Alpass, S. Humphrics, C. Massey, S. Morris and N. Long. 2004. The technology acceptance model and use of technology in New Zealand Dairy Farming. *Agricultural Systems*, 80(2): 199-211.

[7] Franzel, S., R. Coe, P. Cooper F. Place and S. J. Scherr. 2001. Assessing the adoption potential of agroforestry practices in sub-Saharan Africa. *Agricultural Systems,* 69: 37-62.

[8] Schroth, G. and F. L. Sinclair. 2003. Impacts of trees on the soil fertility of agricultural soils. pp. 1-9. In: G. Schroth and F.L. Sinclair (eds.) Trees, Crops and Soil Fertility CAB International, UK.

[9] Wale, E. and A. Yallew. 2007. Farmers' variety attribute preferences: implications for breeding priority setting and agricultural extension policy in Ethiopia. *African Development Review* 19, 379–396.

[10] Asrat, S., M. Yesuf., F. Carlsson and E. Wale. 2010. Farmers' preferences for crop variety traits: Lessons for on-farm conservation and technology adoption. *Ecological Economics* 69: 2394–2401.

[11] Shiferaw, S. and S. T. Holden. 1998. Resource degradation and adoption of land conservation technologies: a case study in AnditTid, North Shewa. *Agricultural Economics*, 18: 233-247.

[12] Adebayo, K., A. M. Omotayo, C. J. Garforth and M. Awotunde. 2002. Small farmers' perception of the characteristics of new farm practices in Ogun State, Nigeria. *Journal of Extension Systems*, 18(2): 79-92.

[13] Wossink, G. A. A., A. J. de Buck, J. H. van Niejenhuis and H. L. M. Haverkamp. 1997. Farmers' perceptions of weed control techniques in sugar beet. *Agricultural Systems*, 55(3): 409-423.

[14] Austin, E. J., J. Willok, I. J Deary, G. J. Gibson, J. B. Dent, G. E. Jones, O. Morggan, R. Grieve and A. Sutherland. 1998. Emprrical models of farmer behavior using psychological, social and economic variables. *Agricultural Systems*, 58(2): 203-224.

[15] Sall, S., D. Norman and A. M. Featherstorne. 2000. Quantitative assessment of improved rice variety adoption: the farmer's perspective. *Agricultural Systems*, 66:129-144.

[16] Collinson, M. 2001. Institutional and professional obstacles to a more effective research process for smallholder Agriculture. *Agricultural Systems,* 69(1&2): 27-36.

[17] Banglapedia. 2003. *National Encyclopedia of Bangladesh*. Dhaka: Asiatic Society of Bangladesh.

[18] Lightfoot, C. 1985. Indigenous Research and On Farm Trials. *Agric. Administration and Extension*, 24(87): 79-89.

[19] Rogers, E. M. 1995. *Diffusion of Innovations*. 5thed. New York: The Free Press.

[20] Siddaramaiah, B. S. and D. A. N. Shree. 2000. Attributes measurement through semantic differential technique. *Indian Journal of Extension Education*, 36(1&2): 72-75.

[21] Neog, P. K. and D. K. Gogoi. 2001. Appropriateness of recommended sali rice cultivation practices as perceived by small farmers. *Indian Journal of Extension Education*, 37(1&2): 49-57.

[22] Paris, T.R., D. Manzanilla., G. Tatlonghari., R. Labios., A. Cueno., D. Villanueva. 2011. Guide to participatory varietal selection for submergence-tolerant rice. Los Baños (Philippines): International Rice Research Institute. 111 p.

[23] Kashem, M. A. 2004. *Fundamentals of Extension Education*. Mymensingh: Lima Printing Press.

[24] Reed, G. V., M. R. Binks and C. T. Ennew. 1991. Matching the characteristics of a service to the preference of customers. *Managerial and Decision Economics*, 12: 231-240.

[25] Williams, R., L. Fontes., D. da Silva., A. Dalley, B. Monaghan. 2008. Participatory variety selection increases adoption of modern varieties by subsistence farmers in East Timor. In: Proceedings of the 14th Australian Agronomy Conference, September 2008, Adelaide, Australia.

[26] Ortiz-Ferrara, G., A.K. Joshi., R. Chand., M.R. Bhatta., A. Mudwari., D.B. Thapa., M.A. Sufian., T.P. Sakia., R. Chatrath., J.R. Witcombe., D.S. Virk., R.C. Sharma. 2007. Partnering with farmers to accelerate adoption of new technologies in South Asia to improve wheat productivity. *Euphytica* 157(3): 399-407.

[27] Hasan, S., M.E., Haque, M.S.I. Afrad, Alam, M. Z., Hoque, M. Z. and M.R. Islam, (2021). Pest risk analysis and management practices for increasing profitability of lemon production. Journal of Agriculture and Ecology Research International, 22(1): 25-35.

[28] Hasan, S., M. E. Haque, M. S. I. Afrad, M. Z. Alam, M. Z. Hoque, and M. R. Islam. 2021. Influences of socio-economic factors on lemon pest management practices in Tangail district of Bangladesh. *South Asian Journal of Social Studies and Economics*, 10(3): 59-67.

[29] Hoque, M.Z., M. E. Haque, M. S. I. Afrad, M. A. Hossain. 2010. Adoption of farming technology by the Charland farmers. *Bangladesh Journal of Extension Education,* 22(1&2):49-55.

[30] Shah, M., W. Grant, and S. Stocklmayer. (2014). Adoption of hybrid rice in Bangladesh: farm level experience. *Journal Agricultural Science,* 6(7): 157-171.

[31] Khalil M.I., M. E. Haque, M. Z. Hoque. 2013. Adoption of BARI recommended potato (*Solanumtuberosum*) varieties by the potato farmers of Bangladesh. *The Agriculturists*. 2013; 11(2): 79-86.