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Adoption of Selected Ecological Agricultural Practices by the Farmers*

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Abstract

The main purpose of the study was to determine the adoption of selected ecological agricultural practices by the farmers and the personal and psychological factors affecting the adoption. Proshika-selected ecological farmers of six selected upazilas of four districts of Bangladesh constituted the population of the study. A total of 144 farmers were finally selected as the sample of the study. Data were collected from the farmers during February to August, 2006 by using a pre-tested interview schedule. Seven factors (four personal and three psychological) of the farmers were considered as the independent variables, while adoption of selected ecological agricultural practices by the farmers was the dependent variable. Overwhelming majority (86%) of the farmers had very low to low composite adoption of selected ecological agricultural practices, ecological nutrient management practices (84%) and ecological pest management practices (79%), while none had high adoption of composite ecological agricultural practices, ecological nutrient management practices and ecological pest management practices. Step-wise multiple regression analysis indicated that among the selected personal and psychological factors, attitude towards ecological agriculture of the farmers was the most crucial factor which very strongly and positively influenced their adoption of selected ecological agricultural practices. Risk orientation of the farmers also had remarkable positive influence upon adoption of selected ecological agricultural practices. The standardized partial 'b' co-efficients of these two significant independent variables formed the equation contributing to 65.1% of the total variation in adoption.

Keywords: *Adoption, factors, ecological agriculture, Proshika, farmers*

Introduction

Ecological agriculture, also popularly known as organic farming, now-a-days has been emerged as a new approach to sustainable agriculture. Many authors consider it to be the farming system which best fulfils the requirements of sustainability (Lampkin, 1990; Gerber and Hoffmann, 1998). The concept of ecological agriculture has been manifested by different terms by different researchers as well as different organizations. All possible non-chemical methods are used for nutrient and pest management for this type of agricultural farming.

Ecological agriculture is just a comprehensive agricultural production

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system intensively engaged in accordance with the principles of ecology. The practices that are used in ecological agriculture are known as ecological agricultural practices. Ecological agriculture is the combination of agricultural practices without using any agro-chemicals (fertilizers and pesticides).

The crop land of Bangladesh has been losing its fertility by using anti-natural practices like use of chemical fertilizers and chemical pesticides. Murakami (1991) stated that the anti-natural agricultural practices degrade the soil and ecological balance in many ways. The anti-natural practices increase the cost of production in one hand and decrease the microbial activities in the soil, on the other, which creates new hazardous situation in the entire crop production system including health hazards. Chemical fertilizers and chemical pesticides not only contaminate surface water, they also affect fish population and human health as well.

In Bangladesh, Proshika NGO became very much concerned about the devastating effect of imbalanced use of chemical fertilizers and pesticides and earnestly felt the need for developing an alternative agricultural strategy that is sustainable, productive and environment-friendly. Since 1976, Proshika has been working towards development of this alternative strategy and termed it as "Ecological Agriculture" (Proshika, 2002). Ecological agricultural farming is steadily gaining popularity throughout the world including Bangladesh. Gradually, governments are recognizing that ecological agriculture could make a major positive contribution to the problems created by modern conventional farming (McRobie, 1990).

Adoption of ecological agricultural practices by the Proshika farmers is supposed to be influenced through interacting forces of many factors in their surroundings. Personal and psychological factors of the farmers are very important for this aspect. But very little research works have so far been done to determine the extent of adoption of ecological agricultural practices by the target farmers of Proshika. On these considerations the researchers felt necessity to conduct this research on the following objectives:

- To determine and describe the extent of adoption of selected ecological agricultural practices by the Proshika farmers,
- To determine and describe some selected personal and psychological factors of the Proshika farmers, and
- To explore the contributions of the selected factors of the Proshika farmers to their extent of adoption of selected ecological agricultural practices.

Methodology

Under the guidance of Proshika, 761,845 farmers were successfully practising ecological agricultural practices and brought 93,533 hectares of land under this programme in 196 Area Development Centers (ADCs) of Bangladesh (Proshika, 2006). Six ADCs namely Ghatail and Madhupur under Tangail district, Muktagacha under Mymensingh district, Pakundia under Kishoreganj district, and Belabo and Raipura under Narsingdi district were purposively selected as the study area

where a sister programme of ecological agriculture introduced by Proshika existed.

The total number of farmers producing organic vegetables in the selected six ADCs was 478 which constituted the study population. A total of 144 farmers were randomly selected as the study sample. A pre-tested interview schedule (in Bengali language) containing direct questions and some scales was used for data collection from each respondent. Data were collected during February to August, 2006.

Adoption of selected ecological agricultural practices was the dependent variable of the study. A total of 20 ecological agricultural practices were selected finally on the basis of judges rating for 9-point suitability continuum for each practice. In descending order of suitability index (SI), twenty ecological agricultural practices containing 10 for nutrient management and 10 for pest management were selected.

The adoption of a particular ecological agricultural practice by each farmer was then measured by the following formula:

$$A = \sum_{1}^{4} \frac{e_i}{p} 100 M_i$$

Where,

A = Adoption of a particular practice

e_i = Effective area (in hectare) actually covered by the practice under respective mode

M_i = weight of respective mode of application of the practice (i = 1, 2, 3, 4)

p = Potential area (in hectare) suitable for the practice

Weight of mode of application of each practice was as follows:

Mode of application of the practice		**Weight**
Mode-1 (M_1):	No use of the practice	0.00
Mode-2 (M_2):	Less use of the practice with large use of chemical fertilizers or chemical pesticides (large use of chemical fertilizers means use of $\geq$50% of the recommended doses of chemical fertilizers and large use of chemical pesticides means use of chemical pesticides for pest control at normal attack.)	0.33
Mode-3 (M_3):	Large use of the practice with less use of chemical fertilizers or chemical pesticides (less use of chemical fertilizers means use of <50% of the recommended doses of chemical fertilizers and less use of chemical pesticides means use of chemical pesticides for pest control only at the time of severe attack.)	0.67
Mode-4 (M_4):	Use of the practice without any chemical fertilizers or chemical pesticides	1.00

Thus, adoption of a particular ecological agricultural practice could range from 0 to 100, where 0 indicated no adoption and 100 indicated very high adoption of that ecological agricultural practice.

Score of adoption of ecological nutrient management practices of each farmer was measured by summing up all the scores of ten selected ecological nutrient management practices. Thus, score of adoption of ecological nutrient management practices of the farmers could range from 0 to 1000, where 0 indicated no adoption and 1000 indicated very high adoption of ecological nutrient management practices.

Similarly, score of adoption of ecological pest management practices of the farmers could range from 0 to 1000, where 0 indicated no adoption and 1000 indicated very high adoption of ecological pest management practices.

Composite adoption of ecological agricultural practices of each farmer was then determined by adding up the scores of adoption of ecological nutrient management practices and adoption of ecological pest management practices. Therefore, score of composite adoption of ecological agricultural practices could range from 0 to 2000, where 0 indicated no adoption and 2000 indicated very high adoption of ecological agricultural practices.

Appropriate methods were used to measure the personal characteristics of the farmers. While constructing attitude towards ecological agriculture scale, twelve statements were selected in the final scale including 6 positive and 6 negative statements from initially selected 55 statements with the help of the combination of Thurstone's Technique of Equal Appearing Interval Scale and Likert's Technique of Summated Ratings Scale (Edwards, 1957) with slight modification. The selected statements were expressed in positive and negative views towards ecological agriculture. The nature of responses of the respondents to the statements were 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree' and scores were assigned as 4, 3, 2, 1 and 0 respectively for the positive statements and the reverse scores were given for the negative statements. The scoring method was slightly modified from that of Likert (1932). The possible range of score of attitude towards ecological agriculture was from 0–48, where 0 indicated very highly unfavourable attitude and 48 indicated very highly favourable attitude towards ecological agriculture.

A 10-item aspiration scale was prepared by picking up 8 items from Islam's (2000) scale with some modifications. To have clear responses from the farmers, the items (statements) were provided with 5-point response categories weighted from 0 to 4 indicating low to high level of aspiration. Level of aspiration score of a respondent was determined by adding the score for his responses to all the items in the scale. Therefore, total score of a respondent could range from 0 to 40, while 0 indicating no aspiration and 40 very high level of aspiration.

In order to construct risk orientation scale, twelve statements (containing 7 positive and 5 negative) were finally selected from initially collected 20 statements with the help of Likert's Technique of Summated Ratings. These 12 statements were administered to the farmers with five alternative choices of responses, *viz.* 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree' and weights were assigned to the five alternative responses as 4, 3, 2, 1 and 0 respectively for the positive statements and the weighting system were reversed for the negative statements. Finally risk orientation score of a respondent was determined by adding up the weights for his responses to all the 12 statements. Thus, possible risk orientation score of an individual could range from 0 to 48, while 0 indicating no risk orientation and 48 indicating very high risk orientation.

Findings and Discussion

Extent of Adoption of Selected Ecological Agricultural Practices

Salient features like possible range, observed range, mean, standard deviation and co-efficient of variation of adoption scores of the two broad dimensions of ecological agricultural practices along with composite adoption of selected ecological agricultural practices with category wise distribution of the farmers are presented in Table 1.

Table 1. Salient features and distribution of the Proshika farmers according to their extent of adoption of two types of ecological agricultural practices and composite adoption of selected ecological agricultural practices (N=144)

Dimensions of ecological agricultural practices	Categories	Range		Farmers		Mean	SD	CV
		Possible	Observed	Number	%			
Ecological Nutrient management practices	Very low adoption (upto 166.7)	0 - 1000	88.3 - 470	24	17	242.11	78.17	32.29%
	Low adoption (166.8 - 333.3)			97	67			
	Medium adoption (above 333.3)			23	16			
Ecological pest management practices	Very low adoption (upto 166.7)	0 - 1000	69.5 - 439	7	5	271.60	68.83	25.34%
	Low adoption (166.8 - 333.3)			106	74			
	Medium adoption (above 333.3)			31	21			
Composite ecological agricultural practices	Very low adoption (upto 333.3)	0 - 2000	157.8 - 899.7	11	8	513.71	133.75	26.04%
	Low adoption (333.4 - 666.7)			113	78			
	Medium adoption (above 666.7)			20	14			

A great majority of the farmers had very low to low adoption of ecological nutrient management practices (84%), ecological pest management practices (79%) and composite adoption of ecological agricultural practices (86%). Nobody had high adoption of ecological agricultural practices. These facts implied that adoption of nutrient management practices and pest management practices in terms of ecological dimensions is yet far from the desired level of satisfaction. The situation regarding adoption of nutrient management practices is further worse.

Personal and psychological factors of the farmers

Salient features of the selected seven (four personal and 3 psychological) factors of the farmers have been shown in Table 2 for better understanding. Data contained in Table 2 indicated that the largest proportion of the farmers were middle aged, while most of

them had secondary education, medium family size, medium working family size, moderately favourable attitude towards ecological agriculture, medium aspiration and high risk orientation. Thus, in most cases, the farmers existed in the middle situation.

Table 2. Slient features of the selected personal and psychological factors of the Proshika farmers (N=144)

Factors (with measuring units)		Categories (with basis of categorization)	Farmers		Mean	SD	CV (%)
			No.	%			
Personal factors	Age (years)	Young (upto 30)	31	22	38.31	9.38	24.48
		Middle-aged (31 t0 50)	101	70			
		Old (above 50)	12	8			
	Education (schooling years)	Illiterate (0)	15	10	5.58	3.82	68.46
		Can sign only (0.5)	23	16			
		Primary (1 to 5)	33	23			
		Secondary (6 to 10)	68	47			
		Higher secondary (above 10)	5	4			
	Family size (number)	Small family (upto 4)	35	24	5.78	1.63	28.20
		Medium family (5 to 7)	88	61			
		Large family (above 7)	21	15			
	Working family size (scores)	Small working family (upto 3)	53	37	3.92	1.42	36.22
		Medium working family (4 to 5)	66	46			
		Large working family (above 5)	25	17			
Psychological factors	Attitude towards ecological agriculture (scores)	Low favourable (25 to 32)	51	35	34.63	4.36	12.59
		Medium favourable (33 to 40)	79	55			
		High favourable (above 40)	14	10			
	Aspiration (scores)	Low (upto 13)	50	35	15.88	4.79	30.16
		Medium (14 to 26)	88	61			
		High (above 26)	6	4			
	Risk orientation (scores)	Low (upto 16)	17	12	29.52	8.19	27.74
		Medium (17 to 32)	62	43			
		High (above 32)	65	45			

Contribution of Selected Characteristics of the Farmers to Adoption of Selected Ecological Agricultural Practices

Pearson product moment correlation was initially done and it was found that age (X_1), education (X_2), working family size (X_4), attitude towards ecological agriculture (X_{23}) and risk orientation (X_{25}) of the farmers had significant positive relationship with their adoption of ecological agricultural practices. Full model multiple regression analysis was then run by involving all the selected 7 independent variables with adoption of ecological agricultural practices (Y) as the dependent variable. It was observed that the full model regression results were misleading due to the existence of interrelationships among the independent variables. However, in order to avoid the misleading results due to the problem of multi-collinearity and also to determine the best explanatory variables as suggested by Droper and Smith (1981), the method of step-wise multiple regression was employed by involving all the seven independent variables with the adoption of selected ecological agricultural practices. Results of step wise multiple regression

analysis in the form of table and equation have been discussed below:

Table 3 revealed the summarized results of step-wise multiple regression analysis of the farmers' adoption of selected ecological agricultural practices with their seven independent variables. It was observed that out of seven independent variables only two variables namely attitude towards ecological agriculture and risk orientation were entered into the regression equation.

Table 3. Summary of stepwise multiple regression analysis showing the contribution of seven selected personal and psychological factors to the adoption of ecological agricultural practices

Variables entered	Standardized partial 'b' coefficient	Value of 't' (with probability level)	Adjusted R^2	Increase in R^2	Variation explained in%
Attitude towards ecological agriculture (X_{23})	0.535	8.219 (0.000)	0.581	0.581	58.1
Risk orientation (X_{25})	0.352	5.398 (0.000)	0.651	0.070	7.0
		Total		0.651	65.1

Multiple R = 0.810
R-square = 0.655
Adjusted R - square = 0.651
F-ratio = 134.144 at 0.000 level of significance

The remaining variable i.e. age (X_1), education (X_2), family size (X_3), working family size (X_4) and aspiration (X_{24}) were not entered into the regression equation.

Data presented in Table 3 indicated that the multiple R, R^2 and adjusted R^2 in the step-wise multiple regression analysis were 0.810, 0.655 and 0.651 respectively, and the corresponding F-ratio of 134.144 was significant at 0.000 level. The regression equation so obtained is presented below:

$Y = 169.704 + 0.535\ X_{23} + 0.352\ X_{25}$
$R^2 = 0.651$

This indicated that the whole model of seven variables explained 65.1% of the total variation in adoption of ecological agricultural practices of the respondents. But since the standardized regression coefficients of the two variables formed the equation and were significant, it might be assumed that whatever contribution was there, it was due to these two variables.

Results of stepwise multiple regression analysis again indicated that attitude towards ecological agriculture (X_{23}) of the farmers was considerably more important factor than risk orientation. Both the variables strongly and positively influenced the adoption of ecological agricultural practices.

It is quite logical that the farmers having more favourable attitude towards ecological agriculture would like to adopt the same in a larger scale. This might be the reason for attitude towards ecological agriculture having the positive contribution to adoption of ecological agricultural practices. Islam (1996) found that attitude towards the use of indigenous technical knowledge (ITK) had significant positive relationship with use of ITK and considerable contribution to use of

ITK. Nuruzzaman (2000) and Hamidi (2004) also found positive significant relationship between attitude towards integrated pest management (IPM) and adoption of the same.

Risk orientation was the 2nd important contributing factor of the farmers and had significant and positive influence on their adoption of ecological agricultural practices. Some farmers thought that there were some risks in ecological agriculture. It is quite logical that the farmers having more orientation towards risk could adopt ecological agriculture in a larger scale. This might be the reason for risk orientation having the positive contribution to adoption of ecological agricultural practices. Hamidi (2004) found positive significant relationship between risk orientation and adoption of integrated pest management practices.

Conclusion

Most of the Proshika farmers had very low to low adoption of selected ecological nutrient management practices (84%), ecological pest management practices (79%) and composite adoption of ecological agricultural practices (86%). Nobody had high adoption of selected ecological agricultural practices, while only a small proportion had medium adoption. Regression analysis indicates that attitude towards ecological agriculture and risk orientation of the Proshika farmers had significant and positive effect on their adoption of selected ecological agricultural practices. These facts led to the conclusion that more and more motivational programmes including training and non-formal educational activities need to be arranged by the concerned agencies in order to form favourable attitude towards ecological agriculture and cope with risk by the farmers to achieve desired benefit with regard to selected ecological agricultural practices. An effort to involve the agricultural scientists to explore some organic materials containing high quantity of soil nutrients and pest killing substances will be of great contribution in this respect.

References

Droper, N. K. and H. Smith. 1981. *Applied Regression Analysis.* New York: John Wiley and Sons Inc.

Edwards, A.L. 1957. *Techniques of Attitude Scale Construction.* New York: Appleton-Century Crafts, Inc.

Gerber, A and V. Hoffmann. 1998. The Diffusion of Eco-farming in Germany. In: Roling, N.G. and M. A. G. Wagemakers, (ed.). *Facilitating Sustainable Agriculture. Cambridge.* Cambridge University Press.

Hamidi, M. A. 2004. Adoption of Integrated Pest Management Practices in Rice Cultivation by the Farmers. Ph.D. dissertation, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Islam, M. M. 1996. Farmers' Use of Indigenous Technical Knowledge in the Context of Sustainable Agricultural Development. M. S. thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Islam, M.S. 2000. Farmers' Perception of the Harmful Effects of Using Agro-chemicals in Crop Production with Regard to Environmental Pollution. Ph.D. dissertation, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Lampkin, N. H. 1990. *Organic Farming*. Ipswich: Farming Press.

Likert, R. 1932. A Techique for the Measurement of Attitude. *Arch. Psychol*, No.140.

McRobie, G. 1990. *Tools for Organic Farming*. London: Intermediate Technology Publications.

Murakami, S. 1991. *Lessons from Nature – A Guide to Ecological Agriculture in the Tropics*. Proshika-MUK, Dhaka.

Nurzaman, M. 2000. Knowledge, attitude and practice of FFS and Non-FFS farmers in respect of IPM. *M. S. thesis, Department of Agricultural Extension Education*, Bangladesh Agricultural University, Mymensingh.

Proshika. 2002. Crossing the Poverty Barrier: The Journey Ahead. Activity Report.

Proshika. 2006. Proshila Diary. Proshika, Mirpur, Dhaka