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Research Note

ADOPTION OF IMPROVED PRACTICES BY POTATO FARMERS

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ABSTRACT

The purpose of this study was (i) to determine the selected characteristics of the potato farmers, (ii) to determine the adoption level of improved practices by the farmers in potato cultivation and (iii) to explore the relationships between the selected characteristics of the potato farmers with their adoption of improved practices. Out of 500 potato farmers, which consituted the population, 100 of them were selected following random sampling method. Data were collected from the farmers by interview schedule. Findings revealed that majority of the potato growers (63 percent) had moderate level of adoption, 32 percent low and only 5 percent had high adoption. The correlation analysis indicated that farm size, potato farm area, extension contact and attitude towards improved practices were significantly related with the adoption of improved practices of potato. However, farmers age, education and organizational participation were not related with adoption.

I. INTRODUCTION

In the advanced countries of the West, technological developments in agriculture and their diffusion to millions of farms have changed the method of farming, increased qualitative and quantitative production, but decreased human labour and cost per unit area. By contrast, faced with many socio-economic hard realities, most Third World countries including Bangladesh cannot produce enough food to eat, adequate fibre to clothe and required employment to earn livelihood. They thus remain unable to enjoy a decent living over the years.

Adequate generation and adoption' of scientific knowledge could play a vital role in ameliorating the situation in all areas of human needs-developed agriculture, industry, health and environment. It is estimated that human knowledge gets doubled in every seven years (Morris and Elkins, 1978). This has been due to continuous research activities with their costly endowments. In agriculture, with specific regard to research alone in rice-the most important cereal crop in Asia, the number of journal articles published in 1970 went up by two-folds in 1977 (Busch, 1981). Thus, an `information explosion' phenomenon occurs at the research system. On the other hand, the technology diffusion system represents a gloomy picture. For, 90 of every 100 inventions, which took decades of work, get lost (Lionberger and Gwin, 1982). In Bangladesh agriculture, out of 224 technologies developed by nine national

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research institutes, only *26* percent of these were somehow adopted by the farmers. Government extension services had disseminated only *9.2* percent of the research based information to the farmers (Hossain, *1997).* Clearly, a chronic `information crisis' exists in the linking system and most severely in the client system.

Diffusion[2] of innovations in agriculture represents a complex phenomenon which occurs in an unpredictable fashion. Several factors are intricately related to the process which include, besides other things, clients' characteristics, community norms in which they live, socioeconomic and technological nature of the innovations themselves, and the role of the Government in providing extension and support services. In Bangladesh, extension studies on the characteristics of the client system have been overemphasized on the adoption of cereal and fibre crops, but with less attention to the adoption of vegetable crops including potato. However, these studies could not provide a clear understanding of the contribution of clients' characteristics to their adoption behaviour because of conflicting findings except age which, in most cases, show no relationship with adoption.

Potato has been the staple food in several Western countries which can also meet the chronic food deficit problem in Bangladesh. But the average daily intake of potato is only *25* gms. against the recommended level of 100 gms. The yield has been also very discouraging. While the average yield figures in ton/ha are 44.3 for the Netherlands, 43.4 for Switzerland and *40.7* for UK, it is only 10.5 for Bangladesh (FAO, *1992).*

Rahman *(1988),* however, observed that the yield of potato could easily be increased upto three times by using HYV seeds and adopting recommended practices in the right soil and appropriate season. However, besides these agronomical factors, farmers' socioeconomic characteristics could also play a significant role in the adoption of these recommended practices. Thus, in view of a dearth of literature in the clients' adoption behaviour of the recommended practices of potato, this study was undertaken with the following objectives:

i) To determine the seven selected characteristics of the potato farmers.
ii) To assess the adoption level of improved practices of potato by the farmers.
iii) To explore relationships between seven selected characteristics of the farmers with their adoption behaviour.
iv) To assess the production, yield and utilization of the harvested crop.

The study followed the Ex post facto research design where the investigators had no direct control on the seven characteristics of the farmers because their manifestations had already occurred before the data were collected. Inferences about the relationships were made without direct intervention of these characteristics to the adoption behaviour of the potato growers. The paper is organised as follows: Apart from this section I, Section II deals with methodological issues, Section III is concerned with analysis of the findings and Section IV draws some conclusions based specifically on this research work.

II. METHODOLOGY

Sampling procedure

Out of 17 villages of Chalitadanga Union of Kazipur Thana under Sirajganj District, five were selected using random sampling method. The number of potato farmers in the selected villages were 500. Twenty percent farmers were selected from each village following a table of random numbers which gave 100 farmers as sample. Data were collected using a structured schedule during 13 August to 2 September, 1995.

The characteristics were farmers'age, education, farm size, potato farm area, extension contact, organizational participation, and attitude towards improved practices of potato. The only intervening variable, however, was their adoption of improved practices of potato.

Operationalisation of Variables

Age of the farmers was operationalised by assigning a score of one (1) for each years of age that they had on the day of data collection, the fraction was rounded off as usual. *Eduction* was likewise measured by assigning a score of one (1) for having passed in the final examination of each years of schooling in formal educational institutions. However, if a farmer did not know reading and writing, his educational score was taken as zero. *Farm size* of a subject means the effective area of the farm which he operates and was measured in hectare using the following formula: Farm size = $A_1 + A_2 + A_3 + 1/2 (A_4 + A_5) - A_6 + A_7$

where A_1 = Own land under own cultivation

A_2 = Own land under house

A_3 = Cultivated area taken on lease from others

A_4 = Cultivated area given to others on borga

A_5 = Cultivated area taken from others on borga

A_6 = Cultivated area given to others on lease

A_7 = Homestead area, vacant places in front or behind the house

Potato farm area refers to actual area in ha which was used for potato cultivation by a farmer in Rabi season, 1994. *Extension contact* refers to a farmer's exposure to messages received from each of the 14 communication media in a year prior to data collection. The media constituted a combination of individual e.g., Block Supervisor, Subject Matter Officer etc. group e.g., result demonstration meeting, training course etc. and mass e.g., radio, television and print media. Each farmer was asked to reflect his level of contact for technical meassages for farming from each of the media by using a four-point rating scale-frequent, sometime, rare and never. The weights assigned for responses against these expressions were 3, 2, 1 and 0, respectively. Extension contact of a farmer could range from 0 to 42, 0 indicating no contact at all and 42 reflecting the highest level of contact.

Organizational participation refers to how a respondent took part in a social organization e. g., youth club, cooperative society etc. for a year prior to data collection. Thirteen such local organizations were identified. An organization was conceived as an association of persons which has a name, objective, a constitution and is managed voluntarily by an executive committee elected by the general members usually once a year. Also the organization must have held a general meeting at least once a year. Level of participation of a respondent was measured as ordinary member, executive committee member and executive officer e.g., President, Vice-President, Treasurer, General Secretary etc. The scores assigned were as follows: 1 for ordinary member, *2* for executive committee member and 3 for executive officer, Since there were 13 such organizations, the composite participation score of a farmer could range from 0 to 39.

The variable on *attitude toward improved practices of potato* was operationalised by constructing an attitude scale having consisted of 10 items. Each item was framed independently using a simple statement relating to some aspect of potato e.g., "demand for HYVs of potato is higher in the market." Each statement was read out when the subject reflected his attitude by any of the three expressions: `agree', `no opinion', and `disagree'. For a positive statement as cited above, a score of 3, *2*, and 1 was assigned for these expressions, respectively. The scoring order, however, was reversed for negative statements e. g., "local variety tastes better than HYVs".

The Likert Method of Summated Rating consists of five expressions-'strongly agree', `agree', `no opinion', `disagree' and `strongly disagree'. The use of five expressions was avoided based on present experience. Pretesting of the questionnaire clearly showed that most farmers were hesitant to react to the statements along the `strongly agree - agree', and along the 'disagree- strongly disagree' continuum. Thus, the two extreme expressions, `strongly agree' and `strongly disagree', were deleted in the final scale. This enabled the farmers respond clearly and unhesitantly. These three expressions, rather than five in the Likert type, have been used in many recent extension studies. However, the attitude score of a farmer could theoretically range from 10 to 30, 10 indicating the lowest level of attitude (most unfavourable) and 30, the highest level (most favourable).

Extent of adoption of potato improved practices of potato was the major focus of the study. The adoption of improved practices of potato in the Rabi season, 1994 was measured by checking whether or not a farmer had adopted 15 of the recommended practices. The major practices in the scale included seed selection and treatment, use of HYV seed, planting method, use of fertilizer and insecticide, intercropping with potato, harvesting technique and storage method followed. A score of one (1) was assigned to a farmers for each positive response and zero (0) for negative response. Since there were 15 practices in the scale, the adoption score of a respondent could range from 0 to 15 when 0 indicated complete non-adoption and 15 reflected highest level of adoption of recommended practices.

Method of Analysis

Collected data were analysed by objectives of the study. Statistical measures such as frequency count, percentage distribution, range, mean and standard deviation (SD) were used to analyse the data. Farmers were categorised based on their distribution along the variables. These appear in Table 1. Categorizations based on their age, eduction, farm size and potato farm area are self explanatory.

The observed extension contact scores ranged from 2 to 29 with a mean of 7.76 and SD as 4.34. Farmers having fallen in the score ranges of 2-7, 8-15 and above 15 were labeled to possess 'low extension contact', `medium extension contact', and `high extension contact', respectively, Likewise, the observed organizational participation scores ranged from 0 to 13 with a mean value of 2.67 and SD as 2.47. Based on these distributions, farmers were labeled into four categories: `no participation' - having obtained a score of zero (0); `low participation' - having scored within a range of 1-2; medium participation - having attained a score of 3-5; and high participation - having obtained a score within the range of 6 - 13. Farmers were also classified into three categories based on their distributions of attitude scores and adoption scores (Table 1). The product-Moment Coefficient of Correlation (r) was used to explore the relationships between the variables.

III. ANALYSIS OF THE FINDINGS Selected

Characteristics of the Potato Farmers

It appears from Table 1 that highest proportion of the farmers (47%) were young and also the highest proportion (35%) of them were educated up to the secondary level. The percentage of farmers having educated at this level was two times greater than those educated at the primary level (17%). On the whole, majority of them (65%) were educated from primary to the highest levels (above secondary). Further, highest proportion of them (41%) had small farm, and majority (71%) possessed small potato farm area.

Data also revealed that majority of them (54%) had low extension contact and highest proportion (38%) of them had low organizational participation. Interestingly, an overwhelming of 96 percent farmers held `favourable' to `high favourable' attitude toward improved practices of potato cultivation. This reflects that the change in the attitudinal component of the farmers was quite satisfactory which is a difficult task to accomplish from persuasive communication view point.

Adoption of Improved Practices

Adoption scores ranged from 2 to 13 with a mean of 7.21 and standard deviation (SD) value of 2.03. The percentages of farmers having adopted improved practices to the low, moderated and high levels were 32, 63, and 5, respectively. Thus, majority of them (68%) had adopted practices from moderate to high levels which is satisfying on the part of DAE's

Table 1. Categories and Salient Features of the Selected Characteristics of the Potato Farmers.

Characteristics	Categories	Respondents		Observed range	Mean	Standard deviation
		No	Percent			
1. Age (years)	Young (18-35)	47	47	18-75	38.80	13.50
	Middle aged (36-50)	35	35			
	Old (51-75)	18	18			
2. Education	Illiterate	16	16			
(Schooling years)	Can sign only	19	19	0-14	5.24	4.45
	Primary (1-5)	17	17			
	Secondary (6-10)	35	35			
	Above secondary (>10)	13	13			
3. Farm size (ha)	Small (0.05-0.8)	41	41	.015-4.86	1.34	1.34
	Medium (>0.8-1.5)	28	28			
	Big (>1.5)	31	31			
4. Potato farm	Small (0.006-0.05)	71	71	.006-0.20	0.06	0.05
area (ha)	Medium (>.05-0.1)	22	22			
	Big (>0.1)	7	7			
5. Extension	Low (2-7)	54	54	2-29	7.76	4.34
contact	Medium (8-15)	39	39			
(scores)	High (>15)	7	7			
6. Organizational	No, (0)	16	16	0-13	2.67	2.47
participation	Low (1-2)	38	38			
(scores)	Medium (3-5)	35	35			
	High (6-13)	11	11			
7. Attitude towards	Unfavourable (<20)	4	4	19-30	24.44	2.56
improved	Favourable (21-25)	60	60			
practices (scores)	Highly favourable (>25)	36	36			
8. Adoption of	Low (2-6)	32	32	2-13	7.21	2.03
improved	Moderate (7-10)	63	63			
practices (scores)	High (11-13)	5	5			

extension role. This also reflects that the community, in general, was receptive to change programmes at least in potato cultivation.

Relationships between the Characteristics and Adoption of Practices

The Pearson's Correlation Coefficients (r values) indicate that subjects' farm size, potato farm area, extension contact and attitude towards recommended practices on the one hand, were related significantly with their adoption of recommended practices in potato cultivation, on the other. All these relationships were consistently in the positive direction and the strengths of these relationships were all *low*[3] after Young and Schmid (1962). However, the relationships of age, education, organizational participation on the one hand, and adoption on the other, were insignificant (Table 2).

Table 2. Coefficient of Correlations Showing Relationships between the Characteristics of Potato Growers and their adoption of Improved Practices (AIP).

Characteristics of the farmers	Observed 'r' values (Between characteristics and AIPs)
Age	−0.096 NS
Education	0.067 NS
Farm size	0.223 *
Potato farm area	0.297 **
Extension contact	0.366 ***
Organizational participation	0.094 NS
Attitude towards improved practices	0.267 **

NS = Not significant
* = Significant at 0.05 level
** = Significant at 0.01 level
*** = Significant at 0.001 level

The insignificant relationship between education and adoption is rather surprising. Education affects productivity in several ways. An educated farmer generally absorbs information on new technology better and faster than an illiterate one. For example, in Thailand, farmers with four years of schooling were three times more likely to use new chemical inputs than farmers with one to three years of schooling (World Bank 1991). However, finding of this study seems to conform to that of Dev and Hossain (1995) who observed that farmers' education had no significant role on rice output and technical efficiency in rice production.

The significant positive relationships of farm size and potato farm area with adoption conform to the findings of six previous studies conducted with the adoption of rice technologies (Hossain, 1972; Karim, 1973; Rahman, 1973; Muhammad, 1974; Razzaque, 1977; and Hossain, 1983). Also the significant relationship between extension contact and adoption bears similarity with those of Karim (1973), Muhammad (1974) and Hossain (1981). The significant relationships between farm size and potato farm area both with adoption tend to explain several phenomena. First, the findings are consistent which mean that farmers who had bigger farms had also devoted more area to potato cultivation. Second, land is a basic factor of crop production. The more a farmer possess it, the greater is the chance of adopting the recommended practices which virtually means that he is able to provide other factors of production including inputs. Third, adopting recommended practices, which basically originate from research stations, involve some risk. The big farmers are in a more advantageous position to take such risks by adopting innovations than the small farmers.

The fact that with increased level of extension contact, there was a corresponding increase in the adoption level reveals that the "impact points' of potato, developed in the erstwhile T & V System of the Department of Agriculture Extension, were disseminated by the concerned extension teaching methods at least to a satisfactory level. Being exposed to more of these messages, they possibly improved their knowledge on scientific potato farming which they finally applied in potato cultivation.

The most intersting finding is that a significant relationship existed between attitude and adoption. The two highest levels of communication functions are persuasion by the linking system and action by the client systems which are really hard to accomplish in a developing society. Tan (1981) observes that recent studies by McGruire (1969) and by Fishbein and Ajzen (1975) have broken down persuasion into sub-processes of attention to messages, understanding of the message, retention of these, and finally, action.

The present study, however, had no scope to empirically verify if the potato farmers had proceeded with these sub-processes on a step-to-step basis. This warrants an experimental research design which was never tried in Bangladesh. But it seems to suggest that communication exposure helped the farmers develop a favourable attitude toward the improved practices which finally led them adopt the recommended practices as reflected by their overt behaviour. The only related study that could be reviewed was that of Hossain (1981) who observed no relationship between attitude towards `Intensive Jute Cultivation Scheme' and adoption of improved practices of jute cultivation.

Production and Yield of Potato by Farm Size

An attempt was made to assess the total volume of potato production and yield obtained by the growers under different farm size. It appears from Table 3 that 71 percent of the farmers with small farm size had produced potato with an average yield of 9.85 t/ha. Further, 22

percent with medium potato farm size had received an average yield of 8.63 t/ha. The rest 7 percent with big farm had grown potato with an average yield of 9.1 t/ha. Thus, the contribution of the small farmers was highest in the total production and the yield obtained by them was also highest. Both the production and yield of potato of the small farmers seem to differ significantly than those of the medium and big farmers.

Table 3. Volume of Potato Production and Yield by Farm Size.

Potato Farm size (ha)	Farmers (%)	Volume of production	Yield (t/ha)
Small farm (0.006-0.05>	71	23.4	9.85
Medium farm (>0.05-0.1)	22	13.3	8.63
Big farm (>0.1-0.2)	7	10.7	9.10

Utilization of Potato by the Farmers

Past extension studies in Bangladesh were mainly confined to adoption related aspects of the crops concerned. However, an attempt was made here to know the utilization of potato by the farmers after the harvest. The term "utilization" was conceptualized on a three dimensional measures e.g., extent of use for (i) family consumption only, (ii) family consumption and selling; and (iii) family consumption, selling and storage.

Table 4 indicates that only 6 percent farmers used potato exclusively for their family consumption in their dietary menu. However, a great majority of 69 percent utilized it for family consumption and selling for economic return and the rest 25 percent had utilized it for three reasons–family consumption, selling and storage. Although data were not collected exclusively on the volume of potato utilized for these specific purposes, it may be observed that the most important purpose of potato production was for family consumption and the second important purpose was related to economic motivation.

Table 4. Potato Utilization by the Farmers

Utilization Purpose	Potato farmers	
	No.	Percent
Family consumption only	6	6
Family consumption and selling	69	69
Family consumption, selling and storage	25	25
Total	100	100

IV. CONCLUSIONS

Based on the findings of this study, their logical interpretations and those found in earlier studies, the following conclusions could be drawn.

There was no relationship between age and adoption. Most of other studies showed similar findings. Also in this study 68 percent farmers adopted improved practices from moderate to high levels. Thus, it may be concluded that age is not a critical factor to influence diffusion of farming innovations. The implication is that extension workers can work with equal emphasis with the client system without regard to their age distribution.

About two-thirds to the potato farmers were formally educated from primary to above secondary levels. Again highest proportion (35%) had secondary level of education. Most other studies also show that majority farmers were literate at various levels. Thus, contrary to common belief that most Bangladeshi farmers are illiterate, it is concluded that most of them are formally educated although the national literacy rate is now estimated at 30 percent. This conforms to the generalization of Huque (1990).

Majority of the farmers (54%) were exposed to extension contact to a low level, but extension contact was related with adoption at 001 level of probability. It may be concluded that if teaching methods are employed through more rigorous planning, diffusion of potato related innovations in the community concerned would be highly increased.

Data show that most farmers had in 'real sense' no organizational participation. Further, participation was not related to adoption. This relationship might have been due to inadequate variation in the social participation behaviour of the farmer. The logical conclusion is that group dynamics have not been exploited to the desired level for dissemination of research based innovations. However, in the new National Extension Policy of 1996, the DAE has emphasized farmers get organized into group for increased extension message diffusion.

An overwhelming majority of the farmers (96%) had possessed favourable attitude towards improved practices and attitude was related to adoption at 0.01 level of probability. It may be concluded that the extension service of the DAE in the community has been able to work satisfactorily on the persuasion function of communication.

Footnotes :

We distinguish adoption[1] and diffusion[2] in the frame of analysis. Adoption refers to the decision of an individual farmer to use an innovation. However, when the unit of analysis is a social system, we call it diffusion.

[3]In interpreting the values of r, Young and Schmid (1962) hold that if the sample is large with 100 or more cases, a coefficient greater than 0.20 but less than 0.40 means a *low* correlation.

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