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Improved Vegetable Cultivation Practices: An Adoption Study among the Farmers' of Some Selected Areas in Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MMM and MRI designed the study. Authors TM, NM and MMA performed all the statistical analysis. Data collection was done by the authors MMM, TM, NM and MMA. Authors TM, NM and MMA made the rough draft. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2019/v37i230264

Editor(s):

(1) Dr. Kwong Fai Andrew Lo, Professor & Dean, Institute of Earth Science, College of Science, Chinese Culture University, Taipei, Taiwan.

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(3) Hussin Jose Hejase, Al Maaref University, Lebanon.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/52727>

Original Research Article

Received 15 September 2019
Accepted 19 November 2019
Published 05 December 2019

ABSTRACT

The research work has been done to determine the extent of adoption of improved vegetable cultivation practices by the farmers. Attempt was also made to explore the contribution of selected characteristics of farmers viz. age, education, family size, farm size, experience in vegetable cultivation, annual income, vegetable cultivation knowledge, extension media contact, organizational participation, innovativeness, training experiences and problems confrontation on their adoption of improved practices in vegetable cultivation.

It is a Field Survey Research Shajahanpur upazila under Bogra district of Bangladesh by the department of Agricultural Extension and Information System between January to June of 2018.

Data were collected from randomly selected 112 farmers of Chopinagar union under Shajahanpur upazila of Bogra district by using a structured interview schedule. Appropriate scales were

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developed in order to measure the variables. Multiple regression test was used to ascertain the contribution of the concerned independent variables on the dependent variable of the research work.

50% of the farmers had low adoption while 40% had medium adoption and 9.80% had high adoption of improved practices in vegetable cultivation. Among the selected characteristics education, experiences in vegetable cultivation, annual income, innovativeness and training experiences showed significant and positive contribution to their adoption of improved practices in vegetable cultivation. However, family size and problems confrontation showed the negative significant contribution to adoption of improved practices in vegetable cultivation of the farmers. Age, farm size, vegetable cultivation knowledge, extension media contact and organizational participation did not show any significant contribution on the adoption of improved practices in vegetable cultivation of the farmers.

Adoption of improved vegetable cultivation practices by the farmers will not be possible to improve in a significant extent unless the concerned authorities (like-Bangladesh Agricultural Research Institute, Department of Agricultural Extension) take proper steps.

Keywords: *Adaptation; crops; practices; farming; agriculture workers; Bangladesh.*

1. INTRODUCTION

Bangladesh is predominantly an agricultural country. Agriculture remains the major pillars of the Bangladesh national economy and is highly dependent on its rural economy as 80% of the people live in rural areas [1]. Sustained government investment in irrigation facilities, rural infrastructure, agricultural research and extension services has helped Bangladeshi farmers achieve dramatic increases in agricultural production. The process of agricultural production is, however, fortified by the increasing use of agrochemicals and multiple cropping and while significant production transformation has been achieved. Food production has more than doubled since independence in 1971.

The normal diet of the people of Bangladesh is cereal based, particularly rice based. The intake ratio of cereals and vegetables is about 5:1, whereas in many other developing countries it is about 1:2. The traditional food and culture of Bangladeshi people is one of the reasons for such inequity in the consumption of cereals and vegetable. Hence, Vitamin and mineral deficiency diseases are very common in Bangladesh [2]. In Bangladesh, the average per capita daily vegetable intake is 56 g per day, whereas the recommended intake is 250 g/day [3]. Vegetables not only minimize the malnutrition but also maximize the financial returns. Vegetable generate cash to the growers. It helps to reduce dependence on rice. Eating excess rice, which we do in general, is not good from the health point of view.

Most of the agricultural production in Bangladesh is strenuous in rice, occupying about 75 percent

of total cropped areas, whereas only 7 percent of the total cropped land is used for horticultural crops, including root and tuber crops [4]. The area under vegetable cultivation accounts for only 2.56 percent of the total cropped areas. From this small proportion of the cultivable land area, Bangladesh produces about 1.76 lac metric tons of vegetables annually, of which about 65 percent are produced in winter and the rest in summer. Therefore, production is not well distributed throughout the year and produce for domestic use is relatively scarce in the off-season [5]. So there was a gap between supply and demand. Thus, to fulfill farmers consuming and economic demand they are getting more involved in vegetable cultivation along with rice cultivation [6]. The major vegetable growing areas of Bangladesh are Jessore, Bogra, Comilla, Chittagong, Khulna, Kushtia, Dhaka, Tangail, Rangpur, Rajshahi and Dinajpur [7,8].

It is a matter of sorrow that the quality of vegetables intake is very negligible in Bangladesh. Nutrition survey of Bangladesh [9] reported that average intake meets only 80% of Calorie, 58% of Vitamin A, 50% of Riboflavin and 51% of Vitamin C requirements. The Production of vegetables in Bangladesh is so low that per capita/day available is hardly 32 gm whereas the requirement is estimated to 220 gm. This gap is probably one of the main reasons for widespread malnutrition in the country. Vitamin A is not only important to prevent blindness but also has effect on digestion of food, child morbidity and mortality. It is estimated that about 80 percent of the population suffers from Vitamin C deficiency [2]. Being a poor nation, it is difficult to overcome such a big malnutrition problem by eating fish, meat, egg, butter, ghee. But vegetables can play

a very important role to improve the nutritional level of the rural people in the country which is almost entirely overlooked. In other words, problems related to malnutrition can easily be overcome by eating adequate quantity of vegetables, which require some adjustment in the dietary habit and also by increasing per yield of vegetable [10].

The above-mentioned discussion simply indicates the importance of vegetable in our daily life from nutritional point of view. From the economic point of view, vegetables should be cultivated for higher farm income, increasing cropping intensity, improvement of socio-economic condition and protection of environmental pollution, development of healthy and efficient manpower; higher export potentials, reducing import and enhancement of industrialization, employment generation, and less consumption of cereals, which leads to overcome food shortage. According to Agricultural Marketing Department, Bangladesh earned Tk. 31 core by exporting 8 thousand tons of vegetable [10]. Adoption of improved practices of an individual on certain aspects serves as a driving force for constant efforts on certain perceived action. Unless the farmers of Bangladesh have sufficient knowledge about improved vegetable cultivation practices it would be practically impossible to develop its full potential in Bangladesh. Considering the above fact, it is necessary to undertake a study to determine the adoption of improved vegetable cultivation practices by the farmers.

The main purpose of the study was to have an understanding of the adoption of improved vegetable cultivation practices and problems confrontation by the farmers in vegetable cultivation. In order to explore the main issue, this study attempts to find out the answers of the following research questions: (a) What is the extent of adoption of improved vegetable cultivation practices? (b) What are the characteristics of the farmers who cultivate vegetables? (c) What is the contribution on the selected characteristics of the farmers to adopt improved vegetable cultivation practices?

2. MATERIALS AND METHODS

2.1 Location, Population and Sample Size

The study was conducted in Shajahanpur Upazila of Bogra District. The site was

purposely selected for the study, as this is one of the major vegetables producing area of Bangladesh. Bogra district consists of twelve upazilas and nine union. Here vegetables such as tomato, brinjal, country bean, chilli, cabbage etc. are growing. Out of nine union of Shajahanpur Upazila, Chopinagar union was randomly selected and two villages Shahnagar and Bihigram were randomly selected out of twelve villages of Chopinagar union.

One farmer from each of the vegetable producing families was considered as the respondent. The total number of respondents under the study area was 199. Sub Assistant Agriculture Officers (SAAO) of Shajahanpur Upazila helped to create list of the respondents. There are several methods for determining the sample size; here, Yamane's [11] formula was used to make appropriate sample size for the study. The formula is-

$$n = \frac{z^2 P (1-P) N}{z^2 P (1-P) + N (e)^2} \quad (1)$$

where,

n = Sample size;
N = Population size = 199;
e = the level of precision = 8%;
z = the value of the standard normal variable given the chosen confidence level = 2.57 (with a confidence level of 99%)
p = the proportion or degree of variability = 50%

By using this formula 112 vegetable farmers were selected proportionately and randomly as the sample of the study. For the purpose of data collection, a structured interview schedule was used. Both open and closed form questions were designed to obtain information relating to qualitative variable. For selection of independent variables, the researcher went through past related literature as far as available, discussed with the supervisors and experts in the relevant fields. Then prepared interview schedule was pre-tested with 13 sample respondents from the study area. After making necessary correction on the basis of pre-test, data were collected through personal interviewing by the researcher herself. The data collection took 23 days from 6th March to 4th April, 2018. Data collected from the respondents, were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20.



Fig. 1. The map of Bangladesh showing (red circled) Bogra district



Fig. 2. The map of Bogra district showing (red circled) the study area

2.2 Estimation of the Adoption of Improved Vegetable Cultivation Practices

Adoption was measured by using 5-point scale. Based on available literature on the selection of potato production technologies [12,13,14], field visit and discussion with resource of Department of Agricultural Extension (DAE) the researcher selected 15 improved vegetable cultivation recommended practices for studying. The recommended practices were (i) Use of balanced fertilizer, (ii) Cultivation of Disease resistant variety, (iii) Cultivation of high yielding variety, (iv) Use of quality seed, (v) Use of rouging, (vi) Use of mulching, (vii) Use of light trap to protect vegetables from insect, (viii) Use of pesticides, (ix) Use of proper spacing, (x) Use of shallow tube well for irrigation, (xi) Fertilizer application methods, (xii) Fertilizer dose (xiii) Pruning of vegetables (xiv) Proper harvesting time and method (xv) Use of crop rotation.

The respondents were asked to indicate their adoption of 15 improved vegetable cultivation practices with five options: 'Regularly', 'Frequently', 'Occasionally', 'Rarely' and 'Not at all'. The scores were assigned as 4,3,2,1 and 0 respectively. The extent of adoption scores of a respondent was measured by summing up all score of 15 selected improved practices of vegetables. Thus, the possible extent of adoption scores of a respondent could range from 0 to 60, 0 indicating no adoption of improved practices and 60 indicate the highest adoption of improved vegetable cultivation practices.

2.3 Estimation of the Socio-economic Profile of the Respondent

Age of a respondent was measured by counting the years from his birth to the time of interview. Education of a respondent was measured in terms of classes passed by his/her formal education system. The family size was measured by the total number of members in the family of a respondent. Farm size of the respondent was measured as the size of his farm (including vegetable and other crops) on which he continued his farm practices during the period of study. Each respondent was asked to mention the homestead area, the area of land under his own cultivation, own land given to others on barga system, land taken from others on barga system, and land taken from others on lease system. The area was estimated in terms of full benefit to the farmers or his family. Vegetable

cultivation experience measurement included from the year of starting of first vegetables cultivation till the year of data collection. A score of one (1) was assigned for each year of experience. Annual family income of a respondent was measured on the basis of total yearly earning from agricultural and non-agricultural sources (business, service etc.) earned by the respondent himself and other family members. To measure the vegetable cultivation knowledge of a respondent a 17-items questions was constructed in the interview schedule. Each question was assigned 2 score. Practical score was given for practically correct answer. So correct answer of 17 questions supposed to obtain 34 marks. Wrong answer was assigned zero. So a respondent could get zero if he/she answer wrong all the 17 questions. The possible score of vegetable cultivation score range from 0-34. The extension media contact of a respondent was measured by computing an extension contact score on the basis of his/her extension contact with seventeen (17) selected extension media. Respondents mentioned the nature of his/her contact by putting a tick mark against any one of the four responses -not at all, rarely, frequently and regularly. The score for each respondent was determined by adding his/her response to all the items on the basis of his/her frequency of contact with a score of 0, 1, 2 and 3 respectively. The extension media contact score of the respondents could range from 0 to 51, where 0 indicating no extension media contact and 51 indicating very high extension media contact. Organizational participation of a respondent was measured by his/her nature of membership in different organizations for a particular period of time. This was measured by participation of a respondent in an organization. Different weights were assigned as 0, 1, 2 and 3 for no participation, ordinary member, executive member and president/ secretary respectively. Innovativeness of a respondent was measured on the basis of the earlier or later adoption of 16 improved agricultural practices. The scores were assigned on the basis of time required by an individual to adopt each of the practices. Innovativeness score of a respondent farmer was obtained by adding his/her scores for adoption of all the 16 selected improved agricultural practices. Innovativeness score of a respondent farmer could range from 0 to 64, where, 0 indicating no innovativeness and 64 indicating very high innovativeness. Training experiences was measured by the total number of days of a respondent participated different training

program from different organizations. A score of one (1) was assigned for each day of training attended. To measure problem confrontation of the respondents in adoption of improved practices in vegetable cultivation a 4-point rating scale was developed and designed with 4 kinds of responses namely high, medium, low and not at all problem confrontation and, the corresponding scores assigned for each kind of response were 3, 2, 1 and 0 respectively. Score of problem of a respondent in 24 items could range from 0 to 72, where 0 (zero) indicates no problem confrontation of the respondent in respect of vegetable cultivation and 72 indicate serious problem confrontation.

3. RESULTS AND DISCUSSION

3.1 Adoption of Improved Vegetable Cultivation Practices

Adoption of improved vegetable cultivation score of the respondent farmers ranged from 12 to 46 against possible range 0-60 with a mean and standard deviation of 21.63 and 14.664, respectively. According to adoption of improved vegetable cultivation score of the respondents, they were classified into three categories viz. 'low adoption (1-20)', 'medium adoption (21-40)' and 'high adoption (above 40)'. On the basis of their observed scores and the distribution has been presented in Table 1.

Table 1 indicates that the low adoption experience constitutes the highest proportion (50.00%) followed by medium adoption (40.20%) and high adoption (9.80%). Results revealed that the maximum percentage of respondents was in the category of low to medium adoption (90.20%). Adoption is the measurement of implementation by the farmers as well as vital indicator of agricultural development. It is a continuous process due to change of social system, change of technologies, change of human behavior, change of cropping patterns, change of adoption patterns etc. So, it is suggested that there should be continuous

adoption research in various aspects for agricultural development.

3.2 Variables Contributed to Adoption of Improved Vegetable Cultivation Practices

In order to estimate the adoption of improved vegetable cultivation practices, multiple regression analysis was used which is shown in the Table 2.

The data in Table 2 test the final null hypothesis: There is contribution of the selected characteristics (education, family size, experience in vegetable cultivation, annual income, innovativeness, training experiences and problems confronted in adoption of improved vegetable cultivation practices) of farmers in adoption of improved vegetable cultivation practices.

In order to assess which factors, contribute to adoption of improved vegetable cultivation practices, multiple regression analysis was used. Table 2 shows that education, training experience and problems confronted in adoption of improved vegetable cultivation practices were the most important contributing factors (statistical significance: At the 1% level of significance). Family size, experience in vegetable cultivation, annual income, innovativeness were also the important contributing factors (statistical significance: At the 5% level of significance) while age, farm size, vegetable cultivation knowledge, extension media contact and organizational participation had no significant contribution on the adoption of improved vegetable cultivation practices.

38.3% ($R^2 = 0.383$) of the variation in the respondents' changed adoption can be attributed to their education, family size, experience in vegetable cultivation, annual income, training experiences, innovativeness and problems confronted in adoption of improved vegetable cultivation practices making this an excellent model (Table 2). The F value indicates that the model is significant ($p < 0.003$).

Table 1. Distribution of the respondents according to their adoption of improved vegetable cultivation practices

Categories (score)	Respondents number	Percent	Mean	Standard deviation
Low adoption (1-20)	56	50.00	21.63	14.664
Medium adoption (21-40)	45	40.20		
High adoption (above 40)	11	9.80		
Total	112	100		

Table 2. Multiple regression coefficients of contributing variables related to adoption of improved vegetable cultivation practices

Dependent variable	Independent variables	β	p	R^2	Adj. R^2	F	p
Adoption of improved vegetable cultivation practices	Age	-0.004	-0.064 ^{NS}	0.383	0.342	1.838	0.003***
	Education	0.011	0.009**				
	Family size	-0.004	-0.014*				
	Farm size	-0.084	-0.096 ^{NS}				
	Experience in vegetable cultivation	0.013	0.018*				
	Annual income	0.007	0.035*				
	Vegetable cultivation knowledge	0.012	0.079 ^{NS}				
	Extension media contact	-0.049	-0.051 ^{NS}				
	Organizational participation	0.217	0.150 ^{NS}				
	Innovativeness	0.001	0.011*				
	Training experience	0.001	0.004**				
	Problem confrontation in adoption of improved vegetable practices	-0.016	-0.008**				

** Significant at $p < 0.01$; * Significant at $p < 0.05$; NS = Non-significant

However, each predictor may explain some of the variance in respondents' adoption conditions simply by chance. The adjusted R-square value penalizes the addition of extraneous predictors in the model, but values of 0.342 still show that the variance in respondents' participation can be attributed to the predictor variables rather than by chance, and that both are suitable models (Table 2). In summary, the models suggest that the respective authority should consider the respondents' education, family size, experience in vegetable cultivation, annual income, training experiences, innovativeness and problems confrontation; in adoption of improved vegetable cultivation practices.

4. CONCLUSION

The findings of the study revealed that 50% of the farmers had low adoption of improved vegetable cultivation practices. These facts lead to conclude that farmers had not a satisfactory level of adoption of improved vegetable cultivation practices. But for the increasing need of vegetables, farmers should adopt improved vegetable cultivation practices through different GOs and NGOs to enhance production. Education, experience in vegetable cultivation, annual income, innovativeness, training experience had significant positive contribution to their adoption of improved vegetable cultivation practices. So, it may be concluded that more the education, experience in vegetable cultivation,

annual income, innovativeness and training experiences of the farmer, more their adoption of improved vegetable cultivation practices. And result also indicating that family size and problem confrontation in adoption of improved vegetable practice of the farmers had negative significant contribution on their adoption of improved vegetable cultivation practices. According to research's findings age, farm size, vegetable cultivation knowledge, extension media contact, organizational participation had no significant contribution on the adoption of improved practices in vegetable cultivation. But this variable may influence on the adoption of improved practices in vegetable cultivation.

Based on the discussions and conclusions of the study, it's been recommended that the level of adoption of improved practices of vegetable cultivation was not so encouraging and under this condition, farmers need to adopt all the available vegetable cultivation practices to a greater extent for increasing the yield of vegetables. Furthermore, the present study which mainly highlights some aspects of particular dimensions (adoption of improved practices of vegetable cultivation) of agricultural development. So, it is suggested that concerned agencies should undertake further studies in order to have a deeper insight into the various aspects of the adoption of technologies as well as agricultural development.

ACKNOWLEDGEMENTS

Authors would like to express special thanks of gratitude to the Chairman of the Dept. of Agricultural Extension and Information System for the endless support and guidance on the research work. Authors would like to extend the gratitude to the Pro-vice Chancellor for sanctioning vehicles during data collection.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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