Asian J. Med. Biol. Res. 2015, 1 (2), 367-379; doi: 10.3329/ajmbr.v1i2.25631

Asian Journal of Medical and Biological Research
ISSN 2411-4472 (Print) 2412-5571 (Online)
www.ebupress.com/journal/ajmbr

Article

Attitude of the farmers towards climate change effect on agriculture

Md. Rakibul Islam[1], Md. Jamil Hossain Biswas[2]*, Md. Golam Rabbani Akanda[1], Md. Ruhul Amin[3], Imam Mehedi Hasan[4], Abdulla-Al-Asif [5], S. Sheheli [6] and B.M. Newaz Sharif [5]

[1]Department of Agricultural Extension and Rural Development, Faculty of Agriculture, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh
[2]Department of Entomology, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[3]Department of Soil Science, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[4]Department of Plant Pathology, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[5]Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[6]Department of Agricultural Extension Education, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

*Corresponding author: Md. Jamil Hossain Biswas, Department of Entomology, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh. Mobile: +8801717592762; E-mail: jamil.pstu@gmail.com

Received: 10 August 2015/Accepted: 15 September 2015/ Published: 30 September 2015

Abstract: Global climate change has triggered the increased incidence of extreme disasters like cyclone, flood, soil salinity, etc. in the coastal region of Bangladesh. In the recent past, an amplified number of fatalities happened and the greater impact also acted upon the attitude of coastal people. Badarpur Union under Patuakhali Sadar upazila of Patuakhali District was the selected locale of the concerned study. Data for this research work were personally collected from a randomly sampled 121 farmers from different villages of Badarpur union by using an interview schedule. Attitude of the farmers was ascertained through a five-point-Likert type scale. Co-efficient of correlation (r) was computed to explore the relationships between farmers' attitude and their selected characteristics. The findings revealed that 51.2 percent of the farmers had moderately favourable attitude towards climate change effect while 42.1 percent had slightly favourable and 6.6 percent had highly favourable attitude. The correlation test showed that the education, farming experience, farm size, annual income, training received and agricultural knowledge had positive significant relationships with farmers' attitude towards climate change effect on agriculture while the rest of the characteristics had no relationship in the present study. The focus findings of the present study were that, the attitude of the farmers is changing due to changes in the climatic conditions and there was a positive effect of it on agriculture.

Keywords: farmers; attitude; climate change; effect; agriculture

1. Introduction

Climate change is a phenomenon induced by global warming. It is a topical issue affecting every facet of the world. Developing countries such as Bangladesh are subjected to the catastrophic effects of climate change. Bangladesh is situated at the interface of two contrasting setting with the Bay of Bengal and the North Indian

Ocean to the South and the Himalayas to North. The disadvantageous geographical location, low and almost flat topography, very high population density, high levels of poverty, reliance of many livelihoods on climate sensitive sectors, particularly crop agriculture and fisheries etc. have made the country one of the most vulnerable countries of the world to be affected by the impact of climate change. Climatologists recognized Bangladesh as the most vulnerable in terms of cyclone and 6th most vulnerable in terms of floods (UNDP, 2011). Bangladesh has 80% flat land and 20% land that is 1 meter above or less above sea level. The impacts of climate change on agriculture are global concern but for Bangladesh, where lives and livelihoods depend mainly on agriculture, are exposed to a great danger. Climate change and agriculture have tremendous effects on each other. Climate change has been manifested in different forms such as rise in temperature, melting snow in the mountain of polar region, sea level rise, excess floods and drought conditions, change in the natural behaviours of seasons. These changes have been manmade and mostly due to burning of fossil fuels, emission of CO_2 gases from the greenhouse, over exploitation of resources and destruction of forest and consequently depletion of ozone layers (Wahab and Islam, 2009). There is growing evidence that climate change is increasing the frequency and intensity of climate-related hazards and hence, the level and patterns of often inter-related risks are exacerbating the levels of vulnerability for poor and excluded people. Climate change also threatens the long-term capacity for food production through increased soil erosion and reduced soil fertility (Lal *et al.*, 2011). The certainty of increased need for food to feed a burgeoning global population and the uncertainty of the short-term and long-term impacts of climate change on agriculture combines to make efforts to enhance the resilience of agricultural systems a top societal priority (IFPRI, 2010).The recognition that climate-change related threats to agriculture also represent threats to quality of life on a global scale has led to an increasing amount of attention to adaptation and mitigation strategies for agriculture (Howden *et al.*, 2007; McCarl, 2010). Coastal Bangladesh is particularly vulnerable to sea level rise as 12 out of 19 districts are directly exposed to the sea (Akter, 2009). There are many reasons behind that such as lower crop productivity and less cropping intensity due to increased salinity, increased incidences of pests & diseases, erratic rainfall, higher temperature, drought, tidal surges, cyclone, submergence, large fallow lands/water bodies, land degradation, poor road network, poor marketing facilities and unemployment with long-term cumulative effects of soil-related constraints, and socio-economic problems. But these areas are lagging behind in socio-economic development and vulnerable to different natural disasters and environmental degradation. So, coastal areas of Bangladesh are one of the most affected areas in the world due to the threats of climate change effects. In Bangladesh Noakhali, Bhola, Bagerhat, Patuakhali, Satkhira and southern portion of Khulna districts are the main affected coastal areas by the climate change. The coastal region covers almost 29,000 sq. km or about 20% of the country and more than 30% of the cultivable lands of the country. About 53% of the coastal areas are affected by salinity. Agricultural land use in these areas is very poor, which is much lower than country's average cropping intensity. Salinity causes unfavorable environment and hydrological situation that restrict the normal crop production throughout the year. The dominant crop grown in the coastal region is local transplanted aman rice crop with low yields. The cropping patterns followed in the coastal areas are mainly Fallow-Fallow-Transplanted aman rice. IPCC estimates predict that due to the impact of climate change, sea level in Bangladesh may rise by 14 cm by 2025, 32 cm by 2050 and 88 cm by 2100. Salinity is a current problem, which is expected to exacerbate by climate change and sea level rise. Salinity intrusion due to reduction of freshwater flow from upstream, salinization of groundwater and fluctuation of soil salinity are major concern of Bangladesh. Cyclones and tidal surge are adding to the problem. Tidal surge brings saline water inside the coastal area. In Bangladesh, rice production may fall by 10% and wheat by 30% by 2050 (IPCC, 2007). Therefore, climate change is expected to have serious impacts on the environment, economy and social life of people, especially on the rural farmers whose livelihoods depend largely on agricultural activities. Although Bangladesh has made some efforts to adapt and mitigate climate change risks, the efforts are still rudimentary especially when compared with the impending catastrophe. Hence, the pertinent questions that guided this research work are: what are the perceived causes of climate change in southern Bangladesh; what are the constraints being faced by farmers in adapting to the effects of the changing climate; and what type of attitudes show by farmer in the study area in changing condition of climate. Farmer attitudes toward climate change must be understood if climatologists, scientists, policymakers, and others are to effectively support adaptive and mitigated actions in agriculture. While many recognize that it is important to understand farmer attitudes toward responses to climate change, very little research effort has been focused on this area (Barnes and Toma, 2011). A critical part of this puzzle is perceived vulnerability. As Howden *et al*. (2007) emphasize, if farmers (1) do not believe that climate change is occurring and/or (2) do not perceive it to be a threat to their livelihoods, they will not likely act to adapt to or mitigate climate change. They maintain that farmers' attitudes about the impacts of climate change are key to

successful adaptation and mitigation. This paper presents an analysis of the complex relationships between farmer attitudes about climate change and different characters of farmers. This research assesses farmer attitudes toward climate change effect on agriculture. The 2008 extreme rain events and flood in Bangladesh and the US Midwest, the 2010 heat and drought in Russia, and the 2010 floods in Pakistan are recent examples of weather related disruption of agriculture that led to extraordinary impacts on global food prices and food insecurity for millions of people (IFPRI, 2010). Food production is vulnerable to climate shifts because crops and cropping system are adapted to local conditions: slight alteration such as temperature fluctuations at critical points in crop development has substantial impacts on productivity (Hatfield *et al.*, 2011). It is essential to identify the attitude of farmers towards climate change effect and create awareness for sustainability. This cannot be done effectively without any evidence. Research on attitude of the farmers in adapting climate change effect will therefore promote evidence-based advocacy. By knowing the level of attitude of farmers' in adapting climate change effect the vulnerability to climate change will be minimized. This paper presents an analysis of the complex relationships between farmer attitudes about climate change and different characters of farmers. This research assesses farmer attitudes toward climate change effect on agriculture.

2. Materials and Methods

2.1. Location of the study

The present research work was conducted in Southern portion of Bangladesh which fallen to the Patuakhali sadar upazila under Patuakhali district was an interior coastal region of the country. As per information provided by the Upazila Agriculture Officer of this upazila, the attitude of the farmers of this upazila has been changed due to effect of climate change on agriculture. The upazila locates on the central part of the district. The upazila has a population of about 322713 consisting 51450 farmers household. Among the whole population 163535 was male and 159178 female. A main source of income of this larger population is agriculture (44.45%).The other source of incomes are non-agricultural laborer 6.15%, industry 1.02%, commerce 16%, transport and communication 3.15%, service 13.55%, construction 2.76%, religious service 0.35%, rent and remittance 0.90% and others 10.68%.The reason behind selection of the upazila was the fact that this upazila situated in interior coastal region which is naturally lowland. A map of Patuakhali Sadar upazila showing the study area have been presented in Figure 1.

Figure 1. Map of Patuakhali Sadar upazila.

2.2. Sampling design

Patuakhali sadar upazila was selected purposively among the 8 upazila under Patuakhali district. The Upazila consists of 13 unions, among which one union namely Badarpur was selected randomly. There are 9 villages in Badarpur union. From those 5 villages were selected randomly. From these villages landless and absentee farmers were discarded from the list with the help of SAAOs. Thus the sample population was 1206. Then 10 percent of the sample population from each village was selected separately as the sample of the study by simple random sampling procedure. Thus the sample size was 121.

Table 1. Distribution of population and sampling of the selected farmers.

Upazila	Union	Village	Population	Sample
Patuakhali Sadar	Badarpur	Gabua	229	23
		Badarpur	218	22
		Kholishakhali	230	23
		Shiali	305	31
		Telikhali	224	22
		Total	1206	121

2.3. Selection of variables

Before setting the variables of the study, the researcher himself visited the study area and talked to the farmers. Based on his experiences, review of related literature and consultation with the research supervisor, the researcher selected ten characteristics of the farmer as independent variables. These included: Age, Education, Farming experience, Farm size, annual income, Training received, Communication exposure, Cosmopoliteness, Agricultural knowledge and Fatalism. Attitude of the farmers towards climate change effect on agriculture was the dependent variable of this study.

2.3.1. Measurement of independent variables

2.3.1.1. Age

The age of a respondent was measured in terms of actual years from his birth to the time of interview on the basis of farmers' statement. A score of one (1) was assigned for each year of his age.

2.3.1.2. Education

Education of a respondent was measured by the years of schooling completed as indicated by him to item 2 of the interview schedule. A score of one (1) was assigned for his each year of schooling completed. If a respondent did not know how to read and write, his education score was taken as zero (0). If the respondent could not go to school but his level of educational standard may equal to any class than he got one for each class. 1 for class one, 2 for classes two and so on.

2.3.1.3. Farming experience

The farming experience of a respondent was measured in terms of actual years of experience. A score of one (1) was assigned for his each year of experience.

3.3.1.4. Farm size

The farm size of the respondents was computed in hectares. Question on this variable may be seen in item 4 in the interview schedule. It was measured by using following formula**:**

Farm size =A+B+C+D+E+F+G

Where,

A=Homestead area

B=Land under own cultivation

C=Land taken from other on mortgage

D= Land given to other on mortgage

E= Land taken from other on borga

F= Land given to other on borga

G= Land taken from other on lease

2.3.1.5. Annual income

Annual income of a respondent was measured by computing an "Annual Income Score" on the basis of total yearly earnings Taka from agriculture and other sources and other members of his family as provided in response to the interview. They were asked to indicate the total earnings of his family from crop production, livestock rearing, poultry rising, fish culture, services, business, labor and other sources. The earnings from these sources were added together for computation of annual income score. A score of one (1) was assigned for each one thousand Taka.

2.3.1.6. Training received

Training experience of a respondent was determined by computing a 'training experience score' on the basis of his total number of days for which he received training on various subject matters related to farming during his farming life.

2.3.1.7. Communication exposure

In present study, communication exposure score was computed for each respondent on the basis of his extent of contact with 20 selected extension media as ascertained from their responses to the question. In the interview schedule the items of extension contact was about sub assistant agriculture officer (per 3 month), upazilla agriculture officer (per 6 month), neighbor (per month), friends (per month), relatives (per month), experienced farmers (per month), ideal farmers (per month), agricultural input dealer (per 3 month), NGO worker (s) (per 3 month), participation in group discussion (per year), result demonstration (per 6 month), participation in method demonstration (per week), newspaper (per week), agricultural posters (per 6 month), agricultural leaflets (per year), agricultural leaflets (per year), agricultural booklets (per years), agricultural magazines (per year), agricultural fairs (per year), listening agricultural program in radio (per month), watching agricultural program in television (per month). Communication exposure score was determined by summing the scores of all the 20 communication media. Communication exposure score could range from 0 to 80, where zero (0) indicated no and 80 indicated the highest media contact. The scoring and nature of extension is given in the Figure 2.

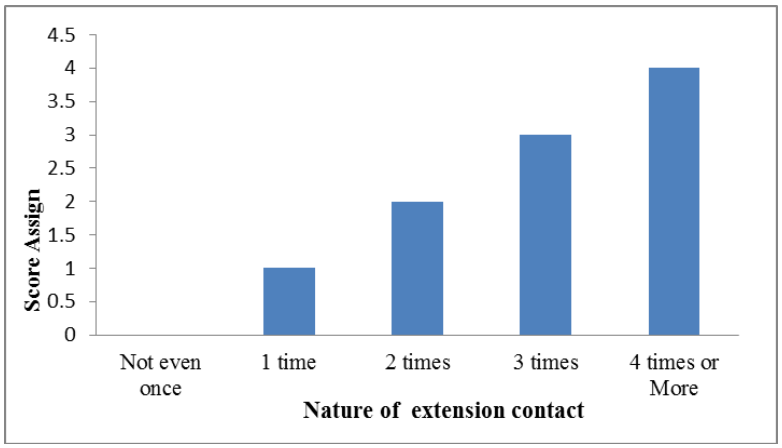

Figure 2. The scoring and nature of extension.

2.3.1.8. Cosmopoliteness

In this study, Cosmopoliteness score was computed for each respondent on the basis of their extent of contact with 6 selected cosmopolite sources as ascertained from his responses to question in the interview schedule. In the interview schedule the items of extension contact was Other union(per month), Own upazila (per year), Other upazila (per year), Own Districts (per year), Other Districts (per year), Capital (In life). Cosmopoliteness score was determined by summing the scores of all the 6 items of contact. Cosmopoliteness could range from 0 to 24, where zero (0) indicated no cosmopoliteness and 24 indicated the highest cosmopoliteness. The scoring and nature of extension is given in the Figure 2.

2.3.1.9. Agricultural knowledge

Score 2 was assigned for each of the questions. The total assigned score of all the questions was 40. If a

respondent was able to provide a correct answer to a question, he could receive full score for that particular question. Accordingly, a respondent could receive zero (0) for wrong answer.

2.3.1.10. Fatalism

Fatalism was measured by using ten (10) statements shown in the item no.10 in the interview schedule. If a farmer fully agrees with the positive statement as stated by the interviewer, he or she got full marks that were 5. If he not agree at all with the statement got zero (0) marks. It is reversed in negative statements. Finally the number obtained by the respondent for each question was added and made a total score. The scoring system in details shown in Figure 3.

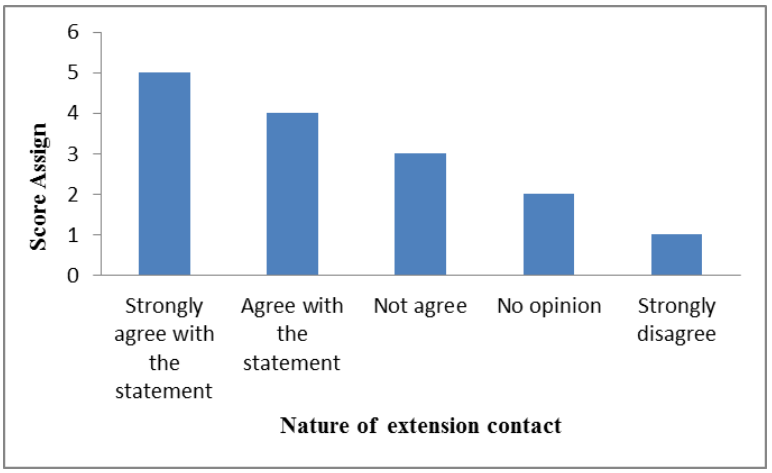

Figure 3. The scoring system.

2.3.2. Measurement of dependent variables

2.3.2.1. Attitude of the farmers' towards climate change effects on agriculture

A-five point rating scale ranging from "fully agree" to "not at all" was developed to measure the attitude of the farmers' towards climate change effects on agriculture. The attitude of the farmers' towards climate change effects on agriculture was computed by adding all scores obtained from 20 statements of climate change observed by the respondents. The attitude of farmers towards climate change ranged from 20 to 100 where 20 indicating unfavorable attitude towards climate change and 100 indicating favorable attitude.

2.4. Statement of hypotheses

The following hypotheses were formulated to explore the relationships between the dependent and independent variables. The research hypothesis for this study was: "There is a relationship between each of age, education, farming experience, farm size, annual income, training received, communication exposure, cosmopoliteness, agricultural knowledge and fatalism and their attitude towards climate change effect on agriculture ".

2.5. Research instrument for data collection

In order to collect valid and reliable information from the farmers, an interview schedule was prepared carefully keeping the objectives of the study in mind. The questions and statements content in the schedule were simple, direct and easily understandable by the farmers without giving rise to any doubt and misunderstanding in their mind. Some minor corrections, additions and alterations were made in the schedule based on pre-test experiences. The schedule was then multiplied in its final form for the collection of data.

2.6. Collection of data

Secondary information was collected from the agriculture office records and union parishad records. Primary data were collected from the farmers. The researcher conducted survey using the pretested interview schedule in the study area from 25 June to 15 September, 2014.

2.7. Data processing and statistical tests

Qualitative data were converted to quantitative one whenever necessary. Data obtained, from the respondents were first put to a master sheet then compiled, tabulated and analyzed in accordance with the objectives of the

study. For clarity of understanding, tables were used in presenting data. For exploring the relationship between each of the selected characteristics of the farmers with their problem in adapting climate change effect on crop production, Pearson's Product Moment Coefficients of Correlation (r) was used.

3. Results and Discussion

3.1. Selected characteristics of the farmers

3.1.1. Age

The respondent's age ranged from 26-70 years. The mean being 46.18 and the standard deviation is 12.81. Based on their age, Farmers were classified into four categories namely, young (<35), middle aged (35-45), aged (46-55) and old (56 and above) as shown in Table 2. Data presented in Table 4.1 suggest that the highest proportion of 33.9% of the farmers were middle aged ranging from 36 to 45 years of age. About 27.3% of the respondents however belonged to old category. About 23.1% of the study population was young. The findings indicate that most of the farmers involved in agriculture are from middle aged. Age distribution of the farmer is given in Table 2.

Table 2. Distribution of the farmers according to their age.

Category	Frequency	Percentage	Observed Range (Years)	Mean	SD
Young	28	23.1			
Middle aged	41	33.9			
Aged	19	15.7			
Old	33	27.3			
Total	121	100	26-70	46.181	12.816

3.1.2. Education

Based on the respondents education scores, they were classified into six categories namely illiterate (0), up to PSC (0-5), up to JSC (6-8), up to SSC, up to HSC, and Up to higher degree as shown in Table 3. The average academic qualification scores of the respondents were 5.19 with a standard deviation of 4.323. Most of the respondents had education up to Primary School Certificate (PSC). Only 7.4 % of the population has higher level of education and about 14% of the farmers have no education.

Table 3. Distribution of the farmers according to their level of education.

Category	Frequency	Percentage	Observed Range (Years of schooling)	Mean	SD
Illiterate	17	14.0			
Up to PSC	63	52.1			
Up to JSC	17	14.0			
Up to SSC	13	10.7			
Up to HSC	2	1.7			
Up to Higher degree	9	7.4	0-16	5.19	4.323
Total	121	100			

3.1.3. Farming experiences

Farming experiences were ranged from 4-45 having a mean of 15.5 with 8.75 standard deviation. Farming experiences were grouped into four categories in terms of years of experiences, such as very low (<10 years), low (10-20 years), medium (20-30 years) and high (>30 years). About 38% of the farmers have farming experiences of very low and same percentage of the farmers of the study has a farming experience of low. Only 5.8% of the farmers have farming experiences of high level. Farming experiences of the farmer is given in Table 4.

Table 4. Distribution of the farmers according to their farming experience.

Category	Frequency	Percentage	Observed Range(Years)	Mean	SD
Very Low	46	38.0	4-45	15.495	8.756
Low	46	38.0			
Medium	22	18.2			
High	7	5.8			
Total	121	100			

3.1.4. Farm size

The farm size of the respondents varied from 0.21 to 3.89 hectares while their average farm size was 0.807 hectares with a standard deviation of 0.48 (Table 5). Farm size of the respondents was grouped into four categories, viz. Marginal size (<0.5 ha), small size (0.5-1 ha), medium size (1-1.5 ha) and large size (>1.5ha). Though the variation among the farmers regarding farm size was high, a significant proportion (62 percent) of them had small farm size, whereas 18.2 percent had marginal, 14 percent medium, and 5.8 percent had large farm size. In rural Bangladesh, the family type is mostly nuclear. Therefore, most (80.2 percent) of the respondents were marginal to small farmers.

Table 5. Distribution of the farmers according to their farm size.

Category	Frequency	Percentage	Observed Range (ha)	Mean	SD
Marginal	22	18.2	0.21-3.89	0.8074	0.4845
Small	75	62.0			
Medium	17	14.0			
Large	7	5.8			
Total	121	100			

3.1.5. Annual income

Annual family income of the farmers varied from Taka 42.1 to 237.1 thousand (Bangladeshi currency) and their average family income was Taka 89.83 thousand with a standard deviation of 30.18 (Table 6). About 41.3 percent of the respondents had low annual family income, while 17.4 and 11.6 percent of them had medium and high annual family income, respectively. Among the respondents about 29.8 percent were very poor. Annual income of the farmer is given in Table 6.

Table 6. Distribution of the farmers according to their annual income.

Category	Frequency	Percentage	Observed Range ('000' tk)	Mean	SD
Very low	36	29.8	0.21-3.89	89.838	30.181
Low	50	41.3			
Medium	21	17.4			
High	14	11.6			
Total	121	100			

3.1.6. Training received

Training experience of the respondents ranged from 0 to 6 days with a mean of 0.87 having a standard deviation of 1.56 (Table 7). The majority (71.9%) of the respondents had no training experience, while, about 17.4% had short training experience.

3.1.7. Communication exposure

The communication exposure score of the respondents ranged from 9 to 57, with an average of 22.64 and standard deviation of 8.87. On the basis of their communication exposure, the farmers were classified into three categories as low, medium and high are presented in Table 8. Data contained in Table 8 indicate that 66.1 percent of the farmers had low communication exposure compared with 24.8 percent having medium communication exposure and 9.1 percent having high exposure.

Table 7. Distribution of the farmers according to their training received.

Category	Frequency	Percentage	Observed Range (ha)	Mean	SD
No Training Receive	87	71.9	0-6	0.876	1.557
Short Training Receive	21	17.4			
Medium Training Receive	12	9.9			
Long Training Receive	1	8			
Total	121	100			

Table 8. Distribution of the farmers according to their communication exposure.

Category	Frequency	Percentage	Range	Mean	SD
Low	80	66.1	9-57	22.644	8.871
Medium	30	24.8			
High	11	9.1			
Total	121	100			

3.1.8. Cosmopoliteness

The cosmopoliteness scores of respondents ranged from 6 to 21. The mean was 13.52 and standard deviation 3.75. Based on the obtained cosmopoliteness scores, the respondents were classified into three categories as shown in Table 9. Data showed that 42.1% of the respondents had medium cosmopolitans compared to (33.1%) high and (24.8%) low cosmopoliteness.

Table 9. Distribution of the farmers according to their cosmopoliteness.

Category	Frequency	Percentage	Range	Mean	SD
Low	30	24.8	6-21	13.52	3.7485
Medium	51	42.1			
High	40	33.1			
Total	121	100			

3.1.9. Agricultural knowledge

The scores of knowledge on agriculture of the respondents ranged from 12 to 28, with an average of 20.363 and standard deviation of 3.57. On the basis of their scores, the farmers were classified into three categories as low (<15), medium (15-20) and high (>20) are presented in Table 10. Data contained in Table 10 indicate that 47.1 percent of the farmers had medium knowledge on agriculture and climate change and livelihood compared with 45.5 percent having high knowledge and 7.4 percent had low knowledge on agriculture and climate change as well as livelihood.

Table 10. Distribution of the farmers according to their agricultural knowledge.

Category	Frequency	Percentage	Range	Mean	SD
Low	9	7.4	12-28	20.363	3.577
Medium	57	47.1			
High	55	45.5			
Total	121	100			

3.1.10. Fatalism

This selected characteristics solely depends on fate were ranged from 18-38 as scale score with 30.14 mean and 4.78 standard deviation. Depending on farmers believes respondents were classified into three categories as in Table 11. About 81 % of the respondents were highly depends on their fate other than performance, which is one of their superstition. 15.7 percent of farmers moderately depend on their fate and 3.3 percent dependent on their fate poorly.

Table 11. Distribution of the farmers according to their fatalism.

Category	Frequency	Percentage	Range	Mean	SD
Low	4	3.3	18-38	30.14	4.789
Medium	19	15.7			
High	98	81.0			
Total	121	100			

3.2. Attitude of farmers towards climate change effect

The attitude of farmers on climate change scores of respondents ranged from 55 to 69. The mean was 60.82 and standard deviation 3.17. Based on the obtained attitude scores, the respondents were classified into three categories as shown in Table 12. Data showed that 51.2% of the respondents had moderately favorable attitude compared to (42.1%) unfavorable and (6.6%) favorable attitude to climate change.

Table 12. Attitude of farmers towards climate change and their distribution.

Category	Frequency	Percentage	Observed Range	Mean	SD
Unfavorable	51	42.1	55-69	60.826	3.166
Moderately Favorable	62	51.2			
Favorable	8	6.6			
Total	121	100			

3.3. Relationships between the independent and dependent variable

This section deals with the findings exploring the relationships between the selected independent and dependent variables of the study. The independent variables were Age, Education, Farming experience, Farm size, Annual income, Training received, Communication exposure, Cosmopoliteness, Agricultural knowledge and Fatalism. The dependent variable was "Attitude of the Farmers towards Climate Change Effect on Agriculture". Pearson's Product Moment Co-efficient of Correlation (r) was used to test the null hypothesis concerning the relationships between two variables. Five percent (0.05) level of probability was used as the basis for rejecting the null hypothesis. The results of correlation of co-efficient test between the dependent and independent variables have been shown in the Table 13.

Table 13. Relationships between the dependent and independent variables.

Independent variables (Selected characteristics)	'r' value with 119 df
1. Age	0.089 NS
2. Education	0.267**
3. Farming experience	0.431**
4. Farm size	0.427**
5. Annual family income	0.285**
6. Agricultural Training Received	0.339**
7. Communication exposure	0.178 NS
8. Cosmopolitans	-0.031 NS
9. Agricultural Knowledge	0.213*
10. Fatalism	-0.019 NS

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
NS = Not significant

3.3.1. Age and attitude

The relationship between age of the farmers and their attitude towards the climate change effects on agriculture was measured by testing the null hypothesis "There is no relationship between age of the farmers and their attitude towards climate change". The calculated value of 'r' = 0.089 was found to be smaller than the tabulated value at 0.05 level of probability. Based on the above findings, the null hypothesis could not be rejected and it

was concluded that age of the farmers had no significant relationship with their attitude towards climate change. So age of the farmers had no influence to form favorable attitude towards climate change. Kashem (1987), Habib (2000), Nurzaman (2000) and Bari (2000) also found no relationships between these two variables.

3.3.2. Education and attitude

The relationship between educational qualification of the farmers and their attitude towards climate change was measured by testing the null hypothesis, "There is no significant relationship between the educational qualification of the farmers and their attitude towards climate change". The calculated value r = 0.267**, was significant with 119 degrees of freedom at 0.01 level as shown in Table 13. It was, therefore, concluded that educational qualification of the farmers had significant positive relationship with their attitude towards climate change. Hence, the null hypothesis in this respect was rejected. These findings clearly indicate that an educated farmer might have gained more favorable attitude towards climate change compared to illiterate farmers. Nurzaman (2000) found that education of the FFS and non-FFS farmers were positively correlated with their attitude on IPM and Habib (2000) observed the similar results. Paul (2000) and Habib (2000) also found similar result.

3.3.3. Farming experience and attitude

According to the computed 'r' value (0.431**) as shown in Table 13 there was a significant relationship between farming experiences of the farmers and their attitude on climate change at 0.01 level of probability and followed a positive trend. Hence, the concerned null hypothesis was rejected. It was assumed that the farmer who had more farming experience they were more positive to change in their conditions and able to cope with the situations. The farmers who had a large farming experience can take the risk for the farming activities and it is an asset for challenging the natural hazards. Similar findings were obtained by Hossain (2006).

3.3.4. Farm size and attitude

The relationship between farm size of the farmers and their attitude towards climate change was studied by testing the concerned null hypothesis: "There is no relationship between farm size of the farmer and their attitude towards climate change". The calculated value of r=0.427** was larger than the tabulated value with 119 degrees of freedom at 0.01 level of probability as shown in Table 13. So the null hypothesis was rejected, and it was concluded that farm size of the farmers had positive and significant relationship with their attitude towards climate change. It means that the farmers' attitude towards climate change was influenced by the farm size. Talukder (2006), Hussen (2001) and Habib (2000) observed the similar results in their study.

3.3.5. Annual income and attitude

The relationship between annual income of the farmers and their attitude towards climate change was examined by testing the concerned hypothesis: "There is no relationship between family income of the farmers and their attitude towards climate change". The calculated value of 'r' 0.285** was greater than the tabulated value of 'r' at 0.01 level of probability as shown in Table 13. It was therefore, concluded that family income of the farmers had a significant relationship with their attitude towards climate change. So, the null hypothesis could be rejected. It was therefore, concluded that annual income of the farmers had relationship with their attitude towards climate change. Kamal (2006) also observed the similar results in his study.

3.3.6. Agricultural training received and attitude

The null hypothesis was "There is no relationship between agricultural training received of the farmers and their attitude towards climate change". The calculated value of `r' = 0.339** was larger than the tabulated value at 0.01 level as shown in Table 13. Thus, the null hypothesis was rejected. It was therefore, suggested that agricultural training experience of the farmers had positive significant relationship with their attitude towards climate change. It also indicates that the farmer who had relatively more agricultural training experience, their attitude towards climate change was favorable. Finally it was concluded that agricultural training experience of the farmers had positive significant relationship with their attitude towards climate change. A similar finding was obtained by Mandal (2011). Noor (1995), Bari (2000) and Habib (2000) also observed the similar results in their study.

3.3.7. Communication exposure and attitude

According to the computed 'r' value (-0.178) as shown in Table 13 there was no relationship between communication exposure of the farmers and their attitude towards climate change. Hence, the concerned null hypothesis could not be rejected. Similar findings were reported by Mandal (2011).

3.3.8. Cosmopoliteness and attitude

The relationship between cosmopoliteness of the farmers and their attitude towards climate change was studied by testing the concerned null hypothesis: "There is no relationship between cosmopoliteness of the farmers and their attitude towards climate change". The calculated value of r = -0.031 was smaller than the tabulated value of 'r' as shown in Table 13. It was therefore, concluded that cosmopoliteness of the farmers had no significant relationship with their attitude towards climate change. So this null hypothesis could not be rejected.

3.3.9. Agricultural knowledge and attitude

According to the computed 'r' value (0.213*) as shown in Table 13 there was a significant relationship between agricultural knowledge of farmers and their attitude to climate change at 0.05 level of probability and followed a positive trend. Hence, the concerned null hypothesis was rejected. Similar findings were obtained by Mondol (2009).

3.3.10. Fatalism and attitude

According to the computed 'r' value (-0.019) as shown in Table 13 there was no relationship between fatalism of the farmer and their attitude on climate change. Hence, the concerned null-hypothesis could not be rejected.

4. Conclusions

In this study 10 selected characteristics of the farmers were selected for investigation. The characteristics were age, education, farming experience, farm size, annual income, training received, communication exposure, cosmopoliteness, agricultural knowledge and fatalism.

The ages of the farmers ranged from 26-70 years with the mean being 46.18 and standard deviation 12.81. The education scores of the farmers ranged from zero to 16 with a mean 5.19 and standard deviation of 4.32. Farming experiences of the farmers ranged from 4-45 having a mean of 15.49 with 8.75 standard deviation. Farm size of the respondents varied from 0.21 to 3.89 hectares while their average farm size was 0.807 hectares with a standard deviation of 0.48. About 41.3% of the respondents had low annual family income, while 17.4% and 11.6% of them had medium and high annual family income, respectively. Training experience of the respondents ranged from 0 to 6 days with a mean of 0.87 having a standard deviation of 1.56. The communication exposure score of the respondents ranged from 9 to 57, with an average of 22.64 and standard deviation of 8.87. The cosmopoliteness scores of respondents ranged from 6 to 21. The mean was 13.52 and standard deviation is 3.75. Agricultural Knowledge of the respondents ranged from 12 to 28, with an average of 20.363 and standard deviation of 3.57. The fatalism scores of farmers ranged from 18-38 with a 30.14 mean and 4.78 standard deviation. About 81 % of the respondents were highly depends on their fate other than performance. Attitude of the farmer towards climate change effect on agriculture was measured by computing statement score, which could range from 20 to 100. However, the observed score ranged from 55 to 69 with a standard deviation of 3.166. Based on their possible attitude scores, the farmers were classified into three categories: "Unfavorable", ''Moderately Favorable" and "Favorable". Analyzed data indicate that the majority (51.2 percent) of the respondents had medium attitude while 69 percent of them had high attitude in regarding climate change effect on agriculture. Data also revealed that most of the farmers (62 percent) of the study area had moderately favorable attitude in regarding climate change effect on agriculture. So, it is necessary to take steps to change the rate of attitude in regarding climate change effect on agriculture.

Conflict of interest

None to declare.

References

Akter T, 2009. Climate Change and Flow of Environmental Displacement in Bangladesh, Unnayan Onneshan. Dhanmondi, Dhaka, Bangladesh.

Bari MA, 2000. Attitude of Farmers Towards Hybrid Rice AALOK 6201 in Naogaon District. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Barnes A and L Toma, 2011. A typology of dairy farmer perceptions towards climate change. Climate Change Published online: 31 August, 2014.

Habib M, 2000. Attitude of Block Supervisors towards the Use of Agrochemicals. M.S. Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Hatfield JL, D Ort, AM Thomson, D Wolfe, RC Izaurralde, KJ Boote, BA Kimball and LH Ziska, 2011. Climate impacts on agriculture: implications for crop production. Agron. J., 103:351–370

Hossain K, 2006. Adoption of Selected High Yielding Variety of Rice by the Fanners of Rajpat Union under Kasiani Upazila in Gopalgonj District. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Howden SM, JF Soussana, FN Tubiello, N Chhetri, M Dunlop and H Meinke, 2007. Adapting Agriculture to Climate Change. Proc. Natl. Acad. Sci., 104 :19691–19696.

Hussen MAM, 2001. Farmers' Knowledge and Adoption of Modern Sugarcane Cultivation Practices. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

IFPRI, 2010. Food security, farming, and climate change: Scenarios, results, policy options. International Food Policy Research Institute, Washington.

IPCC, 2007. Climate Change 2007: Synthesis Report on Soil Salinity in Bangladesh. Paper No. 113, Dhaka, Bangladesh.

Kamal MM, 2006. Preference of Dropout Rural Youth in Selected agricultural and Non-Agricultural Activities for Self-employment. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Kashem MA, 1987. Small Farmers' Constraints to the Adoption of Modern Rice Technology. The Bangladesh Development Studies, 15(40). 18-30.

Lal R, JA Delgado, PM Groffman, N Millar, C Dell and A Rotz, 2011. Soil Water Management to mitigate and adapt to climate change conservation. 66:276–285

Mandal S, 2011. Improvement of Livelihoods of the Farmers due to Extension Activities of Krishi Gyan Samprosaran Kendra (KGSK) (unpublished master's thesis). Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

McCarl BA, 2010. Analysis of climate change implications for agriculture and forestry: an interdisciplinary effort. Climate Change., 100:119–124.

Mondol S, 2009. Adoption Behavior of Farmers Regarding Hybrid Rice Cultivation in Mymensingh District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University. Mymensingh.

Noor MS, 1995. Farmers' attitude towards the cultivation of high yielding varieties of potato. M.S. (Ag. Ext. Ed.) Thesis, Department of Extension Agricultural Education, IPSA, Gazipur.

Nurzaman M, 2000. Knowledge, Attitude and Practice of FFS and Non-FFS Farmers in Respect of IPM. A11-5. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Paul SK, 2000. Attitude of Farmers Towards the Use of Urea Super Granule on Rice Cultivation. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Talukder MMR, 2006. Adoption of Selected Rice Production Practices Farmers of Char Land of Gomoty River. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

UNDP, 2011. Bangladesh Country Environmental Analysis. Bangladesh Development Series Paper No. 12, United Nations Development Program, New York.

Wahab MA, and MA Islam, 2009. Challenges of climate change to fisheries and aquaculture in Bangladesh. In Proc. workshop on "Impact of climate change on livelihoods, agriculture and fisheries sector of Bangladesh" held in Bangladesh Agricultural University, Mymensingh. 01 October, 2009, pp. 65-68.