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Farmer's Perception and Agricultural Adaptation of Climate Change in Drought Prone Areas of Bangladesh

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Abstract

The study was conducted at the selected areas of Bangladesh (Ishwardi and Lalpur upazila). It consisted of 80 randomly selected farmers through an interview schedule to identify the respondent's perception and their agricultural adaptation to climate change. The findings of the study indicate that the farmer's perception about climate change was reasonable for the majority of farmers; majority of (47.5%) farmers claimed that annual precipitation was decreased, 57.5% farmers claimed that summer season temperature was increased, 48.75% farmers claimed that winter season temperature was decreased and 51.25% farmers claimed that yearly mean temperature was increased. However, 38.75% farmers said that the intensity of drought was increased and 58.75% farmers said that the intensity of hotness in summer season was increased. The finding of the study indicates that 70% of the farmers had medium agricultural adaptation capability compare to 23.75% farmers had low and 6.25% farmers had high agricultural adaptation capability. Education, farm size, annual income, credit received, cosmopoliteness had significant relationship with their agricultural adaptation to climate change.

Key words: Agricultural adaptation, Climate change, Farmer's perception

Introduction

Natural disaster is a common phenomenon and till today Bangladesh is facing several disasters, and climate change is the main reason behind it (Daily Star, 2011). Climate change is identified as average weather conditions of the characterized by its own internal dynamics and changing in external factors that affect climate (IPCC, 2001). United Nation Framework Convention on Climate Change (UNFCC, 1992) defines climate change as the resulting from long term direct and indirect activities that induce changes in the compared time which much more than the natural change. On the other hand, the weather is a set of all the phenomena occurring in a given atmosphere at a given time (IAC, 2011). Bangladesh ranked sixth among countries that are most vulnerable to natural disasters, while second among the Asian countries (Daily Star, 2011). In the Barind region resource of surface and ground water is directly related to the rainfall. It is also found that most of the ground water abstraction takes place in the dry months (Ahmed, 2006). During this period water recharge is almost zero, the rate of evapotranspiration is high and river stages go down compared to the ground water table which results into loss of water storage. In a bid to enhance Bangladesh's national capacity to defy climate induced adverse effects, especially for marginal and small holding farmers in hot spots, there should be new impetus for innovation in agriculture (Mahmood, 2011). Adaptation is very much essential for this area for all the sectors of agriculture. Thus, in this situation it is necessary to know the extent of climate change perception and agricultural adaptation. The main objectives of the study were to determine and describe the extent of farmer's perception, agricultural adaptation and socio-economic characteristics to climate change in drought prone area of Ishwardi and Lalpur upazila.

Materials and Methods

The methodology for this study includes site selection, observation and field level data collection through inventory, questionnaire survey and interviews in formal and non-formal ways. The relevant secondary data for this research were mainly collected from the published and unpublished sources. After the union selection with population determination, respondents were then selected at the rate of 5% following simple random method. An interview schedule was prepared for collection of data from the respondents keeping the objectives of the study in mind. Simple and direct questions, different scales, closed and open form statements were included in the interview schedule to obtain necessary information.

Results and Discussion

Age

Age of the respondents in the study area ranged from 22 to 53 years, the average mean 35.11 years and the standard deviation 9.83. The findings indicate that a large proportion (91.25%) of the farmers were young to middle age.

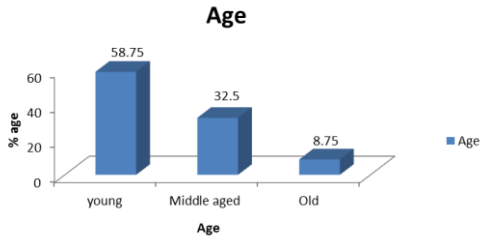

Fig. 1. Age of the farmers

Education

Education score of the farmers ranged from 1 to 11, the mean and standard being 5.82 and 2.40, respectively, Education of a farming community might be helpful in creating favorable perception and

agricultural adaptation of the effects of climate change.

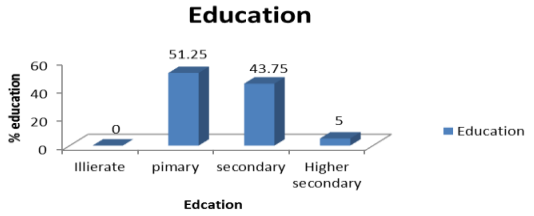

Fig. 2. Education of the farmers

Farm size

The annual farm size score of the farmers ranged from .04 to 4, the mean and standard being .597and .656 respectively. Analyzed data indicated that the highest proportion (51.25 percent) of the farmers had small farm compared to 36.25 % having marginal farm, 8.75 % having small farm and only 3.75 % having large farm.

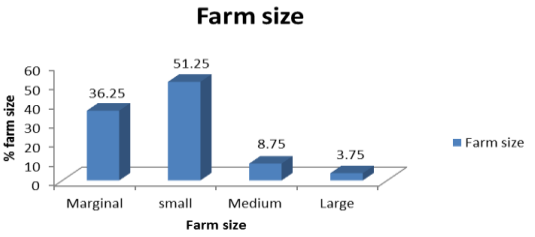

Fig. 3. Farm size of the farmers

Annual family income

The annual family income score of the farmers ranged from 40 to 500, the mean and standard being 114.93 and 71.34, respectively. Since greater proportion (60 %) of the respondents had low to medium annual family income, it is logical to assume that they might have high access to perception and agricultural adaptation of climate change. This is so because family income is associated with perception and agricultural adaptation of climate change.

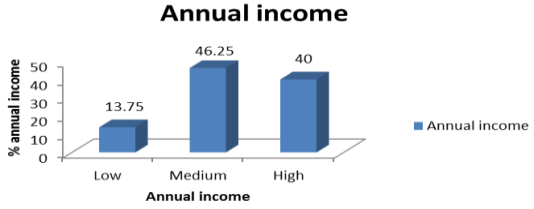

Fig. 4. Annual income of the farmers

Credit received

Credit received score of the respondent's ranges from 0 to 80, the mean and standard being 17.63 and 21.16 respectively. The findings indicate that the highest proportion (47.5%) of the farmer did not get any credit.

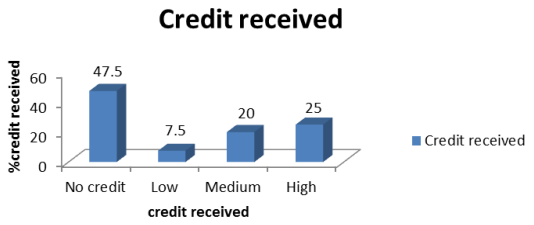

Fig. 5: Credit received of the farmers

Cosmopoliteness

An individual orientation external to his own social system is referred to as cosmopoliteness. Cosmopoliteness scores of the respondents ranged from 6 to 19 against the possible range of 0 to 21. The mean was 12.63 and standard deviation was 4.08. The findings indicate that the majority (43.75%) respondents had medium cosmopolitenes. Cosmopoliteness helps to get new knowledge about climate change and adaptation techniques of climate change.

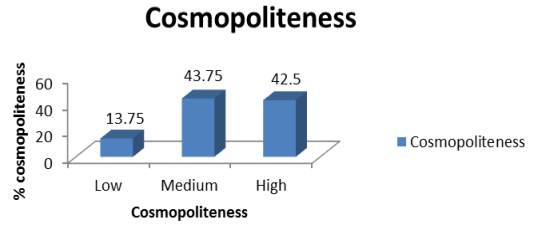

Fig. 6. Cosmopoliteness of the farmers

Farmers' perception of climate change and comparison with meteorological data of the study area

After evaluating climate change parameters, households were asked to identify the perception and impacts of climate change, and variability of annual temperature. About, 47.5% farmers said that the average annual precipitation decreased from last 10 years, 36.25% farmers said annual precipitation increased from last 10 years, 7.5% farmers said annual precipitation had no changed from last last 10 years and only 8.75% farmers had no comment on it. On the other side, the last 10 (2003-2012) years meteorological data of study areas yearly mean precipitation shown in Fig. 7, which indicated that the yearly mean precipitation of 2003 and 2012 were 173.9 and 84.9 mm, respectively. Thus, the total 83.75% of the farmers said that yearly mean precipitation changed from year to year which is supported by meteorological data of precipitation of the last 10 years. Farmers' perception about variability of annual average temperature, summer season temperature and winter season temperature; maximum 51.25% farmers said annual average temperature increased from last 10 years and only 6.24% farmers said annual average temperature reduced from last 10 years, the 48.75% farmers said annual average winter season temperature had reduced but only 20% farmers said winter season temperature increased from last 10 years. However, 57.5% farmers said summer season temperature increased from last 10 years and

where only 25% farmers said summer season temperature reduced from last 10 years

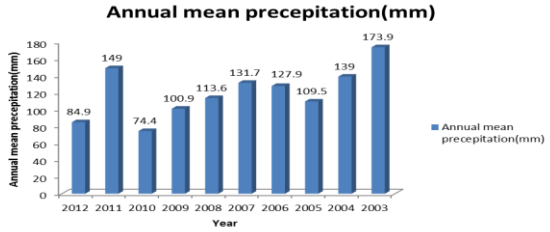

Fig. 7. Bar diagram showing annual mean precipitation of last 10 years

On the other side, the last 10 (2003-2012) year's meteorological data of study areas yearly temperature shown in Fig.8, which indicated that the yearly mean maximum temperature, mean temperature, mean minimum temperature of the last 10 years. The changing trend of yearly mean maximum temperature of Fig.8 indicated that temperature had changed from year to year. The highest 57.5% farmers said that summer season temperature had increased from last 10 years which is supported in minor level by meteorological data of yearly mean maximum temperature of the last 10 years.

Environmental hazards experienced by the farmers

The environmental hazards scores of the respondents ranged from 9 to 13 with a mean of 10.76 and standard deviation 1.20. The majority (71.25%) of the respondent had medium environment hazards scores while 20% had low environment hazards scores and 8.75% had high environmental hazards was found in the study areas. After

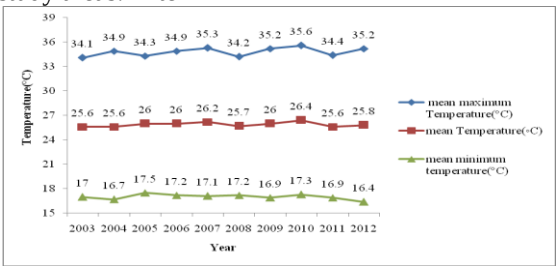

Fig. 8. Showing the yearly mean maximum, yearly mean minimum and yearly mean temperature of last 10 years ((data collected from Ishwardi Meteorological Centre)

The changing trend of yearly mean maximum temperature of Fig. 8 indicated that temperature had changed from year to year. The highest 57.5% farmers said that summer season temperature had increased from before 10 years which is supported in minor level by meteorological data of yearly mean maximum temperature of last 10 years. "Extent of environmental hazards" scores for each of 80 respondents an effort was also made to compare the relative hazards using scoring techniques and the following formula EHI (EHI= N1 x 3 + N2 x 2 + N3 x 1 + N4 x 0). Along with Environmental Hazards Index (EHI) and rank order of each environmental hazard, Environmental hazards index of the respondents of the 7 items (Drought, Spread of pest, Food, Hail stone, Cyclone, Dew, Cold) ranged from 0 to 235. The highest hazard index (235) was found in case of drought. The next index was found in case of dew (225) and cold (225). An impact of climate change index (CCII) (Santa, 2013) was developed to fulfill this objective using the following formula

$CCII = N_1 \times 3 + N_2 \times 2 + N_3 \times 1 + N_4 \times 0$

CCII= Impact of Climate Change Index

N_1 = Number of farmers observed 'high' impact of climate change; $N_{2=}$ Number of farmers observed 'medium' impact of climate change; N_3= Number of farmers observed 'low' impact of climate change;N_4= Number of farmers 'not at all' observed impact of climate change

The CCII for each of the impact of climate change observed by farmers ranged from 0 to 240.

Table 1. Statement-wise score Impacts experienced by the farmers

Impacts	Farmers (N=80)				Impact of climate change Index (CCII)	Rank order
	High	Medium	Low	Not at all		
Drought increase	60	15	5	0	215	4
Decrease source of water	75	5	0	0	235	2
Plant disease	45	27	8	0	197	6
Increase temperature at summer season	80	0	0	0	240	1
Fall temperature at winter season	65	15	0	0	225	3
Change in seasonal diversity	35	40	5	0	190	7
Decrease soil fertility	47	26	7	0	200	5
Decrease crop yield	30	45	5	0	185	8
Cropping pattern change	23	17	8	32	111	10
Decrease annual income	24	37	19	0	165	9

Agricultural adaptation of climate change

Agricultural adaptation of the climate change was measured by computing an adaptation score, which could range from 0 to 63 and the observed scores ranged from 25 to 49 with an average of 43.36 and the standard deviation 6.05. The majority (70%) of the respondents had medium agricultural adaptation while 23.75% of them had low agricultural adaptation and the remaining 6.25% of them had high agricultural adaptation of climate change. Agricultural Adaptation Index (AAI) (Rahman, 2005) could range from 0 to 240, where 0 indicating no adaptation and 240 indicating maximum adaptation of a single statement on agricultural adaptation of climate change. "Increase of irrigation machineries" got the Ist rank among the 15 statements with the total AAI of 225. Increase cultivation of drought resistant rice variety obtained the third highest AAI (177) and stood third in the rank order. "Increase of conserving water in the ditch for irrigation" obtained the least score (102) and so got the last position in rank order regarding the agricultural adaptation of climate change.

Table 2. Relation between selected characteristics of farmers and their agricultural adaptation.

Dependent variable	Independent variable	Correlation Co-efficient (r^2) with perception (N=80)	Table value of (r) at 100 degree of freedom	
			0.05	0.01
Agricultural Adaptation of Climate Change	Age	-.070^{NS}	0.195	0.254
	Education	0.264*		
	Farm size	0.312**		
	Annual income	0.253*		
	Credit Received	0.294**		
	Cosmopoliteness	0.292**		

**=Significant at 0.01 level, *=Significant at 0.05 level

The correlation coefficient between age of the participation and their agricultural adaptation of climate change (r = -0.70) was not significant. The correlation coefficient between education of the participation and their agricultural adaptation of climate change (r = 0.264*) being significant at 0.05 level. The correlation coefficient between farm size of the participation and their agricultural adaptation of climate change (r = 0.312**) being significant at 0.01 level. The correlation coefficient between annual income of the participation and their agricultural adaptation of climate change (r = 0.253*) being significant at 0.05 level. The coefficient of correlation (r = 0.292**) between cosmopoliteness and their agricultural adaptation of climate change was significant at 0.01 level.

Conclusions

Findings reveal that average agricultural adaptation score of climate change was found 34.36, which are not so much satisfactory. Because all aspects of the climate change adaptation were not fulfilled by the farmers in high extent. Thus it can be concluded that such a low adaptation which indicated that there is scope to take necessary steps to make them more aware of agricultural adaptation of climate change.

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