



## **Level of Awareness of Haor Farmers in Combating Climate Change Hazards for Boro Rice Production**

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### **Authors' contributions**

*This work was carried out in collaboration among all the authors. In particular, author MAI designed and supervised the whole study while author MRA played major role in data interpretations and discussions. Author SDB managed the literature searches and played efficient role in data analysis and interpretation. Author MHU collected necessary data, performed statistical analysis, wrote the protocol and first draft of the manuscript. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/AJESS/2018/43953

#### Editor(s):

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Complete Peer review History: <http://prh.sdiarticle3.com/review-history/26360>

**Original Research Article**

**Received 06 July 2018**  
**Accepted 16 September 2018**  
**Published 25 September 2018**

### **ABSTRACT**

Farmers' awareness about the hazards derived from climate change on boro rice production has been a central issue to reduce their crop loss in a sustainable way. In this study, farmers' awareness was measured on the basis of twelve adverse effects of climate change on boro rice production using a four point rating scale. Necessary data were collected through personal interview using a mixed method research design from 100 randomly selected haor farmers of four villages of Tahirpur and Bishwambarpur upazila under Sunamganj district during 20 March to 10 May, 2018. The findings revealed that an overwhelming majority (75 percent) of the haor farmers had conscious to stable awareness while 25 percent were unconsciously aware of the effects of climate change. On the other hand, results of correlation analysis indicated that some characteristics of haor farmers like age and family size had negative and statistically significant relationship while their education level, farm size, annual family income, communication exposure, agricultural training experience, perception on climate change had a positive and statistically significant relationship with their

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awareness about the effects of climate change on boro rice production. The highest awareness level was reported against the effect of flash flood in haor areas while the haor farmers had lowest awareness on crop damage due to the excessive cloudy sky. The findings of this result can be utilized to develop a suitable policy for uplifting of socio-economic status of the haor farmers and also guide to develop suitable strategies to secure boro rice production.

*Keywords: Haor farmer; awareness; boro rice; flash flood; climate change.*

## 1. INTRODUCTION

Climate change is a burning issue for the whole world, especially low-lying and developing countries [1]. According to global climatic risk index 2013, Bangladesh holds the 4<sup>th</sup> position due to geographical location along with various hydrological factors [2]. Bangladesh is the most vulnerable area to several natural disasters and every year natural calamities upset people's lives in some parts of the country. The major disasters concerned here are the occurrences of flood, cyclone and storm surge, flash flood, drought, tornado, riverbank erosion and land slide [3]. Flood is one of the consequences of climate change whose occurs almost regularly in Bangladesh [4].

Flash floods that rise and falls quite rapidly with little or no advance warning, usually resulting from the intense rainfall over a relatively small area during the March-May season in the northeast part of Bangladesh has been a major problem of the country. The severity of flash flood depends on time and quantity of rainfall in the hill and drain out capacity of main rivers [5] while severe and prolonged flash flood was recorded in 2000, 2002, 2004, and 2010 in haor area during April [6]. Recent year's unpredictable trend of flash flood in haor area is one of the major threats of boro rice production loss [7,8].

In most cases, Flash flood water comes into the haor very early in the monsoon and farmers do not get sufficient time to harvest the standing boro rice [9]. The present rice production is not enough to feed the nation and 1.5 million tons annual shortage of food grain exist under current situation [10]. Over the next 20 years, rice yield, therefore, need to be increased from the present 2.74 to 3.74 t/ha to feed the ever-growing population [11].

There is still a minority of the population of the world who are not aware about the effect of climate change. Most of the people only understand climate change as the mean variations in weather patterns while the majority

of people around the world are not able to differentiate between climate change and global warming; hence the need to create awareness on climate change especially through education and provision of Information and Communication Technology (ICT) facilities [12,13,14]. Bangladesh is one of the most disaster-prone countries where the incidence of flood has significantly increased in haor area. In this situation, different Government and non-government organizations are working in Haor areas for a long time to uplift the livelihood of haor inhabitants and increase their awareness level regarding the effect of climate change on boro rice production. This paper examines the haor farmers' level of awareness about the effects of climate change on boro rice production. Finally, the paper suggests some of the key recommendations that would ensure an increase in haor farmers' level of awareness on climatic effects on boro rice production and to develop agricultural sector in haor area.

## 2. MATERIAL AND METHODS

### 2.1 Sampling Method and Data Collection

The study was conducted in four villages of Tahirpur and Bishwambarpur upazila under Sunamganj district of Bangladesh. Data were collected from 100 haor farmers that were selected randomly from each of the four communities thus forming the target sample population. Necessary data were collected personally by the researcher through face to face interview during the period extending from 20 March to 10 May, 2018 using a mixed method research design. Twelve statements regarding effects of climate change on boro rice production were selected through KII and the statements were namely: i) Empty grain of rice increased due to fluctuation of day-night temperature ii) Soil fertility decreased iii) Attack of new insects and pest in rice field iv) Change in seedling showing time v) Requirement of relatively large amount of fertilizers and pesticides vi) Lengthening of vegetative growth stage of boro rice due to heavy

rainfall vii) Loss of matured rice grain due to strong wind and heavy rainfall viii) Decreased boro rice production due to excessive cloudy sky ix) Huge loss of boro rice yield due to sudden flash flood attack x) Quick spreading of flash flooding water xi) Relatively longer waterlogged condition by flash flood and xii) Cultivation of rabi crops to compensate boro rice production loss due to flash flood hazard were taken as the bases to determine haor farmers awareness about the effects of climate change on boro rice production.

The awareness level of the respondents was computed by using an Awareness Index (AI) formula while the scale was 0 indicating not aware, 1 for unconsciously aware, 2 for consciously aware, 3 for stable aware. The AI formula was as follow:

$$AI = A_{NO}W_0 + A_{UN}W_1 + A_{CO}W_2 + A_{STB}W_3$$

Where,

AI = Awareness Index

A<sub>NO</sub> = Frequency of respondents that have no awareness

A<sub>UN</sub> = Frequency of respondents that have unconscious awareness

A<sub>CO</sub> = Frequency of respondents that have conscious awareness

A<sub>STB</sub> = Frequency of respondents that have stable awareness

W<sub>0</sub>, W<sub>1</sub>, W<sub>2</sub>, and W<sub>3</sub> are the weights for each of the scoring categories. The weights against each response of a respondent were added together to obtain his/her level of awareness score. Thus, the level of awareness score of an individual haor farmers could range from 0 to 300, where 0 indicating 'not aware' and 300 indicating 'stable aware' about the effect of climate change on boro rice production. Collected data were analysed using SPSS software to derive necessary results through descriptive statistics and results were shown in the form of probability distribution tables and rank order table.

### 3. RESULTS AND DISCUSSION

#### 3.1 Level of Awareness of the Haor Farmers

The awareness level of haor farmers' ranged from 19 to 36 against the possible range of 0 to 36 while the mean value was 28.22 and the standard deviation was 4.69. Based on the mean ± sd as observed, the haor farmers were classified into four categories as Not aware (0 score), Unconsciously aware (1-24), Consciously awareness (25 – 32) and Stable aware (above 32).

The findings are presented in Table 1.

The findings revealed that the highest portions of the haor farmers (75%) were observed to have conscious to stable awareness and 25 percent had unconscious level of awareness about the effects of climate change on boro rice production. The farmers of the haor area are always struggling against the crop loss due to different climate change related hazards. As the farmers are directly or indirectly connected to the boro rice production practices from generation to generation; majority of the haor farmers were consciously aware about the effects of climate change on their boro rice production. Kuri [15] also found that a vast majority (88.8 percent) of the farmers were moderately aware regarding the effects of climate change on crop production.

#### 3.2 Awareness of Haor Farmers Based on Selected Statements about the Effects of Climate Change on Boro Rice Production

Awareness level of the haor farmers regarding twelve selected statements about the effects of climate change on boro rice production was determined by using the Awareness Index formula and obtained awareness index score against each of the statements as shown in Table 2.

**Table 1. Distribution of the haor farmers depending on their level of awareness**

Categories (score)	Number	Percent	Mean	Standard deviation
Not aware (0 score)	0	0		
Unconsciously aware ( 1 -24 )	25	25.0		
Consciously aware (25 – 32 )	53	53.0	28.22	4.69
Stable aware (above 32)	22	22.0		
Total	100	100.0		

It is manifested from Table 2 that haor farmers had highest awareness index score on "Huge loss of boro rice yield due to sudden flash flood attack" and lowest awareness regarding "Decreased boro rice production due to the excessive cloudy sky". As flash flood occurs almost every year during the March-May season in the haor area, it is a big threat to the livelihoods of the haor people; especially landless haor farmers. In recent times, flash flood causes more damages than the past. When flash flood occur due to sudden heavy upstream rainfall creates pressure on the local hydrological systems, water easily overtops and creates breaching at several locations on the submersible embankment, eventually water quickly enters into the haor very early in the monsoon and farmers do not get sufficient time to harvest the standing boro rice.

In this situation haor farmers directly see the effects of climate change on boro rice production. For this reason, most of the haor farmers were consciously aware of the effects of flash flood on boro rice production. On the other hand haor farmers could not find proper facilities for education and communication that's why they have no clear perception about other effects of climate change on boro rice production; so haor farmers were not properly aware of other climatic changes.

### **3.3 Relationship between Selected Characteristics of the Haor Farmers and Their Awareness on Boro Rice Production against Effects of Climate Change**

To explore the relationships between the selected characteristics of the haor farmers with their level of awareness; Pearson's Product Moment Correlation Co-efficient 'r' has been used to find out the results of the correlation analysis. The correlation result is shown in Table 3.

From the observations, it was revealed that haor farmer's age and family size had a negative and statistically significant relationship while their level of education, farm size, annual family income, communication exposure, agricultural training experience and perception on climate change had a positive and statistically significant relationship with their awareness about boro rice production against effects of climate change. As there was a negatively significant relationship

between age of the farmers and their awareness regarding the effect of climate change on boro rice production ( $-0.617^{**}$ ); that means farmers extent of awareness is somewhat affected by their age. Young age farmers were more aware than the old age framers. Because young age farmers use different modern technologies such as mobile phone, computer, internet etc. that's why those farmers acquire more information from different sources and finally they have clear idea about the effects of climate changes on boro rice production. Kuri [15] also found a negative and statistically significant relationship between age of the farmers and their awareness.

Here it was found that there was a positive significant relationship ( $r = 0.773^{**}$ ) between farmer's education and their awareness regarding effect of climate change on boro rice production. It seemed that educated farmers had more knowledge and had a greater ability to understand and greater access to information than others, which might increase awareness level. Kuri [15] also found that significant relationship between education of the farmers and their awareness.

According to observations, it was found that family size had a negatively significant relationship ( $r = -0.371^{**}$ ) with their awareness regarding effects of climate change on boro rice production. If the family size is small then most of the small family members receive better education and communication facilities to lead their life. For this reason, family members become educated and can acquire more knowledge form different sources. Finally those families become more aware of the effects of climate change on boro rice production. Varkuti et al. [16] also found that negatively significant relationship between family size of the farmers and their awareness.

Also, respondents' farm size had a positive significant relationship ( $r = 0.332^{**}$ ) with their awareness about the effects of climate change on boro rice production. That means a farmer with large farm size usually is more aware than the small farm size farmer. The farmers having large farm size are more aware of the effects of climate change on boro rice production for recovering their big loss for climate change related hazards. Sutradhor [17] also found that a significant relationship between farm size of the farmers and their awareness.

**Table 2. Rank order distribution of selected statements about the effects of climate change on boro rice production**

Selected Statements about the effects of climate change on boro rice production	Awareness index score	Rank
i) Empty grain of rice increased due to fluctuation of day-night temperature	145	10 <sup>th</sup>
ii) Soil fertility decreased	203	5 <sup>th</sup>
iii) Attack of new insects and pest in rice field	197	7 <sup>th</sup>
iv) Change in seedling showing time	146	9 <sup>th</sup>
v) Requirement of relatively large amount of fertilizers and pesticides	199	6 <sup>th</sup>
vi) Lengthening of vegetative growth stage of boro rice due to heavy rainfall	125	11 <sup>th</sup>
vii) Loss of matured rice grain due to strong wind and heavy rainfall	186	8 <sup>th</sup>
viii) Decreased boro rice production due to excessive cloudy sky	105	12 <sup>th</sup>
ix) Huge loss of boro rice yield due to sudden flash flood attack	266	1 <sup>st</sup>
x) Quick spreading of flash flooding water	244	3 <sup>rd</sup>
xi) Relatively longer water logged condition by flash flood water	249	2 <sup>nd</sup>
xii) Cultivation of rabi crops to compensate boro rice production loss due to flash flood hazard	243	4 <sup>th</sup>

**Table 3. Correlation co-efficient between the selected characteristics of the haor farmers and their awareness level against the effects of climate change on boro rice production**

Characteristics of the Haor farmers	Correlation co-efficient (r) values with awareness	Tabulated value of 'r'		Remarks
		0.05 level	0.01 level	
Age	-0.617 <sup>**</sup>			Negatively significant at 0.01 level
Level of education	0.773 <sup>**</sup>			Positively significant at 0.01 level
Family size	-0.371 <sup>**</sup>			Negatively significant at 0.01 level
Farm size	0.332 <sup>**</sup>	0.197	0.257	Positively significant at 0.01 level
Annual family income	0.306 <sup>**</sup>			Positively significant at 0.01 level
Communication exposure	0.726 <sup>**</sup>			Positively significant at 0.01 level
Agricultural training experience	0.554 <sup>**</sup>			Positively significant at 0.01 level
Perception on climate change	0.682 <sup>**</sup>			Positively significant at 0.01 level

<sup>\*\*</sup> Significant at p<0.01 level of probability, <sup>\*</sup> Significant at p<0.05 level of probability

Respondents' annual family income had a positive significant relationship ( $r = 0.306^{**}$ ) with their awareness about the effects of climate change on boro rice production. It was concluded that a farmer with enough income has the ability to use better technologies than the others in the community. For this reason, those farmers are more aware of the effects of climate change on boro rice production and finally they gain very stable awareness on different boro rice production practices.

It was also found that respondents communication exposure had a positive significant relationship ( $r = 0.726^{**}$ ) with their awareness about the effects of climate change on boro rice production. That means farmers having more communication exposure are more aware of the effects of climate change on boro rice production. Communication exposure helps the farmers in gathering more knowledge about various modern farming practices. It might be concluded that communication with extension media enhances farmers' knowledge, attitudes, and perception of climate change which increases their awareness level against effects of climate change on boro rice production.

From the observations, it was revealed that agricultural training experience had a positive significant relationship ( $r = 0.554^{**}$ ) with their awareness about the effects of climate change on boro rice production. That means the farmers having more training are somewhat more aware than the low trained farmers. After being trained the farmers become more aware about various modern farming practices to cope with effect of climate change. Thus making the farmers more aware of doing something better and sometimes new technologies were accepted very quickly by trained farmers compared to non-trained farmers. Kuri [15] also found that significant relationship between training experience of the farmers and their awareness.

In addition to that, the perception on climate change had a positive significant relationship ( $r = 0.682^{**}$ ) with farmers awareness about the effects of climate change on boro rice production. It was found that the farmers having more perception on climate change are more aware about the effects of climate change on boro rice production than others. Most of the haor farmers try to clearly understand about perception on climate change because they suffered greatly and regularly during the year from different effects of climate change on boro rice production.

The farmers who perceive the events of climate change properly are more aware about boro rice production practices against climate change related hazards. Kuri [15] also found that significant relationship between perception on the climate change of the farmers and their awareness.

From the findings above, it can be concluded that farmer's age, level of education, family size, farm size, annual family income, communication exposure, agricultural training experience and perception on climate change play an important role to increase the awareness of haor farmers about the effects of climate change related hazards on boro rice production.

#### 4. CONCLUSION

The haor farmers were consciously aware regarding the effects of climate change on boro rice production while majority of the haor farmers (75 percent) had conscious to stable aware. Thus, it could be concluded that there is a need to implement appropriate development programs that could trigger their literacy level, would provide more ICT facilities and avail more information sources at community level and that could be helpful for generating stable awareness among the haor farmers regarding different effects of climate change on their boro rice production. To attain full self-sufficiency in rice grain production, it is essential to increase the haor farmers' stable awareness about the effects of climate change related hazards. Mass media can play a great role in providing necessary information about crop production practices in response to the effect of climate change. Different income generating opportunities like establishment of agro-processed industry and small cottage industry should be established for increasing the farmers' income. Thus, farmers can save more money, enlarge farm size and ultimately can be economically solvent and finally can increase their awareness level regarding effect of climate change on crop production. Therefore, it may be concluded that attainment of highest possible yields in boro rice and thereby maximizing farmers profit may be achieved only when the haor farmers have stable awareness about the climatic change related hazards on their boro rice production; Thus they can apply the appropriate knowledge in their field condition to secure the maximum boro rice production.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:  
The peer review history for this paper can be accessed here:  
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