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COASTAL FARMERS' ATTITUDE TOWARDS CLIMATE SMART AGRICULTURE IN BANGLADESH

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Abstract

Climate smart agriculture (CSA) aims to improve food security, help communities adapt to climate change and contribute to climate change mitigation by adopting appropriate practices. Attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour. Therefore, this study aims to assess the extent of attitude of farmers toward CSA and explore the contributions of the selected characteristics of the coastal farmers to their attitude. Data were collected by using an interview schedule from 354 coastal farmers of 3 districts namely, Satkhira, Khulna and Bagerhat through Multistage Random Sampling Method during December 2021 to March 2022. Descriptive and inferential statistics were applied. To explore the contribution of the predictor variables to the outcome variables, full model regression analysis was employed. Results indicate that the highest proportion (61.01%) of the farmers had medium favourable attitude towards CSA as compared to 18.65% and 20.34% having low favourable and high favourable attitude towards CSA respectively. Farmers' education, annual agricultural income, training exposure, benefit obtained from CSA and knowledge on CSA had positive significant contributions to their attitude toward CSA. On the other hand, farm size and decision-making ability had negative contributions to their attitude toward CSA. For wider adoption of CSA may require farmers' capacity building through non-formal education, more exposure to training and proper knowledge.

Keywords: CSA, attitude, coastal farmers, favourable

INTRODUCTION

The coastal zone contributes approximately 16 percent of the total rice production of the country, covering about 70 percent of the total paddy-cropped area (Huq *et al*.,

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2005). The entire coastal regions of Bangladesh are increasingly susceptible to flooding tropical cyclones and associated saltwater intrusion (Roy *et al*., 2019; Ramírez-Villegas and Thornton, 2015). The impacts of coastal hazards have been diminishing the potentials of these regions and thus drawing national and international concerns for protecting the coastal agriculture through implementing numerous initiatives such as formulating the Master Plan for the Southern Agricultural Development (MoA and FAO, 2013).

Addressing climatic challenges will require radical changes in agricultural systems. These systems have to become more efficient and resilient at every scale from the farm level to the global level. They have to become more efficient in resource use (use less land, water, inputs to produce more food sustainably) and become more resilient to changes and shocks. In this situation, FAO has introduced the concept of climate smart agriculture (CSA) as a way forward for food security in a changing climate. CSA aims to improve food security, help communities adapt to climate change and contribute to climate change mitigation by adopting appropriate practices, developing enabling policies and institutions and mobilizing needed finances (Mahashin and Roy, 2018). CSA is an approach for transforming and reorienting agricultural development under the new realities of climate change (Lipper *et al.*, 2014). FAO (2013) defined CSA as "agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces and/ or removes Greenhouse gases (mitigation) where possible, and enhances achievement of national food security and development goals". In these definitions, the principal goal of CSA is identified as food security and development (Lipper *et al.*, 2014; FAO, 2013); while productivity, adaptation, and mitigation are identified as the three interlinked pillars necessary for achieving this goal.

Attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour" (Eagly & Chaiken, 1993). It is used to investigate human behavior concerning a topic: How the respondents feel about it (IDAF, 1994). It has been reported in many studies and literature (e.g., Rahman, 2018; Mondal, 2014; Zulkifly *et al.,* 2013) that attitude of an individual plays a significant role in the adoption or rejection of an innovation. The favourable attitude of farmers towards CSA helps to achieve food security and broader development goals under a changing climate and increasing food demand. Therefore, assessing attitude towards CSA will make us understood whether any intervention is needed or not to change their attitude. This study is carried out with three objectives: assessing the extent of the farmers' attitude towards CSA, describing selected characteristics of the coastal farmers, and exploring the influences of the selected characteristics of the farmers to their attitude towards CSA.

MATERIALS AND METHODS

Study area

The study area of this research was three coastal upazilas namely Tala, Dacope and Morrelgonj of the districts of Satkhira, Khulna and Bagerhat respectively. Some basic facts of the study area like agroecological zone (AEZ), area, population, literacy rate, major crops, etc. are presented in Table 1 as stated in BBS (2021).

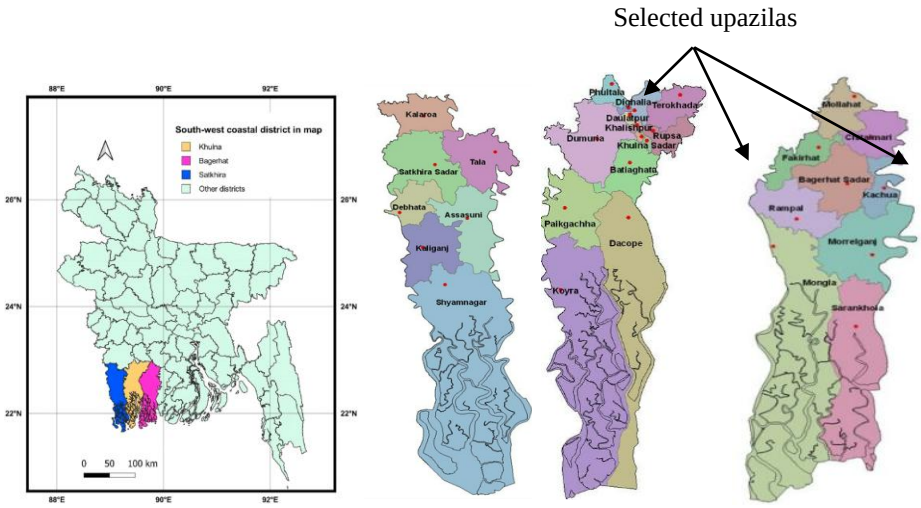

Fig 1. A map of Bangladesh (left side) with its administrative districts. Right side: maps of three districts (Satkhira, Khulna and Bagerhat) with three upazilas (Tala, Dacope and Morrelgonj) from where data were collected

Table 1. Basic Facts of the Study Area

Study area	AEZ	Area (km^2)	Population (000)	Literacy	Major crops	Existing major CSA practices	Cropping intensity
Morrelgonj, Bagerhat	13	460.90	295	60.7%	Paddy, Potato, sugarcane	Plastic irrigation pipe, Salinity resistant variety, Mulching, etc.	132
Dacope, Khulna	13	991.58	152	56%	Paddy, Watermelon, Potato, pumpkin	Plastic irrigation pipe, Rain water harvesting, Watermelon cultivation, etc.	114
Tala, Satkhira	11	344.15	300	50.9%	Paddy, Jute, Brinjal, Sugarcane	Ridge planting, Raised bed planting, mulching, etc.	198

Population and Sample of the Study

Out of 19 coastal districts of Bangladesh 3 districts, viz. Satkhira, Khulna and Bagerhat were purposively selected as study area. Three upazilas were randomly selected from these districts taking one upazila from each district. Nine villages from these three upazilas were again selected randomly taking 3 villages from each upazila. A total of 4489 farm families were found from selected nine villages and this number was considered as the population of the study. As the number of farmers in each of the villages was not the same, from each of the locations a 'proportionate random sampling' technique was used and sample size was found 354. To make a respective sample from the population following formula was used as developed by Kothari (2004).

$n = [Z^2 P QN] / [(N-1) e^2 + Z^2 P Q]$

Where, n = Sample size

Z = Table value at 1 d.f. (1.96)

P = Probability (assume 0.5)

Q = Remaining from probability (1-P) = 0.5

N = Total population = 4489

e = The level of precision (5%)

By putting the values in the above formula, the sample size was determined as follows-

$$n = \frac{Z^2 PQN}{(N-1)e^2 + Z^2 PQ}$$

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5 \times 4489}{(4489-1) \times (0.05)^2 + (1.96)^2 \times 0.5 \times 0.5}$$

$$n = 353.95 \approx 354$$

Variables and Instruments for Data Collection

Data were collected by households' survey, using an interview schedule from 354 coastal farmers during December 2021 to March 2022. Coastal farmers' knowledge on CSA was the main focus of this study and it was considered as the dependent variable. Education, farm size, annual agricultural income, farming experience, extension contact, training exposure, innovativeness, credit availability, access to market, decision making ability, benefit obtained from CSA and knowledge on CSA were considered as the predictor/independent variables of this study.

Measurement of the variables

Measurement of attitude towards CSA: In the present study, an attempt was made to develop an attitude scale for measuring the attitude of coastal farmers towards

CSA. Attitude scale was constructed by following the method of Likert's Technique of Summated Ratings Scale suggested by Edwards (1957) with slight modification. Initially 45 statements related to attitude towards CSA were collected through consultation with the agricultural scientists and extension experts and from review of available related literatures of home and abroad. Then these statements were carefully examined in the light of 14 criteria suggested by Edwards (1957) for screening. After screening, 30 statements were selected for administering pretest. The statements were analyzed on the basis of pre-test data obtained by administering to 24 farmers. The critical ratio (t-value) was calculated as suggested by Edwards (1957). The statements having 't' values ≥ 1.75 were finally selected for the attitude towards CSA scale. As such 18 statements were selected in the final scale of attitude towards CSA including 9 positive and 9 negative statements. The nature of responses of the respondents to the statements were 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree' and scores were assigned as '4', '3', '2', '1' and '0' respectively for the positive statements and the reverse scores were given for the negative statements. The possible range of score of attitudes towards CSA was from 0-72, where 0 indicated very highly unfavourable attitude and 72 indicated very highly favourable attitude towards CSA. Based on the previous studies, for example, Roy *et al*. (2021), the measurement procedure of independent variables is given in Table 2 below.

Table 2. Measurement of independent variables

Variables	Measurement
Education	Number of years of schooling
Farm size	Total quantity of farming land in ha, including gardening and fishery
Annual agricultural income	Total yearly earning from farming
Farming experience	Number of years a farmer was involved in farming
Extension media contact	Total scores of a respondent on his nature and frequency of 14 selected extension media
Training experience	Total number of days that a respondent had undertaken different types of training related to agriculture/climate smart agriculture
Innovativeness	Scores assigned for respondent farmer as 5, 4, 3, 2, and 1 for innovators, early adopters, early majority, late majority and laggards respectively
Credit availability	Percentage of loan received against his/her sought amount
Access to the market	Score by using a 3-point rating scale of buying inputs and selling goods for his farming activities

Variables	Measurement
Decision making ability	Score obtained by using a 3-point rating scale of the six selected items
Benefit obtained from CSA	Score obtained using 4-point rating scale of 20 selected benefits.
Knowledge on CSA	Total score of a respondent obtained from a set of 20 questions related to CSA

Data Entry and Analysis

Data from all the interview schedules were coded, tabulated and analyzed in accordance with the objectives of the study. Data checking tools like outliers checking and removing multi-collinearity were employed. Pearson product moment correlation test was initially done and found no strong correlation ($r > 0.8$) between two or more predictors in the regression model. The analysis was performed using SPSS software version 21. Descriptive analysis such as range, numbers and percentage distribution, mean and standard deviation (SD) were used. Full model regression analysis was used in order to find out the contribution of the predictor variables to the outcome variable.

RESULT AND DISCUSSION

Attitude towards climate smart agriculture

Attitude scores of the coastal farmers varied from 38 to 57 against the possible range of 0 to 72, with a mean of 49.19 and standard deviation 5.28. Based on the observed attitude scores, the respondents were classified into three categories (mean ± SD) namely 'low favourable attitude', 'medium favourable attitude', and 'high favourable attitude'. The distribution of the respondents under each of the four categories has been shown in Table 3. Table 3 reveals that the highest proportion (61.01%) of the farmer had medium favourable attitude towards CSA as compared to 18.65% and 20.34% having low and high favourable attitude towards CSA respectively. The most (79.76 %) of the respondent farmers had low to medium favourable attitude towards CSA.

Table 3. Distribution of the farmers according to their attitude towards CSA

Categories	Number	Percent	Mean	SD	CV
Low favourable attitude (<44)	66	18.65	49.19	5.28	10.73
Medium favourable attitude (44-54)	216	61.01			
High favourable attitude (>55)	72	20.34			
Total	354	100			

Source: Authors

The majority of the farmers had medium knowledge on CSA (Table 4) and knowledge had positive contribution to their attitude towards CSA (Table 5) for which majority of the farmers might be influenced in forming favorable attitudes towards CSA. On the other hand, due to facing unfavourable environment for a long time, farmers were practicing CSA for their farming activities and getting benefits from it (Table 4) which might influence majority of the coastal farmers having favorable attitudes towards CSA.

Farhad and Kashem (2004) found majority (68%) of the respondents having medium attitude while 17% low attitude and 15% high attitude in using IPM in vegetable cultivation. Samad (2010) found majority (69.84 %) of the farmers having favorable attitude towards aerobic rice cultivation. Sarkar (2002) and Hussain (2001) found almost similar result in their respective studies.

Selected Characteristics of the Coastal Farmers

Table 4 indicates that only 12.71% of the farmers were illiterate and the rest 87.29% were literate which was composed of secondary education (59.32%), primary education (20.06%), higher secondary education (5.37%) and tertiary education (2.54%). Over time, government's initiative, different NGO's education programmmes (e.g., BRAC school) and for social involvement and need of the farmers, they somehow obtained literacy for which literacy is little greater than the national average. The small farm holder constituted the highest proportion (60.5%) followed by medium farm holder (22.6%), marginal farm holder (10.2%) and large farm holder (6.8%). About half of the respondents (50.56%) had low annual agricultural income; their annual agricultural income is up to Tk.150000. The next group were medium income farmers (40.68%) while the lowest proportion belongs to high income group (8.76%). Mittra and Akanda (2019) found similar result in their study that majority (62.2%) of the coastal farmers had low annual income. About 73.45% of the coastal farmers did not receive any training while 20.06% received low training, 3.95% received medium training and 2.54% received high training on agricultural matters. Majority (69.49%) of the respondents had medium decision-making ability, while 19.49% and 11.02% had high and low decision-making ability respectively. Hossain (2017) found almost similar result that majority (62.9%) of the respondents had medium decision-making ability. The highest proportion (75.42%) of the farmers belonged to medium benefits obtained from CSA, while 9.32% and 15.26% had low and high benefits obtained from CSA group respectively. Majority (75.14%) of the farmers had medium-level knowledge followed by 14.13% had poor knowledge and 10.73% had high-level knowledge on CSA. Israel (2019) and Ochieng (2015) found almost similar result regarding knowledge on climate change that majority (72% and 81% respectively) of the respondents had poor to medium level knowledge on climate change.

Table 4. Salient features of the selected characteristics of the farmers (n=354)

Characteristics	Measuring unit	Range		Categories	Number	Percent	Mean	SD
		Possible	Observed					
Education	Year of schooling	Unknown	0-15	Illiterate (0-0.5)	45	12.71	7.53	3.51
				Primary education (1-5)	71	20.06		
				Secondary education (6-10)	210	59.32		
				Higher secondary education (11-12)	19	5.37		
				Tertiary education (>12)	9	2.54		
Farm size	Score	1-5	2-5	Marginal farmer (0.021-0.2)	36	10.20	3.26	0.73
				Small farmer (0.21-1.0)	214	60.5		
				Medium farmer (1.01-3.0)	80	22.6		
				Large farmer (> 3.0)	24	6.8		
Annual agricultural income	Score	1-10	1-10	Low-income farmer (<150)	179	50.56	3.94	1.85
				Medium income farmer (151-300)	144	40.68		
				High income farmer (>300)	31	8.76		
Farming experience	Year	Unknown	10-50	Low experienced farmer (<15)	65	18.36	24.60	9.9
				Medium experienced farmer (15-35)	247	69.77		
				High experienced farmer (>35)	42	11.87		
Extension media contact	Score	0-42	15-31	Low contact farmer (< 18)	62	17.51	23.13	4.66
				Medium contact farmer (18-28)	243	68.64		
				High contact farmer (>28)	49	13.85		
Training exposure	No. of days	Unknown	0-7	No trained farmer (0)	260	73.45	0.61	1.26
				Low trained farmer (1-2)	71	20.06		
				Medium trained farmer (3-4)	14	3.95		
				High trained farmer (>4)	9	2.54		
	Score	1-5	1-5	Innovator (5)	39	11.03		
				Early adopter (4)	122	34.46		

Characteristics	Measuring unit	Range		Categories	Number	Percent	Mean	SD
		Possible	Observed					
Innovativeness				Early majority (3)	140	39.54	3.39	0.92
				Late majority (2)	45	12.71		
				Laggard (1)	8	2.26		
Credit availability	Score	0-100	0-83	No credit farmer (0)	288	81.36	9.84	21.16
				Low credit farmer (<50)	18	5.08		
				Medium credit farmer (50-70)	43	12.15		
				High credit farmer (>70)	5	1.41		
Access to market	Score	0-20	10-17	Low access (<11)	29	8.19	13.47	1.79
				Medium access (11-15)	266	75.14		
				High access (>15)	59	16.67		
Decision making ability	Score	6-18	11-17	Low decision making (<12)	39	11.02	13.76	1.77
				Medium decision making (12-15)	246	69.49		
				High decision making (>15)	69	19.49		
Benefit obtained from CSA	Score	0-60	34-55	Low benefit (< 40)	33	9.32	45.91	5.09
				Medium benefit (40-51)	267	75.42		
				High benefit (> 51)	54	15.26		
Knowledge on CSA	Score	0-40	17-32	Poor knowledge (up to 20)	50	14.13	25.45	3.86
				Medium-level knowledge (>20-30)	266	75.14		
				High level knowledge (>30)	38	10.73		

Source: Author

Contributions of selected characteristics of the farmers to their attitude towards CSA

Results presented in Table 5 show the summarized results of full model multiple regression analysis with 12 independent variables on the farmers' attitude towards

CSA. The value of R^2 is 0.410, which means that all of the 12 variables accounted for 41.0% of the variation in attitude towards CSA of the coastal farmers. The regression equation so obtained is presented below-

$$\mathbf{Y = b_0 + b_1X_1 - b_2X_2 + b_3X_3 + b_6X_6 - b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12}}$$

Or, $Y = 27.617 + 0.167X_1 - 1.548X_2 + 0.450X_3 + 0.336X_6 - 0.879X_{10} + 0.261X_{11} + 0.638X_{12}$

i.e., Attitude = 27.617 + 0.167 (education) - 1.548 (farm size) + 0.450 (annual agricultural income) + 0.336 (training exposure) - 0.879 (decision making ability) + 0.261 (benefit obtained from CSA) + 0.638 (knowledge on CSA)

For every one year of passing in schooling, an extra 0.167 attitude score was obtained. For increase every one score of farm size, a score of 1.548 attitude was decreased. For instance, a farmer having land area of 0.021 to 0.2 hectare, had attitude score 1.548 more than those who had land area of 0.21 to 1.0 hectare. For increasing annual income of every Tk.50000 (1 score = Tk. 50000), an extra 0.450 attitude score was obtained. For increasing every one score of training exposure, an extra 0.336 attitude score was obtained. The more the number of days a farmer will receive training, the more they will obtain attitude score. For increasing every one score of decision-making ability, a score of 0.879 of attitude was decreased. This might be due to that the farmers did not feel to take decision from others and decided themselves whether the decision might be right or wrong, because increased decision-making ability indicated less dependency on others while taking decision. For increasing every one score of benefit obtained from CSA, an extra 0.261 attitude score was obtained. For increasing every one score of knowledge on CSA, a score of 0.638 attitude score was obtained.

Table 5. Summary of full model multiple regression analysis showing the contribution of selected characteristics of the farmers to their attitudes toward CSA

Variables entered	'b' Value	Value of 't' (with probability level)
Education (X_1)	0.164*	2.046 (0.041)
Farm size (X_2)	-1.548**	-3.366 (0.001)
Annual agricultural income (X_3)	0.450*	2.443 (0.015)
Farming Experience (X_4)	0.048	1.772 (0.077)
Extension contact (X_5)	0.105	1.665 (0.097)
Training exposure (x_6)	0.336*	2.069 (0.039)
Innovativeness (x_7)	0.318	1.192 (0.234)
Credit availability (x_8)	0.004	0.421 (0.674)

Variables entered	'b' Value	Value of 't' (with probability level)
Access to market (x_9)	0.188	1.392 (0.165)
Decision making ability (X_{10})	-0.879**	-5.035 (0.000)
Benefit obtained from CSA (X_{11})	0.261**	5.194 (0.000)
Knowledge on CSA (X_{12})	0.638**	7.996 (0.000)
Multiple R = 0.640, R-square = 0.410, Adjusted R-square = 0.389, F-ratio = 19.744 at 0.000 level of significance, Standard error of estimate = 4.18553, Constant = 27.617		

*Significant at 0.05 Level, **Significant at 0.001 Level

CONCLUSION

The respondent farmers of the study area had favourable attitude towards CSA with different degrees. The highest proportion (61.01%) of the farmer had medium favourable attitude while high favourable attitude possessing farmers (20.34%) became a little greater than that of low favourable attitude (18.65%) towards CSA. Farmers having smaller farm tended to show more favourable attitudes towards CSA than that of large farm size. Farmers' education, annual agricultural income, training exposure, benefit obtained from CSA and knowledge on CSA had positive significant contributions to their attitudes towards CSA; while farm size and decision-making ability had negative significant contributions to their attitudes towards CSA.

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