



Perception of Farmers on Maize as a Potential Crop for Climate Change Adaptation in Northern Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Author MAA collected review of literatures, collected and analyzed data and wrote the first draft of the manuscript. Author MRK helped in performing statistical analysis and edited the first draft of the manuscript. Author KA assisted in sampling design and data collection. Author MASM helped in designing the study and edited the final draft of the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2021/V11i1130324

Editor(s):

(1) Dr. Elly Josephat Ligate, Sokoine University of Agriculture, Tanzania.

Reviewers:

(1) Ranganadhan S, University of Mysore, India.

(2) Polampalli Madhavi, Professor Jayashankar Telangana State Agricultural University, India.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/64252>

Received 10 November 2020

Accepted 14 January 2021

Published 15 January 2021

Original Research Article

ABSTRACT

The main purposes of this research study was to determine the perception of farmers on maize as a potential crop for climate change adaptation and to access problems faced by the farmers in maize production. Maize cultivation is getting importance in Bangladesh, with economic efficiency of production estimated at 87%. Data were collected from the farmers of four villages of Biral Upazila under Dinajpur district in the Northern Bangladesh during 28 March to April 28 2018 from the 90 randomly selected farmers. Both descriptive and correlation coefficients test was performed for statistical analysis. Results revealed that almost three-fifths (61.10 percent) of the farmers had medium, while 20.00 percent of them had low and 18.90 percent had high perception of maize as a

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potential crop for climate change adaption. Correlation analysis indicated that age, education, cosmopolitaness, training received, knowledge on climate change and extension media contact of the farmers had significant positive relationships with their perception of maize as a potential crop for climate change adaption. On the contrary, farm size, maize cultivation area, farming experience and annual income had no significant relationship with their perception of maize as a potential crop for climate change adaption. 'Non-availability of storage facilities' was ranked as the 1st or top problems for maize production. Other problems (in descending order) included 'getting fair price problem due to interfere of middleman', 'non-availability of farm labour', 'lack of /or inadequate access to weather forecast technologies', 'no hybrid maize seed availability, 'non-habit of human for consumption as food', 'poor information access regarding climate change adaptation strategies by maize farmers', 'lack of inputs in time', 'non-suitability of land for maize cultivation', as well as 'poor agricultural extension service delivery'. Further, it might be recommended that necessary support should be provided for the maize growers to minimize their problems on prioritize basis.

Keywords: Perception; maize; potential crop; climate change adaptation; Bangladesh.

1. INTRODUCTION

Bangladesh is basically an agricultural country. Agriculture plays the vital role in capital formation. The importance of agriculture in Bangladesh can never be emphasized. It is Asia's 5th and world's 7th most populous country. About 47.30 percent of the total population of this country is directly or indirectly involved in agricultural activities. The per capita income is about \$ 520 and its people have a life expectancy of 64.9 years [1]. Agriculture related sector contributes as much as 15.96 percent of the Gross Domestic Product (GDP) of the country [2]. Thus, agriculture plays a vital role in ensuring food security, employment generation, poverty alleviation, and raising standard of living and increasing export earnings.

Climate change is a global environmental threat and development concern. Developing countries are the most adversely affected by the negative effects of climate-induced events because of their low level of adaptation [3]. It is projected that climate change may severely affect global food security by the middle of the 21st century. The largest number of food-insecure people will be located in South Asia. Climate has been found to be one of the major components that significantly influence agricultural production, with large-scale impact on food production and the overall economy. Both natural and human activities such as emission of greenhouse gasses [4]; cause various climate-related disasters that adversely affect agriculture, food security, water resources and biodiversity as a whole [5].

Bangladesh is considered as one of the most vulnerable countries in the world to climate

change [6], because of its geographical location, economic dependence on agriculture, and recurrence of natural disaster [7-8]. A major concern for Bangladesh are climate change victims who are increasing in number every year and must seek refuge due to loss of their homes, land, settlement to river erosion and permanent inundation. A major concern for Bangladesh are climate change victims who are increasing in number every year and must seek refuge due to loss of their homes, land, settlement to river erosion and permanent inundation [9]. Climate change impact affects many sectors, like water resources, agriculture, ecosystems, biodiversity, food security, and human health [10].

Recent studies using simulation models indicate that even moderate increases in temperatures will have negative impacts on cereal crops of smallholder farmers [11]. Every year, agricultural production is severely affected by climate change impact in Bangladesh [12,13]. Crop diversification with rice tolerant varieties, pumpkin *etc* play important role as climate change adaptation strategies [14]. Maddison [15] argues that if farmers learn gradually about the change in climate, they will also learn gradually about the best adaptation options towards it. The socio-economic conditions of the farmers in Bangladesh are some of the most vulnerable in the world to climate change. So, various characteristics such as occupation, education, farm size, daily income and training on disaster management also significantly influence the climate change adaptation options [16]. Therefore, adaptive processes to the effects of climate change are the priority for Bangladesh and crucial to build resilience into the lives of the farmers.

Maize is widely cultivated throughout the world, and a greater weight of maize is produced each year than any other grain. The United States produces 40% of the world's harvest; other top producing countries are: China, Brazil, Mexico, Indonesia, India, France and Argentina. Maize is the third most important cereal crop in Bangladesh, after rice and wheat. It is a major cash crop commonly used in the poultry and fish feed industries for baking and other foods for human consumption. The nutritional value of maize, its economic importance and incredibly diverse uses are significant not only in Bangladesh, but across every region of the world. Maize cultivation is being rapidly expanding both in *Rabi* and *Kharif* season in Bangladesh [17]. Even more feed will be needed soon as poultry meat consumption among Bangladeshi people continues to rise [18]. Maize production is increasing in Bangladesh day by day. The study aimed at finding out those factors, which facilitated and caused barriers to the maize cultivation by the farmers as well as the problems faced by the farmers in maize production.

2. METHODOLOGY

2.1 The Locale of the Study

The study was conducted among the maize growers of Biral Upazila under Dinajpur district due to availability of Maize growers. So, Biral Upazila of Dinajpur district was selected purposively of Dinajpur district. Thus, this Upazila was considered as the locale of the study.

2.2 Population and Sampling

Multistage random sampling procedure was followed in this study. At first Dinajpur district was purposively selected. In the second stage, Biral Upazila/sub-district was selected as purposively, in third stage one union from the Upazila was selected as random sampling procedure, where farmers are involved in the maize cultivation. The selected union consists of 26 villages out of which a total four village Buniadpur, Moheshpur, Shibpur and Madhobbaty were also randomly selected which constitute the study area. An updated list of 291 maize growers (total population) was collected with the help of Upazila Agriculture Office. In the final stage, a total of 90 maize farmers were selected as the sample following random sampling method.

2.3 Collection of Data

The researcher collected data from the sample farmers with the help of a pretested interview schedule. Before starting collection of data, the researchers met with the Sub Assistant Agriculture Officer of the respective blocks in order to explain the objectives of the study and requested them to provide necessary help and co-operation in collection of data. The local leaders of the area were also approached to render essential help. As a result of all these a good working atmosphere was created in the study area which was very helpful for collection of data by the researcher. Before going to the respondents for interview they were informed earlier, so that they would be available in their respective area. The interviews were held individually in the house or farm of the respective respondent. The researcher established adequate rapport so that the respondents did not feel hesitant to provide actual information. Whenever any respondent faced difficulty in understanding a particular question, the researcher took care to explain the same clearly. All possible efforts were made to explain the purpose of the study to the respondents and their answers were recorded sincerely.

2.4 Measurement of Variables

Ten selected characteristics of the farmers were independent variables which were measured by appropriate techniques, statistical scores and scales. Farmers' perception on maize as a potential crop for climate change adaptation was the focus or dependent variable of this study. To measure perception on climate change of the farmers, three dimensions namely; general response, weather conditions, and climatic response were considered [19]. Farmers' response on the general perception was measured by computing the General Response Sub-score (GRS). The farmers were asked to express their general perception on the statements in accordance with their observation/experience on the past years. A respondent was asked to indicate his extent of agreement against each of the statements along 4-point rating scale such as 'high', 'moderate', 'somewhat' and 'not at all' and weights assigned to these responses were 3, 2, 1, and 0 respectively [20]. Similarly, farmers' response on the weather condition and climatic response was measured by computing the Weather Response Sub-score (WRS) and Climatic Response Sub-score (CRS) following the scale and score of

GRS. For making comparative analysis of the farmers perception with respect to general response, weather conditions, and climatic response an overall Perception Indices (PI) was calculated. PI was calculated by adopting the following formula:

$$PI = \frac{P_h \times 3 + P_m \times 2 + P_l \times 1 + P_n \times 0}{3}$$

Where,

P_h = Percentage of farmers for high perception

P_m = Percentage of farmers for moderate perception

P_s = Percentage of farmers for somewhat perception

P_n = Percentage of farmers for not at all perception

2.5 Problem Confrontation

In order to measure the problems regarding perception of farmers on maize as a potential crop for climate change adaptation, a pre-tested questionnaire was used. The purpose of this section was to have an understanding on the problems faced by the farmers in maize production. Problems in each item have been presented with frequency distribution of the farmers in percent. For clear understanding of problems of the farmers an index for each item along with rank order was computed by using the following formula [20-21]:

Problem Confrontation Index

$$(PCI) = P_n \times 0 + P_l \times 1 + P_m \times 2 + P_h \times 3$$

Where,

P_n = Percent of respondent with not at all problem

P_l = Percent of respondent with low problem

P_m = Percent of respondent with medium problem

P_h = Percent of respondent with high problem

2.6 Statistical Analysis

Data collected were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. The statistical measures such as range, mean, standard deviation, percentage etc were used for describing both the selected characteristics of the respondents and the focus issue of the study. Tables were also used in

presenting data for clarity of understanding. To find out the relationship of selected characteristics of the maize growers with each of their perception of maize as a potential crop for climate change adaptation, Pearson's Product Moment Co-efficient of Correlation was used. Five percent (0.05) and one percent (.01) level of probability was used as the basis for rejection of a null hypothesis throughout the study. Co-efficient values significant at 0.05 level is indicated by one asterisk (*), and that at 0.01 level by two asterisks (**). SPSS (Statistical Packages for Social Science) software was used to analysis data.

3. RESULTS AND DISCUSSION

3.1 Selected Demographic Characteristics of the Farmers

In total 10 characteristics of the maize farmers were selected to find out their relationships with their perceptions on maize as a potential crop for climate change adaptation. The selected characteristics included their age, education, farm size, maize cultivation area, farming experience, annual income, cosmopolitaness, training received, knowledge on climate change, extension media contact (Table 1).

3.1.1 Age

The mean age was 38.82 years with standard deviation of 12.55. thus the findings indicates that about half (48.89 percent) of the farmers in the study area was young aged category, while 32.22 percent belonged to middle aged and only 18.89 percent belonged to old aged category.

3.1.2 Education

The education score of the respondents ranged from 0 to 21, with the average being 8.99 and the standard deviation of 4.10. Thus the findings indicate that a little more than half (52.20 percent) of the farmers were secondary education as compared to 3.30 percent were illiterate, 17.80 percent primary education, 25.60 percent above secondary education and a negligible proportion 1.10 percent of them can sign only.

3.1.3 Farm size

Farm size of the respondents ranged from 0.08 hectare to 5.41 hectares with a mean of 1.28 and standard deviation of 1.06. The findings reveals

that more than half (53.30 percent) of the respondents had small farm while 38.90 percent had medium farm, and only 7.80 percent had large farm.

3.1.4 Maize cultivation area

The average area under maize cultivation of the respondents was 0.33 ha with a standard deviation of 0.35 ha. Area under maize cultivation range from 0.04 ha to 2.20 ha. The majority (94.40 percent) of the maize growers had small farm and a negligible proportion 5.60 percent had medium farm. The farming cultivation experience score of the maize growers ranged from 3 to 45 years with a mean of 15.31 and standard deviation of 9.91. The one-half of the respondents (50.00 percent) of the farmers had high experience on maize cultivation while 28.90 percent and 21.10 percent of them had medium and low experience on maize cultivation.

3.1.5 Annual income

Annual family income of the respondents ranged from 50.5 to 1165.0 thousand taka. The mean was 269.03 thousand taka and standard deviation was 215.71. The highest proportion (85.30 percent) of the respondents had annual medium income compared to 12.20 percent of them having high and a negligible proportion 2.20 percent of the respondents had low annual income.

3.1.6 Cosmopolitanness

Cosmopolitanness scores of the respondents ranged from 5 to 17 with a mean of 8.57 and standard deviation of 2.06. The majority (54.40 percent) of the respondents had medium cosmopolitanness while 30.00 percent having low and 15.60 percent having high cosmopolitanness.

3.1.7 Training received

The training received score of the maize farmers ranged from 0 to 10 days with a mean of 3.09 days and standard deviation of 3.10 days. The highest proportion (30.00 percent) of the respondents had no training compared to 21.10 percent had short duration training, while 21.10 percent had medium training and 27.80 percent had long duration training.

3.1.8 Knowledge on climate change

The observed knowledge score of the maize farmers was 19.22 and standard deviation of

4.25. Thus near than two-thirds (65.55 percent) of the maize farmers possessed medium knowledge while 18.89 percent of them possessed low knowledge and 15.56 percent of them had high knowledge on climate change.

3.1.9 Extension media contact

The extension media contact mean and standard deviation was 22.14 and 4.73 respectively. Thus almost two-thirds (65.55 percent) of the maize growers had medium extension media contact compared to 17.78 percent having high extension contact and 16.67 percent of them had low contact.

3.2 Perceptions of the Farmers on Maize as a Potential Crop for Climate Change Adaptation

Farmer's perception on maize as a potential crop for climate change adaptation was the focus issue in this study, where 15 statements were included under three aspects of climate change adaptation (i.e. general response, weather condition and climatic response) included. The dimension wise findings are presented separately in the given sub-sections.

3.2.1 General response of the farmers on maize as a potential crop for climate change adaptation

The total possible scores of general response of the respondents could range from 0 to 15 against the obtained score ranged from 05 to 14 with an average score of 9.77 and standard deviation 2.29. Based on their general response scores, the farmers were classified in to three categories such as 'low response', 'medium response' and 'high response' (Table 2).

Results of Table 2 indicate that about two-thirds (68.88 percent) of the respondents had medium general response, while the proportions of low and high response were same i.e., 15.56 percent. However, the overwhelming majority of the respondents (84.44 percent) were under low to medium response category. It may be conclude that the farmers have average general response on maize as a potential crop for climate change adaptation.

3.2.2 Response on weather condition of the farmers

The possible scores of response on weather condition could range from 0 to 15 against the

obtained score ranged from 03 to 14 with an average score of 9.89 and standard deviation 2.35.

The result in Table 3 indicate that the majority (70.00 percent) of the farmers had medium response on whether condition compared to 15.60 percent having high response on whether condition, and 14.40 percent farmers had given their response on whether condition. The findings imply that majority (85.60 percent) of the farmers

were medium to high response on whether condition. This means that response given on weather condition by the farmers was also satisfactory like general response.

3.2.3 Climatic response of the farmers

The possible scores of climatic response of the maize farmers could range from 0 to 15 against the obtained score ranged from 05 to 14 with an average of 9.68 and standard deviation 2.36.

Table 1. Demographic profile characteristics of the farmers (N=90)

Characteristics	Scoring method	Range Observed (Possible)	Categories	Respondents		Mean	SD
				No.	Percent		
Age	No. of year	19-79 (Unknown)	Young (19-35)	44	48.89	38.82	12.55
			Middle aged (36-50)	29	32.22		
			Old (>50)	17	18.89		
Education	Year of schooling	0-21 (Unknown)	Illiterate (0)	3	3.30	8.99	4.10
			Can sign only (0.5)	1	1.10		
			Primary (1-5)	16	17.80		
			Secondary (6-10)	47	52.20		
			Above secondary (>10)	23	25.60		
Farm size	Hectare	0.08-5.41 (Unknown)	Small (0.02-1.0)	48	53.30	1.28	1.06
			Medium (1.01-3.0)	35	38.90		
			Large (>3.0)	7	7.80		
Maize cultivation area	Hectare	0.04-2.20 (Unknown)	Small (0.02-1.0)	85	94.40	0.33	0.35
			Medium (1.01-3.0)	5	5.60		
Farming experience	No. of year	3-45 (Unknown)	Low (≤ 7)	19	21.10	15.31	9.91
			Medium (8-10)	26	28.90		
			High (>10)	45	50.00		
Annual income	('000' Tk.)	50.5-1165.0 (Unknown)	Low (≤ 53)	2	2.20	269.03	215.71
			Medium (54-484)	77	85.60		
			High (>484)	11	12.20		
Cosmo politeness	Score	5-17 (0-18)	Low (≤ 7)	27	30.00	8.57	2.06
			Medium (8-10)	49	54.40		
			High (>10)	14	15.60		
Training received	Days	0-10 (Unknown)	No (0)	27	30.00	3.09	3.10
			Short (up to 2)	19	21.10		
			Medium (3-5)	19	21.10		
			Long (> 5)	25	27.80		
Knowledge on climate change	Marks	10-28 (0-30)	Poor (≤ 15)	17	18.89	19.22	4.25
			Good (16-23)	59	65.55		
			Excellent (>23)	14	15.56		
Extension media contact	Score	10-45 (0-54)	Low (≤ 17)	15	16.67	22.14	4.73
			Medium (18-26)	59	65.55		
			High (>26)	16	17.78		

Table 2. Distribution of the farmers according to their general response

Observed range (Possible range)	Categories (score)	Farmers		Mean	Standard Deviation
		Number	Percentage		
5-14	Low response (up to 7)	14	15.56	9.77	2.29
0-15	Medium response (8 to 12)	62	68.88		
	High response (above 12)	14	15.56		
Total		90	100.00		

Table 3. Distribution of the farmers according to their weather condition

Observed range (Possible range)	Categories (score)	Farmers		Mean	Standard Deviation
		Number	Percentage		
03-14 0-15	Low response (up to7)	13	14.40	9.89	2.35
	Medium response (8 to 12)	63	70.00		
	High response (above 12)	14	15.60		
	Total	90	100.00		

Table 4. Distribution of the farmers according to their climatic response

Observed range (Possible range)	Categories (score)	Farmers		Mean	Standard deviation
		Number	Percentage		
5-14 0-15	Low climatic response (up to7)	23	26.60	9.68	2.36
	Medium climatic response (8 to 12)	54	60.00		
	High climatic response (above 12)	13	14.60		
	Total	90	100.00		

Data presented in the Table 4 shown that three-fifths (60.00 percent) of the maize farmers were medium climatic response, followed by 25.60 percent low and only 14.40 percent were high climatic response. Most of the maize growers of this study found medium climatic response.

3.2.4 Overall perceptions of the farmers on maize as a potential crop for climate change adaptation

The perceptions of the farmers on maize as a potential crop for climate change adaptation are the summation of the scores of the selected three aspects (i.e. general response, weather condition and climatic response). The possible scores could range from 0 to 45 against the obtained score ranged from 19 to 40 with an average 29.37 and standard deviation 5.07. Based on their perception scores, the respondents were classified in to three categories such as 'low perception', 'medium perception' and 'high perception' (Table 5).

Data furnished in Table 5 shows that almost three-fifths (61.10 percent) of the farmers had medium perception while 20.00 percent of them had low perception and 18.90 percent had high perception of maize as a potential crop for climate change adaptation. Thus, the

overwhelming majority of the respondent (81.10 percent) had medium to low perception. This may be due to the literacy rate of the respondents (77.80 percent) of the study area had secondary and above secondary level education).

3.2.5 Statement wise perception of the farmers on maize as a potential crop

In contrast to have an understanding about the extent of perception of the farmers on maize as a potential crop for climate change adaptation for each statement computed perception indices (PI) and rank order have been shown in Table 6.

It is evident from Table 6 that 'drought has been my motivation to adapt growing maize' has ranked 1st as perceived by the maize growers (77.40). When the farmers perceived that their crops are hampered due to climatic factor they first motivated to form favorable perception in cultivating maize.

The second ranked statement is 'increase insect infestation'. This may be due to the reason that the farmers may feel that insect infestation is occurred due to climatic factor and climate change creates favorable condition for the development of insect.

Table 5. Distribution of the farmers according to their overall perception

Observed range (Possible range)	Categories (score)	Farmers		Mean	Standard deviation
		Number	Percentage		
19-40 (0-45)	Low perception (19-24)	18	20.00	29.37	5.07
	Medium perception (25-34)	55	61.10		
	High perception (above 34)	17	18.90		
	Total	90	100.00		

Table 6. Statement wise perception of the farmers on maize as a potential crop

Sl. no	Statements	Percentage of farmers				PI	Rank order
		H	M	S	N		
A General response							
1	Maize can tolerate extended period of water stress	34.44	32.22	21.11	12.22	62.96	11 th
2	Maize reduce negative impacts of climate change by optimizing crop yields and profits	24.44	42.22	26.67	6.67	61.48	12 th
3	Has drought been your motivation to adapt maize growing?	54.44	27.78	13.33	4.44	77.40	1 st
4	Maize can help to meet national food security on the face of climate change in the future	38.89	33.33	22.22	5.56	68.52	5 th
5	Disease and pests incidences to maize is less compared to other crops	17.78	31.11	50.00	1.11	55.19	14 th
B Weather conditions							
1	Long summer session	31.11	44.44	22.22	2.22	68.14	6 th
2	Short winter session	38.89	36.67	18.89	5.56	69.63	3 rd
3	Rains have become less unexpected over the years	35.56	36.67	23.33	4.44	67.75	7 th
4	The weather becomes more unpredictable from year to year	24.44	40	22.22	13.33	58.51	13 th
5	Uneven rainfall distribution will increase in our lifetime	33.33	35.56	25.56	5.56	65.56	9 th
C Climatic response							
1	A decrease crop yield	22.22	27.78	24.44	25.56	48.89	15 th
2	Increase insect infestation	46.67	31.11	18.89	3.33	73.71	2 nd
3	Changes in climate is threat to farm business	33.33	45.56	16.67	4.44	69.26	4 th
4	Climate change impact on farm profitability	31.11	41.11	23.33	4.44	66.29	8 th
5	Climate change induce farmers to make change in their farm practices	20.00	56.67	20.00	3.33	64.45	10 th

Note: H= high, M= moderate, S= somewhat and N= not at all, PI= Perception Indices

Table 7. Relationship between the focus issue and selected characteristics

Focus issue	Selected characteristics	Computed values of 'r' with 88 df	Tabulated value of 'r'	
			0.01 level	0.05 level
Perceptions on maize as a potential crop for climate change adaptation.	Age	-0.253*	±0.207	±0.270
	Education	0.360**		
	Farm size	0.128		
	Maize farm size	0.172		
	Farming experience	-0.075		
	Annual income	-0.002		
	Cosmopolitaness	0.209*		
	Training received	0.255*		
	Knowledge on climate	0.307**		
	Extension media contact	0.331**		

Note: ** Correlation is significant at the 0.01 level (2-tailed) and * Correlation is significant at the 0.05 level (2-tailed)

Table 8. Problem confrontation by the maize farmers

Sl. No.	Problems	Frequency of citation				PCI	Rank order
		Not at all	Low	Medium	High		
1.	Poor access to climate change adaptation strategies information by maize farmers	19	31	24	16	127	7 th
2.	Lack of /or inadequate access to weather forecast technologies	12	34	27	17	139	4 th
3.	Poor agricultural extension service delivery	31	32	18	9	95	10 th
4.	Non-availability of farm labour	19	18	29	24	148	3 rd
5.	Non-availability of storage facilities	17	21	18	34	159	1 st
6.	Lack of production inputs in time	29	25	26	10	107	8 th
7.	Getting fair price is difficult due to interfere of middleman	21	16	19	34	156	2 nd
8.	No hybrid seed production in Bangladesh	18	32	21	19	131	5.5 th
9.	Non-habit of human for consumption as food	14	34	29	13	131	5.5 th
10.	Non-suitability of land for maize cultivation	31	26	23	10	102	9 th

Note: PCI=Problem Confrontation Index

The 20th ranked statement is 'a decrease crop yield'. The farmers perceived that due to climate change the yield of indigenous crops are decrease and thus need to develop new variety of climate smart crops.

3.3 Relationship between the Selected Characteristics of the Farmers and their Perceptions on Maize as a Potential Crop for Climate Change Adaptation

The selected ten characteristics constituted the independent variables, while perception on maize as a potential crop for climate change adaptation was the dependent variable. To explore the relationships between the dependent and independent variables, Pearson's product moment co-efficient of correlation (r) has been used.

According to the Correlation analysis (Table 7) indicated that age, education, cosmopolitaness, training received, knowledge on climate change and extension media contact of the farmers had significant positive relationships with their perception of maize as a potential crop for climate change adaption. The findings of education and extension media contact are similar to respective outcomes of Karim et al. [21]. Educating farmers on technical know-how of maize cultivation has a positive interaction [22].

On other hand, farm size, maize cultivation area, farming experience and annual income had no significant relationship with their perception of maize as a potential crop for climate change adaption.

3.4 Problem Confrontation Index (PCI)

In order to understand the comparative importance of different problems and to identify their severity, the 10 problems were arranged in rank order (Table 8). Most serious problem faced by the maize farmers was 'non-availability of storage facilities' with problem confrontation index of 159 as 1st problem. The farmers mentioned that maize grain absorbs high moisture and it is very sensitive to fungal attack and that problem was compelled to them sell their produce in local markets at low prices. The 2nd mentioned problem of the maize growers was 'getting fair price is difficult due to interfere of middleman' with the PCI of 156. The 9th mentioned problem of the maize growers was 'non-suitability of land for maize cultivation' with PCI of 102. Non-suitability of land for maize cultivation due to low land was a problem to the farmers. The 10th mentioned problem of the maize growers was 'poor agricultural extension service delivery' with PCI of 95. Farmers mentioned poor agricultural extension service delivery was a problem to adapt climate change problems.

4. CONCLUSION

On the basis of the findings, majority of the maize farmers were medium to high climatic response and the more than half of the maize farmers had medium overall perception on maize as a potential crop for climate change adaptation. As four-fifths of the respondents were young to middle aged category and age was negatively correlated with their perception on maize as a potential crop for climate change adaptation. It may be said that the young farmers are more favorable perception on maize as a potential crop. In addition, majority maize farmers had medium to high knowledge on climate change, so participant' knowledge and understanding of the concept of climate change encourages farmers to cultivate maize against climate change threat. Education and compositeness of the farmers had positive significant relationship with their perception on maize as a potential crop for climate change adaptation. Thus it may be concluded that the higher is the education and higher is the perception of the respondents on climate change adaptation means who have more education cosmopolite in nature having more perception. The majority of the farmers had medium to high response on whether condition. Therefore, it is strongly recommended that different type extensions program should be extended to improve their awareness on climate change. Further, extension media contact was found significantly related with perceptions on maize as a potential crop for climate change adaptation. Hence, it can be recommended that with the availability of extension workers, the group discussion meeting, demonstration meeting and training facilities for the farmers should ensure. Farmers faced higher problems in 'non-availability of storage facilities' followed by 'getting fair price is difficult due to interfere of middleman', 'non-availability of farm labour' and lack of /or inadequate access to weather forecast technologies. Climate change has a direct influence on pest and disease pathogens due to the advantage of multiple life cycles in short time period. Expansion of maize production/adaption driven by climate change will make more areas vulnerable to entry of pests and diseases. Hence, a strong extension programme on crop protection measures has to be taken up to contain onslaught of diseases and pests. Therefore, it may be recommended that necessary technical support should be provided for the maize growers to minimize their problems with priority basis.

CONSENT

As per international standard informed and written consent has been collected and preserved by the author.

COMPETING INTERESTS

Authors have declared that no competing interests

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