

An Assessment of Cultivators' Perception about Climate Change and It's-induced Adaptation Practices in Agriculture of Cooch Behar Sadar Sub-division, West Bengal, India

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Abstract The Perception of climate change and its induced adaptation practices is very important in agricultural activity. This study was conducted at Cooch Behar Sadar sub-division in West Bengal, India, from May to December 2019. The objective was to find out the cultivators' perceptions about climate change and its adaptation practices and also analysis the preferences about Climate Resilient Agriculture (CRA) practices in the study area. Both primary and secondary data were collected using qualitative and quantitative methods. Mean score (MS), conjoint analysis, and Knowledge-adaptation index (KAI) were used to analysis the above mention objectives related to this study. The result shows that the adaptation practices such as high, moderate crop yield and climate resilience agricultural (CRA) practices had a positive utility, implying that these were the most preferred combination of CRA when responding to climate change. Contrary to this, high greenhouse gas emissions, low climate resilience, and low crop yield had a negative utility, implying that these were the least preferred combination. The majority of the respondent cultivators with marginal landholding were almost perceived by the phenomena of climate change. The study established that CRA practices were visible and effective response measures, to address the barriers of climatic variability and changes. So, it should be supported by the adoption of innovative technologies, policies, and strategies.

Keywords: cultivators' perception, climate change and variability, adaptation practices, KAI, conjoint analysis

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1. Introduction

The ecosystem function and services are widely affected by global climate change which is mainly due to anthropogenic causes [1]. The vulnerability of agriculture will also increase locally by this climate change and variability because, the carrying capacity of the biosphere to produce enough food and goods will determine by various climatic parameters [2,3]. The cultivators do more experience about this climatic variability and change as they depend for their livelihood on the natural environment [2]. The people who live in the Cooch Behar district are socially and economically disadvantaged and mainly depend on subsistence farming for their livelihood [2]. The adaptation policy regarding agricultural practices is a widely recognized vital component to cope with climate change [4]. Thus the cultivators' perceptions need to be assessed at the micro-level, for acknowledging local concern. So, the

region-specific policies are formulated and implemented easily with public support.

To assured food security under changing climatic conditions, CRA is a holistic approach [5]. The concept of Climate Resilient Agriculture (CRA), Climate Smart Agricultural Practices (CSAPs), and Smart Agricultural practices (SAPs) were developed by the UN Food and Agriculture Organization in 2010 to improve the agricultural production system in response to climatic variability and change [6]. This CRA also mitigates climate change with a contribution to other development agenda [7]. Such as the long-term agricultural development objective, short-term priorities, reorientation of the agricultural system, etc. Though CRA was developed in 2010 by FAO, its effectiveness in India as well in the study area has not yet been fully assessed.

Thus, a better understanding of the cultivators' perception of climate change, ongoing adaptation practices, and the factors influencing the decision to adopt new mitigation measures is needed to developed new policies and programs for a successful livelihood by

promoting adaptation [8]. So, in this research, it was an attempt to assess the cultivators' perception about climate change and the strategies related to agricultural practices that they adopt in response to such variability and change in this study area.

2. Objectives

The present study was designed to execute the following objectives:

- To study the Cultivators' Perception about climate change and variability in the study area.
- To observed the Cultivators' Perception about climate-induced adaptation practices.
- To analysis the cultivators' preferences on

climate-induced adaptation practices.

3. Study Area

The study was conducted at Cooch Behar Sadar sub-division (Eastern Himalayan agro-climatic region) of West Bengal, India (Figure 1). The working site location as measured by GPS was 26°00'14"N to 26°30'15"N latitude and 89°15'30"E to 89°30'30"E longitude. The mean altitude of the area was 49 m above MSL. The region is sub tropically receiving average annual rainfall of 250-300 mm from the southwest monsoon of which 80% is received from June to August. The summer and winter temperature is around 33°C as the highest in May, while the lowest temperature is 7°C in January.

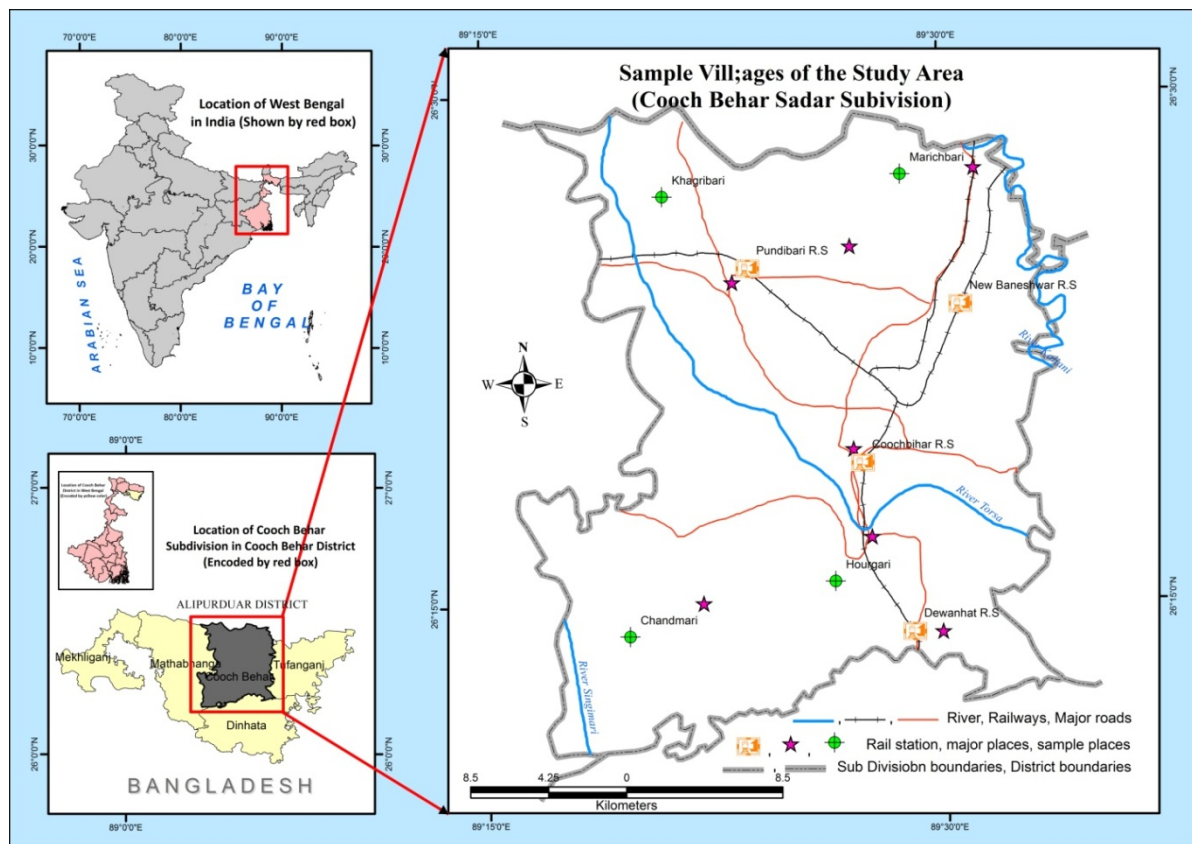


Figure 1. Location of the study area

In the study area, the majority of the respondents were male (85%). Females without their male folk did not respond to our scheduled and so, only 15% female of the total respondents as independent responded. Approx all of the respondents were literate and a majority of them (90%) have attended school up to primary level and the rest of them were more than the primary level. The livelihood of the respondents' depends on cultivation and around 84% of them had landholding in small size.

4. Database and Methodology

4.1. Sampling Technique

The objectives of the study required to achieve a numerical assessment of local perception about climate

change and preferences in the use of CRA. So, the study needs both qualitative and quantitative data. Two-stage sampling techniques were applied to select sample households. In the first stage, a purposive sampling method was used to identify sample village and 4 representative villages, such as Hourgari, Chandamari, Khagrbari, and Marichbari from the study area, considering about various climate induced adaptation practices in that villages. The respondent cultivators were selected by random sampling method and the sample size was determined by using a 95% confidence interval and .05% desired level of precision. Because there were no previous studies conducted on perception of climate change and its induced adaptation practices in the study area, the expected prevalence of climate induced adaptation practice follower cultivator was taken as 7%, and the size was determined by the formula for the infinite population given below.

$$n = \frac{Z^2P(1-P)}{d^2} \tag{1}$$

Where, n= required sample size,
 Z= level of confidence according to the standard normal distribution (for a level of confidence of 95%, Z= 1.96),
 P=7% Expected prevalence or proportion of the population
 d= tolerated margin of error (in present study .05%).
 Based on the above-given formula, the total sample size was expected to be 100.

4.2. Methods Data Collection

Both primary and secondary data were collected in this study. Primary data was collected from the household surveys in the study area. The household scheduled survey, key informants interviews, focus group discussions and field observations methods were employed to collect primary data from the field. Side by side these methods were also enabled to collect more information about important socio-economic issues in this study area. The secondary data such as different documents related to the study were necessary for an in-depth understanding of how far the problem had been studied and what areas had not been covered in the research. These secondary data were obtained from different websites and literature.

4.3. Methods of Data Analysis

The study of quantitative analysis about cultivators' perception of climate change and preference of CRA mainly based on primary data. Cultivators' perception of climate change analyses by mean score (MS), the qualitative information obtained from focus group discussion and key informant interviews (including barriers to adoption of CRA). The CRA attribute profile cards were generating by using orthogonal design in SPSS [9,10]. The respondent preference of CRA was determined by conjoint analysis and perception of various CRA adaptation practices was analyses by the Knowledge-adoption index (KAI). These methods were broadly described as follows.

4.3.1. Mean Score

The statements of climate change perception were exposed to the respondents of more than 40 years of age. This is because they have a keen observation over a considerable period on climate parameters and their change [11]. All the selected statements were exposed to the respondents with three response categories as "Agree," "Undecided" and "Disagree" with the code of A, U, and D respectively. The mean score for every statement was calculated by the following formula:

$$Mean\ score = \frac{n1 - n2}{N} \tag{2}$$

Where, n1= Number of respondents agreed with the statement,
 n2= Number of respondents disagreed with the statement, and
 N = Total number of respondents.

The average means score with all statements Considered for the parameter was also calculated and grouped to perceive the changes in any parameter as (Table 1).

Table 1. Decision scales based on average mean score

Decision	Score
No change	0
Change somewhat	0.01-0.50
Absolutely changed	0.51-1.00

4.3.2. Knowledge-adoption Index (KAI)

The perceptions about climate-induced adaptation practiced in agriculture were recorded in the adaptation section of the schedule as opinion statements respectively to quantify the overall adaptation strategies. We tried to get an idea regarding the knowledge and adoption level (number of respondents adopted/using different strategies) of different adaptive strategies (both indigenous and recommended). A community-level knowledge-adoption index (KAI) for each strategy was calculated based on the knowledge and adoption of any strategy by the respondents. It is calculated as:

$$KAI = \frac{fk + 2fa}{2N} \tag{3}$$

Where, fk = Number of respondents who only know about the strategy but not adopted, fa = Number of respondents who had adopted the strategy, N = Total number of respondents.

4.3.3. Orthogonal Design

To understand the farmers' preferences towards specific Climate induced adaptation practices or CRA practices, a rating-based method was employed. As the experiment relies on the rating-based method of conjoint analysis, the preference card of the CRA attribute combination needs to be prepared. So, the orthogonal design was used to prepare this preference card of the CRA attribute combination. The aim of this design is the smallest manageable combination of potential profiles to test with respondents. So that rather than showing thousands of combinations, a much smaller number such as less than 30 could be shown for knowing that the statistical analysis at the end would be able to separate the main effects from the design.

The orthogonal design is widely accepted due to its flexibility to judge preferences for different levels of attributes and its easy interpretation as compared to the other. Therefore, four attributes were used for the Preference card generation in this study i.e. productivity level, utilization of organic fertilizer, GHG emission, and climate resilience agriculture, with two, two, two, and three-factor levels respectively.

Attribute I: Productivity with the level of high and low crop yield (two levels).

Attribute II: GHG emission with the level of high and low emission (two levels).

Attribute III: Utilization of organic fertilizer with the level of main and supplementary (two levels).

Attribute IV: Climate resilience Agricultural practices with the level of high, moderate, and low resilience (three levels).

Table 2. Combination of Climate Resilient agriculture (CRA) attributes levels

Profile card	Productivity level	Greenhouse gas emission level	Utilization of organic fertilizer	Climate Resilient Agricultural	Status
1	Low	Low	Supplementary	Low	Design
2	High	High	Supplementary	Moderate	Design
3	Low	High	Supplementary	High	Design
4	High	High	Supplementary	Low	Design
5	High	Low	Supplementary	High	Holdout
6	Low	Low	Main	High	Design
7	High	High	Main	Moderate	Design
8	High	Low	Main	Low	Design
9	High	High	Main	High	Design
10	Low	Low	Main	Low	Design
11	Low	High	Supplementary	Moderate	Design
12	Low	High	Main	Moderate	Design
13	Low	High	Main	Low	Design
14	Low	Low	Supplementary	High	Design
15	Low	Low	Supplementary	Moderate	Design
16	High	Low	Supplementary	Moderate	Design
17	Low	Low	Main	Moderate	Design
18	High	High	Main	Low	Design
19	High	Low	Supplementary	High	Holdout
20	High	Low	Supplementary	High	Design
21	High	Low	Supplementary	Low	Design
22	Low	High	Supplementary	Low	Design
23	High	Low	Main	High	Design
24	High	High	Supplementary	High	Design
25	High	Low	Main	Moderate	Design
26	Low	High	Main	High	Design

Source: Computed by the Author.

From this combination, a total of $2 \times 2 \times 2 \times 3 = 24$ profiles (Table 2) were generated as a full factorial design and an extra 2 are holdout profiles.

4.3.4. Conjoint Analysis

Conjoint analysis method was developed by Professor Paul Green for the analysis of the respondent preference level about different attributes. It was also designed by mathematical psychologists and statisticians Luce Tukey in 1964 [12,13,14,15]. Quantitative information obtained from household interviews (including farmers' preferences for CRA) were cleaned to ensure quality, coded and recorded in Excel sheets, then subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) Version 25. Using a syntax procedure as described in the IBM SPSS syntax editor manual. Therefore, the following syntax was applied to the conjoint analysis of CRA attributes and practice.

```
FILE='D:\respondent_pref26.sav'.
CONJOINT PLAN = 'D:\cra_combination26.sav'
/ATA = 'D:\respondent_pref26.sav'
/SEQUENCE = pref1 TO pref26
/SUBJECT = ID
/FACTORS = pro_lev (LINEAR MORE) ghge (LINEAR MORE) org_fer (DISCRETE) cra (LINEAR MORE).
/UTILITY = 'Directory\utility.sav'
/PLOT = all. Where, pro_lev is the productivity level, ghge is the greenhouse gas emission, org_fer is the utilization of organic fertilizer, and cra is the climate resilience agriculture.
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5. Result and Discussion

5.1. Cultivators' Perception about Climate Change

In this study mean score is used for the analysis of the cultivators' perception about climate change and variability; IMD data were applied for judged the analysis. The instance perceptions of cultivators and other than cultivators might be different because the cultivator directly interacts with nature to perform their cultivation activities and thus might be more aware of the changes than the latter [2]. A detailed analysis, however, is done to understand the variation in responses.

According to the cultivators' perception, the present climate is in a changing phase than what it was in past years. The overall community perception toward change in rainfall and temperature-related events is high with an average perception score of 0.71 (Table 3). Most of the cultivators perceived that average day temperature is increased in pre-monsoon with the perception score of 0.95 is followed by Range of day and night temperature increased (0.87), Duration of rainy days decreased (0.85), Coldness in winter decreased (0.79), Change in intensity and pattern of rainfall (0.76), Average night temperature decreased (0.66), Winds are getting warmer (0.59), Duration of cloudy days decreased (0.56), and Wind storms getting stronger (0.37).

Table 3. Cultivators’ perception about magnitude climate change

Statement	A	U	D	MS
Change in intensity and pattern of rainfall	85	6	9	0.76
Duration of rainy days decreased	89	7	4	0.85
Duration of cloudy days decreased	66	34	10	0.56
Average day temperature increased in pre-monsoon	97	1	2	0.95
Average night temperature decreased in pre-monsoon	80	6	14	0.66
Range of day and night temperature increased	91	3	4	0.87
Wind storms getting stronger	57	23	20	0.37
Winds are getting warmer	66	27	7	0.59
Coldness in winter decreased	81	17	2	0.79
Magnitude of change in climate events (average)				0.71

Source: Computed by the Author. Where, A= Agree, U = Undecided, D= Disagree, MS = Mean score.

On the other hand, the overall community perception toward change in climate events regularity is medium with an average perception score of 0.53 (Table 4). The majority of the respondent cultivators believed that the monsoon rainfall trend is the late-onset and early withdrawal from the season with a perception score of 0.96. However this perception is followed by Duration of any season are changing (0.94), Rainfall is being

unpredictable day by day (0.87), Dry spell lengthen than before (0.86), Duration of winter has decreased (0.86), sudden heavy rainfall (0.73), and Incidents of floods is increasing (0.86). The perception about the uneven distribution of rainfall, Late withdrawal of monsoon rains and Early onset of monsoon rains are less important according to the cultivator with the perception score of -0.14, -0.17, and -0.34.

Table 4. Cultivators’ perception about regularity of climate change

Statement	A	U	D	MS
Rainfall is being unpredictable day by day	93	1	6	0.87
Uneven distribution of rainfall	22	42	36	-0.14
Late onset of monsoon rains	98	0	2	0.96
Early onset of monsoon rains	5	56	39	-0.34
Late withdrawal of monsoon rains	12	59	29	-0.17
Early withdrawal of rains in monsoon	98	0	2	0.96
Sudden heavy rainfall in monsoon	78	17	5	0.73
Duration of any Season are changing	97	0	3	0.94
Incidents of floods is increasing	83	2	15	0.68
Dry spell lengthen than before	91	4	5	0.86
Duration of winter has decreased	89	5	6	0.86
Average perception score on change in regularity and duration of climatic events				0.53

Source: Computed by the Author. Where, A= Agree, U = Undecided, D= Disagree, MS = Mean score.

Table 5. Rainfall and temperature data

Year	1901-1929	1930-1959	1960-1989	1990-2019
Maximum temperature in °C	29.75	30.05	30.12	30.88
Minimum temperature in °C	19.39	19.76	19.69	20.23
Rainfall in mm	176.24	180.28	177.94	171.70

Source: <https://www.indiawaterportal.org>, IMD.

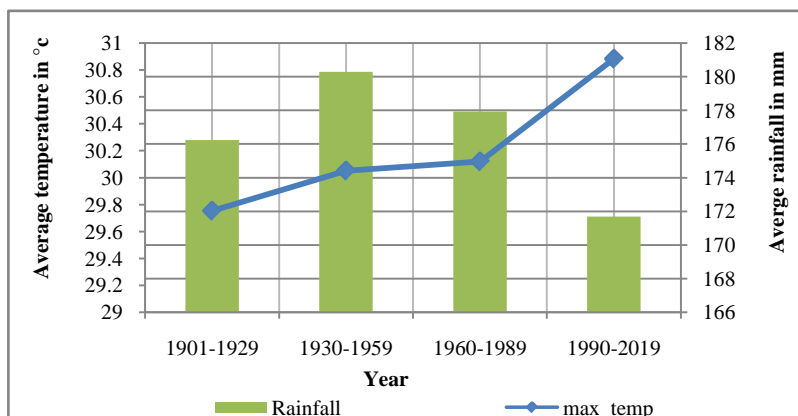


Figure 2. Temperature and rainfall pattern of Cooch Behar District (1901-2019)

The studies from different parts of the Himalayan region indicate the temperature rising, season shifting, winter melting, and also changes in timing, magnitude, and intensity of rainfall [16]. The response nature might also affect because there has a difference in age, gender, education, and experience in the cultivation of the individual cultivators to our questions. The perception of increased temperature and decreased rainfall with the uncertain charter is coinciding with the trend analysis from meteorological data of the last climatic decade (Table 5). The line graph of 35 years (1901-2019) average maximum temperature indicates an increasing trend, whereas the bar diagram of annual rainfall shows a decreasing trend over time (Figure 2). So, the cultivators' perceptions about climate change in different weather parameters (especially rainfall and temperature) are correlative across this region of the country and assure necessary findings.

5.2. Cultivators' Perception of Climate-induced Adaptation Practices

Community's ability to perceive climate change is a key precondition for their choice of adaptation [2,17], and in this study area, the majority of the respondents had perceived climate change. The adaptation level indicates that the community has adopted one or a combination of adaptation options as they were aware of climate change [18]. The adaptation strategies mainly depend on the educational status, landholding, and economic condition of the respondent [5]. A higher level of education is often hypothesized to increase the probability of adopting new technologies [5,19] as it increases one's ability to receive, decode and understand information relevant to making innovative decisions [20]. It was reported that communities with extreme poverty levels do not adopt any new technology and they rely on their basic technologies [21]. In this study area, the adaptation index is medium because most of the cultivators had attended school at least up to the primary level. As 90% of the cultivators of this study had landholding is small size and economic condition is low. The medium level of the knowledge-adoption index of the adaptation strategies is quite understandable which is primarily based on their basic technologies and most of which are economically viable and socially acceptable.

After assessing the perceptions of climate change, it is important to assess how the change is managed by the cultivator, which can provide important lessons for the design and implementation of adaptive responses and policies. Based on the knowledge- adoption index score, it can be said that overall adaptation in response to climate change is medium with an average mean score of 0.64 (Table 6). A total of 16 options of adaptation (CRA) strategies were adopted in the study area by the cultivator. Though a number of the adoption strategies i.e., Bio-flock fish farming, Mulching, Drought tolerant crop varieties, Zero tillage, integrated farming, Soil conservation techniques, Use of insurance, Mushroom cultivation are unknown, all of these strategies are more or less adopted by the cultivator in the study area. The level of the knowledge-adoption index is high with the score of 0.73 to 0.99 about Use of HYV seed, Use of short duration

crop varieties, Alteration of sowing dates, Crop rotation, use of organic and inorganic products to control disease, insects, and pest, Intercropping so, these were adopted by the majority of the cultivator. The low to medium level of knowledge-adoption index score 0.26 to 0.61 are found in Use of insurance, Rainwater harvesting, Zero tillage, Pulse production in the wasteland, Integrated farming, Mushroom cultivation, Mulching, Soil conservation techniques, Drought tolerant crop varieties, Bio-flock fish farming so, these are not popularly adopted by the cultivator.

Table 6. Distribution of cultivator according to knowledge-adoption statements

Adaptation options	Know		DK	KAI
	A ^d	NA ^d		
Alteration of sowing dates	86	14	0	0.93
Crop rotation	66	44	0	0.88
Inter cropping	45	55	0	0.73
Use of HYV seed	99	1	0	0.99
Mulching	40	10	50	0.45
Zero tillage	18	72	10	0.54
Rainwater harvesting	19	79	2	0.59
Use of short duration crop varieties	95	5	0	0.98
Integrated farming	16	71	13	0.52
Drought tolerant crop varieties	7	56	37	0.35
Use of organic and inorganic products to control disease, insects and pest	75	25	0	0.88
Soil conservation techniques	2	85	13	0.45
Use of insurance	46	30	24	0.61
Pulse production in waste land	10	86	4	0.53
Mushroom cultivation	13	71	16	0.49
Bio-flock fish farming	7	37	56	0.26
Average				0.64

Source: Computed by the Author

Where, A^d = Adopted, NA^d = Not adopted, DK= Don't Know, KAI = Knowledge-adoption Index.

The decision about climate change-related adaptation in agriculture is mainly influenced by socioeconomic, geographical, ecological, cultural, and political factors [17,22,23,24]. The institutional factors such as robustness of livelihoods and alternatives, assets, access to appropriate technology, skills, infrastructure, information, policies, microfinance, equity, and pseudonym perceptions also affect the human-environment interactions [22,25,26]. So the adaptation decision may not only depend on the amount and scope of scientific awareness available but also individual attitudes to risk, policy, and institutional barriers [27,28,29]. In this study area, most of the cultivators were poor, marginal with lacking expertise, and low capacity that should be needed on the right measures. All these options involve either some financial investment or technical know-how on which they are not trained to adopt and might involve some risk which the farmers avoid. So, the adaptation strategies need to the cultivator for their better socio-economic status, food security, alternative income sources, and livelihood diversification.

5.3. Cultivator's Preferences on Climate-induced Adaptation Practices

Cultivator's preference on climate-induced adaptation practices is measured by the analysis of relative importance of CRA attributes and its conjoint score. In this method higher the positive utility value is the higher preferences of the respondent to that particular Attribute level and those received negative utility value does not mean that the factor level was unattractive to the respondent, just about the respondent are more choosy about it.

5.3.1. Relative importance CRA attributes

The result (Table 7) indicated that among the various resilient cultivation attribute, the relative importance of climate resilience agriculture score (34.504) is high and it was followed by crop yield (30.387), Greenhouse gas emission (30.084), Utilization of organic fertilizer (5.025) respectively, which was shown in (Figure 3).

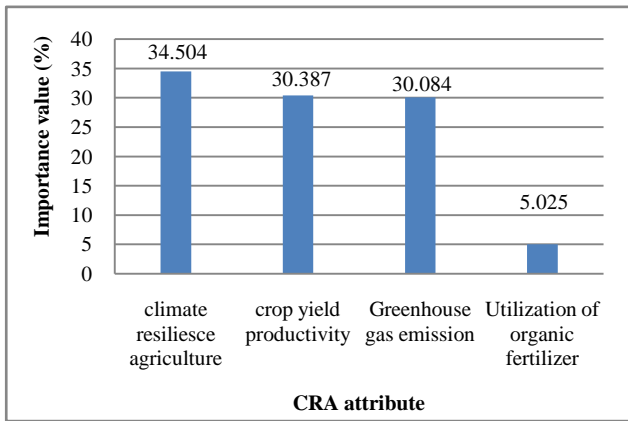


Figure 3. Relative importance score of the CRA attribute

Table 7. Relative importance score of CRA attribute

Climate resilient agriculture attribute	Importance values
ORG_FER	5.025
CYP	30.387
GHGE	30.084
CRA	34.504

Source: Computed by the Author.

5.3.2. Cultivators' Preferences about CRA Attribute

A conjoint analysis result (Table 8) indicated that the attribute levels had different influences on cultivators' preferences for CRA practices. The highest utility value was obtained from high crop yield (10.027), followed by high climate resilience (7.825) and Moderate climate-resilient agriculture with a utility value of 5.217. Low crop yield, low climate-resilient agriculture, and organic fertilizers as supplement fertilizer received utility values of 5.014, 2.608, and 0.406 respectively. However, the highest disutility value was observed on high GHG emission (-9.755) followed by low GHG emission (-4.878) and organic fertilizers as main fertilizer (-0.406) respectively.

Table 8. Conjoint score of cultivators' preferences about CRA practices

Attributes	Attribute levels	Estimated Utility	Std. Error
ORG_FER	Main	-0.406	0.692
	Supplementary	0.406	0.692
CYP	Low	5.014	1.383
	High	10.027	2.767
GHGE	Low	-4.878	1.383
	High	-9.755	2.767
CRA	Low	2.608	0.847
	Moderate	5.217	1.694
	High	7.825	2.541
Constant		7.079*	3.458*

Source: Computed by the Author.

Where, ORG_FER = Organic fertilizer; CYP = Crop yield productivity; GHGE = Greenhouse gas emission; CRA = Climate resilient agriculture. *The constant value can be interpreted as base utility while the other factor values contrast with constant in positive and negative direction.

The Pearson's R correlation coefficient shows the correlation of observed preference score versus the conjoint model estimated preference score; whereas Kendalls' tau correlation coefficient shows the discrepancy of the ranks between the predicted and actual profiles [30]. In this study, the correlation coefficient value indicates that the data generated by conjoint analysis is valid as shown in (Table 9) both Pearson's R-value (0.807) and Kendalls tau value (0.638). This logic of judgment made by the model was appropriate because this significance value is quite high and also indicates that the model is well fitted to predict the respondents' preferences for different attributes.

Table 9. Correlations between observed and estimated preferences

Correlation	Value	Sig.
Pearson's R	0.807	0.000
Kendall's tau	0.638	0.000

Source: Computed by the Author.

6. Conclusion

The challenges of an arrangement of food for the growing world population become increase [31]. Due to prolonged overuses land, water, and other natural resources also become degraded gradually [32]. There is no assuredness that, these challenges will not be enhanced in the future by such kind of population pressure on the resource environment. The process of global warming with its potential for affecting the climatic parameters of every region in the world is influenced by these [33,34]. The trend of rising temperature, increasing drought, frequent and unpredictable erratic rainfall create the vulnerability of agriculture in the Eastern Himalayan Agro-climatic region also [2].

According to the agricultural Census of India (2011), an estimated 61.5% of the 1300 million Indian populations are rural and dependent on agriculture. Agriculture is the main livelihood of rural India and the number of farming

households is 159.6 million. The consumers were not satisfied with this conventional agricultural production system in this variable climatic context. To reduce the adverse impacts of climate change in agriculture various adaptation actions are required. In this regard, to deal with the combined problems of food security and climate change, the application of CRA practice plays a vital role. However, limited work has been done on climate change perception of the cultivators' and also the preferences of CRA practices in the Cooch Behar Sadar sub-division (Eastern Himalayan Agro-climatic region) to avoid these climate change impacts.

The findings indicated that most of the cultivators' perceptions about climate change are increase temperature and decrease with unpredictable rainfall in pre-monsoon, monsoon season. So, in this context, high crop yield and high climate-resilient agriculture were the most preferred attribute of climate change adaption practices by the cultivators. Contrary to this, high GHG emission, low climate resilience, and low crop yield was the least preferred attribute of climate change adaption practices. Therefore, the best choice for the farmers was a combination of high crop yield, low GHG emission, and high or moderate climate-resilient agriculture. So, it could be said that the result revealed that crop yield and climate resilience were the most important factors that influence farmers' preferences for CRA practices. In addition to this, the perception and adoption of various CRA adaptations practiced such as HYV seed, Alteration of sowing dates, Use of short duration crop varieties, Use of and Crop rotation, and Use of organic and inorganic products to control disease, insects, and pest are more preferable. Based on the findings, we recommend that existing CRA practices need to be well planned and up-scaled by integrating them with innovative policies and strategies so, that the adoption range is enhanced at the local level.

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