

Understanding of farmers' perception of climate change and adaptation strategies: A case study in Jhargram district of West Bengal, India

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Abstract

A study on farmers perceived prevalence of climate change, manifested by the phenomena like increasing temperature, fluctuating rainfall etc. and in the considered agro-ecological areas was conducted in Binpur II block of Jhargram district of West Bengal to assess the extent of farmers' perception about the climate change and their adaptation strategies to cope up with losses due to climate change. Results showed that the farmers' perception of climate change greatly influenced farmers' readiness to adapt climate change by considering some adjustments to their cultivation and production practices. The findings showed that the farmers' perception of climate change was at a high-level group of respondents. Results showed that 50% of respondents were optimistic with the idea that they can cope up the climate change problems if they get proper government assistance. Only about 13% of farmers perceived Government plans on climate change. Regarding the adaptation strategies, 40% of respondents followed more or less strategies, whereas most of the respondents did not adopt any strategies in this regard.

Keywords: Adaptation, Adaptation strategies, Climate change, Perception

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INTRODUCTION

Global climates are changing very rapidly with creating uncertainty and insecurity in all aspects of global environments necessary for living beings. Climate change is a serious threat to the sustainable development of the nation because of its potential negative effects to the environment, human health, food security, economic activities, natural resources and physical infrastructures (Patrick *et al.*, 2017). The ill-effects of climate change have emerged as floods, drought, erratic rainfall, and extreme events and exerted bad consequences on increasing uncertainties of agricultural and food security programs. Climate change phenomenon such as drought, flood and soil degradation are among the major factors responsible for the decreased agricultural productivity (Yirga 2007; Asrat and Simane, 2017a). Apart from these, greater faith on traditional farming techniques and poor complementary services (such as extension, credit, marketing, etc.) are also responsible for

reducing the adaptive capacity or increasing the vulnerability of smallholder farmers to climate change, which ultimately influences the performance of the already weak agriculture sector of the country (Asrat and Simane, 2017a).

Adaptation to mitigate climate change may only be carried out when (a) farmers can perceive that climate change is really occurring, (b) farmers are capable of identifying adaptation options available for them to mitigate climate change and (c) farmers respond to climate change adaptation as per their production practices followed in agriculture and allied sector (Adiyoga, 2018). Therefore, a complete understanding of farmers' perception on climate change is very important as because it establishes farmers' readiness to adapt themselves towards mitigation of climate change by considering some adjustments to their existing cultivation and production practices (Das, 2009). Hence, there is an urgent requirement to understand location-specific drivers of perception and adaptation to climate change among smallholder

farmers. This becomes helpful to formulate appropriate policies or strategies based on the vulnerability and sensitivity level of each location as well as the accessibility of the adaptation options. In this background, with an objective to know the extent of farmers' perception about the climate change and their adaptation strategies, the present study has been carried out in the Kuila village of Jhargram district of West Bengal.

MATERIALS AND METHODS

The study was conducted in Binpur II block of Jhargram district of West Bengal. The village Kuila was purposively selected as the farmers are known to scientists of Regional Research Station, Bidhan Chandra Krishi Viswavidyalaya, Jhargram during 2018 and 2019. For the selection of respondents' random technique was followed. Total 30 farmers were selected as respondents who were personally interviewed for the study as per the parameters in table 1. Farmers' perception about climate change was studied on three point's continuum with 2, 1, and 0 scores as per the procedure of Kaur and Talukdar (2007) with slight modification. The responses were collected against each of the response categories. Further, the perception scores of each respondent were worked out by summing up the scores obtained on eighteen dimensions of this variable. On the basis of total scores obtained by the respondent, they were classified into three categories *viz.* low, medium and high using the procedure followed by Das (2009). A total of nine variables (*viz.*, age, educational level, annual income, size of operational land, no. of years in cultivation, training exposure, no. of cattle, mass media exposure, communication with different departments) have been selected after consulting with officials of department of agriculture and allied assuming that these personal and socio-economic characteristics of respondents will affect their perception about climate change. For finding out the relationship between farmers' perception about climate change and socio-economic characteristics of the farmers, Karl Pearson's Product Moment Correlation Co-efficient (Chee, 2015) was used. For identifying the adaptation strategies followed by the respondents, a set of questions as depicted in table 4, were prepared and responses were collected from them.

RESULTS AND DISCUSSION

Farmers' perception about climate change: A perusal of Table 1 revealed that the climate change is perceived to some extent by 70.00 % of the respondents, whereas 23.33 % respondents understood the climate change very much. Further, 73.33 % respondents had noticed to some extent that groundwater table was depleting. It was evident that all respondents had a common perception regarding temperature, which in-

creased year after year. However, few respondents had little bit knowledge about many facts like duration and timing of seasons are changing (50%) because even in the season of sowing seeds and transplantation of seedlings they have to wait for congenial soil and environmental condition which are not occurring in time as earlier. The occurrence of irregular and erratic rainfall is increasing (80%) as they are experiencing heavy rainfall for short spell causing temporary flood-like situation as well as alternatively they are experiencing dry spell that causes water scarcity for plants in critical growth stages. Similarly, Asrat and Simane (2018) also reported that more than 55% of the respondents perceived an increasing trend in temperature while 42 and 25% of them perceived a stable and decreasing temperature, respectively and regarding rainfall, about 64% of the respondents pointed out a decreasing trend while 34% of them perceived an increasing trend. Natural calamities are increasing (76.77%) as they are facing more numbers of the storm, hailstorm, even earthquake for the last few years. Soil health is deteriorating (63.34%) because extreme chemical fertilizers are using, and as a result, natural soil organisms are decreasing in numbers day by day. These findings corroborate with the outcomes of Kassie *et al.* (2009) and Wossen *et al.* (2015). Similarly, weed population is increasing (70.00%), diseases of cattle are increasing (66.67%), peoples' modern lifestyle is responsible for climate change (53.34%) as we are using different electronic items for our daily life. Farmers are well known about the extreme use of chemicals and fertilizers leads to environmental pollution and climate change (53.33%). Most of the farmers, more or less, supported the fact that small and marginal farmers are facing the climate change problem. This result might be attributed to the educational and socio-economic exposure of the respondents towards the changes of climate and climate change adaptation in smallholder agriculture was vital to reduce rural poverty and maintain ecosystem health. This is in the same line of findings of research of Deresa *et al.* (2009) and Asrat *et al.* (2004). Besides, adaptation to climate change was a two-step process which was farmers' perceptions on climate change in the first step and respond to changes in the second step through adaptation and the same were also reported by Asrat and Simane (2017a).

It was observed that the scores secured by the respondents varied from a minimum of 2.00 to maximum of 30.00 showed a mean value of 18.96 and S.D. of 6.34. Further, 6.60, 36.70, and 56.70 % of the respondents belong to low, medium and high levels of perception about climate change respectively. The findings show that the farmers' perception about climate change is at a high level group of respondents (Table 2). This result might

Table 1. Distribution of respondents based on responses on Farmers' perception about climate change (no. of respondents 30).

Sl.No.	Dimension	Response category	Freq.	%
1	Climate is changing	Perceived very much	7	23.33
		To some extent	21	70.00
		Not at all	2	6.67
2	Groundwater table is depleting	Perceived very much	4	13.33
		To some extent	22	73.33
		Not at all	4	13.34
3	Temperature is increasing	Perceived very much	13	43.33
		To some extent	17	56.67
		Not at all	0	0.00
4	Stubble burning is harmful for the environment	Understand very much	3	10.00
		To some extent	12	40.00
		Not at all	15	50.00
5	Zero tillage and other conservation method is beneficial for the environment	Understand very much	3	10.00
		To some extent	10	33.33
		Not at all	17	56.67
6	Duration and timing of seasons are changing	Agree very much To some extent	6	20.00
			15	50.00
		Not at all	9	30.00
7	Occurrence of irregular and erratic rainfall is increasing	Agree very much	5	16.67
		To some extent	24	80.00
		Not at all	1	3.33
8	Natural calamities are increasing	Agree very much	3	10.00
		To some extent	23	76.67
		Not at all	4	13.33
9	Satisfactory crop production is becoming a challenge	Agree very much	17	56.67
		To some extent	12	40.00
		Not at all	1	3.33
10	Climate change is affecting the cultivation	Agree very much	9	30.00
		To some extent	14	46.67
		Not at all	7	23.33
11	Soil health is deteriorating	Perceived very much	7	23.33
		To some extent	19	63.34
		Not at all	4	13.33
12	Weed population is increasing	Agree very much	1	3.33
		To some extent	21	70.00
		Not at all	8	26.67
13	Diseases of cattle are increasing	Agree very much	2	6.66
		To some extent	20	66.67
		Not at all	8	26.67
14	Climate change is affecting our daily life	Perceived very much	9	30.00
		To some extent	14	46.67
		Not at all	7	23.33
15	People's modern lifestyle is responsible for climate change	Agree very much	4	13.33
		To some extent	16	53.34
		Not at all	10	33.33
16	Extreme use of chemicals and fertilizers leads to environment pollution and climate change	Agree very much	8	26.67
		To some extent	16	53.33
		Not at all	6	20.00
17	Small and Marginal farmers are facing the climate change problem	Agree very much	13	43.33
		To some extent	14	46.67
		Not at all	3	10.00
18	Production is hampering because of climate change	Perceived very much	13	43.33
		To some extent	13	43.33
		Not at all	4	13.34

be due to the fact that the farmers are fully able to perceive all changes in climate and its effect because of their real-life experiences and the problems faced by them.

The results of Table 3 show that there was a positive and significant correlation of educational level, mass media exposure, training exposure and communication with farmers' perception about the

Table 2. Distribution of respondents depending on various perception levels about the climate change.

Category	Score range	Frequency of respondents	Mean	S.D.
Low	2-7.5	2 (6.60)		
Medium	7.6-15.0	11(36.70)	18.96	6.34
High	15.1-30.0	17(56.70)		

(Figures in the parentheses indicate %age)

Table 3. Relationship between Farmers' perceptions about climate change and socio-economic characteristics of the respondents.

Sl. No.	Variables**	'r' value
1	Age	-0.421*
2	Education level	0.349*
3	Annual income	0.122
4	Size of operational land	-0.136
5	No. of years in cultivation	-0.392*
6	Training exposure	0.235*
7	No. of cattle	-0.011
8	Mass-media exposure	0.404*
9	Communication with different departments	0.264*

*Significant at 0.05 % level; ** variables have been selected based on personal and socio-economic characteristics of respondents after consulting with officials of the department of agriculture and allied sectors

climate change might be due to the fact that income from these sources might provide the farmers with additional capacity to finance the adaptive measures. Deresa *et al.* (2009) and Asrat *et al.* (2004) also reported that education was also posi-

tively correlated with the farmers' climate change perceptions and adaptive suggestions as educated persons were better to recognize the risk associated with climate change. Findings further reveal that age and number of years in cultivation are negatively but significantly correlated with farmers' perception about the climate change showing that income from these sources may not be invested for adaptation in the crop sector. Similar results were also reported by Asrat and Simane (2018). It indicates that education and social mobilization play a significant role in making farmers' perception about climate change. Graft and Onumah (2011) reported that education had a significant positive effect on the farmers' perception regarding climate change. Sofuluwe *et al.* (2011) informed that annual income of the family had also a significant positive influence on farmers' perception about climate change.

Regarding the adaptation strategies, 40% respondents followed more or less strategies whereas most of the respondents didn't adopt any strategies in this regard. Different adaptation measures taken by the respondents were such as planting fruit trees/other trees (40% respondents), cultivation of tolerant varieties (6.6% respondents), livestock management (16.6% respond-

Table 4. List of Farmers' Adaptation strategies.

Adaptation strategies		Frequency (N=30)	%age
Applied adaptation strategies	Yes	12	40.00
	No	18	60.00
Different adaptation measures taken	Planting fruit tree /tree	12	40.00
	Cultivation of tolerant varieties	2	6.66
	Livestock management	5	16.66
	Re excavation of pond	-	-
	Other coop up mechanism		
Other coop up mechanism	Off farm employment	28	93.33
	Looking for government aid	30	100.00
	Reduction of consumption	21	70.00
	Use of credit services	26	86.66
Who to solve climate problem	Selling assets like livestock	20	66.66
	Government	30	100.00
	God	12	40.00
Who to solve climate problem	Farmers with Government assistance	15	50.00
	Heard about Government's plans on climate		
	Yes	4	13.33
Heard about Government's plans on climate	No	26	86.66
	Can we have capacity to solve the climate problems		
Can we have capacity to solve the climate problems	Yes	-	-
	No	30	100.00

ents). This result is in the line of research findings of Lobell *et al.* (2008) and Asrat and Simane (2017b) which indicated that by growing drought-tolerant varieties or planting fruit/other trees requiring less rainfall or maintaining livestock, farmers could overcome the bad effect of climate change, especially low rainfall areas. Moreover, growing of high value horticultural crops (like fruit crops) is a good adoption strategy aiming at more economical utilization of scarce natural resources (like water and land) and maximization of returns. Further, appropriate mechanisms are the important parts for small and marginal farmers to survive with a climate change scenario. Majority of the respondents (93.3%) attempted to cope up the perceived climate change by adopting off-farm employment like daily paid labourers in different field like building construction, leather factory, jewelry factory, cloth making factory nearby or by going to different states. This might be attributed to the fact that the ready cash earned through these off-season professions helped the farmers for building up a good mental strength to cope up with the probable risks raised from climate change. The findings are in the line of research outcome of Ansari *et al.* (2018). About 70 % of respondents tried to cope up the climate change problem by reducing household consumption. Reduction of the level of household consumptions like quantity and variety of food items could affect human health and their productivity, which ultimately influenced the food security of the country. About 86 % of the respondents tried to use credit services to cope up the adverse effect of climate change. This practice may increase the further vulnerability of society for climate change and increase the vicious cycle of poverty and vulnerability. About 66 % respondents told that selling household assets such as cattle is a common practice to get extra income and to reduce household cost if there is crop failure as a result of climate change activities like drought or flood. Lobell *et al.* (2008) and Asrat and Simane (2017b) also reported such type of observations in their research findings. All the respondents expect the need for government support to cope up challenge. In addition, to get Government support, 40 % respondents are not sure for getting the same. Fifty % respondents are optimistic with the idea that farmers themselves can cope up the climate change problems if they get proper government assistance. Only about 13 % farmers heard about Government's plans on climate change. All respondents opined that we didn't have the capacity to solve the climate problems, only we can adopt different measures.

Conclusion

The study concluded that farmers' perceived prevalence of climate change, which was manifested by the phenomena like increasing temperature,

fluctuating rainfall and many others mentioned in the study. From the two years trial, it has also been found that farmers in the considered agro-ecological areas are trying to adapt the consequences of climate change on their livelihood by implementing available and affordable technologies. But it is necessary to assist them with all possible opportunities. Findings showed that education and social mobilization play a significant role in making farmers' perception about climate change. About 40% respondents followed more or fewer strategies whereas most of the respondents don't adopt any strategies in this regard. Majority of the respondents(93.3%) attempted to cope up the perceived climate change by adopting off-farm employment, and about 70 % of respondents tried to cope up the climate change problem by reducing household consumption.

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