Factors affecting the Perception of Farmers about Climate Change in Agriculture

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Abstract

Climate is a critical factor in the livelihoods of people and socioeconomic development as a whole, however the recent developments have adversely affected climate and its effect is seen in all the sectors. Among these different sectors, agriculture is highly sensitive to climate change where a large number of small and marginal farmers depend on agriculture and allied activities for their livelihood. In view of this, a study was undertaken in two states having different vulnerabilities to climate change with an objective of assessing the perception of farmers about climate change in agriculture and factors associated with their perception. The study reveals that a majority of the respondents perceived that the summer temperature is increasing during daytime (84.44% and night time (68.89%), water requirement for the crops has increased (80.00%). The variables such asage, education, extension contact and mass media had a positive and significant relationship at one percent level of probability. Hence, timely access to extension services and weather information are crucial in shaping the perception of farmers about climate change.

Key words: Climate change, Perception, Farmers, Uttarakhand, Karnataka

Introduction

India is considered one of the most vulnerable countries in the world to climate change because of its geographical location, economic dependence on agriculture, and the recurrence of natural hazards (IPCC, 2007). Agricultural production is severely affected by climate change in India where a large portion of the poverty-stricken population depends on agriculture and allied activities for their livelihood. Sudden natural disasters such as storm surges, floods, droughts, and cyclones are associated with long-term changes in salinity due to the rising sea level, landslides which alter the landscape and lead to the emergence of new pests and diseases. These are a few of the challenges of climate change in India. In order to address the emerging threats of climate change a number of efforts are being undertaken by public and private organizations to enhance the resilience of India's agricultural sectors in the face of climate change. Among different sectors, agriculture is one of the most sensitive sectors therefore, concentrated efforts are required for adaptation and to reduce the vulnerability of Indian agriculture to the adverse impacts of climate change and making Indian agriculture more resilient.

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The perceptual understanding of farmers about climate change can shape the preparedness of these actors to adapt and change their practices. The adoption and successful implementation of new technology by farmers in their ecosystems depend on their tendency to perceive and react accordingly to the changes in climate and the environment. Perception strongly affects how farmers deal with climate-induced risks and opportunities; the precise nature of their behavioural responses to this perception will shape adaptation options and outcomes (Adger*et al*. 2009; Pauw 2013).The misconception about climate change and its associated risks may result in no adaptation or maladaptation thus increasing the negative impact of climate change (Grothmann and Patt 2005).Hence, there is a desperate need to increase the ability of the farmers to tackle the ill effects of climate change. The present research study was undertaken to find out the perception level of farmers towards climate change in agriculture with the following specific objectives;

i. To understand the perception of the farmers about Climate Change in agriculture.

ii. To find out the factors affecting the perception of farmers about climate change in agriculture

Research Methodology

The study was conducted in two States of India namely, Uttarakhand and Karnataka as these two States were most frequently exposed to climate vagaries such as floods and drought, respectively. These two states were adopted under the National Innovations on Climate Resilient Agriculture(NICRA)project of Government of India based on the vulnerability index. In this context, Dunda village of Uttarkashi district in Uttarakhand State and Nagenahalli village of Tumkur district in Karnataka State were purposively selected. A total of forty-five farmers who were the beneficiaries of the NICRA project were selected randomly as respondents. The primary data were collected using both structured and semi-structured interview schedule and focus group discussion was also conducted to collect qualitative data from the farmers. The quantitative data were analyzed using statistical tools like percentage, frequency, multiple regression and descriptive statistics were used to analyze the farmers' responses to interpret and draw meaningful results.

Results and Discussion

Table 1. Distribution of respondents based on their perception about climate change (n=45)

S.N	Statements	Increased	Decreased	No change
1	Changes in environmental temperature			
	a) Summer Temperature (day time)	38(84.44)	0(0.00)	7(15.56)
	b) Summer Temperature (night time)	31(68.89)	2(4.44)	12(26.67)
	c) Winter temperature (day time)	19(42.22)	20(44.44)	6(17.78)
	d) Winter temperature (night time)	15(33.33)	22(48.89)	8(4.00)
	e) Extended summer period	30(66.67)	6(13.33)	9(20.00)

2	Changes in rainfall			
	a) Total quantity of rain fall	7(15.56)	36(80.00)	2(4.44)
	b) No. of rainy days in a year	1(2.22)	39(86.67)	5(11.11)
3	Heat wave in summer	22(48.89)	23(51.11)	0(0.00)
4	Cold wave in winter	16(35.56)	29(64.44)	0(0.00)
5	Water table in the reservoirs	7(15.56)	34(75.56)	4(8.89)
6	Water requirement of crops	36(80.00)	9(20.00)	0
7	Changes in pest and disease incidence	31(68.89)	14(31.11)	0(0.00)
8	Changes in the cost of production			
	a) Expenditure on seeds	29(82.86)	5(14.29)	1(2.86)
	b) Expenditure on fertilizers	23(51.11)	16(35.56)	6(13.33)
	c) Expenditure on pesticide	23(51.11)	11(24.44)	11(24.44)
	d) Expenditure on weeding	15(33.33)	21(46.67)	9(20.00)
	e) Expenditure on harvesting	14(31.11)	19(42.22)	12(26.67)
9	Feeding behaviour of dairy animals	32(71.11)	13(28.89)	0(0.00)
10	Occurrence of disease in animals due to climate change	27(60.00)	18(40.00)	0(0.00)
11	Distress sale of animals due to the effect of climate change	23(51.11)	22(48.89)	0(0.00)
12	Investment in agriculture due to climate change	35(77.78)	10(22.22)	0(0.00)

The above table clearly indicates that the majority of the respondents have perceived that the summer temperature is increasing during daytime (84.44 per cent) as well as in the night time (68.89 per cent). Rathore *et al* (2013) also indicated in their study report that the increasing trends were significant over Karnataka, and Uttarakhand. This finding is similar to studies conducted by Nhemachen and Hassan (2007) and they concluded that 84.40 per cent and 100 per cent of the respondents have perceived that there is a significant change in the atmospheric temperature. A vast majority of the respondents (84.44 per cent) perceived that the winter temperature has decreased both during day and night time and summer period was extended. The majority (70.00 per cent) of the respondents also perceived that the heat wave in the summer increased.Further, 80 per cent of the respondents perceived that total quantity of rainfall has decreased.

Water table in the reservoirs like canals, bore wells and open wells has decreased (75.56 per cent) and on the other hand water requirement for the crops has increased (80.00 per cent) in major crops like paddy and wheat due to increased temperature. More than half (55.00 per cent) of the respondents have perceived the increase in the occurrence of pests and diseases due to the change in climate. The respondents

have also noticed new pest and diseases in the field which they felt are very difficult to control. The effect of climate change also changed the cost of production. A vast majority of the respondents (80.00 per cent) perceived that there was an increase in expenditure on seeds. This might be due to delayed/ abrupt rain in the study area which has resulted in poor germination of some crops hence respondents have purchased seed material more than once for re-sowing or gap-filling. Nearly half of the respondents (42.22 per cent) have perceived that the expenditure on harvesting operation was reduced; it might be due to the usage of machinery of custom hiring centers established as part of NICRA project.

Three-fourths of the respondents (71.11 per cent) perceived that there were changes in feeding behavior of animals in the study area; animals feeding pattern changed from open grazing to feeding of the mineral mixture and concentrated feed mixture to get higher milk yield. Feeding behavior of animals changed from dry fodder to mineral mixture and concentrated feed mixture.Farmers felt that desi cows require less fodder and they give an average yield even when fed with dry fodder. But in case of crossbred they have to be fed with a lot of green fodder with extra mineral mixture;then only the farmer will be able to get high milk yield. About 60.00 per cent of the respondents perceived that there was an increase in the occurrence of diseases in animals due to climate change. Intensive training/demonstration and other educational activities on breed improvement, feed management, health and shelter management of KVK in the adopted village helped the respondents to cope up with changes in animal husbandry in the study area.

Due to change in the climate, 77.78 per cent of the respondents perceived that there was an increase in investment in agriculture. More investment has to be made in purchase of quality seeds, fertilizers and plant protection measures and other management practices have to be taken to protect the crops from the vagaries of climate change and to obtain good yield. Similar cases have been reported earlier by Parameswaranaik *et al*. (2015), Simelton *et al*. (2013), Deressa *et al*. (2011), Bryan *et al*. (2009) and Mertz *et al*. (2009).

Association and contribution of profile characteristics of the respondents towards climate change in agriculture

Table 2. Association and contribution of profile characteristics with their perception towards climate change(n=45)

S.No	Profile characteristics	'r' Value	PRC	SE	't'Value
1	**(X_1)** Age	0.618	1.312	0.533	2.462**
2	**(X_2)** Gender	0.272	0.809	0.744	1.085^{NS}
3	**(X_3)** Education	0.588	1.408	1.402	3.001**
4	**(X_4)** Experience in farming	0.286	1.602	0.876	0.910*
5	**(X_5)** Family Size	-0.342	0.708	0.748	1.807^{NS}
6	**(X_6)** Occupation	0.285	0.126	0.221	0.571^{NS}

S.N	Profile characteristics	'r' Value	PRC	SE	't'Value
7	**(X_7)** Annual Income	0.507	0.564	0.239	1.714^{NS}
8	**(X_8)** Extension Contact	0.468	2.365	1.425	2.188**
9	**(X_9)** Social Participation	0.364	0.759	0.344	0.205*
10	**(X_{10})** Mass Media	0.588	0.529	0.249	3.216**
	R2		0.546		
	F value		6.642**		
	Constant		12.185		

PRC=Partial Regression Co-efficient NS =Non-Significant
SE= Standard Error **= Significant at 0.01 level *= Significant at 0.05 level

The association and contribution of profile characteristics of respondents with their perception towards climate change have been presented in this section. The results revealed that the variables age, education, extension contact and mass media had a positive and significant relationship at one per cent level of probability; whereas experience in farming and social participation had significant relationship at five percent level of probability. However, variables, such as gender, family size, occupation and annual income depicted a non-significant relationship with the dependent variable. The extent of contribution of independent variables with the dependent variable was worked out, while using multiple regression analysis and the results have been presented in table 2. The result indicated that the R_2 value was 0.546, which revealed that 54.60 percent variation in the perception of respondents towards climate changewas explained by ten independent variables selected for the study. The 'F' value (6.642) was significant at one percent level of probability. The prediction equation was fitted in as below:

Y1= 12.185 + 1.132(X1) +0.809(X2) +1.408(X3) + 1.602(X4) + 0.708(X5) + 0.126(X6) + 0.564(X7) +2.365(X8) + 0.759(X9) + 0.529(X10)

The profile characteristics namely, age, education, extension contact and mass media had maximum level of association with the perception level of respondents towards climate change in agriculture. This may be due to the fact that as a person gets older he feels and observes the changes in his surrounding environment and his education level also opens a mental horizon of the individual into the ongoing phenomena of his surroundings. Extension contact and mass media exposure enables the cosmopoliteness of the respondents. When the respondents have contact with different extension functionaries and mass media he/shewill have more opportunities to learn about climate change and its effect on agriculture.Hence, age, education, extension contact and mass media exposure had significantly contributed towards the perception level of respondents towards climate change in agriculture. While experience in farming and social participation also contributed towards the perception level of respondents towards climate change, it may be due to the longer years of experience in farming that they may realize the changes in climate

which affects crop production. Similarly, due to social participation of respondents in different public meetings or discussions with other members, he might have gained knowledge about climate change and its effect on agriculture. Hence these two factors i.e., experience in farming and social participation also associated and contributed in the perception level of respondents towards climate change in agriculture.

Conclusion

Climate change is likely to affect all the natural ecosystems as well as socio-economic conditions of Indian farmers. Farmers have rightly perceived about climate change and its effect on agriculture and they have identified the increase in environmental temperature, changes in rainfall, emergence of new pests and diseases in their field and also depletion of the water table. Hence, timely access to extension services and weather information are crucial in shaping the perception of farmers about climate change which could be incorporated into site-specific adaption strategies. It is therefore important that all the factors influencing farmer's perception be taken into consideration to improve their perception as these factors further influence the field level adaptation strategies to combat vagaries of climate change in agriculture.

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