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Analysis of Farmers' Perception and Adaptation Strategies to Climate Change

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Abstract : Agriculture is the most important sector of the economy in India and it is highly dependent on climate. Change in climate impacts cropping patterns, water availability and to some extent productivity of crops as well. The impacts may be significant and negative and required for substantial change in farm management practices. The purpose of this study was to determine the ability of farmers to detect climate change and to ascertain how they have adapted to whatever climate change they believe has occurred. The study was based on interview of 500 farmers in one district of India. The study revealed that significant numbers of farmers believe that temperatures have already increased and the precipitation has declined along with late onset and early withdrawal of monsoon with long dry spells. Majority of respondents have changed agricultural management practices in response to changes in climate conditions.

Key words: Agriculture % Climate change % Farmer % Perception % Adaptation

INTRODUCTION

Agriculture is the most important sector of the economy in India provides food and livelihood security to much of the Indian population. It plays a crucial role in the country's development contributing 35% of India's Gross National Product (GNP). Although, during the post-independence era the food grain production quadrupled still India continues to face a persistent challenge of feeding a growing population against a background of climatic uncertainties [1]. Climate is one of the key components influencing agricultural production in Indian and has large-scale impacts on food production and overall economy [2]. Increasing global warming has caused various climate-related disasters thereby adversely affecting agriculture, food security, water resources and biodiversity as a whole. Irrespective of production systems, climate-related events such as droughts, cyclones, floods, hailstorms, frost, high winds and extreme temperature contribute to farmers' vulnerability and impact on national food security. While the magnitude of impact varies greatly by region, climate change is expected to impact on agricultural productivity and shifting crop patterns. In this context, the impact of climate change on agriculture is an issue of great significance to the lives and livelihoods of millions of poor people in India who depend on agriculture for food and livelihood. The impact of climate change on agriculture could result in problems with food security

and may threaten the livelihood activities upon which much of the population depends. Climate change can affect crop yields both positively and negatively, as well as the types of crops that can be grown in certain areas, by impacting agricultural inputs such as water for irrigation, amounts of solar radiation that affect plant growth, as well as the prevalence of pests.

The impact of global climatic change on agriculture has recently become a subject of increasing importance [3]. The global climate change has been drawing attention of many to this very important topic of climate change, though it was a difficult proposition for many to accept that whether the farmers have the ability to perceive the change in climate that have already occurred. As the understanding on global climate and its change is pre requisite to take appropriate initiatives to combat climate change. Adaptation to climate change requires that farmers first notice that the climate has altered. Farmers then need to identify potentially useful adaptations and implement them. This realization investigated to undertake a study to determine the ability of farmers to detect climate change and to ascertain how they have adapted to whatever climate change they believe has occurred.

METHODOLOGY

The study was conducted in Bundi district of Rajasthan. In all five hundred farmers were selected randomly as respondents to analyse the perception of

climate change, the adaptations strategies adopted by the farmers to cope with these changes. The selected respondents were interviewed personally with the help of a well structured and pre-tested interview schedule. Data collected focuses on farm history, memory of extreme climate events and the impact of more frequent anomalies and management responses to those anomalies. The data thus collected were tabulated and statistically analyzed to interpret the results. Descriptive statistics were used to characterize farmer perceptions on climate changes as well as various adaptation measures being used by farmers.

RESULTS AND DISCUSSION

Assessing Farmer Perceptions to Climate Change:

Finding of farmer perceptions regarding change in climate are presented in Table 1. The results indicated that most farmers perceived that the temperature distribution has undergone a significant shift in addition to an overall increase in temperatures. By contrast almost none believed they had decreased. The results for precipitation show a similar uniformity of opinion across the sample. The majority of farmers believed that the rainfall levels had decreased. Similarly, the overall perception on changes in precipitation is that the region is getting drier and that there are pronounced changes in the timing of rains and frequency of droughts. A sizeable minority of respondent farmers also believed they had witnessed uneven distribution and unpredictable behaviour of the rains.

Factors Affecting Farmer Perceptions to Climate Change:

The results of analysis examining the factors influencing the farmer perceptions to climate change depicted in Table 2. The results revealed that the age, farming experience, innovativeness, environmental consciousness and exposures to mass media had a positive and significant relationship with farmer perceptions to climate change. The farmer's best placed to pronounce on whether climate change has occurred are presumably those who have had the most experience of farming and who are innovative, environmental conscious having exposure to mass media.

Adaptation to Climate Change: The various adaptation strategies being used by farmers in response to changing climatic are presented in Table 3. Analyzing adaptations made by all respondents revealed that an integrated farming system was considered to be one of the most important adaptations in response to climatic vagaries.

Table1: Farmer perceptions of climate

	Perception		
	Increased	Decreased	No change
Temperature	393	0	107
Precipitation	27	347	126
Occurrence of drought	319	97	84
Late onset of monsoon	257	175	68
Early withdrawal of monsoon	281	137	82
Long dry spell	312	123	65
Uneven distribution rainfall	402	12	86
Unpredictable rain fall	367	32	101

Table 2: Relationship between independent variables and farmer perceptions to climate change

Independent variables	'r' value
Age	0.403*
Farming experience	0.712*
Size of land holding	0.019
Education	0.029
Innovativeness	0.642*
Environment consciousness	0.432*
Contact with extension personnel	0.011
Exposure to mass media	0.421*

* Significant at 5 % probability level

Table 3: Adaptations to climate change by respondents farmers (n=500)

Adaptation	Respondents	
	Number	Percent
Integrated farming system	423	84.6
Use of short duration crop varieties	219	43.8
Use of water conservation techniques	301	60.2
Change in time of farm operation	356	71.2
Soil conservation techniques	261	52.2
Pre-monsoon dry seeding	213	42.6
Stubble mulching	257	51.4
Crop rotations	374	74.8
Intercropping	362	72.4
Rainwater harvesting	169	33.8
Zero tillage to conserve soil moisture and save time	63	12.6
Drought tolerant crop and crop varieties	312	62.4
Agro forestry	209	41.8
Use of insurance	62	12.4

Table 4: Relationship between independent variables and adaptation

Independent variables	'r' value
Age	0.373*
Farming experience	0.437*
Size of land holding	0.381*
Education	0.001
Innovativeness	0.331*
Environment consciousness	0.527*
Contact with extension personnel	0.641*
Exposure to mass media	0.312*

* Significant at 5 % probability level

Adjusting the cropping sequence, including changing the timing of sowing, planting, spraying and harvesting, to take advantage of the changing duration of growing seasons and associated heat and moisture levels was another option. To cope with climate variability, farmers have developed a wide range of management practices such as pre-monsoon dry seeding, stubble mulching, crop rotations and intercropping. The abrupt climate fluctuations such as drought had made the farmers to harvest rainwater for irrigation in dry days. Some the respondent farmers adopted zero tillage technology of wheat showing in rice wheat cropping system to same time and to make best use of residual moisture of rice field.

Factors Influencing Adaptation: The results of determinants of adaptation measures are presented in Table 4. The results indicated that the adaptation process is driven by a number of factors. Firstly, it is apparent that more experienced farmers are more likely take up an adaptation measure. Being in receipt of extension advice relating about either livestock or crop production also strongly increases the probability of the farmer adapting. The respondent's level of education also greatly

increases the probability of adaptation. All of these factors have obvious implications for the question of what can be done to help farmers adapt to climate change. It appears that larger farms are more likely to adapt to climate change. This is consistent with the idea that adaptation has a fixed cost element, implying that information gathering is less worthwhile for small farmers. Environmental conscious farmer heaving good mass media exposure appeared willing to adapt.

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