Received : 16.10.2021 | Accepted : 10.11.2022 | Online published : 16.12.2022
https://doi.org/10.54986/irjee/2022/dec_spl/327-331
IRJEE SOCIETY OF EXTENSION EDUCATION

RESEARCH ARTICE

Farmers' Perspectives on Climate Change in Satpura Range Agro Climatic Zone of Madhya Pradesh's

Deepali Suryawanshi[1] and Shobhana Gupta[2]

1. Ph.D. Scholar,
2. Sr. Scientist and Head,
Department of Agricultural Extension & Communication, RVSKVV, Gwalior (M.P.)
Corresponding author e-mail: deepsuryaa@gmail.com

ABSTRACT

This study is aimed at analyzing farmers' perception to climate change in Madhya Pradesh's Satpura range agro climatic zone. The present study was conducted at Chhindwara district of agro-climatic zone Satpura range of M.P. The study was conducted by considering 17 independent variables consisting 5 socio-economical, 4 communicational and 8 psychological characteristics along with dependent variables e.i. Perception towards climate change on agriculture. Data were collected qualitatively as well as quantitatively. The statistical tools used in the study were: Frequency, Percentage, and Correlation. The study shows that about 92.50 per cent (222 respondents) perceive an increased in the temperature and about 55.00 per cent (132 respondents) of them perceive a decrease in the temperature. Most of the farmers felt that there was an abrupt change in the temperature over the years. The relationship between the general characteristics of the respondents with their perception of climate change states that the variables like educational level and occupation had strong and positive correlation with their perception regarding climate change, whereas, in the case of farming experience, it was found non-significant with perception of farmers towards climate change.

Key words: *Climate change; Variables; Farmers' perception; Correlation*

In India, the agriculture sector is the most important sector for the economy of India; Like most other developing countries, people in India are largely dependent on their natural resources for livelihood and economy. And more than 50 per cent of Indian agriculture depends on rain-fed, but it is predicted to be negatively impacted by climate change and it is clear that climate change will bring the agriculture sustainability losses of the food system since climate and agriculture are interlocked with global process. The small change in the climatic parameters (temperature, precipitations and relative humidity) adversely affects the agriculture sector and livelihood of the resource poor people. As per ICAR projections 10 to 40 per cent loss will be in the crop productivity by 2100 and the significant loss will be there in the rabi season where one degree increase in the temperature reduces wheat production by 4-5 million tons (*https://icar.org.in/node/1738*). On an average 30 per cent reduction in the crop yield is expected to reduce by mid-21st century in the South Asian countries. Apart from this, alters pathogens invasion that gradually affect the growth and yields of crops severely and also lead to increase in the pest and disease of the crops which limits the future food production. Thereby enhancing the crop productivity is most significant for safe guarding the food and nutritional security especially small and marginal framers who are most vulnerable to the climate change.

Madhya Pradesh is an agrarian state with about 70 per cent of the population depending on agricultural sector for their livelihood. Moreover, the state agriculture sector is predominating by small and marginal farmers of 76 per cent with 48 per cent of the total arable land (Agriculture census, 2015-16). The climatic variability and climate change has greater threat to the agriculture sector in Madhya Pradesh state.

According to the analysis of *Mishra et al. (2016)* the frequency of severe, extreme, and exceptional droughts has increased in Madhya Pradesh. Droughts

in the recent years were severe and wide-spread. The number of hot days has increased significantly and the number of heat waves became more frequent during the recent years in the state. With this climatic variability, farmers in the state are vulnerable because their livelihood is totally dependent on agriculture.

In this perspective, the present research seeks to find out the relationship between farmers' perceptions of climate change and its impact with selected independent variables among the farmers of Madhya Pradesh's Satpura range agro climatic zone.

According to the analysis of *Sarkar S and Padaria R.N. (2015).* the study proved moderate level of information and knowledge base of farming community in the study area. Only 22 per cent respondents knew about climate change in the area, while 43 per cent respondents had knowledge about the diverse human induced causes of climate change.

Kumari et. al (2020) the present study revealed that farmer in Ranchi district of Jharkhand perceived significant change in agriculture and allied activities and primarily attributed the changes to shift in climate over 30 years in the region.

Kumar et. al (2022) the study showed that change in cropping patterns, installation of bore wells, selling of field trees and livestock were the major coping adaptation strategies to reduce the effect of climate change in the region. Size of Landholding, education, family type, and value orientation were the significant factors that determine the attitude of an individual farmer in the study area while awareness and value orientation influenced knowledge.

METHODOLOGY

The present study was conducted at Chhindwara district of agro climatic zone Satpura range of M.P. The Satpura slope is faced sharp on the south and gentle on the north. The region is drained by Tawa, Johila, Denwa, Wainganga and Vardhan rivers. The area includes Chhindwara, Betul and Seoni districts. The soil type is shallow black and the prominent crops are Maize, Paddy, Tur, Sugarcane, Wheat, Vegetable, Gram and Soybean with an average rainfall of 1084 mm.

Out of 3 districts under ACZ- Satpura range viz., Betul, Chhindwara and Seoni, district Chhindwara was selected purposively, as according of Madhya Pradesh State Action Plan on Climate Change, this district comes under high vulnerability index and also their is increase in sensitivity level of the district.

The selected district Chhindwara consists of 11 blocks. Out of 11 blocks, 6 blocks i.e. Mohkhed, Bichhua, Chhindwara, Parasia, Amarwada and Chourai were selected randomly. Out of selected blocks 2 villages from each block were selected randomly. In total 12 villages were selected & from each of these villages, 20 farmers were randomly selected. Thus, total 40 farmers were selected from each block, making total no. of respondents as 240 from all the 6 blocks.

The research methodology where entire process of planning and carrying out of the research is finalized. The research design seeks the answers to the questions and in this study ex-post-facto design was employed to investigate which gives information after occurring of events. The study was conducted by considering 17 independent variables consisting 5 socio-economical, 4 communicational and 8 psychological characteristics along with dependent variables e.i. Perception towards climate change on agriculture. Data were collected qualitatively as well as quantitatively. Qualitative data were converted into quantitative data. The quantitative data were tabulated on the basis of logical categorization method as described earlier. The statistical tools used in the study were: Frequency, Percentage, Correlation. In statistics the frequency (or absolute frequency) of an event is the number of times the event occurred in an experiment or study. The term 'percentage' means a fraction whose denomination is 100 and the numeration of the fraction is called percentage. For calculating percentage, frequency was multiplied by 100 and divided by total respondents.

$$\text{Percent (\%)} = \frac{X}{N} \times 100$$

Where,
X= Frequency of respondents
N= Total number of respondents

Correlation coefficient: Karl Pearson's coefficient of correlation: This technique was used to find out the relationship between dependent variable and selected independent variable were ascertained by calculating correlation coefficient ('r' value), which was further used to find out the relative importance of different components (independent variables) of dependent variable. Following formula was used for computations of 'r' value. The formula is as follows: -

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}} x = \frac{\sum (x - \bar{x})(y - \bar{y}}{\sqrt{\sum (x - \bar{x})^2 \ \sum (y - \bar{y})^2}}$$

Where,

r = Co-efficient of correlation
x = Independent variable
y = Dependent variable

Rank Order: The term 'Rank order' is used to determine each respondent's order of preference for a list of items.

RESULTS AND DISCUSSION

Perceptions of farmers towards climate change : The perception of the farmers with respect to climatic variables in the study area presented in the Table 1. The findings show that about 92.50 per cent (222 respondents) perceive an increased in the temperature and about 55.00 per cent (132 respondents) of them perceive a decrease in the temperature. Most of the farmers felt that there was an abrupt change in the temperature over the years. About 72.92 (175 respondents) perceive a decrease in the number of rainy days. However, 55.83 and 50.42 per cent of them perceive an increase in the number of rainy days and rainfall intensity respectively. Similarly, around 56.25 per cent of the respondents perceived changes in increased relative humidity. However, 58.75 per cent of farmers noticed a decline and the remaining 41.25 per cent did not observe any change in relative humidity. The findings are consistent with those of *Mishra et al. (2016),* who reported that precipitation decreased across the MP state from 1951 to 2013, but temperature increased significantly during the same time period. The farmer's perception of climate change is significantly influenced by recent changes in the climatic variables and extreme changes. The present study concluded that more than half (51.25 %) of the respondents had a high perception of the changing climate. The findings are in line with *Shrivastava (2018).*

Percentage distribution of farmers based on perception on climate change : The distribution of the respondents based on perceptions of climatic parameters is presented in Table 2. The findings reveal that about (51.25 %) of them fall under the high category, followed by 26.25 per cent of them in the medium category and 22.00 per cent of them lie under low category.

Table 1. Perception of the farmers towards changing climate parameters in the study area

Climatic variables change	No. (Yes)	%	No. (No)	%
Increased temperature	222	92.50	18	7.50
Decreased temperature	132	55.00	108	45.00
Increased in number of rainy days	134	55.83	106	44.17
Increased rainfall intensity	121	50.42	119	49.58
Increased in rainfall duration	126	52.50	114	47.
Decreased in number of rainy days	175	72.92	65	27.08
Decreased in rainfall intensity	138	57.50	102	42.50
Decreased in rainfall duration	139	57.92	101	42.08
Increased in relative humidity	135	56.25	105	43.75

Table 2. Distribution of farmers based on overall perceptions towards climatic parameters in the study area

Category	No.	%
Low (10 -16)	54	22.50
Medium (17 - 23)	63	26.25
High (24 - 30)	123	51.25
Total	240	100.00

The findings infer that most respondents had a high (51.25 %) perception of climatic parameters in the study area.

Further, on analyzing the perception of respondents towards long term climate change, it was found that about 92.50 per cent of the respondents observed the changed timing of rain. Further, respondents observed other abrupt changes in seasons/changes in growing seasons and an increased frequency of drought and crop failure. They also observed higher probability of pest invasion and widespread disease prevalence. It was also found that the farmers agreed with the fact that the situation of water bodies is becoming worse and post-harvest losses have increased in frequency of floods and farm destruction. They also observed lack of potable water and found that more irrigation is required due to changes in the rainfall pattern and the problem of soil erosion has increased, resulting in frequent crop failure.

Relationship between general characteristics of the respondents and perception of climate change: The distribution of farmers is based on long term changes in the mean climatic variables shows in the Table 3. The finding indicates, at rank I, with mean score of 1.92, about 92.50 per cent of the respondents observed "changed timing of rains". However, about 7.50 per cent of the respondents expressed that they had not observed any change in the rainfall. At rank II, with a mean score of 1.85, about 85.00 per cent of the respondents observed an "abrupt change in seasons/ changes in growing season" and about 84.58 per cent observed an "increased frequency of drought and crop failure" whilst, 15 and 15.42 per cent of them observed

Table 3. Distribution of farmers according to their perception towards long term changes in climate variable

Statement	Change observed (No.)	%	Change not observed (No.)	%	MS	Rank
Changed timing of rains	222	92.50	18	7.50	1.92	I
Abrupt change in season/changes in growing season	204	85.00	36	15.00	1.85	II
Reduced cropping (growing) season	107	44.58	133	55.00	1.45	V
Increased frequency of drought and crop failure	203	84.58	37	15.42	1.85	II
Increased frequency of floods and farms destructions	108	45.00	132	55.00	1.45	V
Postharvest losses	124	51.67	116	48.33	1.52	IV
Pests invasion	156	65.00	84	35.00	1.65	III
Prevalence of disease	157	65.42	83	34.58	1.65	III
Lack of potable water	98	40.83	142	59.17	1.41	VI
Problem of soil Erosion	91	37.92	149	62.08	1.38	VII
Extinction of some crops and crop varieties	28	11.67	212	88.33	1.11	IX
Death of livestock	26	10.83	214	89.17	1.11	IX
Rural- urban migration due to crop failure	92	38.34	148	61.66	1.38	VII
Situation of water bodies is becoming worst	126	52.50	114	47.50	1.52	IV
Disappearance of vegetation cover	70	29.16	170	70.84	1.29	VIII
More Irrigation required	97	40.42	143	59.58	1.41	VI

no “change in growing season” and “frequency of drought and crop failure” respectively. At rank III, with a mean score of 1.65 about 65.00 per cent of respondents observed “higher probability of pest invasion” and 65.42 per cent of them observed “widespread diseases prevalence”. At rank IV, with a mean score of 1.55, about 52.50 per cent of the respondents observed “situation water bodies are becoming worse” and about 51.67 per cent observed “post-harvest losses”. At rank V, with a mean score of 1.45, about 44.58 per cent of the respondents observed “reduced cropping (growing) season” while 45.00 per cent of them observed “increased frequency of floods & farm destruction”. At rank VI, with a mean score of 1.41 about 40.42 per cent of respondents observed “lack of potable water” and 65.42 per cent of them observed “more irrigation required due to change in the rainfall pattern”. At rank VII, with a mean score of 1.38, about 37.92 per cent of the respondents observed “a problem of soil erosion” and about 62.08 per cent observed “rural- urban migration due to frequent crop failure”. At rank VIII, with a mean score of 1.29, about 29.16 per cent of the respondents observed the “disappearance of vegetation cover”. At rank IX, with a mean score of 1.11, about 11.67 per cent of the respondents observed “extinction of some crops and crop varieties” and about 10.83 per cent observed “death of livestock”. However, 88.33 per cent of them did not observe any change regarding “extinction of some crops and crop varieties” whilst, 89.17 per cent of them did with “death of livestock” in the study area.

The relationship between the general characteristics of the respondents with their perception of climate change states that the variables like educational level and occupation had strong and positive correlation with their perception regarding climate change, whereas, in the case of farming experience, it was found non-significant with perception of farmers towards climate change. Age of the respondents did not have any association with their perception of climate change. The same findings were observed by *Ofuokus (2011); Ansari et al. (2018)* and *Marie et al. (2020).*

Relationship between general characteristics of the respondents and perception regarding climate change : That profile of the respondents like educational level and occupation had strong and positive correlation with their perception regarding climate change. While the association between age and perception of climate change was also found strong but negative (Table 4). The profile of the respondent like farming experience did not have any association with perception of climate change.

Table 4. Relationship between general characteristics of the respondents and perception regarding climate change

General profile of the farmers	r value
Age	-0.321**
Farming experience	0.063^{NS}
Educational level	0.850**
Occupation	0.415**

Table 5. Relationship between socioeconomic characteristics of the respondents and perception regarding climate change

Socio -economic variables	r value
Annual family income	0.651**
Land holding	0.032 ^{NS}
Cropping pattern	0.741**
Farm machinery use	-0.045^{NS}
Sources of Irrigation	0.048^{NS}

Relationship between socioeconomic characteristics of the respondents and perception regarding climate change: Relationship between socio economic characteristics of the respondents and their perception regarding climate change is computed and presented in which clearly shows positive and significant relationship of annual family income and cropping pattern with perception regarding climate change at 1% level of significance (Table 5). The relationship of remaining socio-economic variable like land holding, farm machinery uses and source of irrigation was found not significant.

CONCLUSION

The present study was conducted at Chhindwara district of agro-climatic zone Satpura range of M.P. Based on rainfall, existing cropping pattern and agro climatic conditions and administrative units, the state is divided into eleven Agro Climatic Zones (ACZ). Out of 11 ACZs, the Satpura range ACZ is identified as being among the highest in state in terms of socioeconomic vulnerability. Thus, to counter the impact of changing climate and know the adaptation strategies followed by the farmers of Satpura range ACZ and their perception towards climate change, the present study was conducted on "Perception and Adaptation to Climate Change among Farmers of Satpura Range Agro Climatic Zone of Madhya Pradesh"

Categorization of farmers based on perceptions:

- Most of respondents had a high perception of the climatic parameters in the study area.
- *General characteristics:* Their educational level and occupation had a strong and positive correlation with their perception regarding climate change.
- *Socioeconomic characteristics:* The annual family income and cropping pattern had a strong and positive correlation with their perception of the climate.
- *Communications parameters:* The extension participation, social participation and cosmopolitans exhibited positive and strong associations with their perception regarding climate change.
- *Psychological variables:* Economic motivation, decision making ability, adaptation strategies and innovativeness all head positive and significant relationship with their perception of climate change.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

REFERENCES

Ansari MA, Joshi S, Raghuvanshi R. (2018). Understanding farmers' perceptions about climate change: a study in a North Indian state. *Adv. Agri. Envi. Sci*.,**1**(2): 85−89.

Kumar, Ashok; Meena, H.R.; Rashmi, I. and Kumar, Kuldeep (2022). Farmers' perceptions, vulnerability and adaptation strategies to climate change in South-Eastern Rajasthan. *Indian Res. J. Ext. Edu.*, **22** (3): 1-9.

Kumari, N.; Bara, N.; Jha, B.K. and Kumar, R. (2020). Effect of climate change on agriculture and allied activities in Jharkhand: An inference from farmer perception. *Indian Res. J. Ext. Edu.,* **20** (1): 77-79.

Marie, Mequannt; Fikadu, Yirga; Mebrahtu, Haile and Filmon, Tquabo. (2020). Farmers' choices and factors affecting adoption of climate change adaptation strategies: evidence from northwestern Ethiopia. *Heliyon,* **6**(4): 167-175.

Mishra,Vimal; Tiwari, Amar Deep; Aadhar, Saran; Shah,Reepal; Mu Xiao, D.S. Pai, Lettenmaier, Dennis (2019). Drought and Famine in India, 1870–2016. *Geophysical Research Letters*, 46 (4): 2075-2083

Ofuokus, AU. (2011). Rural farmers' perception of climate change in central agricultural zone of Delta state, Nigeria. *Indonesian J. Agril. Sci.,* **12**: 63–69.

Sarkar Sujit and Padaria R.N. (2015). Measuring farmers' awareness and knowledge level about climate change and formulating future extension strategies. *Indian Res. J. Ext. Edu.,* **15** (1):107-111.

Shrivastava, V.; Khare. N.K. and Pande, A.K. (2018). Farmers' perception on climate vulnerability and responsive adaptation measures in district Jabalpur, Madhya Pradesh. *J. Pharma. and Phyto.*. **7**(4): 1238-1243.

https://doi.org/10.1002/2016GL071407

https://seea.org.in/uploads/pdf/2022-71-1-9.pdf

https://agcensus.nic.in/document/agcen1516/T1_ac_2015_16.pdf

https://icar.org.in/node/1738

https://seea.org.in/view/content/a-measurement-tool-for-the-assessment-of-farmers-perception-about-impact-of-changing-climate-on-agriculture-in-india

• • • • •