Constraints Perceived by Farmers towards Climate Change in Bundelkhand Region

Abstract

Aim: To study the various constraints perceived by farmers.

Study Design: Analytical and descriptive research designs were applied to this research.

Place & Duration of study: The study was conducted in Bundelkhand region in 2024, which is located in the north-central part of India. It consists of 13 districts which lie between 23°8'to 26°30'N latitude and 78°11' to 81°30'E longitude that are divided by the states of Madhya Pradesh and Uttar Pradesh.

Methodology: Respondents were selected through simple random sampling constraints were categorized based on PCI value.

Result: Farmers face several challenges in adopting climate-smart agricultural practices, which they rank by severity. Based on the PCI constraints were categorized into several ranks such as high cost of farm inputs, inadequate farm labour, lack of training and exposure visits to climate change and so forth the other constraints too.

Keywords*:* Adaptation practices, climate change, climate-smart agriculture, constraints, problem confrontation index.

Introduction

Agriculture is extremely vulnerable to weather and environment. It also relies significantly on land, water, and other natural resources that are influenced by the climate. Climate changes (such as in temperature, precipitation, and frost timing) could expand the growing season or allow different crops to be cultivated in some places (Walsh et al., 2020). Agriculture is one of the industry's most vulnerable to the negative effects of climate change. Agricultural productivity is directly impacted by climate change. Put differently, agriculture is climate change-sensitive by nature (Edame et al., 2011; Banna et al., 2016). It's a current problem that impacts every aspect of the global economy. Developing nations like India are at risk from the disastrous consequences of climate change. Agriculture and climate change are highly interdependent. The economic, social and environmental pillars of sustainable development must be integrated to meet the needs of the present without compromising the standard of living for future generations to address the challenges facing the agricultural sector today (Fischer et

al., 2002). Climate change has the potential to significantly lower agricultural productivity, which would impact rural poverty and per capita income (Esham and Garforth, 2013).

However, there are barriers to climate change adaptation because of a lack of capital, inadequate technological know-how, institutional capacity and a lack of awareness of the challenges surrounding climate change (IPCC, 2007; Jones and Boyd, 2011; Gifford et al., 2011).

Previous studies have also confirmed that the majority of the land used for agriculture was already under cultivation ten years ago and that agriculture is spreading into regions with less precipitation, highlighting the necessity of implementing improved soil conservation techniques (Maeda et al., 2011; Pellikka et al., 2013; Pellikka et al., 2018).

Adaptive capacity is the ability of the farmer to adjust his farm plans and programmes in the face of emerging risks, constraints and currently available information. The effects of climate change on humans and the environment are so vital that they can hardly be ignored. Bundelkhand region is one of the most vulnerable continents to environmental and climate change because of multiple stress and low adaptive capacity.

Climate change has affected human and natural systems on every continent, albeit the evidence for natural systems is stronger (IPCC, 2014).

Unpredictable weather was the study's biggest obstacle to climate change adaptation plans. The additional limitations included low soil fertility, inadequate extension personnel, high input costs, land tenure concerns, inadequate government support, and limited access to weather information. Global warming is a phenomenon that causes climate change. Sea levels rose by between 10 to 25 millimeters throughout the 20th century, and estimates indicate that they will continue to rise by anywhere between 20 and 90 centimeters during the 21st century (IPCC, 2013). The present study was undertaken to identify the major constraints faced by farmers in the Bundelkhand region in response to climate change. By analysing these challenges, the research aims to provide critical insights that can guide the formulation of targeted interventions by policy makers, agriculture experts and development agencies.

towards climate change. The study will be provide a scientific nuanced for policymakers, agricultural experts, and development agencies can formulate targeted interventions to strengthen the resilience of smallholder farmers.

Methodology

The present study was conducted in the Bundelkhand region, which is located in the north-central part of India, between the Indo-Gangetic plain's north-south boundary and the Vindhyan Ranges. It consists of 13 districts which lie between 23°8'to 26°30'N latitude and 78°11' to 81°30'E longitude that are divided by the states of Madhya Pradesh and Uttar Pradesh. Two districts will be selected purposively from the Bundelkhand Region, namely Jalaun and Datia. According to Dr. J. S. Samra's report, on drought mitigation techniques for UP and MP Bundelkhand that states that throughout the 18th and 19th centuries, the region faced a catastrophic drought every 16 years, which tripled from 1968 to 1992 (Samra, 2008). Two blocks from each selected district were selected randomly. Therefore, blocks Mahewa and Kadaura from Jalaun district and Bhander and Datia from Datia district respectively were selected by using a simple random sampling method after the selection of blocks, a block-wise list of villages was prepared from secondary sources. From each selected block, four villages were selected randomly. Thus, a total of sixteen villages were included in this study. From each village, twenty (20) farmers were selected as respondents through simple random techniques. Thus, the total sample size for the study was three hundred twenty (320).

Statistics analysis

Analytical and descriptive research designs were applied to this research. Based on the problem confrontation index (PCI), the constraints were categorized. The formula for PCI calculation, {PCI=Pn×0+Pl×1+Pm×2+Ph×3}.

Results and Discussion

Farmers face several challenges in adopting climate-smart agricultural practices, which they rank by severity. Table 1 and Fig. 1 present data on the constraints identified through field surveys, including their ranked severity (PCI).

Data presented in the table indicate that the most significant constraint for climate change adaptation is the high cost of farm inputs, with a Problem Confrontation Index (PCI) of 637 and 44.37% of respondents reporting it as a high-frequency issue. The present results are in agreement with Masud et al., (2017) who reported that the most critical impediment was the high cost of farm inputs which had a constraint problem confrontation index (PCI) value of 797. This was followed by inadequate farm labour (PCI 588, 34.06% high constraints) and a lack of training and exposure visits (PCI 583, 37.18% high constraints). Other notable constraints include poor availability of drought and heat-tolerant crop varieties (PCI 555,

18.75% high constraints) and ineffective crop insurance policies (PCI 539, 25.00% high constraints). Constraints such as the lack of awareness about climate resilience (PCI 544, 19.68% high constraints) and unpredictable weather (PCI 498, 17.50% high constraints) were also significant. Conversely, the lack of technical advisory services at the local level (PCI 449, 17.18% high constraints) and lack of awareness about long-term climate change (PCI 465, 18.43% high constraints) were among the least perceived constraints**.** The present findings align with Quayum and Ali (2012) and Kabir et al., (2020) who reported that a lack of knowledge can influence negatively adaptation strategies toward climate change. Uddin et al., (2014) and Billah et al., (2015) reported that a lack of water, shortage of land unpredicted weather, lack of credit money and lack of market access are the major problems with a growing population of cultivable land used as non-farm activities such as housing, construction facilities and other industrial purpose etc. Rohit et al., (2023) reported that lack of awareness about climate-smart agricultural technologies carriages a major challenge apparent by farmers in the study area.

Table 1. Constraints perceived by respondents during adaptability towards climate change.

n= 320

SI. No.	**Statement**		**Degree of Constraints**					
			NP	**LP**	**MP**	**HP**	**PCI**	**Rank**
1.	Lack of awareness about long-term climate change.	**F**	89	56	116	59	465	XIV
		%	*27.82*	*17.50*	*36.25*	*18.43*		
2.	Lack of awareness about climate resilience.	**F**	45	69	143	63	544	V
		%	***14.08***	***21.56***	***44.68***	***19.68***		
3.	Lack of timely information related to climate-resilient technologies.	**F**	57	49	149	65	542	VI
		%	***17.82***	***15.31***	***46.56***	***20.31***		

4.	Poor availability and accessibility of short-duration drought and heat-tolerant crop varieties.	**F**	52	41	167	60	555	IV
		%	***16.26***	***12.81***	***52.18***	***18.75***		
5.	Lack of crop demonstration and trials on farmer's fields concerned with climate change.	**F**	53	60	149	58	532	VIII
		%	***16.57***	***18.75***	***46.56***	***18.12***		
6.	Unpredictable weather.	**F**	68	62	134	56	498	XII
		%	***21.25***	***19.38***	***41.87***	***17.50***		
7.	Difficult to work in the field due to the severe temperature.	**F**	65	48	145	62	524	X
		%	***20.31***	***15.00***	***45.31***	***19.38***		
8.	Decrease of groundwater level.	**F**	73	62	87	98	530	IX
		%	***22.81***	***19.37***	***27.18***	***30.62***		
9.	Inadequate farm labour.	**F**	48	65	98	109	588	II
		%	***15.00***	***20.32***	***30.62***	***34.06***		
10.	Lack of storage facilities nearby villages.	**F**	75	54	128	63	499	XI
		%	***23.45***	***16.87***	***40.00***	***19.68***		
11.	Lack of knowledge regarding appropriate adaptation measures.	**F**	84	53	117	66	485	XIII
		%	***26.25***	***16.56***	***36.56***	***20.63***		
12.	Ineffective crop insurance policies.	**F**	62	57	121	80	539	VII
		%	***19.37***	***17.81***	***37.82***	***25.00***		
13.	Lack of training and exposure visits related to climate change.	**F**	60	56	85	119	583	III
		%	**18.75**	**17.50**	**26.57**	**37.18**		

14.	Lack of technical advisory services at the local level.	**F**	78	90	97	55	449	XV
		%	**24.37**	**28.12**	**30.33**	**17.18**		
15.	High cost of farm inputs.	**F**	55	35	88	142	637	I
		%	**17.18**	**10.95**	**27.50**	**44.37**		

Note: {NP (Pn), LP (Pl), MP (Pm), HP (Ph)}

(NP=Not- perceived, LP= Low perceived, MP=Medium perceived and HP= High perceived)

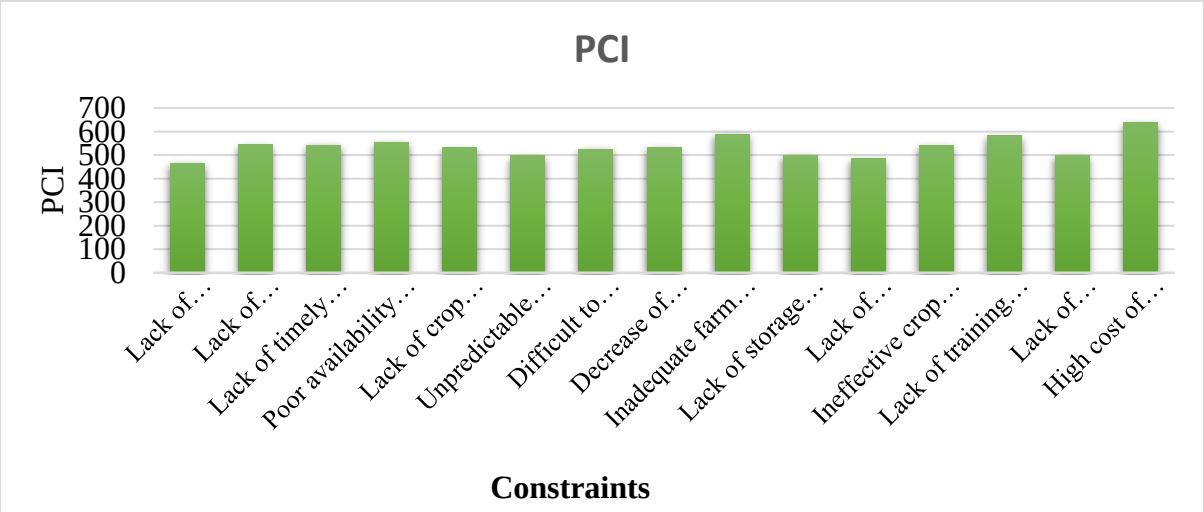

Fig. 1 Constraints faced by farmers

Conclusion

The study found that farmers in the Bundelkhand region were having difficulty adapting to climate change. Based on the study's findings, it was determined that farmers are dealing with several obstacles in their attempts to adapt to climate change, the main one being the high cost of agricultural inputs. The study's conclusions led to the recommendation that the agricultural development program raise awareness and spread tried-and-true methods to increase farmers' capacity to adapt to climate change. The need for appropriate and reasonably priced technologies and inputs is still a major concern. Farmers also face serious problems from shifting weather patterns and rising climate variability. It will take a combination of climate information services, efficient water management, and adaptable agricultural varieties to adapt to these changes. Therefore, different development organizations should encourage farming communities to implement long-term mitigation strategies for climate hazards and should offer sufficient technical support and extension services in addition to training, education, and opportunities for earning revenue.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (Chat GPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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