Farmers' Knowledge of Adaptation Strategies to Mitigate Climate Change and Factors Influencing their Adoption

ABSTRACT

Climate change has emerged as a global threat negatively affecting the productivity and production efficiency of agriculture systems thereby endangering food security and livelihoods of rural communities in most of the developing countries like India. Climate change and extreme climatic events have caused India's agriculture production to decline and exacerbated food insecurity during the last few decades. Consequently, Indian farmers have developed indigenous practices to mitigate the adverse impacts of climate change on agriculture. This study aims at studying farmers' knowledge of adaptation strategies, identifying the adoption of adaptation strategies and find out various factors influencing farmers' adoption of adaptation strategies to cope up with climate change. The present study draws upon data collected through personal interviews with 180 farmers in one district of North-Western Himalayan state of Uttarakhand. The results showed that farmers knowledge of adaptation strategies was found to be medium; most common adaptation strategies employed were – change in sowing time/ date, crop diversification, inter/ mixed cropping, use of drought and heat resistant crop varieties, and short duration and early maturing crop varieties*. Further, Using Karl Pearson Correlation, the results indicated that age, farming experience, landholding, annual income, information seeking behavior, scientific orientation, credit and subsidy orientation, decision making ability, extension contact were likely to affect their knowledge of adaptation strategies to cope up with climate change. The results of the present study will provide policy makers with new insights for the government and encourage agricultural extension services providers to promote location specific adoption of coping strategies so as to tackle the adverse impacts of climate change on agriculture.*

Keywords: Climate change, adaptation strategies, Mitigating climate change, Climate smart Agriculture, Farmers' knowledge of Climate change.

1. INTRODUCTION

Developing countries with agrarian economies like India have been facing challenges from climate change and its consequences. Climate change poses a serious threat to developing countries where most of their population depends on climate-sensitive livelihoods with poor adaptive capacity [1]. Climate change has emerged as a potent threat disrupting the development process and is hurting several sectors of Indian economy, especially the agriculture sector. Knowledge about these disruptive factors can enable the farmers to mitigate the negative impact of climate change on agriculture. Therefore, the understanding of location-specific farmers' perceptions and their adaptive behaviors can provide a better

insight to design appropriate policy measures and guidelines to address these challenges effectively [2]. Agriculture-based livelihoods, dominant in rural areas of developing countries, are struggling to cope up with climate change and extreme climatic events [3]. Adaptation to climate change is therefore crucial to achieve food security and sustainable agricultural development. Consequently, the agricultural sector of developing countries like India is being restructured, reformed and realigned to contextualize the climate change-sustainable agriculture-farm livelihood nexus [4].

Agriculture is the mainstay of India's economy as it contributed around 20.3 % to the GDP (PIB, GOI, 2023). Erratic, unpredictable and unexpected changes in climate are threatening agriculture productivity as well as livelihood security of rural communities. Climate variability and Climate change can disrupt food supply chain, reduce access to food, and affect food quality [5]. However, Indian agriculture is the extremely vulnerable to climate change as it heavily relies on their environmental resources [6,7, 8,9,10]. The adverse impacts of climate change, due to changes in weather patterns, increase in temperature, erratic& excess rainfall and precipitation and other related factors can be seen in the form of both lower yields and increase production risks in agriculture. Consequently, livelihoods of farmers, food security and health may all suffer due to climate change [11,12,13].

Further, climate change has both direct or indirect effects on agricultural productivity; direct effects including changes in average temperature, precipitation, rainfall, and extremes heat waves, etc. or indirect effects including changes in soil moisture and frequency of infestation by pests and diseases, insects' diseases, changes in concentration of carbon dioxide in atmospheric level and ground level ozone concentrations, changes in the nutritional quality of some foods, change in growing season of crops, etc. Additionally, climate change may cause yield losses ranging from 3 to 30% and the extinction from 15–37% of land plants and animal species by 2050 [14]. IPCC (2007) reported that rain-fed crop yields will decline by 10–20% by 2050, and crop revenue may decrease by 90% by 2100, whereas the rise of temperature may cause an increase in pest attacks and disease occurrence, which in turn may directly affect the food security and poverty level among farming communities.

Farmers' perceptions about climate change strongly affect how they deal with climate induced risks and uncertainties, and undertake specific adaptation measures to mitigate the adverse impact of climate on agriculture [15]. Further, climate knowledge of farmers influences the adaptation and mitigation measures shielding the farm households in climatically vulnerable regions [16]. Therefore, adaptation measures seem to be the most efficient and friendly way for farmers to reduce the negative impacts of climate change [17]. Adaptation to climate change is the adjustments or to make changes in the system to minimize the negative impacts and optimize the positive effects of climate change. These adaptations can be done at different levels by government (regional, national, sub-national and regional levels) or local level by farmers, as it is the most critical aspect because adaptation to climate change varies from region to region, local people face specific challenges and severity of climate change [18]. Effective adaptation of climate change can't be done alone it involves two processes, firstly perceptions about

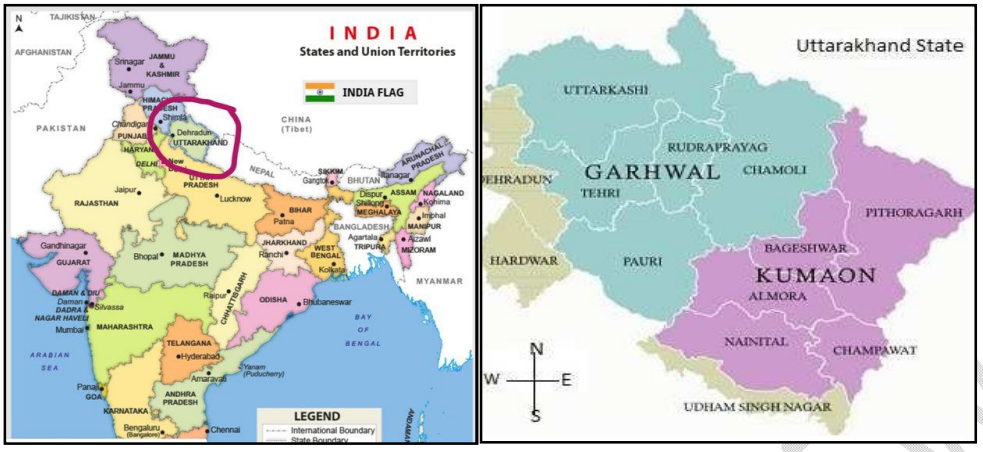
climate change and then taking a correct decision, whether to adapt or not [19]. Therefore, perceiving climate change is the first step that leads to adapting to climate change and the way they perceive the climate change is important to design policy regarding adaptation in agriculture. Hence, farmers' perception on climate change is also crucial to determine the factors which are responsible to shape their adaptive capacity for adaptation.

Assessing farmers' various adaptation strategies at local level to cope up with climate change and its factors is the most critical part to assure food and economic security of millions, not only for rural areas, but also the urban areas as well. This is more important because the majority of farmers in India are small and marginal. Farmers' adoption of appropriate adaptation strategies to cope up climate change is believed to minimize the negative impacts of climate change on crop yields.

2. MATERIALS AND METHODS:

The present study was undertaken in Tarai (foothills) region of the North-western Himalayan state of Uttarakhand, selected purposively as it is known as food bowl of the state, and contributes almost 90 percent of the foodgrains produced in the state. The study sought to find out farmers' knowledge of climate change and assess their adaptive capacity to cope up with the negative impact of climate change.

- **Study area:** Tarai region is mainly known for high agricultural productivity, and is the region where most of the population is mainly dependent on agriculture as the main economic activity and source of their livelihoods. Climate variability poses a huge threat to farmers in the area; the stressful problems being overwhelming reliance on small-scale agriculture, land degradation due to excessive use of fertilizers and chemicals, and water shortages.
- **Sampling:** One district **(**Udham Singh Nagar) was selected purposively for the present study as it is known as the food bowl of Uttarakhand. This district has maximum area under cultivation in the state and the productivity of major crops (Rice, Wheat, etc.) is also highest in the state. Further, three blocks (Gardapur, Sitarganj & Bazpur) were selected randomly and a total of six villages – two from each block- were selected. The study sample comprised of 180 farmers (30 from each village) selected randomly.



(Figure -1 showing study location)

- **Data collection**: The data for the study was collected with the help of a pre-tested structured interview schedule. Besides, observation and focus group discussions were also done during the study to supplement and illuminate any blind spots in the quantification of research data. Total six focus group discussions (FGDs) was conducted in six villages. The data, thus collected, was analysed using SPSS (version 18).

3. RESULTS AND DISCUSSION

The results obtained are presented under four sub-heads: 3.1) Profile characteristics of respondents; 3.2) Knowledge of adaptation measures to mitigate climate change, 3.3) Types of adaptation strategies to mitigate climate change, 3.4) Correlation between selected characteristics of farmers and their knowledge on adaptation measures to mitigate climate change.

3.1 Profile characteristics of respondents

Under socio-personal characteristics of the farmers, five attributes *viz.,* age, gender, education, secondary occupation, and farming experience were included in the present study. To find out farmers' economic status, attributes included were land holding, and annual income. Further, to identify their communication characteristics extension contact, information seeking behaviour and training received were taken under consideration. The study also included their few psychological characteristics such as scientific orientation, credit and subsidy orientation, and decision making ability.

3.1.1 Socio-personal profile characteristics of respondents

Table-1: Distribution of respondents according to socio-personal profile characteristics

S. No.	Attributes	Categories	Percentage
		Young age (Up to 39 years)	20.56

1.	Age	Middle age (39-56 years)	46.11
		Old age(More than 56 years)	33.33
2.	Gender	Male	92.22
		Female	7.78
3.	Education	Illiterate	2.22
		Functionally literate	2.78
		Primary education	11.67
		High school	52.22
		Intermediate school	23.33
		Diploma	1.67
		Graduation and above	6.11
4.	Secondary occupation	Faring + Livestock	62.65
		Farming + Business	21.69
		Farming + Service	4.82
		Farming + labor	10.84
5.	Farming experience	Low (Less than 21years)	27.22
		Medium (21-36 years)	65.00
		High (More than 36 years)	7.78

From the above table, it is evident that nearly half of the respondents (46.11%) belonged to middle age category followed by 33.33 per cent in old age category and the remaining 20.56 percent in young age category. Thus, it could be concluded that majority of the farmers in the study sample were in middle age group. We know that people in this age group are more enthusiastic and more receptive to new ideas and practices, have courage to take risk as compared to old age group as they are reluctant to change old practices being followed by them, while young farmers can be influenced by unwillingness of older farmers. Further, 92.22 percent were male, while only 7.78 were female in the study sample. So, this could be interpreted that majority of the respondents were male; it might be due to that women have a major role in household activities such as preparing food, managing children although they are also involved in farming.

As regards education, more than half of the respondents (52.22%) were educated up to high school level, followed by 23.33 percent educated up to intermediate level. Further, 11.67 percent of the respondents were educated up to primary school level, 6.11 percent had education up to graduation level,

2.78 percent were functionally literate and only 2.22 percent were illiterate. Further, 1.67 percent of the respondents had done Diploma. Thus, it can be concluded more than 80 percent of the farmers in study sample were educated. As regards occupation followed by the respondents, it was found that more than half of the respondents (62.65%) of the respondents were engaged in livestock as a secondary occupation, followed by 21.69 percent engaged in business, whereas 10.84 percent of the respondents were engaged as casual labour. Further, only 4.82 percent were engaged in service as a secondary occupation. As regards farming experience, it was also observed that more than half of the respondents (65%) had medium level of farming experience. This might be due to the fact that they started farming at an early age as farming was their primary source of income. Further, 27.22 percent of the respondents had low farming experience, while only 7.78 percent of the respondents had high level of farming experience.

3.1.2 Economic profile of respondents: Table-2 below gives the study findings in respect of economic profile of the respondents

Table - 2: Distribution of respondents according to economic profile

S. No.	Attributes	Category	Percentage
1.	Land holding	Small (Up to 2.50 acres)	35.00
		Medium (2.51 to 5.0 acres)	35.00
		Large (Above 5.0 acres)	30.00
2.	Annual income	Low (Less than Rs. 52333)	7.78
		Medium (Rs.52333-1011667)	90.55
		High (More than Rs.1011667)	1.67

As it is evident from the above table, 35 percent of the respondents had small land holding and an equal number having medium size of landholding, while only 30 percent had large size of land holding. As regards annual income, a large majority of the respondents (90.55%) reported middle level of annual income, followed by 7.78 percent with low level and only 1.67 percent of the respondents had high level of annual income. Thus, it could be interpreted that majority of the farmers in the study area had middle level of annual income. This might be due to many climate induced risks and uncertainties such as drought, flood and poor extension contact leading to large yield gaps, crop failures, crop damages due to extreme climatic events besides lack of assured and adequate irrigation facilities. These uncertainties were affecting almost all the respondents included in the study sample as they were quite evenly spread among three different categories of land holding.

3.1.3 Communication characteristics of respondents:

Communication plays a critical role in information seeking/ sharing behaviour which enable them to cope-up with various climate related risks and uncertainties. Communication characteristics of respondents are given in table-3 below.

Table-3: Distribution of respondents according to communication profile characteristics

S. No.	Attributes	Category	Percentage
1.	Information seeking behaviour	Low (Less than 8)	46.11
		Medium (8 to 16)	49.44
		High (More than 16)	4.44
2.	Extension contact	Low (Up to 7)	96.11
		Medium (7 to 22)	1.11
		High (Above 22)	2.78
3.	Training received	Yes	2.22
		No	97.78

Majority of the respondents (49.44%) displayed medium level of information seeking behaviour, followed by 46.11percent with low level of information seeking behaviour, while only 4.44 percent of the respondents had high level of information seeking behaviour. Regarding extension contact, the above table reveals that a large majority of the respondents (96.11%) had low level of extension contact and only 2.78 percent of the respondents had high level of extension contact, while 1.11 percent of the respondents had medium level of extension contact. Thus, it may be concluded that extension contact in the study areas was found to be very low. The probable reason could be that public extension services were not working properly in the villages, besides poor ratio of extension agent to farmers, or just lack of trust by the farmers. During the present study it was also observed that majority of the respondents preferred local Agri-input dealers for agricultural inputs, fertilizers, besides advice.

It can also be noticed from the above table that almost all the respondents (97.78%) did not attend any training during last few years and only 2.22 percent farmers had received any training. Thus, it could be interpreted that farmers have not attended any training in recent past, which is quite surprising as well as intriguing. Either they didn't attend any training due to lack of interest, or do not have any need for training although every Krishi Vigyan Kendra (Farm Science Center), which exists in every district, conducts need based and demand driven training periodically.

3.1.4 Psychological profile characteristics of respondents: These characteristics play a critical role in positively orienting and motivating the individuals for change. This illustrate their perceptions, thinking and

outlook towards change. The study findings related to selected psychological characteristics of respondents in given below in table-4

Table – 4: Distribution of respondents according to psychological characteristics

S. No.	Attributes	Category	Percentage
1.	Scientific orientation	Low	1.67
		Medium	90.55
		High	7.78
2.	Credit and subsidy orientation	Low	38.89
		Medium	58.89
		High	2.22
3.	Decision making ability	Low	12.22
		Medium	67.22
		High	20.56

The results in respect of psychological variables reveals that a large majority of the respondents (90.55%) had medium level of scientific orientation, while 7.78 percent of the respondents had high level of scientific orientation, and only 1.67 percent of the respondents had low level of scientific orientation. This might be due to that majority of the farmers were educated up to high school, but had low extension contact; extension personnel may have more focus on progressive farmers or large farmers than small and medium farmers, or may have stereotyped mentality and were not interested to know the things scientifically.

It is evident from the table (4) that more than half of the respondents (58.89%) had medium level of credit and subsidy orientation, followed by 38.89 percent who had low level of credit and subsidy orientation. Only 2.22 percent of the respondents were found to be having high level of credit and subsidy orientation. Thus, it can be inferred that majority of the farmers had medium to low level of credit and subsidy orientation. This might be due to that majority of the respondents were small farmers having moderate resources and also had poor extension contact. Some of them reported that amount of borrowing is very less; sometimes they have to borrow from their relatives, friends, etc. Further, it was also reported that the process of borrowing money from bank is very complicated; and as they don't have sufficient information/ documents required for credit and subsidy process, they didn't avail credit facilities.

Further, it can be inferred from the above table (4) that more than half of the respondents (67.22%) had medium level of decision making ability, followed by 20.56 percent with high level of decision making

ability. Further, 12.22 percent had low level of decision making ability. Thus, we can conclude that as majority of the farmers had small size of family, the interaction among family members might be less. Besides, lack of extension contact, lack of social interaction and lack of updated knowledge and skills may have contributed in their decision making ability.

3.2 Adaptation strategies to cope up with climate change

Adapting to climate change involves introducing innovations/ changes in agriculture production systems. It calls for adopting the appropriate location-specific measures at the right time to minimise the adverse effects of climate change. It helps in making the appropriate adjustments and changes in cultivation practices and crop cycle. Results regarding farmers' knowledge about adaptation strategies to cope-up with climate change are presented below.

3.2.1 Farmers' knowledge of adaptation strategies to mitigate climate change

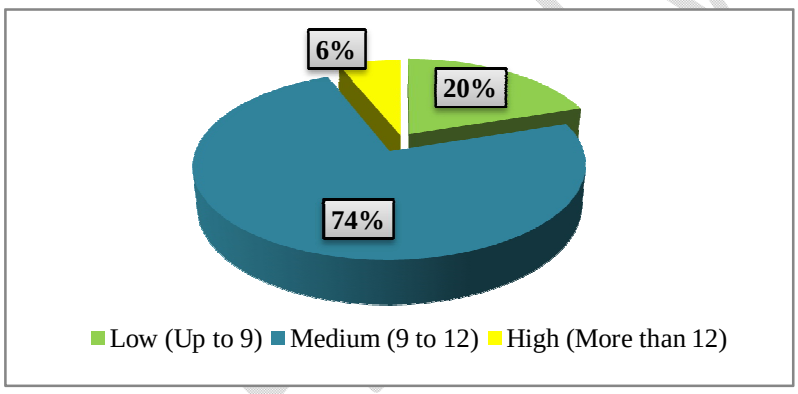


Fig. -2: Distribution of respondents according to knowledge of adaptation strategies

From the above fig.-2, it is observed that majority of the respondents (74%) displayed medium level of knowledge of various adaptation strategies, followed by 20 percent having low level of knowledge and only 6 percent of the respondents possessed high level of knowledge about adaptation strategies to mitigate adverse effects of climate change. This could be interpreted as - since majority of the farmers were in middle age group, so people in these groups are more energetic or curious to know about new technologies and practices, have innovative ideas, and have more social interaction within as well as outside the society. They were more capable to adopt new practices immediately as they can take/bear more risk as compared to older age group. Joshi [20] also found that majority of the farmers had medium level of adaptation strategies to cope up with climate change. Raghuvanshi [21] also reported the similar findings that majority of the respondents had medium level of adaptation measures to cope up with climate change. The findings are in conformity with the results of Kharumnuid *et al. [22]* who also found that majority of the farmers had medium level of adaptation strategies to climate change.

3.2.2 Farmers' Knowledge of different adaptation strategies to mitigate climate change

A number of adaptation strategies have been recommended by various agencies and researchers to mitigate negative impact of climate change. The results obtained are graphically illustrated in figure-3.

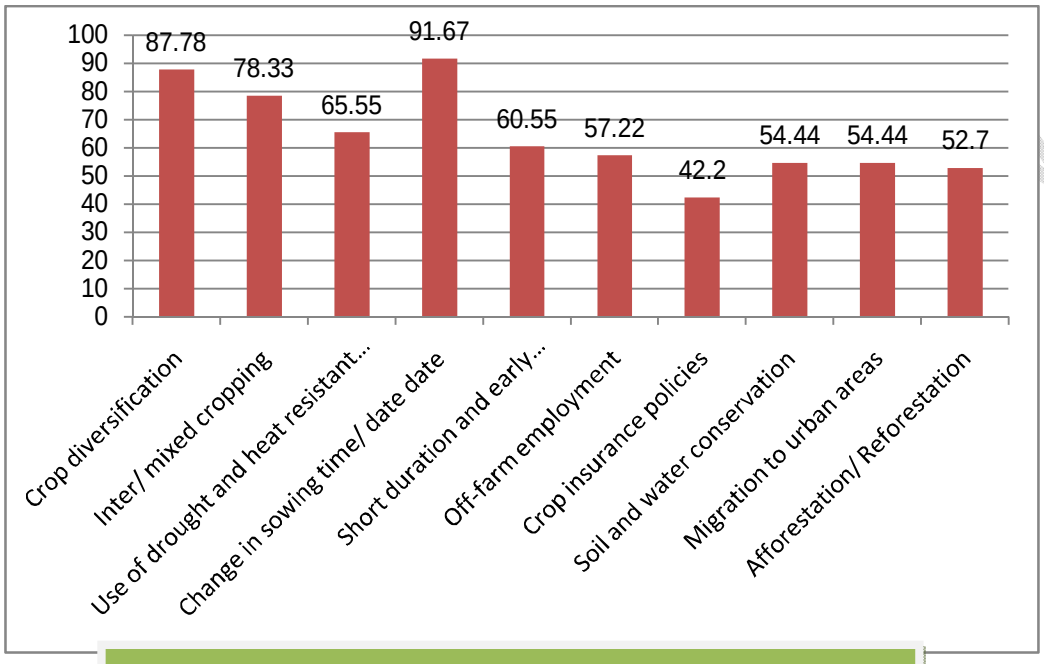


Fig.-3: Knowledge of adaptation strategies mitigate

As discussed earlier, farmers in the study area displayed 'medium' level of knowledge of adaptation strategies to cope-up with climate change. Further, it was investigated to explore farmers' adoption of adaptation strategies to mitigate climate change.

It is evident from the figure-3 that a large majority of the respondents (91.67%) reported that they had altered/ changed sowing time and date of crops due to changes in climate change. Thus, it could be concluded that as they perceive that climate has changed in last few years, and they have been forced to change the sowing time and date in order to cope up with such changes. Further, 'crop diversification' was another adaptation strategy followed by 87.78 percent farmers in the study area, inter/ mixed cropping was followed by 78.83 percent, and use of drought & heat resistant varieties followed by 65.55 percent farmers, respectively. The other adaptation strategies adopted by the farmers in the study area included: Short duration and early maturing verities (60.55%), Off-farm employment (57.22%), Soil & Water conservation practices, and Migration to Urban Areas (54.44% each), Afforestation/ Reforestation (52.7%) and taking Crop Insurance policies (42.2%). The study findings are supported by [23, 24, 25, 26]

and many others who have reported that farmers adopted different location specific adaptation strategies in order to mitigate the negative impact of climate change on agriculture productivity.

3.3 Relationship between farmers' selected characteristics and their knowledge on adaptation strategies to mitigate climate change

The correlation coefficient was employed to find out the relationship between selected independent variables (age, education, farming experience, landholding, annual income, information seeking behaviour, scientific orientation, credit and subsidy orientation, decision making ability, extension contact and training received) and dependent variable (Knowledge of adaptation strategies to cope up with climate change). The findings presented in table (5) below indicate that all independent variables namely; age, education, farming experience, landholding, annual income, information seeking behavior, scientific orientation, credit and subsidy orientation, decision making ability, extension contact and training received were found to be positively related with dependent variable. Further, it was found that some attributes (age, farming experience, information seeking behavior, credit and subsidy orientation, decision making ability, extension contact) were found to be significant at 5 % level of significance, whereas landholding, annual income, scientific orientation had significant relationship with dependent variable at 1 % level of significance.

Table-5: Correlation between farmers characteristics and their adoption of adaptation strategies

Sl. No.	Independent Variables	Karl Pearson's (r) value
1.	Age	0.29*
2.	Education	0.13
3.	Farming experience	0.15*
4.	Landholding	0.54**
5.	Annual income	0.31**
6.	Information seeking behaviour	0.52*
7.	Scientific orientation	0.37**
8.	Credit and subsidy orientation	0.21*
9.	Decision making ability	0.19*
10.	Extension contact	0.15*
11.	Training received	0.08

**= Significant at 5% level of significance; **= Significant at 1% level of significance*

As it is clearly stated in the table-5 that age of the household head turned out to be positively and significantly associated with the knowledge on adaptation practices to mitigate climate change, which indicates that in the middle age farmers are more likely to adopt as compared to older farmers possibly as they are more innovative and keener to try new technology and methods to improve agriculture. Additionally, older farmers could also not be aware of recent innovations in agriculture or are reluctant to

try new methods. The findings obtained are in line with [27] who found the significant relationship between age and their adaptation measures of climate change. Tazeze *et al. [28]* (2012) also found the positive and significant relationship between age and their adaptation strategies to mitigate the effects of climate change.

The variable 'farming experience' was also found to be positively and significantly associated with the knowledge of adaptation practices to climate change; so, this could be concluded that when farmers have more experienced they have better understanding of past weather events and can evaluate their surroundings better. Therefore, this will help to increase likelihood of practicing different farming strategies to the erratic, unpredictable, and extreme weather events to cope up with climate change. The findings are also supported by [29] who found a significant and positive relationship between farming experience and their adaptation strategies of climate change. Significant and positive relationship between farming experience of farmers and adaptation strategies of climate change also reported by [30].

Further, landholding was found to be positively and significantly affected their choice of multiple coping strategies to climate change. So, this could be concluded that when farmers had large size of landholding, the more farmers opted for the combination of several coping strategies to cope up climate change. [31] Shankara also found the positive and significant relationship between landholding and their adaptation strategies of climate change. The study finding is also supported by [32] who found the relationship between farmer's landholding and the adaptation strategies being positive and significant.

Scientific orientation enables an individual to organize knowledge systematically in the form of testable explanation to solve problem at field condition. However, scientific methods require skills and knowledge, hence the information they are getting from different sources must be scientific in nature and updated. Scientific orientation of farmers was found to be significantly associated with the knowledge of adaptation measures to climate change. This might be due to the fact that majority of the farmers in the study area were in middle age group, have access to extension contact, had good social interaction with innovative leaders and progressive farmers. [33] also found a positive and significant relationship between scientific orientation and adaptation strategies of climate change. [34] also reported that the positive and significant relationship between scientific orientation and adaptation strategies of climate change.

Further, annual income was found to be positively and significantly related to knowledge on adaptation strategies to climate change. Hence, we can conclude that farmers who are economically well may have more access to diverse agricultural inputs, resulting in higher adoption of adaptation strategies regarding climate change as compared to others. This is because they have enough income to deal with the risk of adaptation and usually have adequate reserved money on their own. [35] also reported a positive and significant relationship between family income and adaptation strategies of climate change.

The result obtained is also similar with [36] who found the positive and significant relationship between annual income of farmers and their adaptation strategies of climate change.

Further, Credit and subsidy orientation was also found positively and statistically significant related to their knowledge on adaptation strategies to climate change. The high cost of required agri-inputs and advanced technologies might be the major factor that hinders farmers from adopting improved crop variety, fertilizer, water conservation technique, etc. Thus, the availability of credit and subsidies can allow farmers to purchase the adaptation inputs and technologies to cope up climate change. The findings are in conformity with the results of [37] & [38] who found the positive and significant relation between credit and subsidy orientation of farmers and their adaptation measures regarding climate change.

Decision making ability also had positive and significant relation with their knowledge on adaptation strategies to cope up with climate change. This is because in situations of uncertainty, farmers often make decisions with heuristic shortcuts or decision rules, rather than using computational or logical methods. Therefore, informed, accurate and quick decision making is crucial in making the farming profitable and sustainable. At farm level, farmers have to make various decisions which may be related to adoption of new agriculture technology or agri-inputs such as seeds, fertilizers, agrochemicals, etc. Thus, those farmers are able to make decisions in different situations, they are more likely to adopt adaptation strategies to climate change. This could be the reason of relationship between decision making ability and knowledge on adaptation strategies to climate change.

The independent variable, information seeking behavior was found to be positively and significantly related to their knowledge on adaptation strategies to climate change. Therefore, this could be concluded that farmers who have high level of information seeking behavior have better opportunities to be aware of changing climatic conditions and accordingly they can adopt various adaptation practices as well as that they can help to adapt to changes in climatic conditions. [39] reported the positive and significant relation between information seeking behaviour of farmers and their knowledge on adaptation measures of climate change. Further, [40] also found the positive and significant relationship between information seeking behaviour of farmers and their adaptation measures regarding climate change.

Extension and advisory services serve as an important source of information for climate change related knowledge and adaptation practices. The active involvement and engagement of extension agents facilitate sharing knowledge, discuss their problems and motivate for collaborative practices that enhance their awareness about the adaptation strategies to cope up climate change. Extension contact showed positive and significant relation with knowledge on adaptation strategies to climate change. [41] also found the positive and significant relation between extension contact of farmers and their adaptation measures regarding climate change.

4. CONCLUSION

Climate change has now become as one of the biggest threats to agricultural productivity and it is now threatening national food security. The study findings showed that majority of farmers (74%) had moderate level of knowledge about adaptation strategies. Among the various adaptation practices known/ recommended by the researchers, five such strategies - change in sowing time/ date, crop diversification, inter/ mixed cropping, use of drought and heat resistant crop varieties, and short duration and early maturing crop varieties were mostly adopted by the farmers. Further, almost all the independent variables were found to be positively related with farmers' adoption with climate change. The adoption of specific adaptation strategies will help the farmers to reduce the climate change related risks and uncertainties, and enhance the agriculture productivity and production efficiency. Besides this, findings also provide a clear policy insight that government should ensure better infrastructure, financial access, and better access to agriculture extension services to promote location specific adoption of coping strategies and re-orient the present cultivation practices to attain a higher adaptation status to climate change. Besides, it is important to note that the factors influencing farmers' knowledge and adoption of climate change adaptation strategies can vary across regions and contexts. Strategies to promote knowledge and adoption should consider these factors and be tailored to specific agricultural systems and farming communities.

CONSENT: The prior consent of the respondents was taken with due care and confidentiality.

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