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Assessing Perception and Coping Strategies to Changing Climate by Sample Farmers of Northern Dry Zone of Karnataka

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ABSTRACT: Climate change has been the biggest global threat of the 21st century. The climate continues to heat up and its impact grows more severe. Agriculture farmers around the world are increasingly challenged. The human-induced changes in climate are adding pressures on global agricultural and food systems. Changing climate and agriculture are interrelated and it has become a serious threat to Indian agriculture by affecting crop production and livelihood activities. The farmers' responses to changing climate are often dependent on their perceptions and their coping strategies on climate change. Therefore, it becomes necessary to understand the nature perception and coping strategies that are feasible and practiced at the farm level. Multistage sampling was adopted to select and interview 240 rain-fed farmers of the Northern Dry Zone of Karnataka. The most common perception was the decreased crop yield with a Weighted Average Index (WAI) of 2.85 followed by droughts (WAI=2.77). The relationship between the perception levels and independent variables was found positive and significant like age, education, land area, income, and farming experience. A higher level of perception was found in Group III followed by Group II and Group I. The most preferred cereal crop was sorghum with a garret score of 69.59. The most ranked coping strategy was the use of drought/tolerant crops (90.42 %) followed by mixed/intercropping (72.50%).

Keywords: Coping strategy, Change in climate, Garrett score, Northern dry zone, Perception, WAI.

INTRODUCTION

Climate change is directly or indirectly attributed to human activities that alter the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods (UNFCCC,1992). Induced changes in climate are adding pressures on global agricultural and food systems. Hence, it has become a serious threat to agriculture by affecting crop production and livelihood. Farmers suffer most, as they have to continuously respond to climatic variations. Among all developing countries, India has been recognized as one of the most vulnerable developing countries towards climate change risks (IPCC, 2014; Guntukula, 2020; Praveen and Sharma, 2019).

Higher temperatures, shifts in the rainy season, more frequent extreme weather events, erratic and uneven distribution of rainfall over the years is the major cause of yield uncertainty and makes rainfed agriculture one of the riskiest enterprises in semi-arid tropical India (Altea, 2020; Kahsay *et al.*, 2019). A shifting trend from floods to droughts was higher than from droughts to floods. This results from microclimatic changes across the Indian subcontinent triggered by local climate change drivers such as land-use-surface change, deforestation, encroachments upon mangroves, and wetlands (Mohanty, 2020). The drastic climate changes alter the progressive stages of pathogens that eventually affect the growth and yields of crops severely and also could lead to an increase in pest and insect population, ultimately devastating the overall productivity (Srinivas Rao *et al.*, 2019). Studies indicate that Indian agriculture will be negatively affected by climate change by an expected reduction in the yields of wheat, soybean, mustard, groundnut, and potato by 3–7 per cent for every one-degree increase in temperature (Aggarwal *et al.*, 2009). After the occurrence of drought, farmers generally took about one to four years to recover from the shock and the loss. In general, small and marginal farmers and landless laborers are the worst affected and they took the longest time of three to five years to recover from the shock and loss (Singh, 2012). Over the years, the majority of the farmers perceive that there have been changes in the precipitation and temperature levels. Farmers' perceptions of changes in temperature and precipitation levels are based on the personal experiences that act as key catalysts of their adaptation actions. Farmer's perception of climate is based on several factors such as

the skills of farmers, demographic features such as age, educational qualification, gender, and geographic location, ethnicity, and other socio-economic parameters (Deressa *et al.*, 2009; Jha and Gupta, 2021). Increases in cropping intensity, non-farm income, and crop diversification were the important coping strategies (Kumar *et al.*, 2020, Samal and Pandey, 2005). Farmers' livelihood is dependent on agriculture, adaptation to the adverse effects of climate change becomes crucial. Factors like inadequate access to credit, insurance, legal rights, barriers are suffered most by small and marginal farmers about technology adoption (Asfaw *et al.,* 2016). Sustainable ways by which farmers can produce more food and adapt to climate change are integrating crop-livestock-forestry systems, rehabilitating degraded pastures, planting agroforestry systems, and pursuing sustainable forestry (Calmon and Barbieri, 2019).

Climate change is happening. Farmers should be able to perceive that there is climate change and cope up with it, to mitigate its negative effects. Over the years due to climate changes, there has been a continuous decline in agricultural production and farm income due to droughts and floods in the state. Thus, affecting rain-fed agriculture as Karnataka state stands second having the largest area under rain-fed agriculture i.e., 7.01 m ha after Rajasthan in the country. The number of studies that aim at understanding farmers' climate change perception has been increasing, Studies about traditional/ local knowledge of farmers concerning the perceptions of change in climate on agriculture, livestock, and livelihood in the Northern Dry zone of Karnataka is limited. In this context, a study was undertaken to explore sample farmers' perceptions and coping strategies about the change in the climate. We hypothesized that farmers' perceptions of climate change are highly influenced by socioeconomic and environmental factors.

MATERIAL AND METHODS

Karnataka State has ten Agro-Climatic Zones under the National Agricultural Research Project (NARP) program based on the distribution of rainfall, irrigation pattern, soil characteristics, cropping pattern, and other physical and social characteristics. Northern Dry zone is purposively selected for the study because it has the largest area of 4.78 M ha which is mainly affected by changing climate and the drought vulnerability is 81 per cent which comes under very high vulnerable class according to the report published by Karnataka State Natural Disaster Monitoring Centre (KSNDMC, 2017). The annual rainfall ranges from 464.5-785.7 mm. The elevation ranges between 450-900 meters. The soils are shallow to deep black clay soils. It comprises 35 taluks.

Primary data was collected on farmers' perception and coping strategies on changing climate during the year 2020 from randomly selected rainfed farmers of the selected taluks with the help of a pre-tested schedule through a personal interview method. Multi-stage sampling was adopted. The first stage comprises of selection the Northern Dry zone. In the second stage, taluks were categorized based on the area of irrigation and rainfall data. This classification aimed to know the condition of rainfed farmers away from the irrigation belts. Taluks were divided into three groups i.e., low, medium, and high named Group I, Group II, and Group III as shown in Table 1. In the third stage, four taluks were selected for each group. In total, 12 taluks were selected. In the fifth stage, for each taluk, two villages were selected i.e., 24 villages. In the final stage, from each village several ten rainfed farmers will be selected randomly making a total sample of 240.

Simple calculation of percentages and ranking method by Weighted Average Index (WAI) was used to study the perception of farmers about changing climate. A Chi-square test was done to know the relationship between the independent variables and the levels of perception in SPSS version 16.0. The ranking method was used to know the coping strategies adopted by the farmers in the study area. A weighted average index (WAI) for an individual perception was computed to find out the important strategies in the study area.

$$\frac{Fh^* 3 + Fm *2 + Fl *1}{N}$$

where WAI = weighted average index, Fh = frequency of responses with high effect, Fm = frequency of responses with moderate effect, Fl = frequency of responses with low effect and N = total number of responses.

Table 1: Selection of taluks from Northern Dry zone of Karnataka.

Sr. No.	Particular	Taluks (District)	Villages	Samples per village
1.	Group I	Gadag (Gadag)	2	10
		Ron (Gadag)	2	10
		Mundargi (Gadag)	2	10
		Navalgund (Dharwad)	2	10
2.	Group II	Ramdurg (Belgavi)	2	10
		Bagewadi (Vijayapura)	2	10
		Vijayapura(Vijayapura)	2	10
		Raibag (Belgavi)	2	10
3.	Group III	Gokak (Belgavi)	2	10
		Indi (Vijayapura)	2	10
		Sindagi (Vijayapura)	2	10
		Athani (Belgavi)	2	10
Total		**12**	**24**	240

RESULTS AND DISCUSSIONS

To know farmers' perceptions and coping strategies on changing climate, it becomes necessary to know their socio-economic condition. Hence an attempt was made to know the condition of sample farmers of the study area by interview. Information like age, family size, and type, education status, occupation, etc. were collected. Sample respondents were completely dependent on the changes in climate for agriculture practices.

The socio-economic condition of the total sample of farmers was reported in Table 2. It was revealed that 44.58 percent of total sample farmers were in their old age (>50 years) especially group III (17.92 %) followed by middle age and young farmers with 31.25 and 24.16 per cent respectively. The total average age of sample farmers was 57.67 years with a standard deviation of 11.73. It was reported that the total average family size of sample farmers was 5.64. The average family size was rounded to six members which were composed of two males, two females, and two children. Most of the sample farmers belonged to nuclear families (65.00 %). The analysis of education the level of the total sample respondents showed that farmers who studied in primary school were 37.08 per cent mostly group I (12.92%) followed by illiterate (26.25 %) and high school (19.58 %). The remaining sample of farmers had degree education (9.58 %) and junior college (7.50 %). Most of the sample farmers with a degree of education were observed in group III (4.17 %). The occupational pattern of the total sample farmers showed agriculture was the only occupation among 97 farmers (i.e., 40.42 %). The most popular subsidiary enterprise along with agriculture was the rearing of livestock (22.08 %) found in group III farmers. Agriculture labor along with agriculture as the occupation was noticed in group II farmers (12.92 %). Agriculture with other jobs like petty business, grocery, tractor driving, etc was observed among 8.75 per cent of farmers especially group III (3.75%). The average size of dry land is 3.77 ha. Most of the large holding were observed in group III farmers i.e., the average size of dry land was 4.65 ha. The average rental land was 1.19 ha. The average total landholding and operational landholdings were 4.96 and 2.58 ha respectively. It was reported that the majority of respondents owned Pakka house i.e., 50.42 per cent followed by the mixed house (Pakka + kaccha) i.e., 49.58 per cent. It was also reported that most of the sample farmers had basic agricultural equipment (88.75 %) like wooden/iron plow, harrow, spade, axe, bullock cart, sprayer, etc whereas 29.58 per cent had modern agricultural equipment like seed drill, tractor, etc. The Annual agricultural income of sample farmers revealed that most of them lie in the range of Rs.50,000-Rs.1,00,000 whereas 25.00 per cent of them have their agricultural income less than Rs. 50,000. Only 15.83 per cent of them have crop income above Rs.1,00,000 mostly group III farmers (8.33 %).

In Group III, Most of the farmers were old, educated, large land area and practiced nuclear families. Farmers had basic and modern agricultural equipment and owned pakka houses compared to Group I and Group II farmers. Group III farmers reared livestock and had good crop income compared to Group I and Group II farmers. Overall, Group III farmers were found well of compared to other groups.

Farmers' perception of change in climate over the years was analyzed by a ranking method based on a weighted average. Perceptions that were common among the rainfed farmers were decreased crop yield, loss of net income, decrease in the number of rainy days, late onset of monsoon, increase in pests and diseases, droughts, crop failures, floods, increase in temperature, drying of water resources and decreased livestock yield. The overall perception of rainfed farmers was reported in Table 3. The most common perception was the decreased crop yield with WAI of 2.85 followed by droughts, decrease in several rainy days, late onset of monsoon, loss of net income, increase in pests and diseases, crop failures, floods, drying of water resources, and decreased livestock yield with WAI of 2.77, 2.76, 2.72, 2.70, 2.61, 2.60, 2.54, 2.47,2.36 and 2.30 respectively. The least perceived statement was an increase in temperature with a WAI of 2.11.

Almost all farmers believed that there will be a decrease in yield if there is a change in climate over the years and had effects on variability of weather. Droughts were frequent, floods were rare. A decrease in rainfall was found more concerned to farmers than the increase in temperature. A study conducted on farmers of North-west Bangladesh identified that the scarcity of soil water as having the highest effect on drought with a WAI of 2.93 followed by the increased cost of production (WAI=2.66) and decrease in crop production (WAI=2.55) (Mardy *et al*., 2018). A study on Tamil Nadu farmers perceived climate variability and reported that delayed monsoon onset, intermittent dry spells, and decreasing soil moisture as the critical factors affecting their cultivation. Another major response focused on reducing the area under cultivation and the necessity of using more fertilizers, pesticides, and insecticides due to increasing pests and insect attacks. It was also reported that none of them were aware of the crop weather insurances (Dhanya and Ramachandran, 2016). A study on farmers' perception and awareness of crop insurance was conducted by Goudappa *et al*., (2012) revealed that in north-eastern parts of Karnataka due to very little rainfall compared to other parts of Karnataka, the people of this region always suffer from dry spells and droughts. Similar results were reported by Niles and Mueller (2016) that the majority of farmers perceived that there is an increase/decrease in annual rainfall and temperature. The perceptions of changing climate were correlated with increased belief in climate change and an increased concern for future climate impacts.

Table 2: General characteristics of sample farmers.

Sr. No.	Particulars	Group I (n=80)	percentage	Group II (n=80)	percentage	Group III (n=80)	percentage	Total farmers (m=240)	Percent to total
1.	Age								
	Young age (<35 years)	18	7.50	23	9.58	15	6.25	56	24.17
	Middle age (35-50 years)	25	10.42	29	12.08	22	9.17	76	31.25
	Old age (>50 years)	37	15.42	28	11.67	43	17.92	108	44.58
	Average age (years)	48.79	—	61.33	—	62.89	—	57.67	—
	Standard deviation	10.78	—	13.96	—	9.87	—	11.53	—
2.	Educational status								
	Illiterate	26	10.83	20	8.33	17	7.08	63	26.25
	Primary school	31	12.92	30	12.50	28	11.67	89	37.08
	High school	12	5.00	17	7.08	18	7.50	47	19.58
	College	5	2.08	6	2.50	7	2.92	18	7.50
	Graduate	6	2.50	7	2.92	10	4.17	23	9.58
3.	Family composition								
	Average Family size	5.67	--	6.51	—	6.43	—	5.64	—
	Average Male	2.33	—	2.21	—	2.59	—	2.37	—
	Average Female	1.78	—	1.62	—	1.57	—	1.65	--
	Average Children	1.56	—	2.68	—	2.37	—	2.2	--
	Type of family								
	Nuclear	45	18.75	54	22.50	57	23.75	156	65.00
	Joint	35	14.58	26	10.83	23	9.58	84	35.00
4.	Occupation								
	Agriculture	37	15.42	25	10.42	35	14.58	97	40.42
	Agriculture+ Agriculture labour	23	9.58	31	12.92	15	6.25	69	28.75
	Agriculture+ Livestock	13	5.42	19	7.92	21	8.75	53	22.08
	Agriculture+ Others	7	2.92	5	2.08	9	3.75	21	8.75
5.	Land size								
	Average Dryland (ha)	3.11	—	3.56	—	4.65	—	3.77	—
	Average Irrigated land (ha)	—	—	—	—	—	—	—	—
	Average Land on rent (ha)	0.45	—	1.25	—	1.87	—	1.19	—
	Total land holdings (ha)	3.56	—	4.81	—	6.52	—	4.96	—
	Total operational landholding (ha)	2.66	—	2.31	—	2.78	—	2.58	—
6.	Assets								
	Pakka house	33	13.75	41	17.08	47	19.58	121	50.42
	(Pakka+ kaccha)house	47	19.58	39	16.25	33	13.75	119	49.58
	Basic Agricultural equipment	55	22.92	67	27.91	64	26.67	213	88.75
	Modern Agricultural equipment	37	15.42	31	12.92	40	16.67	71	29.58
7.	Annual Agricultural Income								
	Less than Rs.50,000	27	11.25	20	8.33	13	5.42	60	25.00
	Rs.50,000- Rs.1,00,000	45	18.75	50	20.83	47	19.58	142	59.17
	Above Rs.1,00,000	8	3.33	10	4.16	20	8.33	38	15.83

Source-field data

Table 3: Farmers' perception of change in climate by rain-fed farmers.

S. No.	Statements	Group 1(n=80)					Group 2 (n=80)					Group 3 (n=80)					Total (N=240)				
		Effects			WAI (n=80)	Rank	Effects			WAI (n=80)	Rank	Effects			WAI (n=80)	Rank	Effects			WAI (n=240)	Rank
		High	Medium	Low			High	Medium	Low			High	Medium	Low			High	Medium	Low		
1.	Decreased crop yield	69	7	4	2.81	I	71	7	2	2.86	I	73	5	2	2.89	I	213	19	8	2.85	I
2.	Loss of net income	65	8	7	2.73	II	64	12	4	2.75	IV	60	10	10	2.63	VI	189	30	21	2.7	V
3.	Droughts	60	14	6	2.68	III	68	6	6	2.78	III	69	11	0	2.86	II	197	31	12	2.77	II
4.	Late-onset of monsoon	54	23	3	2.64	IV	57	22	1	2.70	VI	65	15	0	2.81	IV	176	60	4	2.71	IV
5.	Decrease in number of rainy days	50	30	0	2.63	V	68	8	4	2.80	II	70	8	2	2.85	III	188	46	6	2.75	III
6.	Increase in pests and diseases	48	30	2	2.58	VI	60	15	5	2.69	VII	50	25	5	2.56	VIII	158	70	12	2.60	VI
7.	Crop failures	47	31	2	2.56	VII	61	18	1	2.75	V	55	10	15	2.50	IX	163	59	18	2.60	VII
8.	Floods	36	43	1	2.44	VIII	53	22	5	2.60	IX	52	23	5	2.59	VII	141	88	11	2.54	VIII
9.	Increase in temperature	32	46	2	2.38	IX	46	19	15	2.39	XI	40	10	30	2.13	XI	118	75	47	2.29	XI
10.	Drying of water resources	30	46	4	2.33	X	57	20	3	2.68	VIII	45	22	13	2.40	X	132	88	20	2.46	IX
11.	Decreased livestock yield	19	39	22	1.96	XI	53	12	15	2.48	X	62	8	10	2.65	V	134	59	47	2.36	X

Source-field data

Further to know the relationship between socioeconomic variables and levels of perception chi-square test was done. The relationship between the levels of perception and the age of the farmer was found positive with a Pearson chi-square value of 10.45. It was found that age, education, land area, income, and farming experience were found positive and significant in the case of 240 farmers. Family size and type were positive but had a non-significant p-value. Variables significant at one percent were age and education. Variables significant at five percent were land area, income, and farming experience.

In this study, old and educated farmers had a high level of perception. These types of farmers were found in group III. It was observed that Group III farmers had a high level of perception than Group I and Group II.

The results of a study by Twongyirwe *et al.,* (2019) showed that 13 per cent of the respondents reported being "doing nothing" to respond to the droughts. Significant ($p<0.05$) determinants of coping strategies include a combination of the size of farmland, total income from crops, no. of livestock, and marital status. The adaptive capacity of farm-households depends on several socio-economic and demographic factors such as family size, age, gender, education level, and farm size and varies at regions and local levels (IPCC, 2014). Past studies have found perception and coping strategies to climate change are influenced by several socio-economic and environmental factors (Nhemachena & Hassan, 2007; Deressa *et al.,* 2009; Nhemachena, 2009; Deressa *et al.*, 2010). The studies conducted by Carlos *et al.,* (2019); Asrat and Simane (2018) had similar results on perceptions on climate change that were influenced by socio-economic factors of farmers.

Farmers were also asked about the preferable crops when there is climate change, especially drought. The most preferred cereal crop was sorghum with a garret score of 69.59 followed by commercial crop i.e., cotton. Red gram was the preferred pulse crop and sunflower was the preferred oilseed crop.

A study in Tamil Nadu made evident from the Focus Group Discussion that the farmers were reluctant to take up Kuruvai crops especially paddy due to the delay and poor performance of south-west monsoon rainfall in this area. Most of them were hopefully waiting for the next monsoon (Dhanya and Ramachandran, 2016). Similar results were also obtained by a study titled "Climate Change and Crop Diversity: Farmers' Perceptions and Adaptation on the Bolivian Altiplano" where local crops and varieties were perceived as vulnerable to changing climate whereas bitter potatoes and wild relatives of quinoa and cañahua were perceived as highly stress-tolerant and provide good harvest during extreme conditions (Meldrum, 2018).

Table 4: Relationship between socio-economic variables and levels of perception.

Sr. No.	Independent variables	Df	Group I(n=80)		Group II(n=80)		Group III(n=80)		Total(N=240)	
			Pearson Chi-Square	p values	Pearson Chi-Square	p values	Pearson Chi-Square	p values	Pearson Chi-Square	p values
1.	Age	4	13.99**	0.00	11.96**	0.00	15.67**	0.00	10.45**	0.00
2.	Education	8	10.68*	0.02	12.65*	0.05	9.56**	0.00	10.96**	0.01
3.	Family Type	2	1.21	0.19	0.79**	0.00	2.45	0.24	2.48	0.25
4.	Family Size	2	6.34	0.38	3.26	0.67	10.68	0.54	5.76	0.23
5.	Land Area	2	5.63	0.09	5.97	0.92	9.63*	0.1	9.07*	0.04
6.	Income	2	23.96**	0.00	19.64**	0.00	39.33*	0.02	23.65*	0.03
7.	Farming Experience	4	2.89**	0.00	2.905	0.57	2.44**	0.00	2.52*	0.02

Source: field data. *- Significant at the 5per cent level. **- Significant at the 1per cent level

Table 5: Farmers' perception of change in climate over specific crops.

Sr. No.	Crop	Garret score	Rank
1.	Sorghum	69.59	I
2.	Cotton	60.10	II
3.	Pearl millet	53.72	III
4.	Red gram	56.02	IV
5.	Maize	42.00	V
6.	Wheat	51.10	VI
7.	Chickpea	37.23	VII
8.	Greengram	16.13	VIII
9.	Groundnut	29.73	IX
10.	Sunflower	11.50	X

Source: field data.

Farmers practiced many coping strategies when climate change was observed presented in Table 6. Some of the practices were changed in sowing area, change in cropping pattern, shift to non-agricultural activity change in planting and harvesting time, mixed/intercropping, use of drought/tolerant crops/crop varieties, use of any water/soil moisture conservation structures, cultivation of tree crops, institutional help and livestock for sale. The most ranked coping strategy was the use of drought/tolerant crops/ other crop varieties (90.42 %) followed by a change in cropping pattern/ mixed/intercropping, institutional help, change in planting and harvesting time, change in cropping pattern, change in crop varieties, use of any water/ soil moisture conservation structures, change in sowing area/land rotation, shift to non-agricultural activity, livestock for sale, cultivation of Horticulture/ vegetables crops and migration.

A study on the perception of farmers on drought impacts of Maharashtra State reported that they seek various options such as migration for employment, selling of livestock, farmers' non-agricultural income sources, and even less choose crops requiring less water to deal with drought. However, it was observed that farmers from less irrigated areas tend to be well prepared to deal with anticipated drought by storing harvested grain and saving money as compared to medium-and high-irrigated areas (Udmale *et al.*, 2014). Another study on rural farmers' perception and coping strategies towards climate change and their determinants were conducted in Khyber Pakhtunkhwa province, Pakistan the main adaptation strategies carried out by the small farmers were irrigation, non-farm activities, and early planting schemas (Ali *et al.*, 2021). Similar results were obtained by a study conducted on rural farmers of Uganda coping strategies towards extreme events were storing food, income diversification, and digging drainage channels (Okonya, 2013).

Table 6: Farmers' coping mechanisms for changing climate.

Sr. No.	Coping Strategies	Group I (n=80)	Group II (n=80)	Group III (n=80)	Total sample farmers (m=240)	Rank
1.	Use of drought/tolerant crops/other crop varieties	73(30.42)	69(28.75)	75(31.25)	217(90.42)	I
2.	Change in cropping pattern/ Mixed/intercropping/	56(23.33)	60(25.00)	58(24.17)	174(72.50)	II
3.	Institutional help	64(26.67)	55(22.92)	50(20.83)	169(70.42)	III
4.	Change in Planting and harvesting time	67(27.92)	43(17.92)	53(22.08)	163(67.92)	IV
5.	Use of any water/ soil moisture conservation structures	69(28.75)	47(19.58)	45(18.75)	161(67.08)	V
6.	Change in sowing area/land rotation	57(23.75)	53(22.08)	47(19.58)	157(65.42)	VI
7.	Shift to non-agricultural activity	55(22.92)	43(17.92)	58(24.17)	156(65.00)	VII
8.	Livestock for sale	33(13.75)	38(15.83)	28(11.67)	99(41.25)	VIII
9.	Cultivation of Horticulture/Vegetable crops	9(3.75)	17(7.08)	26(10.83)	52(21.67)	IX
10.	Migration	10(4.17)	15(6.25)	18(7.50)	43(17.92)	X

Source -field data

CONCLUSIONS

Assessment of farmers' perceptions to change in climate and coping strategies to secure their livelihood in the Northern Dry Zone of Karnataka. The study confirms that the majority of the respondents were aware of Changing climate. Farmer's perceptions and the meteorological information gathered were matched and were true. Perceptions that were common among the 240 rainfed farmers were decreased crop yield, droughts, loss of net income, decrease in the number of rainy days, late onset of monsoon, increase in pests and diseases and crop failures, floods, increase in temperature, drying of water resources and decreased livestock yield. The most preferred cereal crop was sorghum followed by commercial crop i.e., cotton. Red gram was the preferred pulse crop and sunflower was the preferred oilseed crop. The relationship between the levels of perception and age, education, land area, income, and farming experience were found positive and significant. The most ranked coping strategy was the use of drought/tolerant crops/ other crop varieties

followed by mixed/intercropping and institutional help. Farmers expressed the need for irrigation facilities when there was a decrease in crop yield due to rainfall. Despite the good perception of climate change the preferences given for coping up were traditional and not good enough. Climate-resilient practices and strategies, adoption of crop insurance, diversification of livelihood, etc may reduce farm vulnerability. The government provided measures, provided low satisfaction among farmers. It is expected that this study will help Indian policymakers to develop more appropriate policies to cope up with climate changes.

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