Original Research Article

A Study on adoption of climate adaptation strategies and its causes for adoption by farmers in Tiruchirapalli District of Tamil Nadu State

ABSTRACT

Climate change is widely viewed as one of the most serious concerns confronting society today. Climate change is due to natural internal processes or external factors, as well as long-term anthropogenic changes in atmosphere composition and land use. The main purpose of the study was to find out the climate adaptation strategies followed by the respondents and their causes of adoption. Random sampling techniques was used for the selection of the respondents. A total of 60 farmers were selected for the study. The data were collected through direct face-to-face personal interviews, and then after it compiled, tabulated, and analyzed to get answers with the help of appropriate statistical tools. In this research study, major findings were more than 90 percent of the farmers had low to medium levels of climate adaptation strategies and the major cause for the adoption of adaptation strategies was the neighborhood aspect (67.3%) followed by less prone to climate effects (65.60%) and shorter duration varieties (56.30%).

Keywords: Adaptation strategies, Causes, Climate change, Tiruchirapalli

1. INTRODUCTION

Climate is the average weather in a location over a lengthy period (30-50 years). Climate change is “a systematic change in the long-term state of the atmosphere over multiple decades or more(1)caused by increasing human activities such as industrialization, deforestation, urbanization, agriculture, change in land use patterns, etc. results in greenhouse gases emission which leads to fluctuations in temperature, rainfall, wind, and other components.According to IPCC, modern humans have never before seen the observed changes in our global climate, and some of these changes are irreversible over the next hundreds to thousands of years(2)which linked to other catastrophic weather phenomena such as more occurrences and strong hurricanes, droughts, floods, wildfires, and winter storms(3). Climate changehas been a threat to all sectors all over the world such as trade, industry, and particularly the agricultural field. Agriculture is one of the sectors that depends on climatic conditions which is more vulnerable to climate change which affects agriculture in many ways. Crops are very sensitive to the changes in temperature, precipitation and other extreme weather conditions (4).

Climate change leads to increased number of incidence in pest and disease occurrence which results in changes in food quality(5)and disturb food availability, decrease access to food, as reported by USDA(6)If the projected climate change continues till 2100, there will be 20-30% reduction in rice yield, 20-45% reduction in maize and 5-50% in wheat(7) .Tamil Nadu is one of the state that is most vulnerable to climate change in India.(Varadan) which experience drought once in every 2.5 years(8) .There will be 0.7 to 6.3% expected reduction in rice yield of Tamil Nadu(9).Marginal and smallholder farmers are particularly helpless to impact of climate change.These transformations lead to damaging the agricultural growing areas, putting millions of people at risk of chronic famine. The sustainable climate change

mitigation is very important to reduce the negative impact of climate change and extreme weather events on agriculture productivity suitable adaptation strategies are required such as adoption of heat tolerant, drought tolerant variety, changes in agronomical practices, efficient utilization of water, soil conservation practices etc., (10). The climate change Hence the study was undertaken to analyze the climate adaptation strategies followed by the farmers.

2. METHODOLOGY

2.1 Locale of the study

The present study was conducted in the Tiruchirapalli district of Tamil Nadu state. The study area of Tiruchirapalli district was purposively selected. Tiruchirapalli district was consisted of 14 blocks. Among these Andhanallur Block from Srirangam Taluk of the district was selected using the random sampling techniques.

2.2 Population and Sampling

"Ex post facto" research design was used to undertake the study. Selection of the villages and farmers were by using random sampling procedure. The list of total number of villages in the block was obtained from the State Department of Agricultural office. Out of the total villages, two villages were selected using a random sampling technique. From each village, thirty farmers were selected randomly. Thus, a total of 60 farmers from two villages were selected for the study.

2.3 Selection of variables

A list of relevant variables is sent to the Subject Matter Specialists of State Agricultural University specialists, Extension scientists and ICAR institutions for Judges opinion. Based on the score obtained from the judge's opinion independent variables of the study were selected whereas climate adaptation strategies followed by the farmers were focused as the dependent variable of the study.

2.4 Measurement of climate adaptation strategies

A seven climate adaptation strategies in the field level were selected for study purposes by discussing with the Agricultural Officers at Block level. The scoring value of 2 and 1 was given to the respondents who followed the climate adaptation strategy and not followed the climate adaptation strategies respectively.

2.5 Causes of adopting the climate adaptation strategies

A seven-item statement was considered for finding out the causes of adoptionwas followed by Ashrafi(11). A five point Likert type modified scale was used which consists of five degrees of freedom such as strongly agree, agree, undecided, disagree and strongly disagree were employed against each statement. A scoring of 5 (Strongly agree), 4 (Agree), 3 (Undecided), 2 (Disagree) and 1 (Strongly Disagree) were assigned against the rating scale. Causes of Adoption Index was used to find the most important cause for adoption by using the following formula

$$CAI\ (\%) = \frac{\text{OISCA}}{\text{HPISCA}} \times 100$$

$$\text{OISCA} = N_{sa} \times 5 + N_{ag} \times 4 + N_{ud} \times 3 + N_{da} \times 2 + N_{sd} \times 1$$

OISCA = Observed Index Score for Causes of Adoption
HPISCA = Highest Possible index score for causes of adoption

N_{sa} - Number of respondents pointed as a strongly agree

N_a - Number of respondents pointed as a agree

N_{ud} - Number of respondents pointed as undecided

N_{da} - Number of respondents pointed as a disagree

N_{sd} - Number of respondents pointed as a strongly disagree

The score for the causes of Adoption Index varies from 60-300 where 60 indicates the lowest number of causes and 300 indicates the highest number of causes for adoption of climate adaptation strategies. The causes for adoption were ranked by the percentage of CAI score.

3. RESULTS AND DISCUSSION

3.1 Selected characteristics of the respondents

The selected characteristics of the respondents shown in Table 1. The majority of the respondents (51.7%) was old age compared to middle-aged (30.0%) and young age (18.3 %).Above 80.0% percent of the respondents were male compared to female category (11.7%). The highest proportion (40.0%) of the respondents belonged to middle education level followed by collegiate (38.3 %), illiterate (11.7%) and the lowest proportion is secondary and primary education level (5.0%). The major proportion (60.0%) of the respondents belongs to nuclear family while 40.0 percent belong to joint family. Most of the respondents (95%) percent of the respondents belongs to the occupation of farming alone followed by farming and business (5.0%). The majority (36.7%) of the respondents possessed small farm followed by marginal farm (35.0%), medium farm (21.7%) and large farm (6.7%). 48.3 % percent of respondents utilizes bore well as irrigation source followed by Open well and bore well (31.7%).73.3 percent of the respondents had high farming experience followed by 16.7% person had low farming experience and 10.0 % had medium farming experience. The highest proportion (60.0%) of the respondents had low annual income followed by medium (26.7%) and high annual income (13.3%). Majority (43.3%) of the respondents belongs to medium information seeking behavior while 28.3% respondents had high and low information seeking behavior. About 50.0 % of the respondents taking independent decision while other 43.3% taking decision with others.31.7% of the respondents have high risk orientation followed by low (45.0%) and medium (23.3%). Majority (41.7%) of the respondents had medium scientific orientation followed by low (35.0%) and high (23.3%).61.7 percent of the respondents have medium innovativeness followed by high (21.7%) and low (16.7%).

Table1.Selected characteristics of the respondents

(n=60)

S.No	Characteristic	Categories	Respondents	
			No	%
1	**Age**	Young (≤ 40 years)	11	18.3
		Middle-aged(41 to 50 years)	18	30.0
		Old aged (≥ 51 years)	31	51.7
2	**Gender**	Male	53	88.3
		Female	7	11.7

3	**Educational status**	Illiterate	7	11.7
		Primary education	3	5.0
		Middle Education	24	40.0
		Secondary education	3	5.0
		Collegiate	23	38.3
4	**Family type**	Joint Family (≤ 5 members)	24	40.0
		Nuclear Family(> 5 members)	36	60.0
5	**Occupational status**	Farming alone	57	95.0
		Farming + wage earner	0	0
		Farming + business	3	5.0
		Farming + services	0	0
6	**Farm size**	Marginal (≤ 2.5 acres)	21	35.0
		Small (2.6 – 5.0 acres)	22	36.7
		Medium (5.1-10.00 acres)	13	21.7
		Large (≥ 10.00 acres)	4	6.7
7	**Source of Irrigation**	Canal / Ponds	5	8.3
		Open well	7	11.7
		Bore well	29	48.3
		Open well + Bore well	19	31.7
8	**Farming experience**	Low (≤ 10 years)	10	16.7
		Medium (11 to 25 years)	6	10.0
		High (>25 years)	44	73.3
9	**Annual income**	Low (≤ Rs 1,00,000)	36	60.0
		Medium (Rs 1,00,000 - 2,50,000)	16	26.7
		High (>Rs 2,50,000)	8	13.3
10	**Social Participation**	Low (≤ 3)	35	58.3
		Medium (3 – 4)	21	35.0
		High (>4)	4	6.6
11	**Information seeking behavior**	Low (≤ 39)	17	28.3
		Medium (39 to 44)	26	43.3

		High (> 44)	17	28.3
12	**Decision-making pattern**	Independent decision of respondent	34	56.6
		Joint decision with outsiders	26	43.3
13	**Risk orientation**	Low (≤ 22)	27	45.0
		Medium (22 to 24)	14	23.3
		High (> 24)	19	31.7
14	**Scientific Orientation**	Low (≤ 21)	21	35.0
		Medium (21 - 24)	25	41.7
		High (> 24)	14	23.3
15	**Innovativeness**	Low	10	16.7
		Medium	37	61.7
		High	13	21.7

3.2 Distribution of respondents according to their adaptation strategies

The result from Table 2 indicates that the majority of the respondents belong to low adaptation strategies category (48.3 %) following medium adaptation strategies (43.3 %), Only five percent of the respondents showed high adaptation strategies. The results are similar with Magesha et al., (2023) in which these adaptation strategies are welcome development and may be beneficial to the farmers but not effective to the extreme climatic events.(12)

Table 2. Distribution of respondents according to their adaptation strategies

(n=60)

S.No	Categories	Respondents No	Percentage
1	Low	29	48.3
2	Medium	26	43.3
3	High	5	8.3
	Total	**60**	**100**

3.3 Adaptation strategies followed by the respondents

The respondents adopted the adaptation strategies to a different extent (Figure 1). Changes in the sowing and planting date according to the changes in the occurrence of the monsoon were adopted by the farmers to the highest extent (67.20 %) while the lowest is the mixed cropping (28.10%). The other adaptation strategies were a selection of climate-resilient crops (64.10%), direct sowing after precipitation (54.70%), short-duration varieties (48.40%), intercropping (37.50 %), and selection of climate-specific variety (35.90%)

3.4 Causes for the adoption of adaptation strategies

Farmers' cause for adoption are illustrated in Figure 2.Most (67.30 %) of the respondents adopted climate adaptation strategies because of the neighborhood aspect followed by less

prone to climate change affect (65.60 %) and short duration varieties (56.30%). The contingency plan by the government was the least important cause for its adoption (29%).

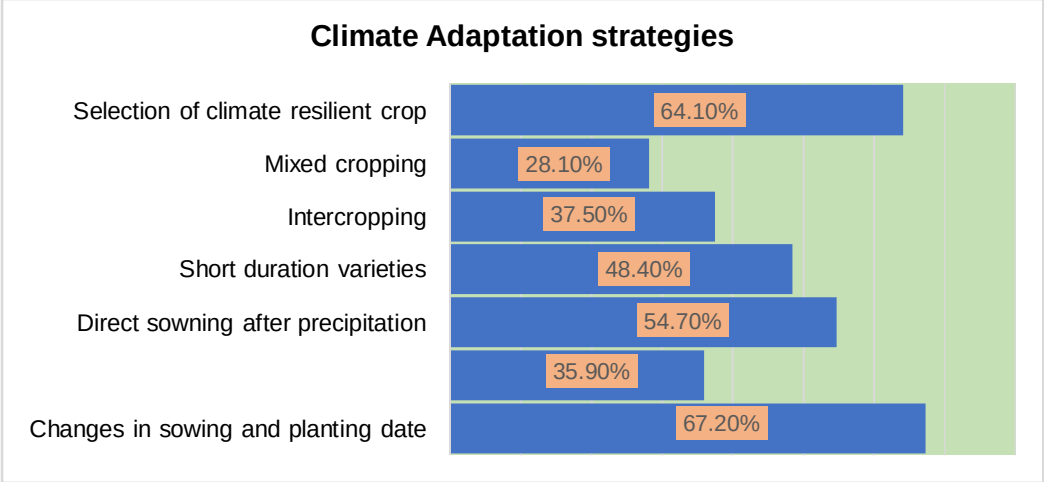

Figure 1. Climate Adaptation strategies of the respondents

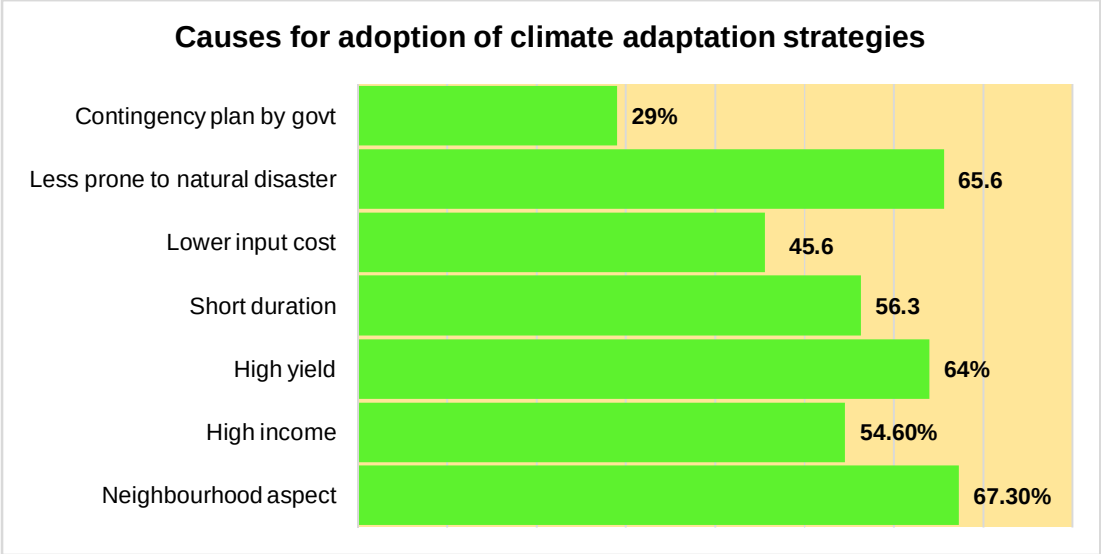

Figure 2. Causes for adoption of climate adaptation strategies by the respondents

3.5 Relationship between the selected characteristics of the respondents and their respondent's adaptation strategies

The zero-order correlation coefficients were computed for the examination of the relationship between the independent variables and the extent of use of extension teaching methods by extension personnel. The results to this effect are presented in Table 3

Table 3. Relationship between the selected characteristics of the respondents and their climate adaptation strategies

Variable Code	Characteristics	r value
X_1	Age	0.131
X_2	Gender	-0.20
X_3	Educational status	0.243
X_4	Family type	0.218
X_5	Occupational status	-0.154
X_6	Farm size	0.102
X_7	Irrigation source	0.282*
X_8	Farming experience	-0.007
X_9	Annual income	0.295*
X_{10}	Social Participation	0.309*
X_{11}	Information seeking behavior	0.401**
X_{12}	Decision-making behavior	0.224
X_{13}	Risk orientation	0.602**
X_{14}	Scientific Orientation	0.623**
X_{15}	Innovativeness	0.505**

** - Significant at one percent level * - Significant at five percent level

Among the 15 selected characteristics of the respondents, information-seeking behavior, scientific orientation, risk orientation, and innovativeness were positively and significantly correlated with the climate adaptation strategies at a one percent level of significance while farmers' irrigation source, annual income, farming experience, social participation were positively and significantly correlated at five percent level of significance.

4. CONCLUSION

Climate resilient agriculture plays a crucial role in sustainable production, ensures food security and the well-being of communities in the face of climate change. Study provided valuable insights into climate adaptation strategies and their causes for adoption. Even though half of the farmers had middle and collegiate education levels and most of the farmers were in the category of farming alone as a major source of income, respondents were in the category of low to medium levels of adaptation strategies. However, these adaptation strategies were seen as welcome development against the impact of climate change.It also revealed the causes for adoption being the most prevalent neighbourhood aspects being the most prevalent followed by less prone to natural disasters. Moreover, the study identifies the household attributes such as irrigation source, annual income, social participation, information-seeking behavior, risk orientation, scientific orientation, and innovativeness, as significant contributors to the adoption of climate adaptation strategies. as highly followed adaptation strategies.Overall the research emphasizes the importance of climate adaptation strategies and factors influencing to adoption of those strategies.

5.IMPLICATIONS FOR PRACTICE AND POLICY

The findings have several implications for increasing the adoption of climate adaptation strategies

1. Awareness should be created among the farmers about climate adaptation strategies and their benefits by the Agricultural department officials and extension officials.

2. Farmers should be encouraged to adopt the climate adaptation strategies by providing them with subsidiary or developing a scheme for the beneficial of the farmers.

3.Contigency crop planning and early warning of weather forecasting with systematic approach of institutional mechanism as suggested by Aggarwal et al., (2021) (13)

4. Constraints faced by the farmers in climate adaptation strategies should be identified and tackle them with better alternatives.

5. Demonstration and more hands-on training practices should be given to the farmers for increasing the adoption of climate adaptation strategies

6.LIMITATIONS AND FUTURE RESEARCH

The study was limited to the Tiruchirapalli District, and caution should be exercised in generalizing the content to other regions. The dependence on verbal responses may have caused some bias.

1.Expanding the geographical scope to allow for comparisons within the State

2. Investigating the relationship between the climate adaptation strategies and actual farm productivity to assess the impact of climate adaptation strategies.

3.In-depth qualitative research for better understanding the barriers for adoption of climate adaptation strategies

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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