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Climate Change Impact on Paddy Farming in Erode and Tiruchirapalli Districts of Tamil Nadu

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ABSTRACT

Climate change implies both direct and indirect impact on the general well-being of the people in the rural community such as agriculture and allied sectors for their livelihood security. A study was conducted on the small and marginal paddy farmers of Tamil Nadu. A sample of 200 paddy farmers was selected from the districts of Erode and Tiruchirappalli, Tamil Nadu. Findings revealed that paddy farmers perceived climate change impacts include five major components viz. crop nature, pest incidence, disease menace, water crisis and agro climatic status. It was found that farmers were much aware of the variations in rainfall pattern and its distribution followed by variability in temperature and changes in wind speed and direction. Receipt of low rainfall was found to be the most pertinent issue.

India is a large country with 15 agro-climatic zones, with diverse seasons, crops and farming systems. For a majority of people in India, to this day, agriculture is the main stay of livelihood. Agriculture is the most vulnerable sector to climate change as it is inherently sensitive to climate variability and climate change is going to impact on Indian agriculture in different ways both directly and indirectly

Agriculture is inherently sensitive to climate conditions and is the most vulnerable sector to the risks and impacts of climate change (Sagun, 2009). Climate change is the long term conspicuous deviation from usual prevailing climate bringing variations in normal temperature, rainfall and atmospheric parameters. There is an urgent need to understand the effects of climate change on agricultural sector both at global and as well as at regional levels, especially from the point of view of providing food to vulnerable section of the population. Developing countries are more vulnerable to climate change than developed countries because of the predominance of agriculture in their economies and scarcity of capital for adaptation measures (Fischer, 2005). Sinha and Swaminathan (1991) have showed that an increase of 2^{o} C in temperature would decrease rice yield by about 0.75 ton/ha. In this regard climate change impact especially among the small and marginal paddy farmers with limited resources is of great concern. Mohanraj and Karthikeyan (2014) reported that 92.72% perceived change in long term temperature in selected districts of Tamil Nadu. The study was conducted in the

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Vaiyampatty block of Tiruchirapalli district (Ponnaniyar basin) and Erode block of Erode district (Kalingarayan basin) in Tamil Nadu. They were selected based on the water availability for farming situation. Seven villages in Ponnaniyar basin and eleven villages in Kalingarayan basins were selected for the study.

METHODOLOGY

Paddy is the staple food crop of Tamil Nadu and is heavily exposed to the extreme and extraneous events of climate change. Erode and Tiruchirapalli districts were purposively selected for the study as the district has high range of variability in both rainfall and temperature. Kalingarayan (Erode) and Ponnaniyar (Tiruchirapalli) basins were then chosen as they have maximum acreage under paddy with majority of the farmers being small (2.5 to 5 acres) and marginal (< 2.5 acres). Canal irrigation was also found to be prominent in these basins resulting in farmers becoming more vulnerable to climate change events. Based on the discussions with the officials and subject matter specialists of the agricultural department one block was selected from each basin. For the selection of villages, an inventory of revenue villages in each block was collected. Then ten villages from each block were randomly chosen. The total sample size was 200 with randomly selecting 100 paddy farmers (comprising 50 male farmers and 50 female farmers) from each of the blocks.

FINDINGS AND DISCUSSION

A. Impact of Climate Change on Crop Nature

Climate change is clearly recognized as a major threat to agricultural system. The expected increase in temperature, atmospheric CO_2, heavy and unseasonal rainfall, increased humidity, drought and

Table 1.
Impact of Climate Change on Crop Nature (n=200)

Sl.No.	Crop nature	Kalingarayan basin n=100	Ponnaniyar basin n=100
		Mean score	Mean score
1.	Changes in cropping system	1.980	1.970
2.	Changes in harvesting time	1.990	1.950
3.	Changes in crop growing season	1.900	1.790
4.	Crop destruction	1.910	1.770
5.	Scorching of crops in direct sown paddy	1.800	1.580
6.	Scorching of crops in transplanted paddy	1.390	1.510
	Average mean score	**1.828**	**1.761**

cyclones are likely to affect paddy crop. Hence, an attempt was made to assess the perceived impact of climate change on crop nature.

It is referred from Table 1 that the average mean score of impact of climate change on crop nature in Kalingarayan basin was worked out to 1.828 where the sub items like changes in cropping system, changes in harvesting time, changes in crop growing season and crop destruction as identified with higher mean score of 1.980, 1.990,1.900 and 1.910 respectively. The mean score of other sub items fell below the average mean score. The average mean score of Ponnaniyar basin worked out for the impact of climate change on crop nature was 1.761 where the sub items like changes in cropping system, changes in harvesting time, changes in crop growing season and crop destruction were identified with higher mean score of 1.970, 1.950,1.790 and 1.770 respectively.

Table 2.
Impact of Climate Change on Pest Incidence (n=200)

Sl.No.	Pest incidence	Kalingarayan basin n=100	Ponnaniyar basin n=100
		Mean score	Mean score
1.	Pest outbreak	1.310	1.190
2.	Arrival of new pests	1.480	1.430
3.	Stem borer infestation	1.940	1.900
4.	Leaf folder infestation	1.920	1.860
5.	Rice mite infestation	1.340	1.280
6.	Gall midge infestation	1.120	1.100
7.	Thrips infestation	1.180	1.120
8.	Plant hopper infestation	1.260	1.270
9.	Leaf hopper infestation	1.400	1.420
10.	Ear bug infestation	1.690	1.800
	Average mean score	**1.474**	**1.432**

Study area of Kalingarayan and Ponnaniyar basin is extremely vulnerable to the vagaries. Moreover due to the erratic rainfall in quantity and distribution, the area is often subjected to drought which results in crop damage and low yield. Monsoon failure and shifting of monsoon may adversely affect the crop growing season.

B. Impact on Climate Change on Pest Incidence

The data presented in Table 2 reveal that

Table 3.
Impact of Climate Change on Disease Menace (n=200)

Sl.No.	Disease menace	Kalingarayan basin n=100	Ponnaniyar basin n=100
		Mean score	Mean score
1.	Disease outbreak	1.330	1.300
2.	Occurrence of new diseases	1.500	1.450
3.	Blast occurrence	1.820	1.880
4.	Leaf spot occurrence	1.770	1.800
5.	Bacterial blight occurrence	1.640	1.760
6.	Sheath blight occurrence	1.280	1.260
7.	Sheath rot occurrence	1.240	1.160
8.	Rice thungro disease	1.200	1.150
9.	False smut occurrence	1.010	1.180
	Average mean score	**1.422**	**1.438**

the average mean score worked out for the impact of climate change on pest incidence in Kalingarayan basin was found to be with1.474 and the stem borer infestation, leaf folder infestation, ear bug infestation and arrival of new pest secured higher mean score of 1.940, 1.920, 1.690 and 1.480 respectively. In Ponnaniyar basin the average mean score worked out for the impact of climate change on pest incidence was 1.432 and the stem borer infestation, leaf folder infestation and ear bug infestation secured higher mean score of 1.900, 1.860and 1.800 respectively. In other sub items the mean scores were found to be below the average mean score. Climate change influences the ecology and biology of insects.

Table 4.
Impact of Climate Change on Water Crisis (n=200)

Sl.No.	Water crisis	Kalingarayan basin n=100	Ponnaniyar basin n=100
		Mean score	Mean score
1.	Increased water salinity	1.300	1.100
2.	Deterioration of water nutrients	1.300	0.990
3.	Irrigation water shortage	1.820	1.770
4.	Damaged agro wells	1.740	1.670
	Average mean score	**1.540**	**1.380**

Increased temperature and moisture might adversely affect specific pest species and could result in proliferation of destructive pest population.

C. Impact of Climate Change on Disease Menace

The average mean score of disease menace in Kalingarayan basin was found to be 1.422 (Tables 3). Blast occurrence (1.820), leaf spot occurrence (1.770), bacterial blight occurrence (1.640) and occurrence of new diseases (1.500) were the major impacts of climatic variation in paddy crop. Whereas in Ponnaniyar basin the average mean score was found to be 1.438 and the blast occurrence (1.880), leaf spot occurrence (1.800), bacterial blight occurrence (1.760) and occurrence of new diseases (1.450) were the major impact of climatic variation in paddy crop. Impact of climate change like rise in temperature affects the pollination in paddy crop which resulted in poor grain setting. Further the fungal diseases are common and can spread via spores carried by wind.

D. Impact of Climate Change on Water Crisis

The average mean score (Table 4) worked out for the impact of climate change on water crisis in Kalingarayan basin was found to be with 1.540 and the irrigation water shortage and damaged agro wells secured higher mean score of 1.820 and 1.740 respectively. Similarly in Ponnaniyar basin the average mean score was worked out with 1.380 and the irrigation water shortage and damage agro wells secured higher mean score of 1.770 and 1.670 respectively.

Prolonged drought, variation in the temperature and less ground water potential lead to water scarcity. More amount of salinity in irrigation water source is one of the major problems that affect crop cultivation. In Ponnaniyar basin due to severe water scarcity, they changed from food crops to fodder, flower, vegetable and perennial crops. The perennial crops like guava, coconut etc., flower crops like jasmine, vegetables like beans, bitter guard, ridge guard, tomato, fodder crop like fodder sorghum were grown. In case of Kalingarayan basin water availability was decreasing, but not like Ponnaniyar basin. So they had followed only summer ploughing and some of them had livestock.

E. Impact of Climate Change on Agro Climatic Status

Kalingarayan basin the average mean score (Table 5) of impact of climate change on agro climatic status was 1.422 where rise in temperature (1.970), reduction in number of rainy days (1.910) and monsoon shifting (1.900) are observed. Likewise in Ponnaniyar basin the average mean score of agro climatic status was 1.440 and had mean scores of 1.950, 1.940 and 1.950 respectively. The mean score of others fell below the average mean score. Due to impact of climate change the climate variability is increased and this would lead to increase the risk of drought. Severe drought has led to hardening of the land in worst-affected provinces, which would

Table 5.
Impact of Climate Change on Agro Climatic Status (n=200)

Sl.No.	Agro climatic status	Kalingarayan basin n=100	Ponnaniyar basin n=100
		Mean score	Mean score
1.	Monsoon shifting	1.900	1.950
2.	Reduction of number of rainy days	1.910	1.940
3.	Rise in temperature	1.970	1.950
4.	Increased wind speed	1.090	1.020
5.	Increased humidity	1.120	0.970
6.	Severe drought	1.450	1.400
7.	Flash flooding	0.920	0.850
	Average mean score	**1.422**	**1.440**

increase the chance of rain or even light rain turning into flash flood.

Majority of the Kalingarayan basin respondents were shifted from growing long duration varieties to short duration varieties from paddy crops to vegetable crops and fruit crops. Most of the farmers changed their cropping pattern from paddy- paddy- turmeric to paddy - turmeric - banana. They were not interested to raise community nursery mainly to avoid conflict among farmers.

Ponnaniyar basin farmers also had changed their cropping pattern to flower crops and vegetable crops. All of them were not willing to grow community nursery because it would create problem among the farmers. Most of them quit growing paddy crop and not cultivated intercrops due to water scarcity.

CONCLUSION

Adverse effects of climate change in the study area had made farmers to leave farming activities and migrate to urban areas as daily wage earners. This is a lightning call for policy makers and development departments to implement suitable programmes to reverse the scenario so as to build confidence and to improve status of farmers by making farming a profitable occupation. The action needed for farmers to mitigate ill effects of climate change were, early warning has to be given about environmental changes and creating awareness about appropriate adaptation measures against climate change. Departments need to ....reasonable support price, insurance to all crops and subsidies has to be given to paddy farmers in order to sustain their livelihood security under adverse climatic change. These supportive measures taken by the government through respected and line department people will help the farmers to develop and adopt themselves from the climate change impacts.

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