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Influence of landholding size on the adoption of climate resilient technologies and agro-advisory services

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Abstract

Climate change has emerged as a significant challenge affecting agriculture, particularly in rainfed regions where farmers are highly vulnerable to climatic variability. The present study was undertaken to evaluate the adoption of Climate Resilient Technologies (CRTs) and Weather-Based Agro-Advisory Services (WBAAS) by farmers belonging to different landholding size groups in the erstwhile Kurnool and Anantapur districts of Andhra Pradesh. These districts were selected purposively as the National Innovations on Climate Resilient Agriculture (NICRA) project has been implemented in six villages since 2010-11. A total sample of 180 farmers (30 from each village) was selected using the nth number random sampling technique. Both primary and secondary data were utilized. Primary data were collected through a pre-tested semi-structured interview schedule, while secondary data were sourced from NICRA reports, KVKs, websites, journals, and other relevant publications. Statistical tools such as percentages, chi-square test, correlation, ANOVA, and multiple regression were employed using SPSS software for data analysis. The study found significant variation in the adoption levels of CRTs and WBAAS across landholding size groups. Small farmers showed higher adoption of CRTs, whereas medium and big farmers were more likely to adopt WBAAS. Mass media exposure, participation in capacity-building programmes, and perception of climate change were positively associated with CRT adoption. Based on the findings, key suggestions include strengthening WBAAS delivery through Rythu Bharosa Kendras (RBKs), promoting farmer networks for rapid information exchange, leveraging digital tools, and institutionalizing support mechanisms such as seed banks, fodder banks, and custom hiring centers at the village level. The study highlights the need for targeted interventions to improve the adoption of climate-resilient practices among small and marginal farmers, thereby enhancing their adaptive capacity and ensuring agricultural sustainability in the face of climate change.

Keywords: Agro-advisory, climate resilient technologies, landholding

Introduction

The problem of human induced climate change caught the attention of the scientists and policy makers for the first time when Inter Governmental Panel on Climate Change (IPCC) was established in 1988 [8]. IPCC defined climate in a narrow sense as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). Climate change is any change in climate over time that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere in addition to natural climate variability observed over comparable time periods (IPCC, 2007) [8]. Since climatic factors serve as direct inputs to agriculture, any change in climatic factors is bound to have a significant impact on crop yields. Studies have shown a significant effect of climate change on the average crop yield (Dinar *et al*. 1998) [7].

According to the IPCC, the greenhouse gas emission could cause an average global temperature to rise by another 1.4ºC to 5.8ºC. Already the symptoms of climate change were observed at a faster rate in the Arctic and Antarctic regions through melting of the ice, with the danger of submergence of the coastal zones. Climate change has increased the intensity, frequency and duration of storms, rainfall, floods, droughts and coastal erosion. In turn, it has brought reduced crop yields and loss of biodiversity (Behailu *et al*. 2021; Change *et al*. 2022) [2, 3], economic decline, and threats to human health, often leading to grave consequences in urban areas (Debone *et al*. 2020) [6]. It is one of the most significant contemporary challenges faced by ecosystems and urban societies (Cortekar *et al*. 2016; Pachauri and Meyer, 2014) [5, 11].

Any shift in agriculture can affect the food system to some extent, and thus lead to the vulnerability of resource-poor farmers. There is a need to understand the possible coping strategies adopted by different sections and categories of farmers to deal with global climatic change. Nyong *et al* (2019) [10] revealed that small-scale farmers in Cameroon faced mostly negative impacts of climate variability and change. Saddam (2019) [12] opined that the perception of most of the farmers is associated with gender, size of the land holding, education, occupation, extension contacts and farming experience in the Barak valley zone of Assam. Latha *et al*. (2012) [9] reported that small and medium rainfed farmers were highly vulnerable to climate change and therefore adopted to a large extent the coping mechanisms for climate change when compared to large farmers.

The present study was taken with an objective to evaluate the adoption of climate resilient practices and adoption of weather based agro advisory services by different category of farmers based on the land holding size.

Methodology

The erstwhile Kurnool and Anantapur districts were selected for the study as the NICRA project was being implemented since 2010-11. The NICRA project was implemented in six villages from the erstwhile Kurnool and Anantapur districts of Andhra Pradesh. All these six project villages were purposively chosen as the sample for the study, *viz*., Yagantipalle, Meerapuram and Cherlokothuru, Chamalur, Chakaraipeta and Peravali. These villages fall under the purview of three revenue mandals namely Banaganapalle, Singanamalla and Narpala, which belonged to two revenue divisions called Nandyal and Anantapur. The list of all farmers from the above six villages who have participated in the implementation of the NICRA project was prepared and following the n^{th} number random sampling technique method, 30 farmers were selected as the sample from each village for the study. The sample size was fixed at 30 from each project village because 30 is considered a large sample in Statistics, and the findings based on a large sample would be valid and reliable and facilitate inter-district comparison of specific parameters. Thus, 90 sample farmers each were chosen from the erstwhile Kurnool and Anantapur districts, together constituting a total of 180 sample farmers for the study. The sampling framework adopted for the study is shown in table 1.

Both Primary and Secondary data constitute the sources of data for the study. Primary data was collected from the sample farmers. Secondary data was collected from the annual reports of the NICRA project from Anantapur and Kurnool KVKs, the ATARI zone 10 website, the NICRA website, the ICAR website, various journals in the field of agricultural sciences, social sciences, books, magazines, and other published articles in leading newspapers etc.

Based on the objectives of the study, a semi-structured interview schedule was prepared for the study. The interview schedule was pretested with 30 samples and made modifications for more accurate data. With the finalized interview schedule the data was personally collected by interviewing the sample farmers who acted as the respondents for the study. The farmers were contacted at their residences or field.

The data collected from the respondents was scored, tabulated, and analysed using statistical tools and techniques such as percentage mean, standard deviation, chi-square test, correlation, ANOVA and multiple regression with the help of a computer using SPSS (statistical package for social sciences).

Based on the objectives of the study, variables were identified with the help of experts and based on the available literature. Independent variables like Age, Education, Farming experience, and Farm size were classified into certain categories. Dependent variables like Perception, Adoption, Timeliness of messages, Ease of understanding of the message, Extent of adoption of WBAAS were measured on a three-point continuum scale (0-2). Dependent variables such as Quality of information, Utility of information and Satisfaction with WBAAS were measured on a five-point continuum Scale (0-4).

1. Land holing size

The distribution of sample farmers by landholding size group is presented in table 2. It may be seen that in both the study districts taken together, about 34 per cent were small farmers and 15 per cent marginal farmers. The medium farmers constituted about 36 per cent and big farmers 16 per cent. Thus, about 49 per cent of the sample farmers belonged to the category of small and marginal farmers, while 51 per cent belonged to the category of medium and big farmers. The proportion of small and marginal farmers was substantially higher in Kurnool district (71 per cent) as compared to Anantapur district (27 per cent). On the other hand, the proportion of medium and big farmers was substantially higher in Anantapur district (73 per cent) when compared to Kurnool district (29 per cent). The chi-square value indicates a strong association between landholding size group and study district among the sample farmers, significant at 1 per cent probability level.

The above results could be perceived that majority of overall project farmers are medium and small. Majority of Kurnool farmers are small and majority of the Anantapur farmers are medium. Due to sub-division of land holdings from generation to another generation lead to declining the land holding size of individual farmer in the country. The same results were given by Archana (2017) [1] and Chinnam Naidu (2012) [4].

2. Variations in the Adoption of Climate Resilient Technologies and WBAAS across the Landholding size groups

It is also important to examine whether there were any significant variations across the landholding size groups in the adoption of CRTs and WBAAS by the sample farmers. The results of ANOVA F test are presented in table 3. It could be noted that the variation across the landholding size groups was significant at 1 per cent and 5 per cent probability level, respectively, in respect of mass media exposure and capacity building programmes attended by the sample farmers; the medium and big farmers had a higher mean score than the small and marginal farmers in these two parameters. On the other hand, there was no significant variation in the extension contact of sample farmers across the landholding size groups. Further, the variation in the perception of sample farmers on climate change was significant at 5 per cent probability level across the landholding size groups, with the medium and big farmers faring better than the small and marginal farmers, whereas there was no significant variation in the perception of sample farmers on CRTs across the landholding size groups. Also, the variation in the adoption of CRTs by the sample farmers across landholding size groups was significant at 1 per cent probability level, with the small farmers faring better than the medium, big, and marginal farmers. In respect of different dimensions of WBAAS, the variations across the landholding size groups were significant at 1 per cent probability level in the case of opinion of sample farmers on quality of information and advisory services and at 5 per cent probability level in the case of ease of understanding of information. On the other hand, there was no significant variation in the opinion of sample farmers on timeliness and utility of information across the landholding size groups. Finally, there was a significant variation at 10 per cent probability level in the adoption of WBAAS by the sample farmers across the landholding size groups, with the medium and big farmers faring better than the small and marginal farmers.

Table 1: Sampling Framework for the study

District	Revenue division	Mandal	Village	No. of sample farmers
Kurnool	Nandyal	Banaganapalle	Yagantipalle	30
Kurnool	Nandyal	Banaganapalle	Meerapuram	30
Kurnool	Nandyal	Banaganapalle	Cherlokothur	30
Ananthapur	Anantapur	Singanamalla	Chamalur	30
Ananthapur	Anantapur	Singanamalla	Chakaraipet	30
Anantapur	Anantapur	Narpala	Peravali	30

Table 2: Distribution of Sample farmers by Landholding size group

S. No.	Landholding size group		No. of farmers		
			Kurnool	Anantapur	Total
1	Marginal farmers (up to 2.5 acres)		20	7	27
		%	22.2	7.8	15.0
2	Small farmers (2.5 - 5 acres)		44	17	61
		%	48.9	18.9	33.9
3	Medium farmers (5 - 10 acres)		23	41	64
		%	25.6	45.6	35.6
4	Big farmers (Above 10 acres)		3	25	28
		%	3.3	27.8	15.6
	Total		90	90	180

Note: Chi-square value = 40.558* Significant at 1% probability level

Table 3: Variations in the Adoption of Climate Resilient Technologies and WBAAS across the Landholding size groups: Results of ANOVA F test

S. No.	Particulars	Mean Score					F value
		Marginal Farmers	Small Farmers	Medium Farmers	Big Farmers	Total	
1	Mass Media exposure Score	8.04	10.43	11.47	12.71	10.79	4.9***
2	Capacity Building Attendance Score	11.41	14.93	16.92	17.11	15.45	3.6**
3	Extension Contact Score	8.41	9.18	9.39	9.04	9.12	0.2 NS
4	Perception on Climate Change	13.67	15.16	17.09	17.61	16.01	2.9**
5	Perception on Climate Resilient Technologies	26.59	28.44	28.45	27.25	27.98	1.0 NS
6	Adoption of Climate Resilient Technologies	22.19	33.84	32.08	32.32	31.23	6.1***
7	Opinion on Timeliness of Information	16.07	15.80	15.81	16.04	15.88	0.1 NS
8	Opinion on Quality of Information	20.93	24.03	24.63	26.00	24.08	4.3***
9	Opinion on Utility of Information	21.07	20.10	21.09	21.79	20.86	1.0 NS
10	Opinion on Advisory Services	7.00	8.85	10.25	11.14	9.43	9.9***
11	Ease of Understanding Information	7.74	8.57	9.55	9.39	8.92	3.0**
12	Adoption of Weather Based Advisory Services	15.67	16.56	17.16	18.18	16.89	2.5*
Note: *, ** and *** denote significance at 10 per cent, 5 per cent and 1 per cent probability level, respectively.							

Conclusion

Thus, it becomes clear from the above analysis that there were significant variations in the adoption of CRTs and WBAAS by the sample farmers across the landholding size groups. While small farmers fared better than the medium, big and marginal farmers in the adoption of CRTs, the medium and big farmers fared better than the small and marginal farmers in the adoption of WBAAS. As such, there is a need to focus on small and marginal farmers to improve their levels of adoption of WBAAS.

Suggestions for reaching the CRTs and WBAAS to all the farmers

1. As Weather-based agro advisory services had a positive impact on adoption of climate resilient technologies, these messages should be made available at each RBK (Rytu Barosa kendras) level in the state. All the farmers should receive weather-based crop advisories in time.
2. Networking of the farmers would help in sharing of information related to availability of inputs, weather information, plant protection measures, market rates expeditiously. Harness the power of digital tools for building climate resilience, scaling out climate resilient technologies and next-generation climate services.
3. As there is a positive and significant relationship between Mass media exposure, capacity building programmes attendance, extension contact, perception on climate change, and perception on climate resilient technologies (independent variables) and the adoption of climate resilient technologies among the farmers, these variables should be taken into consideration while planning future programmes for different categories of

farmers.
4. Institutional mechanism should be strongly established at the village level like seed bank, fodder bank, custom hiring centers, purchasing centers etc so that the technologies will be adopted by all categories of farmers.
5. Promotion of small and marginal farmers with incentives and support system of government for the produce by way of exports and value addition. All the farmers should be digitally connected and agro-advisory services should be regional specific and should reach every farmer.

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