Profile Characteristics of Beneficiaries of National Innovations in Climate Resilient Agriculture (NICRA) Project in Telangana, India

Abstract

This study aimed to examine the profile characteristics of farmers adopting Climate Resilient Agricultural (CRA) technologies under the National Innovations in Climate Resilient Agriculture (NICRA) project in the villages of Suryapet and Khammam districts, Telangana State, India. An *ex-post facto* research design was employed, with a sample of 200 farmers chosen using a multistage simple random sampling method. The study results revealed that the majority of farmers belonged to middle-aged (36.50%) with an education level up to primary school (28.00%) and belonged to medium family size (65.00%). Among the respondents sampled, most of the respondents in the sample villages had low income (42.50%) with medium farming experience (41.00%) and labour + subsidiary + agriculture as an occupation (42.00%). The majority of the respondents were found to possess medium landholding (27.00%), Ag/Horticulture crops + AH/Poultry/goat as integrated farming systems (35.50%), low material possession (52.00%), having rainfed agriculture (94.50%) with irrigation under critical stages (49.00%), got drought once in four years (100.00%), medium individual contact (56.00%) and low mass media contact (44.00%), medium economic motivation (52.00%), high risk-taking ability (51.50%) and medium innovative proneness (63.00%).

Keywords: Profile characteristics, Climate-resilient Agricultural technologies, NICRA, Multistage random sampling

Introduction

Agriculture sector is highly vulnerable to the impacts of climate change, which include rising temperatures, unpredictable rainfall patterns, and increased frequency of floods and droughts. These climatic uncertainties can significantly affect water availability and, consequently, agricultural productivity (Dhungana et al., 2020; Xu et al., 2019). Rainfall and temperature are the most critical climate variables for agricultural production (Fahad et al., 2018, 2019a). It is anticipated that reduced precipitation may impact crop planting and harvesting over the next two to three decades (Amanullah et al., 2020). Furthermore, unexpected and increased rainfall has become a reality in many regions worldwide (Wester et al., 2019). Average and seasonal maximum temperatures are expected to keep rising (Thakuri et al., 2019). Therefore, farmers must adopt a multifaceted approach to adapting agricultural systems to changing weather patterns both now and in the future. The adoption of drought-resistant crops and other climate-

smart technologies is essential for mitigating the impact of changing climate patterns on agriculture and ensuring global food security (Dey, 2023). The approaches should include new ideas, strategies, and technologies that integrate environmental, agronomic, social, molecular, and institutional aspects, ensuring a comprehensive and binding solution (Harrison et al., 2021; Sloat et al., 2020; Bell et al., 2015).

The implications of climate change and the associated risks are particularly significant in developing countries like India. Moreover, it has been reported (Jatav & Kalu, 2023; Singh & Nayak, 2014) that a substantial proportion of Indian farmers (85%) have limited financial resilience to cope with changing climate conditions. Globally, the Climate Change, Agriculture, and Food Security (CCAFS) program under CGIAR has supported research on climate-smart agriculture (CSA) in various regions. The primary goal of these smart practices, technologies, and information is to address the challenges of adopting CSA on a broader scale amidst unpredictable weather patterns (Martinez-Baron et al., 2018). In light of these considerations, the Indian Council of Agricultural Research (ICAR) initiated a major network project, originally called the National Initiative on Climate Resilient Agriculture and later renamed the National Innovations in Climate Resilient Agriculture (NICRA), in February 2011 (Naik et al., 2024; Pabba et al., 2021). This project aims to address the development needs of the country's highly vulnerable populations. NICRA has paved the way for enhancing climate resilience in its project villages. To better understand the current situation and promote greater adoption of Climate Resilient Agriculture (CRA) technologies among farmers, this study examines the profile characteristics of beneficiary farmers in NICRA-implemented villages in Suryapet and Khammam districts of Telangana State, India.

Methodology

The present study employed an ex-post facto research design, as described by Kerlinger (1973), which involves systematic empirical inquiry where the researcher does not directly control the variables due to their prior occurrence or inherent non-manipulability.

Suryapet and Khammam districts in Telangana State, India, were purposively selected for this study because they are among the 151 districts chosen for project implementation due to their high climatic vulnerability. Within these districts, respondents were selected from three villages *viz.*, Nandyalagudem, Boring Thanda, and Kotha Thanda of Suryapet district, and Nacharam village in Khammam district where NICRA interventions have been implemented over recent years and where farmers are beneficiaries of the project.

A multistage simple random sampling technique was used to select a sample of 40 farmers from each village, resulting in a total sample size of 200 respondents. Data were collected using

a structured interview schedule and analyzed using descriptive statistical methods, such as frequency distribution and percentages. The results of the study were then presented.

Results and Discussion

Table 1. Distribution of respondents according to their Age

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Young (Up to 42 years)	45	30.00	11	22.00	56	28.00
2	Middle (43 to 52 years)	53	35.33	20	40.00	73	36.50
3	Old (53 years and above)	52	34.67	19	38.00	71	35.50
	Total	150	100	50	100	200	100

Age

Age significantly influences perceptions and decision-making in farming (Cauffman et al., 2010). Table 1 shows that most farmers in Suryapet and Khammam districts are middle-aged (35.33% and 40.00%), followed by older (34.67% and 38.00%) and younger farmers (30.00% and 22.00%). Overall, 36.50% of respondents are middle-aged, 35.50% are older, and 28.00% are younger. The findings suggest that older and middle-aged farmers are more engaged in agriculture, while younger farmers, often better educated, pursue non-agricultural careers due to the perceived unprofitability of farming. These results align with Ashok (2012).

Table 2. Distribution of respondents according to their education

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Illiterate	24	16.00	7	14.00	31	15.50
2	Primary (Up to 5th class)	40	26.67	16	32.00	56	28.00
3	Upper primary school (6th & 7th class)	30	20.00	12	24.00	42	21.00
4	High school (8,9 & 10th class)	28	18.66	7	14.00	35	17.50

5	Intermediate (11^{th} & 12^{th})	14	9.33	6	12.00	20	10.00
6	Graduation and above	14	9.33	2	4.00	16	8.00
	Total	150	100	50	100	200	100

Education

Education is vital for farming growth (Hinrichs et al., 2004). Table 2 reveals that in Suryapet, 26.67% of farmers completed primary education, while in Khammam, 32.00% did. Across both districts, the majority of farmers had primary (28.00%) and upper primary (21.00%) education. This trend reflects increased awareness and access to free education through government schools, improving educational levels compared to previous years. These findings align with Archana (2017).

Table 3. Distribution of respondents according to their family size

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Small (1 to 4 members)	42	28.00	10	20.00	52	26.00
2	Medium (5 to 6 members)	98	65.33	32	64.00	130	65.00
3	Large (6 members and above)	10	6.67	8	16.00	18	9.00
	Total	150	100	50	100	200	100

Family size

Findings from Table 3 reveal that the majority of respondents from both Suryapet and Khammam districts fall into the medium family-size category, with 65.33% and 64.00%, respectively. This is followed by the small family-size category (28.00% and 20.00%) and the large family-size category (6.67% and 16.00%). Overall, 65.00% of respondents have medium family sizes (5 to 6 members), followed by small (26.00%) and large (9.00%) family sizes. Table 3 shows that most respondents belong to medium and large family sizes. It is common in the rural areas of the district to have medium and large families. These findings are consistent with the study by Panda (2017).

Table 4. Distribution of respondents according to their annual income

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Low(Up to 2 lakhs)	65	43.33	20	40.00	85	42.50
2	Medium (2.1 to 4 lakhs)	71	47.34	7	14.00	78	39.00
3	High (4.1 lakhs and above)	14	9.33	23	46.00	37	18.50
	Total	150	100	50	100	200	100

Annual income

Most respondents had medium farm holdings and relied on agriculture, leading to similar income patterns. Farmers in Khammam had higher incomes due to larger land holdings and additional income sources, while those in Suryapet mostly fell into the medium-income category with smaller holdings. Table 4 shows that in Suryapet, nearly half (47.34%) of farmers are in the medium-income category, while in Khammam, 46.00% are in the high-income category. Overall, 42.50% have low incomes, 39.00% medium, and 18.50% high. These findings align with Kalyan et al. (2012).

Table 5. Distribution of respondents according to their occupation

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Farming/Agriculture	32	21.33	6	12.00	38	19.00
2	Labour + Agriculture	28	18.67	17	34.00	45	22.50
3	Subsidiary + Agriculture	14	9.33	19	38.00	33	16.50
4	Labour + Subsidiary + Agriculture	76	50.67	8	16.00	84	42.00
	Total	150	100	50	100	200	100

Occupation

Table 5 reveals that most farmers in Suryapet (50.67%) are involved in a combination of labor, subsidiary activities, and agriculture, while in Khammam, the majority (38.00%) focus on subsidiary activities and agriculture. Overall, 42.00% of farmers combine labor, subsidiary

activities, and agriculture, reflecting a need for diversified income sources due to unstable agricultural earnings. Many farmers engage in multiple occupations to sustain their livelihoods. These findings are consistent with those of Archana (2017).

Table 6. Distribution of respondents according to their farming experience

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Low (Up to 22 years)	42	28.00	8	16.00	50	25.00
2	Medium (23 to 31 years)	56	37.33	26	52.00	82	41.00
3	High (32 years and above)	52	34.67	16	32.00	68	34.00
	Total	150	100	50	100	200	100

Farming experience

Farming experience plays a key role in adopting new agricultural technologies (Adesina and Forson, 1995). Table 6 reveals that in Suryapet, 37.33% of farmers have medium experience, followed by high (34.67%) and low (28.00%). In Khammam, over half (52.00%) have medium experience, followed by high (32.00%) and low (16.00%). Overall, 41.00% of farmers have medium experience, with 34.00% high and 25.00% low. The predominance of medium to high experience reflects the fact that many middle-aged and older farmers chose agriculture as their primary profession due to limited alternatives. These findings align with Babu et al. (2016).

Table 7. Distribution of respondents according to their landholding

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Marginal (up to 1 ha)	38	25.33	11	22.00	49	24.50
2	Small (1.1 to 2 ha)	44	29.34	6	12.00	50	25.00
3	Semi-medium (2.1 to 4 ha)	18	12.00	8	16.00	26	13.00
4	Medium (4.1 to 10 ha)	38	25.33	16	32.00	54	27.00
5	Large (>10 ha)	12	8.00	9	18.00	21	10.50

	Total	150	100	50	100	200	100

Landholding

Table 7 shows that in Suryapet, 29.34% of farmers have small farms, followed by marginal and medium (25.33%), semi-medium (12.00%), and large (8.00%). In Khammam, 32.00% have medium farms, followed by marginal (22.00%), large (18.00%), semi-medium (16.00%), and small (12.00%). Overall, 27.00% of farmers have medium farm sizes, followed by small (25.00%), marginal (24.50%), semi-medium (13.00%), and large (10.50%). This distribution reflects a trend of decreasing farm sizes due to the subdivision of land across generations, consistent with Sridhar (2002).

Table 8. Distribution of respondents according to their farming system

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	>1 crop (Agriculture or Horticulture)	29	19.33	0	0.00	29	14.50
2	Ag crops + Horticulture crops	0	0.00	6	12.00	6	3.00
3	Ag/Horticulture + AH/Poultry/goat	68	45.33	3	6.00	71	35.50
4	Ag crops + Horticulture crops+ AH/Poultry/Goat	21	14.00	30	60.00	51	25.50
5	Ag crops+ Horticulture crops+ AH/poultry/goat + mulberry + sericulture +Agro forestry	32	21.34	11	22.00	43	21.50
	Total	150	100	50	100	200	100

Farming system

Table 8 shows that in Suryapet, 45.33% of farmers practice integrated farming with agriculture/horticulture crops and animal husbandry, while in Khammam, 60.00% do the same. Overall, more than one-third of farmers engage in this combination. This trend likely reflects the primary cultivation of agriculture or horticultural crops, with goat rearing as a secondary income source. Suryapet farmers are also shifting to sericulture for additional income, while Khammam farmers focus on agroforestry and chili cultivation. These findings are consistent with studies by Magombo et al. (2012).

Table 9. Distribution of respondents according to their material possession

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Low (Up to 3 materials)	86	57.33	18	36.00	104	52.00
2	Medium (4 to 6)	48	32.00	25	50.00	73	36.50
3	High (7 and above)	16	10.67	7	14.00	23	11.50
	Total	150	100	50	100	200	100

Material possession

Table 9 shows that in Suryapet, 57.33% of farmers have low material possession, followed by medium (32.00%) and high (10.67%). In Khammam, 50.00% have medium material possession, followed by low (36.00%) and high (14.00%). Overall, 52.00% of farmers have low material possession, with 36.50% medium and 11.50% high. The predominance of low material possession in Suryapet is due to many farmers having small land holdings, while Khammam's higher medium material possession reflects larger land holdings. These results align with Kittur (1976).

Table 10. Distribution of respondents according to their availability of water resources

S.No.	Availability of water resources		NICRA farmers				Overall NICRA farmers (n=200)	
			Suryapet (n_1=150)		Khammam (n_2=50)			
			f	%	f	%	f	%
1	Rainfed	Yes	142	94.67	47	94.00	189	94.50
		No	8	5.33	3	6.00	11	5.50
2	Irrigated	Yes	68	45.33	30	60.00	98	49.00
		No	82	54.67	20	40.00	102	51.00

#Multiple responses

Table 10.a. Distribution of respondents according to their source of irrigation

S.No.	Source of irrigation	NICRA farmers		Overall NICRA farmers (n=200)
		Suryapet (n_1=150)	Khammam (n_2=50)	

		f	%	f	%	f	%
1	Open wells	31	45.58	9	30.00	40	40.81
2	Bore wells	63	92.64	27	90.00	90	91.83
3	Tanks/water houses	0	00.00	1	3.33	1	1.02
4	Canals	37	54.41	14	46.67	51	52.04

Availability of water resources

Tables 10 and Table 10a. reveal that most farmers in Suryapet (94.67%) and Khammam (94.00%) are rainfed, with a significant portion relying on bore wells for irrigation during critical stages. Overall, 94.50% of farmers depend on rainfed agriculture, with 91.83% using bore wells. KVK scientists' initiatives under the NICRA project, including check dam renovations and farm pond construction, have improved water access, aligning with findings by Alam et al. (2016).

Table 11. Distribution of occurrence of drought as elicited by the respondents

S.No.	Source of irrigation	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Once in 4 years	150	100.00	50	100.00	200	100.00
2	Once in 3 years	0	0.00	0	0.00	0	0.00
3	Once in 2 years	0	0.00	0	0.00	0	0.00
4	Yearly once	0	0.00	0	0.00	0	0.00
	Total	150	100	50	100	200	100

Frequency of occurrence of drought

Table 11 shows that all farmers in both Suryapet and Khammam districts experience drought once every four years. This indicates that drought occurs every four years for all farmers in these districts. The likely reason is that drought affects farmers once every decade, with erratic rainfall in both districts leading to suboptimal yields for rainfed crops. These findings are inconsistent with the results reported by Archana (2017).

Table 12. Distribution of respondents according to their individual contact

		NICRA farmers					
S.No.	Individual contact	Suryapet (n_1=150)			Khammam (n_2=50)		
		Regular	Occasional	Never	Regular	Occasional	Never
		f(%)	f(%)	f(%)	f(%)	f(%)	f(%)

1	Agricultural Extension Officer/ MAO	67 (44.67)	83 (55.33)	0 (0.00)	21 (42.00)	29 (58.00)	0 (0.00)
2	Scientists of Agricultural Universities	82 (54.67)	68 (45.33)	0 (0.00)	33 (66.00)	17 (34.00)	0 (0.00)
3	Input Agencies/ Dealer	27 (18.00)	123 (82.00)	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)
4	NGO personnel	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)
5	Neighbors/ Friends	73 (48.67)	55 (36.66)	22 (14.67)	19 (38.00)	17 (34.00)	14 (28.00)

Individual contact

Table 12 reveals that in both Suryapet and Khammam districts, the majority of farmers contacted Agricultural Extension Officers/Mandal Agriculture Officers occasionally (55.33% and 58.00%) rather than regularly (44.67% and 42.00%). More than half of the farmers engaged regularly with agricultural university scientists (54.67% and 66.00%) versus occasionally (45.33% and 34.00%). A large proportion also contacted input agencies/dealers occasionally (82.00% and 78.00%) rather than regularly (18.00% and 22.00%). Farmers in both districts did not contact NGO personnel and primarily interacted regularly with neighbours/friends (48.67% and 38.00%) compared to occasional (36.66% and 34.00%) or never (14.67% and 28.00%) contact.

Table 13. Distribution of respondents according to their Mass contact

		NICRA farmers					
S.No.	**Mass contact**	**Suryapet (n_1=150)**			**Khammam (n_2=50)**		
		Regular	**Occasional**	**Never**	**Regular**	**Occasional**	**Never**
		f(%)	**f(%)**	**f(%)**	**f(%)**	**f(%)**	**f(%)**
1	Radio	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)
2	Television	46 (30.67)	44 (29.33)	60 (40.00)	15 (30.00)	9 (18.00)	26 (52.00)
3	News paper	33 (22.00)	25 (16.67)	92 (61.33)	8 (16.00)	11 (22.00)	31 (62.00)
4	Magazines/Books on agriculture and allied fields	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)
5	Mobiles	102 (68.00)	38 (25.33)	10 (6.67)	31 (62.00)	12 (24.00)	7 (14.00)
	Computers	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)

Mass contact

Table 13 shows that in both Suryapet and Khammam districts, most farmers had regular contact with mobile phones (68.00% and 62.00%) rather than occasional (25.33% and 24.00%) or none (6.67% and 14.00%). Nearly half of the respondents never used television (40.00% and 52.00%) or newspapers (61.33% and 62.00%). Additionally, farmers from both districts did not use computers, agricultural magazines/books, or radios.

Table 14. Distribution of respondents according to their economic motivation

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Low (Up to 18)	7	4.67	3	6.00	10	5.00
2	Medium (19 to 25)	79	52.66	25	50.00	104	52.00
3	High (26 and above)	64	42.67	22	44.00	86	43.00
	Total	150	100	50	100	200	100

Economic motivation

Table14 shows that in both Suryapet and Khammam districts, about half of the respondents (52.66% and 50.00%) had medium economic motivation, followed by high (42.67% and 44.00%) and low (4.67% and 6.00%) levels. Overall, 52.00% had medium economic motivation, while 43.00% had high, and 5.00% had low motivation. The majority of farmers demonstrated medium to high economic motivation, likely due to awareness raised by KVK scientists on climate-resilient technologies in NICRA-implemented villages. This led to investments in technologies like farm ponds, micro irrigation, dairying, and crop diversification. These findings align with those of Mandlik (2012).

Table 15. Distribution of respondents according to their risk taking ability

S.No.	Categories	NICRA farmers	

		Suryapet (n_1=150)		Khammam (n_2=50)		Overall NICRA farmers (n=200)	
		f	%	f	%	f	%
1	Low (Up to 10)	5	3.33	2	4.00	7	3.50
2	Medium (11 to 14)	69	46.00	21	42.00	90	45.00
3	High (15 and above)	76	50.67	27	54.00	103	51.50
	Total	150	100	50	100	200	100

Risk-taking ability

Table 15 reveals that in both Suryapet and Khammam districts, more than half of the farmers (50.67% and 54.00%) had high risk-taking ability, followed by medium (46.00% and 42.00%) and low (3.33% and 4.00%) levels. Overall, 51.50% of farmers had high risk-taking ability, with 45.00% showing medium and 3.50% low. The majority's high risk-taking ability is likely due to their financial stability, as they engaged in integrated farming systems like Ag + Horticulture + AH/poultry/goat. Encouraged by programs like NICRA, IWMP, and MGNREGS, farmers adopted soil conservation practices, reflecting findings by Subramaniyam (2003).

Table 16. Distribution of respondents according to their innovative proneness

S.No.	Categories	NICRA farmers				Overall NICRA farmers (n=200)	
		Suryapet (n_1=150)		Khammam (n_2=50)			
		f	%	f	%	f	%
1	Low (Up to 6)	38	25.33	14	28.00	52	26.00
2	Medium (7 to 8)	92	61.33	34	68.00	126	63.00
3	High (9 and above)	20	13.34	2	4.00	22	11.00
	Total	150	100	50	100	200	100

Innovative proneness

Table 16 shows that the majority of farmers in Suryapet and Khammam (61.33% and 68.00%) exhibited medium innovative proneness, followed by low (25.33% and 28.00%) and high (13.34% and 4.00%) levels. Overall, 63.00% had medium innovative proneness, likely due to their medium education levels, aligning with the findings of Gopinath (2005).

Conclusion and Policy Implications

The above results conclude that majority of the farmers were middle-aged with an education level up to primary school and belonged to medium family size. Among the respondents sampled, most of the respondents in the sample villages had low income with medium farming experience and labour + subsidiary + agriculture as an occupation. The majority of the respondents were found to possess medium landholding, Ag/Horticulture crops + AH/Poultry/goat as integrated farming systems, low material possession, rainfed agriculture with irrigation under critical stages, got drought once in four years, medium individual contact and low mass media contact, medium economic motivation, high risk-taking ability and medium innovative proneness. Given the socio-economic and psychological characteristics of the farmers, NICRA project officials should develop targeted strategies for designing and disseminating technologies. This approach will help enhance the adoption of these technologies by the farming community.

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