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Limitations Encountered in Adaptation of Climate Resilient Technology by NICRA Beneficiaries and Non-beneficiaries in Jodhpur, Rajasthan

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ABSTRACT: This study examined the characteristics and challenges faced by beneficiaries and non-beneficiaries of the NICRA project in Jodhpur district, Rajasthan, involving 50 beneficiaries and 50 non-beneficiaries with 1520 and 464 animals, respectively. Among beneficiaries, most were middle-aged, male, with middle school education, high income, and diversified farming practices, including self-sourced fodder. They exhibited high confidence, innovativeness, and training exposure in climate-resilient agriculture, with moderate access to credit and mass media. In contrast, non-beneficiaries had lower educational levels (primary school), limited exposure to climate-resilient training, and lower innovativeness and mass media engagement. Both groups faced common challenges in adopting climate-resilient technologies, such as high concentrate feeding costs, water shortages for fodder crops, inadequate government policies, and limited access to improved fodder varieties and grazing land. Key barriers also included insufficient financial resources and a lack of awareness about climate variability.

Keywords: Climate resilient technology, Climate variability, Diversification, Limitations and NICRA.

INTRODUCTION

India's population heavily depends on natural resources for food, shelter, and income, with over 56% engaged in agriculture and many others relying on coastal areas. Climate change, driven by rising temperatures, increased frequency of extreme weather events, and environmental degradation, poses a significant threat to ecosystems and human livelihoods globally. Climate change can affect the productivity and economic viability of the livestock production systems (Reddy *et al.,* 2024) In India, the impacts of climate change are particularly concerning, with escalating desertification, heatwaves, droughts, and intensified storms. India has ranked two places up with 8th rank in the 2023 Climate Change Performance Index (UNDP, 2011). The country has seen a temperature increase of 0.7°C between 1901 and 2018, with projections indicating that many regions may face even more severe droughts in the coming decades. As a result, climate change exacerbates challenges such as flooding, food and water scarcity, disease spread, and economic losses, placing additional pressure on agriculture and rural communities.

In response to these challenges, the Indian government launched the National Innovations in Climate Resilient Agriculture (NICRA) project in 2011, led by the Indian Council of Agricultural Research (ICAR) in collaboration with the Ministry of Agriculture and Farmers Welfare. This initiative aims to assess the impact of climate change on Indian agriculture, develop adaptive strategies, and implement technologies to mitigate its adverse effects. NICRA focuses on enhancing climate resilience through strategic research, technology demonstrations, capacity building, and institutional interventions.

Furthermore, climate change directly affects livestock productivity through heat stress, disease, and reduced feed availability, significantly influencing agricultural outcomes. Despite these challenges, there is limited understanding of the factors influencing farmers' adoption of climate-resilient technologies.

This study aims to analyze the profiles of beneficiaries and non-beneficiaries under the NICRA project, with a focus on understanding the factors influencing farmers' behavior toward adopting climate-resilient practices. It also examines the barriers they face in implementing these technologies, with the ultimate goal of informing future strategies to combat climate change and build resilience in agriculture.

METHODOLOGY

The study was conducted in 2024 in the Jodhpur district of Rajasthan, focusing on the National Innovations on Climate Resilient Agriculture (NICRA) project under the animal component. Among the three blocks of Jodhpur district where the NICRA project was operational—Luni, Bhopalgarh, and Mandor—the Luni block was purposively selected due to the highest concentration of NICRA beneficiaries. Within the Luni block, two NICRA-adopted villages, Lunawas and Purkhawas, and two non-adopted villages, Sar and Rohicha, were chosen for the study. A total sample of 100 respondents was randomly selected, comprising equal representation from both adopted and non-adopted villages. A pre-structured interview schedule was developed as the primary tool for data collection. The study employed an ex-post facto research design to analyze and compare the outcomes between NICRA-adopted and non-adopted villages.

RESULT AND DISCUSSIONS

Table 1 reveals that a higher proportion (58%) of beneficiaries belonged to the middle-aged category, while a majority (52%) of non-beneficiaries fell into the old-age group. Additionally, 38% of beneficiaries were in the old-age category, compared to 42% of non-beneficiaries in the middle-age group. A small proportion of both beneficiaries (4%) and non-beneficiaries (6%) were in the young-age category.

Regarding education, 42% of beneficiaries had completed middle school, while 36% of non-beneficiaries had primary-level education. This was followed by 30% of beneficiaries and 26% of non-beneficiaries completing primary and middle school, respectively. Additionally, 18% of beneficiaries had high school education compared to 18% of non-beneficiaries who were illiterate. Among the remaining respondents, 10% of beneficiaries were illiterate, 8% of non-beneficiaries could read and write, 6% of non-beneficiaries could only read, and just 2% of non-beneficiaries had attained graduate or higher education. Education and milk sale were found to have positive and significant correlation (Sruthi *et al.*, 2024).

In terms of gender distribution, the majority of both groups were males (82% of beneficiaries and 92% of non-beneficiaries), while females represented 18% of beneficiaries and 8% of non-beneficiaries.

When examining herd and flock composition, beneficiaries owned 190 cows, 69 buffaloes, 535 sheep, and 726 goats. Non-beneficiaries, on the other hand, possessed 170 cows, 135 buffaloes, 80 sheep, and 79 goats. Among beneficiaries, livestock categories included milking cows (75), dry cows (44), and young stock (71), along with milking buffaloes (26), dry buffaloes (22), and young stock (21). Their sheep population included 108 milking, 147 dry, and 280 young stock, while goats were categorized into 166 milking, 206 dry, and 354 young stock. For non-beneficiaries, the livestock breakdown was as follows: cows (59 milking, 44 dry, 67 young stock), buffaloes (45 milking, 43 dry, 47 young stock), sheep (23 milking, 15 dry, 42 young stock), and goats (20 milking, 26 dry, 33 young stock).

In terms of annual income, 50% of beneficiaries were in the high-income category, while the majority of non-beneficiaries (94%) were in the low-income group. Medium-income levels were recorded for 48% of beneficiaries and only 6% of non-beneficiaries, while a mere 2% of beneficiaries were in the low-income category. These results are in line with the study of Harikrishna (2019); Singh (2015); Shrivastava (2018); Yadav (2022).

Farming diversification patterns showed that 94% of beneficiaries and 90% of non-beneficiaries practiced a combination of agriculture/horticulture with livestock or poultry. Only 6% of beneficiaries and 10% of non-beneficiaries focused solely on livestock.

For fodder sources, 90% of beneficiaries relied entirely on their own production, whereas 64% of non-beneficiaries combined their own production with purchases from fellow farmers. Additionally, 6% of beneficiaries supplemented their production with purchases, while 24% of non-beneficiaries depended solely on their own production. A small proportion (2%) of beneficiaries collected fodder from jungle and grazing lands, while 8% of non-beneficiaries purchased it from markets. These results are in line with the study of Thatikonda (2017).

When analyzing self-confidence, 64% of beneficiaries displayed high levels, while 76% of non-beneficiaries exhibited medium levels. Medium confidence was observed in 32% of beneficiaries and 16% of non-beneficiaries, while low confidence was recorded in 4% of beneficiaries and 8% of non-beneficiaries.

Credit accessibility was predominantly moderate, with 78% of beneficiaries and 56% of non-beneficiaries falling into this category. Low credit access was reported by 22% of beneficiaries and 44% of non-beneficiaries.

For risk orientation, 72% of beneficiaries and 54% of non-beneficiaries showed medium levels, while 18% of beneficiaries and 46% of non-beneficiaries displayed low levels. High-risk orientation was noted in 10% of beneficiaries, with no non-beneficiaries in this category. These results are in line with the study of Pardhan (2021).

Innovativeness levels were high among 48% of beneficiaries, while 54% of non-beneficiaries displayed low levels. Medium innovativeness was observed in 42% of beneficiaries and 38% of non-beneficiaries, with only 10% of beneficiaries showing low innovativeness and 8% of non-beneficiaries demonstrating high innovativeness.

In terms of mass media exposure, 48% of beneficiaries had moderate exposure, while 68% of non-beneficiaries had low exposure. Low exposure was observed in 38% of beneficiaries and 28% of non-beneficiaries, with only 14% of beneficiaries and 4% of non-beneficiaries having high exposure.

Training received was significantly higher among beneficiaries, with 68% attending more than eight training programs, compared to 74% of non-beneficiaries who had received no training.

Table 1: Profile characteristics of beneficiary and non-beneficiary farmers.

Sr. No.	Categories	Beneficiaries (n = 50)		Non-beneficiaries (n = 50)	
		(f)	%	(f)	%
Age					
1	Young (Up to 35 years)	2	4.00	3	6.00
2	Middle (36 – 55 years)	29	58.00	21	42.00
3	Old (Above 55 years)	19	38.00	26	52.00
Education					
1	Illiterate	5	10.00	9	18.00
2	Can read only	0	00.00	3	6.00
3	Can read and write	0	00.00	4	8.00
4	Primary	15	30.00	18	36.00
5	Middle	21	42.00	13	26.00
6	High School	9	18.00	2	4.00
7	Graduate and above	0	00.00	1	2.00
Gender					
1	Male	41	82.00	46	92.00
2	Female	9	18.000	4	8.00
Annual income					
1	Low (50,000 - 2,33,333)	1	2.00	47	94.00
2	Medium (1,33,334 – 4,16,666)	24	8.00	3	6.00
3	High (4,16,667 – 6,00,000)	25	50.00	0	00.00
Farming Diversification					
1	Livestock	3	6.00	5	10.00
2	Ag/Horti + livestock/poultry	47	94.00	45	90.00
Fodder Sources					
1	Own production	45	90.00	12	24.00
2	Purchased from fellow farmer	0	00.00	2	4.00
3	Own production + Purchased from fellow farmer	3	6.00	32	64.00
4	Collected from jungle and grazing land	1	2.00	0	0.00
5	Own production + Purchased from fellow farmer + Collected from jungle and grazing land	1	2.00	0	00.00
6	Purchased from market	0	0.00	4	8.00
7	Own production + Purchased from fellow farmer + Purchased from market	0	00.00	0	00.00
Self confidence					
1	Low (8 - 18)	2	4.00	4	8.00
2	Medium (19 - 29)	16	32.00	38	76.00
3	High (30 - 40)	32	64.00	8	16.00
Credit access					
1	Low (Up to 12)	11	22.00	22	44.00
2	Medium (13 to 15)	39	78.00	25	56.00
3	High (Above 15)	0	00.00	0	00,00
Risk Orientation					
1	Low (6 - 14)	9	18.00	23	46.00
2	Medium (15 - 22)	36	72.00	27	54.00
3	High (23 - 30)	5	10.00	0	00.00
Innovativeness					
1	Low (5 - 11)	5	10.00	27	54.00
2	Medium (12 - 18)	21	42.00	19	38.00
3	High (19 - 25)	24	48.00	4	8.00
Mass media exposure					
1	Low (0 - 8)	19	38.00	34	68.00
2	Medium (9 - 16)	24	48.00	14	28.00
3	High (17 - 24)	7	14.00	2	4.00
Training received on climate resilient agriculture					
1	No training	0	00.00	37	74.00
2	Less than eight training	16	32.00	13	26.00
3	More than eight training	34	68.00	0	00.00

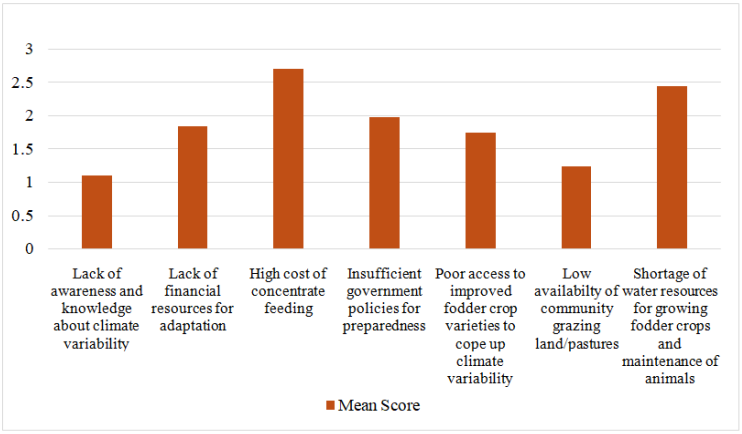

Fig. 1. Limitations encountered by respondents in adoption of climate resilient technologies.

Additionally, 32% of beneficiaries and 26% of non-beneficiaries had attended fewer than eight training sessions. These results are in line with the study of Charitha (2017); Bodsa (2021).

Fig. 1 highlights key limitations in adopting climate-resilient technologies. The high cost of concentrate feed ranked as the top challenge (mean score: 2.7), followed by water scarcity for fodder and animal maintenance (2.44). Insufficient government policies for climate preparedness ranked third (1.98), with financial constraints for adaptation ranking fourth (1.84). Limited access to improved fodder varieties (1.74), lack of community grazing land (1.24), and insufficient awareness of climate variability (1.1) were also notable barriers.

CONCLUSIONS

In conclusion, NICRA beneficiaries demonstrated higher adaptability to climate-resilient technologies due to their middle-age demographic, larger livestock holdings (goats, sheep, cows, and buffaloes), higher annual incomes, and self-reliance in fodder production. These factors enhanced their confidence, innovativeness, and risk-taking capacity. While most beneficiaries exhibited moderate mass media exposure, there is a need to improve their awareness and participation in extension activities for better access to agricultural information. Additionally, their participation in more than eight training programs significantly contributed to their knowledge and adoption of climate-resilient practices.

Conversely, NICRA non-beneficiaries, predominantly older farmers with primary-level education, faced limitations in self-confidence, credit access, risk orientation, and innovativeness due to lower incomes and limited training exposure. Their low mass media engagement further hindered their access to critical agricultural information.

Farmers suggested actionable measures for better adoption of climate-resilient technologies, including subsidized concentrate feed, timely input supply (e.g., improved fodder seeds), financial assistance for water harvesting structures (e.g., tankas and beris), enhancement of market infrastructure, and promotion of livestock insurance schemes to safeguard against natural disasters. Addressing these needs will strengthen resilience and productivity among farming communities.

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Conflict of Interest. None.

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