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Enhancing Climate Resilience through NICRA Interventions: A Case Study of Village Rupana, Sirsa, Haryana

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Abstract

The NICRA project in village Rupana, Sirsa, Haryana, implemented various climate-resilient interventions from 2011 to 2022, addressing key agricultural challenges such as erratic rainfall, soil salinity, and pest/disease management. Interventions like laser levellers, stress-tolerant crop varieties, and integrated pest management (IPM) practices led to significant improvements in farm productivity. Mechanization saw notable increases in tractor usage, sprayers, and threshers. Water management was enhanced with the introduction of farm ponds and bore wells. Varietal interventions, such as salt-tolerant wheat and frost-tolerant raya, led to higher yields and better economic returns. Pest and disease management, including seed treatments and neem-based insecticides, improved cotton yields by 12.1%. Livestock interventions, including mineral mixtures, boosted milk yields by up to 13%. Overall, NICRA's interventions resulted in higher yields, improved profitability, and enhanced resilience against climate stresses, significantly benefiting farmers' livelihoods.

Keywords: Climate-resilient agriculture, integrated pest management, soil and water conservation, stress-tolerant crop varieties, farm mechanization

Introduction

The National Innovations in Climate Resilient Agriculture (NICRA) project, launched by the Indian Council of Agricultural Research (ICAR) in 2011, was designed to address the growing challenges posed by climate change in India. The project is focused on four major components: Strategic Research, Technology Demonstration, Capacity Building, and Sponsored/Competitive Grants. These elements work together to foster resilience in agriculture by introducing innovative solutions tailored to local challenges. Science and technology can solve climate change related issues (Gardezi and Arbuckle 2020) ^[2]. Sirsa district in Haryana, which is largely an agricultural region, was chosen for NICRA interventions due to its significant vulnerability to climatic variations. With an average annual rainfall of less than 300 mm and erratic precipitation patterns, Sirsa relies heavily on canal irrigation and tube wells to meet its water needs. The district's soils, though generally flat and productive, face challenges such as low nitrogen levels and varying quality of groundwater. A notable concern is the presence of sodic and saline groundwater, which affects crop production. Climate change affects the yield of crops through increased exposure to high temperature, water, salinity and flooding stresses. Agricultural activity primarily relies on climate variables, including temperature, water availability, and weather conditions for crop production. Because of the heavy dependency of agriculture on climate variables, any changes or disruptions in these variables could enormously influence crop yield and productivity (Subedi *et al* 2023) ^[8]. The village of Rupana, situated in Nathusari Chopta block of Sirsa, was selected for NICRA due to its distinct climatic vulnerabilities, including salt-affected areas and water scarcity. With a total cultivable area of 780 hectares, the village faces issues like high soil salinity in certain regions, which hampers agricultural productivity. The initial phase of the NICRA project focused on understanding these challenges by gathering key data on climate, soil conditions, and socio-economic factors, laying a strong foundation for tailored interventions.

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Materials and methods

Major climatic constraints: In the year 2011, village Rupana was selected and base line data of the village was collected to identify the socio economic status of the village and climatic constraints so that suitable interventions may be demonstrated in the village to curtail these climatic constraints.

Base line Survey

Base line survey of NICRA village was done in the year 2011 before start of the project to know about the constraints and based on the constraints CRTs were demonstrated to the farmers.

Table 1: The major climatic constraints and suitable climate resilient technologies

Index	Constraints	CRTs demonstrated
Natural Resource management (Soil)	Undulated soil	Use of laser leveller
	Low organic carbon content in soil	Preparation of quality FYM
	Surface accumulation of salts	Use of salt tolerant varieties of wheat
Erratic Rainfall	Draught	Stress tolerant varieties
	incidence of insects and pests in cotton	IPM practices
Hot winds during summer and frost during winter	Frost during winter	
	Milk reduction on milch animals	Use of mineral mixture

To evaluate the effectiveness of NICRA interventions in the adopted villages, data of various climate resilient

technologies was compared with control and effect of these interventions was measured in terms of yield.

Results and Discussion

Table 2: Impact of NICRA interventions on mechanization in NICRA village

Implement specifications	Before the initiation of NICRA (2010) NICRA	Current situation (2022)
No. of tractors	90	196
M.B.Plough	-	3
Rotavators	-	55
Disc harrows	85	180
Levelling blades	45	140
Zero-till drill	-	10
Happy seeder	-	1
Direct seeded drill	45	120
Knapsack sprayer	250	490
Power operated sprayer	-	100
Tractor operated sprayer	5	70
Tractor mounted	1	20
Multicrop thresher	20	85

The table 2. shows agricultural technology and equipment usage before the National Innovations on Climate Resilient Agriculture (NICRA) initiative in 2010 and the current situation in 2022. Over this period, there has been a significant increase in the number of tractors, from 90 to 196, and other machinery such as disc harrows, levelling blades, and direct seeded drills. New equipment, like

rotavators, zero-till drills, and power-operated sprayers, has been introduced. The increase in manual and tractor-operated sprayers indicates a shift towards more mechanized and efficient farming practices. The introduction of modern tools like the Happy Seeder and the growth in the number of multi-crop threshers highlight improved agricultural productivity and resilience to climate change under NICRA.

Table 3: Impact on farm ponds and number of bore wells

Number of Water harvesting structures	Before the initiation of NICRA (2010) NICRA	Current situation regarding structures (2019)
Farm ponds (lined)	0	2
Bore wells	70	100

Impact of NRM interventions

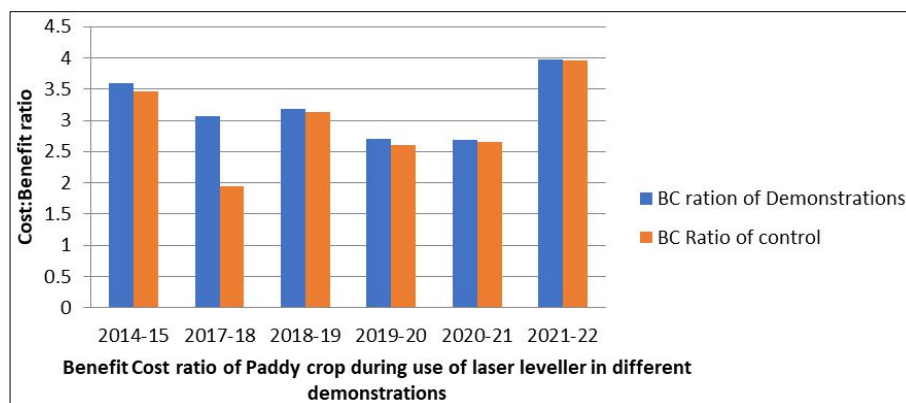


Fig 1: Impact of laser leveller leveller on economics of paddy

Fig1 depicts effect of laser leveller in paddy by using laser leveller. The use of a laser land leveller significantly improved the economic returns from paddy cultivation. As shown in the BC (Benefit-Cost) ratio variations, demonstration plots consistently recorded higher BC ratios than control plots across the years. Earlier years, such as 2017–18, show a stark difference, with demonstrations outperforming controls by a large margin. This reflects the

laser leveller's role in enhancing water-use efficiency, uniform crop stand, and reduced input costs, ultimately leading to improved profitability and resilience in paddy farming. These results are in line with Ashraf *et al.* (2017) and Ramya *et al* (2022) ^[1, 6] who notices increase in yield and economics of paddy by laser levelling.

Impact of Crop related Interventions

Table 4: Impact of varietal interventions over years on yield and economics

Year	Technology Demonstrated	Crop	No of Farmers	Area (ha)	Yield (Q/ha)		% Increase	Yield (Q/ha)	
					Demo	Check		Demo	Check
2013-14	Salt tolerant variety KRL 210	Wheat	16	16	40	28	42	2.84	1.39
2014-15	Salt tolerant variety KRL 210	Wheat	20	8	40	32	25	2.90	1.70
2014-15	Frost tolerant variety RH-749	Raya	20	8	22	19	15	3.20	2.15
2015-16	Salt tolerant Variety KRL 210	Wheat	10	4	35	18	94.4	1.65	0.85
2015-16	Frost tolerant variety RH-0749	Raya	20	8	20	18	16.6	3.72	3.35
2015-16	Draught tolerant variety HG-2-20	Guar	30	12	10	8	25	2.13	1.7
2016-17	Drought tolerant variety HG 2-20	Guar	12	5	13	10	37	1.98	1.6
2016-17	Frost tolerant variety RH-0749	Raya	20	8	23	21	9.5	3.35	3.15
2016-17	Rust tolerant variety HD 2967	Wheat	10	4	50	47.5	5.3	2.44	2.36
2016-17	Rust tolerant variety WH 1105	Wheat	10	4	47	45	4.4	2.31	2.26
2017-18	Rust tolerant variety HD 2967	Wheat	20	8	46.8	44	6.3	2.30	2.21
2017-18	Rust Resistant Variety WH 1105	Wheat	25	10	45	43	4.6	2.21	2.16
2017-18	Frost Resistant Variety RH-0749	Raya	10	4	23.5	22.5	4.4	3.73	3.69
2017-18	Salt Tolerant Variety KRL 210	Wheat	10	4	35	22	59	1.73	1.09
2017-18	Salt Tolerant Variety KRL 213	Wheat	10	4	32	22	45	1.59	1.09
2018-19	Draught tolerant variety HG-2-20	Guar	50	20	12	9	33	2.33	1.86
2019-20	Rust tolerant variety HD 3086	Wheat	40	16	54	52	4	2.73	2.63
2019-20	Frost tolerant varieties RH725	Raya	20	8	23.4	22	6	3.03	2.8
2020-21	Draught tolerant variety HG 2-20	Guar	15	6	11.1	9	23.3	2.37	1.92
2020-21	Salt tolerant variety KRL-213	Wheat	25	10	36	22	18.1	1.72	1.15
2020-21	Salt tolerant variety KRL-283	Wheat	10	4	36	22	18.1	1.84	1.17
2020-21	Frost tolerant varieties RH-725	Raya	25	10	28	25	10.6	4.24	3.72
2021-22	Draught tolerant variety HG 2-20	Guar	12	5	13	10	30	3.11	2.38
2021-22	Rust tolerant variety HD -3086	Wheat	20	8	40	38	5.2	2.35	2.27
2021-22	Salt tolerant variety KRL -210	Wheat	20	8	30	16	87	1.79	0.98
2021-22	Frost tolerant variety RH-725	Raya	40	16	24	22.5	6.6	7.75	7.46
Total and average			520	218	30.38	24.9	23.53	2.74	2.27

The impact of varietal interventions under the NICRA project from 2013-14 to 2021-22 (Table 4.) showed significant improvements in crop yield and farm economics. Across 520 farmers and 218 hectares, different stress-tolerant varieties were introduced in wheat, raya, and guar crops. Salt-tolerant wheat varieties like KRL 210, KRL 213, and KRL 283, frost-tolerant raya varieties such as RH-0749 and RH-725, drought-tolerant guar variety HG 2-20, and rust-tolerant wheat varieties HD 2967, HD 3086, and WH 1105 were demonstrated. The average yield in

demonstration plots was 30.38 quintals/ha compared to 24.9 quintals/ha in local varieties, reflecting an average yield increase of 23.53%. Economic analysis showed a higher average cost: benefit ratio (BCR) of 2.74 in demonstrations against 2.27 in local practices. Certain interventions, like the salt-tolerant wheat variety KRL 210 and frost-tolerant raya variety RH-725, recorded exceptionally high yield gains and BCRs. These varietal interventions enhanced the resilience of farmers to stresses like salinity, drought, frost, and rust, leading to better productivity and profitability. The

consistent positive results over the years underline the importance of introducing climate-resilient varieties for sustainable agricultural growth in NICRA villages. Similar result have been noticed by Nirmala *et al* (2019). Gopal *et al*

(2023) ^[5, 3] adoption of climate-resilient practices played a pivotal role in averting crop failures, enabling timely operations, and positively influencing farmers' economic well-being.

Table 5: Impact of Nutrient management interventions

Year	Technology demonstrated	Crop	No. of farmers	Area (ha)	Yield (Q/ha)		% increase	Cost : Benefit Ratio	
					Demo	Check		Demo	Check
2013-14	Spray of 1 percent KNO ₃	Cotton	20	8	13.0	9.7	34	1.92	1.21
2015-16	Spray of 1 percent KNO ₃	Cotton	20	8	12.4	8.6	50	1.66	1.11
2020-21	Spray of 1 percent KNO ₃	Cotton	20	8	12.8	9.6	25	1.72	1.38
2021-22	Spray of 1 percent KNO ₃	Cotton	20	8	16.2	14.9	7	3.37	3.16

Nutrient management interventions, particularly the foliar spray of 1% potassium nitrate (KNO₃), demonstrated has been demonstrated in table 5. A notable impact on cotton yields and economic returns have been seen across multiple years. Implemented on 20 farmers covering 8 hectares annually, the intervention consistently outperformed control plots. In 2013–14, yield increased by 34%, with a benefit-cost (BC) ratio of 1.92 compared to 1.21 in the control. The trend continued in 2015–16 with a 50% yield boost and a

BC ratio of 1.66 versus 1.11. In 2020–21, a 25% yield increase was observed, and by 2021–22, although the percentage increases was lower (7%), absolute yields were highest at 16.2 Q/ha in demonstrations, with an impressive BC ratio of 3.37. These results indicate improved profitability and crop performance through effective nutrient supplementation. These results are in line with the findings Sharma *et al* (2025) ^[7] who have recorded Improvement in yield and B:C ratio with foliar spray of KNO₃.

Table 6: Effect of Pests and disease management interventions in NICRA village

Year	Interventions	Technology demonstrated	Critical input	No. of farmers	Area (ha)	Yield		% increase	Cost: Benefit Ratio	
						Demo	Local		BCR	BCR
2013-14	Disease management	Control of Bakane disease by seed treatment	Cotton	200	80	47.5	45.8	3.7	5.67	5.61
2014-15	Pest management	Use of neem based insecticides for control of white fly	Cotton	5	2	21	18.5	13.5	2.28	2.02
2020-21	Pest management	Use of neem based insecticides for control of white fly	Cotton	20	8	11.8	9	31.1	1.70	1.29
2020-21	Disease Management	Spray of Cobalt Chloride for controlling parawilt	Cotton	20	8	13	10.8	20.3	1.86	1.55
2021-22	Pest management	Use of neem based insecticides for control of white fly	Cotton	5	2	17	15	13	3.6	3.2
2021-22	Disease management	Spray of Cobalt Chloride for controlling parawilt	Cotton	20	8	16.5	16	3.1	3.41	3.31
Total and average				270	108	21.13	19.18	12.1	3.09	2.83

Pest and disease management interventions under the NICRA project significantly improved cotton productivity in the village (Table 6). Over the years, a total of 270 farmers covering 108 hectares were involved in demonstrations focusing on controlling major issues like Bakane disease, white fly infestation, and parawilt. Technologies such as seed treatment for Bakane disease, use of neem-based insecticides, and cobalt chloride sprays were promoted. The average yield from demonstration plots was 21.13 quintals/ha compared to 19.18 quintals/ha under local

practices, showing a 12.1% yield increase on average basis. Economic analysis revealed a higher average cost: benefit ratio (BCR) of 3.09 in demonstration plots against 2.83 in local practices. Notably, the control of Bakane disease in 2013-14 and use of neem insecticides showed strong results in improving both yield and profitability. These interventions enhanced pest and disease resilience in cotton, leading to more stable and sustainable crop production.

Institutional Interventions

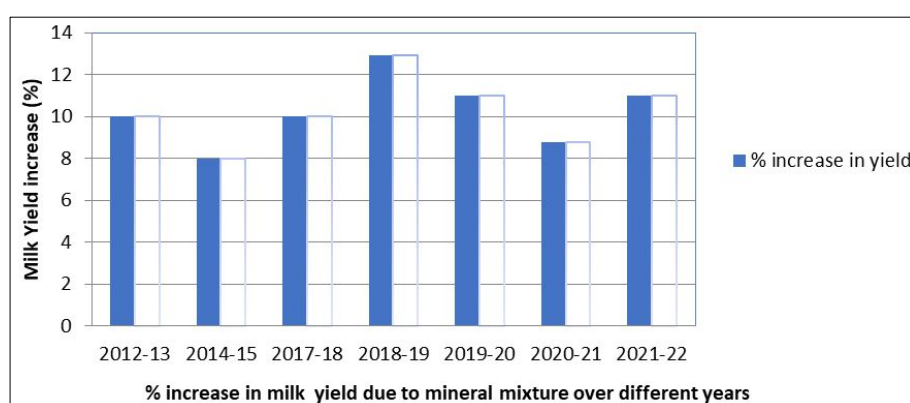


Fig 2: Effect of mineral mixture on yield enhancement during different years

The effect of supplementation of mineral mixture in livestock on milk yield over the years 2012 to 2022 have been presented in figure 2. As illustrated in the figure, milk yield increase ranged from 8% to 13%, with peak improvement observed in 2018–19 at around 13%. Consistent gains were noted in other years as well—10% in 2012–13 and 2017–18, 11% in 2019–20 and 2021–22, and a modest 9% in 2020–21. These results highlight the crucial role of balanced nutrition in dairy production. The consistent yield increases demonstrate the effectiveness of mineral mixtures in addressing nutrient deficiencies, improving animal health, and enhancing productivity, thereby contributing to better livelihoods and economic returns for dairy farmers. These results are in line with those obtained by Islam *et al* (2023) ^[4].

Conclusion

The NICRA project in Village Rupana has successfully demonstrated a wide range of climate resilient interventions over the last decade. These include improvements in mechanization, soil and water conservation, nutrient management, pest and disease control, and varietal enhancement. The cumulative effect has been a consistent increase in crop yield and profitability, empowering local farmers to better adapt to climate challenges. Continued support and adaptive innovations are essential for maintaining these gains and ensuring the long-term sustainability of agriculture in climate-vulnerable regions like Sirsa.

References

1. Ashraf M, Ejaz K, Arshad MD. Water use efficiency and economic feasibility of laser land levelling in the fields in the irrigated areas of Pakistan. *Sci Technol Dev.* 2017;36(2):115-127.
2. Gardezi M, Arbuckle JG. Techno-optimism and farmers' attitudes toward climate change adaptation. *Environ Behav.* 2020;52(1):82-105.
3. Gopal CV, Shivalingaiah YN, Pujar SS, Mutteppa C. Harvesting resilience: Unveiling the transformative impact of NICRA on rural livelihood security in Chikkaballapura, Karnataka. *Pharma Innov J.* 2023;SP-12(12):2835-2840.
4. Islam MRU, Shafi M, Naikoo M, Yattoo MA. Effect of dietary supplementation of mineral mixture on milk yield in crossbred dairy cows. *Indian J Vet Sci Biotechnol.* 2023;19(2):99-100.
5. Nirmala B, Waris PA, Muthuraman P, Rao SN. An economic evaluation of potential of stress tolerant rice varieties. *Int J Curr Microbiol Appl Sci.* 2019;8(1):576-584.
6. Ramya S, Mahesh N, Revathi P, Raju D. Effect of laser land levelling and establishment methods on economics and water productivity of rice. *Sci Technol Dev.* 2022;40:1-5.
7. Sharma B, Singh B, Kumari P, Kumari R, Sharma C. Application of potassium nitrate influenced yield, nutrient and water use efficiency and profitability of *Gossypium herbaceum* in canal irrigated region of Western India. *Int J Econ Plants.* 2025;12:1-6.
8. Subedi B, Poudel A, Aryel S. The impact of climate change on insect pest biology and ecology: Implications for pest management strategies, crop production, and food security. *J Agric Food Res.* 2023;14:1-17.