



**NICRA: NATIONAL INNOVATIONS IN CLIMATE
RESILIENT AGRICULTURE**

**ICAR-AGRICULTURAL TECHNOLOGY
APPLICATION RESEARCH INSTITUTE
ZONE-III, KANPUR**

THE CENTRAL MESSAGE

*Building climate-resilient agriculture through
proven technologies, empowered farming
communities, resource-efficient practices and
scalable field-level solutions.*



**ICAR-AGRICULTURAL TECHNOLOGY APPLICATION
RESEARCH INSTITUTE (ATARI), ZONE-III, KANPUR | NICRA**

Year of Publication: 2026

Compiled by:

**Raghwendra Singh
Ajay Kumar Singh
Ranjay K Singh
Seema Yadav
Preeti Yadav
Abhishek Singh
Saurabh Raj Pandey
Rajeev Singh**

**© All rights reserved
ICAR-ATARI, Zone-III, Kanpur**

PME Ref. No.: ATARI-3/Technical Bulletin/2026/05

ATARI-III/Technical Bulletin/2026/NIRCA

Published by:

**Director
ICAR-Agricultural Technology Application
Research Institute (ATARI), Zone-III,
Kanpur-208 001, Uttar Pradesh, India**

Tel: 0512-2533560; Fax: 0512-2533560

Email: zpdicarkanpur@gmail.com

Website: <https://atarikanpur.org.in/>

Assistance by:

**Gyanendra Singh, Pooja Yadav, Shubranshu Singh, Saurabh
Pandey, Pramod Singh, Ajay Singh Gautam, Gaurav Tiwari,
Fareed Ahmad, Somdutt Tripathi, Prajjwal Singh and Ujjwal
Tiwari**



PREFACE

It gives me pleasure to present this Technical Impact Bulletin documenting the scientific achievements and field-level experience of the Technology Demonstration Component of NICRA through ICAR-ATARI, Zone-III, Kanpur. The bulletin brings together climate vulnerability assessment, climate-resilient technologies, field performance, resource conservation, institutional mechanisms, farmer capacity building, convergence and pathways for scaling.

The source presentation covers 17 risk-prone districts in Uttar Pradesh, grouped around heat and drought, sodicity, flood and groundwater depletion. It also records technology demonstrations across different farming-system typologies, including rainfed and irrigated systems with or without livestock. The evidence includes crop and livestock productivity, economics, resource conservation, seed and fodder banks, Custom Hiring Centre performance, VCRMC and related institutional mechanisms.

The bulletin is intentionally evidence-led. Reported values and terminology from the supplied presentation have been retained. Where source tables contain incomplete fields or formatting inconsistencies, those fields are not silently replaced with outside values. Readers should therefore interpret individual results in relation to the location, climate stress, crop, technology, season and measurement conditions reported in the source.

This document is intended as a technical reference for KVKs, extension professionals, researchers, development agencies and stakeholders interested in translating climate risk into practical farm-level resilience.



Dr. Raghwendra Singh
Director
ICAR-ATARI, Zone-III,
Kanpur

Dr. Raghwendra Singh
Director, ICAR-ATARI, Zone-III, Kanpur



CONTENTS

S. No.	Contents	Page No.
1	Introduction	1–2
2	NICRA Implementation Modules and Climate Vulnerability Profile in Uttar Pradesh	3–4
3	Climate-resilient Technology Demonstrations by Farming System	5–6
4	Technology Impact Profiles	7–11
5	Horizontal Expansion and Scaling	12
6	Convergence with Line Departments	13
7	Institutional Mechanisms, Seed Banks and Fodder Banks	14–21
8	Capacity-building and Extension Programmes	22
9	Challenges, Lessons and Scaling Priorities	23
10	New Delivery Mechanisms and Future Road Map	24
11	Success Story: Beetroot Cultivation under NICRA in Kaushambi	25–26
12	Recognition for Field-level Impact	27
13	Awards	28



1. Introduction

Climate change and increasing climatic variability are major challenges to agricultural production, natural resources and rural livelihoods. Drought, heat stress, floods, erratic rainfall, water scarcity, land degradation and other climate-related stresses can adversely affect crop and livestock productivity, particularly in vulnerable farming systems. Strengthening the resilience of agriculture is therefore essential for maintaining productivity, food security and farmers' livelihoods under changing climatic conditions. Recognizing these challenges, the Indian Council of Agricultural Research (ICAR) launched the National Innovations on Climate Resilient Agriculture (NICRA) project in February 2011. NICRA integrates strategic research, technology demonstration, capacity building and knowledge management to develop, validate and promote climate-resilient technologies for crops, horticulture, livestock, fisheries and natural resource management. The project emphasizes the assessment and demonstration of location-specific technologies under farmers' field conditions.

In Uttar Pradesh, ICAR-Agricultural Technology Application Research Institute (ATARI), Zone-III, Kanpur, has facilitated the implementation of NICRA interventions through Krishi Vigyan Kendras (KVKs) in climate-vulnerable districts. The documented NICRA portfolio covers 17 risk-prone districts, representing four major vulnerability groups: heat and drought, sodicity, flood and groundwater depletion. These interventions represent four major farming-system typologies, namely rainfed without animals, rainfed with animals, irrigated without animals, and irrigated with animals. The interventions implemented through ATARI, Zone-III, Kanpur encompass Natural Resource Management, Crop Production, Livestock and Institutional Interventions, supported by extension and capacity-building activities. These include water harvesting and moisture conservation, check dams, green manuring, resource recycling, salt-tolerant and climate-resilient varieties, short-duration crops, direct-seeded rice, zero tillage, raised-bed planting, improved livestock nutrition, fodder banks, seed banks, Custom Hiring Centres (CHC's) and village-level institutions.

The present Technical Impact Bulletin of NICRA through ICAR- ATARI, Zone-III, Kanpur brings together field-level evidence of climate-resilient interventions implemented in Uttar Pradesh. It documents technology performance, productivity enhancement, economic benefits, resource conservation, institutional development, seed and fodder security, farm machinery services, capacity building, convergence and horizontal expansion. The experiences presented in the bulletin cover diverse climate-risk situations and both crop and livestock-based farming systems. Farmer capacity building and extension are integral to this process. Training programmes, frontline demonstrations, farmer fairs, exposure visits, awareness activities, advisories and other extension approaches have supported farmers in understanding and adopting climate-resilient technologies. The NICRA experience demonstrates the importance of combining appropriate technology, field evidence, farmer feedback, institutional support and convergence for strengthening resilience at farm and village levels.



Thus, the NICRA experience of ICAR-ATARI, Zone-III, Kanpur represents a field-to-scaling approach in which climate risks are linked with locally appropriate technologies, demonstrated under farmers' conditions and supported through institutions, capacity building and convergence. This Technical Impact Bulletin presents these experiences as a technical reference for KVKs, researchers, extension professionals, development agencies and other stakeholders working towards climate-resilient agriculture in Uttar Pradesh.

In this context, the NICRA interventions implemented through ICAR-ATARI, Zone-III, Kanpur are guided by the broader objectives of strengthening the resilience of Indian agriculture, validating and demonstrating climate-resilient technologies under farmers' field conditions, building the capacity of scientists and stakeholders, and generating evidence-based policy guidelines for wider adoption.

Accordingly, the major objectives of NICRA are as follows:

1. To enhance the resilience of agriculture in Uttar Pradesh to climatic variability and climate change through strategic research on adaptation and mitigation.
2. To validate and demonstrate climate-resilient technologies on farmers' fields.
3. To strengthen the capacity of scientists and other stakeholders in climate-resilient agriculture.
4. To draw policy guidelines for wide-scale adoption of resilience technologies and options.



2. NICRA Implementation modules and Climate Vulnerability Profile in Uttar Pradesh

The NICRA implementation modules in Uttar Pradesh integrate climate-resilient agricultural technologies with locally relevant interventions to address diverse climate-related risks. The module encompasses natural resource management, crop production, livestock, institutional mechanisms and extension activities, while interventions are tailored to the specific vulnerabilities of different districts.

Implementation modules and illustrative climate-resilient technologies

Table 1 summarizes the major NICRA implementation modules and the key climate-resilient technologies demonstrated under each module. The interventions cover six major areas: Natural Resource Management, Crop Production, Livestock, Institutions and Extension. These include soil and water conservation, resilient crop varieties and efficient crop establishment, livestock nutrition and fodder management, collective institutional mechanisms, and farmer-oriented capacity-building and awareness activities. Together, these modules reflect a multi-dimensional approach to strengthening climate resilience at farm and village levels.

Table 1. Major NICRA implementation modules and illustrative climate-resilient technologies

Module	Focus in the supplied record	Illustrative technologies
Natural Resource Management	Water, soil and moisture management	Check dams, brown mulching, green manuring, resource recycling
Crop production	Resilient varieties and efficient establishment	Salt-tolerant rice/wheat/mustard, short-duration crops, DSR, zero tillage, raised beds
Livestock	Nutrition, breed and fodder resilience	Mineral mixture after deworming, improved poultry/goat, fodder banks
Institutions	Local collective mechanisms	VCRMC/CCRM, Custom Hiring Centre, seed and fodder banks
Extension	Awareness, capacity and exposure	Training, farmer fairs, field demonstrations, exposure visits, media and advisories



Risk-prone restricts and vulnerability

Table 2 presents the 17 districts covered under the NICRA portfolio in Uttar Pradesh, categorized according to the major climate-related vulnerabilities addressed. Among these, 7 districts fall under heat and drought-prone conditions, 6 districts are identified as flood-prone, 3 districts are affected by sodicity, and Baghpat is categorized underground water depletion. This distribution reflects the diverse climate risks and agro-ecological conditions addressed through NICRA interventions across the state.

Table 2. Districts and climate risks recorded under the NICRA portfolio

S.No.	District	Vulnerability addressed
1	Jalaun	Heat and drought
2	Jhansi	Heat and drought
3	Hamirpur	Heat and drought
4	Chitrakoot	Heat and drought
5	Banda	Heat and drought
6	Bhadohi	Heat and drought
7	Sonbhadra	Heat and drought
8	Kanpur Dehat	Sodicity
9	Kaushambi	Sodicity
10	Pratapgarh	Sodicity
11	Mahrajganj	Flood
12	Bahraich	Flood
13	Basti	Flood
14	Gonda	Flood
15	Gorakhpur	Flood
16	Kushinagar	Flood
17	Baghpat	Groundwater depletion



3. Climate-resilient Technology Demonstrations

The NICRA demonstrations covered diverse farming systems representing different combinations of rainfall, irrigation, livestock integration and climate stresses. The major farming-system typologies included rainfed systems with and without animals, as well as irrigated systems with and without animals. The following sections highlight the climate-resilient technologies demonstrated under these farming systems and their reported effects on crop and livestock productivity (Table 4).

Table 4. Farming-system typologies represented in the NICRA demonstrations

FST	System	District example	Climate stress / focus
FST-1	Rainfed without animal	Chitrakoot	Drought and heat stress
FST-2	Rainfed with animal	Jalaun	Drought and heat; livestock resilience
FST-3	Irrigated without animal	Bahraich / Baghpat	Flood, drought/dry spell, high temperature, groundwater-related efficiency
FST-4	Irrigated with animal	Kanpur Dehat / Pratapgarh	Sodicity and integrated crop-livestock resilience

The promising CRTs under FST-1 in the district Chitrakoot rainfed system supported crop productivity under drought and heat stress. Sesame productivity reached 339-460 kg/ha, while chickpea variety JG-14 recorded 1,470-1,524 kg/ha. Farmer practice productivity was 91.45% and 96.46% of NICRA productivity for sesame and chickpea, respectively. These results highlight the potential of stress-tolerant varieties and foliar NPK application to improve crop performance under rainfed conditions (Table 5).



Table 5. Impact of promising CRTs in FST-1: district Chitrakoot rainfed system without animals

Stress	Climate-resilient technology	Crop	NICRA productivity	Farmer practice productivity	CRT impact (%)
Drought	Short-duration sesame variety	Sesame	339 kg/ha	310 kg/ha	91.45
Heat stress	Short-duration and heat-tolerant JG-14	Chickpea	1,524 kg/ha	1,470 kg/ha (stress-year row)	96.46
Drought (stress year)	Short-duration sesame + foliar NPK	Sesame	460 kg/ha	400 kg/ha	86.96
Heat stress (stress year)	JG-14 + foliar NPK	Chickpea	1,470 kg/ha	1380 kg/ha	96.46

3.4 Flood/irrigated system with animal in Gorakhpur district

As presented in Table 6, promising climate-resilient technologies (CRTs) improved crop productivity in the flood-prone, irrigated farming system with animals in Gorakhpur district. Under normal conditions, direct-seeded rice (DSR) with green manuring (CG Dev Bhog) recorded the highest NICRA productivity of 52.0 q/ha, compared with 45.7 q ha⁻¹ under farmer practice. In wheat, DBW-187 with a super seeder and zero tillage recorded productivities of 48.2 and 46.7 q/ha, respectively. During stress years, Swarna Sub-1 under transplanting yielded 42.2 q/ha, compared with 28.6 q/ha under farmer practice. Similarly, DBW-187 with a super seeder and zero tillage recorded yields of 46.0 and 45.2 q/ha, respectively, demonstrating the potential of these technologies to sustain crop productivity under adverse conditions.

Table 6. Impact of promising CRTs in flood/irrigated systems with animals in Gorakhpur District

Technology	NICRA productivity (q/ha)	Farmer practice (q/ha)	CRT impact (%)
DSR + green manuring (CG Dev Bhog)	52	45.7	81.15
DBW-187 + super seeder	48.2	40.6	95.43
DBW-187 + zero tillage	46.7	42.2	96.78
Swarna Sub-1 + transplanting (stress year)	42.2	28.6	67.77
DBW-187 + super seeder	46	37.5	81.52
DBW-187 + zero tillage	45.2	39.6	87.61

4. Technology Impact

4.1 Mulching in sugarcane in Gonda district

Mulching in sugarcane in Gonda district during 2018-19 to 2023-24 recorded an average demonstration yield of 844.75 q/ha, compared with 704.3 q/ha under farmer practice, resulting in a yield increase of 19.94% and an average yield gap of 140.45 q/ha. The average benefit–cost ratio was higher under demonstrations (4.09) than farmer practice (3.42), indicating improved productivity and profitability (Table 7).

Table 7. Year-wise performance of mulching in sugarcane in Gonda district

Year	Demo yield (q/ha)	Farmer yield (q/ha)	Yield gap (q/ha)	Increase %	B:C demo	B:C FP
2018-19	830	692	138	19.94	4.12	3.43
2019-20	842	702	140	19.94	4.07	3.39
2020-21	850	709	141	19.89	4.1	3.42
2021-22	854.5	711.8	142.7	20.05	4.06	3.48
2022-23	842	702	140	19.94	4.07	3.39
2023-24	850	709	141	19.89	4.1	3.42
Average	844.75	704.3	140.45	19.94	4.09	3.42



Mulching in sugarcane for soil moisture conservation and improved crop productivity in Gonda district.



4.2 Salt-tolerant varieties in Pratapgarh district

The demonstration of salt-tolerant varieties CS-58 and CS-60 under sodic soil conditions in Pratapgarh district during 2018-19 to 2023-24 recorded an average yield of 15.65 q/ha, compared with 11.65 q/ha under farmer practice, resulting in a yield gap of 4.00 q/ha and a 34.37% increase. The average benefit–cost ratio was higher under demonstrations (4.22) than farmer practice (3.31), indicating improved productivity and profitability through the adoption of salt-tolerant varieties (Table 8).

Table 8. Year-wise performance of salt-tolerant varieties in Pratapgarh district

Year	Demo yield (q/ha)	Farmer yield (q/ha)	Yield gap (q/ha)	Increase %	B:C demo	B:C FP
2018-19	10.2	7.6	2.6	34.21	2.82	2.25
2019-20	15.8	11.5	4.3	37.39	4.26	3.3
2020-21	16.3	12.4	3.9	31.45	4.53	3.58
2021-22	17.5	13	4.5	34.62	5	4
2022-23	16.5	12.2	4.3	35.25	4.22	3.4
2023-24	17.6	13.2	4.4	33.33	4.5	3.3
Average	15.65	11.65	4	34.37	4.22	3.31



Demonstration of salt-tolerant rice variety CS-58



4.3 Check-dam rainwater harvesting for rabi crops in Chitrakoot district

Check-dam rainwater harvesting for wheat cultivation in Chitrakoot district during 2018-19 to 2023-24 recorded an average demonstration yield of 36.11 q/ha, compared with 29.59 q/ha under farmer practice, resulting in a 22.03% yield increase. The average benefit–cost ratio was higher under demonstrations (1.85) than farmer practice (1.46), indicating improved wheat productivity and profitability (Table 9).

Table 9. Year-wise performance of check-dam rainwater harvesting for wheat in Chitrakoot district

Year	Farmer s	Area (ha)	Demo yield	Farmer yield	Yield gap	Increas e %	B:C demo	B:C FP
2018-19	95	30.48	38.25	32.4	5.85	18.06	1.8	1.13
2019-20	69	14.4	35.21	26.25	8.96	34.13	1.95	1.66
2020-21	64	15	37.2	33.23	3.97	11.95	1.69	1.59
2021-22	67	14	37.25	29.75	7.5	25.21	2.04	1.71
2022-23	90	29	36.22	30.54	5.68	18.6	1.7	1.12
2023-24	60	12	32.55	25.36	7.19	28.35	1.89	1.52
Average	445	114.88	36.11	29.59	6.53	22.03	1.85	1.46



Check-dam water harvesting and storage



After intervention, Performance of wheat crop

4.4 Less-water-requiring crops + raised-bed mustard in Baghpat district

The integration of less water-requiring crops in crop rotation and raised-bed planting of mustard in Baghpat district during 2018-19 to 2023-24 recorded an average demonstration yield of 19.88 q/ha, compared with 16.42 q/ha under farmer practice, resulting in a yield gap of 3.46 q/ha and 21.09% yield increase. The average benefit-cost ratio was higher under demonstrations (3.54) than farmer practice (2.95), indicating improved mustard productivity and profitability (Table 10).

Table 10. Integration of Less Water-Requiring Crops in Crop Rotation and Raised Bed Planting of Mustard in Baghpat district

Year	Demo yield (q/ha)	Farmer yield (q/ha)	Yield gap (q/ha)	Increase %	B:C demo	B:C FP
2018-19	19.85	16.4	3.45	21.04	3.12	2.7
2019-20	17.45	13.15	4.3	32.7	3.2	2.97
2020-21	21.44	17.85	3.59	20.11	4.23	3.22
2021-22	19.24	16.85	2.39	14.18	3.35	2.86
2022-23	19.85	16.4	3.45	21.04	3.12	2.7
2023-24	21.44	17.85	3.59	20.11	4.23	3.22
Average	19.88	16.42	3.46	21.09	3.54	2.95



Raised-bed mustard demonstration in Baghpat district

4.5 Mineral mixture after deworming in Hamirpur district

Supplementation of mineral mixture after deworming of dairy animals in Hamirpur district during 2018-19 to 2023-24 resulted in an average milk yield of 6.22 litres/day, compared with 5.19 litres/day under farmer practice, recording an average increase of 19.95% and a yield gap of 1.04 litres/day. The average benefitcost ratio was higher under demonstrations (1.74) than farmer practice (1.31), indicating improved milk productivity and economic returns (Table 11).

Table 11. Supplementation of mineral mixture after deworming of dairy animals in Hamirpur district

Year	Demo milk (lit/day)	FP milk (lit/day)	Gap (lit/day)	Increase %	B:C demo	B:C FP
2018-19	6.25	5.25	1	19.05	1.9	1
2019-20	6.44	5.36	1.08	20.15	1.34	1.08
2020-21	6	5.1	0.9	17.65	1.7	1.56
2021-22	6.4	5.07	1.33	26.23	1.91	1.63
2022-23	6.25	5.25	1	19.05	1.9	1
2023-24	6	5.1	0.9	17.65	1.7	1.56
Average	6.22	5.19	1.04	19.95	1.74	1.31



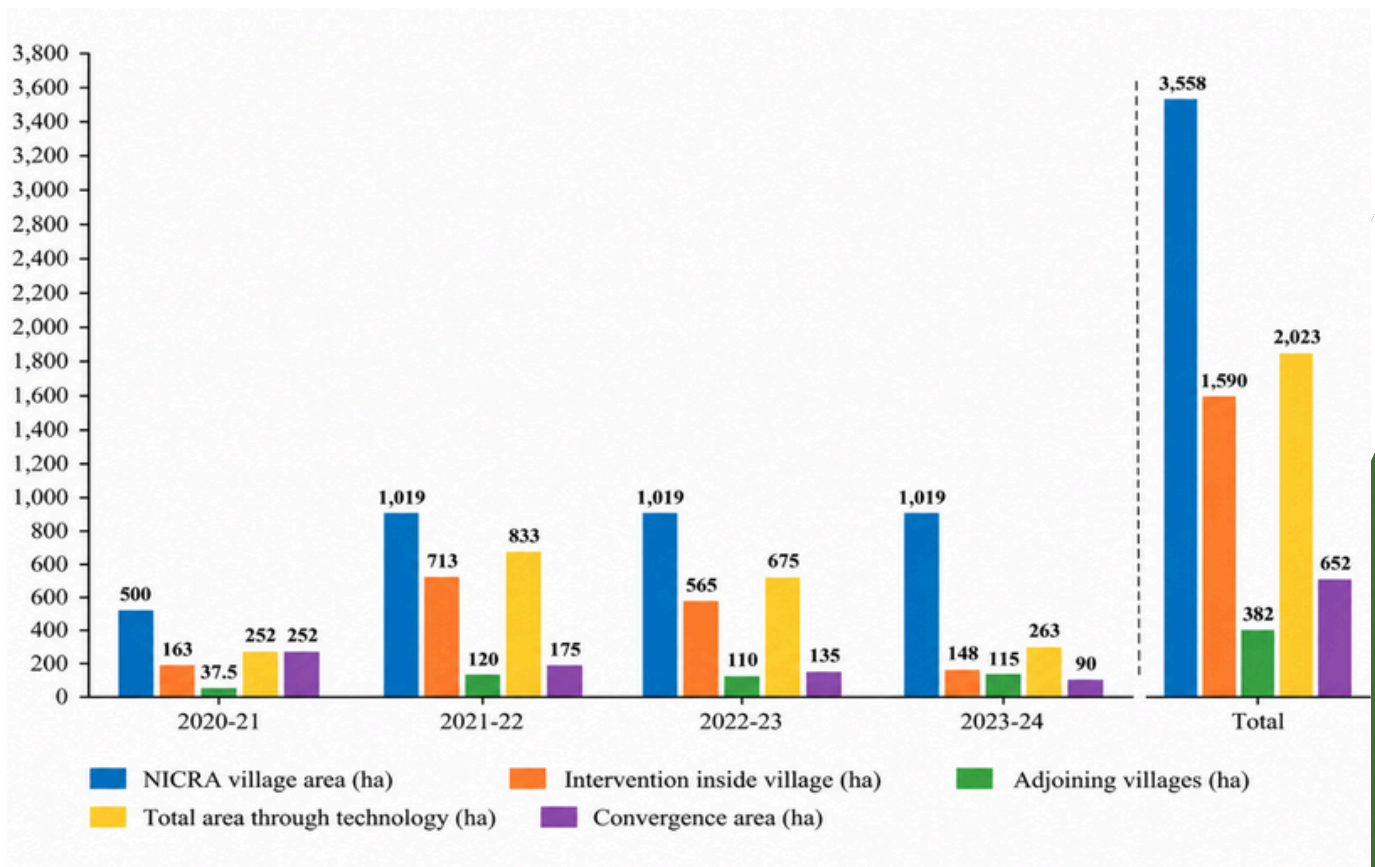
Livestock intervention / mineral-mixture demonstration in Hamirpur district



5. Horizontal Expansion and Scaling

The horizontal expansion of climate-resilient technologies under the National Innovations in Climate Resilient Agriculture (NICRA) programme demonstrated the progressive dissemination of improved agricultural practices beyond the initially targeted villages. During 2020–21 to 2023–24, the total reported area of NICRA villages was 3,558.32 ha, of which 2,023.6 ha was covered through climate-resilient technology interventions, representing approximately 56.87% of the total area. The annual coverage varied across the study period, reflecting differences in the implementation and adoption of technologies according to local agricultural needs and resource availability.

In addition, 382.5 ha in adjoining villages was covered, indicating the spread of climate-resilient practices beyond the original intervention areas through technology demonstrations, extension activities and farmer-to-farmer learning. Furthermore, convergence with other developmental programmes contributed a coverage of 652 ha, highlighting the importance of coordinated efforts in expanding the reach of these interventions. Such convergence can facilitate access to improved agricultural technologies, essential inputs and resource-conservation practices. Overall, the findings emphasize the role of technology demonstrations, farmer participation, extension support and programme convergence in promoting wider dissemination of climate-resilient practices and strengthening agricultural resilience across villages.



6. Convergence with line departments and schemes

Table 12 shows the expansion of climate-resilient technologies through convergence with line departments and government schemes. Heat-tolerant wheat varieties recorded the largest increase in coverage, from 25 to 100 ha, benefiting 250 farmers compared with 60 initially. Citrus-based intercropping expanded from 5 to 50 ha, while year-round green fodder coverage increased from 5 to 25 ha. Salt-tolerant rice and wheat varieties, water-saving irrigation systems, ponds, and check-dam renovation also showed increased coverage. These results highlight the role of institutional convergence, training, demonstrations, and input distribution in scaling climate-resilient technologies and extending their benefits to more farmers.

Table 12. Convergence with line departments and schemes

Technology	Initial area ha	Initial farmers	Scaled area ha	Scaled farmers	Convergence agency/scheme
Salt-tolerant rice CSR-46	38	95	45	110	Dept. Agriculture + FPOs
CSR-BIO soil conditioner/nutrient mobiliser	6	13	8	21	Dept. Agriculture + FPOs
Salt-tolerant wheat KRL-210	15	35	19	48	Dept. Agriculture + FPOs
Halo Azo + Halo PSB in wheat	4	10	6	15	Dept. Agriculture + FPOs
Salt-tolerant mustard CS-60	4	12	6	16	Dept. Agriculture + FPOs
Horticultural diversification: beetroot & spinach	4	17	7	21	Dept. Agriculture + FPOs
Renovation of check dam	20	20	30	30	Irrigation Department
Drip & sprinkler	15	50	20	75	PDMC/RKVY
Pond	20	50	30	75	PMKSY Khet Talab Yojana
Heat-tolerant wheat Raj-4120 & 4079	25	60	100	250	KVK Jhansi training/demonstration
Citrus orchard + turmeric/ginger intercrop	5	10	50	100	KVK Jhansi + line department
Year-round green fodder: Napier + MP Chari/Bajra +	5	10	25	100	Training / fodder seed / root-slip distribution

7. Institutional Mechanisms

Institutional mechanisms play a vital role in strengthening climate resilience by promoting community participation, collective resource management, and access to agricultural technologies. The key mechanisms include Village Climate Risk Management Committees (VCRMCs), Community Climate Risk Management Committees (CCRMCs), Custom Hiring Centres (CHCs), seed banks, and fodder banks. These institutions facilitate local-level planning, improve access to agricultural machinery and quality seeds, and support fodder availability for livestock. Their functioning through village-level participation and resource-sharing arrangements helps farmers address climate-related risks, reduce resource constraints, and promote the wider adoption of climate-resilient agricultural practices. The following tables present the coverage, functioning, and contributions of these institutional mechanisms.

Table 13. Institutional mechanisms supporting climate resilience

Institution	Villages	Members	Meetings
VCRMC	38	393	30
CCRMC	30	530	45
CHC	40	4000	80
Fodder Bank	45	2250	40
Seed Bank	30	2000	75
Climate Smart Village	40	3000	50

Table 13 highlights the role of institutional mechanisms in promoting climate resilience. Custom Hiring Centres (CHCs) recorded the highest participation, with 4,000 members across 40 villages and 80 meetings. Climate Smart Villages covered 40 villages with 3,000 members, while fodder banks and seed banks covered 45 and 30 villages, respectively. VCRMCs operated across 38 villages with 393 members. Overall, these institutions supported community participation, collective resource management, and the dissemination of climate-resilient agricultural practices.



7.1 Custom Hiring Centre performance

Table 14. Implement-wise use and revenue

S.No.	Implement	Area operated	Farmers using	Revenue (₹)
1	Multi crop seed	4	10	5,000
2	Trench opener	2	5	2,000
3	Sprayer machine	8	20	1,000
4	Tractor trolley 4-	5.5	38	460
5	Tractor trolley 2-	3.5	20	360
6	Rotavator 1.5 m	30.4	65	1,520
7	Seed cum fertilizer	25.2	73	1,260
8	Zero-till seed drill	8.8	7	440
9	Tractor harrow 12	55.2	146	1,380
10	Edger 3 furrow	13.6	17	340
11	Power sprayer	20	14	30
12	Cono weeder	5	6	0
13	Leveller	5.5	38	100
14	Seed drill	126.5	196	127,950
15	Thresher	65	89	19,500
16	Land leveller	25.5	67	31,375
17	Rain gun	15	39	4,500
18	Reaper binder	35	59	17,500
19	BBF	12	45	3,600
20	Battery operated	508	1,317	11,030
21	Spata-44	89.09	157	7,000
22	ZT machine	39.34	129	6,300
23	Raised bed planter	23.4	97	3,900
24	Multi crop thresher	533	113	7,800



25	MB plough	34.8	92	5,050
26	Disk harrow	92.5	102	8,200
27	Cultivator	85	157	8,750
28	Disk bund former	93.1	102	7,700
29	Rotavator	90	186	9,050
30	Sugarcane beeder	44.5	44	7,100
31	Rotary mulcher	15	28	6,550
32	Doll maker	3.5	15	1,150
33	Battery sprayer	42	85	1,800
34	Ridge maker +	6	15	400
35	Seed cum fertilizer	5	5	1,000
36	Land leveller	3	3	600
37	MB plough	8	5	1,600
38	Trolley sprayer	3	5	1,000
39	Power sprayer	3	6	1,200
40	Disc harrow	3	3	400
41	Bund maker	20	100	1,500
42	Multi crop seed drill	100	200	7,000
43	Groundnut	50	100	1,000
44	Tractor-operated	50	100	6,500
45	Animal weight	-	50	-
46	MB plough	20	50	2,000
47	Supa (leveller)	20	50	2,000
48	Cultivator	46	105	2,230
49	Harrow	28	89	1,530
50	Leveller	8	40	480
51	Bund maker	18	67	1,500
52	Mini power tiller	6	126	560
53	Battery-operated	106	329	1,047

54	Looper	-	14	250
55	Seed cum fertilizer drill	30	98	1,540
56	Zero till	106.8	490	29,362
57	Drum seeder	102.4	305	14,030
58	Trench opener	35.6	329	7,686
59	Power sprayer	12.5	45	375

The performance of Custom Hiring Centres (CHCs) demonstrated their role in improving farmers' access to agricultural machinery. As shown in Table 14, the multi-crop thresher recorded the largest operated area (533 ha), while the battery-operated sprayer served the highest number of farmers (1,317) across 508 ha. The seed drill generated the highest reported revenue of ₹1,27,950, followed by the land leveller (₹31,375) and zero-till machine (₹29,362). The zero-till machine and drum seeder also covered 106.8 and 102.4 ha, benefiting 490 and 305 farmers, respectively. Overall, CHCs facilitated the use of diverse farm implements, supporting timely agricultural operations and wider access to mechanization

7.2 Seed banks in NICRA villages

Table 15. Seed-bank performance in NICRA villages

Village	Crop	Variety	Area ha	Farmers	Produced (a)	Revenue / note
Daulatpur/Patoli	Wheat	HD3298	2.75	7	133.1	Farmer purchase seed
Sikhera/Patoli/Daulatpur	Mustard	RH761	10	25	219	Farmer purchase seed
Rampurva	Wheat	K-1317	0.2	4	4.25	Farmer purchase seed
Rampurva	Chickpea	JG 14	0.2	4	2.3	Farmer purchase seed
Rampurva	Mustard	NRCHB 101	0.2	2	1.56	Farmer purchase seed
Rampurva	Rice	Pusa 2511	1	3	1.35	Farmer purchase seed
Rampurva	Pigeonpea	IPA 206	1	3	1.9	Farmer purchase seed
Rampurva	Greengram	IPM2-3	0.4	1	1.56	Farmer purchase seed
Bambampurwa	Wheat	HD2067/D BW-187/200	174.1	311	385	Farmer purchase seed
Narayanpur Sal	Toria	PT-303/Bhawani/Tapes	55	28	2.75	Farmer purchase seed

Rajapur	Mustard	NDR8501	110	39	5.5	Farmer purchase seed
Mahopar	Rice	Samba Sub-1	2	4	90	₹2,80,000
Tighra	Wheat	DBW-187	2	4	84	₹3,31,800
Piyaniranjanpur	Moong	Shikha	10	25	62.5	₹4,88,362
Piyaniranjanpur	Sesame	GT-06	5	13	21.85	₹1,82,281
Piyaniranjanpur	Mustard	RH-725	20	50	250	₹13,38,750
Piyaniranjanpur	Lentil	KLB-345	8	20	74.96	₹4,52,652
Piyaniranjanpur	Chickpea	JG-36	5	13	62.5	₹3,17,812
Piyaniranjanpur	Field pea	IPFD-13-2	10	25	193.7	₹7,11,266
Piyaniranjanpur	Wheat	K-1317	10	25	468.6	₹10,22,865
Birgua	Wheat	Raj-4079	50	125	1,500	₹55,00,000
Bawaltanda	Chickpea	RVG-202	10	25	110	₹7,20,000
Birgua	Field pea	IPFD-10-12	10	25	120	₹7,60,000
Gandhinagar	Mustard	RH-749	10	25	100	₹9,80,000
Gandhinagar	Sesame	RT-351	2	5	6	₹75,000
Aurangabad	Wheat	KRL-213	5.4	23	25	₹63,250
Amawakhas	Paddy	MTU-7029	5	10	15	₹45,000
Amawakhas	Paddy	Sarju-52	5	10	20	₹60,000
Amawakhas	Paddy	MTU-7029	5	10	20	₹60,000
Karauta urf Nebuiya	Rice	Swarna Sub-1	4	10	180	Farmer purchase seed
Laxmipur Mahant	Rice	Swarna Sub-1	4	10	175	Farmer purchase seed
Lendwa	Rice	Swarna Sub-1	4	10	190	Farmer purchase seed

Karauta urf Nebuiya	Wheat	DBW-187	8	20	280	Farmer purchase seed
Laxmipur Mahant	Wheat	DBW-187	8	20	304	Farmer purchase seed
Lendwa	Wheat	DBW-187	8	20	264	Farmer purchase seed

Table 15 highlights the contribution of seed banks to the production and availability of quality seeds across NICRA villages. Wheat, mustard, and rice were among the major crops covered, alongside pulses, sesame, and toria. Birgua recorded the highest reported wheat seed production (1,500 q) under variety Raj-4079, while Piyaniranjanpur recorded 468.6 q of wheat (K-1317) and 250 q of mustard (RH-725). Seed production and distribution involved multiple villages and farmers, with several entries indicating farmer-to-farmer seed purchases. These initiatives supported local seed availability, facilitated access to improved varieties, and strengthened community-based seed systems in NICRA villages



7.3 Fodder banks in NICRA villages

Table 16. Fodder-bank performance in NICRA villages

Village	Fodder	Variety	Area ha	Farmers	Produced	Used as feed
Sikhera/Patoli/Daulatpur	Napier grass	Super Napier	2	51	1,100	1,100
Patoli/Daulatpur	Wheat straw	HD3298	2.75	7	13.2	13.2
Rampurva	Napier grass	Pusa Giant	1	20	785	785
Bambampurwa	Berseem	Maskavi	15	233	6,645	6,645
Rajapur	Oat	JHO-20004	6.1	128	2,305	2,305
Narayanpur Sal	Jowar	Crystal SX-17	9.5	126	4,465	4,465
Piyaniranjanpur + Sadhara	Berseem	BB-2	2	10	1,600	All
Birgua	Napier	IGFRI-3	5	25	1,000	500
Birgua	Bajra	NT-31B	5	25	1,000	500
Bawaltanda	MP Chari	PC-06	5	25	1,000	500
Bawaltanda	Berseem	BB-2	5	25	1,500	800
Aurangabad	Napier	IGFRI-7	0.2	3	9.7	9.7
Amawakhas	Jowar	Anant	1.5	25	1,380	1,380
Amawakhas	Jowar	Anant	1.13	24	1,370	1,370
Amawakhas	Berseem	BL-42	1.5	16	685	685
Amawakhas	Berseem	BL-42	1.5	10	653	653
Karauta urf Nebuiya	Berseem	BL-42	2	20	600	600
Laxmipur Mahant	Berseem	BL-42	2	20	550	550
Lendwa	Berseem	BL-42	2	20	480	480

Table 16 shows that fodder banks established in NICRA villages contributed to improving fodder availability for livestock. The major fodder resources included Napier grass, berseem, oat, jowar, bajra, and wheat straw. Bambampurwa recorded the highest berseem production (6,645), followed by jowar at Narayanpur Sal (4,465) and oat at Rajapur (2,305). Napier grass production was also substantial at Sikhera/Patoli/Daulatpur (1,100) and Birgua (1,000). At several locations, the entire quantity produced was utilized as animal feed, while Birgua and Bawaltanda reported partial utilization. Overall, fodder-bank initiatives promoted local fodder production, improved access to livestock feed, and strengthened the resilience of mixed crop–livestock farming systems.

7.4 Year-round Fodder, Livelihood Resilience and Extension

Table 17 highlights the year-round fodder and livelihood-resilience strategy for NICRA villages, focusing on ensuring a continuous supply of green and dry fodder for livestock. The strategy promotes seasonal fodder cultivation, including Chari and other fodder crops during Kharif, berseem and oat during Rabi, and perennial Napier grass during summer and the remaining months. Fodder banks and the utilization of wheat, field pea and chickpea residues are emphasized to overcome seasonal feed shortages. In addition, multi-cut Napier cultivation, distribution of Napier slips and farmer training are proposed to strengthen fodder availability, improve livestock feeding practices, reduce fodder scarcity and enhance livelihood resilience in climate-vulnerable farming systems.

Table 17. Year-round fodder and livelihood-resilience strategy

Fodder strategy	Implementation approach
Whole-year fodder security	Develop fodder bank at NICRA village
Perennial grasses	Provide Napier slips; grow Napier on farm bunds
Kharif	Jowar and Bajra / Chari
Rabi	Berseem and Oat
Summer	Napier
Seasonal sequence	Kharif Chari → Rabi Berseem → remaining months Napier
Residue-based feed	Wheat straw + field-pea straw + chickpea straw throughout the year
Multi-cut Napier	Sensitization, production technology training and sucker distribution

7.5 Capacity-building and other extension programmes

Table 18 presents the capacity-building and extension programmes conducted across six thematic areas, comprising 695 programmes that reached 20,078 beneficiaries, including 15,441 males and 4,637 females. The highest number of programmes (187) and beneficiaries (5,343) was recorded under crop and cropping systems, followed by natural resource management with 131 programmes and 3,680 beneficiaries. Horticulture accounted for 121 programmes, while livestock, institutionalization and miscellaneous activities, and Integrated Farming System (IFS) contributed to strengthening agricultural knowledge and livelihood opportunities. Farmer feedback indicated improved understanding of water-saving practices, agronomic management, livestock productivity, vegetable selection, and recycling of farm by-products for year-round income generation. However, shortages and delayed supplies of green-manure seed, along with concerns regarding pesticide use, were identified as areas requiring further attention. Overall, the programmes supported technology awareness, capacity development and farmers' willingness to adopt improved agricultural practices on a larger scale.

Table 18. Capacity-building and extension programmes

Thematic area	Programmes	Male beneficiaries	Female beneficiaries	Reported farmer feedback
Natural resource management	131	3,002	678	Water-saving learning; shortage/late supply of green-manure seed noted
Crop and cropping systems	187	4,264	1,079	Improved crop production through appropriate agronomic management
Horticulture	121	2,376	1,032	Suitable vegetable selection; concern about pesticide use
Livestock	103	2,244	684	Improved livestock productivity
IFS	55	1,141	286	Recycling of by-products and year-round income generation
Institutionalization and miscellaneous	98	2,414	878	Good technology performance and willingness for large-scale adoption



8. Challenges, Lessons and Scaling Priorities

8.1 Implementation and upscaling challenges recorded in the presentation

The implementation and upscaling of climate-resilient technologies under NICRA require sustained efforts in capacity building, awareness generation, institutional convergence and improved access to essential agricultural resources. Regular training programmes, farmer fairs and frontline demonstrations are necessary to enhance farmers' knowledge and encourage the adoption of climate-resilient agricultural practices. Vaccination and animal-health camps should be organized to strengthen livestock preparedness and management before and after flood events. Awareness programmes and exposure visits for farmers and school students in NICRA villages can further improve understanding of demonstrated technologies and facilitate the wider dissemination of successful practices. Strengthening convergence with various line departments is also essential for expanding the reach and effectiveness of climate-resilient interventions. Continuous demonstrations, group discussions and media coverage can support knowledge sharing and promote wider adoption among farming communities. Furthermore, timely access to farm machinery is required to facilitate trench sowing of sugarcane, zero-tillage wheat cultivation and drum-seeder-based rice establishment. The mass availability of submergence-tolerant paddy varieties through district agriculture departments is another important requirement for reducing flood-related crop losses. In addition, the establishment of crop-residue-management and resource-recycling units, including vermicomposting and mushroom production units, through district horticulture departments can improve residue utilization and create supplementary livelihood opportunities. Addressing these implementation requirements through coordinated institutional support, targeted extension activities and improved input availability is essential for scaling up climate-resilient technologies across vulnerable agricultural regions.

8.2 Evidence-derived lessons

The evidence generated through NICRA interventions highlights the importance of selecting climate-resilient technologies according to locally recorded climatic and resource-related stresses, including drought, heat, floods, soil sodicity and groundwater pressure. Long-term demonstration records are valuable for assessing the consistency of technology performance, production stability and economic differences across years. Institutional mechanisms such as Custom Hiring Centres (CHCs), seed banks and fodder banks complement technology demonstrations by improving farmers' access to agricultural inputs, machinery and livestock feed resources. Convergence with other schemes and line departments further facilitates the expansion of demonstrated technologies beyond individual plots, as reflected in the reported technology coverage of 2,023 ha and convergence coverage of 652 ha. Farmer feedback and exposure activities are equally important for identifying and addressing practical constraints related to seed availability, machinery access and input-use concerns. Moreover, crop–livestock integration and year-round fodder security strengthen the resilience of farming households in areas where climatic stresses affect both crop production and animal husbandry. Overall, these lessons emphasize the need for location-specific technology selection, sustained demonstrations, institutional support, interdepartmental convergence and participatory extension approaches to enhance the adoption and wider scaling of climate-resilient agricultural practices.



9. New Delivery Mechanisms and Future Road Map

Table 19. New delivery mechanisms and future scaling roadmap

Delivery mechanism	Evidence visible in the source record	Scaling implication
Village institutions	VCRM, CCRM, CHC, seed bank and fodder bank	Build local ownership and continuity
Shared machinery	CHC with a broad implement portfolio and reported revenue	Improve access to costly machinery and timely operations
Local seed systems	Multiple village-level seed-bank entries across cereals, pulses and oilseeds	Reduce dependence on delayed external seed supply
Fodder security	Fodder banks + seasonal fodder sequences + perennial Napier	Strengthen livestock resilience during climate stress
Convergence	Agriculture, irrigation, PDMC/RKVY, PMKSY and training linkages	Convert successful demonstrations into wider-area adoption
Evidence-based extension	Demonstration data, farmer feedback, exposure, media and publications	Use local evidence to support informed technology choice

Table 19 highlights the new delivery mechanisms and future scaling roadmap for strengthening climate-resilient agriculture under NICRA. Village-level institutions, including VCRMCs, CCRMCs, Custom Hiring Centres (CHCs), seed banks and fodder banks, play an important role in promoting local ownership and ensuring continuity of interventions. Shared farm machinery through CHCs can improve access to costly equipment and facilitate timely agricultural operations, while village-level seed banks covering cereals, pulses and oilseeds can reduce dependence on delayed external seed supplies. Fodder banks, seasonal fodder sequences and perennial Napier cultivation can strengthen livestock resilience during periods of climatic stress. Convergence with agriculture, irrigation, PDMC/RKVY, PMKSY and training programmes provides opportunities to expand successful demonstrations across wider areas. Furthermore, the systematic use of demonstration data, farmer feedback, exposure visits, media coverage and publications can strengthen evidence-based extension and support informed technology selection. Overall, these mechanisms provide a coordinated approach for improving resource accessibility, enhancing institutional capacity and scaling up climate-resilient agricultural technologies among vulnerable farming communities



Success Story: Enhancing Farmers' Income through Beetroot Cultivation under NICRA in Kaushambi District, Uttar Pradesh

Background and Farmer Profile

Shri Chandrasekhar Maurya, a marginal farmer from Village Umarchha, Post Mahgaon, Block Mooratganj, Tehsil Chail, District Kaushambi, Uttar Pradesh, owns 2.0 ha of agricultural land to support his family's livelihood. Before adopting crop diversification under the National Innovations in Climate Resilient Agriculture (NICRA) project, he primarily cultivated paddy and wheat. To improve farm productivity, diversify his cropping system and enhance household income, he participated in the NICRA-supported demonstration of improved beetroot cultivation.

Technology Demonstrated

During the Rabi season of 2024–25, Krishi Vigyan Kendra (KVK), Kaushambi, demonstrated the improved beetroot variety Ragini F-1 under the horticultural crop diversification programme of NICRA. The demonstration covered 2.0 ha and involved 20 farmers. The variety was selected for its high yield potential, improved bulb quality and reported tolerance to soil sodicity. The intervention aimed to diversify the existing cereal-based cropping system, improve productivity and reduce dependence on traditional paddy–wheat cultivation.

Institutional Support and Extension Interventions

KVK Kaushambi facilitated the implementation of the technology through village-level surveys and farmer selection in coordination with the Gram Pradhan. Timely sowing, field-level technical guidance, regular visits by KVK scientists and interaction-based training were important components of the intervention. Farmers also received guidance on soil testing, integrated crop management, cultivation of salt-tolerant cereal crops and horticultural crop diversification. These activities helped strengthen farmers' technical knowledge and encouraged the adoption of improved agricultural practices in the NICRA village and surrounding areas.

Impact on Crop Productivity and Farm Returns

The adoption of beetroot variety Ragini F-1 resulted in an increase in productivity and farm income. According to the comparative performance data reported in the success story, beetroot yield under the demonstration was 228 q/ha, compared with 194 q/ha under farmers' practices, representing a 17.52% increase in productivity. The gross cost of cultivation was ₹56,400/ha under the demonstration, compared with ₹55,400/ha under farmers' practices. Gross income increased from ₹3,49,200/ha to ₹4,10,400/ha, while net income increased from ₹2,93,800/ha to ₹3,54,000/ha. Thus, the demonstrated technology generated an additional net income of ₹60,200/ha over farmers' practices, highlighting the economic potential of beetroot cultivation as a crop diversification option.

Improvement in Livelihood and Technology Adoption

The successful cultivation of beetroot helped demonstrate the potential of horticultural diversification to strengthen the livelihood of small and marginal farmers. The increased net income provided an incentive to adopt improved cultivation practices and consider alternatives to conventional cereal-based cropping systems. The performance of Ragini F-1 also encouraged horizontal dissemination of the technology among farmers in the selected village and neighbouring NICRA villages, creating opportunities for wider adoption of diversified cropping systems.



Farmers' Feedback and Replication Potential

Following the successful implementation of the demonstration, farmers expressed strong interest in the performance of beetroot variety Ragini F-1 and its improved cultivation practices. Shri Chandrasekhar Maurya emerged as a role model for farmers in his village and nearby areas. The reported increase in yield and net income motivated other farmers to explore beetroot cultivation as an additional income-generating enterprise. The intervention indicates that improved horticultural varieties, supported by timely technical guidance and institutional extension services, can encourage crop diversification and contribute to agricultural livelihood improvement in Kaushambi district.

Overall Outcome and Significance

The NICRA-supported beetroot demonstration by KVK Kaushambi during Rabi 2024–25 illustrates the potential of horticultural crop diversification to improve farm productivity and profitability in areas where soil sodicity is an important production constraint. The demonstrated Ragini F-1 variety achieved a 17.52% increase in yield and an additional net income of ₹60,200/ha compared with farmers' practices. The experience highlights the importance of location-relevant crop selection, farmer training, timely technical support and participatory demonstrations in promoting climate-resilient and economically viable farming systems. Scaling up suitable horticultural diversification options, alongside soil testing and integrated crop management, may further strengthen farmers' livelihoods and improve agricultural resilience in Kaushambi district.



ude: 25.546668
itude: 81.63497



Recognition for Field-Level Impact

ICAR-AEXT-ATARIKAN-UnitEstablishment-2024-073



INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Certified that

Raghwendra Singh

(Lead Developer)

Associate Developers

Shantanu Kumar Dubey, U.S. Gautam, S.K. Singh

Sadhna Pandey, Seema Yadav, Rajeev Singh

Dharm Vir Singh, Ajay Kumar, Rajeev Singh

of

ICAR-ATARI, Kanpur

has developed the technology

**Custom Hiring Centre as the process for
enhancing farm efficiency for supplementing climate
resilience regime in Uttar Pradesh**

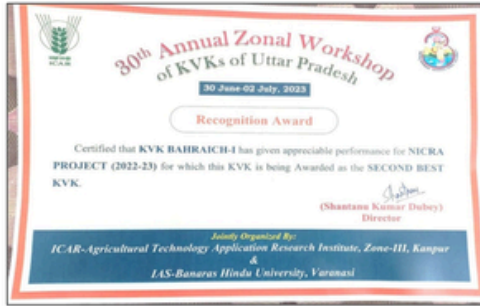
16th July, 2024
New Delhi

(Rajarshi Roy Burman)
Assistant Director General (AE)

(U.S. Gautam)
Deputy Director General (AE)



Photographs of Awards



48





भारत
ICAR

ICAR - Agricultural Technology Application Research Institute
(ATARI), Zone-III, Kanpur (UP)

