Agricultural Adaptation and Resilience in Response to Climate Variability

Technology Demonstration Component
National Innovations in Climate Resilient Agriculture (NICRA)

Annual Report 2023-24

भाकृअनुप– कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान
क्षेत्र–1, लुधियाना–141004, पंजाब, भारत
ICAR–Agricultural Technology Application Research Institute
Zone–1, Ludhiana–141 004, Punjab, India

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ANNUAL REPORT
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Ashish Santosh Murai
Palvi Kataria
Parvender Sheoran

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ICAR- Agricultural Technology Application Research Institute, Zone-I,
Ludhiana-141 004, Punjab, India
Telephone: 0161 - 2401018; Fax: 0161 - 2412719
e-mail Id: atari.ludhiana@icar.gov.in
Website: https://atariz1.icar.gov.in/

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Designed By : Gurpreet Singh

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KVK	Contributors		
	Head of KVK	**Project In-charge**	**SRF/YP**
Bathinda	Gurdeep Singh Sidhu	Gurmeet Singh Dhillon	Parkash Singh Sidhu
Faridkot	Amandeep Singh Brar	Rakesh Kumar	Dharamjit Singh
Gurdaspur	Sarbjit Singh Aulakh	Anil Kumar khokhar	-
Moga	Amandeep Singh Brar	Manpreet Jaidka	Harkanwaljot Singh
Bandipora-I	Tariq Sultan	Tahir Saleem	Saba Bukhari
Anantnag	Ishtiyaq A. Khan	Ishtiyak Ahmad Mir	Suheel Ahmad Ganai
Kathua	Vishal Mahajan	Berjesh Ajrawat	Sushant Sharma
Poonch	Ajay Gupta	Mushtaq Guroo, Muzafar Mir	Ramandeep Kour
Chamba	Rajeev Raina	Kehar Singh Thakur	-
Kullu	Chanderkanta Vats	R.K. Rana	Pooja
Mandi	Pankaj Sood	Shakuntla Rahi	Ranjana Kumari
Bilaspur	Seema Shah	Manpreet Kour	-
Tehri garhwal	Aalok Gulabrao Yewale	Aalok Gulabrao Yewale	Udit joshi
Uttarkashi	Chitrangad Singh Raghav	R.L Meena	Pankaj Chauhan
Bageshwar	Raj Kumar	Kamal Kumar Pande	Suraj Kumar
Champawat	Amresh Sirohi, Deepali Tewari Pandey	Sachin Pant	Leema
Leh-I	Feroz Din Sheikh	Kunzang Lamo	Stanzin Dorjey

PREFACE

भाकृअनुप– कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान
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ICAR–Agricultural Technology Application Research Institute
Zone–1, Ludhiana–141 004, Punjab, India

Climate change poses significant threats to food security and economic stability worldwide, with India being particularly vulnerable due to its substantial reliance on agriculture and allied sectors for sustenance. To address these challenges, the Indian Council of Agricultural Research (ICAR) launched the "National Innovations in Climate Resilient Agriculture (NICRA)" network project in February 2011. This initiative aims to enhance the resilience of Indian agriculture—including crops, livestock, and fisheries—by developing and applying advanced production techniques and risk management strategies to combat climatic variability and change.

A cornerstone of this project, the Technology Demonstration Component (TDC), has been instrumental in promoting climate-resilient practices across vulnerable districts in the country. Through the dedicated efforts of ICAR-ATARI, Zone-I, Ludhiana, and in partnership with Krishi Vigyan Kendras (KVKs), the TDC has collaborated with farmers and stakeholders to implement impactful, location-specific demonstrations, capacity-building programs, and extension activities across 17 districts in Punjab, Himachal Pradesh, Uttarakhand, Jammu & Kashmir, and Ladakh.

The initiative has introduced a range of technological interventions, including in-situ moisture conservation methods, water harvesting techniques, climate-resilient crop varieties, heat-tolerant livestock breeds, capacity-building workshops, and the establishment of community seed and fodder banks. These measures aim to stabilize agricultural productivity and profitability while addressing the vulnerabilities posed by climate change. Additionally, community-level mechanisms have been introduced to foster cooperation and resource-sharing, further strengthening the resilience of the farming communities.

This publication highlights the significant achievements of the TDC-NICRA project during 2023–24. We extend our deepest gratitude to Dr Himanshu Pathak, Secretary, DARE, and Director General, ICAR; Dr U. S. Gautam, Deputy Director General (Agricultural Extension), ICAR; and the NICRA-TDC team at ICAR-CRIDA, Hyderabad, for their guidance and support in the project's implementation and this publication's preparation.

We also wish to express our appreciation to the Directors of Extension Education at various State Agricultural Universities in Zone-I, Programme Coordinators of NICRA KVKs, and most importantly, the farmers, farmwomen, and stakeholders whose contributions have been integral to this initiative. Our gratitude extends to the dedicated scientists and staff at ATARI for their relentless efforts in compiling this document in an accessible and practical format.

We are optimistic that the collaborative efforts of KVK-ATARI will continue to yield impactful results, empowering farmers to adopt practices that mitigate losses and reduce the risks associated with climate variability and change.

NICRA Project Team

CONTENTS

S.No.	Title	Page No.
	Preface	
	Introduction	1 - 2
1	Bathinda, Punjab	3 - 18
2	Faridkot, Punjab	19 - 40
3	Moga, Punjab	41 - 52
4	Gurdaspur, Punjab	53 - 70
5	Mandi, Himachal Pradesh	71 - 100
6	Bilaspur, Himachal Pradesh	101 - 110
7	Kullu, Himachal Pradesh	111 - 132
8	Chamba, Himachal Pradesh	133 - 146
9	Champawat, Uttarakhand	147 - 152
10	Tehri Garhwal, Uttarakhand	153 - 168
11	Bageshwar, Uttarakhand	169 - 176
12	Uttarkashi, Uttarakhand	177 - 186
13	Leh, Ladakh	187 -196
14	Kathua, Jammu & Kashmir	197 - 204
15	Poonch, Jammu & Kashmir	205 - 216
16	Anantnag, Jammu & Kashmir	217 - 226
17	Bandipora, Jammu & Kashmir	227 - 234
I	Zonal Workshop	235 - 238
II	Annexures	239 - 246

भाकृअनुप
ICAR

Introduction

Climate change is one of the most pressing challenges facing humanity today, exerting significant pressure on global economies and critical concerns like food and nutritional security. In countries like India, where agriculture is the backbone of livelihoods and sustains a rapidly growing population, addressing climate change is paramount. Recognizing this, the Indian Council of Agricultural Research (ICAR) launched the National Innovations in Climate Resilient Agriculture (NICRA) program in February 2011, initially titled the National Initiatives in Climate Resilient Agriculture.

NICRA emphasizes innovative strategies to combat climate change. By adopting localized and climate-smart technologies, farming communities can better navigate extreme weather and climatic shifts. These technologies not only enhance adaptability but also contribute to lowering Greenhouse Gas (GHG) emissions.

Agricultural resilience refers to the sector's capacity to endure and swiftly recover from the adverse effects of climate change. NICRA aims to address this by developing effective responses to climate variability and enhancing the sector's resilience through Strategic Research, Technology Demonstration, Capacity Building, and Sponsored/Competitive Grants.

Technology Demonstration Component (TDC-NICRA)

A pivotal element of NICRA is its Technology Demonstration Component (TDC), which involves participatory demonstrations of climate-resilient technologies directly on farmers' fields. These demonstrations are complemented by extension activities and capacity-building initiatives to promote the widespread adoption of such innovations. Within demonstration villages, integrated technology packages target adaptation and mitigation strategies for crop and livestock systems to address climate variability. Initiated during the XII Five Year Plan, this component extends its activities to surrounding areas via Krishi Vigyan Kendras (KVKs).

Objectives of TDC-NICRA

1. Strengthen the resilience of agriculture, including crops, livestock, and fisheries, against climate variability and change through advanced production and risk management technologies.
2. Conduct site-specific demonstrations of climate-resilient technologies in vulnerable districts.
3. Raise awareness and build capacity among farmers and other stakeholders in resilient agricultural practices.

Approach to Demonstrating Climate-Resilient Technologies

Demonstrating climate-resilient technologies involves a structured, step-by-step approach:

1. **Climatic Constraint Analysis**: Examine long-term climate data to identify specific challenges and vulnerabilities faced by the village.

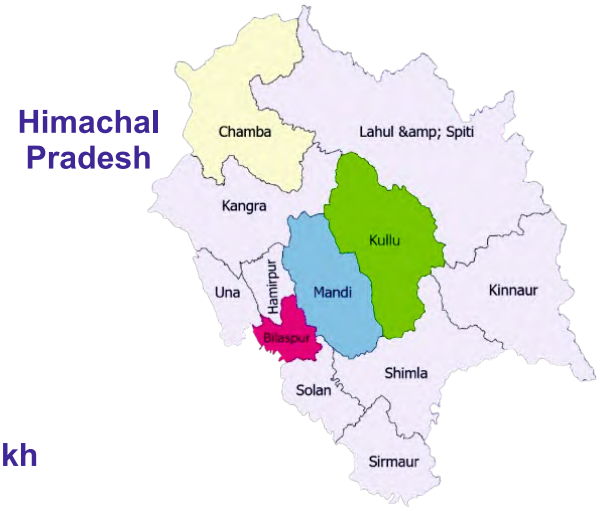
2. **Natural Resource Assessment**: Evaluate available resources to determine their condition and potential for supporting climate-resilient initiatives.

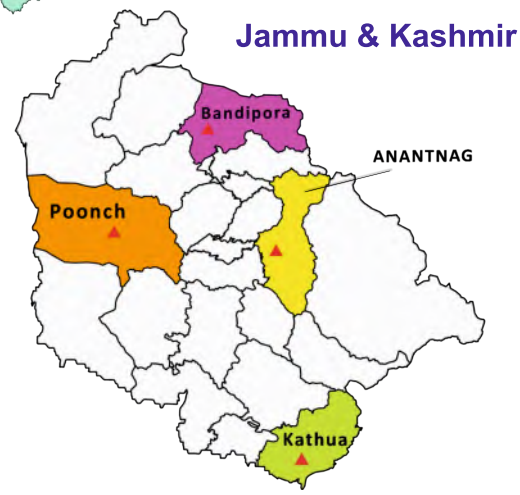
3. **Production System Identification**: Focus on key agricultural systems to implement targeted interventions.

4. **Institutional Structure Review**: Analyze existing institutional frameworks to pinpoint areas for improvement.

5. **Community Engagement**: Conduct focus group discussions with farmers and stakeholders to finalize effective interventions.

The selection of interventions is tailored to unique climate-related challenges and resources. Concurrently, capacity-building programs equip farmers with knowledge and tools to address climate challenges effectively. These efforts aim to build robust agricultural systems and strengthen communities against the impacts of climate change.





Bathinda

1

Bathinda District, located in the southern region of Punjab State, lies at the heart of the Malwa region. It is positioned between 29°33' to 30°36' North and 74°38' to 75°46' East. The district shares borders with Haryana's Sirsa and Fatehabad in the south, Sangrur and Mansa districts in the east, Moga in the northeast, and Faridkot & Muktsar in the northwest. Covering an area of 3,385 square kilometres, the district had a population of 1,388,525 as per the 2011 Census. Bathinda District comprises a total of 292 villages (including seven Municipal Councils namely Sangat, Raman Mandi, Maur, Kotfatta, Rampura, Bhucho Mandi, Goniana, and Municipal Corporation Bathinda) and five uninhabited villages. Additionally, there are 307 Gram Panchayats and 9 Market Committees operating within the district.

The district is home to 86,167 farming families, among which 4,860 are classified as marginal and small farmers, owning less than 2 hectares of land. This highlights the urgent need for initiatives promoting cooperative farming to enhance agricultural profitability. Climate-wise, Bathinda experiences extreme weather conditions. Summers are scorching hot, winters are bitterly cold, and the year can be divided into three seasons. The cold winter spans from November to February, followed by the hot, dry summer from March to June, and a mild rainy season from June to September. Dust storms are common during the summer, and the monsoon, which typically begins in July, brings limited rainfall, with occasional showers in the winter months.

NICRA VILLAGES:

The villages within Bathinda District that were selected for the implementation of climate-resilient technologies under the NICRA (National Innovations in Climate Resilient Agriculture) program are detailed in Table 1.1. The program's inception in 2010 commenced with village Killi Nihal Singh. Subsequently, six additional villages in this district, namely Deon, Burj Mehma, Mehma Sarja, Bhisiana, Kothe Chet Singh and Mehma Sarkari, were also included for the demonstration of climate-resilient technologies.

Table 1.1 Information about the NICRA villages

Details of Villages	Village 1	Village 2	Village 3	Village 4	Village 5	Village 6	Village 7
Name	Killi Nihal Singh	Deon	Burj Mehma	Mehma Sarja	Bhisiana	Kothe Chet Singh	Mehma Sarkari
Year adopted in NICRA	2010	2017	2018	2018	2021	2021	2023

FARMING SYSTEM TYPOLOGIES:

The farming system typology within the NICRA villages was categorized into two sections: Irrigated without animal (FST 3) and Irrigated with animal (FST 4) (Table 1.2). A large number of farmers of all villages are actively engaged in the FST 4 category. This phenomenon can be attributed to the fact that a majority of the farmers in NICRA villages opted for livestock farming in conjunction with agriculture to enhance their income and produce milk-based products at the household level. Additionally, the incorporation of farmyard manure derived from livestock rearing played a vital role in boosting crop productivity and enriching soil nutrients. Among these villages, Killi Nihal Singh exhibited the highest degree of farmer engagement in FST 4 (Irrigated with animal).

Table 1.2: Summary of Interventions

Villages	No. of farmers involved in demonstrations	
	FST 3 (Irrigated without animal)	FST 4 (Irrigated with animal)
Killi Nihal Singh	14	72
Deon	17	20
Burj Mehma	12	59
Mehma Sarja	10	27
Bhisiana	2	10
Mehma Sarkari	16	37
Total	**71**	**225**

TECHNOLOGY DEMONSTRATIONS:

Climate-resilient technologies were effectively showcased within FST 4 (Irrigated with animal), focusing on natural resource management technologies like Direct Seeded Rice (DSR), Happy Seeder technology, Super Seeder and Surface Seeder technology (Table 1.3). Crop production within

Table 1.3: Climate Resilient Technologies (CRTs)

Irrigated with animal (FST 4)		
Natural Resource Management (NRM)	**Crop Production**	**Livestock**
Direct Seeded Rice (DSR)	Summer Moong	Backyard poultry
Happy Seeder technology (Wheat sown /residue retention)	Application of pre-emergence herbicide in DSR (Stomp Pendimethalin 30 EC)	Mineral mixture
Super Seeder technology (Wheat sown /residue incorporation)	Short duration variety of Paddy (PR 126)	Silage (Maize)
Surface Seeder technology (Wheat sown/residue retention)	Foliar application of potassium nitrate (13:0:45) in Paddy	Fodder production (Maize J 1006)
	Heat-tolerant variety of Wheat (PBW 826)	
	Foliar application of potassium nitrate (13:0:45) in Wheat	
	Gram var. PBG 8 (Low water requiring crops)	
	Vermicompost	
	Kitchen gardening	

Irrigated without animal (FST 3)	
Natural Resource Management (NRM)	**Crop Production**
Direct Seeded Rice (DSR)	Summer Moong
Happy Seeder technology (Wheat sown /residue retention)	Application of pre-emergence herbicide in DSR (Stomp (Pendimethalin) 30EC)
Super Seeder technology (Wheat sown /residue incorporation)	Short duration variety of Paddy (PR 126)
Surface Seeder technology (Wheat sown/residue retention)	Foliar application of potassium nitrate (13:0:45) in Paddy
	Heat-tolerant variety of Wheat (PBW 826)
	Foliar application of potassium nitrate (13:0:45) in Wheat
	Gram var. PBG 8 (Low water requiring crops)
	Vermicompost
	Kitchen gardening

FST 4 was significantly improved through strategic measures, which involved the incorporation of summer moong in crop rotation, the application of pre-emergence herbicide in DSR, the use of short-duration paddy varieties, foliar application of KNO_3 sprays, the cultivation of heat-tolerant wheat varieties, promotion of kitchen gardening, cultivation of low water requiring crops and vermicomposting. In terms of livestock management, farmers were encouraged to establish backyard poultry operations, employ mineral mixtures, utilize maize-based silage, and grow high-quality fodder for improved livestock nutrition.

Within FST 3 (Irrigated without animal), similar climate-resilient technologies were demonstrated, also focusing on natural resource management and employing the same technologies as in FST 4 (Irrigated with animal). To enhance crop production, the same strategies were applied in FST 3 as in FST 4. The primary distinction lies in livestock production and management within FST 3.

NATURAL RESOURCE MANAGEMENT (NRM) INTERVENTIONS:

Demonstrations on Climate Resilient Technologies (CRTs) were adopted on a larger scale, with the active participation of 50 farmers covering 20 hectares in Direct Seeded Rice (DSR). And 20 farmers covering 8 hectares adopted Happy Seeder technology (wheat sown /residue retention) (Table 1.4). Similarly, Super Seeder technology (wheat sown /residue incorporation) and Surface Seeder Technology (wheat sown/residue retention) were also adopted in all villages, with the active participation of 40 farmers and 5 farmers on 16 hectares and 4 hectares respectively.

Table 1.4: NRM interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Direct Seeded Rice (DSR)	50	50	20
Happy Seeder technology (Wheat sown /residue retention)	20	20	8
Super Seeder technology (Wheat sown /residue incorporation)	40	40	16
Surface Seeder technology (Wheat sown/residue retention)	5	5	4

Direct Seeded Rice (DSR) demonstration field

Demonstration on Wheat sown with Happy Seeder

CROP PRODUCTION INTERVENTIONS:

The demonstrations had a significant impact, resulting in the adoption of various technologies by a considerable number of farmers. Active farmer participation was observed in demonstrations focusing on summer moong, application of pre-emergence herbicide in DSR (Stomp (Pendimethalin) 30 EC), short duration variety of paddy (PR 126), foliar application of potassium nitrate (13:0:45) in paddy, heat tolerant variety of wheat (PBW 826), etc. Numerous farmers embraced these technologies to improve income and achieve greater yield profitability. The dissemination of these technologies was facilitated through demonstrations and training sessions, contributing to widespread adoption among the farming community.

LIVESTOCK INTERVENTIONS:

Demonstrations on Climate Resilient Technologies (CRTs) were adopted on a larger scale, with the active participation of 60 farmers covering 24 hectares in fodder maize production (J 1006), followed by 30 farmers providing mineral mixtures to 90 animals. (Table 1.6). Additionally, maize as silage and backyard poultry practices were also adopted by many farmers.

Table 1.5: Crop Production interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Summer Moong	40	40	16
Application of pre-emergence herbicide in DSR (Stomp (Pendimethalin) 30EC)	50	50	20
Short duration variety of Paddy (PR 126)	40	40	40
Foliar application of potassium nitrate (13:0:45) in Paddy	20	20	8
Heat-tolerant variety of Wheat (PBW 826)	10	10	4
Foliar application of potassium nitrate (13:0:45) in Wheat	50	50	40
Gram var. PBG 8 (Low water requiring crops)	10	10	2
Vermicompost	2	2	-
Kitchen gardening	200	200	-

Table 1.6: Livestock interventions

Resilient practice	No. of Demo	Farmers covered	No. of animals covered	Area covered (ha)
Backyard poultry	10	10	200 birds	-
Mineral mixture	30	30	90	-
Silage (Maize)	15	15	-	12
Fodder production (Maize J 1006)	60	60	-	24

Monitoring of Summer Green Gram crop

Silage making unit in the NICRA village

BY-PRODUCTS PRODUCED:

Among the different crops and other interventions 48.7 q/ha wheat straw, 12.0 q/ha mustard oil cake and 54.7 q/animal/year farm yard manure were produced as by-products. The selling price for wheat straw was Rs. 280 /q, Rs. 2800 /q for mustard oil cake and 150/q obtained by the farmers.

Table 1.7: By-products produced and recycled

By product produced	Quantity (q/ha)	Selling price (Rs./q)	Amount mobilised (Rs./ha)
Wheat straw	48.7	280	13636
Mustard oil cake	12.0	2800	33600
Farmyard manure	54.7 q/animal/year	150	8205

CUSTOM HIRING CENTRE:

The Custom Hiring Center (CHC) is a vital facility that houses a wide range of agricultural machinery, implements, and equipment available for rental on an as-needed basis. Its primary objective is to provide small, marginal, and low-income farmers with affordable access to agricultural machinery, allowing them to rent equipment at reduced rates for short-term usage. The CHC plays a pivotal role in ensuring that these farmers can commence their farming activities on schedule, without the financial burden of purchasing costly machinery. The CHC model involves the active collaboration of farmers, entrepreneurs, and societies, all working together to enhance agricultural productivity and improve the livelihoods of rural communities.

Table 1.8: Institutional interventions (Custom Hiring Centre)

Implements	Amount mobilised (Rs.)	Farmers covered	Area covered (ha)
Direct Seeding Rice Drill	1600	5	6.0
Happy Seeder	800	3	3.2
Rotavator	5650	14	22.6
Soil Steering Plough (7 tynes)	900	2	3.6
Sub-soiler (single tyne)	200	1	0.8
Multi Crop Raised Bed Planter	1200	5	4.8

In Bathinda district, the performance of the CHC was assessed during the period under consideration, revealing active farmer participation in the utilization of rotavators over a large area, highlighting the machine's potential and its impact on farmers (Table 1.8). This was followed by the adoption of the Direct Seeding Rice Drill, Multi Crop raised bed Planter, Soil Steering Plough (7 tynes), Happy Seeder and Sub-soiler (single tyne) by the farmers.

SEED PRODUCTION:

During the year 2023-24, seed production activities were carried out in NICRA villages, with the active participation of 6 farmers in the production of Berseem (BL 42) across 2 hectares, and 8 farmers in the production of paddy (PR 126) across 6 hectares. Additionally, 2 farmers were engaged in the production of GSC 7 gobhi sarson seeds, utilizing just 1.6 hectares of land (Table 1.9).

Table 1.9: Institutional interventions (Seed bank)

Seed system	Seed produced (tonnes)	Farmers covered	Area covered (ha)	Amount mobilised (Rs.)
Berseem (BL 42)	0.2	6	2.0	54000
Paddy (PR 126)	20.0	8	6.0	80000
Gobhi Sarson (GSC 7)	2.0	2	1.6	2000

FODDER PRODUCTION:

In NICRA villages, a total of 1,027 tonnes of maize fodder was produced by 60 farmers across 24 hectares, while 15 farmers produced 540 tonnes of maize silage on 12 hectares. The initiative mobilized Rs. 51,350 and Rs. 29,700 for maize and maize silage, respectively (Table 1.10).

Table 1.10: Institutional interventions (Fodder bank)

Fodder system	Fodder produced (tonnes)	Farmers covered	Area covered (ha)	Amount mobilised (Rs.)
Maize (J 1006)	1027	60	24	51350
Maize Silage	540	15	12	29700

Exposure visit of farmers to PAU

CAPACITY BUILDING:

The capacity-building programs in 2023-24 had highest number of beneficiaries in natural resource management, with both men and women actively participated. This was followed by fodder and feed management and crop management (Table 1.11). Additionally, resource conservation technology, soil health management, nutritional garden and livestock management also received substantial participation from farmers.

Table 1.11: Capacity Building programmes (HRD)

Theme	No. of training programmes	Number of beneficiaries		
		Male	Female	Total
Crop management	2	52	0	52
Farm implements and machinery	1	28	0	28
Fodder and feed management	2	61	0	61
Forest tree/ agroforestry plantation	1	30	0	30
Management of horticultural crops	1	28	0	28
Natural resource management	2	64	6	70
Nutritional garden	1	44	4	48
Pest and disease management	1	39	0	39
Resource conservation technology	1	50	0	50
Livestock management	2	48	0	48
Seed production	1	31	0	31
Soil health management	1	50	0	50
Awareness of abuse on social issues	1	28	6	34
Water saving technology	1	36	0	36

EXTENSION PROGRAMS:

The extension activities conducted over time showed that the highest numbers of beneficiaries participated in awareness programs, followed by agro-advisory services. Field days, exposure visits of farmers, and group discussions also had a significant number of participants (Table 1.12).

NICRA awareness camp

Table 1.12: Other extension activities

Name of program	Participants
Exposure visits of farmers	92
Field days	98
Awareness	502
Women awareness	22
Group discussion	86
Soil health day	25
Agro advisory services	298

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

Demonstrations of Climate Resilient Technologies (CRTs) on wheat sown with Super Seeder were adopted on a larger scale in villages Killi Nihal Singh, Deon, Burj Mehma, Mehma Sarja, Bhisiana and Mehma Sarkari, with active participation from 30 farmers converged with State Department of Agriculture, and from village Mehma Sarkari and Deon, 2 farmers adopted this technology (Table 1.13). However, the cultivation of the short-duration paddy variety PR126 was adopted by 2 farmers who converged with the State Department of Agriculture.

Table 1.13: Summary of Upscaling of technologies

Village name	Technology scaling up/out	No. of farmers reached	Convergence with the programme
Killi Nihal Singh Wala, Deon, Burj Mehma, Mehma Sarja, Bhisiana, Mehma Sarkari	Wheat sown with Super Seeder	30	State Deptt. of Agriculture
Mehma Sarkari, Deon	Wheat sown with Surface Seeder	2	
Mehma Sarja	Direct Seeded Rice	2	

EXTREME WEATHER EVENTS:

In the period from July 2023 to March 2024, the NICRA villages within the Bathinda district encountered extreme weather events, including both heavy rainfall and high temperatures, which had a profound impact on the crops cultivated in these areas (Table 1.14). Excessive rainfall during July 2023 resulted in the shedding of flower buds, and flowers and sudden wilting in cotton crops. The high temperatures experienced during the second fortnight of August 2023 resulted in unfavourable conditions for horticultural crops, high mortality of young plants, and poor pollination in vegetable crops which ultimately resulted in low yield of crops.

The extreme weather events observed during January 2024 had significant repercussions on the crops, including severe frost and fewer sunshine hours of an average of 0.9 hours, which affected various crops such as potato, sarson, wheat and Neem tree (Table 1.14). Livestock (dairy animals and goatry) were also affected with foot and mouth disease (FMD) due to prolonged cloudy weather. Hailstorms and rainfall with high wind speed during 2024 caused the lodging of wheat, shredding the ear at the milking stage of wheat.

Table 1.14: Extreme events observed

Climate stress during the year (Drought, flood, heat stress, cold stress, cyclones etc)	No. of days	Crop	When (stage of the crop)	Impact on Crop
Heavy rainfall during 9,10 &17 July 2023 (91.8 mm)	3	Cotton	Flowering stage	Heavy rains resulted in the shedding of flower buds, and flowers and sudden wilting in cotton. Therefore, significant yield reduction occurred in cotton.
High-temperature second fortnight of August 2023 (Avg. T_{min} 27.1, T_{max} 36.4)	Second fortnight of August	Horticultural crops	Different stages	High mortality of young plants. Pollination in vegetables was affected which resulted in low-yield
Frost and less sunshine hours (Avg. 0.9hours) during January, 2024	January	Potato	Tuber formation	Frost injury occurred and the incidence of late blight in potato was higher.
		Sarson	Crop period	Prolonged cold weather results in a reduction in yield from last year.
		Wheat	-	High infestation of weeds like *Phalaris minor* (Guli Danda) due to prolonged cold weather and fewer sunshine hours. The farmers avoided the application of herbicides during this period due to the poor efficacy of herbicides.
		Neem tree	-	Long-time cold weather affected the Neem trees. Due to this, vegetative growth started very late. About 5-10% of Neem trees died.
		Livestock (dairy animals & goatry)	-	Spread of foot and mouth disease (FMD) due to prolonged cloudy weather
Hailstorm on 3 March 2024	1	Wheat	Milking stage	Lodging of wheat, shredding the ear in wheat due to the high speed of hailstorms
Rainfall with high wind speed in the first week of March 2024		Wheat		Lodging of wheat

SIGNIFICANT ACHIEVEMENTS:

The influence of technology demonstrations on farmers in NICRA villages was evident, with a notable impact observed (Table 1.15). A significant number of farmers (260) adopted the use of potassium nitrate in cotton and wheat which protect the crop from heat stress and increase the yield. This was followed by the adoption of silage production and kitchen gardening. Other technologies also garnered significant attention from farmers for adoption.

Table 1.15: Significant achievements

Description	No. of farmers covered	Impact
Direct Seeded Rice (DSR)	60	Saving in cost of cultivation and water
Kitchen Gardening	200	Provide fresh vegetables and save pocket money
Maize for Silage	230	Increase in milk production
Fruit Nutrition Garden	20	Provide fresh fruits
Wheat sown with Happy Seeder/Super Seeder	44	Improve soil health, save natural resources
A spray of potassium nitrate (13:0:45) on Cotton and Wheat	260	Protect the crop from heat stress and increase the yield

Table 1.16: Publications from the project

Description	Citation
Research paper	Sodhi G P S, Singh R K, Dhillon G S, Ahuja S, Kaur A, Sunidhi, Kaur T, Murai A S, Singh R and Kaur S (2023). Adoption behaviour of climate-resilient agricultural practices in Punjab under NICRA project. *IIJEE* **59 (2) (2023):** 46-50.
Research paper	Dhillon G S, Sidhu P S, Singh G and Singh P (2024). Farmer's participatory evaluation of wheat establishment methods following in situ rice residue management vis-à-vis conventional tillage in north-western India. *Journal of Community Mobilization and Sustainable Development* **19:** 263-270.

IMPACT OF CRTs:

The demonstration of Climate Resilient Technologies (CRTs) in the NICRA villages of Bathinda district exhibited remarkable positive outcomes for NICRA farmers.

NRM INTERVENTIONS:

Direct Seeding of Rice: The Direct Seeding of Rice (DSR) technique involves the direct sowing of rice seeds in the field, bypassing the traditional method of transplanting seedlings. Specialized tractor-powered equipment is used to drill the seeds into the soil, eliminating the need for seedling nurseries. This approach simplifies the rice cultivation process, making it more efficient and less labour-intensive. Directly sowing the seeds not only saves time but also reduces costs, all while achieving comparable or even improved yields compared to traditional transplanting methods. DSR is increasingly gaining popularity as an effective and sustainable approach to rice cultivation, contributing to enhanced productivity and the conservation of agricultural resources (Table 1.17 a).

Demonstration trials were carried out to assess the impact of Climate Resilient Technologies (CRTs) on both NICRA and Non-NICRA farmers, focusing on the use of direct-seeded rice. The results revealed that NICRA farmers adopting DSR saved water worth Rs. 3750 (Table 1.17 b), reducing the cost of cultivation by Rs. 52,820 as compared to Non-NICRA farmers (Table 1.17 a). These demonstrations underscore the potential of DSR utilization in agriculture and its capacity to bring about significant benefits.

Happy Seeder for paddy residue management: The Happy Seeder was developed to address the challenge of planting wheat seeds in fields obstructed by rice straw. This innovative tractor-mounted device efficiently chops and lifts rice straws, allowing for the seamless sowing of wheat into the soil. Furthermore, the Happy Seeder intelligently mulches the sown area with straw, promoting sustainable farming practices.

As part of the NICRA project's initiatives in adopted villages, successful demonstrations have been conducted for sowing wheat crops with the Happy Seeder in standing rice stubble fields, eliminating the need for traditional tillage. This method leverages the existing soil moisture, enabling the sowing of wheat without additional irrigation (Rauni) and saving approximately 7-10 days in the sowing process. The adoption of the Happy Seeder not only addresses the issue of rice straw interference during wheat sowing but also encourages water conservation and efficient land use. By preserving the rice stubble and incorporating it into the soil, the Happy Seeder contributes to improved soil health, reduced labour requirements, and enhanced crop productivity in the adopted villages.

In Bathinda, demonstrations conducted on wheat sown with the Happy Seeder had a positive impact on NICRA farmers, resulting in increased productivity of up to 60.5 quintals per hectare, reduced cultivation costs (Rs. 31,980 per hectare), including the saving of fertilizer cost Rs. 5340, labour cost Rs. 15300, pesticide cost Rs. 2625 and a huge amount of diesel Rs. 1760 (Table 1.17 b), improved gross returns (GR) at Rs. 1,37,637, as compared to Non-NICRA farmers (Table 1.17 a). These results highlight the substantial benefits of adopting the Happy Seeder in agriculture.

Table 1.17 a : Information on demonstrated NRM interventions

Crop	TD	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	COC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	COC (Rs./ha)	GR (Rs./ha)
Paddy	Direct Seeded Rice	PTR	24	73.9	52820	162801	20	74.6	54210	164343
Wheat	Happy Seeder	Wheat sowing following residue burning	20	60.5	31980	137637	20	54.5	42302	123987
Wheat	Super Seeder	Conventional	24	55.7	39042	126717	24	54.5	42302	123987
Wheat	Surface Seeder	CT	10	54.0	30955	122850	10	52.5	42302	119437
Total			**78**		**154797**	**550005**	**74**		**181116**	**531754**

Super Seeder for paddy residue management: The Super Seeder is an innovative tractor-mounted device designed to streamline the process of planting wheat in fields that have rice straw. It efficiently chops and incorporates paddy straw into the soil, facilitating the smooth planting of wheat. An important aspect addressed by the Super Seeder is the reduction of paddy residue burning during the wheat-sowing season. The burning of paddy residue not only hampers soil fertility but also releases harmful pollutants that can have adverse effects on human health, animals, and the environment. By utilizing the Super Seeder and promoting the incorporation of rice straw into the soil organic matter, farmers can effectively mitigate these negative impacts, promoting sustainable agricultural practices. Thus, the Super Seeder offers an efficient, eco-friendly, and soil-friendly approach to wheat planting while addressing the issue of paddy residue burning. This technology contributes to water conservation, soil enrichment, and a healthier environment for all.

Economically, demonstrations of wheat sown with the Super Seeder showed positive results for NICRA farmers in terms of reduced cost of cultivation compared to Non-NICRA farmers (Table 1.17 a). The productivity, which reached 55.7 quintals per hectare, was higher in the case of wheat sown with the Super Seeder. The gross return of Rs. 1,26,717 and the saving of diesel worth Rs. 2200 (Table 1.17 b) indicate promising results for this technology among NICRA farmers.

Table 1.17 b: Input saving

Technology demonstrated	Season	Input saving				
		NICRA farmers			Non-NICRA farmers	
		Input	Input Qty	Cost (Rs.)	Input Qty	Cost (Rs.)
Direct Seeded Rice (DSR)	*Kharif*	Fertilizer	325	1924	337.5	1998
		Water	-	3750	-	5250
		Labour	50	22500	60	27000
		Pesticide	-	7500	-	7600
		Seed	20	1125	12.5	703
Wheat sown with Happy Seeder	*Rabi*	Fertilizer	275 + 137.5	5340	325 + 137.5	5636
		Water	4	1000	5	1250
		Labour	34	15300	50	22500
		Pesticide	-	2625	-	3250
		Seed	112.5	4218	125	3125
		Diesel	20	1760	53.75	4730
Wheat sown with Super Seeder	*Rabi*	Fertilizer	325 + 137.5	5636	325 + 137.5	5636
		Water	5	1250	5	1250
		Labour	47	21150	50	22500
		Pesticide	-	3250	-	3250
		Seed	125	3125	125	3125
		Diesel	25	2200	57.75	4730
Wheat sown with Surface Seeder	*Rabi*	Fertilizer	275 + 137.5	5340	325 + 137.5	5636
		Water	4	1000	5	1250
		Labour	33	14850	50	22500
		Pesticide	-	2625	-	3250
		Seed	112.5	4218	125	3125
		Diesel	10	880	53.75	4730
Foliar application of 13:0:45	*Rabi*	Fertilizer	325 + 137.5	5636	325 + 137.5	5636
		Water	5	1250	5	1250
		Labour	50	22500	50	22500
		Pesticide	-	3250	-	3250
		Seed	125	3125	125	3125
		Diesel	53.75	4730	53.75	4730
		Foliar application of 13:0:45	10 kg	1800	-	-

(Units of input quantity: Fertilizer-kg, Water- no. of irrigation, Labour- No., Seed- kg, Diesel- ltr)

Surface Seeder for paddy residue management: Surface seeding of wheat is an environmentally friendly and cost-effective technique where paddy harvesting and wheat sowing occur simultaneously. This method has been introduced to effectively manage agroecosystems, ensuring sustained productivity and increased profits for farmers while preserving natural resources.

In Bathinda, demonstrations of Surface Seeding of wheat showcased its ability to enhance wheat productivity, reaching 54 quintals per hectare in NICRA fields, along with a reduction in the cost of cultivation (Rs. 30,955) for NICRA farmers, including saving of fertilizer cost Rs. 5340, labour cost Rs. 14,850, pesticide cost Rs.2625 and huge amount of diesel Rs. 880 (Table 1.17 b), as compared to Non-NICRA farmers (Table 1.17 a). Additionally, Gross Returns (GR) of Rs. 1,22,850 were higher for NICRA farmers than Non-NICRA farmers. These results underscore the significant potential of this technology in the rice-wheat farming system.

CROP INTERVENTIONS:

Summer green gram cultivation: The impact of Climate Resilient Technologies (CRTs) was demonstrated through the cultivation of the summer moong variety SM 1827 on farmers' fields in both NICRA and Non-NICRA villages. The results indicated that NICRA farmers achieved higher productivity, with 12.2 quintals per hectare, compared to Non-NICRA farmers, who averaged 10.5 quintals per hectare (Table 1.17 c).

The cost of cultivation of summer moong in NICRA fields at Rs. 29515 per hectare was lower compared to Rs. 29990 per hectare in Non-NICRA fields, the demonstration showcased that the adoption of the NICRA program led to increased gross returns (GR) of Rs. 94611 when compared to the Non-NICRA scenario.

Foliar spray of potassium nitrate (KNO_3) in Paddy: Foliar fertilizers serve as an effective means to boost nutrient levels in plants and address nutritional deficiencies. They offer a significant advantage in terms of high absorption efficiency, reaching levels as high as 90%, far surpassing the 10% absorption rate typically achieved with soil applications. Furthermore, their complete water solubility ensures immediate and direct access to the plant. It's worth noting that foliar sprays are generally less concentrated than soil-applied fertilizers.

Heat tolerant Wheat variety (PBW 826)

In the Bathinda district, demonstration trials were carried out to assess the impact of Potassium Nitrate spray on Paddy. The paddy demonstrations yielded higher productivity of 74.2 quintals per hectare in NICRA fields, as opposed to 73.4 quintals per hectare in Non-NICRA fields (Table 1.17 c). These trials revealed promising returns, with NICRA fields recording Cost of Cultivation (CC) at Rs. 54950, and Gross Returns (GR) of Rs. 1,63,462.6 per hectare, which surpassed the figures in the Non-NICRA fields. These demonstrations underscore the significant economic advantages of utilizing Potassium Nitrate treatment for paddy cultivation. They demonstrate a positive impact on yield and profitability, thereby encouraging farmers to consider its adoption in their agricultural practices.

Heat tolerant variety of Wheat: Climate resilient technologies demonstrated under crop interventions by adopting heat tolerant variety of wheat, resulted in enhanced productivity of 62q/ha. This improvement led to increased gross returns of Rs. 141,050 for selected NICRA farmers compared to Non-NICRA farmers.

Foliar spray of potassium nitrate (KNO_3) in Wheat: Demonstration trials were carried out to assess the impact of potassium nitrate spray in wheat crops. The wheat demonstrations yielded higher productivity of 58 quintals per hectare in NICRA fields, as opposed to 56.7 quintals per hectare in Non-NICRA fields (Table 1.17 c). These trials revealed promising returns, with NICRA fields recording cost of cultivation (CC) at Rs. 43720, and gross returns (GR) of Rs. 1,31,950 per hectare, which surpassed the figures in the Non-NICRA fields.

Demonstration on Wheat sown with Super Seeder

LIVESTOCK INTERVENTIONS:

Climate resilient technologies were demonstrated for FST 4 (Irrigated with animal) under livestock management by adopting mineral mixture and silage making, feeding to cows proved beneficial for NICRA farmers (Table 1.17 d). Average milk production was increased to 7.5 l/day/animal and 7.8 l/day/animal with mineral mixture and silage feeding respectively, improved gross returns at Rs. 337.5/day/animal and Rs. 351/day/animal of NICRA farmers as compared to Non-NICRA farmers. Also, the improved fodder variety of Maize (J 1006) proved beneficial to NICRA farmers, giving a fodder yield of 390 q/ha and gross returns of Rs. 1,75,500.

Table 1.17 c) Crop interventions

Crop	TD	Details of farmers' practice	Season	NICRA farmers				Farmers practice			
				Area (ha)	Yield (q/ha)	COC (Rs/.ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	COC (Rs./ha)	GR (Rs./ha)
Moong	POP for Summer Moong	CT	Summer	16	12.2	29515	94611	16	10.5	29990	81427
Paddy	Foliar application of 13:0:45	No foliar application of 13:0:45	*Kharif*	20	74.2	54950	163462	20	73.4	54560	161700
Wheat	Heat tolerant variety	Conventional	*Rabi*	10	62.0	42800	141050	10	58.2	42300	132405
Wheat	Foliar application of 13:0:45	No foliar application of 13:0:45	*Rabi*	40	58	43720	131950	40	56.7	42450	128992
Total				**86**		**170985**	**531073**	**86**		**169300**	**504525**

Table 1.17 d) Livestock interventions

TD	Details of farmers' practice	No.	NICRA farmers			Farmers practice				
			Avg. Milk Production (l/day/animal)	Selling price (Rs./kg)	Avg. Cost of production (Rs.) (Rs./day/animal)	Gross returns (Rs./day/ animal)	Avg. Milk Production (l/day/animal)	Selling price (Rs./kg)	Avg. Cost of production (Rs./day/animal)	Gross returns (Rs./day/ animal)
Mineral mixture	Conventional	50	7.5	45	162	337	7.3	45	165	328
Silage	Without silage	20	7.8	45	165	351	7.2	45	164	324
TD	**Details of farmers' practice**	**No.**	**Fodder Yield (q/ha)**	**Selling price (Rs./q)**	**Cost of production (Rs./ha)**	**Gross Returns (Rs./ha)**	**Fodder Yield (q/ha)**	**Selling price (Rs./q)**	**Cost of production (Rs/.ha)**	**Gross Returns (Rs./ha)**
Fodder production Maize (J-1006)	Fodder production local	50	390	450	27500	175500	350	450	27535	157500
Total					**27827**	**176188**			**27864**	**158152**

Faridkot

2

Faridkot, situated in the southwestern region of Punjab, India, serves as the administrative centre for the Faridkot district and the Faridkot division. The topography of the area is characterized by low-lying flat terrain, forming a depositional plain shaped by the rivers that traverse these plains. The climate in Faridkot is predominantly dry, featuring a scorching summer, a brief rainy season, and a brisk winter. The cold season spans from November to March, followed by the summer season extending until the end of June. The period from July to mid-September experiences the southwest monsoon season, while the latter half of September and October mark the post-monsoon or transition period.

NICRA VILLAGES:

Several villages in the district, namely Pindi Blochan, Ghuduwala, Veerewala, Bhag Singh Wala, and Jalaleana, were chosen for the Technology Demonstration Component of the National Innovations in Climate Resilient Agriculture (NICRA) in the years 2010, 2016, 2017, 2021, and 2022 respectively. All these villages are entirely dependent on irrigation without any rainfed or flood-prone areas.

Table 2.1: Information about the NICRA villages and the focus of activities in these villages

Details of Villages	Village 1	Village 2	Village 3	Village 4	Village 5
Name	Pindi Blochan	Ghudduwala	Virewala	Bhagh Singh Wala	Jalaleana
Year adopted in NICRA	2010	2016	2017	2021	2022

WEATHER PATTERN:

In the selected NICRA villages, the annual rainfall for 2023-24 was 623.4 mm. Despite encountering multiple dry spells lasting for 10, 15, and 20 days throughout 2023, a noteworthy intensive rain spell of over 60 mm/day occurred. There were no flood situations affecting crops in these villages.

Table 2.2: Rainfall characteristics

Month		Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Annual
Rainfall received (mm)		79.4	267.6	0	114	35.2	5.8	0	1.2	623.4
No. of dry spells during *Kharif* season 2023	>10 days	1	-	3	1	2	1	3	3	14
	>15 days	-	-	2	1	1	1	2	2	9
	>20 days	-	-	1	-	-	1	1	1	4
No. of intensive rain spells (2023)	>60 mm/day	-	2 (9th and 23rd July)	-	-	-	-	-	-	-

Table 2.3: Rainfall (mm) distribution

Rainfall 2023-24												
Date	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	0	0	0	3.2	70.0	0	0	0	0	0	0	4.8
2	0	0	0	4.0	0	0	0	0	0	0	0	0
3	0	0	0	0.8	0	0	0	0	0	0	0	0
4	0	0.1	0	0	14.0	0	0	0	0	0	0	0
5	0	0	0	0	4.8	0	0	0	0	0	0	0
6	0	0	0	0	9.6	0	0	0	0	0	0	0
7	0	0	0	0	0.2	0	0	0	0	0	0	0
8	0	0	0	0.2	48.6	0.2	2.0	0	0	0	0	0
9	0	0	0	0.2	0	0	0	0	0	0	0	0
10	0	0	0	0.3	0	0	8.0	0	0	0	0	0
11	0	0	0	0	0	0	4.0	0	0	0	0	0
12	0	0	0	0.1	0	0	0	0	0	0.1	0	0
13	0	0	0	0.2	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0.1	0	0	0	0	0	0
15	0.4	0	0	99.6	0.8	0	0	0.6	0	0	0	0
16	0	0	0	11.4	3.0	0	0	0	0	0	0	0
17	0	0	12	15.0	0	0	0	0	0	0	0	10.0
18	0	0	14.4	0	0	0	0	0	0	0	0	2.2
19	1	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0.8	0	0
21	0	0	58.4	21.8	0	0	0	0	0	0.2	0	2.8
22	0	0	0	11.0	0	0.1	0	0	0	0	0	0
23	0	0.6	0	21.2	0	0	0	0	0	0	0	0
24	0	0.2	0	3.2	0	0.8	0	0	0	0	0	2.0
25	0	0	0	0	0.1	36.4	0	0	0	0	0	46.2
26	0	0	0	0	0	3	0	0	0	0	0	0
27	0	0	0	0	0.1	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0.1	0
29	0	9	0	0.2	0	0	0	0	0.1	0	0	0
30	0	0.1	0	2.2	0	0	0	0	0.8	0	0	0.1
31	0	0	0	2.1	0	0	0	0	0	2.0	0	0.2

Monitoring of demonstration on DSR

Demonstration on Summer Moong

TECHNOLOGY DEMONSTRATIONS:

A maximum number of farmers (278) from selected NICRA villages actively participated in FST 4 system (Irrigated with animal) followed by 216 farmers in FST 3 (Irrigated without animal) for demonstrations of climate resilient technologies.

Table 2.4: Summary of Interventions

Village	No. of farmers involved in demonstrations	
	FST 3 (Irrigated without animal)	FST 4 (Irrigated with animal)
Village 1	63	89
Village 2	74	42
Village 3	31	69
Village 4	27	46
Village 5	21	32
Total	**216**	**278**

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Extensive demonstrations were carried out in chosen NICRA villages, covering a substantial area, to showcase various agricultural practices. These demonstrations encompassed Direct Seeded Rice (DSR), Zero Till Drill (ZTD), Happy Seeder (HS), Super Seeder, Smart Seeder, laser levelling, and green manuring. Among these, the largest area was dedicated to demonstrations focused on green manuring, as outlined in Table 2.5.

Table 2.5: Natural resource management interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
DSR	10	10	4
ZTD, HS, Super Seeder, Smart Seeder	160	160	64
Laser levelling	50	50	50
Green manuring (Dhaincha)	100	100	100

Demonstration on Paddy Straw Management

CROP PRODUCTION INTERVENTIONS:

Resilient agricultural technologies were showcased in FST 3 (Irrigated without animal) and FST 4 (Irrigated with animal) to enhance crop improvement, featuring the adoption of improved varieties such as summer moong (SML 1827), short duration rice (PR 126), foliar spray of KNO_3 on paddy and wheat and custom hiring centres for timely operations.

Table 2.6: Crop Production interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Summer Moong (SML 1827)	32	32	12.8
Short Duration Rice (PR 126)	192	192	172.8
Foliar spray of KNO_3 on Paddy and Wheat	186	186	148.0
Custom Hiring Centres for timely operations	216	216	472.0
Gobhi Sarson Canola (GSC 7)	50	50	20.0
New Wheat variety (PBW 766)	54	54	21.6
Kitchen gardening	192	192	0.4
Varietal evaluation	50	50	50.0

LIVESTOCK INTERVENTIONS:

For mineral mixture supplementation, 50 demonstrations covered 50 farmers and 400 animals. The *Kharif* fodder (Maize J 1006) and *Rabi* fodder Berseem (BL 42) initiatives covered 113 and 72 farmers, respectively, with corresponding areas of 33.2 ha and 12.5 ha. Urea molasses mineral blocks and backyard poultry practices involved 50 and 15 farmers, respectively, benefiting 400 animals and 750 poultry. Additionally, silage units and improved shelter initiatives had 22 and 1 demonstrations, while preventive vaccination and animal health checkups were conducted with 50 and 2 demonstrations, respectively, covering significant numbers of animals and farmers as mentioned in Table 2.7.

Table 2.7: Livestock interventions

Resilient practice	No. of Demo	Farmers covered	No. of animals covered	Area covered (ha)
Mineral Mixture	50	50	400	-
Kharif fodder (Maize J 1006)	113	113	594	33.2
Rabi fodder Berseem (BL 42)	72	72	512	12.5
Urea molasses mineral blocks	50	50	400	-
Backyard Poultry	15	15	750	-
Silage units	-	-	-	-
Animal health checkup	2	20	40	-
Deworming	50	50	400	-
Improved shelter	1	1	17	-
Preventive vaccination	2	50	300	-
Silage making	22	22	176	23.6

Demonstration on Maize Silage making

In the Faridkot district, the adoption of various agricultural technologies across five villages resulted in significant variations in productivity and net returns for NICRA farmers (Table 2.8 a).

The spray of KNO_3 showed a productivity range for NICRA farmers from 53.9 to 54.8 q/ha, with net returns ranging from Rs. 82,661 to Rs. 84,636. For Non-NICRA farmers, productivity ranged from 51.5 to 52.9 q/ha, with net returns from Rs. 75,554 to Rs. 80,264.

Happy Seeder technology demonstrated productivity for NICRA farmers between 54.3 and 55.5 q/ha, yielding net returns from Rs. 87,271 to Rs. 90,149. For Non-NICRA farmers, productivity ranged from 51.5 to 52.9 q/ha, with net returns from Rs. 75,554 to Rs. 80,264.

The Super Seeder had a productivity range for NICRA farmers from 52.7 to 53.6 q/ha, with net returns between Rs. 82,126 and Rs. 84,301. Non-NICRA farmers consistently achieved 51.5 to 52.9 q/ha, with net returns from Rs. 75,554 to Rs. 80,264. Smart Seeder productivity ranged from 54.6 to 55.4 q/ha for NICRA farmers, resulting in net returns from Rs. 85,946 to Rs. 89,481. Non-NICRA farmers had productivity from 51.5 to 52.9 q/ha, with net returns from Rs. 75,554 to Rs. 80,264. Surface Seeder technology resulted in NICRA farmers experiencing productivity between 52.5 and 53.5 q/ha, with net returns from Rs. 84,095 to Rs. 86,810. Non-NICRA farmers reached productivity from 51.5 to 52.9 q/ha, with net returns from Rs. 75,554 to Rs. 80,264.

The adoption of the short-duration variety PR 126 resulted in productivity ranging from 77.2 to 77.8 q/ha for NICRA farmers, with net returns between Rs. 1,22,423 and Rs. 1,24,429. Non-NICRA farmers achieved productivity from 75.5 to 76.5 q/ha, with net returns from Rs. 1,16,897 to Rs. 1,19,586.

The DSR (Direct Seeded Rice) technology showed productivity for NICRA farmers between 77.9 and 78.6 q/ha, yielding net returns from Rs. 1,26,354 to Rs. 1,28,835. For Non-NICRA farmers, productivity ranged from 75.5 to 76.5 q/ha, with net returns from Rs. 1,16,897 to Rs. 1,19,586.

Green manuring resulted in productivity for NICRA farmers from 76.3 to 76.96 q/ha, with net returns from Rs. 1,19,890 to Rs. 1,21,951. Non-NICRA farmers had productivity from 75.46 to 76.5 q/ha, with net returns from Rs. 1,16,897 to Rs. 1,19,586.

The crop GSC 7 demonstrated productivity for NICRA farmers ranging from 19.8 to 20.3 q/ha, with net returns from Rs. 85,735 to Rs. 89,343. Non-NICRA farmers saw productivity from 18.6 to 19.4 q/ha, with net returns from Rs. 78,922 to Rs. 84,161 (Table 2.8 a)

Overall, the cumulative results indicate that these technological interventions led to increased productivity and net returns for NICRA farmers across all five villages, highlighting their effectiveness in enhancing agricultural resilience and economic viability amidst climatic stress.

Table 2.8 a: Impact of CRTs in FST 3 (Farming system typology- Irrigated without animal)

(Village- Ghuduwala)

Technology adopted/ demonstrated		Irrigated without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Crop	Spray of KNO_3	13	54.8	84636	3.2	52.1	77919
NRM	Happy Seeder	5	54.9	89264	3.8	52.1	77919
NRM	Super Seeder	1	53.4	83671	2.0	52.1	77919
NRM	Smart Seeder	2	55.1	88674	2.6	52.1	77919
NRM	Surface Seeder	1	53.3	86205	2.4	52.1	77919
Crop	Short duration variety PR 126	5	77.5	123643	3.0	76.2	118510
NRM	DSR	12	78.4	128132	4.4	76.2	118510
NRM	Green manuring	16	76.8	121383	5.2	76.2	118510
Crop	GSC 7	2	20.2	88543	0.6	19.2	82103

(Village- Virewala)

Technology adopted/ demonstrated		Irrigated without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Crop	Spray of KNO_3	10	54.2	83241	3.4	51.5	76193
NRM	Happy Seeder	5	54.6	88271	4.0	51.5	76193
NRM	Super Seeder	1	53.0	82909	2.4	51.5	76193
NRM	Smart Seeder	2	54.7	87476	2.8	51.5	76193
NRM	Surface Seeder	1	52.9	85129	3.0	51.5	76193
Crop	Short duration variety PR 126	5	77.3	122971	3.8	75.5	116897
NRM	DSR	5	78.2	127287	3.6	75.5	116897
NRM	Green manuring	9	76.6	120668	4.6	75.5	116897
Crop	GSC 7	2	19.9	86620	0.4	18.6	78922

(Village- Pindi Blochan)

Technology adopted/ demonstrated		Irrigated without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Crop	Spray of KNO_3	13	54.7	84200	3.8	52.2	77554
NRM	Happy Seeder	5	54.6	88815	3.2	52.2	77554
NRM	Super Seeder	1	53.2	83428	1.0	52.2	77554
NRM	Smart Seeder	2	54.9	87945	3.6	52.2	77554
NRM	Surface Seeder	7	53.1	85850	3.0	52.2	77554
Crop	Short duration variety PR 126	18	77.8	124429	2.0	76.5	119437
NRM	DSR	16	78.6	128835	2.6	76.5	119437
NRM	Green manuring	3	76.9	121951	0.8	76.5	119437
Crop	GSC 7	13	20.3	89343	3.8	19.0	80774

(Village- Bhagh Singh Wala)

Technology adopted/ demonstrated		Irrigated without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Crop	Spray of KNO_3	9	53.9	82661	3.2	51.7	76179
NRM	Happy Seeder	5	54.3	87375	3.8	51.7	76179
NRM	Super Seeder	1	52.7	82126	2.0	51.7	76179
NRM	Smart Seeder	2	54.6	85946	2.6	51.7	76179
NRM	Surface Seeder	4	52.5	84095	3.0	51.7	76179
Crop	Short duration variety PR 126	8	77.2	122423	4.4	75.6	117177
NRM	DSR	6	77.9	126354	5.2	75.6	117177
NRM	Green manuring	2	76.3	119890	0.6	75.6	117177
Crop	GSC 7	9	19.8	85735	3.2	18.7	79158

(Village- Jalaleana)

Technology adopted/ demonstrated		Irrigated without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Crop	Spray of KNO_3	5	54.7	85549	3.0	52.9	80264
NRM	Happy Seeder	5	55.5	90149	3.6	52.9	80264
NRM	Super Seeder	1	53.6	84301	2.4	52.9	80264
NRM	Smart Seeder	2	55.4	89481	2.6	52.9	80264
NRM	Surface Seeder	2	53.5	86810	3.6	52.9	80264
Crop	Short duration variety PR 126	5	77.7	124309	3.2	76.4	119586
NRM	DSR	5	78.5	128578	4.0	76.4	119586
NRM	Green manuring	1	76.9	121925	0.6	76.4	119586
Crop	GSC 7	5	20.3	89175	3.0	19.4	84161

Input Saving due to technologies:

Direct Seeded Rice (DSR): In Direct Seeded Rice (DSR) technology, NICRA farmers saved on DAP fertilizer and water costs, using 325 kg of urea fertilizer costing Rs. 1,924, while Non-NICRA farmers used 337.5 kg costing Rs. 1,998. NICRA farmers did not use DAP, unlike Non-NICRA farmers who used 62.5 kg costing Rs. 1,625. Water usage for NICRA farmers cost Rs. 3,750 compared to Rs. 5,250 for Non-NICRA farmers. Labour costs for NICRA farmers were Rs. 22,500 for 50 labourers, whereas Non-NICRA farmers spent Rs. 27,000 for 60 labourers. Pesticide costs were Rs. 7,500 for NICRA and Rs 7,900 for Non-NICRA farmers. Diesel costs were Rs. 3,528 for 42 litres for NICRA farmers and Rs. 4,536 for 54 litres for Non-NICRA farmers.

Wheat Sown with Happy Seeder: NICRA farmers adopting the Happy Seeder technology used 275 kg of urea costing Rs. 1,650, compared to Non-NICRA farmers who used 325 kg costing Rs. 1,950. They also saved on DAP, using 137.5 kg costing Rs. 3,712, while Non-NICRA farmers used 150 kg costing Rs. 4,050. Four irrigations cost Rs. 1000 for NICRA farmers and five irrigations cost Rs. 1,250 for Non-NICRA farmers. Labour costs for NICRA farmers were Rs. 15,750 for 35 labourers, compared to Rs. 20,700 for 46 labourers for Non-NICRA farmers. NICRA farmers saved Rs. 2,550 in pesticide costs as compared to Non-NICRA farmers. Seed costs were Rs. 4,500 for 120 kg for NICRA farmers and Rs. 4,688 for 125 kg for Non-NICRA farmers.

Wheat Sown with Super Seeder: In the Super Seeder technology, NICRA farmers used 275 kg of urea costing Rs. 1,650, while Non-NICRA farmers used 325 kg costing Rs. 1,950. NICRA farmers used 137.5 kg of DAP costing Rs. 3,712, whereas Non-NICRA farmers used 150 kg costing Rs. 4,050.

Forty labourers costs Rs.18,000 for NICRA farmers compared to Rs. 20,700 for 46 labourers of Non-NICRA farmers. Pesticide costs were Rs. 2,850 for NICRA farmers and Rs. 3,300 for Non-NICRA farmers. Diesel costs were Rs. 3,360 for 40 litres for NICRA farmers and Rs. 4,620 for 55 litres for Non-NICRA farmers.

Wheat Sown with Surface Seeder: Using the Surface Seeder technology, labour costs for NICRA farmers were Rs. 16,200 for 36 persons, whereas Non-NICRA farmers spent Rs. 20,700 for 46 persons. Pesticide costs were Rs. 2,550 for NICRA farmers and Rs. 3,300 for Non-NICRA farmers. Seed costs were Rs. 4,313 for 115 kg for NICRA farmers and Rs. 4,688 for 125 kg for Non-NICRA farmers. Diesel costs were Rs. 2,100 for 25 litres for NICRA farmers and Rs. 4,620 for 55 litres for Non-NICRA farmers.

Wheat Sown with Smart Seeder: NICRA farmers used 137.5 kg of DAP costing Rs. 3,712, compared to 150 kg costing Rs. 4,050 for Non-NICRA farmers. Pesticide costs were Rs. 2,700 for NICRA farmers and Rs. 3,300 for Non-NICRA farmers. Diesel costs were Rs. 3,024 for 36 litres for NICRA farmers and Rs. 4,620 for 55 litres for Non-NICRA farmers.

Spray of Potassium Nitrate: For the spray of Potassium Nitrate technology, NICRA farmers used 275 kg of urea costing Rs. 1,650, while Non-NICRA farmers used 325 kg costing Rs. 1,950. NICRA farmers used 137.5 kg of DAP costing Rs. 3,712, compared to 150 kg costing Rs. 4,050 for Non-NICRA farmers. Pesticide costs were Rs. 3,150 for NICRA farmers and Rs. 3,300 for Non-NICRA farmers. Additionally, diesel costs were Rs. 4,200 for 50 litres for NICRA farmers and Rs. 4,620 for 55 litres for Non-NICRA farmers.

Short duration variety PR 126: For short duration variety PR 126, NICRA farmers used 325 kg of urea costing Rs. 1,924, while Non-NICRA farmers used 337.5 kg costing Rs. 1,998. NICRA farmers did not use DAP, whereas Non-NICRA farmers used 62.5 kg costing Rs. 1,625. Water usage for NICRA farmers cost Rs. 4,250 compared to Rs. 5,250 for Non-NICRA farmers. Labour costs for NICRA farmers were Rs. 23,400 for 52 persons, whereas Non-NICRA farmers spent Rs. 27,000 for 60 persons. Pesticide costs were Rs. 7,500 for NICRA farmers and Rs. 7,900 for Non-NICRA farmers. Diesel costs were Rs. 4032 for 48 litres for NICRA farmers and Rs. 4536 for 54 litres for Non-NICRA farmers.

Table 2.8 b: Input saving due to technologies (Irrigated without animal)

Technology adopted/ demonstrated	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost	Quantity	Cost
Direct Seeded Rice (DSR)	Fertilizer (urea)	325	1924	337.5	1998
	DAP	-	-	62.5	1625
	Water	-	3750	-	5250
	Labour	50	22500	60	27000
	Pesticide	-	7500	-	7900
	Seed	20	1125	12	675
	Diesel	42	3528	54	4536
Wheat sown with Happy Seeder	Fertilizer (urea)	275	1650	325	1950
	DAP	137.5	3712	150	4050
	Water	4	1000	5	1250

Technology adopted/ demonstrated	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost	Quantity	Cost
Wheat sown with Happy Seeder	Labour	35	15750	46	20700
	Pesticide	-	2550	-	3300
	Seed	120	4500	125	4688
	Diesel	30	2520	55	4620
Wheat sown with Super Seeder	Fertilizer (urea)	275	1650	325	1950
	DAP	137.5	3712	150	4050
	Water	5	1250	5	1250
	Labour	40	18000	46	20700
	Pesticide	-	2850	-	3300
	Seed	120	4500	125	4688
	Diesel	40	3360	55	4620
Wheat sown with Surface Seeder	Fertilizer (urea)	275	1650	325	1950
	DAP	137.5	3712	150	4050
	Water	4	1000	5	1250
	Labour	36	16200	46	20700
	Pesticide	-	2550	-	3300
	Seed	115	4312	125	4688
	Diesel	25	2100	55	4620
Wheat sown with Smart Seeder	Fertilizer (urea)	275	1650	325	1950
	DAP	137.5	3712	150	4050
	Water	4	1000	5	1250
	Labour	38	17100	46	20700
	Pesticide	-	2700	-	3300
	Seed	115	4313	125	4688
	Diesel	36	3024	55	4620
Spray of Potassium Nitrate	Fertilizer (urea)	275	1650	325	1950
	DAP	137.5	3712	150	4050
	Water	5	1250	5	1250
	Labour	46	20700	46	20700
	Pesticide	-	3150	-	3300
	Seed	112.5	4219	125	4688
	Diesel	50	4200	55	4620
	Potassium Nitrate	10	600	-	-
Short Duration Variety of Paddy (PR 126)	Fertilizer (urea)	325	1924	337.5	1998
	DAP	-	-	62.5	1625
	Water	-	4250	-	5250
	Labour	52	23400	60	27000
	Pesticide	-	7500	--	7900
	Seed	12	675	12	675
	Diesel	48	4032	54	4536

(Units of input quantity: Fertilizer-kg, Water- no. of irrigation, Labour- No., Seed- kg, Diesel- ltr, Cost- Rs.)

Table 2.8 c: Technology Demonstration and Farmers' Perceptions

Technology demonstrated	Specificity of Technology	Farmers' Perception of Technology
Spray of KNO_3	Foliar application of potassium nitrate helped in mitigating heat stress and checked grain sterility further aiding in grain filling, thereby, improving crop productivity.	Farmers who have adopted the technology as per the recommendation got higher yield.
Short duration variety PR 126	Since PR-126 is a short-duration variety that matures in about 125 days (From seed to seed), it saves water upto 15% and labour also. High-yielding variety with less straw load thus helps in the easy management of paddy straw which is the biggest problem in Punjab state.	Farmers who have adopted the technology as per the recommendation got higher yield, saved water, labour and even pesticides.
Green manuring	Green manuring helps in building organic matter, and soil structure, supplies nitrogen to the following crop and also increases the water-holding capacity of soil.	Farmers who have adopted the technology as per the recommendation got higher yield.
Happy Seeder	This technology sows wheat in the standing paddy stubbles in a way that disturbs the land only where the furrow opener has to move and the remaining land in the furrows remains as such which gives the mulching effect over the land that in turn restricts the growth of weeds and also helps in holding moisture in the field.	
Super Seeder	Super Seeder is the tractor-operated one-pass sowing solution machine. In this machine, a rotavator is fitted ahead of the seed cum fertilizer drill, which incorporates and mixes the paddy stubbles with soil, prepares land and SCF simultaneously sows wheat seeds. The rotavator used in this is fitted with J-type blades, that are fitted on rotary to ensure proper mixing of residues with soil effectively. This technology fulfils the apprehension of the farmers to sow the wheat seeds in the paddy straw without the visibility of straw on the field.	
Smart Seeder	This technology manages the paddy residues by incorporation and surface mulching, in this technology, straw is incorporated and mixed into soils on the area only where the seed is sown (up to 2-inch area between rows) and the rest area is left as such and, thus, smartly retains the benefits of both Happy Seeder and Super Seeder in a single machine. Wheat sown in a combine-harvested paddy field using the PAU Smart Seeder emerges earlier than Happy Seeder and Super Seeder. This technology has an added advantage over Super Seeder is that it operated with less fuel consumption and with less HP tractor than Super Seeder. In comparison with Happy Seeder, the field sown with Smart Seeder looks like the wheat sown after ploughing and over the ugly look of Happy Seeder sown field.	

Technology demonstrated	Specificity of Technology	Farmers' Perception of Technology
Surface Seeder	PAU Surface Seeder is a cost-effective and simple machine, equipped with a seed and fertilizer box featuring a fluted roller metering system. Mounted on a cutter-cum-spreader, it sows wheat seeds and applies basal fertilizer, while cutter-cum-spreader is used to cut stubble at a height of 4-5 inches above the soil surface and simultaneously spread the paddy straw evenly over the surface. A 45HP tractor or higher can easily operate this machine, sowing 1.5 acres of wheat in an hour.	Farmers who have adopted the technology as per the recommendation got a higher yield.

BY-PRODUCTS PRODUCED:

In five villages, Ghuduwala, Virewala, Pindi Blochan, Bhagh Singh Wala and Jalaleana, wheat straw as a by-product was produced and recycled, ranging from 35 to 39 quintals per hectare. The selling price of wheat straw was consistently Rs. 250 per quintal across all villages. In terms of financial mobilization from selling the wheat straw, Ghuduwala and Pindi Blochan both generated Rs. 9375 per hectare, Virewala and Bhagh Singh Wala each mobilized Rs. 8750 per hectare, and Jalaleana mobilized Rs. 9750 per hectare (Table 2.9). These findings indicate a significant production of wheat straw in the Faridkot district with a moderate variation in the quantity produced and amount mobilized across the different villages.

Table 2.9: By-products produced and recycled in farming system typologies

Village	By product produced	Quantity (q/ha)	Selling price (Rs./q)	Amount mobilised (Rs.)
Ghuduwala	Wheat straw	37.5	250	9375
Virewala		35.0	250	8750
Pindi Blochan		37.5	250	9375
Bhagh Singh Wala		35.0	250	8750
Jalaleana		39.0	250	9750

IMPACT OF CRTS IN FST 4 (IRRIGATED WITH ANIMAL):

The adoption of specific animal-based technologies among NICRA farmers in terms of productivity and net returns proved beneficial. For silage making with fodder maize, NICRA farmers cultivated 23.6 hectares, achieving productivity of 110 quintals per hectare and a net return of Rs. 49,500 per hectare, while Non-NICRA farmers did not adopt this technology. In the case of the combined use of mineral mixture (Min Mix), bypass fat, and UMMB (Urea Molasses Mineral Block) bricks, NICRA farmers had 156 animals with a productivity of 2029 kg/animal and a net return of Rs. 25,372 per animal. Non-NICRA farmers had 134 animals with a productivity of 1654.8 kg/animal and a net return of Rs. 11,075 per animal. The total net return for NICRA farmers from these technologies was Rs. 74,872, compared to Rs. 11,075 for Non-NICRA farmers (Table 2.10 a).

Table 2.10 a: Impact of CRTs in FST 4 (Irrigated with animal) (village 1&2)

Technology adopted/ demonstrated		Irrigated with animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha) or animal	Yield (q/ha or l/animal)	Net return (Rs./ha) or Rs/animal	Area (ha) or animal	Yield (q/ha) or l/animal	Net return (Rs./ha or Rs/animal)
Animal-based	Silage making with fodder Maize	23.6	110	49500	-	-	-
Animal-based	Min Mix +Bypass Fat + UMMB Brick	156	2029	25372	134	1654.8	11075
Total				**74872**			**11075**

Climate resilient technologies were demonstrated for FST 4 (Irrigated with animal) under livestock management in village Virewala by adopting Min Mix +Bypass Fat + UMMB Bricks, silage making, seeds of improved fodder varieties (Maize J 1006 and Berseem BL 42) feeding to cows proved beneficial for NICRA farmers (Table 2.10 b).

Table 2.10 b: Impact of CRTs in FST 4 (Irrigated with animal) (Village- Virewala)

Animal	No.	Technology adopted/ demonstrated	Yield (l/year)	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity (q/year)	Unit price (Rs.)	Net Returns (Rs./year)
CB Cow **(NICRA Farmer)**	32	Min Mix +Bypass Fat + UMMB Bricks (Silage making Seeds of Improved fodder varieties (Maize J 1006 and Berseem BL 42)	20543	34	66334	584	70	13634
CB Cow **(Non-NICRA Farmer)**	28	Without Min Mix, Bypass Fat and UMMB bricks Local fodder variety	14357	32.5	49817	512	70	11947

In village Ghudduwala, climate-resilient technologies were demonstrated for livestock management under FST 4 (Irrigated with animal). NICRA farmers adopted Min Mix, Bypass Fat, UMMB Bricks, and silage making, and fed cows with improved fodder varieties (Maize J 1006 and Berseem BL 42). This resulted in a gross return of Rs. 76,838 per animal and a net return of Rs. 13,610, while Non-NICRA farmers, using local fodder varieties and without these supplements, had a gross return of Rs. 55,963 per animal and net returns of Rs. 12,775.

Similarly, in village Pindi Blochan, NICRA farmers adopted the same technology that led to an annual production of 21,639 kg milk per year, with a selling price of Rs. 35 per kg, resulting in gross returns of Rs. 69,965 per animal and net returns of Rs. 14,052. In contrast, Non-NICRA farmers, using local fodder varieties and without these supplements, had an annual production of 15,598 kg milk per year, a selling price of Rs. 33 per kg, gross returns of Rs. 57,217 per animal, and net returns of Rs. 11,498/year.

(Village- Ghudduwala)

Animal	No.	Technology adopted/ demonstrated	Production (l/ year)	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity (q/year)	Unit price (Rs.)	Net Returns (Rs./year)
CB Cow **(NICRA Farmer)**	32	Min Mix +Bypass Fat + UMMB Bricks (Silage making Seeds of Improved fodder varieties (Maize J 1006 and Berseem BL 42)	23708	34.5	76838	419	70	13610
CB Cow **(Non-NICRA Farmer)**	30	Without Min Mix, Bypass Fat Local fodder variety	17812	32.5	55963	547	70	12775

(Village- Pindi Blochan)

Animal	No.	Technology adopted/ demonstrated	Production (l/year)	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity (q/year)	Unit price (Rs.)	Net Returns (Rs./year)
CB Cow **(NICRA Farmer)**	33	Min Mix +Bypass Fat + UMMB Bricks (Silage making Seeds of Improved fodder varieties (Maize J 1006 and Berseem BL 42)	21639	35	69965	602	70	14052
CB Cow **(Non-NICRA Farmer)**	27	Without Min Mix, Bypass Fat and UMMB bricks Local fodder variety	15598	33	57217	493	70	11498

The NICRA farmers used advanced technologies and improved fodder varieties, resulting in a higher production of 19,874 kg per year with a selling price of Rs. 35 per kg, leading to gross returns of Rs. 69,083 per animal. They also produce 512 quintals of by-products annually, sold at Rs. 70 per quintal, achieving net returns of Rs. 11,947 per year. In contrast, Non-NICRA farmers used traditional methods and local fodder varieties, producing 14,564 kg per year at Rs. 32 per kg, with gross returns of Rs. 54,848 per animal. Their by-product production was lower at 474 quintals per year, resulting in net returns of Rs. 11,078 per year.

NICRA farmers, who adopted climate-resilient technologies like mineral mix, bypass fat, UMMB bricks, and improved fodder varieties, achieved a higher annual production of 21,085 kg per year at a selling price of Rs. 35 per kg. This results in gross returns of Rs. 71,900 per animal for NICRA farmers. They also generated 567 quintals of by-products annually, priced at Rs. 70 per quintal, yielding net returns of Rs. 13,225 per year. Conversely, Non-NICRA farmers using traditional methods and local fodder varieties produced 12,538 kg per cow annually at Rs. 33 per kg, leading to gross returns of Rs. 54,001 per animal. Their by-product output is lower at 425 quintals per year, resulting in net returns of Rs. 9,812 per year.

(Village- Bhagh Singh Wala)

Animal	No.	Technology adopted/ demonstrated	Production (l/year)	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity (q/year)	Unit price (Rs.)	Net Returns (Rs./year)
CB Cow **(NICRA Farmer)**	28	Min Mix +Bypass Fat + UMMB Bricks (Silage making Seeds of Improved fodder varieties (Maize J 1006 and Berseem BL 42)	19875	35	69083	512	70	11947
CB Cow **(Non-NICRA Farmer)**	26	Without Min Mix, Bypass Fat and UMMB bricks, Local fodder variety	14564	32	54848	474	70	11078

(Village- Jalaleana)

Animal	No.	Technology adopted/ demonstrated	Production (l/year)	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity (q/year)	Unit price (Rs.)	Net Returns (Rs./year)
CB Cow **(NICRA Farmer)**	31	Min Mix +Bypass Fat + UMMB Bricks (Silage making Seeds of Improved fodder varieties (Maize J 1006 and Berseem BL 42)	21085	35	71900	567	70	13225
CB Cow **(Non-NICRA Farmer)**	23	Without Min Mix, Bypass Fat and UMMB bricks, Local fodder variety	12538	33	54001	425	70	9812

Table 2.10 c: Technology Demonstration and Farmers' Perceptions

Technology demonstrated	Specificity of Technology	Farmers' Perception of Technology
Min Mix +Bypass Fat + UMMB Bricks	Mineral mixture fulfils mineral losses due to sweating, and helps to overcome the heat stress, and ultimately conception rate increases. Bypass fat during the summer season helps to cover negative energy balance.	Farmers who have adopted the technology as per the recommendation got higher milk yield and better animal health.

BY-PRODUCTS PRODUCED AND RECYCLED:

Wheat straw is produced at a rate of 36 quintals per hectare and is sold at Rs. 250 per quintal. Cow dung has higher production, with 2,849 kg/animal generated, sold at Rs. 70 per quintal, resulted in amount mobilization of Rs. 1,99,399.

CUSTOM HIRING CENTRE:

The performance of implements used in agriculture was assessed during 2023 in NICRA villages where utilization of rotavators attracted farmers' interest.

Table 2.11: By-products produced and recycled in farming system typologies

By product produced	Quantity	Selling price (Rs./q)	Amount mobilised (Rs.)
Wheat straw	36 q/ha	250	-
Cow dung	2849 kg/animal	70	199399

Table 2.12: Institutional interventions (Custom Hiring Centre)

Implements	Amount mobilised (Rs.)	Farmers covered	Area covered (ha)
Rotavator	24000	67	96
Lucky Seed Drill	4000	15	16
Zero Till Drill	1625	16	13
Straw Reaper cum Shredder	11800	52	59
Fodder Cutter cum Loader	5000	8	5
Pre Seed Cleaner	1800	23	9
Spike Tooth Harrow	2800	31	28
Disc Harrow	4725	54	63
Happy Seeder	3000	7	6
Maize Bed Planter	6500	22	26
Smart Seeder	14000	31	28
Super Seeder	16000	27	32
Seven Tyne Chiesel Plough	3375	25	27
Single Tyne Chiesel plough	3000	19	24
Sarson Seed Cum Fertilizer Drill	4375	88	35

SEED PRODUCTION:

The seed system used for crop production during CRT demonstrations in 2023-24 showed great performance in the case of berseem, gobhi sarson and sugarcane where several farmers were involved.

Table 2.13: Institutional interventions (Seed bank)

Seed system	Seed produced (tonnes)	Farmers covered	Area covered (ha)	Amount mobilised (Rs.)
Sugarcane (COJ 91)	41.0	2	0.4	174250
Sugarcane (COJ 85)	38.5	3	0.4	163625
Gobhi Sarson Canola (GSC 7)	0.2	1	0.1	37500
Berseem (BL 42)	0.1	1	0.2	36000

FODDER PRODUCTION:

The Fodder Maize (J 1006) system produced 9.6 tonnes of fodder maize, involving 2 farmers and covering an area of 2.4 hectares, mobilizing an amount of Rs. 1,92,000.

Table 2.14: Institutional interventions (Fodder bank)

Fodder system	Fodder produced (tonnes)	Farmers covered	Area covered (ha)	Amount mobilised (Rs.)
Maize J 1006	9.6	2	2.4	192000

CAPACITY BUILDING PROGRAMMES:

Various training programmes were conducted for capacity building in agriculture and livestock management, highlighting the number of beneficiaries, including both male and female farmers. The programmes focused on natural resource management, diversification in crops, pest and disease management, along with training on livestock management, resource conservation technology soil health management, etc. (Table 2.15).

Table 2.15: Capacity Building programmes (HRD) taken up for farmers

Theme	No. of training programmes	No. of beneficiaries		
		Male	Female	Total
Crop management	2	18	6	24
Enterprises for self-employment	1	13	3	16
Farm implements and machinery	2	33	0	33
Fodder and feed management	2	29	8	37
Forest tree/ agroforestry plantation	1	14	2	16
Irrigation management	1	21	0	21
Livestock management	2	28	12	40
Management of horticultural crops	1	9	0	9
Natural resource management	3	51	7	58
NICRA awareness	1	24	8	32
Nutritional garden	2	28	11	39
Pest and disease management	2	21	0	21
Post-harvest technology	1	12	3	15
Resource conservation technology	2	36	0	36
Seed production	1	18	0	18
Soil health management	2	32	0	32
Vegetable production	1	9	3	12
Water saving technology	1	17	0	17
Awareness of abuse on social issues	1	12	11	23

OTHER EXTENSION ACTIVITIES:

Various extension activities were conducted during the year 2023-24, such as exposure visits of 152 farmers, which helped them learn through firsthand experiences, and field days with 379 participants, where farmers observed new techniques and technologies. Method demonstrations, attended by 470 farmers, provide practical, hands-on learning opportunities. Additionally, agro-advisory services were utilized by 282 participants, offering expert guidance on agricultural practices (Table 2.16).

Other activities such as strengthening Self-Help Groups (SHG) with 10 participants, integrated farming system training for 17 participants, block-level camps for 119 participants, women awareness programs for 37 participants, group discussions involving 173 participants, and a soil health day event with 38 participants were also conducted.

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

To enhance climate resilience and promote sustainable agricultural practices, a series of interventions were implemented, showcasing effective convergence with the State Department of Agriculture. Technologies implemented included laser levelling, which helps in achieving a levelled

field to improve water distribution and increase crop yield. Straw baling and Happy Seeder technologies were employed to manage crop residues and reduce air pollution. Zero tillage and Super Seeder techniques were introduced to conserve soil moisture and reduce soil erosion. Broadcasting and Smart Seeder methods were also used to enhance sowing efficiency. Direct seeded rice and green manuring practices aimed at improving soil health and reducing water consumption. Fodder crops such as maize and berseem were promoted to support livestock nutrition, while the use of mineral mixtures and UMMB (Urea Molasses Mineral Block) helped improve animal health. Short duration varieties of paddy (PR 126), summer moong (SML 1827), low water requiring crops like mustard, a spray of KNO_3 in wheat, Punjab Sunheri (PBW 766), and kitchen gardening were encouraged to diversify agricultural production and improve food security (Table 2.17).

Table 2.16: Other extension activities

Name of program	Participants
Exposure visits of farmers	152
Strengthen - SHG	10
Integrated farming system	17
Field days	379
Method demonstrations	470
Block level camp	119
Women awareness	37
Group discussion	173
Agro advisory services	282
Soil health day	38

Table 2.17: Summary of Upscaling of technologies

Village name	Technology scaling up/out	No. of farmers reached	Convergence with the programme
NICRA and adjoining villages	Laser Levelling	197	State Department of Agriculture
	Straw Baling	311	
	Happy Seeder	11	
	Zero Tillage	59	
	Super Seeder	261	
	Broad casting	14	
	Smart Seeder	29	
	Direct Seeded Rice	153	
	Green manuring	103	
	Fodder crop (Maize and Berseem)	238	
	Use of mineral mixture and UMMB	580 (animals)	
	Summer Moong (SML 1827)	119	
	Paddy (PR 126)	542	
	Low water requiring crop (Mustard)	281	
	Spray of KNO_3 in Wheat	332	
	Punjab Sunheri (PBW 766)	92	
	Kitchen Gardening	325	

Diagnostic visit to farmer's field

EXTREME WEATHER EVENTS:

In 2023, the occurrence of prolonged dry spells lasting more than 10 days affected critical stages of crops, including seedling, booting/flowering, and milking/dough stages. To mitigate these impacts, irrigation was implemented as an intervention measure.

In the year 2023, extreme weather events characterized by high temperatures and a month-long absence of rainfall adversely impacted crop yields, leading to sterility in flowers. To address this issue, an intervention involving the application of spray potassium nitrate/salicylic acid was recommended (Table 2.18).

Table 2.18: Dry spells observed

Nature of event	Date	Crop stage impacted	Intervention taken
Dry spells	10-15 days (12-6-23 to 25-6-23)	Seedling	• Meet crop water requirements through ground and canal water • Apply irrigation through alternate wetting and drying method • Advised to spray potassium nitrate as per university recommendation
	31 days (01-8-23 to 1-8-23)	Booting / Flowering	
	15 days (01-9-23 to 15-9-23)	Milking / Dough	

AGRO ADVISORIES ISSUED:

From June to January, four agro-met bulletins were issued each month, with the highest number of bulletins being consistent at four across all months. Additionally, eight other advisories were issued every month during this period.

Table 2.19: Details about agro advisories issued

Month	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Number of agro-met bulletins issued	4	4	4	4	4	4	4	4
Other advisories issued	8	8	8	8	8	8	8	8

Exposure visit of farmers to PAU Kisan Mela

IMPACT OF CONTINGENCY MEASURES:

In 2023, prolonged dry spells affected critical crop stages, including the booting stage, prompting the implementation of irrigation as a key intervention. Extreme weather events with high temperatures and a month-long absence of rainfall further exacerbated the situation, leading to sterility in flowers. To address these issues, wheat crops were sprayed with potassium nitrate at a 2% concentration during the boot leaf and early milk stages. This intervention, applied from March 16, 2022, to April 12, 2023, involved 98 farmers and resulted in a yield increase to 51.2 q/ha, compared to 49.4 q/ha with farmers' practice, marking an improvement of 1.8 q/ha. Additionally, for crossbreed cows affected by the same dry spell, mineral mixture supplementation was provided to address mineral losses due to sweating, with five farmers and 58 demo participants administering 1-2 litres per animal daily.

Table 2.20: Impact of contingency measures taken up in the village

S.No.	Dry spell (Duration)	No. of Days	Crop name	Crop stage affected	Intervention taken up	No. of farmers involved	Impact on crop yields (q/ha)		
							Farmers' practice	Demo	Increase over farmers' practice
1	16-03-2023 to 12-04-2023- No rainfall and sudden rise in temperature was observed	27	Wheat	Boot stage	Spray the wheat crop with potassium nitrate @2% in the month of March at boot leaf and early milk stages	98	49.4	51.2	1.8
2	-do-	27	Cross-breed cows	-	Mineral mixture supplementation to fulfil mineral losses due to sweating	5 and 58	-	-	1-2 lt/ animal/day

SIGNIFICANT ACHIEVEMENTS:

The influence of technology demonstrations on farmers in NICRA villages was evident, with a notable impact observed (Table 2.21). A significant number of farmers (542) adopted the short-duration rice variety PR 126, which reduced the area under long-duration varieties like PUSA 44 with heavy straw loads, leading to less straw burning and saving time, labour, and water. Kitchen gardening was adopted by 325 farmers, helping to fulfil their family's nutritional requirements throughout the year and saving up to Rs. 12,000-15,000 annually. The foliar spray of KNO_3 at the boot stage was adopted by 332 farmers, helped to mitigate heat stress, check grain sterility, and improve crop productivity. Technologies like Happy Seeder, Super Seeder, Smart Seeder, and Surface Seeder for wheat sowing were adopted by 364 farmers, aiding in the management of paddy straw, timely sowing of wheat, curbing environmental pollution, and improving soil health. Straw baling was practised by 311 farmers, significantly helped to curb environmental pollution. Green manuring was adopted by 103 farmers, contributing to improved soil health.

Table 2.21: Significant achievements

Description	No. of farmers covered	Impact
Adoption of short-duration Paddy (PR 126)	542	Reduction in the area under long-duration varieties like PUSA 44 with heavy straw load which leads to straw burning by farmers and also saves time, labour and water. This helps in saving natural resources
Kitchen gardening	325	Helped to fulfil the nutritional requirement of the family throughout the year and saved money up to 12000-15000 per year
Spray of KNO_3	332	Foliar application of potassium nitrate helped in mitigating heat stress and checked grain sterility further aiding in grain filling, thereby, improving crop productivity
Wheat sown with Happy Seeder, Super Seeder, Smart Seeder, Surface Seeder	364	These technologies helped in the easy management of paddy straw and the timely sowing of wheat. Also helps in curbing environmental pollution and improves soil health
Straw baling	311	Helped in curbing environmental pollution
Green manuring	103	Helped in improving soil health

SUCCESSFUL INTERVENTIONS IN NICRA VILLAGE:

In 2023-24, various successful interventions were carried out on natural resource management (NRM), crop varieties, and livestock in five NICRA villages. For wheat sowing, the use of zero till drill, Happy Seeder, Super Seeder, Smart Seeder and mulching has been adopted in the 1038 ha area of the village, while straw baling for paddy/basmati has been adopted in the 1308 ha area of the village. The introduction of the laser leveller has facilitated precise land levelling in an area of 808 ha. Furthermore, the application of potassium nitrate (13:0:45) as a foliar treatment has been carried out over 543 ha for both wheat and paddy/basmati crops, improving nutrient availability and crop yield.

For specific crop varieties, these villages have embraced several new and improved varieties. The short-duration variety (SML 1827) of summer moong has been adopted in 57.8 ha, demonstrating a shift towards more efficient cropping patterns. Green manuring with the local variety of Dhaincha has been

practised in 446 ha, enhancing soil fertility. Direct seeded rice (DSR) with PR 126 and PUSA Basmati 1718 varieties have been adopted in 217.5 ha, improving water use efficiency and yield. Additionally, the oilseed variety Gobhi Sarson (GSC 7) has been cultivated in 72.4 ha, while the *kharif* fodder maize variety J 1006 has been planted in 98 ha. For *Rabi* fodder, Berseem variety BL 42 has been adopted in 21 ha, supporting livestock feed requirements.

In livestock management, the use of area-specific mineral mixtures has been beneficial, with 380 animals receiving these supplements. Kitchen gardening has also been promoted, covering an area of 0.65 ha, contributing to household nutrition.

Table 2.22: Adoption of successful interventions in the NICRA village & the adjoining villages

Successful interventions	Crop	Variety	Extent of adoption in the village in ha (2023)
ZTD/HS/SS/SmS/mulching	Wheat	Recommended varieties	1038
Straw baling	Paddy/Basmati	Recommended varieties	1308
Laser leveller	-	-	808
Foliar application of potassium nitrate (13:0:45)	Wheat and Paddy/Basmati		543
Short duration variety	Summer Moong	SML 1827	57.8
Green manuring	Dhaincha	Local	446
Direct Seeded Rice (DSR)	Paddy/Basmati	PR 126/PUSA Basmati 1718	217.5
Oilseed	Gobhi Sarson	GSC 7	72.4
Kharif fodder	Maize	J 1006	98
Rabi fodder Berseem (BL 42)	Berseem	BL 42	21
Area-specific mineral mixture	-	-	380 (animals)
Kitchen gardening	-	-	0.7

POPULARIZATION OF CLIMATE-RESILIENT VARIETIES:

For the *Kharif* 2023 season, the rice variety PR 126 was incorporated, covering approximately 35,200 hectares. In the *Rabi* 2023 season, the wheat variety PBW 766 was introduced, spanning around 10350 hectares.These initiatives highlight the State Department's focus on enhancing agricultural sustainability and resilience against climate change.

Table 2.23: Popularization of Climate Resilient Varieties

Crop	Climate Resilient Varieties incorporated in the *Kharif* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Kharif* 2023 (ha)	Climate Resilient Varieties incorporated in the *Rabi* 2023 plan of the State Department	Approx. Area brought under the variety by the state department during the *Rabi* 2023 (ha)
Paddy	PR 126	35200	-	-
Wheat	-	-	PBW 766	10350

Moga

3

Moga town, positioned along the Ferozepur-Ludhiana road, serves as the district's headquarters. As per the 2011 census, the district's population stands at 995,746, featuring a sex ratio of 893 females for every 1000 males and a literacy rate of 71.6%. In 2021, Meenia village in this district was chosen as the site for the Technology Demonstration Component of NICRA. This village is entirely devoid of rainfed zones.

FARMING SYSTEM TYPOLOGIES:

The major farming system typologies of this village are Irrigation without animal (FST 3) and Irrigation with animal (FST 4). Maximum 243 farmers are involved in the Irrigation without animal farming system, and 150 farmers are involved in the Irrigation with animal farming system.

WEATHER PATTERN:

The NICRA-designated village experienced reduced annual rainfall during the 2023-24 period compared to the typical annual precipitation observed in previous years. Notably, the village received increased rainfall in July; however, June and August experienced exceptionally low precipitation in the specified year. The total *Kharif* rainfall registered a shortfall, amounting to 242.1 mm, contrasting less with the average historical rainfall.

Throughout the year 2023-24, the village underwent four dry spells lasting over 10 days, three dry spells persisting for more than 15 days, along with two dry spells for more than 20 days. Additionally, a singular intensive rain spell exceeding 60 mm/day occurred during this timeframe. Despite these weather fluctuations, no flood incidents were reported in any of the crops within the village during the specified period.

Table 3.1: Day-wise rainfall distribution

Rainfall		Year	
		Normal RF	2023-24
Annual rainfall (mm)		524.2	401.2
June		72.9	5.0
July		121.7	230.1
August		123.9	7.0
September		93.4	0.0
Total *Kharif* rainfall		411.9	242.1
No. of rainy days		29	10
No. of dry spells during *Kharif* season 2023	>10 days	-	4
	>15 days	-	3
	>20 days	-	2
No. of intensive rain spells (2023)	>60 mm/day	-	1

Table 3.2: Rainfall (mm) distribution

Rainfall 2023-24												
Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	3.0	0	3.0	0	0	0	0	0	0	0	1.0	0
2	36.0	2.0	0	0	0	0	0	0	0	0	0	12.0
3	3.0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	1.0	29.7	0	0	0	0	0	0	0	0
6	0	0	0	84.0	0	0	0	0	0	0	0	0
7	0	0	0	21.8	0	0	0	0	0	0	0	0
8	0	0	0	30.6	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	3.0	2.0	0	0	0	0
11	0	0	0	0	0	0	0	10.0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	7.0	0	2.0	0	0	0	0	0
16	0	0	0	0	0	0	6.2	0	0	0	0	0
17	0	12.0	0	0	0	0	0	0	0	0	0	0
18	11.0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	2.0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	45.0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1.0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	3.0	0	0	0	0	0	0	0	1.0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	3.0	0	0	0	0	0	0	0	0
29	1.0	6.0	0	9.0	0	0	0	0	0	0	0	10
30	1.0	2.0	0	0	0	0	0	0	0	0	0	0
31	0	22.0	0	0	0	0	0	0	0	1.0	0	0

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Demonstrations in this village were conducted for FST 3 (Irrigated without animal) and FST 4 (Irrigated with animal) on wheat sown with a Happy Seeder, wheat sown with a Super Seeder, wheat sown with a Surface Seeder, wheat sown with Smart Seeding, mould board plough (MBP), direct seeding of rice (DSR), irrigation scheduling in rice (alternate wetting and drying) 2 days after infiltration of water, as farmers showed great interest in adoption of farming system typology (Table 3.3).

Table 3.3: Natural resource management interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
FST 4 (Irrigated with animal)			
Happy Seeder technology/Smart Seeder (Residue retention)	15	15	15
Surface Seeding in Wheat crop (Residue retention)	5	5	5
Super Seeder (Residue incorporation)	22	22	22
MB Plough (Residue incorporation)	14	14	14
Direct seeding of Rice (DSR)	15	15	15
Irrigation scheduling in Paddy crop 2 days after infiltration of water	5	5	5
FST 3 (Irrigated without animal)			
Happy Seeder Technology/Smart Seeder (Residue retention)	11	11	11
Surface Seeding in wheat crop (Residue retention)	4	4	4
Super Seeder (Residue incorporation)	19	19	19
MB Plough (Residue incorporation)	9	9	9
Direct seeding of rice (DSR)	7	7	7
Irrigation scheduling in paddy crop 2 days after infiltration of water	4	4	4

CROP PRODUCTION INTERVENTIONS:

The demonstrations had a significant impact, resulting in the adoption of various technologies by a considerable number of farmers. Active farmer participation was observed in demonstrations focusing on summer green gram (SML 1827), short duration variety of paddy (PR 126), green manuring, heat-tolerant wheat variety (PBW 826), foliar spray of potassium nitrate in wheat, kitchen gardening and nutritional gardening (Table 3.4).

Table 3.4: Crop Production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
FST 4 (Irrigated with animal)			
Summer Green Gram (SML 1827)	25	25	25
Green Manuring	5	5	5
Short-duration Paddy variety (PR 126)	25	25	25
Heat-tolerant Wheat variety (PBW 826)	25	25	25
Foliar spray of potassium nitrate in Wheat	12	12	12
Kitchen garden and nutrition garden	25	25	25
FST 3 (Irrigated without animal)			
Summer Green Gram (SML 1827)	18	18	18
Green Manuring	4	4	4
Short-duration Paddy variety (PR 126)	22	22	22
Heat-tolerant Wheat variety (PBW 826)	17	17	17
Foliar spray of potassium nitrate in Wheat	8	8	8
Kitchen garden and nutrition garden	17	17	17

Monitoring of demonstration on DSR

Demonstration on Paddy Straw Management

LIVESTOCK INTERVENTIONS:

Demonstrations on Climate Resilient Technologies (CRTs) were conducted, involving active participation from 20 farmers to mitigate mineral deficiencies in animals. Mineral mixtures were provided to 10 animals, and 20 demonstrations of urea molasses mineral blocks benefited 10 animals. Similarly, 10 demonstrations on backyard poultry were conducted, covering 10 farmers and 400 animals.

Table 3.5: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of animals
FST 4 (Irrigated with animal)			
Mitigation of Mineral deficiency	20	20	10
Urea Molasses Multinutrient bricks (UMMB)	20	20	10
Backyard poultry	10	10	400
FST 3 (Irrigated without animal)			
Backyard poultry	10	10	400

IMPACT OF CRTs in FST 4 (Irrigated with animal):

Surface Seeding in wheat crop: Surface Seeding of wheat is an environmentally friendly and cost-effective technique where paddy harvesting and wheat sowing occur simultaneously. This method has been introduced to effectively manage agroecosystems, ensuring sustained productivity and increased profits for farmers while preserving natural resources.

In Moga, demonstrations of Surface Seeding of wheat highlighted its ability to enhance wheat productivity, achieving 55.2 quintals per hectare in NICRA fields (Table 3.6 a). This technique also reduced the cost of cultivation to Rs. 40,313 for NICRA farmers, including savings of Rs. 1250 on sowing cost, Rs. 4,650 on labour and 93 labour hours, Rs. 1,738 on weedicides, and 30.0 cm water (Table 3.6 b) compared to Non-NICRA farmers.

Additionally, NICRA farmers achieved higher Gross Returns (GR) of Rs. 1,17,322 compared to Non-NICRA farmers (Table 3.6 a). These results underscore the significant potential of Surface Seeding technology in the rice-wheat farming system.

Wheat sown with Smart Seeder: The use of a Smart Seeder for wheat sowing by NICRA farmers showed significant improvements in productivity and economic outcomes. NICRA farmers reported an average yield of 54.8 q/ha and gross returns of Rs. 1,16,535 per hectare comparable to Non-NICRA farmers.

Table 3.6 a: Impact of Climate Resilient Technologies (CRTs) in FST 4 (Irrigated with animal)

Crop	TD	Area impacted	NICRA farmers				Non-NICRA Farmers			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
Wheat	Surface Seeding in Wheat crop	5.0	1.0	55.2	40313	117322	1.0	54.1	43280	115005
Wheat	Smart Seeder	15.0	1.0	54.8	41815	116535	1.0	54.0	43156	114772
Rice	Short duration variety (PR 126)	15.0	1.0	80.4	48163	165583	1.0	79.2	50650	163217
Total			**3.0**		**130291**	**399440**	**3.0**		**137086**	**392994**

Table 3.6 b: Input saving due to technologies

Technology demonstrated	Season	Input saving				
		Input	NICRA farmers		Non-NICRA farmers	
			Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Surface Seeding in Wheat	*Rabi*	Sowing cost	-	1250	-	7500
		Water (cm)	30.0	(electricity is free)	35.0	(electricity is free)
		Labour (hrs)	93	4650	105	5250
		Weedicide (ml)	1000 (post-emergence)	1738	2500 (Pre-emergence) 1000 (post-emergence)	3238
Short-duration Paddy variety (PR 126)	*Kharif*	Fertilizer (Urea bags)	5	1333	8.5	2265
		Water (cm)	210	(electricity is free)	270	(electricity is free)
		Labour (hrs)	280	14000	337	16850

Table 3.6 c: Technology Demonstration and Farmers' Perceptions

Technology demonstrated	Specificity of Technology	Farmers' Perception of Technology
Surface Seeding in Wheat crop	Cultivation of Wheat crop without residue burning	Technology being the easiest and quickest method of crop residue management, saves farm capital with little infestation of weeds
Smart Seeding in Wheat crop	Cultivation of Wheat crop without residue burning	Low energy requiring CRM technology that saves time with minimal soil disturbance and less weed infestation
Short duration Paddy variety (PR 126)	Short duration variety	Variety matures in about 90 days after transplanting. Saves water, time, and farm capital with less straw load that is easy to manage

Short-duration paddy: The demonstration of the short-duration variety PR 126 in rice covered 15 hectares during the *Kharif* season. NICRA farmers achieved a productivity of 80.4 quintals per hectare. Their cost of cultivation was Rs. 48,163 per hectare, and their gross returns were Rs. 1,65,583 per hectare. In contrast, Non-NICRA farmers had a productivity of 79.2 quintals of paddy per hectare, and

cost of cultivation of Rs. 50,650 per hectare, and gross returns of Rs. 1,63,217 per hectare. Moreover, cultivation of short-duration paddy saves five urea bags costing Rs. 1,333, 210 cm water and 280 hours of labour costs Rs. 14,000 (Table 3.6 b).

These results indicate that the short-duration variety PR 126 in rice can enhance productivity and reduce costs for NICRA farmers, resulting in higher gross returns compared to traditional farming practices.

LIVESTOCK INTERVENTIONS:

The livestock demonstrations focused on the impact of using area-specific mineral mixtures on the milk yield and economic returns for NICRA and Non-NICRA farmers. For NICRA farmers, the use of area-specific mineral mixtures was demonstrated on seven animals, resulting in an average milk yield of 2816 kg per lactation. With a selling price of Rs. 55 per kg, the average gross returns per animal were Rs. 1,54,916 and the average net returns were Rs. 79,766.

Table 3.7: Impact of CRTs in FST 4 (Irrigated with animal)

Farmer	No.	Technology demonstrated	Average Milk Yield/ lactation (l)	Selling price (Rs./l)	Average Gross returns (Rs./animal)	Average Net returns (Rs./animal)
NICRA	7	Use of area-specific mineral mixture	2816	55	154916	79766
Non-NICRA	7	No use of area-specific mineral mixture	2730	55	150150	73935

In contrast, for Non-NICRA farmers who did not use area-specific mineral mixtures, the same number of animals (seven) had an average milk yield of 2730 kg per lactation. The selling price remained at Rs. 55 per kg, leading to average gross returns of Rs. 1,50,150 per animal and average net returns of Rs. 73,935 per animal.

The comparison highlights that the use of area-specific mineral mixtures by NICRA farmers resulted in higher milk yield, gross returns, and net returns compared to Non-NICRA farmers who did not use the mineral mixtures. This demonstrates the significant economic benefits of adopting this specific climate-resilient technology in dairy farming.

BY-PRODUCTS PRODUCED AND RECYCLED:

In Meenia village, by-products from agricultural and animal activities contribute significantly to the local economy and sustainable farming practices. The by-product from crops, specifically the straw, is produced at a rate of 27.50 quintals per hectare. This by-product is valued at Rs. 540 per quintal, promoting sustainable management of agricultural residues while generating Rs. 14,850.

Animal by-products, particularly dung, are also integral to the farming system. Each animal produces approximately 17.91 quintals of dung annually, which is applied as organic manure in fields. Valued at Rs. 1254 per quintal, this dung enhances soil fertility and structure, contributing to the overall sustainability of the farming system by recycling nutrients and minimizing the need for chemical fertilizers.

Table 3.8: By-products produced and recycled in farming system typologies

By product produced	Quantity (q)	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Crop straw	27.50/ha	540	Sold	14850
Animal dung	17.91/animal	70	Used as manure	1254
Poultry manure	0.18/bird	300	Used as manure	53

Poultry by-products, at 0.18 quintals, are also used as manure and contribute Rs. 53. These values highlight the economic and ecological benefits of effectively managing and utilizing agricultural and animal by-products.

IMPACT OF CRTs in FST 3 (Irrigated without animal):

In Moga district, various demonstrations of climate-resilient technologies in agriculture have showcased their benefits in enhancing productivity and reducing costs.

Wheat sown with Surface Seeder: The Surface Seeding technique for wheat, applied over 4 hectares during the *Rabi* season, achieved an average productivity of 55.1 quintals per hectare for NICRA farmers. This method reduced the cost of cultivation to Rs. 40,298 per hectare, leading to gross returns of Rs. 1,17,173 per hectare (Table 3.9 a). This is compared to traditional methods where Non-NICRA farmers, in the same area, achieved a slightly lower productivity of 54.2 quintals per hectare, with a higher cost of cultivation at Rs. 43,305 per hectare and gross returns of Rs. 1,15,197 per hectare. Notably, Surface Seeding saved Rs. 1,125 in sowing costs, 30 cm of water, and 91 hours of labour, alongside a reduction in weedicide costs (Table 3.9 b).

Wheat sown with Smart Seeder: The use of the Smart Seeder for wheat sowing was demonstrated over 11 hectares during the *Rabi* season. NICRA farmers using this technology recorded an average yield of 54.7 quintals per hectare and gross returns of Rs. 1,16,302 per hectare, compared to Non-NICRA farmers who achieved a productivity of 54.2 quintals per hectare and gross returns of Rs. 1,15,154 per hectare. The Smart Seeder also contributed to reduced cultivation costs and improved productivity.

Short-duration paddy: For short-duration variety PR 126, NICRA farmers achieved a productivity of 79.6 quintals per hectare with a cost of cultivation of Rs. 48,109 per hectare, resulting in gross returns of Rs. 1,64,058 per hectare. In contrast, Non-NICRA farmers had a productivity of 79.0 quintals per hectare, with a higher cost of cultivation at Rs. 50,712 per ha. The short-duration paddy variety also led to savings of 5 bags of urea, 220 cm of water, and 275 hours of labour, showcasing substantial economic and resource efficiency benefits for NICRA farmers compared to traditional practices.

Technology demonstrations were carried out on backyard poultry, with a total of 60 birds, the average annual egg production was reached to 2,940 eggs. These eggs were sold at a rate of Rs. 8 per unit, generating average gross returns of Rs. 23,520. Additionally, the by-product from these poultry, which amounts to 3.0 quintals, was sold at Rs. 300 per quintal (Table 3.10), resulting in an additional revenue of Rs. 900. This information underscores the economic benefits and efficiency of backyard poultry practices in the NICRA program.

Table 3.9 a: Impact of CRTs in each FST 3 (Irrigated without animal)

Crop	TD	Areas impacted	Season	NICRA farmers				Non-NICRA farmers			
				Area (ha)	Yield (q/ha)	COC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	COC (Rs./ha)	GR (Rs./ha
Wheat	Surface Seeding in Wheat crop	4.0	*Rabi*	1.0	55.1	40298	117173	1.0	54.2	43305	115197
Wheat	Smart Seeder	11.0	*Rabi*	1.0	54.7	41835	116302	1.0	54.2	43240	115154
Rice	Short duration variety (PR 126)	7.0	*Kharif*	1.0	79.6	48109	164058	1.0	79.0	50712	160801
Total						**130242**	**397533**			**137257**	**391152**

Table 3.9 b: Input saving due to technologies.

Technology demonstrated	Season	Input saving				
			NICRA Farmers		Non-NICRA Farmers	
		Input	Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Surface Seeding in Wheat	*Rabi*	Sowing cost	-	1125	-	7125
		Water (cm)	30.0	(electricity is free)	35.0	(electricity is free)
		Labour (hrs)	91	4550	105	5100
		Weedicide (ml)	1000 (post-emergence)	1738	2500 (Pre-emergence) 1000 (post-emergence)	3238
Short-duration Paddy variety (PR 126)	*Kharif*	Fertilizer (Urea bags)	5	1200	8.5	2132
		Water (cm)	220	(electricity is free)	270	(electricity is free)
		Labour (hrs)	275	14000	330	16500

BY-PRODUCTS PRODUCED AND RECYCLED:

In Meenia village, agricultural and animal by-products play a crucial role in supporting the local economy and fostering sustainable farming practices. Crop by-products, specifically straw, are produced at a rate of 25.6 quintals per hectare. This straw, valued at Rs. 540 per quintal, is sold, generating a total of Rs. 13,824. This practice promotes sustainable management of agricultural residues and supports the local economy.Poultry by-products are produced at a rate of 0.16 quintals per bird and are used as manure. Poultry manure had a selling price of Rs.300 per quintal. The data highlights the economic benefits and ecological advantages of effectively managing and utilizing agricultural and animal by-products in Meenia village.

Table 3.10: By-products produced and recycled in farming system typologies

By product produced	Quantity (q)	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Crop straw	25.6/ha	540	Sold	13824
Poultry manure	0.16/bird	300	Used as manure	50

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

The performance of various agricultural implements has been evaluated, demonstrating their significant impact on modernizing and optimizing the farming practices. The Lucky Seed Drill, which was utilized by 17 farmers, covered an area of 32 hectares and mobilized Rs. 7,050. The Bed Planter/Multi Crop 3 Row Planter, employed by 27 farmers, covered the same area of 32 hectares, generating Rs.6,200. Ridger/Bund Maker, used by 34 farmers, covered a larger area of 75 hectares and mobilized Rs. 4,600. Additionally, the sale of seeds and other planting materials for demonstrations reached Rs. 15,750, covering 328 farmers and an equivalent area of 328 hectares. These tools have significantly contributed to implementing advanced cultivation techniques, reflecting a commitment to improving agricultural productivity and sustainability.

Table 3.11 a: Institutional interventions (Custom Hiring Centre)

Implements	Amount mobilised (Rs.)	Farmers covered	Area covered (ha)
Lucky Seed Drill	7050	17	32
Bed Planter/Multi crop 3-row Planter	6200	27	32
Ridger/Bund maker	4600	34	75
Sale of seed and other planting material for demonstrations	15750	328	328

SEED AND FODDER BANK:

Notably, paddy covered an area of 2.7 hectares, involving 35 farmers and yielding 209.25 quintals. The wheat cultivation spanned 7.52 hectares with 42 participating farmers, resulting in a production of 414.38 quintals of seeds. Fodder maize, encompassed 1.25 hectares in which 25 farmers were engaged resulted in a production of 21.88 quintals seeds (Table 3.12 b).

Table 3.11 b: Institutional interventions

Seed/Fodder system	Seed produced (q)	Farmers covered	Area covered (ha)	Quantity of seed retained for next season	Amount mobilised (Rs.)
Paddy	209.25	35	2.70	209.25	431055
Wheat	414.38	42	7.52	414.38	901276
Fodder maize	21.88	25	1.25	21.88	131280

CAPACITY BUILDING PROGRAMMES:

Various capacity-building programs covered a range of topics including crop production, animal science and vegetable production (Table 3.13). These training sessions reflect a broad effort to enhance skills and knowledge in various agricultural and livestock practices.

OTHER EXTENSION ACTIVITIES:

Several extension activities were taken up in NICRA villages such as awareness camps, field days, exposure visits to farmers, and farmer scientist interface.

Demonstration on Summer Green Gram

Exposure visit of farmers to PAU, Ludhiana

Table 3.12: Capacity Building programmes (HRD)

Theme	No. of training programmes	No. of beneficiaries		
		Male	Female	Total
Animal Science	1	19	1	20
Crop Production	1	43	0	43
Crop Production	1	39	7	46
Vegetable Production	1	27	7	34

Table 3.13: Other extension activities

Name of program	Participants
Awareness Camp	46
Farmer-Scientist Interface	38
Farmer-Scientist Interface	34
Exposure Visit	44
Field Day	52

AGRO ADVISORIES ISSUED:

Number of agromet bulletins released from June to January, each month has 8 agromet bulletins. Additionally, other advisories were also issued in varying numbers, with the highest number being 11 in November.

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

Demonstrations of Climate Resilient Technologies (CRTs) on the installation of an underground drainage system were adopted in village Meenia with active participation from 45 farmers, converged with the Department of Soil and Water Conservation, Punjab (Table 3.16).

Table 3.14: Details about agro advisories issued

Month	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Number of agro-met bulletins issued	8	8	8	8	8	8	8	8
Other advisories issued	4	3	5	7	6	11	8	9

Table 3.15: Summary of Upscaling of technologies

Village name	Technology scaling up/out	No. of farmers reached	Convergence with the programme	Approx. amount mobilised
Meenia	Installation of underground drainage system	45	Department of Soil and Water Conservation, Punjab	7,00,000

Table 3.16: Publications from the project

Nature of publication	Citation
Research Article	Jaidka M, Brar A S and Singh H (2024) Production efficiency of rice-wheat cropping system and path coefficient analysis of wheat under climate-smart technologies. *IJRA* **7(2):** 504-508
Research Article	Jaidka M, Brar A S and Singh H. Effect of heat stress on nutrient use and grain yield of wheat. Accepted for publication in the Journal of Community Mobilization and Sustainable Development

SUCCESSFUL INTERVENTIONS IN NICRA VILLAGE:

In 2023-24, various successful interventions were carried out on natural resource management (NRM), crop varieties, and livestock in Meenia village. In NRM, the use of Super Seeders for wheat has seen an adoption rate of over an area of 330, while a short-duration variety of paddy was cultivated on 300 ha of land in the village. In livestock management, dairy cattle were supplemented with mineral mixtures, benefiting 40 farmers.

Table 3.17: Adoption of successful interventions in the NICRA village & the adjoining villages

Successful interventions	Crop	Variety	Extent of adoption in ha (2023)
NRM			
Surface Seeding/Happy Seeder technology	Wheat	-	22
Super Seeder technology	Wheat	-	330
CROP			
Short duration variety	Paddy	PR 126	300
Foliar spray of potassium nitrate	Wheat	-	41
Summer Green Gram	Summer green gram	SML 1827	89
LIVESTOCK			
Mineral Mixture	-	-	(40 Farmers)

Gurdaspur

4

Gurdaspur, situated in the Indian state of Punjab, is a city nestled between the Beas and Ravi rivers. Serving as the administrative headquarters of Gurdaspur district, this city holds a strategic position at the geographical centre of the district, sharing a border with Pakistan. As per the 2011 India census, Gurdaspur district recorded a population of 2,299,026, comprising 1,212,995 males and 1,086,031 females.

NICRA VILLAGE:

Bharath village was involved in Technology Demonstration Component (TDC) of NICRA since 2021 and Khokhar village was chosen for TDC in September 2022.

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of this village are Irrigated without animal (FST 3) and Irrigated with animal (FST 4). Maximum farmers i.e. 184 farmers are involved in Irrigated with animal farming system and 114 farmers are involved in Irrigated without animal farming system.

Table 4.1: Day-wise rainfall (mm) distribution

Rainfall 2023-24												
Date	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	0	24.1	0.2	0	0	0	0	0	0	30.5	0	0
2	1.2	0	0	0	0	0	0	0	0	0	6.0	0
3	0	0	0	0	0	0	0	0	0	0	34.8	0
4	0	0	0	0	0	0	0	0	0	1.3	0	0
5	0	0	34.8	24.2	0	0	0	3.1	0	1.5	0	0
6	0	0	89.3	22.6	0	0	0	0	0	0	0	0
7	9.6	25.8	8.2	23.8	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	141.2	0	1.5	0	0	0	0	0	0	0
10	0	17.2	10.4	18.5	0	12.5	0	0	0	0	0	0
11	0	0	0	0	4.2	0	43.8	0	0	0	0	0
12	0	0	0	5.2	2.6	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	7.8	0	1.2	49.7	0	0	0	0	0	0.1	0
15	0	9.0	0	6.3	0.6	12.4	0	0	0	0	0	0
16	0	0	5.2	0	0	0	0	0	0	0	0	11.7
17	0	0	25.4	0	0	35.2	0	0	0	0	0	0
18	0	0	0	0	30.4	1.0	0	0	0	0	0	0

Rainfall 2023-24												
Date	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April
19	0	31.0	0	0	56.8	0	0	0	0	0	0	0
20	0	0	0	3.2	5.6	0	0	0	0	1.5	0	1.2
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	32.8	5.2	0	0	0	0	0	0	0	0
23	0	0	10.3	0	13.7	0	0	0	0	0	0	0
24	11.5	0	0	0	0	0	0	0	0	0	0	0
25	0.2	0	0	0	0	0	0	0	0	0	0	0
26	23.4	65.7	0	0	0	0	0	0	0	0	0	0
27	0	5.2	0	0	0	0	0	0	0	0	0	3.2
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0.8	0	2.1	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	14.8	0	0	0	14.2	3.8
31	10.9	0	0	0	0	0	0	0	1.8	0	8.6	0

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Most of the demonstrations in this village were conducted for FST 3 (Irrigated without animal) on soil chiselling before wheat sowing, laser land levelling for resource conservation, green manuring in rice and basmati rice, direct seeding of rice, irrigation scheduling in rice (alternate wetting and drying), wheat sown with Happy Seeder, wheat sown with Super Seeder, wheat sown with Surface Seeder, wheat sown with Smart Seeder, as farmers showed great interest in adoption of farming system typology (Table 4.2).

Table 4.2: Natural resource management interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Soil chiseling before wheat sowing	6	6	2.4
Laser land levelling	6	6	2.4
Green manuring in Rice and Basmati Rice	20	20	8.0
Direct seeding of Rice	6	6	2.4
Irrigation scheduling in Rice (alternate wetting and drying)	12	12	4.8
Wheat sown with Happy Seeder	6	6	2.4
Wheat sown with Super Seeder	6	6	2.4
Wheat sown with Surface Seeder	6	6	2.4
Wheat sown with Smart Seeder	6	6	2.4
Total	**74**	**74**	**29.6**

CROP PRODUCTION INTERVENTIONS:

The demonstrations had a significant impact, resulting in the adoption of various technologies by a considerable number of farmers. Active farmer participation was observed in demonstrations focusing on short-duration variety of paddy (PR 126) and high-yielding basmati rice variety (Punjab Basmati 7). In the domain of heat stress management, 64 NICRA farmers adopted temperature-tolerant wheat variety

PBW 826 on an area of 25.6 hectares. For the sterility management in rice with 1.5% foliar spray of KNO_3 at the boot stage, 20 NICRA farmers adopted this technology on an area of 8 hectares (Table 4.3). Numerous farmers embraced these technologies to improve income and achieve greater yield profitability.

Table 4.3: Crop Production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Short duration Rice variety (PR 126)	50	50	20.0
High-yielding Basmati Rice variety (Punjab Basmati 7)	20	20	4.0
Temperature-tolerant Wheat variety (PBW 826)	64	64	25.6
Sterility management in rice with 1.5% foliar spray of KNO_3 at boot stage	20	20	8.0
Total	**154**	**154**	**57.6**

LIVESTOCK INTERVENTIONS:

Demonstrations on Climate Resilient Technologies (CRTs) were adopted on a larger scale, with the active participation of 50 farmers in the mitigation of mineral deficiencies in animals by providing mineral mixtures to 50 animals, followed by 20 demonstrations on urea molasses mineral blocks in which 20 animals were benefitted (Table 4.4).

Table 4.4: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of animals
Mineral mixture	50	50	50
Urea molasses mineral blocks	20	20	20

IMPACT OF CRTs IN FST 3 (Irrigated without animal):

CROP BASED INTERVENTIONS:

Short-duration Paddy: The evaluation of improved short-duration rice variety (PR 126) under the purview of the NICRA initiative has yielded insightful benefits, highlighting variations in productivity and net returns. The adoption of PR 126 rice variety resulted in average yield of 67.9 q/ha, improved average net returns (ANR) of Rs. 85,768 and savings of 6 irrigations, along with a reduction in labour and costs amounting to Rs. 2,982 (Table 4.5 b).

High-yielding Basmati Rice: Most of the demonstrations in this village were conducted for FST 3 (Irrigated without animal) on high-yielding basmati rice variety (Punjab Basmati 7), NICRA farmers achieved a notable average yield of 51.9 q/ha, illustrating its potential to enhance economic returns for farmers, thereby contributing to the overall resilience of agricultural systems in the face of climate challenges. This technology saved 2 irrigations and reduced labour costs by Rs. 994.

Temperature-tolerant wheat variety (PBW 826): In the domain of heat stress management, the comparison between NICRA and Non-NICRA farmers reveals substantial differences in performance outcomes. For temperature tolerant variety of wheat PBW 826, NICRA farmers consistently outperformed their Non-NICRA counterparts, achieving average yield increases of 54.3 q/ha, leading to higher average net returns. In contrast, Non-NICRA farmers experienced comparatively lower average yield increases of 51.1 q/ha. This highlights the effectiveness of the heat stress management strategy under NICRA, contributing to enhanced yields and economic returns for farmers. Additionally, this technology saved 2 irrigations and labour, costs totaling Rs. 994.

Sterility management in rice with 1.5% foliar spray of KNO_3: In rice cultivation with a 1.5 % spray of KNO_3, NICRA farmers demonstrated a modest average yield of 71.2 q/ha, with a corresponding increase in average net returns of Rs. 89,542. Non-NICRA farmers experienced a relatively lower average yield of 68.3 q/ha. This indicates that the adoption of climate-resilient practices, as promoted by NICRA, has a positive impact on mitigating heat stress in rice crops, leading to improved productivity and economic outcomes.

NRM BASED INTERVENTIONS:

Chiselling: Soil chiselling involves deep tillage to break up compacted soil layers. This enhances water infiltration, reduces runoff, and improves root growth, leading to better crop yields and soil health. The adoption of this technology increased productivity to 58.0 q/ha and net returns to Rs. 93,274 for NICRA farmers, outperforming Non-NICRA farmers.

Laser land levelling in Rice: Laser land levelling is a transformative practice in modern agriculture, offering substantial benefits in terms of water efficiency, crop yield, and operational efficiency. Using laser land levelling technology in rice cultivation, the average productivity increased to 72.5 quintals per hectare. This led to improved average net returns of Rs. 90,244 for NICRA farmers, compared to Non-NICRA farmers.

Green manuring: Most of the demonstrations in this village were conducted for FST 3 (Irrigated without animal) on green manuring in rice, NICRA farmers achieved a notably higher average productivity of 72.6 q/ha than Non-NICRA farmers. In the context of green manuring in basmati rice, NICRA farmers consistently achieved higher yields and net returns compared to Non-NICRA counterparts. The average yield increased to Rs. 1,02,528, showcasing the effectiveness of this practice in enhancing productivity and economic returns. The adoption of green manuring in basmati rice demonstrated notable advantages for NICRA farmers, with improved average net returns.

Direct Seeding of Rice: Direct seeding of rice involves sowing seeds directly into the field rather than transplanting seedlings. This method reduces labour costs, shortens the crop cycle, and improves water use efficiency. Direct sowing of seeds not only saves time and reduces costs but also achieves comparable results to traditional transplanting methods. Compared to Non-NICRA farmers who practised puddling, this approach saves four irrigations, four labour units, ten tractor hours, and thirty litres of diesel, and reduces costs by Rs. 10,088 (Table 4.5 b).

Wheat sown with Surface Seeder

Table 4.5 a: Impact of CRTs in FST 3 (Irrigated without animal)

Technology adopted/ demonstrated	Irrigated without animal				
	Area (ha)	NICRA farmers		Non-NICRA farmers	
		Yield (q/ha)	Net return (Rs./ha)	Yield (q/ha)	Net return (Rs./ha)
Crop based interventions					
Short duration Rice variety (PR 126)	1.2	67.9	85768	69.6	87490
High-yielding Basmati Rice variety (Punjab Basmati 7)	1.2	51.9	107672	42.4	79372
Temperature-tolerant Wheat variety (PBW 826)	1.2	54.3	96340	51.1	88909
Sterility management in Rice with 1.5% foliar spray of KNO_3	1.2	71.2	89542	68.3	84949
NRM based interventions					
Chiselling	1.2	58.0	93274	53.5	84146
Laser land levelling (Rice)	1.2	72.5	90244	67.9	84125
Green manuring in Rice	1.2	72.6	84670	70.4	89207
Green manuring in Basmati Rice	1.2	54.3	102528	50.0	98428
Direct seeding of Rice	1.2	71.2	95978	72.9	94288
Irrigation scheduling in Rice (alternate wetting and drying)	1.2	71.4	91838	70.8	90031
Wheat sown with Happy Seeder	1.2	60.8	110493	58.9	98703
Wheat sown with Super Seeder	1.2	54.9	108427	54.4	101660
Wheat sown with Surface Seeder	1.2	56.3	113943	53.5	101553
Wheat sown with Smart Seeder	1.2	55.1	111033	54.3	102142
Total	**16.8**		**1381755**		**1285006**

Irrigation scheduling in rice (Alternate wetting and drying): Irrigation scheduling in rice using alternate wetting and drying (AWD) involves periodically allowing the soil to dry before re-flooding. This technique conserves 4 irrigation water, and 4 labourers, reduces methane emissions, and can maintain or even enhance rice yield.

Wheat sown with Happy Seeder: For farmers employing the Happy Seeder technology, NICRA farmers achieved a notable average yield increase of 60.8 q/ha, surpassing Non-NICRA farmers whose average productivity was 58.9 q/ha. This translated into higher net returns for NICRA farmers, showcasing the effectiveness of the Happy Seeder technology in enhancing both productivity and economic outcomes. Sowing with Happy Seeder saves both energy and time, reducing tractor charges to Rs. 3,561 compared to Rs. 5,794 for those who did not adopt this method.

Wheat sown with Super Seeder: Similarly, in the case of Super Seeder adoption, NICRA farmers demonstrated superior performance with average net returns increased to Rs.1,08,427, while Non-NICRA farmers experienced less average net returns of Rs. 1,08,427. The higher resultant net returns for NICRA farmers reflect the positive impact of adopting climate-resilient technologies promoted under NICRA. Additionally, Super Seeder technology saves energy, time, and costs, reducing expenses to Rs. 4,206 (Table 4.5 b).

Wheat sown with Surface Seeder: Wheat sowing with a Surface Seeder involves placing seeds directly on the soil surface, followed by a light incorporation into the topsoil. This method ensures efficient

seed distribution and optimal germination conditions, enhancing crop establishment and yield. With the adoption of Surface Seeder, NICRA farmers experienced higher average productivity of 56.3 q/ha and improved average net returns of Rs. 1,13,943. Moreover, NICRA farmers saved energy, time, and tractor charges, reducing expenses to Rs. 1,753 compared to Rs. 5,794 for Non-NICRA farmers (Table 4.5 b).

Wheat sown with Smart Seeder: Wheat sowing with a Smart Seeder leverages advanced technology for precise seed placement and optimal depth. This method enhances germination rates, improves crop uniformity, and maximizes yield potential, providing NICRA farmers with higher net returns and substantial profits. By enhancing productivity and ensuring better economic outcomes, this technology saves the cost of Rs. 3,274.

Table 4.5 b: Input saving due to technologies

Technology adopted/ demonstrated	Irrigated without animal				
	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Short duration Rice variety (PR 126)	Irrigation & labour (No.)	6	2982	-	-
High-yielding Basmati Rice variety (Punjab Basmati 7)		2	994	-	-
Temperature-tolerant Wheat variety (PBW 826)		2	994	-	-
Direct seeding of Rice	Irrigation,labour andtractorcharges /Puddling	4 irrigations, 4 labour, tractor hours 10 & diesel 30 litres	10088	Puddling-25 hours/ha	-
Irrigation scheduling in Rice (alternate wetting and drying)	Irrigation & labour (No.)	4	1988	-	-
Wheat sown with Happy Seeder	Energy and time	Tractor charges	3561	-	5794
Wheat sown with Super Seeder			4206	-	5794
Wheat sown with Surface Seeder			1753	-	5794
Wheat sown with Smart Seeder			3274	-	5794

BY-PRODUCTS PRODUCED:

In 2023-24, Basmati rice straw was produced at a rate of 51.87 q/ha and sold for 95 Rs./ha. Wheat straw, on the other hand, had a production rate of 34.58 q/ha and fetched a higher selling price of 450 Rs./ha. These by-products from farming play a crucial role in the recycling and sustainability of agricultural systems, providing additional income streams for farmers while promoting environmental stewardship.

Table 4.6: By-products produced and recycled in farming system typologies

By product produced	Quantity (q/ha)	Selling price (Rs./q)
Basmati Rice straw	51.87	95
Wheat straw	34.58	450

IMPACT OF CRTs IN FST 4 (Irrigated with animal):

CROP BASED INTERVENTIONS:

Short-duration rice variety (PR 126): The adoption of the short-duration rice variety PR 126 by NICRA farmers in Khokhar village led to insightful improvements in productivity and net returns. NICRA farmers achieved an average productivity of 71.3 q/ha and average net returns of Rs. 91,061 per hectare, compared to Non-NICRA farmers who reported slightly lower average productivity of 70.5 q/ha and average net returns of Rs. 89,345 per hectare. Also, short-duration paddy saved 6 irrigations and 500 m^3 water/irrigation, along with a reduction in costs amounting to Rs. 600 (Table 4.9 b).

High-yielding basmati rice variety (Punjab Basmati 7): NICRA farmers in Khokhar who adopted the high-yielding basmati rice variety Punjab Basmati 7 experienced significant economic benefits. They achieved an average yield of 48.2 q/ha and net returns of Rs. 93,028 per hectare, whereas Non-NICRA farmers recorded a lower yield of 40.4 q/ha and net returns of Rs. 76,211 per hectare. This technology saved 2 irrigations and 500 m^3 of water/irrigation, ultimately reducing costs by Rs. 200.

Temperature-tolerant wheat variety (PBW 826): NICRA farmers using the temperature-tolerant wheat variety PBW 826 achieved higher productivity and net returns compared to their Non-NICRA counterparts. The NICRA farmers reported an average yield of 57.2 q/ha and net returns of Rs. 1,08,125 per hectare, whereas Non-NICRA farmers had an average yield of 53.5 q/ha and net returns of Rs. 99,632 per hectare.

Sterility management in rice with 1.5% foliar spray of KNO_3 at the boot stage: The use of 1.5% foliar spray of KNO_3 at the boot stage in rice cultivation showed positive results for NICRA farmers. They achieved an average yield of 75.8 q/ha and net returns of Rs. 99,018 per hectare, compared to Non-NICRA farmers who recorded an average yield of 72.6 q/ha and net returns of Rs. 93,670 per hectare.

NRM-BASED INTERVENTIONS:

Chiselling: The practice of chiselling among NICRA farmers resulted in higher productivity and net returns. NICRA farmers achieved an average productivity of 58.8 q/ha and net returns of Rs. 95,094 per hectare, while Non-NICRA farmers recorded an average productivity of 52.7 q/ha and net returns of Rs. 82,251 per hectare.

Laser land levelling (Rice): NICRA farmers who adopted laser land levelling for rice saw improvements in both productivity and economic returns. They reported an average yield of 73.9 q/ha and net returns of Rs. 93,265 per hectare, whereas Non-NICRA farmers had an average yield of 70.6 q/ha and net returns of Rs. 89,687 per hectare.

Green manuring in rice: Green manuring in rice by NICRA farmers led to enhanced productivity and net returns. NICRA farmers achieved an average yield of 73.1 q/ha and net returns of Rs. 87,480 per hectare, compared to Non-NICRA farmers who recorded an average yield of 70.2 q/ha and net returns of Rs. 88,863 per hectare.

Green manuring in basmati rice: The practice of green manuring in basmati rice among NICRA farmers showed positive results. They achieved an average yield of 51.9 q/ha and net returns of Rs. 93,485 per hectare, while Non-NICRA farmers had an average yield of 47.3 q/ha and net returns of Rs. 88,885 per hectare.

Direct seeding of rice: NICRA farmers who adopted direct seeding of rice experienced improved productivity and economic outcomes. They reported an average yield of 71.5 q/ha and net returns of Rs. 96,528 per hectare. This practice saved 4 irrigations, 10 tractor hours, and 30 litres of diesel compared to the traditional puddling practice.

Irrigation scheduling in rice (Alternate wetting and drying): The practice of irrigation scheduling in rice (alternate wetting and drying) by NICRA farmers resulted in better productivity and net returns. NICRA farmers achieved an average yield of 74.2 q/ha and net returns of Rs. 97,610 per hectare, compared to Non-NICRA farmers. This technique conserves 4 irrigations and reduces costs by Rs. 400.

Wheat sowing with a Happy Seeder: The use of a Happy Seeder for wheat sowing among NICRA farmers led to higher productivity and net returns. NICRA farmers reported an average yield of 53.8 q/ha and net returns of Rs. 1,06,468 per hectare, whereas Non-NICRA farmers had an average yield of 53 q/ha and net returns of Rs. 98,532 per hectare. Sowing with Happy Seeder saved 1 irrigation water, 5 tractor hours and 15 litres of diesel, reducing the cost to Rs. 100, Rs. 2,775 and Rs. 1,275 respectively compared to Rs. 5,794 for those who did not adopt this method.

Wheat sowing with Super Seeder: NICRA farmers who used a Super Seeder for wheat sowing experienced positive outcomes in productivity and economic returns. They achieved an average yield of 54.9 q/ha and net returns of Rs. 1,07,619 per hectare, while Non-NICRA farmers recorded an average yield of 52.9 q/ha and net returns of Rs. 98,195 per hectare. Additionally, Super Seeder technology saves 4 tractor hours amounting to Rs. 2,200 and 12 litres of diesel of Rs. 1,020 (Table 4.7 b).

Wheat sowing with Surface Seeder: The adoption of a Surface Seeder for wheat sowing among NICRA farmers resulted in higher productivity and net returns. NICRA farmers achieved an average yield of 55.2 q/ha and net returns of Rs. 1,12,216 per hectare, compared to Non-NICRA farmers who had an average yield of 54.50 q/ha and net returns of Rs. 1,01,937 per hectare. Surface Seeder technology also saved tractor hours, diesel and herbicide when compared to Non-NICRA farmers.

Wheat sowing Smart Seeder: The use of a Smart Seeder for wheat sowing by NICRA farmers showed significant improvements in productivity and economic outcomes. NICRA farmers reported an average yield of 54.1 q/ha and net returns of Rs. 1,07,705 per hectare with savings of 5 tractor hours and 15 litres of diesel.

ANIMAL-BASED INTERVENTIONS:

Area-specific mineral mixture: NICRA farmers who adopted the area-specific mineral mixture for their animals experienced higher economic returns. They reported an average net return of Rs. 162,405, compared to Non-NICRA farmers who had an average net return of Rs. 147,772. Additionally, animals fed with mineral mixtures require fewer artificial inseminations (AI) compared to those that are not fed with mineral mixtures (Table 4.7 b).

Diagnostic field visit

Table 4.7 a: Impact of CRTs in FST 4 (Irrigated with animal)

Technology adopted/ demonstrated	Irrigated with animal					
	NICRA farmers			Non-NICRA farmers		
	Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Crop production interventions						
Short duration Rice variety (PR 126)	1.2	71.3	91061	0.4	70.5	89345
High-yielding Basmati Rice variety (Punjab Basmati 7)	1.2	48.2	93028	0.4	40.4	76211
Temperature-tolerant Wheat variety (PBW 826)	1.2	57.2	108125	0.4	53.5	99632
Sterility management in rice with 1.5% foliar spray of KNO_3 at boot stage	1.2	75.8	99018	0.4	72.6	93670
NRM interventions						
Chiselling	1.2	58.8	95094	0.4	52.7	82251
Laser land levelling (Rice)	1.2	73.9	93265	0.4	70.6	89687
Green manuring in Rice	1.2	73.1	87480	0.4	70.2	88863
Green manuring in Basmati Rice	1.2	51.9	93485	0.4	47.3	88885
Direct seeding of Rice	1.2	71.5	96528	0.4	72.1	92777
Irrigation scheduling in Rice (alternate wetting and drying)	1.2	74.2	97610	0.4	72.3	93121
Wheat sowing with Happy Seeder	1.2	53.8	106468	0.4	53.0	98532
Wheat sowing with Super Seeder	1.2	54.9	107619	0.4	52.9	98195
Wheat sowing with Surface Seeder	1.2	55.2	112216	0.4	54.5	101937
Wheat sowing Smart Seeder	1.2	54.1	107705	0.4	53.7	99988
Livestock interventions						
Area-specific mineral mixture		3609	162405		3284	147772
Urea molasses mineral blocks (Given to animals with low milk production)		3090	139080		2907	130845
Total	**16.8**		**1690190**	**5.6**		**1571715**

Table 4.7 b: Input saving due to technologies

Technology adopted/ demonstrated	Irrigated with animal				
	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Short duration Rice variety (PR 126)	Irrigation (No.)	6	600	-	-
	Water (m^3)	500/irrigation	-	-	-
Short duration Basmati Rice variety (Punjab Basmati 7)	Irrigation (No.)	2	200	-	-
	Water (m^3)	500/irrigation			-
Direct seeding of Rice	Irrigation (No.)/ Puddling	4 irrigations	400	Puddling- 25 hour/ha	-
	Tractor hours	10	5550	-	-
	Diesel (l)	30	2550	-	-
Irrigation scheduling in Rice (Alternate wetting and drying)	Irrigation (No.)	4	400	-	-

Technology adopted/ demonstrated	Irrigated with animal				
	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Wheat sown with Happy Seeder	Irrigation (No.)	1	100	-	5794
	Tractor hours	5	2775	-	-
	Diesel (l)	15	1275	-	-
Wheat sown with Super Seeder	Tractor hours	4	2200	-	-
	Diesel (l)	12	1020	-	-
Wheat sown with Surface Seeder	Tractor hours	7.5	4125	-	5794
	Diesel (l)	22.5	1900	-	-
	Herbicide (Stomp in litres)	3.75	8751	-	-
Wheat sown with Smart Seeder	Tractor hours	5	2775	-	5794
	Diesel (l)	15	1275	-	-
Area-specific mineral mixture	Need for AI	1	200	2-3	400-600

Table 4.7 c: Technology Demonstration and Farmers' Perceptions

Technology demonstrated	Specificity of Technology	Farmers' Perception of Technology
Crop Based Interventions		
Short duration Rice variety (PR 126)	Matures in about 93 DAT as compared to unrecommended varieties 140 days. It is transplanted in 1st fortnight of July. Ensures timely sowing of wheat and provides a sowing window of 30-35 days	Saves 6 irrigation, fertilizer, insecticides, and labour and gives higher net returns
High-yielding Basmati Rice variety (Punjab Basmati 7)	High yielding (46.5 q/ha) variety of basmati as compared to popular varieties Pusa Basmati 1121 (34 q/ha) and Pusa Basmati 1509 (38 q/ha)	It is highly aromatic like traditional Basmati varieties. Less disease incidence as it is resistant to all the ten presently prevalent pathotypes of bacterial blight pathogen in the Punjab state
Temperature-tolerant Wheat variety (PBW 826)	PBW 826 has the highest average yield (60 q/ha) as compared to all the wheat varieties recommended by PAU. It is short duration variety maturing in 148 days whereas other varieties take 155 to 160 days for maturity	PBW 826 is less prone to lodging as compared to other varieties. It gave a 6.7% higher yield and Rs. 7962/ha net returns
Sterility management in rice with 1.5% foliar spray of KNO_3 at boot stage	Sterility in paddy grains occurs due to various biotic and abiotic factors, such as bacterial and fungal infections, nutrient deficiencies, extreme temperature fluctuations, and improper cultivation practices	1.5% potassium nitrate spray at the boot stage reduces sterility in rice and increases grain yield by 4.3% and net returns (Rs. 4971/ha)
NRM Interventions		
Chiselling (Wheat)	Breaks the hardpan, improves water and air movement in the soil, and increases root growth thereby increasing the uptake of nutrients from the soil	Soil chiselling before wheat sowing is a simple and cost-effective (Rs. 600/acre) technology that increases productivity (10.0%)

Technology demonstrated	Specificity of Technology	Farmers' Perception of Technology
NRM INTERVENTIONS		
Laser land levelling (Rice)	Efficient use of resources due to uniform distribution of water and fertilizer	In laser levelled fields, less time is required to apply irrigation resulting in water saving (10-15%) and higher yield (5.6%) and net returns (Rs. 1488/ha)
Green manuring in Rice	Integrated nutrient management to improve soil organic matter, water water-holding capacity and reduce the use of inorganic fertilizers	Green manuring is a simple technology that can be adopted by farmers on a large scale. It improves soil health and gives a higher yield (3.7%)
Green manuring in Basmati Rice	Integrated nutrient management to improve soil organic matter, and water-holding capacity and reduce the use of inorganic fertilizers	Green manuring is a simple technology that can be adopted by farmers on a large scale. It improves soil health and gives higher yield (9.0%) and net returns (Rs. 4250)
Direct seeding of Rice	Water and labour-saving technology with low methane emission and early maturity. Better soil physical condition for succeeding crops	Yield obtained in DSR and TPR are comparable. DSR requires less labour as nursery raising, uprooting of seedlings, puddling and manual transplanting operations are not required. Farmers face difficulty in weed management but with timely spray can control weeds effectively
Irrigation scheduling in Rice (alternate wetting and drying)	AWD is a water-saving technology that farmers can apply to reduce their irrigation water consumption in rice fields without decreasing its yield	AWD irrigation by farmers is easy to learn and implement in the field. Farmers reported less incidence of inset-pest and diseases and obtained slightly higher yield (1.7%) and net returns (Rs. 2498/ha) than continuous flooding
Wheat sown with Happy Seeder	Wheat seeds can be directly drilled into combined harvested paddy fields without any straw burning or removal	Farmers reported a reduction in the cost of field preparation, timely sowing of wheat, reduction in weed count, time-saving in wheat sowing, saving of irrigation water, and the number of implements required for paddy straw management are reduced. Increase in yield with higher net returns (Rs. 7629/ha)
Wheat sown with Super Seeder	Wheat seeds can be directly drilled into combined harvested paddy fields without any straw burning or removal	Farmers reported a reduction in the cost of field preparation, timely sowing of wheat, reduction in weed count, time-saving in wheat sowing, saving of irrigation water, and the number of implements required for paddy straw management are reduced. Increase in yield (2.6%) with higher net returns (Rs. 13,190/ha)
Wheat sown with Surface Seeder	For uniform broadcasting of seed and fertilizer along with cutting and spreading of whole straw in a combined harvested (fitted with Super SMS) field	Farmers reported a reduction in the cost of field preparation, timely sowing of wheat, reduction in weed count, time-saving in wheat sowing, saving of irrigation water, and the number of implements required for paddy straw management are reduced. Increase in yield (2.2%) with higher net returns (Rs. 10,742/ha)

Urea molasses mineral blocks (Given to animals with low milk production): The use of urea molasses mineral blocks among NICRA farmers led to improved economic returns from their livestock. NICRA farmers reported an average net return of Rs. 1,39,080, whereas Non-NICRA farmers had an average net return of Rs. 1,30,845.

NRM INTERVENTIONS:		
Technology demonstrated	**Specificity of Technology**	**Farmers' Perception of Technology**
Wheat sown Smart Seeder	Wheat seeds can be directly drilled into combined harvested paddy fields without any straw burning or removal	Farmers reported reductions in the cost of field preparation, timely sowing of wheat, time-saving in wheat sowing, and number of implements required for paddy straw management. Increase in yield (1.3%) with higher net returns (Rs. 8726/ha)
LIVESTOCK INTERVENTIONS		
Area-specific mineral mixture	Contains all the essential minerals in the required quantity	Increases milk production and improves reproductive efficiency of animal
Urea molasses mineral blocks (Given to animals with low milk production)	It is a readily available source of energy, protein and minerals for animals	Increases milk production and improves reproductive efficiency of animal

Field day on Rice (PR 126)

BY-PRODUCTS PRODUCED AND RECYCLED:

Basmati Rice Straw: In Khokhar village, the by-product of basmati rice cultivation, specifically the straw, is produced at a quantity of 51.9 q/ha. This straw is primarily used as animal fodder and is valued at Rs. 95 per quintal. This practice not only provides a valuable feed resource for livestock but also contributes to the sustainable management of agricultural residues (Table 4.8).

Wheat Straw: The by-product of wheat cultivation, wheat straw, is produced at a quantity of 34.6 q/ha. It is also utilized as animal fodder and has a selling price of Rs. 450 per quintal. The high value of wheat straw as fodder highlights its importance in the livestock feeding system, providing essential nutrients and reducing feed costs.

Animal By-product: The by-product produced by animals, specifically dung, amounts to 6.0 tonnes per animal per year. This dung is applied in fields as organic manure, enhancing soil fertility and structure. It is valued at Rs. 275 per tonne, contributing to the overall sustainability of the farming system by recycling nutrients back into the soil and reducing reliance on chemical fertilizers.

Table 4.8: By-products produced and recycled

By product produced	Quantity	Selling price (Rs.)	Recycling of by-products
Basmati Rice straw	51.9 q/ha	95/q	Used as animal fodder
Wheat Straw	34.6 q/ha	450/q	Used as animal fodder
Animal Dung	6.0 tonnes/animal/year	Rs. 275/tonne	Applied in field

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

Performance of various implements used in agriculture was assessed in this NICRA village where utilization of Super Seeder attracted farmers' interest (Table 4.9). These implements have significantly contributed to modernizing and optimizing farming practices, enabling farmers to cover larger areas efficiently and implement advanced cultivation techniques. The adoption of such agricultural machinery reflects a proactive approach towards sustainable and technologically enhanced agriculture.

Table 4.9: Institutional interventions (Custom Hiring Centre)

Implements	Amount mobilised (Rs.)	Farmers covered	Area covered (ha)
Rotavator	3300	22	9.9
Seed-cum Fertilizer Drill	1250	22	10.0
Sub-soiler	600	10	4.2
Super Seeder	5100	16	6.8
Happy Seeder	800	3	2.0
Smart Seeder	900	3	2.1
Cutter cum Spreader	1100	8	6.6
Bed Planter	1250	11	7.5
Total	**14300**	**95**	**49.1**

SEED PRODUCTION:

Notably, paddy (PR 126 variety) covered an area of 2.0 hectares, involving five farmers and yielding 12 tonnes. The wheat cultivation, specifically the PBW 826 variety, spanned 4.0 hectares with ten participating farmers, resulting in a production of 20 tonnes of seeds. Additionally, berseem cultivation, which encompassed 0.5 hectares in which ten farmers were engaged resulted in a production of 0.5 tonnes of seeds.

Table 4.10: Institutional interventions (Seed bank)

Seed system	Seed produced (tonnes)	Farmers covered	Area covered (ha)	Quantity of seed retained for next season (tonnes)
PR 126	12.0	5	2.0	2.0
PBW 826	20.0	10	4.0	6.0
Berseem	0.5	10	2.0	0.5

FODDER PRODUCTION:

The Fodder Maize (J 1007) system produced 147 tonnes of fodder, involving 24 farmers and covering an area of 4.8 hectares, mobilizing an amount of Rs. 94,000. Similarly, the Fodder Bajra (FBC 16) system produced 144 tonnes of fodder, involving 20 farmers and covering an area of 4.0 hectares, mobilizing an amount of Rs. 69,000.

Table 4.11: Institutional interventions (Fodder bank)

Fodder systems	Fodder produced (tonnes)	Farmers covered	Area covered (ha)	Amount mobilised (Rs.)
Fodder maize (J 1007)	147	24	4.8	94000
Fodder bajra (FBC 16)	144	20	4.0	69000

CAPACITY BUILDING PROGRAMMES:

Various training programmes were conducted for capacity building in agriculture and livestock management, highlighting the number of beneficiaries, including both male and female farmers.The programmes focused on diversification in crops, integrated pest and disease management, and weed management in wheat along with training on dairy farming, poultry farming, goat farming, protected cultivation and nursery raising of fruit, vegetable and flower crops and mushroom cultivation (Table 4.12).

Table 4.12: Capacity Building programmes (HRD) taken up for farmers

Theme	No. of training programmes	No. of beneficiaries		
		Male	Female	Total
Short duration training				
Improved production technology of Millets	1	18	06	24
Raising of Rice nursery and selection of Rice varieties	1	23	04	27
Integrated Disease Management in *Kharif* crops	1	12	02	14
Improved cultivation practices for *Rabi*, oil seed and pulse crops	1	19	07	26
Weed management in Wheat	1	28	06	34
Integrated Pest and Disease Management in seed crop of Berseem	1	14	05	19
Vocational Training				
Dairy farming	1	2	-	2
Poultry farming	1	2	-	2
Protected cultivation and nursery raising of fruit, vegetable and flower crops	1	1	-	1
Mushroom cultivation	1	3	-	3
Goat farming	1	3	-	3

Various training programmes were conducted for KVK staff, highlighting the beneficiaries, including both male and female KVK staff, and the respective dates. The programmes focused on the ICAR-CAFT course on Modern diagnostic and control approaches to safeguard livestock health, capacity building programme for extension personnel, paddy straw management workshop, training on organic farming, orientation programme on recent extension activities, workshop on horticultural crops, and research and extension specialist workshop (Table 4.13).

Table 4.13: Capacity Building programmes (HRD) taken up for KVK Staff

Theme	No. of programmes	No. of beneficiaries		
		Male	Female	Total
Attended 21 days ICAR-CAFT course on modern diagnostic and control approaches to safeguard livestock health from 4.01.24 to 24.01.2024	1	1	0	1
Capacity building programme for extension personnel at PAU Ludhiana on 21.04.2024	3	2	2	4
Paddy straw management workshop at PAU Ludhiana 09.06.2023	1	2	0	2
Training on organic farming at PAU Ludhiana on 31.08.2023	1	0	1	1
Orientation programme on recent extension activities at PAU Ludhiana 30.11.2023	1	1	1	2
Workshop on Horticultural Crops from 30 to 31 January 2024	1	0	1	1
Research and Extension Specialist Workshop at PAU Ludhiana 22 to 23 February 2024.	1	1	2	3

OTHER EXTENSION ACTIVITIES:

Several extension activities were taken up in NICRA villages such as awareness camps, field days, exposure visits to farmers, kisan gosthis, and animal welfare camps.

Table 4.14: Other extension activities

Name of the activity	Details about the activity	No. of beneficiaries
Awareness camps	Collection of soil samples and interpretation of results	32
	Kisan Gosthi cum animal welfare camp and water saving campaign	36
	Animal disease management, basmati cultivation & DSR	27
	Parthenium management	22
	Management of infertility and other reproductive disorders in dairy animals	19
	Weed and irrigation management in *Rabi* crops	32
Field day	Rice variety (PR 126)	28
	Punjab Basmati 7	21
	Surface Seeding of Wheat	24
Exposure visits	CRM Kisan Mela at KVK, Amritsar	100
	Kisan Mela at Regional Station Gurdaspur	-

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

Demonstrations of Climate Resilient Technologies (CRTs) on laser levelling, Super Seeder, green manuring, terminal heat tolerant wheat (PBW 826) were adopted on a larger scale in village Khokhar with active participation from 24, 90, 35 and 78 respectively, converged with the State Department of Agriculture (Table 4.15).

Table 4.15: Summary of Upscaling of technologies

Village	Technology scaling up/out	Farmers	Convergence with the programme
Khokhar	Laser levelling	24	Department of Agriculture
	Super Seeder	90	
	Green manuring	35	
	Terminal heat tolerant Wheat (PBW 826)	78	

EXTREME WEATHER EVENTS:

During the interval from 6-9 July 2023, the NICRA villages within Gurdaspur district encountered floods, which had a profound impact on the crops cultivated in these areas (Table 4.16). Excessive floods during July 2023 resulted in mortality and uprooting of transplanted rice crops.

Table 4.16: Extreme weather events observed

Nature of event	Date	Impact on crop yield
Flood	6th to 9th July 2023	Submergence of rice resulting in mortality and uprooting of transplanted crop

AGRO ADVISORIES ISSUED:

Agro advisories, specifically agromet bulletins, are communications directed at the agricultural community to provide guidance based on meteorological data and forecasts. Number of agromet bulletins released from June to January, with the highest number being 10 in July and August.

Table 4.17: Details about agro advisories issued

Month	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Number of agromet bulletins issued	9	10	10	8	9	8	9	9

IMPACT OF CONTINGENCY MEASURES:

During a flooding event from July 6th to 10th, contingency measures were implemented to mitigate the impact on rice crops at the establishment stage. For the short-duration rice variety PR 126, 10 farmers retransplanted seedlings, leading to an increased yield from 56 q/ha with traditional practices to 71 q/ha with the intervention, marking a 26.8% improvement. Similarly, for the short-duration basmati rice variety Pusa Basmati 1509, 6 farmers retransplanted seedlings, boosting yields from 32.5 q/ha to 42 q/ha, resulting in a 29.2% increase over the traditional approach.

Table 4.18: Impact of contingency measures

Extreme weather event	Duration	Intervention taken up	Farmers	Impact on crop yields (q/ha)		
				Farmers' practice	Demo	Increase
Flooding in Paddy & Basmati	6th to 10th July	Seedlings of PR 126	10	56.0	71	26.8
		Seedlings of Pusa Basmati 1509	6	32.5	42	29.2

Field day on Basmati (Punjab Basmati 7)

SIGNIFICANT ACHIEVEMENTS:

The influence of technology demonstrations on farmers in NICRA villages was evident, with a notable impact observed (Table 4.19). A significant number of farmers (64) adopted the temperature-tolerant wheat variety (PBW 826), this was followed by the adoption of short-duration rice variety PR 126, high-yielding basmati rice variety Punjab Basmati 7 and sterility management in rice with 1.5% foliar spray of KNO_3 at boot stage. Other technologies also garnered significant attention from farmers for adoption.

Table 4.19: Significant achievements

Description	Farmers	Impact
Short duration Rice variety (PR 126)	50	Saving of 5 irrigations and cultivated by 30% of the farmers
High-yielding Basmati Rice variety (Punjab Basmati 7)	20	Gave 15 to 25% higher yield than farmers variety
Temperature-tolerant wheat variety (PBW 826)	64	Gave 4.6 to 11.7% higher yield than farmers variety and cultivated by 25% of the farmers
Sterility management in Rice with 1.5% foliar spray of KNO_3 at boot stage	20	Gave 2.0 to 7% higher yield and this practice is followed by 15% of the farmers
Wheat sown with Surface Seeder	6	Gave 2.0 to 4% higher yield with higher net returns

SUCCESSFUL INTERVENTIONS

In 2023-24, various successful interventions were carried out on natural resource management (NRM), crop varieties, and livestock in Khokhar village. In NRM, the use of Super Seeder for wheat, encompassing various wheat varieties, has seen an adoption rate of 65%, while alternate wetting and drying techniques for rice have been adopted by 40% of the village. For specific crop varieties, 25% of the area has adopted the PBW 826 wheat variety, and 30% has adopted the PR 126 rice variety. In livestock management, 20% of dairy cattle were supplemented with PAU mineral mixtures.

Table 4.20: Adoption of successful interventions in the NICRA & adjoining villages

Successful interventions	Crop	Variety	Extent of adoption in the village (2023)
NRM			
Super Seeder	Wheat	Wheat varieties	65%
Alternate wetting and drying	Rice	Rice varieties	40%
CROP BASED			
Temperature tolerant Wheat	Wheat	PBW 826	25%
Short duration Rice	Rice	PR 126	30%
LIVESTOCK			
Mineral mixture	Dairy cattle	PAU mineral mixture	20%

POPULARIZATION OF CLIMATE-RESILIENT VARIETIES:

For the *Kharif* 2023 season, the rice variety PR 126 was incorporated, covering approximately 12,740 hectares. In the *Rabi* 2023 season, the wheat variety PBW 826 was introduced, spanning around 32,940 hectares. These initiatives highlight the State Department's focus on enhancing agricultural sustainability and resilience against climate change.

Table 4.21: Popularization of Climate Resilient Varieties

Crop	Climate Resilient Varieties incorporated in the *Kharif* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Kharif* 2023 (ha)	Climate Resilient Varieties incorporated in the *Rabi* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Rabi* 2023 (ha)
Rice and Wheat	PR 126	12740	PBW 826	32940

Field day on Wheat sown with Surface Seeder

Mandi

5

Mandi is a prominent administrative district of Himachal Pradesh nestled in the lap of the Himalayas. It is often referred to as the "Varanasi of the Hills" due to the presence of numerous ancient temples. The district serves as a gateway to the picturesque Kullu Valley and is strategically positioned on the banks of the Beas River. Agriculture plays a crucial role in the district's economy, with a focus on horticulture and cash crops. The region is known for its apple orchards, making it a key contributor to the state's fruit production. The diverse topography of Mandi, ranging from lush valleys to high-altitude areas, supports a variety of crops and vegetation.

NICRA VILLAGE:

Seradh village has been involved in the Technology Demonstration Component of NICRA since 2020-21. Seradh has a total population of 505 people, out of which the male population is 49.50% while the female population is 50.50%.

Table 5.1: Day-wise rainfall (mm) distribution

Rainfall 2023-24												
Date	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	21.0	23.0	0	0	0	0	3.4	0	10.6	0	0	0
2	3.4	0	0	0	0	0	0	0	32.7	0	0	0
3	0.7	0	56.0	0	0	0	0	0	0	0	0	0
4	0	0	1.0	0	0	0	0	0	5.1	15.8	0	0
5	0	0	0.5	37.8	0	0	3	0	56.9	0	0	0
6	0.4	8.4	0.9	0	0	0	0	0	7.0	0	0	0
7	0	11.3	5.4	0	0	0	0	0	0	0	0	0
8	0	0.2	0.4	0	0	0	0	0	0	0	0	0
9	0	83.2	0	0	0	0	0	0	0	0	0	0
10	0	67.9	0	0	0	0	0	0	0	0	0	1.0
11	1.0	45.0	44.2	0.3	0	11.3	0	0	0	0	0	0
12	0	0	73.0	0	0	0	0	0	0	0	0	0
13	0	10.2	166.1	0	0	0	0	0	0	0	0	0.1
14	1.6	3.2	168.4	0	0	0	0	0	0	0	1.1	0
15	0.5	45.4	38.0	0	0	0	0	0	0	0	6.0	0
16	0.3	1.2	0	4.3	12.8	0	0	0	0	0	0.6	0
17	0	30.0	0	0.5	0	0	0	0	0	0	0.6	0
18	0	2.0	0	3.2	0.4	0	0	0	0	0	0	0
19	0.4	9.0	0	0	0	0	0	0	0	0	3.2	0
20	0	9.0	0	0	0	0	0	0	7.4	0	0	0

Rainfall 2023-24												
Date	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April
21	0	0.2	0	0	0	0	0	0	1.2	0	0	1.6
22	4.7	88.0	7.6	0	0	0	0	0	0	0	0	0
23	12.6	2.0	105.0	0	0	0	0	0	0	0	0	3.2
24	70.0	2.6	11.0	0.4	8.8	0	0	0	0	0	0	1.4
25	92.2	0	18.7	0	0	0	0	0	0.8	0	0	6.6
26	3.1	0	0	0	0	0	0	0	0	0	0	0
27	2.7	37.6	0	0	0	0	0	0	0	0	3.0	0
28	0	0	0	0	0	0	0	0	0	0	11.6	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	21.5	4.9	0	0	0	0	0	0	0	24.5	14.4	0
31	0	0	0	-	0	0	0	4.2	0	10.0	0	0

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of Seradh village are Rainfed with animal and Irrigated with animal. The majority of the farmers opted- Irrigated with animal farming system typology. Farmers of this village always depend on animal husbandry along with agriculture.

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Various demonstrations were taken up in this NICRA village under natural resource management interventions such as water harvesting and recycling for supplemental irrigation, biomass mulching for ginger, ridges and furrows for maize sowing, aimed to enhance water efficiency, soil health, and crop productivity in different farming systems.

Table 5.2: Natural resource management interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Water harvesting and recycling for supplemental irrigation	5	5	0.32
Biomass mulching for Ginger	10	10	0.24
Ridges and furrows for Maize sowing	10	10	0.16

CROP PRODUCTION INTERVENTIONS:

Climate resilient technologies were demonstrated in which farmers were introduced to high-yielding hybrids of crops like cucumber, bitter gourd, and bottle gourd, as well as disease-resistant varieties of onion, garden pea, and wheat. Off-season capsicum cultivation under protected conditions was also

Protected cultivation of Capsicum

introduced on a small scale. Additionally, high-yielding, drought-tolerant, and disease-resistant varieties of paddy, wheat, and garden pea were promoted. Efforts were made to utilize barren land by planting horticultural fruit trees like lime, persimmon, and plum.

Table 5.3: Crop Production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Diversification through the introduction of high-yielding hybrid for more income (Cucumber, Bitter gourd, Bottle gourd)	42	42	0.72
Introduction of Offseason Capsicum cultivation under protected condition	7	7	0.07
Introduction of high yielding and purple blotch disease-resistant variety of Onion for income generation	10	10	0.16
Introduction of high yielding and powdery mildew disease-resistant variety of garden peas for income generation	12	12	0.32
Popularisation of high yielding, drought and blast disease resistant variety HPR 2795	10	10	0.75
Popularisation of high yielding, scented and short-duration Paddy variety HPR 2612	16	16	1.25
Popularisation of timely sown and rust-resistant variety HPW 368	14	14	2.0
Popularisation of late sown and drought tolerant variety HPW 373	3	3	1.0
Introduction of Lime, Persimmon and Plum horticultural fruit plants on barren land	12	12	0.187

LIVESTOCK INTERVENTIONS:

These interventions focused on improving the nutrition and health of milch (dairy) animals. Quality fodder production was demonstrated using sorghum and bajra, covering a small area of 0.24 hectares each and benefiting 23 and 25 animals, respectively. Additionally, health supplements were promoted to improve nutrition, with mineral mixtures provided to 46 animals and urea molasses bricks to 42 animals. These efforts were demonstrated to multiple farmers to improve livestock health and productivity.

Table 5.4: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of animals	Area (ha)
Quality fodder production for milch animals (Sorghum)	15	15	23	0.24
Quality fodder production for milch animals (Bajra)	15	15	25	0.24
Up-scaling of health supplements through mineral mixture for nutrition management in milch animals	40	40	46	-
Up-scaling of health supplements through urea molasses bricks for nutrition management in milch animals	39	39	42	-

Biomass mulching and high-yielding, rhizome rot resistant variety (Himgiri) of Ginger: The adoption of biomass mulching and the high-yielding, rhizome rot-resistant variety of ginger (Himgiri) helped conserve moisture during the crop's growth and rhizome formation stages, protected it from climatic stress. As a result, NICRA farmers achieved higher productivity of 128.8 q/ha and net returns of Rs. 1,72,673/ha compared to Non-NICRA farmers (101.9 q/ha and Rs. 1,16,880/ha). In terms of input

savings, NICRA farmers used fewer seeds (12.5 q/ha vs. 15 q/ha), less FYM, and fewer fertilizers like urea, leading to a total input saving of Rs. 3,200 compared to Non-NICRA farmers.

Rainwater harvesting for Cauliflower (Golden GS 385): Rainwater harvesting and recycling for supplemental irrigation were demonstrated in cauliflower crops during the growth stage. This technology allowed NICRA farmers to achieve significantly higher productivity of 260.7 q/ha and net returns of Rs. 1,92,740/ha compared to Non-NICRA farmers (212.9 q/ha, Rs. 1,42,900/ha). Input savings for NICRA farmers totalled Rs. 8,350/ha due to reduced seed, urea, and water requirements, contributing to more efficient resource usage.

High-yielding Wheat variety (HPW 368) resistant to yellow rust: The yellow rust-resistant, high-yielding wheat variety HPW-368 was demonstrated to farmers, helping the crop withstand climatic challenges during critical growth stages like crown root initiation (CRI) and grain filling. NICRA farmers saw better productivity (27.47 q/ha) and higher net returns (Rs. 43,536/ha) compared to Non-NICRA farmers (23.9 q/ha, Rs. 32,050/ha). Input savings for NICRA farmers amounted to Rs. 2,570/ha, due to optimized usage of seed, urea, and fertilizer (Table 5.5 b).

Drought-tolerant Wheat variety (HPW 373): The demonstration of the drought-tolerant wheat variety HPW 373, which was late-sown but adapted to dry conditions, led to increased productivity for NICRA farmers (28.9 q/ha) with higher net returns (Rs. 44,856/ha) compared to Non-NICRA farmers (24.5 q/ha, Rs. 31,600/ha). The adoption of this variety also brought about Rs. 2,340/ha in input savings due to more efficient use of seed, urea, and herbicides.

Diversification through Climate-Resilient Fruit Crops (Kagzi Lime, Persimmon, Plum): The use of barren land for the cultivation of climate-resilient fruit crops like Kagzi lime, persimmon, and plum was demonstrated as a resource management strategy to diversify income sources and increase resilience to climate stresses. However, mortality rates (10-15%) due to prolonged drought were noted, but this initiative is still in progress, aiming to improve income from horticultural crops.

Table 5.5 a: Impact in FST 2 (Rainfed with animal)

Crop/ Perennials	Technology adopted/ demonstrated	Area impacted by climatic stress, crop and stage	Rainfed with animal					
			NICRA farmer			Non-NICRA farmer		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Ginger (Himgiri)	In situ moisture conservation through Biomass mulching	Growth and rhizome formation stage	0.12	128.8	172673	0.12	101.9	116880
Cauliflower (Golden GS 385)	Water harvesting and recycling for supplemental irrigation in Cauliflower hybrid	Growth stage	0.06	260.7	192740	0.06	212.9	142900
Wheat (HPW 368)	Yellow rust resistant, timely sown wheat high-yielding variety	Growth, CRI and grain filling	0.24	27.5	43536	0.24	23.9	32050
Wheat (HPW 373)	High-yielding drought-tolerant and late-sown wheat cultivars	Growth, CRI and grain filling	0.24	28.9	44856	0.24	24.5	31600
Mushroom	Oyster mushroom for ancillary enterprise	-	30 bags	1.9 kg/bag	3114	-	-	-

Oysterm mushroom as an ancillary enterprise: Oyster mushroom cultivation was introduced as an ancillary enterprise to diversify income sources. NICRA farmers produced 1.94 kg per bag (30 bags), resulting in an additional income of Rs. 3,114, providing a supplementary revenue stream through mushroom farming (Table 5.5 a).

Table 5.5 b: Input saving due to technologies

Crop/ Perennials	Technology adopted/ demonstrated	Input	Input saving per ha (NICRA farmers)		Input saving per ha (Non-NICRA farmers)	
			Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Ginger (Himgiri)	In situ moisture conservation through Biomass mulching	Seed (q)	12.5	50000	15	60000
		FYM (q)	150	15000	100	10000
		Bio-mass mulch (kg)	150	2000	100	700
		NPK (kg)	140	4200	80	2400
		Fungicides + Insecticides (l)	0.5	800	1.0	1600
		Water (l)	5000	500	10000	1000
		Man days	25	17500	25	17500
Total				**90000**		**93200**
Cauliflower hybrid (Golden GS 385)	Water harvesting and recycling for supplemental irrigation	Seed (g)	400	24000	450	27000
		FYM (q)	100	10000	100	10000
		Urea (kg)	150	1050	200	1400
		NPK (kg)	130	3900	150	4500
		Fungicides + Insecticides (l)	0.5	800	1.0	1600
		Water (l)	4000	400	5000	500
		Man days	25	17500	30	21000
Total				**57650**		**66000**
Wheat (HPW 368)	Disease resistant timely sown wheat cultivar	Seed (kg)	100	4000	120	4800
		Field preparation (hrs)	6	6000	6	6000
		FYM (tonnes)	5	5000	5	5000
		Urea (kg)	100	1000	150	1500
		NPK (kg)	120	4080	150	5100
		Herbicide (l)	0.25	250	0.25	250
		Fungicide (l)	-	0	0.25	250
		Threshing (hrs)	8	4800	8	4800
Total				**25130**		**27700**
Wheat (HPW 373)	Drought tolerant late sown wheat cultivar	Seed (kg)	125	5000	150	6000
		Field preparation (hrs)	6	6000	6	6000
		FYM (tonnes)	5	5000	5	5000
		Urea (kg)	125	1250	200	2000
		NPK (kg)	140	4760	150	5100
		Herbicide (l)	0.50	500	0.75	750
		Threshing (hrs)	8	4800	8	4800
Total				**27310**		**29650**

Experts' visit to demonstration on Cauliflower

BY-PRODUCTS PRODUCED:

Wheat straw as a by-product is produced in rainfed farming systems with animals. About 25 quintals of wheat straw were produced per hectare, with a selling price of Rs. 850 per quintal. The total amount mobilized from selling the wheat straw was Rs. 21,250 per hectare. This indicates that wheat straw can be a valuable by-product for generating additional income in such farming systems.

LIVESTOCK INTERVENTIONS:

Health supplements (Area-specific mineral mixture)

NICRA farmers used an area-specific mineral mixture to improve the nutrition of their milch animals, the annual milk production per animal was 2,018 litres, sold at Rs. 50 per litre. This generated gross returns of Rs. 1,05,000 per animal. Additionally, 41.8 quintals of farmyard manure (FYM) were produced as a by-product, sold at Rs. 150 per quintal, resulting in Rs. 6,275 from FYM sale (Table 5.6 a).

High-yielding variety (PL 101) of Bajra for fodder production

NICRA farmers adopted the high-yielding variety of Bajra (PL 101) for fodder production, yielding 690 quintals per hectare. The selling price was Rs. 120 per quintal, leading to gross returns of Rs. 82,840. The adoption of this high-yielding variety contributed to improved fodder availability for livestock.

Table 5.6 a: Impact in FST 2 (Rainfed with animal)

Technology adopted/ demonstrated	Production/ year	Selling price (Rs./unit)	Gross returns (Rs./animal)	By-products (FYM) quantity	Unit price (Rs.)	Net Returns (Rs.)
Area-specific mineral mixture	2018 l	50/l	105000	41.8 q	150/ q	6275
High-yielding variety (PL 101) of Bajra	690 q/ha	120/q	82840	-	-	-

Input saving due to Livestock interventions

Mineral mixture: For NICRA farmers, the adoption of an area-specific mineral mixture as a nutrient supplement for animals resulted in a daily feed and fodder cost of Rs. 150 per animal, amounting to an annual cost of Rs. 54,750. Additional costs included labour at Rs. 32 per day (Rs. 11,680 annually) and

miscellaneous expenses at Rs. 5 per day (Rs. 1,825 annually). The total input cost for NICRA farmers was Rs. 68,255 per animal annually. In comparison, Non-NICRA farmers had a slightly lower feed and fodder cost of Rs. 130 per day (Rs. 47,450 annually), leading to a total input cost of Rs. 60,955 per animal.

Bajra (High-yielding variety PL 101 as quality fodder)

In terms of Bajra cultivation for fodder, NICRA farmers used 10 kg of high-yielding variety PL 101 seeds, costing Rs. 5,000 per hectare, whereas Non-NICRA farmers used 20 kg of seed, costing Rs. 10,000. Other input differences included urea, with NICRA farmers using 120 kg (Rs. 1,200) compared to 140 kg (Rs. 1,400) for Non-NICRA farmers. Additionally, NICRA farmers used less water (5,000 l vs. 10,000 l) and fewer labour days (20 days vs. 25 days). Overall, NICRA farmers saved significantly on inputs, with a total cost of Rs. 21,700 compared to Rs. 29,900 for Non-NICRA farmers.

Table 5.6 b: Input saving due to technologies

Technology adopted/ demonstrated		Input	NICRA Farmers		Non-NICRA Farmers	
			Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Mineral mixture	Area-specific mineral mixture as a nutrient supplement	Feed & fodder (Rs./day/animal)	150	54750	130	47450
		Labour (Rs./day/animal)	32	11680	32	11680
		Miscellaneous (Rs./day/animal)	5	1825	5	1825
Total				**68255**		**60955**
Bajra	High-yielding variety (PL 101) as quality fodder	Seed (kg/ha)	10	5000	20	10000
		FYM (q/ha)	50	5000	50	5000
		Urea (kg/ha)	120	1200	140	1400
		Water (l)	5000	500	10000	1000
		Man (days)	20	10000	25	12500
Total				**21700**		**29900**

BY-PRODUCTS PRODUCED:

In rainfed farming systems with animals during 2023-24, 75 quintals per hectare of farmyard manure (FYM) or vermicompost were produced. Although the selling price is Rs. 100 per quintal, the farmers did not sell the by-products. Instead, they used them for their fields, contributing to improved soil fertility and reducing the need for external inputs like fertilizers.

CROP INTERVENTIONS:

Early Maturing Paddy (HPR 2612): The demonstration of early maturing paddy variety HPR 2612 was shown to increase productivity and net returns. NICRA farmers achieved a yield of 28.7 q/ha and a net return of Rs. 53,150/ha, while Non-NICRA farmers had a lower yield of 24.4 q/ha and a net returns of Rs. 37,500/ha. The input savings were significant for NICRA farmers, with savings on seed (25 kg vs. 30 kg), urea (110 kg vs. 150 kg), NPK (12:32:16) fertilizer, and ploughing and puddling operations. Total input costs for NICRA farmers were Rs. 32,550, compared to Rs. 35,800 for Non-NICRA farmers, demonstrating the cost-effectiveness of the CRTs.

Wheat (Vesta Herbicide): Wheat productivity and net returns were higher for NICRA farmers using Vesta Herbicide for weed management, with yields of 28.87 q/ha and net returns of Rs. 44,487/ha

compared to Non-NICRA farmers who achieved 23.8 q/ha and Rs. 30,100/ha. NICRA farmers saved costs on seed (120 kg vs. 150 kg), urea (100 kg vs. 80 kg), and herbicides, resulting in total input savings of Rs. 27,680 compared to Rs. 29,400 for Non-NICRA farmers.

Cucumber Hybrid (Noori): NICRA farmers using the high-yielding cucumber hybrid Noori achieved higher productivity (252.24 q/ha) and net returns (Rs. 1,82,243/ha) compared to Non-NICRA farmers who produced 201.1 q/ha and earned Rs. 1,27,113/ha. Input savings included lower seed costs (3.5 kg vs. 4 kg), lower urea usage (250 kg vs. 270 kg), and reduced pesticide usage. NICRA farmers' total input cost was Rs. 72,450, while Non-NICRA farmers spent Rs. 79,240, showing cost savings and increased profitability.

Bottle Gourd Hybrid (Mallika): The introduction of the high-yielding bottle gourd hybrid Mallika improved productivity and profitability for NICRA farmers, yielding 230.6 q/ha and generating net returns of Rs. 1,65,577/ha, while Non-NICRA farmers achieved lower yields of 188.4 q/ha and returns of Rs. 1,21,447/ha. NICRA farmers also saved on inputs, with total costs of Rs. 61,050, compared to Rs. 70,075 for Non-NICRA farmers.

Bitter Gourd Hybrid (Palli): NICRA farmers using the high-yielding hybrid Palli for bitter gourd saw a higher yield of 167.1 q/ha and net returns of Rs. 1,15,107/ha, compared to Non-NICRA farmers who produced 138.1 q/ha and earned Rs. 85,093/ha. Input savings were achieved in seed quantity (4.5 kg vs. 5 kg), urea, and NPK fertilizer (12:32:16). NICRA farmers' input costs totalled Rs. 52,150, while Non-NICRA farmers incurred Rs. 59,200.

Garden Pea (Him Palam Matar-1): NICRA farmers cultivating the powdery mildew-resistant Him Palam Matar-1 variety of garden peas had yields of 141.82 q/ha and net returns of Rs. 1,06,820/ha, while Non-NICRA farmers had yields of 124.5 q/ha and net returns of Rs. 88,540/ha. Input savings included lower seed quantities (75 kg vs. 100 kg), and NICRA farmers had lower total input costs (Rs. 41,400) compared to Non-NICRA farmers (Rs. 52,700).

Onion (Palam Lohit): The introduction of the high-yielding and purple blotch-resistant variety Palam Lohit helped NICRA farmers achieve higher yields (243.78 q/ha) and net returns (Rs. 1,81,553/ha), compared to Non-NICRA farmers (Table 5.7 a). NICRA farmers also saved on inputs, with lower NPK fertilizer use (12:32:16) and lower overall costs of Rs. 46,600 compared to Rs. 58,000 for Non-NICRA farmers.

Harvested Tomato crop for marketing

Diagnostic visit to Tomato field

Demonstration on Cucumber

Table 5.7 a: Impact of CRTs in FST 4 (Irrigated with animal)

Crop/ Perennials	Technology adopted/ demonstrated	Area impacted by climatic stress, crop and stage	Irrigated with animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Paddy	Early maturing paddy (HPR 2612)	Tillering & grain filling	0.24	28.7	53150	0.24	24.4	37500
Wheat	Weed management	Crop growth	0.24	28.9	44486	0.24	23.8	30100
Cucumber	High-yielding hybrid Noori	Flowering and fruiting	0.24	252.2	182243	0.24	201.1	127113
Bottle gourd	High-yielding hybrid Mallika		0.12	230.6	165576	0.12	188.4	121446
Bitter gourd	High-yielding hybrid Palli		0.06	167.1	115106	0.06	138.1	85093
Tomato & Cucumber	Hybrids		0.96	269.2	197293	0.96	187.1	113113
Garden pea	Powdery mildew-resistant Him Palam Matar-1	Flowering and pod formation	0.06	141.8	106820	0.06	124.5	88540
Onion	Purple blotch resistance Onion Palam Lohit	Growth and bulb formation	0.06	243.8	181553	0.06	172.4	108393

Table 5.7 b: Input saving due to technologies

Crop/ Perennials	Technology adopted/ demonstrated	Input	NICRA farmers		Non-NICRA farmers	
			Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Paddy	Early maturing Paddy (HPR 2612)	Seed (kg/ha)	25	2500	30	3000
		FYM (tonnes/ha)	5	5000	3	3000
		Urea (kg/ha)	110	1100	150	1500
		NPK (kg/ha)	150	5100	200	6800
		Ploughing & Puddling (hrs)	12	9600	15	12000
		Pesticide (l)	0.5	250	1	500
		Harvesting & Threshing charges (hrs)	10	5000	6	3000
		Inter culture operations (Man days)	10	4000	15	6000
Total				**32550**		**35800**
Wheat	Weed management	Seed (kg/ha)	120	4800	150	6000
		FYM (tonnes/ha)	5	5000	5	5000
		Urea (kg/ha)	100	1000	80	800
		NPK (kg/ha)	120	4080	100	3400
		Ploughing (hrs)	6	6000	6	6000
		Herbicide (l)/Man days	1.5	1500	6 Man days	2400
		Fungicide (ml)	500	500	1000	1000
		Threshing (hrs)	8	4800	8	4800
Total				**27680**		**29400**
Cucumber	Introduction of high-yielding hybrid Noori	Seed (kg/ha)	3.5	37000	4	40000
		FYM (q/ha)	100	10000	100	10000
		Urea (kg/ha)	250	1750	270	1890
		NPK (kg/ha)	150	4500	165	4950
		Water (l)	8000	900	10000	1200
		Pesticides (l)	0.5	800	1.0	1600
		Man days	25	17500	28	19600
Total				**72450**		**79240**
Bottle gourd	Introduction of high-yielding hybrid Mallika as a cash crop	Seed (kg/ha)	4.5	30000	5	35000
		FYM (q/ha)	100	10000	100	10000
		Urea (kg/ha)	150	1050	175	1225
		NPK (kg/ha)	100	3000	125	3750
		Water (l)	8000	800	10000	1000
		Pesticides (l)	0.5	800	1.0	1600
		Man days	22	15400	25	17500
Total				**61050**		**70075**
Bitter gourd	Introduction of high-yielding hybrid Palli	Seed (kg/ha)	4.5	15750	5	17500
		FYM (q/ha)	100	10000	100	10000
		Urea (kg/ha)	200	1400	300	2100
		NPK (kg/ha)	150	4500	200	6000
		Water (l)	8000	800	10000	1000
		Pesticides (l)	0.5	800	1.0	1600
		Man days	27	18900	30	21000
Total				**52150**		**59200**

Crop/ Perennials	Technology adopted/ demonstrated	Input	NICRA farmers		Non-NICRA farmers	
			Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Capsicum	Introduction of offseason F1 hybrid Paladin under protected condition	Seed (g/ha)	250	35000	250	35000
		FYM (q/ha)	100	10000	100	10000
		NPK (19:19:19) (kg/ha)	200	30000	300	45000
		Water (l)	7000	700	10000	1200
		Pesticides (l)	1.0	1600	2.8	4600
		Man days	40	28000	50	35000
Total				**105300**		**130800**
Garden pea	Introduction of High yielding and powdery mildew disease-resistant variety Him Palam Matar-1 for income generation	Seed (kg/ha)	75	6750	100	9000
		FYM (q/ha)	100	10000	100	10000
		NPK (kg/ha)	185	5550	220	6600
		Water (l)	8000	800	10000	1000
		Pesticides (l)	0.5	800	1.0	1600
		Man days	25	17500	35	24500
Total				**41400**		**52700**
Onion	Introduction of High yielding and purple blotch disease-resistant variety Palam Lohit	Seed (kg/ha)	8	6400	10	8000
		FYM (q/ha)	150	10000	100	10000
		NPK (kg/ha)	200	7400	250	9200
		Water (l)	10000	1000	12000	1200
		Pesticides (l)	0.5	800	0.1	1600
		Man days	30	21000	40	28000
Total				**46600**		**58200**

Health supplements (Area specific mineral mixture): NICRA farmers adopted the area-specific mineral mixture for nutrition management in milch animals, leading to a production of 1983 litres of milk per year per animal, sold at Rs. 50/litre, generating gross returns of Rs. 1,05,500 per animal. In addition, farmers produced 41.7 quintals per hectare of farmyard manure (FYM), valued at Rs. 150 per quintal, contributing Rs. 6,250 to their income. NICRA farmers also saved on input costs, with feed and fodder expenses reduced from Rs. 150/day/animal (Rs. 54,750 annually for Non-NICRA) to Rs. 130/day/animal (Rs. 47,450 annually), resulting in a total cost of Rs. 60,955 compared to Rs. 68,255 for Non-NICRA farmers.

High yielding variety (KH 115) of Sorghum for fodder production: The introduction of the high-yielding sorghum variety KH 115 for fodder production in NICRA farming resulted in 517 quintals of sorghum per hectare, sold at Rs. 120 per quintal, yielding gross returns of Rs. 62,040. NICRA farmers also benefited from input savings by using 60 kg of seed (vs. 80 kg for Non-NICRA), 5000 litres of water (vs. 10,000 litres), and slightly less urea (120 kg vs. 140 kg). Total input costs for NICRA farmers amounted to Rs. 46,700, compared to Rs. 59,900 for Non-NICRA farmers, showing reduced costs through the use of efficient CRTs (Table 5.7 d).

Wheat straw was produced at a quantity of 12 quintals per hectare, generating an income of Rs. 10,200, while paddy straw amounted to 25 quintals per hectare, contributing Rs. 6,500. In livestock interventions, farmers produced 500 quintals of farmyard manure (FYM) through vermicomposting, valued at Rs. 100 per quintal. This by-product was recycled by using it as compost to enhance soil quality in their fields, highlighting its significance in sustainable agricultural practices.

Table 5.7 c: Impact in FST 4 (Irrigated with animal)

Animal (No.)	Technology adopted/ demonstrated	Production/ year	Selling price (Rs./unit)	Gross returns (Rs./animal)	By-product (FYM) quantity	Unit price (Rs.)	Net Return (Rs./ha)
3	Area-specific mineral mixture	1983 l	50/l	105500	41.67 q/ha	150/q	6250
5	High-yielding var. of Sorghum (KH 115)	517 q/ha	120/q	62040	-	-	-

Table 5.7 d: Input saving

Technology adopted/demonstrated	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Mineral mixture	Feed & fodder cost (Rs./day/animal)	150	54750	130	47450
	Labour (Rs./day/animal)	32	11680	32	11680
	Miscellaneous (Rs./day/animal)	5	1825	5	1825
Total			**68255**		**60955**
Sorghum (KH 115)	Seed (kg/ha)	60	30000	80	40000
	FYM (q/ha)	50	5000	50	5000
	Urea (kg/ha)	120	1200	140	1400
	Water (l)	5000	500	10000	1000
	Man days	20	10000	25	12500
Total			**46700**		**59900**

Table 5.7 e: By-products produced and recycled

By product produced	Quantity (q/ha)	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Wheat straw	12	850	-	10200
Paddy straw	25	250	-	6500
FYM / Vermicomposting	500	100	Used as compost for their field to improve the quality of the soil	-

Harvested Cucumber (Poly-house)

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

Custom hiring centre showed great performance of power weeder where 27 farmers were covered on 8.5 ha and Rs. 5500 rent was obtained. Also, wheel hoes, reapers, earth augers and power sprayers covered several farmers and obtained profitable amounts as rent (Table 5.8 a).

Table 5.8 a: Institutional interventions (Custom Hiring Centre)

Custom hiring centre	Implements	Amount mobilised (Rs.)	Farmers	Area (ha)
A custom hiring centre has been installed at Seradh (NICRA-adopted village)	Power weeder	5500	27	8.50
	Earth auger	400	12	1.20
	Wheel-Hoe	1200	25	3.75
	Reaper	1000	15	5.25
	Power sprayer	250	5	0.25
	Chaff cutter	200	5	-

SEED BANK:

Seed system for crop production used during CRTs demonstrations in 2023-24 showed great performance in the case of HPW 368 variety of wheat where 10 farmers were involved. Likewise, the adoption of Himgiri of ginger and Palam Hara Soya of soybean also performed well during interventions opted at that time.

Table 5.8 b: Institutional interventions (Seed bank)

Seed systems	Seed produced (q)	Farmers covered	Area covered (ha)	Quantity of seed retained for next season (kg)	Amount mobilised (Rs.)
Wheat HPW 368	78.0	10	3.00	2500	86000
Ginger Himgiri	5.0	10	0.24	200	30000
Soybean Palam Hara Soya	1.5	10	0.24	50	4000

FODDER BANK:

Cultivation of high-yielding varieties, PL 101 Bajra performed very well for NICRA farmers as they use it for their animal consumption. The huge impact was recorded as lot of farmers showed participation in these interventions during CRTs.

CAPACITY BUILDING:

Most of the training programmes for capacity building were carried out for scientific nursery raising of vegetable crops, production technology of various crops, soil fertility management, etc., where several male and female farmers showed involvement. Maximum participation of male and female farmers was shown in tomato and cucumber hybrid production technology (Table 5.9 a).

Various capacity-building programmes attended by KVK staff in 2023-24, focusing on themes like organic farming, animal health, climate resilience, and weather-related challenges. Six training sessions, including national conferences, refresher courses, and virtual meetings, were attended by KVK staff, with each programme having one participant (female). These sessions aimed to enhance staff expertise in modern agricultural practices and strategies, ensuring they are equipped to address ecological, economic, and environmental issues in agriculture. The overall goal is to improve the staff's ability to support sustainable farming practices.

Table 5.9 a: Capacity Building programmes (HRD) for farmers

Theme	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Concept of Nutrigarden and its purpose for family use	1	0	15	15
Water harvesting management technology	1	10	5	15
Animal nutrition management	1	8	32	40
Poultry production	1	14	6	20
Silage production technology	1	13	4	17
Garden Pea, Garlic and Onion production technology	1	13	11	24
Winter vegetable production technology	1	6	1	7
Soil fertility management	1	9	13	22
Mushroom cultivation	1	21	10	31
Nursery raising	1	4	7	11
Exotic vegetable cultivation	1	18	13	31
Layout and management of horticultural fruit crops	1	9	6	15
Scientific sheep and goat rearing	1	12	9	21
Drone technology	1	13	9	22
Tomato and cucumber hybrid production technology	1	30	17	47
IPM technology in vegetable crops	1	22	15	37

Table 5.9 b: Capacity Building programmes (HRD) for KVK Staff

Theme	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Attended three days National conference on Natural & Organic farming for ecological, economic & nutritional security w.e.f. 07.06.2023 to 09.06.2023 at CSKHPKV, Palampur by Dr. Brij Vanita	1	0	1	1
Attended one-day Interface meeting series 2023 on Advances in animal health & production with VO of AH Department & KVKs of HP organized by ICAR IVRI & ICAR IVRI on dated 09.06.2024 Regional station Palampur on the virtual mode by Dr Brij Vanita	1	0	1	1
Attended a two-day refresher course for animal scientists working in KVKs w.e.f. 01.09.23 to 02.09.2023 at KVK Mandi on virtual Mode Dr. Brij Vanita	1	0	1	1
Attended 14 days National Training Programme on Natural Farming: "Present Status and Future Prospects" held at CSKHPKV Palampur w.e.f. 14.09.2023 to 27.09.2023 by Dr. Neha Chauhan	1	0	1	1
Brainstorming session on weather aberrations in HP: Challenges in farming & coping strategies organized by ICAR ATARI Zone 1 Ludhiana on 23.09.23 at KVK Kullu by Dr Brij Vanita	1	0	1	1
Attended ICAR sponsored 21 days winter school on Climate Smart Agricultural Practices for system resilience in cereal based cropping systems w.e.f. 15th February to 6th March 2024 at Central Soil Salinity Research Institute Karnal by Dr. Neha Chauhan	1	0	1	1

OTHER EXTENSION ACTIVITIES:

Several extension activities were taken up in NICRA village such as meetings of VCRMC, exposure visits, plant clinics, and field days where male and female farmers showed active participation during 2023-24.

Table 5.10: Other extension activities

Name of program	Participants
Live Programme on 100th episode of Mann Ki Baat	65
Plant clinic cum field day on Onion	43
Field Day on Wheat	13
World Veterinary Day celebration	11
Monitoring of Technology Demonstration on protected cultivation of Cucumber, Capsicum and Poultry demonstration unit	10
Exposure visit of farmers to attend the Regional Agriculture Fair	20
Exposure visit cum farmers scientists interaction Programme (Hon'ble Vice Chancellor Chief guest)	33
Interaction meeting cum Exposure visit of Director ATARI Ludhiana and NICRA members regarding ongoing activities under the NICRA Project at KVK	8
Field day on Cauliflower GS 385	12
Plant Clinic cum Women in agriculture day	5
Plant clinic cum protected cultivation of vegetable crops	21
VCRMC Member meeting regarding the management of CHC equipment	15
VCRMC Member meeting regarding management and maintenance of CHC	22
Mushroom unit, Polyhouse unit dairy unit and field Technology demonstrations visit	18
Field visit of technology demonstrations site	11
Plant clinic cum awareness programme on soil testing	22
Field visit of technology demonstration of Tomato and other crops	15

Field day on Early Cauliflower hybrid

Awareness Programme

VCRMC Meeting

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

It includes precision farming initiatives such as polyhouse units for vegetable cultivation and high-density citrus plantations, both utilizing micro-irrigation and fertigation techniques. These interventions reached a total of 11 farmers, with financial and programmatic support from the State Department of Agriculture and the Department of Horticulture through schemes like Mukhyamantri Nutan Polyhouse Pariyojna and HP SHIVA. Additionally, one farmer adopted high-value mushroom production under the Khumb Vikas Yojna, while solar fencing was installed to protect crops from wild animals, funded under the ATMA scheme. The total amount mobilized for these activities was substantial, indicating significant investment in agricultural development in the region.

Table 5.11: Summary of Upscaling of technologies

Technology scaling up/out	No. of farmers reached	Convergence with the programme	Amount mobilised (Rs.)
Three Polyhouse units for precision farming of vegetables, Micro irrigation and fertigation	2	State Department of Agriculture (Mukhyamantri Nutan Polyhouse	377581
High-density cluster plantation of Citrus (Sweet orange) as Precision farming of fruits, Micro irrigation and fertigation	8	HP SHIVA (Department of Horticulture)	1500000
High-value production of mushroom	1	Khumb Vikas Yojna (Department of	1800000
Solar fencing for the protection of wild animals and monkey menace	1	State Department of Agriculture under ATMA	265000

EXTREME WEATHER EVENTS:

During 2023-24, nine dry spells were experienced in the months of October, November, December, January, February, March and April. High-intensive rain spells were also experienced during the monsoon season in July to August. No waterlogging and flooding situations were observed during this course of time. Dry periods caused delays in sowing essential crops like wheat, mustard, chickpea, and garden pea, leading to poor vegetative growth, water stress, and early maturity, which resulted in reduced grain quality and yields. Sensitive crops like cauliflower, onion, and garlic also suffered, with poor curd and bulb formation, while horticulture crops faced issues like flower drop and fruit loss. Additionally, dry spells impacted livestock, reducing milk, egg, and chick production. High-intensity rains during July and August caused waterlogging in crops like maize, black gram, and soybean, further affecting growth and development. These adverse conditions highlight the vulnerability of agriculture to extreme weather, leading to significant losses in both crop and livestock productivity.

Table 5.12: Extreme events, high-intensity rains and dry spells observed

Nature of event/Date	Impact on crop yield
Drought/ Dry spell	
01.10.2023 to 15.10.2023 (15 days)	• Delay sowing of early wheat, Mustard and chickpea. • Affected vegetative growth of early cauliflower and poor quality of curd • Poor pod formation of early garden pea
25.10.2023 to 10.11.2023 (17 days)	• Delay sowing of wheat, chick pea and garden pea
12.11.2023 to 31.11.2023 (20 days)	• Delay sowing of late sown wheat and main season garden pea
06.12.2023 to 31.12.2023 (26 days)	• Wheat, mustard and chickpea crops experienced water stress and forced early maturity with yellowing, underdeveloped and shrivelling of grains. • Poor germination in late-sown wheat • Delay sowing in garden peas and poor curd formation in cauliflower
01.01.2024 to 30.01.2024 (30 days)	• Wheat, mustard and chickpea crops experienced water stress and forced early maturity with yellowing, underdeveloped and shrivelling of grains • Poor germination in late-sown wheat • Delay sowing in garden peas and poor curd formation in cauliflower
06.02.2024 to 19.02.2024 (14 days)	• Poor vegetative growth, poor flowering and pod setting in chickpea and garden pea • Affected the grain filling of wheat and caused early maturity
26.02.2026 to 03.03.2024 (10 days)	• As the bulb formation stage in onion and garlic are temperature sensitive, thus dry weather affects the quality and yield of bulb crops
05.03.2024 to 29.03.2024 (25 days)	• Underdeveloped and shrivelling of wheat grain thus resulted in poor yield
01.04.2024 to 13.04.2024 (14 days)	• In horticulture crops, affected flower setting and caused fruit drop
The dry spell impacted animal output in terms of reduced milk production, chick growth, and egg production	
High-intensity rains	
High-intensity rains of more than 60 mm per day during the month of July to August 2023 affected plant growth and development of maize, black gram and soybean as these crops are considered vulnerable to water logging as field soil moisture content is higher than 80% in NICRA village.	

AGRO ADVISORIES ISSUED:

Agro advisories and bulletins issued from June to January, each month, 8 to 9 agro-met bulletins were consistently released, offering weather-related guidance to farmers. Additionally, other advisories, ranging from 2 to 5 per month, were also issued, covering more specific agricultural recommendations. The highest number of these additional advisories were released in July and August, aligning with the peak monsoon season when weather conditions can significantly impact farming activities.

Table 5.13: Details about agro advisories issued

Month	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Number of agro-met bulletins issued	9	8	9	9	9	8	9	9
Other advisories issued	3	5	5	4	3	2	2	2

These dry spells affected crops like wheat, garden pea, cauliflower, and other vegetables, particularly during critical growth periods such as sowing, germination, vegetative growth, flowering, and fruiting. To mitigate the impact, interventions like pre-sowing irrigation, use of drought-tolerant varieties, irrigation through rainwater harvesting, and application of nutrients were implemented. A significant number of farmers adopted these practices, leading to considerable improvements in crop yields compared to traditional methods. The measures helped mitigate yield losses, demonstrating the effectiveness of timely interventions during adverse weather conditions.

Table 5.14: Impact of contingency measures

S.No.	Dry spell (No. of days)	Duration	Crop name	Crop stage affected	Intervention taken up	No. of farmers involved	Impact on crop yield (q/ha)		
							Farmers' practice	Demo	Increase
1	15 days	01.10.2023 to 15.10.2023	Wheat	Delay sowing of early varieties of wheat	Pre.sowing irrigation growing of drought.tolerant varieties, water harvesting structure	45	26.05	30.46	14.47
2	17 days	25.10.2023 to 10.11.2023	Wheat & Garden Pea	Delay sowing of early and main season wheat & garden pea	Pre.sowing irrigation and growing of drought.tolerant varieties	62	110.84 (Garden Pea)	143.22	22.60
3	20 days	12.11.2023 to 31.11.2023	Wheat & Garden Pea	Delay sowing of late varieties of wheat and main season pea	Pre.sowing irrigation and growing drought.tolerant and disease.resistant varieties	62	110.84 Garden Pea)	143.22	22.60
4	26 days	06.12.2023 to 31.12.2023	Wheat & Garden Pea	Germination, growth and vegetative stage	Irrigation	62	110.84 (Garden Pea)	143.22	22.60
5	30 days	01.01.2024 to 30.01.2024	Wheat, Garden Pea & Cauliflower	Growth and Vegetative stage	Irrigation	54	209.76 (Cauliflower)	260.55	19.43
6	14 days	06.02.2024 to 19.02.2024	Wheat, Garden Pea & Cauliflower	Affected tillering stage of wheat, bulb formation in onion & garlic and Flowering and curd formation in cauliflower	Application of muriate of potash 0.2 % @ 80 gm /40 lit of water/bigha (2 Sprays First on boot leaf stage & 2nd at post.anthesis stage	74	26.05 (Wheat)	30.46	14.47

S.No.	Dry spell (No. of days)	Duration	Crop name	Crop stage affected	Intervention taken up	No. of farmers involved	Impact on crop yield (q/ha)		
							Farmers' practice	Demo	Increase
7	10 days	26.02.2024 to 03.03.2024	Garden Pea & Cauliflower	Flowering and curd formation stage	Irrigation	36	209.76 (Cauliflower)	260.55	19.43
8	25 days	05.03.2024 to 29.03.2024	Garden Pea & Cauliflower	Pod setting and curd formation stage	Irrigation	36	110.84 (Garden pea)	143.22	22.60
9	14 days	01.04.2024 to 13.04.2024	Wheat	Affected the grain filling of wheat and caused early maturity, affected growth and flowering stage in Tomato & Capsicum	Use of rainwater harvesting tank for irrigation	42	26.05 (Wheat)	30.46	14.47
10	10 days	01.05.2024 to 10.05.2024	Solanaceous and Cucurbits	Vegetative, flowering and fruiting stage	Use of rainwater harvesting tank for irrigation	48	216.95 (Cucumber)	278.44	22.08

Celebration of World Veterinary Day

Harvested Cucumber (Open field)

SIGNIFICANT ACHIEVEMENTS:

During 2023-24, key initiatives include the promotion of drought-tolerant and disease-resistant wheat varieties, resulting in expanded cultivation and increased farmer appreciation. Diversification into high-value vegetable crops like tomatoes, cucumbers, and cauliflower led to significantly higher income compared to traditional cereal farming. Eco-friendly fruit fly management techniques in tomato and cucurbits helped reduce insecticide use and improve yields. Barren land was transformed into productive orchards, while area-specific mineral mixtures improved livestock health and milk production. Additionally, fodder crop introduction extended the availability of quality feed for animals. The establishment of Custom Hiring Centres (CHCs) provided farmers with access to modern agricultural tools, reducing labour costs and improving operational efficiency across a broad area.

Table 5.15: Significant achievements

Description	No. of farmers	Impact
Popularisation of drought tolerant, yellow rust resistant, timely sown (HPW 368) and late sown (HPW 373) Wheat varieties		
The climate constraints experienced in the village are drought and erratic rainfall, especially during the germination and grain-filling stage in wheat crops. Further low temperatures during February – March and heavy rainfall favour yellow rust. To combat this problem, climate-resilient and yellow rust-resistant wheat variety HPW-368 has been demonstrated in rain-fed areas of NICRA village.	123	About 90 % of the farmers of the NICRA and adjoining villages appreciated the performance of these varieties and the area has increased from 5 ha to 25 ha areas in the village and 20 ha area in the surrounding villages under these varieties.
Diversification through high-value vegetable crops (Tomatoes, Cucumber, Bottle gourd, Bitter gourd, Ginger, Cauliflower and Garden Pea)		
Before the intervention of NICRA, farmers of Seradh village were growing non-remunerative cereal crops like maize, paddy and wheat due to drought and erratic rainfall. After the inception of NICRA, demonstrations on diversification towards high-value cash crops of cucurbits, and early cauliflower were conducted during the summer and rainy season of 2023 in the irrigated areas and ginger in rainfed areas, garden Pea and onion during *the Rabi* season. Now the farmers are shifted towards cash crops as the productivity as well as income per unit area is higher compared to traditional farming. The yield and productivity of tomatoes, cucurbits, cauliflower and garden peas have significantly increased as the farmers get more net returns per unit area. While it was merely less compared to pre-NICRA with the production of only cereal crops.	64	The farmers of the village appreciated the performance of tomato and cucurbits (Cucumber, bottle gourd & bitter gourd) hybrids, cauliflower and garden pea as cash crops and to adopt for future cultivation to increase their income. The livelihood of farm families of NICRA village has significantly improved as they are now getting net returns to the tune of 2.00 to 2.50 lakh per ha for the production of different vegetable crops while it was merely 25000 to 30000 pre-NICRA with the production of only cereal crops. About 62 % of farmers of NICRA and adjoining villages have adopted vegetable cultivation and the area has been increased from 0.40 ha to 1.85 ha in NICRA village and 2.0 ha area in the surrounding villages.
Low-cost and Eco-friendly management of fruit flies in Tomatoes and Cucurbits:		
In cucurbits, installation of fruit fly traps @ 25 traps/ ha along with BAT (jaggery + Malathion) application thrice increased fruit yield by 20-30 % in cucurbits while in tomato yield advantage of technology was 16-18%.	-	About 62 % of farmers of NICRA and adjoining villages have adopted fruit fly traps as low-cost and eco-friendly. Installation of fruit fly traps reduced the number of insecticidal applications from 6-7 to 3, reducing not only labour costs but also saving time and money. Women were always engaged in farm operations in the village and were exposed to harmful insecticides resulting in many ill effects. As the trap installation has reduced the number of applications, the chances of women's health hazards have also been reduced.

Description	No. of farmers	Impact
Introduction of fruit plants in barren land as resource management		
The 2 ha area under NICRA village was barren which has not been used under cultivation. After the inception of NICRA, in the village farmers were motivated to use that barren land as resource management for the plantation of horticultural fruit plants. KVK has demonstrated pomegranate (Kandhari), Lemon (key lime), persimmon (fuyu) and plum (Anjilina, Sentarosa, Satluj Purple, Black amber, Red Beauty) cultivation in a 2.64 ha area from 2022 onwards for more income.	20	Farmers were interested in horticultural crop cultivation to make use of barren land as resource management for income generation.
Area-specific mineral mixtures for animals		
Demonstrated supplementation through area-specific mineral mixtures for improvement of animal health and milk productivity. Feeding of area-specific mineral mixture to crossbred cattle under the intervention showed improvement in the health of the animal along with an average increase in the milk yield, respectively.	128	The introduction of the area-specific mineral mixture through NICRA interventions witnessed a surge in adoption, with 90% of farmers in the village and adjoining areas using it as a livestock feed supplement by 2023. This widespread adoption helped correct regional mineral deficiencies, significantly improving livestock productivity and profitability.
Introduction of fodder crops (Sorghum and Bajra)		
The introduction of fodder crops (Sorghum & Bajra) during the *Kharif* season and Rye (Makhan grass) during the *Rabi* season has increased the availability of quality fodder for 8-10 months which was earlier available for 6- 8 months.	70	NICRA promoted Bajra as a drought-tolerant and nutritious fodder crop through demonstrations, seed distribution, and capacity building. Its dual-purpose utility, integration with livestock rearing, and use in intercropping systems facilitated better adoption. Successful demonstrations in NICRA villages led to a spillover effect, prompting adoption in adjoining areas (2.0 ha) and more than 200 farmers.
Custom Hiring Services		
Custom hiring centres (CHCs) were established in NICRA village for timely agricultural purposes which could successfully empower farmers to tide over the shortage of labour. Energy-efficient tools and implements have been provided to the villagers on a custom hiring basis. The farmers of the village are making the best use of these implements by paying nominal charges for this service.	89	About 64 % of the farmers of the NICRA and adjoining villages benefited & appreciated that the Custom Hiring Centre (CHC) is a cost-saving approach and reduces the drudgery of farming operations. The implements have been used in an area of about 18.95 ha on a custom hiring basis and revenue was generated to the tune of Rs. 5550/- during 2023-24.

Table 5.16: Publications from the project

Description	Citation
Research Papers	Thakur S, Sood P, Rahi S, Yadav D S, Sharma L K, Chauhan N, Vanita B, Arya K and Sharma K (2024). Perception, adoption and utility of weather agro advisory services by farmers of Mandi district of Himachal Pradesh. *International Journal of Agriculture Extension and Social Development* **7(2):** 498-502.
	Chauhan N, Sharma S K, Rana S S, Datt N, Kumar P, Shabnam, Vishvamitera S, Choudhary D, Vanita B, Thakur S, Hetta G, Kumar S and Chauhan N (2023). Assessing the effect of weed management practices on physical soil properties in an acid Alfisol of Western Himalayas. *Biological Forum-An International Journal* **15(3):** 78-84.
	Vanita B, Sood P, Yadav D S, Rajput R, Thakur A, Sharma L K, Chauhan N and Thakur A (2023). Constraints perceived by the livestock owners of district Mandi in Indigenous dairy farming. *International Journal of veterinary sciences and animal husbandry* **SP-8(5)**:318-320.
	Choudhary D, Datt N, Sharma S K, Pathania P, Kumar P, Chauhan N, Gupta K and Prakriti (2023). Impact of crop diversification on soil physical properties and Maize grain equivalent yield in a Typic Hapludalf of Himachal Pradesh. *Biological Forum – An International Journal* **15(5):** 1162-1167.

NRM INTERVENTIONS:

Water harvesting and supplemental irrigation in Cauliflower (Hybrid Golden GS 385): NICRA farmers implemented rainwater harvesting and supplemental irrigation during the growth and flowering stages. This resulted in higher productivity of 267.2 q/ha and gross returns of Rs. 2,67,170/ha compared to Non-NICRA farmers who did not use this technology, achieving lower productivity of 215.4 q/ha and returns of Rs. 2,41,390/ha. Farmers appreciated the performance and adopted the technology for future use.

Biomass mulching in Ginger: NICRA farmers used biomass mulching to conserve moisture during the growth stage, leading to increased productivity of 128.2 q/ha and gross returns of Rs. 3,84,600/ha, compared to Non-NICRA farmers who had lower productivity of 101.4 q/ha and returns of Rs. 3,04,080/ha (Table 5.17 a).

CROP INTERVENTIONS:

High-yielding Paddy variety (HPR 2612): NICRA farmers adopted this early-maturing, scented, and short-duration rice variety during the *Rabi* season. This technology showed significantly higher productivity of 27.9 q/ha and gross returns of Rs. 83,700/ha compared to Non-NICRA farmers. The variety was well adapted to the region, and farmers appreciated its performance.

Timely sown and rust-resistant Wheat (HPW 368): NICRA farmers cultivated this variety, known for its resistance to rust and adaptability to timely sowing, during the *Rabi* season. This resulted in better yields (28.8 q/ha) and returns (Rs. 72,000/ha), making it a preferred choice compared to traditional practices used by Non-NICRA farmers.

Late-sown drought tolerant Wheat (HPW 373): This variety was demonstrated as a solution for late sowing and drought conditions. NICRA farmers achieved a productivity of 29.2 q/ha with gross returns of Rs. 73,000/ha, surpassing the results of Non-NICRA farmers who used local wheat varieties.

Table 5.17 a: Detailed information on NRM interventions demonstrated

NRM Interventions:								
Technology demonstrated		Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Specificity of technology	Farmers' perception
NICRA Farmers	Water harvesting and recycling for supplemental irrigation in Cauliflower hybrid Golden GS 385	Growth and flowering stage	0.32	267.2	57650	267170	Rainwater harvesting technology for supplemental irrigation in crops	Farmers appreciated the performance of technology and adapted for cultivation in the village.
Non-NICRA Farmers	-	Growth and flowering stage	0.32	215.4	66000	241390	-	-
NICRA Farmers	Biomass mulching in Ginger	Growth stage	0.40	128.2	90000	384600	In situ moisture conservation through biomass mulching in Ginger	Adopted in the village and surrounding areas
Non-NICRA	-	Growth stage	0.40	101.4	93200	304080	-	-

Weed management in Wheat: NICRA farmers applied herbicides like Vesta for effective weed control, leading to higher yields (28.2 q/ha) compared to Non-NICRA farmers who relied on manual weeding. This technology reduced labour and improved overall productivity.

High yielding hybrid Cucumber (Noori): During *Kharif* 2023, NICRA farmers adopted the Noori hybrid variety, known for its high yield and Downy mildew tolerance. They achieved a remarkable productivity of 259.4 q/ha, significantly higher than Non-NICRA farmers, making it a popular choice.

Hybrid Bottle gourd (Mallika): NICRA farmers cultivated Mallika as a cash crop during *Kharif* 2023, attaining a productivity of 231.2 q/ha and high profitability, encouraging its adoption in the region.

Hybrid Bitter Gourd (Palli): The Palli variety was introduced to NICRA farmers, resulting in a productivity of 167.90 q/ha. Its high yield potential was well-received and adopted by farmers in the area.

Off-Season Capsicum (F1 Hybrid Paladin): Under protected cultivation, NICRA farmers grew this high-yielding hybrid capsicum during *Kharif* 2023, achieving impressive yields (802.9 q/ha) and adopting it as a profitable off-season crop.

Disease resistant Onion (Palam Lohit): NICRA farmers introduced the Palam Lohit variety, resistant to purple blotch disease, during *Rabi* 2023-24. With a productivity of 245.3 q/ha, this technology was well accepted due to its high yield and disease resistance.

Powdery mildew resistant Garden Pea (Him Palam Matar-1): NICRA farmers grew this high-yielding, rust- and powdery mildew-resistant variety during *Rabi* 2023-24, leading to productivity of 152.8 q/ha. The variety was adopted widely for income generation.

Horticultural Fruit Crops in Barren Land: NICRA farmers also introduced fruit crops like key lime, persimmon, and plum in previously unused barren land. Despite some plant mortality due to drought, the initiative is inprogress, aiming to improve income from horticulture.

Table 5.17 b: Detailed information on Crop production interventions

Technology demonstrated		Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Specificity of technology	Farmers' perception
NICRA Farmers	Popularisation of High yielding, scented and short-duration variety HPR 2612 of Paddy	Tillering and grain filling	1.00	27.9	32550	83700	Early maturing rice variety	Very well adapted to the region
Non-NICRA Farmers	-	Tillering and grain filling	1.00	24.2	35800	72600	-	-
NICRA Farmers	Popularisation of Timely sown and rust-resistant variety HPW 368 of Wheat	Rust resistant timely sown wheat variety	1.00	28.8	25130	72000	Timely sown, rust-resistant variety HPW 368	Very well adapted to the region
Non-NICRA Farmers	-		1.00	24.2	27700	60500	-	-
NICRA Farmers	Popularisation of late sown, drought tolerant wheat variety HPW 373	Late sown drought tolerant wheat variety HPW 373	1.00	29.2	27310	73000	Late Sown, drought-tolerant variety	Very well adapted to the region
Non-NICRA Farmers	Local Check	Local check	1.00	23.8	29650	59500	-	-
NICRA Farmers	Weed management in wheat	Weed manageme nt through Herbicide Vesta	2.00	28.2	27680	70500	Control of Grassy and broad-leaf weeds	Effective in weed management
Non-NICRA Farmers	Manual weeding	Manual Weeding	1.00	24.1	29400	60250	-	-
NICRA Farmers	Introduction of high-yielding hybrid of cucumber Noori	Flowering and fruiting stage	0.32	259.3	72450	259360	High-yielding and Downey mildew tolerance hybrid	High-yielding and Downey mildew tolerance hybrid

Technology demonstrated		Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Specificity of technology	Farmers' perception
Non-NICRA Farmers	Cucumber 6125	Flowering and fruiting stage	0.32	200.9	79240	200890	-	-
NICRA Farmers	Introduction of high-yielding hybrid Mallika of bottle gourd as a cash crop	Flowering and fruiting stage	0.20	231.2	61050	231210	High productivity and profitability	Adopted in the region
Non-NICRA Farmers	Bottle gourd Mulayam	Flowering and fruiting stage	0.20	188.9	70075	188970	-	-
NICRA Farmers	Introduction of high-yielding hybrid Palli of bitter gourd	Flowering and fruiting stage	0.20	167.9	52000	167900	High yielding	Appreciated the results of the technology and adopted in the region
Non-NICRA Farmers	Bitter gourd F1 hybrid var.	Flowering and fruiting stage	0.20	139.1	55000	139080	-	-
NICRA Farmers	Introduction of Offseason capsicum F1 hybrid Paladin under protected condition	Flowering and fruiting stage	0.08	802.9	105300	802910	High-yielding and suitable for offseason cultivation under protected condition	Adopted in the region
Non-NICRA Farmers	Capsicum Bharat	Flowering and fruiting stage	0.08	638.7	130800	638720	-	-
NICRA Farmers	Introduction of High yielding and purple blotch disease-resistant variety Palam Lohit	Growth and Bulb formation stage	0.16	245.3	46600	245320	Good-keeping quality, purple blotch disease resistant and high-yielding	Appreciated the results of the technology and adopted in the village and surrounding areas
Non-NICRA Farmers	Onion AFDR (Agri found Dark Red)	Growth and Bulb formation stage	0.16	169.9	58000	169890	-	-

Technology demonstrated		Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Specificity of technology	Farmers' perception
NICRA Farmers	Introduction of High yielding and powdery mildew disease-resistant variety Him Palam Matar-1 of Garden pea for income generation	Flowering and pod formation stage	0.32	152.8	41400	152780	High-yielding, rust tolerance and powdery mildew resistance	Very well adopted in the region
Non-NICRA Farmers	GS 10	Flowering and pod formation stage	0.32	102.4	52700	102430	-	-

LIVESTOCK INTERVENTIONS:

Area specific mineral mixture for cattle:

The use of area-specific mineral mixtures by NICRA farmers is tailored to address local mineral deficiencies in forage and feeds, enhancing cattle health and productivity. This intervention led to the production of 2,100 litres of milk per year, with a selling price of Rs. 50 per litre, generating gross returns of Rs. 1,05,000 with a production cost of Rs. 74,460. Additionally, the by-products, primarily manure, produced 42.0 quintals, generating an extra Rs. 6,300 in returns. Farmers appreciated the improved animal health, growth, and reproductive performance, considering the mixtures cost-effective despite being pricier than generic alternatives. They also found it convenient to use a single tailored supplement for multiple deficiencies. However, some farmers faced scepticism regarding the benefits or had difficulty accessing these mixtures. In contrast, Non-NICRA farmers used rock salt as a supplement, which produced 1,785 litres of milk with lower returns and less impact on animal health.

High yielding Sorghum (KH 115) for fodder:

NICRA farmers introduced the high-yielding sorghum variety KH 115, specifically bred to produce more biomass and improve nutritional quality for livestock feed. This intervention yielded 510 quintals/ha of fodder at Rs. 120 per quintal, with gross returns of Rs. 61,200 and production costs of Rs. 20,500. The variety's resistance to biotic and abiotic stresses, along with its higher yield, made it a valuable resource for meeting livestock feed demands. Farmers viewed it as promising due to the increased fodder supply, although some expressed concerns about higher input costs and the potential environmental impact. Non-NICRA farmers used traditional maize fodder, which produced lower yields (475 quintals/ha) and returns.

High yielding Bajra (PL 101) for fodder:

NICRA farmers adopted Bajra PL 101, a high-yielding variety developed to enhance fodder productivity through increased biomass, nutritional quality, and stress resistance. This variety produced 705 quintals/ha of fodder at Rs. 120 per quintal, generating Rs. 84,600 in gross returns with production costs of Rs. 21,000. Farmers appreciated the technology for its potential to boost fodder availability, although some raised concerns about higher costs and the impact on traditional varieties. Compared to NICRA practices, Non-NICRA farmers cultivating maize fodder had lower productivity, achieving 490 quintals/ha with reduced returns. Overall, PL-101 was seen as an effective technology for improving fodder supplies for livestock (Table 5.17 c).

Table 5.17 c: Detailed information on Livestock interventions

Technology demonstrated		Production /year	Selling price (Rs.)	Cost of production (Rs./ animal)	Gross returns (Rs./ha)	By product quantity (q)	Unit price of by-product (Rs./q)	Gross returns from by-products (Rs./q)
NICRA Farmers	Area-specific mineral mixture	2100 l	50/l	74460	105000	42.0	150	6300
Specificity of technology	• Area-specific mineral mixtures for cattle are formulated to address the specific mineral deficiencies in the forages and feeds available in a particular region. • he mineral composition and proportions in these mixtures are tailored to the soil types, climatic conditions, and forage quality of the region. This approach is based on the understanding that mineral deficiencies and excesses can vary significantly across different geographical locations, even within the same country or state. A "one-size-fits-all" approach to mineral supplementation may not be effective in addressing the unique nutrient deficiencies of each area.							
Farmers' perception of technology	• Improved animal health and performance: Many cattle farmers perceive area-specific mineral mixtures to be beneficial for maintaining optimal animal health and improving productivity. They believe that these tailored mixtures can better meet the specific mineral requirements of their cattle, leading to improved growth rates, reproductive performance, and overall herd health. • Cost-effectiveness: While area-specific mineral mixtures may be more expensive than generic alternatives, some farmers consider them a worthwhile investment due to the potential for improved animal productivity and reduced healthcare costs associated with mineral deficiencies or imbalances. • Convenience: Farmers appreciate the convenience of having a single mineral mixture that addresses multiple mineral deficiencies in their area, rather than having to purchase and administer various individual mineral supplements. • Scepticism: However, there may also be scepticism among some cattle farmers regarding the claimed benefits of area-specific mineral mixtures. They may question the scientific evidence behind the formulations or doubt the ability of these mixtures to outperform generic alternatives significantly. • Accessibility: In some regions, cattle farmers may face challenges in accessing area-specific mineral mixtures due to limited availability or distribution channels.							
Non-NICRA Farmers	Rock salt	1785 l	45/l	69350	80325	40.0	150	6000
Popularisation of high-yielding variety (KH-115) of Sorghum as quality fodder production for milch animals								
NICRA Farmers	Sorghum KH 115	510 q/ha	120/q	20500	61200	-	-	-
Specificity of technology	High-yielding variety developed through selective breeding or genetic modification to produce higher biomass yields per unit area, potentially with improved nutritional quality or resistance to biotic and abiotic stresses							
Farmers' perception of technology	Many farmers perceive high-yielding sorghum fodder varieties as a promising option for increasing fodder production and meeting the growing demand for livestock feed, but some may have concerns about the higher input costs, potential impacts on the environment or traditional varieties, and the long-term sustainability of these varieties							

Livestock interventions:								
Technology demonstrated		Production /year	Selling price (Rs.)	Cost of production (Rs./ animal)	Gross returns (Rs./ha)	By product quantity (q)	Unit price of by-product (Rs./q)	Gross returns from by-products (Rs./q)
Non-NICRA Farmers	Maize fodder	475 q/ha	120/q	19500	57000	-	-	-
Popularisation of high-yielding variety (PL 101) of Bajra as quality fodder production for milch animals								
NICRA Farmers	Bajra PL 101	705 q/ha	120/q	21000	84600	-		--
Specificity of technology	PL 101 is a high-yielding variety of Bajra fodder to increase biomass yield, nutritional quality, and resistance to various stresses, to enhance overall fodder productivity.							
Farmers' perception	While some farmers view the high-yielding PL 101 Bajra fodder variety as a promising option for increasing fodder availability and meeting livestock feed demands, others may have concerns about higher input costs, potential impacts on traditional varieties or the environment, and the long-term sustainability of cultivating such varieties.							
Non-NICRA Farmers	Maize fodder	490 q/ha	120/q	19500	58800	-	-	-

TECHNOLOGY SPREAD IN NICRA VILLAGES:

Several interventions have been adopted successfully in Seardh and adjoining villages in the context of natural resource management, crop cultivation and livestock management. Under NRM, 0.78 ha has been opted for a high-yielding rhizome rot-resistant variety of ginger and 0.72 ha under vegetables by utilizing rainwater harvesting for irrigation. Improved varieties of wheat, paddy, cucumber, bottle guard and garden pea were adopted to improve the profitability of farmers. For the management of livestock, area-specific mineral mixture, bajra and sorghum were utilized for nutrient management in milch animals. Performance of the interventions concerning the variable weather was evaluated as NICRA was started in January 2022 in KVK Mandi, and hence farmers were motivated concerning mulching methods, use of FYM & Vermicomposting and rainwater harvesting structures to combat water stress in future through capacity building programme.

Table 5.18: Adoption of successful interventions in the NICRA village & the adjoining villages

Successful interventions	Crop	Variety/ hybrid	Extent of adoption in the village in ha (2023)
NRM			
Biomass mulching	Ginger	Himgiri	0.78
Water harvesting & recycling for supplemental irrigation	Cauliflower Early	Golden GS 385	0.72
CROP			
Early maturing Paddy	Paddy	HPR 2612	2.39
Weed management in Wheat	Wheat	HPW 368	15.84
	Wheat	HPW 373	9.36
High yielding hybrid of Cucumber	Cucumber	Hybrid Noori	0.89
High yielding hybrid of Bottle gourd	Bottle gourd	Mallika	0.45
Powdery mildew resistant Pea	Garden Pea	Him Palam Matar 1	0.85

Successful interventions	Crop	Variety/ hybrid	Extent of adoption in the village in ha (2023)
LIVESTOCK			
	Area specific mineral mixture	-	140 crossbred cattle of 90 farmers
High yielding var. of Bajra	Bajra	PL 101	0.78
High yielding var. of Sorghum	Sorghum	KH 115	0.63

During *Kharif* season, 2,000 hectares were brought under the climate-resilient paddy variety HPR 2612 and 52 hectares under the ginger variety Himgiri. For *Rabi* 2023, two wheat varieties were promoted: HPW 368, covering 12,000 hectares, and HPW 373, covering 3,000 hectares. These varieties are chosen for their adaptability to changing climate conditions, ensuring better yields and resilience in agriculture.

Table 5.19: Popularization of Climate-Resilient Varieties

Crop	Climate Resilient Varieties incorporated in the *Kharif* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Kharif* 2023 (ha)	Climate Resilient Varieties incorporated in the *Rabi* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Rabi* 2023 (ha)
Wheat	-	-	HPW 368	12000 ha
	-	-	HPW 373	3000 ha
Paddy	HPR 2612	2000	-	-
Ginger	Himgiri	52	-	-

Exposure visit to exhibition

NICRA farmer awarded Second Best prize in quality vegetable production at Regional Fair, CSKHPKV, Palampur (12-14.06.2023)

Bilaspur

6

Bilaspur is at 31.33°N 76.75°E, with an average elevation of 673 m (2,208 ft). It is situated on the foot of the Bandla Hills, along the left bank of river Sutlej which forms a picturesque landscape here owing to the creation of Govind Sagar Dam on it. Bilaspur experiences warm summers and cool winters but is protected from the extreme temperatures of the surrounding mountains by its valley location. The monsoon, from July to September, is a period of high rainfall. The highest temperature months are May and June when the temperature is typically around 37°C (99°F) and 38°C (100°F), sometimes exceeding 40°C (104°F). As of the 2011 Indian census, Bilaspur district had a population of 3,81,956. Males constituted 50.46% of the population and females 49.53%. Bilaspur has an average literacy rate of 91%, higher than the national average of 74%.

NICRA VILLAGE:

Badi Majerwan village of this district was selected for the Technology Demonstration Component of NICRA in the year 2022. A cultivated area of 150 ha is under this village without any flood-prone area.

Table 6.1: Day-wise rainfall (mm) distribution

Rainfall 2023-24												
Date	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	0	0	0	0	0	0	0	0	27.0	0.5	0.5	0
2	0	1.2	0	0	0	0	0	0	28.0	7.0	0	0
3	30.0	0	4.8	0	0	0	0	0	1.0	26.0	0	0
4	0	10.8	0	0	0	0	0	0	6.5	8.5	0	0
5	0	0	0	0	0	0	0	0	26.5	0.5	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	64.8	0	0	0	0	0	0	0	0	0	0
8	0	77.2	0	0	0	0	0	0	0	0	0	0
9	24.8	201.2	11.3	0	0	0	0	0	0.5	0	0	0
10	0	135.0	55.6	0	0	0	0	0.5	0	0	0	0
11	0	0	70.2	0	0	0	0	0	0	0	0	0
12	0	0	100.8	0	0	0	8.4	0	0	0	0	0
13	0	0	190.4	0	0	0	0	0	0	0	0	0
14	0	40.6	126.2	0	0	0	0	0	0	0.5	0	0
15	0	0	25.2	0	0	0	0	0	0	0	3.0	0
16	11.0	0	0	0	0	10	0	0	0	0	2.0	0
17	5.4	0	0	0	0	0	0	0	0	0	0	0
18	0	0	12	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	7.0	0
20	0	0	0	0	0	0	0	0	2.0	0	0	0

Rainfall 2023-24												
Date	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May
21	0	0	0	0	0	0	0	0	0.5	0	0	0
22	0	44.8	0	0	0	0	0	0	0	0	0	0.5
23	100.0	0	0	0	0	0	0	0.5	0	0	0	0
24	28.4	6.8	0	0	62.0	0	0	0	0	0	0	0
25	8.2	1.8	0	0	10.0	0	0	0	0	0	0	0
26	24.8	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0.5	0
28	2.4	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	1.8	0	0	0	0	0	0	0	0	19.0	5.5	0
31	0	0	0	0	0	0	0	0	0	2.5	0	0

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of this village are Rainfed with animal and Irrigated with animal. The maximum farmers in this villages opted farming system- Irrigated with animal. Farmers of this selected NICRA village always depend on animal husbandry along with agriculture. Most of the farmers (138) of the selected NICRA village actively participated in the FST 4 (Irrigated with animal) followed by 112 farmers participating in FST 2 (Rainfed with animal).

TECHNOLOGY DEMONSTRATIONS:

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) and FST 4 (Irrigated with animal) under natural resource management by adopting water harvesting and recycling for supplemental irrigation which proved beneficial for 10 selected NICRA farmers.

Climate resilient technologies were demonstrated for FST 2 and FST 4 under crop improvement by adopting rust tolerant wheat variety HPW 368, short duration turmeric variety (IISR Pragati), use of potassium nitrate for heat stress in wheat crop, management of fall armyworm in maize, weed management in wheat and diversification through vegetable cultivation which proved beneficial for selected NICRA farmers.

Table 6.2: Crop Production interventions

Resilient practice	Technology Demonstrated	No. of Demo	Farmers covered	Area covered (ha)
Crop Production interventions	Rust tolerant Wheat (HPW 368)	1	50	6
	Short duration Turmeric (IISR Pragati)	1	25	4
	Management of Fall armyworm in Maize	1	100	10
	KNO_3 for heat stress management (@2% spray)	1	50	4
	Weed Management in Wheat	1	50	6
	Diversification through vegetable cultivation	1	25	1

Impact of CRTs in FST 2 (RAINFED WITH ANIMAL):

Turmeric – Improved Variety IISR Pragati: In 2023, the improved variety of turmeric IISR Pragati was demonstrated on 2 hectares during the *Kharif* season. This short-duration, high-yielding variety, rich in curcumin, replaced the local variety, which takes 3 years to mature. NICRA farmers achieved a

productivity of 180 q/ha with a gross return (GR) of Rs. 8,80,500 per hectare, compared to the local variety which had a productivity of 74 q/ha and GR of Rs. 3,70,000. Although the cost of cultivation (CoC) was higher for NICRA farmers at Rs. 2,87,000 (compared to Rs. 1,87,000 for local variety), the higher yield and quality of rhizomes made the technology highly beneficial.

Wheat – Heat Stress Management: During the *Rabi* season, heat stress in wheat was managed by spraying a 2% potassium nitrate (KNO_3) solution during the grain-filling stage. This technology was demonstrated on 4 hectares, resulting in a productivity of 27 q/ha for NICRA farmers, with a gross return of Rs. 62,100 and a cost of cultivation (CoC) of Rs. 35,545. In comparison, traditional practices yielded 25 q/ha, with a gross return of Rs. 57,500 and a slightly lower CoC of Rs. 34,265. The KNO_3 spray improved wheat yield under heat stress conditions, increasing productivity and returns.

Wheat–Rust Tolerant Variety: The demonstration of the rust-tolerant wheat variety HPW 368 was conducted on 3 hectares during the *Rabi* season. This variety reduced rust incidence significantly, leading to increased yields. NICRA farmers achieved a yield of 28 q/ha, with a gross return of Rs. 64,400 and a cost of cultivation of Rs. 34,515 (Table 6.3 a), while traditional methods yielded 25 q/ha, with a gross return of Rs. 57,500 and a CoC of Rs. 33,265. The use of the rust-tolerant variety proved effective in enhancing wheat yield and managing disease pressure.

Maize – Fall Armyworm Management: In the *Kharif* season, maize was protected from fall armyworm infestations using Emamectin Benzoate spray (0.4g/l) at the vegetative stage, demonstrated on 5 hectares. NICRA farmers achieved a productivity of 39 q/ha, with a gross return of Rs. 70,100, compared to the traditional practices which had a productivity of 35 q/ha and GR of Rs. 63,000. The cost of cultivation for NICRA farmers was Rs. 35,400, slightly higher than Rs. 34,000 for traditional practices. The use of insecticide effectively reduced armyworm incidence and increased maize yield.

Wheat – Weed Management: Weed management in wheat was demonstrated using the herbicide Vesta (400g/ha) during the *Rabi* 2023-24 season. This technology was conducted on 3 hectares, and resulted in a productivity of 28 q/ha, with a gross return of Rs. 64,400 and a cost of cultivation of Rs. 34,850 for NICRA farmers. Traditional practices yielded 25 q/ha, with a gross return of Rs. 57,500 and a CoC of Rs. 32,850. The use of herbicide significantly reduced weed pressure and improved wheat yield, leading to higher returns.

Demonstration on improved Wheat cultivation methods

Table 6.3 a: Impact in FST 2 (Rainfed with animal)

Crop/ Perennials	Technology Demonstrated	Area impacted by technology (ha)	Area (ha)	NICRA farmers			Non-NICRA farmers (Using traditional variety)		
				Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
Turmeric	Improved Variety IISR Pragati	2.0	0.01	180	287000	880500	74	187000	370000
Rhizome Formation stage	IISR Pragati is a short-duration high-yielding variety rich in curcumin content	Demonstrated technology replaces the 3-year crop duration of the existing local variety. The turmeric rhizome is deep yellow and therefore can be rich in curcumin content.							
Wheat	Heat stress management in wheat	4.0	0.06	27	35545	62100	25	34265	57500
Grain filling stage	Spray of KNO_3 (@2% spray) to reduce heat stress	Demonstrated technology enhances the wheat yield.							
Wheat	Rust tolerant Wheat	3.0	0.06	28	34515	64400	25	33265	57500
	Use of rust-tolerant variety HPW-368	The incidence of rust has been reduced significantly and increased the wheat yield.							
Maize	Fall Army worm management in Maize	5.0	0.06	39	35400	70100	35	34000	63000
Vegetative Stage	Spray of insecticide (Emamectin Benzoate 0.4g/L)	Demonstrated technology reduces the armyworm incidence and increases Maize yield.							
Wheat	Weed management in Wheat	3.0	0.06	28	34850	64400	25	32,850	57500
	Spray of herbicide (Vesta @ 400 g/ha)	Demonstrated technology reduces weeds significantly and increases wheat yield.							

In FST 2 (Rainfed with animal), mineral bricks and mixture were fed to buffaloes during lactation to improve appetite, feed intake, and overall animal growth, ultimately enhancing digestibility. NICRA farmers using this technology saw a significant improvement in milk production, yielding 1800 litres per year with a gross return (GR) of Rs. 1,26,000 and a cost of production of Rs. 21,600 per animal. Additionally, by-products like dung produced 5560 kg, priced at Rs. 2.0 per kg, generating an extra Rs. 11,120 (Table 6.3 b). In contrast, Non-NICRA farmers, produced 1350 litres of milk, with a gross return of

Rs. 94,500 and a production cost of Rs. 18,250 per animal, alongside lower by-product returns. The mineral mixture improved the overall health and productivity of NICRA farmers' buffaloes, leading to higher milk yields and additional income from by-products.

Table 6.3 b: Impact in FST 2 (Rainfed with animal)

Animal	No.	Technology adopted/ demonstrated	Milk Yield/ year (l)	Selling price (Rs./l)	Cost of production (Rs./animal)	Gross returns (Rs./animal)	By products quantity (kg)	Unit price (Rs./kg)	Gross Returns (Rs.)
Buffalo **(NICRA Farmer)**	1	Mineral bricks and mixture	1800	70	21600	126000	5560	2.0	11120
Animals impacted during lactation	Improve appetite, and feed intake, all of which improve the overall growth of animal digestibility and overall growth of animal		Higher milk production						
Buffalo **(Non-NICRA farmer)**	1	-	1350	70	18250	94500	5270	2.0	10540
Animals impacted during lactation	Lower milk production with poor health of the animal		Poor animal growth and less production						

Impact of CRTs in FST 4 (IRRIGATED WITH ANIMAL):

Vegetables- Crop Diversification with Vegetable Cultivation: In the Irrigated farming system, crop diversification with vegetable cultivation was demonstrated on 1 hectare during the *Kharif* and *Rabi* seasons. NICRA farmers achieved a productivity of 227 q/ha, with a gross return (GR) of Rs. 9,08,000 and a cost of cultivation (CoC) of Rs. 3,14,500. In comparison, farmers using traditional practices had a lower productivity of 31 q/ha, with a GR of Rs. 71,300 and CoC of Rs. 35,700. This technology provided a continuous source of income, improving agroecological conditions and ensuring consistent production of high-quality vegetables with reduced pest and disease infestation.

Turmeric - Short Duration Variety IISR Pragati: The short-duration, high-yielding turmeric variety IISR Pragati was demonstrated on 2 hectares during the *Kharif* and *Rabi* seasons. NICRA farmers experienced productivity of 147 q/ha, with a gross return of Rs. 7,35,000 and a cost of cultivation of Rs. 2,87,000 per hectare. Farmers using the traditional variety achieved a lower yield of 79 q/ha, with a GR of Rs. 3,95,000 and a CoC of Rs. 1,87,000. The IISR Pragati variety reduced the typical 3-year crop duration and produced deep yellow rhizomes, rich in curcumin content, resulted in higher productivity and better economic returns.

Wheat- Rust Tolerant Variety (HPW 368): The rust-tolerant wheat variety HPW 368 was demonstrated on 6 hectares during the *Rabi* season. This technology significantly reduced rust incidence, leading to higher wheat yields. NICRA farmers saw a productivity of 31.3 q/ha, with a gross return of Rs. 71,990 and a cost of cultivation of Rs. 34,515. Farmers following traditional practices produced 26.3 q/ha, with a gross return of Rs. 60,490 and a CoC of Rs. 32,265. The use of rust-tolerant wheat improved disease resistance and productivity, enhanced economic returns.

Maize- Armyworm management: Armyworm management in maize was demonstrated on 4 hectares during the *Kharif* season. NICRA farmers applied Emamectin Benzoate (0.4g/l) at the vegetative stage, resulting in productivity of 40 q/ha, with a gross return of Rs. 72,000 and a cost of cultivation of Rs. 35,450 (Table 6.4 a). Traditional methods yielded 35 q/ha, with a gross return of Rs. 63,000 and a CoC of Rs. 34,000. The demonstrated technology effectively reduced armyworm infestations, leading to higher maize yields and better economic outcomes.

Table 6.4 a: Impact of CRTs in FST 4 (Irrigated with animal)

Crop/ Perennials	Technology Demonstrated	Area impacted by technology (ha)	Area (ha)	NICRA farmers			Non-NICRA farmers		
				Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
Vegetables	Crop diversification with vegetable cultivation	1.0	0.04	227.0	314500	908000	31.0	35700	71300
Flowering and fruit formation	A continuous source of income with the improved agro-ecological situation		Continuous availability of agri-horti quality produce with fewer pest and disease infestations.						
Turmeric	Short duration Turmeric IISR Pragati	2.0	0.01	147.0	287000	735000	79.0	187000	395000
	IISR Pragati is short duration yielding variety and is rich in curcumin content		Demonstrated Technology replaces the 3-year crop duration of the existing local variety. The turmeric rhizome is deep yellow and therefore can be rich in curcumin content.						
Wheat	Rust tolerant Wheat	6.0	0.06	31.3	34515	71990	26.3	32265	60490
	Use of rust-tolerant variety HPW 368		The incidence of rust has been reduced significantly.						
Maize	Armyworm management in Maize	4.0	0.06	40.0	35450	72000	35.0	34000	63000
Vegetative Stage	Spray of insecticide (Emamectin Benzoate 0.4g/l)		Demonstrated Technology reduces the armyworm incidence and increases Maize yield						
Wheat	Weed management in Wheat	5.0	0.06	31.0	34850	71300	28.0	32950	64100
	Spray of herbicide (Vesta @ 400 g/ha)		Demonstrated Technology reduces weeds significantly and increases wheat yield.						

Wheat – Weed management with Vesta herbicide: Weed management in wheat was demonstrated on 5 hectares during the *Rabi* 2023-24 season using Vesta herbicide (400g/ha). NICRA farmers achieved a productivity of 31 q/ha, with a gross return of Rs. 71,300 and a cost of cultivation of Rs. 34,850. Traditional practices yielded 28 q/ha, with a gross return of Rs. 64,100 and a CoC of Rs. 32,950. The use of Vesta herbicide significantly reduced weed pressure, improving wheat yields and increasing gross returns.

In FST 4 (Irrigated with animal), mineral bricks and mixture were provided to cows during lactation to enhance their appetite, feed intake, and overall growth, leading to higher milk production. NICRA farmers

using this technology achieved a significant increase in milk production, with cows producing 1980 litres per year, generating gross returns (GR) of Rs. 1,18,800 per animal and a cost of production (CoC) of Rs. 20,075. Additionally, the by-products, such as dung, yielded 4745 kg, priced at Rs. 2.0 per unit, resulting in extra returns of Rs. 9,490. In contrast, Non-NICRA farmers had lower milk production of 1080 litres per year, with gross returns of Rs. 64,800 and a CoC of Rs. 16,425. The by-products for Non-NICRA farmers were also lower, generating only Rs. 8,776.

Table 6.4 b: Impact in FST 4 (Irrigated with animal)

Animal	No.	Technology adopted/ demonstrated	Milk Yield/ year (l)	Selling price (Rs./l)	Cost of production (Rs./animal)	Gross returns (Rs./animal)	By products quantity (kg)	Unit price (Rs./kg)	Gross Returns (Rs.)
Cow **(NICRA Farmer)**	1	Mineral brick and mixture	1980	60	20075	118800	4745	2.0	9490
Animals impacted during lactation	Improve appetite, and feed intake, all of which improve the overall growth of animals.		High production and milk content.						
Cow **(Non NICRA farmer)**	1	Control	1080	60	16425	64800	4388	2.0	8776
Animals impacted during lactation	Low milk production with poor health of animal		Poor animal growth and less production.						

In Irrigated farming system with animal (FST 4), crop diversification with vegetable cultivation technology was demonstrated during both the *Kharif* and *Rabi* seasons. The significant impact of this technology was the reduction in the need for pesticides among NICRA farmers. NICRA farmers reported zero usage of pesticides and, therefore, incurred no pesticide-related costs. In contrast, Non-NICRA farmers, following traditional farming practices, used 650 ml/ha of pesticide, which resulted in a cost of Rs. 800 per hectare. This technology not only promoted healthier crop growth with reduced pest and disease pressure but also led to cost savings by eliminating the need for pesticide applications, making the system more environmentally and economically sustainable for NICRA farmers.

Demonstration of *Rabi* Onion at farmer field

Demonstration of Onion cv. AFDR at farmer field

BY-PRODUCTS PRODUCED:

In FST 2 (Rainfed with animal), 2500 kg cow dung was produced, leading to a cost saving of Rs. 37,500. In FST 4 (Irrigated with animal), the quantity of cow dung recycled was higher, at 4000 kg, resulting in greater savings of Rs. 60,000. The recycling of cow dung not only provided substantial cost savings but also contributed to soil health improvement by reusing organic materials in the farming systems.

Table 6.4 c: By-products produced

FST	Demo	Details of By-products	Savings due to by-product recycling	
			Quantity (kg)	Cost saved (Rs.)
FST 2	1	Cow dung	2500	37500
FST 4	1		4000	60000

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

The performance of various implements used in agriculture was assessed in this NICRA village where utilization of rotavator, power sprayer, power weeder, and mini crest tullu pump attracted farmers' interest. Initially, the farmers of the village were hesitant to use it, however, they were made aware through demonstrations/motivation to use this equipment.

Table 6.5: Institutional interventions (Custom Hiring Centre)

S.No.	Name of Implement	Area (ha)	No. of farmers	Amount generated (Rs.)
1.	Rotavator 6 feet With 42 Blade	1.0	10	500
2.	Seed Cum Fertilizer Drill with Nine Tines	0.6	4	200
3.	Foot Sprayer (700 Watt)	0.5	08	80
4.	Power Sprayer (15 litre capacity)	1.5	10	100
5.	Mini Crest Tullu Pump (IHP)	1.5	10	100
6.	Cultivator (Nine Tine)	0.4	3	60
7.	Power Weeder 7 hp	1.0	10	500
Total		**6.5**	**55**	**1540**

Demonstration on Rotavator

SEED PRODUCTION:

Seed system for crop production used during CRTs demonstrations in 2023-24 showed great performance in the case of HPW 368 variety of wheat where 50 farmers were involved over the area of 6 ha. The turmeric variety IISR Pragati was adopted on 0.1 hectares by 5 farmers, resulting in a production of 9 quintals of seed.

Table 6.6: Institutional interventions (Seed bank)

S. No.	Crop	Variety	Area (ha)	No. of farmers	Quantity produced (q)	Quantity Seed utilized (q)
1.	Turmeric	IISR Pragati	0.1	5	9	9
2.	Wheat	HPW 368	6.0	50	168	168

CAPACITY BUILDING:

Most of the training programmes for capacity building were carried out for training on crop management, fodder and feed management, horticultural crop management, value addition, and vegetable production where both male and female farmers participated.

Table 6.7: Capacity Building programmes (HRD)

Thematic area	Title of training	No. of Courses	No. of beneficiaries	
			Male	Female
Crop management	Improved cultivation techniques in Wheat	1	18	32
	Integrated Crop Management in Wheat	1	13	37
Fodder and feed management	Techniques for year-round fodder production	1	51	49
Management of horticultural crops	Fruits as a component of an integrated farming system	1	21	34
Vegetable production	Management of winter vegetable crops	1	37	63
	Integrated crop management in *Rabi* Onion	1	18	28
	Management of Fruit flies in Cucurbits	1	27	39
Value addition	Value addition of agriculture and horticulture crops	2	0	50

OTHER EXTENSION ACTIVITIES:

Several extension activities were taken up in NICRA village such as exposure visits, method demonstrations, self-help groups (SHG), and agro advisories where male and female farmers actively participated.

Table 6.8: Other extension activities

Name of the activity	Details about the activity	No.	No. of beneficiaries	
			Male	Female
Exposure visits	Kisan Mela at CSKHPKV	1	10	20
Strengthen - SHG	Value addition of Turmeric, Elephant foot yam & seasonal fruits	3	0	43
Method demonstrations	Seed Treatment in Turmeric	2	7	18
	Sprinkler Irrigation in Wheat	1	8	5
Agro-advisory	Crop-based agro-advisory services	104	36	64

Awareness programme on CRT

Diagnostic visit to farmer's field

TECHNOLOGIES SCALED UP:

A total of 130 farmers adopted improved practices on 15 hectares, such as high-yielding varieties of turmeric and wheat. These technologies were spread through awareness camps, farmer meetings (Gosthis), training, and personal contacts, promoting wider adoption and increasing productivity.

Table 6.9: Summary of Upscaling of technologies

Name of technology	Area (ha) adoption	Farmers (No.)	Mode of spread (Process)
Improved variety of Turmeric	5	50	Awareness camps, Gosthis, trainings, personal contacts
High-yielding variety of Wheat	10	80	Awareness camps, Gosthis, trainings, personal contacts
Total	**15**	**130**	

TECHNOLOGY SPREAD IN NICRA VILLAGES:

The impact of these demonstrations led to the adoption of these technologies by a number of farmers where farmers actively participated in demonstrations conducted for high yielding variety of turmeric IISR- Pragati and wheat HPW 368. These interventions indicate the farmers' shift towards using high-yielding and resilient varieties to enhance crop productivity.

Improved Wheat cultivation techniques in NICRA village

Kullu

7

Kullu is the administrative headquarters of the Kullu district of the Indian state of Himachal Pradesh. It is located on the banks of the Beas River in the Kullu Valley. As of the 2011 India census, Kullu district had a population of 437,903. Males in Kullu are 225,452, whereas females are 212,451. The sex ratio of Kullu is 942 females per 1000 males, which is higher than the national sex ratio.

NICRA VILLAGES:

Five villages of this district- Chhoel Gaduari, Seriber, Teguber, Mohal-1, and Reri- were selected for the Technology Demonstration Component of NICRA in 2011, 2017, 2017, 2018, and 2021, respectively. Promising technologies were demonstrated and scaled up in these villages to increase farmers' profitability.

Table 7.1: Information about the NICRA villages

Villages	Chhoel Gaduari	Seriber	Teguber	Mohal-1	Reri
Year adopted	2011	2017	2017	2018	2021
Nature of activity	Hand Holding- taking some interventions	Hand Holding	Scaling up	Taking up interventions	Taking up interventions

Table 7.2: Day-wise rainfall (mm) distribution

Rainfall 2023-24												
Date	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April
1	18.8	0	0	0	0	0	4.2	0	34.5	0	10.8	0
2	9.0	0	0	0	1.2	0	1.0	0	27.6	46.0	0	7.4
3	0.2	0	0	0	0	0	0	0	0	31.0	0	0
4	0	0	0	0	0	0	0	0	2.3	13.4	0	0
5	0	1.2	0.3	0	0	0	0	0	40.0	0	0	0
6	14.0	6.6	0	0	0	0	0	0	7.2	0	0	0
7	0	8.2	0	0	0	0	0	0	1.0	0.4	0	0
8	2.3	0	0	0	0	0	0	0	0	0	0	0
9	0	96.2	0	0	0	0	0	0	0	0	1.2	0
10	0	85.4	0	0	8.2	0	0	0	0	0	0	0.2
11	0	54.6	22.3	0	0	8.2	0	0	0	0	0	7.2
12	0	0	4.4	0	0	0	0	0	0	4.2	1.0	1.0
13	0	0.4	0.2	0	0	0	0	0	0	0	0	0
14	0.3	0	59.0	0	0	0	0	0	0	5.2	2.4	0
15	11.0	0	20.6	0	5.0	0	0	0	0	0	8.4	0
16	1.5	31.3	0	12.2	0	0	0	0	0	0	1.4	0

Table 7.2: Day-wise rainfall (mm) distribution

Rainfall 2023-24												
Date	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April
17	0	8.2	1.2	0	3.4	0	0	0	0	0	0	0
18	0	4.0	0	7.3	0	0	0	0	0	0	0	0
19	0.2	2.1	0	7.0	0	0	0	0	0	0	0	0
20	0	4.0	0	0	0	0	0	0	8.6	0	4.0	0
21	0	6.3	0	0	0	0	0	0	5.0	0	0.5	0
22	0	6.2	0	0	0	0	0	0	2.2	5.4	6.0	0
23	0	5.0	0	0	0	0	0	0	1.0	0	0	0
24	0	0	7.0	0	0	0	0	0	0	0	4.0	0
25	1.0	4.0	5.0	0	0	0	0	0	1.2	0	6.4	5.0
26	17.9	0	0	0	0	0	0	0	0	0	4.4	0
27	3.3	0	0	0	0	0	0	0	0	0	8.8	0
28	0	5.3	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	3.3	0	0
30	0	1.9	0	0	0	0	0	0	0	14.2	20.4	0
31	0	0	0	0	0	0	0	6.4	0	38.1	0	0

FARMING SYSTEM TYPOLOGIES:

Two farming system typologies- FST 2 (Rainfed with animal), and FST 4 (Irrigated with animal) exist in these villages. Maximum farmers of Reri and Mohal 1 village actively participated in demonstrations conducted for FST 2 whereas farmers of Chhoel Gaduari village showed interest in the FST 4 system.

Table 7.3: Summary of Interventions

Villages	No. of farmers involved in demonstrations	
	FST 2 (Rainfed with animal)	FST 4 (Irrigated with animal)
Chhoel Gaduari	34	100
Mohal-1	152	60
Reri	500	70
Total	686	230

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Maximum demonstrations under NRM were conducted on lifesaving irrigation and soil testing covering 11 ha and 10 ha respectively. Two demonstrations were conducted on in-situ moisture conservation covering an area of 0.5 ha.

Table 7.4: NRM interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Lifesaving irrigation	40	40	11.0
In-situ moisture conservation - Mulching	2	2	0.5
Soil testing -Soil test based fertilizer application	30	30	10.0

CROP PRODUCTION INTERVENTIONS:

Under crop production, several interventions were taken up for the farmers of NICRA adopted villages such as drought and yellow rust tolerant variety of wheat (HPW 368), composite varieties of maize (Bajaura Makka and Early composite), deep-rooted pulse crop, location-specific intercropping in Plum and Pomegranate orchard during *Rabi* season, etc.

Table 7.5: Crop Production interventions

Resilient practice	No. of Demo	Farmers covered	Area (ha)
Drought and yellow rust tolerant variety of Wheat (HPW 368)	94	94	15.0
Composite varieties of Maize's viz. Bajaura Makka and Early composite	293	293	30.0
Low-chilling fruit crops and coloured strains of Apple for low and mid-hill areas	21	21	1.3
Location-specific intercropping in Plum and Pomegranate orchard during *Rabi* season	53	53	2.7
Diversification through improved variety of Garlic GHC 1 as a cash crop	12	12	1.0
Deep-rooted pulse crop- Black gram and treatment of pulse crop with Rhizobium	105	105	8.0

LIVESTOCK INTERVENTIONS:

Several demonstrations were conducted on the production of fodder crops and the use of mineral mixture for milch animals to enhance farmers' income.

Table 7.6: Livestock interventions

Resilient practice	No. of Demo	Farmers covered	No. of animals	Area (ha)
Improved feeding practices-"UMMB/Mineral mixture for lactating animals during the lean period	200	200	550	-
Demonstration on backyard poultry with the improved breed - Him Samridhi	130	130	6000 (birds)	-
Improved feeding practices -Year-round production of green fodder crops: *Kharif* season Chari, Bajra and Maize (African tall) & *Rabi*: Oats and Berseem	122	122	350	8.5

Drought and yellow rust tolerant variety of Wheat (HPW 368)

FST 2 (RAINFED WITH ANIMAL):

Intercropping in Plum and Pomegranate Orchards with Pea: In Chhoel Gaduari village, NICRA farmers adopted location-specific intercropping of peas within plum and pomegranate orchards. This strategy resulted in significantly higher productivity for NICRA farmers (163.3 q/ha) when compared to Non-NICRA farmers (133.3 q/ha). The net returns were also substantially higher at Rs. 1,91,533/ha for NICRA farmers (Table 7.7 a), while Non-NICRA farmers earned Rs. 87,900/ha. This demonstrates the effectiveness of intercropping in enhancing both productivity and profitability in mixed farming systems.

Drought and yellow rust tolerant Wheat variety (HPW 368): For wheat, NICRA farmers utilized a drought and yellow rust-tolerant variety (HPW 368), which improved productivity and resilience. The yield for NICRA farmers was 32.3 q/ha, higher than the 29.4 q/ha achieved by Non-NICRA farmers. As a result, the net returns for NICRA farmers (Rs. 39,774/ha) were also better compared to the Non-NICRA farmers (Rs. 32,899/ha). This indicates that drought and disease-tolerant varieties can provide economic benefits under rainfed conditions.

Short duration composite variety for Maize: NICRA farmers adopted an early maturing composite variety of maize, achieving a productivity of 31.0 q/ha, while Non-NICRA farmers yielded 29.0 q/ha. The net returns for NICRA farmers were Rs. 34,100/ha, exceeding the Rs. 29,333/ha for Non-NICRA farmers. Short-duration maize varieties allowed for better management of the limited water resources in rainfed systems, leading to higher returns.

Integrated Crop Management (ICM) in Pomegranate: NICRA farmers implemented Integrated Crop Management (ICM) practices in pomegranate, which resulted in higher yields of 136.7 q/ha compared to 128.3 q/ha for Non-NICRA farmers. The net returns for NICRA farmers were significantly higher at Rs. 6,83,333/ha, while Non-NICRA farmers achieved Rs. 5,77,500/ha (Table 7.7 a). The ICM approach, which includes proper pest and nutrient management, demonstrated its effectiveness in boosting productivity and economic returns in pomegranate cultivation.

Table 7.7 a. Impact in Chhoel Gaduari for FST 2 (Rainfed with animal)

Crop/ Perennials	Technology adopted/ demonstrated	NICRA farmer			Non-NICRA farmer		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha	Net return (Rs./ha)
Pea	Location-specific intercropping in Plum and Pomegranate orchard with pea	0.24	163.3	191533	0.24	133.3	87900
Wheat	Drought and yellow rust tolerant variety of Wheat (HPW 368)	0.24	32.3	39774	0.40	29.4	32899
Maize	Short duration Composite variety Early composite	0.48	31.0	34100	0.96	29.0	29333
Pomegranate	ICM in Pomegranate	0.32	136.7	683333	0.28	128.3	577500
Total		**1.28**		**948740**	**1.88**		**727632**

NICRA farmers adopted year-round fodder production with improved varieties like oats, berseem, chari, bajra, and maize, along with UMMB and mineral mixtures for lactating animals during lean periods. This resulted in higher milk production (2552 l/year), generating gross returns of Rs. 62,300 per animal, and additional by-products worth Rs. 12,583 (Table 7.7 b). In contrast, Non-NICRA farmers, using local fodder without mineral mixtures, produced less milk (1919 l/year) with lower gross returns (Rs. 58,530) and by-products worth Rs. 10,250. Additionally, NICRA farmers raised backyard poultry (Palam Samridhi), earning Rs. 50,983 from 50 chicks and achieving net returns of Rs. 46,350, showing the overall benefit of CRT adoption for livestock productivity and profitability.

Demonstration on short duration Maize

Table 7.7 b. Impact in Chhoel Gaduari for FST 2 (Rainfed with animal)

Animal	No.	Technology adopted/ demonstrated	Yield/ year	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity (kg/year)	Unit price (Rs.)	Net Returns (Rs.)
NICRA	5	Year-round production Fodder crops: *Rabi*: Oats and Berseem, *Kharif* season -Chari, Bajra Maize (AT), UMMB / Mineral mixture for lactating animals during the lean period	2552 l	40	62300	5033	2.5/kg	12583
	1 unit (50 chicks)	Backyard Poultry-Palam Samridhi	7283 eggs	7/egg	50983	-	-	46350
Non-NICRA	4	No Feeding of UMMB and Mineral mixture, Use of local varieties of fodder	1919 l	40	58530	4100	2.5/kg	10250

BY-PRODUCTS PRODUCED AND RECYCLED:

In Chhoel Gaduari, maize stover was produced at 40.1 q/ha and sold at Rs. 350 per quintal, generating Rs. 14,030 and was used as animal fodder. Wheat straw production was slightly higher at 41.1 q/ha, with a selling price of Rs. 800 per quintal, yielding Rs. 32,850, and used as fodder. Additionally, cow dung was produced at 30 q/ha, valued at Rs. 250 per quintal, and was recycled by being applied to the field, mobilizing Rs. 7,500. This demonstrates the efficient recycling of farm by-products, contributing to livestock nutrition and soil health (Table 7.7 c).

Improved Garlic Variety (GHC 1) as a cash crop: In village Mohal, NICRA farmers adopted GHC 1, an improved variety of garlic, for diversification as a cash crop. This led to higher productivity of 165.0 q/ha compared to 150.7 q/ha for Non-NICRA farmers. The net return for NICRA farmers was Rs. 4,95,000/ha, significantly higher than the Rs. 4,52,000/ha earned by Non-NICRA farmers. This demonstrates that the improved garlic variety provided better yields and profitability, making it a viable option for increasing farm income in rainfed systems (Table 7.8 a).

Table 7.7 c: By-products produced and recycled (Chhoel Gaduari)

By product produced	Quantity	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Maize stover	40.1 q/ha	350	Used as fodder for animal	14030
Wheat straw	41.1 q/ha	800	Used as fodder for animal	32850
Cow dung	30.1 q	250	Used in the field	7500

Composite Varieties of Maize: NICRA farmers used an early composite maize variety, resulting in a productivity of 31.6 q/ha, while Non-NICRA farmers achieved 28.5 q/ha. The net return for NICRA farmers was Rs. 62,466/ha, compared to Rs. 56,800/ha for Non-NICRA farmers. Cultivating composite maize varieties led to higher yields and financial returns, highlighting the benefits of adopting improved varieties in rainfed farming systems.

Table 7.8 a. Impact in Mohal for FST 2 (Rainfed with animal)

Crop/ Perennials	Technology adopted/ demonstrated	Rainfed with animal					
		NICRA farmer			Non-NICRA farmer		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Garlic	Diversification through improved variety of Garlic GHC 1 as a cash crop	0.32	165.0	495000	0.24	150.7	452000
Maize	Composite varieties of Maize Early composite	0.32	31.6	62466	0.24	28.5	56800
Total				**557466**			**508800**

In Mohal village, NICRA farmers with 7 animals used year-round fodder production, including oat and berseem in *Rabi*, Chari, bajra, and maize during *Kharif*, along with UMMB and mineral mixtures for lactating animals during lean periods. This resulted in higher annual milk production of 3678 l/animal compared to Non-NICRA farmers (1423 l/animal), who used local fodder without mineral mixtures. NICRA farmers achieved gross returns of Rs. 62,877 per animal, with additional by-products (7033 kg/year) generating Rs. 17,583. Non-NICRA farmers, with only 3 animals, had lower gross returns of Rs. 56,906 and fewer by-products (3000 kg/year) worth Rs. 7,500.

Additionally, NICRA farmers also practised backyard poultry farming with 50 chicks of the Palam Samridhi breed, yielding Rs. 51,216 in gross returns and Rs. 46,583 in net returns, further enhancing their overall income (Table 7.8 b).

BY-PRODUCTS PRODUCED AND RECYCLED:

Maize stover was produced at a rate of 39.9 q/ha and sold for Rs. 350 per quintal, generating Rs. 13,962. This stover was recycled as animal fodder, supporting livestock nutrition. Additionally, cow dung was produced at 28.0 q, valued at Rs. 250 per quintal, and used as organic fertilizer in the fields, mobilizing Rs. 7,000. This efficient recycling of by-products enhances animal feed supply and soil fertility, contributing to sustainable farming practices (Table 7.8 c).

Short-Duration Composite Variety of Maize (Bajaura Makka): NICRA farmers in village Reri adopted the short-duration composite variety of maize, Bajaura Makka. This led to a productivity of 32.8 q/ha, higher than the 28.8 q/ha achieved by Non-NICRA farmers. The net returns for NICRA farmers were Rs. 36,366/ha, significantly better than the Rs. 29,133/ha earned by Non-NICRA farmers, showing the benefits of using improved maize varieties in rainfed systems (Table 7.9 a).

Table 7.8 b. Impact in Mohal for FST 2 (Rainfed with animal)

Animal	No.	Technology adopted/ demonstrated	Yield/ year	Selling price (Rs./unit)	Gross returns (Rs./animal)	By-products quantity (kg/year)	Unit price (Rs.)	Net Returns (Rs.)
NICRA	7	Year-round production Fodder crops: *Rabi*: Oats and Berseem, *Kharif* season - Chari, Bajra Maize (AT), UMMB / Mineral mixture for lactating animals during the lean period	3678 l	40	62877	7033	2.5/ kg	17583
	1 unit (50 chicks)	Backyard Poultry-Palam Samridhi	7317 eggs	7	51216	-	-	46583
Non-NICRA	3	No Feeding of UMMB and Mineral mixture, Use of local varieties of fodder	1423 l	40	56906	3000	2.5/ kg	7500

Table 7.8 c: By-products produced and recycled (Mohal)

By product produced	Quantity	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Maize stover	39.9 q/ha	350	Used as fodder for animal	13962
Animal cow dung	28.0 q	250	Used in the field	7000

Drought-tolerant Wheat variety (HPW 368): NICRA farmers used the drought-tolerant wheat variety HPW 368, which resulted in a productivity of 28.9 q/ha compared to 28.3 q/ha for Non-NICRA farmers. The net return for NICRA farmers was Rs. 32,479/ha, slightly higher than the Rs. 30,419/ha for Non-NICRA farmers. This indicates the value of drought-tolerant varieties in maintaining productivity and income stability under water-limited conditions.

Area-specific intercropping in Fruit Orchards with Pea: NICRA farmers practised intercropping with pea in fruit orchards, which yielded 185 q/ha, generating a substantial net return of Rs. 2,17,03/ha. Non-NICRA farmers did not adopt this intercropping technique, demonstrating the significant economic advantage NICRA farmers gained by integrating pea cultivation within orchards.

Diversification with improved Garlic variety (GHC 1): The improved garlic variety GHC 1 was adopted by NICRA farmers for diversification, leading to a productivity of 156.7 q/ha, far surpassing the 124 q/ha achieved by Non-NICRA farmers. NICRA farmers earned net returns of Rs. 4,13,766/ha, significantly higher than the Rs. 3,12,583/ha of Non-NICRA farmers, indicating that diversification with improved garlic varieties can substantially enhance income in rainfed systems.

Black gram with *Rhizobium* inoculation: NICRA farmers cultivated black gram with *Rhizobium* inoculation, aimed at improving soil health. This resulted in a productivity of 7.1 q/ha and net returns of Rs. 56,673/ha, compared to 6.3 q/ha and Rs. 46,973/ha for Non-NICRA farmers (Table 7.9 a). The use of Rhizobium inoculation not only improved yields but also contributed to better soil fertility, further boosting returns.

Table 7.9 a: Impact in Reri for FST 2 (Rainfed with animal)

Crop/ Perennials	Technology adopted/ demonstrated	Rainfed with animal					
		NICRA farmer			Non-NICRA farmer		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Maize	Short-duration composite variety of Maize- Bajaura Makka	0.08	32.7	36366	0.08	28.8	29133
Wheat	Drought-tolerant Wheat variety (HPW 368)	0.16	28.9	32479	0.08	28.3	30419
Pea	Area-specific intercropping in fruit orchards	0.08	185.0	217033	-	-	-
Garlic	Diversification through an improved variety of Garlic (GHC 1)	0.16	156.7	413766	0.08	124.0	312583
Black gram	Leguminous crop + *Rhizobium* inoculation to improve soil health	0.08	7.1	56673	0.08	6.3	46973
Perennial	Low-chilling Apple varieties (Gala) on seedling rootstock	0.32	-	-	-	-	-
Total		**0.88**		**756317**	**0.32**		**419108**

Table 7.9 b: Impact in Reri for FST 2 (Rainfed with animal)

Animal	No.	Technology adopted/ demonstrated	Yield/ year (l)	Selling price (Rs./ unit)	Gross returns (Rs./animal)	By-products quantity (kg)	Unit price (Rs.)	Net Returns (Rs.)
NICRA	6	Year-round production Fodder crops: *Rabi*: Oats and Berseem, *Kharif* season-Chari, Bajra Maize (AT), UMMB/ Mineral mixture for lactating animals during the lean period	3072 l	40	61433	6100	2.5	15250
	1 unit (50 chicks)	Backyard Poultry- Palam Samridhi	7467 eggs	7/egg	52183	-	-	47633
Non-NICRA	4	No Feeding of UMMB and Mineral mixture, Use of local varieties of fodder	1742 l	40	53733	4000	2.5	10000

Low-Chilling Apple Varieties (Gala): NICRA farmers planted low-chilling apple varieties (Gala) on seedling rootstock over 0.32 ha. This initiative likely aimed to diversify and adapt to the local climate, promoting long-term resilience in the farming system.

In Reri village, NICRA farmers, with 6 animals, adopted year-round fodder production (*Rabi*: oats and berseem; *Kharif*: chari, bajra, maize) along with UMMB (Urea Molasses Mineral Block) and mineral mixtures for lactating animals during lean periods. This resulted in higher milk production (3072 l/year per animal) compared to Non-NICRA farmers, who produced 1742 l/year per animal. NICRA farmers achieved gross returns of Rs. 61,433 per animal, while Non-NICRA farmers earned Rs. 53,733. NICRA farmers also produced 6100 kg by-products, generating Rs. 15,250, compared to Non-NICRA farmers (4000 kg), valued at Rs. 10,000.

Additionally, NICRA farmers engaged in backyard poultry farming with 50 chicks (Palam Samridhi breed), generating Rs. 52,183 in gross returns and Rs. 47,633 in net returns. Non-NICRA farmers did not adopt poultry farming, highlighting the additional income NICRA farmers gained through CRT adoption.

BY-PRODUCTS PRODUCED AND RECYCLED:

In Reri village, maize stover (41.0 q/ha) and wheat straw (36.7 q/ha) were used as fodder, generating Rs. 16,417 and Rs. 29,362 respectively. Additionally, 63.0 q/ha of cow dung was used as organic fertilizer in the fields, mobilizing Rs. 15,750 (Table 7.9 c). This efficient recycling of by-products enhances livestock feed and soil fertility, contributing to sustainable farm management.

Table 7.9 c: By-products produced and recycled (Reri)

By product produced	Quantity	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Maize stover	41.0 q/ha	400	Used as fodder for animal	16417
Wheat straw	36.7 q/ha	800	Used as fodder for animal	29362
Pea straw	15.5 q/ha	-	Used for animal	-
Animal cow dung	63.0 q	250	Used in the field	15750

FST 4 (IRRIGATED WITH ANIMAL):

Improved Garlic Variety (GHC 1): NICRA farmers in Chhoel Gaduari village adopted the improved garlic variety GHC 1 as a cash crop in their irrigated farming system. They cultivated garlic on 0.56 hectares, achieving a productivity of 190.4 quintals per hectare and generating a significant net return of Rs. 5,71,333 per hectare. In contrast, Non-NICRA farmers, who used GHC 1 on 0.24 hectares, had lower productivity at 148.4 quintals per hectare and a net return of Rs. 4,45,333 per hectare. This demonstrates the superior performance of GHC 1 in increasing yield and profitability for NICRA farmers.

Drought-Tolerant Wheat Variety (HPW 368): The adoption of the drought-tolerant wheat variety HPW 368 by NICRA farmers on 0.24 hectares of irrigated land resulted in a productivity of 34.5 quintals per hectare and a net return of Rs. 73,241 per hectare. Non-NICRA farmers, growing wheat on 0.16 hectares, achieved a lower productivity of 30.8 quintals per hectare, with net returns of Rs. 65,485 per hectare. This variety enhanced wheat productivity and profitability, particularly for NICRA farmers.

Table 7.10 a: Impact in FST 4 (Irrigated with animal) in Chhoel Gaduari

Crop	Technology adopted/ demonstrated	Irrigated with animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Garlic	Improved variety of Garlic GHC 1 as a cash crop	0.56	190.4	571333	0.24	148.3	445333
Wheat	Drought tolerant Wheat variety (HPW 368)	0.24	34.5	73241	0.16	30.8	65485
Total				**644574**			**510818**

In Chhoel Gaduari village, the impact of Climate Resilient Technologies (CRTs) on livestock productivity was assessed for irrigated farming system (Agri-Horti-Animal). NICRA farmers implemented year-round fodder production, including *Rabi* season crops like oats and berseem and *Kharif* crops like chari, bajra, and maize. Additionally, they fed lactating animals with UMMB (Urea Molasses Mineral Block) and mineral mixtures during the lean period. As a result, their seven animals produced 3,822 l per year, with a selling price of Rs. 40/l, generating gross returns of Rs. 65,693 per animal. They also gained 6,867 kg of by-products, priced at Rs. 2.5/kg, with total net returns of Rs. 17,166 (Table 7.10 b).

In contrast, Non-NICRA farmers, who did not feed UMMB or mineral mixtures and used local varieties of fodder, had only three animals producing 1,942 l annually at the same selling price (Rs. 40/l), resulting in

lower gross returns of Rs. 58,766 per animal (Table 7.10 b). Their by-products amounted to 4,000 kg, priced at Rs. 2.5/kg, with net returns of Rs. 10,000.

Additionally, NICRA farmers raised backyard poultry using the Palam Smridhi variety, which resulted in 7,133 eggs production from one unit (50 chicks), selling at Rs. 7/egg, generating Rs. 49,933 in gross returns.

Table 7.10 b: Impact of CRT on livestock productivity in Chhoel Gaduari village

Animal	No.	Technology adopted/ demonstrated	Yield/ year	Selling price (Rs./ unit)	Gross returns (Rs./animal)	By-products quantity (kg/year)	Unit price (Rs.)	Net Returns (Rs.)
NICRA	7	Year-round production Fodder crops: *Rabi*: Oats and Berseem, *Kharif* season - Chari, Bajra Maize (AT), UMMB / Mineral mixture for lactating animals during the lean period	3822 l	40	65693	6867	2.5/kg	17166
	1 unit (50 chicks)	Backyard Poultry- Palam Samridhi	7133 eggs	7	49933	-	-	45300
Non-NICRA	3	No Feeding of UMMB and Mineral mixture, Use of local varieties of fodder	1942 l	40	58766	4000	2.5/kg	10000

BY-PRODUCTS PRODUCED AND RECYCLED:

In Chhoel Gadauri village during 2023-24, various by-products were produced and effectively recycled within the farming system. Wheat straw was produced at a rate of 42.9 quintals per hectare, sold at Rs. 800 per quintal, and primarily used as fodder for animals, generating Rs. 34,280. Maize stover was produced at 41.6 q/ha, with a selling price of Rs. 350 per quintal, and also utilized for animal feeding, yielding Rs. 14,560. Additionally, 34.5 quintals of cow dung per hectare were produced, sold at Rs. 250 per quintal, and used as field manure, contributing Rs. 8,625 to the farm's income. These recycling practices enhanced resource efficiency and farm sustainability.

Table 7.10 c: By-products produced and recycled (Chhoel Gaduari)

By product produced	Quantity	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Wheat straw	42.9 q/ha	800	Used as fodder for animal	34280
Maize stover	41.6 q/ha	350	Used for animal	14560
Animal cow dung	34.5 q	250	Used in the field	8625

Improved Garlic variety (GHC 1): In Mohal Village, NICRA farmers adopted the improved garlic variety GHC 1 as a cash crop, cultivating it on 0.64 hectares. This technology resulted in a productivity of 173.1 quintals per hectare, leading to a substantial net return of Rs. 5,16,000 per hectare. In contrast, Non-NICRA farmers, who also grew garlic on a smaller area of 0.24 hectares, achieved a lower productivity of 129.5 quintals per hectare, resulting in net returns of Rs. 3,88,666 per hectare. The adoption of GHC 1 significantly enhanced both the yield and profitability for NICRA farmers compared to their Non-NICRA counterparts.

Drought tolerant Wheat variety (HPW 368): NICRA farmers in Mohal Village utilized the drought-tolerant wheat variety HPW 368 on 0.4 hectares, achieving productivity of 33.7 quintals per hectare and generating net returns of Rs. 71,237 per hectare (Table 7.11 a). Conversely, Non-NICRA farmers planted the same variety on 0.24 hectares, resulting in a lower productivity of 28.8 quintals per hectare and net returns of Rs. 61,306 per hectare. The adoption of this drought-tolerant variety by NICRA farmers illustrates its effectiveness in improving wheat yield and profitability under irrigated conditions, thereby enhancing overall farm sustainability.

Table 7.11 a: Impact in FST 4 (Irrigated with animal) in Mohal

Crop/ Perennials	Technology adopted/ demonstrated	Irrigated with animal					
		NICRA farmer			Non-NICRA farmer		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Garlic	Improved variety of Garlic GHC 1 as a cash crop	0.64	173.1	516000	0.24	129.5	388666
Wheat	Drought-tolerant Wheat variety (HPW 368)	0.40	33.7	71237	0.24	28.8	61306
Total				**587237**			**449972**

In Mohal village, NICRA farmers implemented year-round production of fodder crops, including *Rabi* season oat and berseem and *Kharif* season chari, bajra, and maize, supplemented with UMMB (Urea Molasses Mineral Block) and mineral mixtures for lactating animals during lean periods. This strategy resulted in a production of 2,123 l per year, with a selling price of Rs. 40 per l, leading to gross returns of Rs. 64,133 per animal. Additionally, they raised backyard poultry using the Palam Samridhi variety, producing 6,983 l from one unit (50 chicks) at Rs. 7 per litre, generating Rs. 48,883 in gross returns, contributing Rs. 44,250 in net returns.

Table 7.11 b: Impact in Mohal for FST 4 (Irrigated with animal)

Animal	No.	Technology adopted/ demonstrated	Yield/ year	Selling price (Rs./unit)	Gross returns (Rs./animal)	By-products quantity (kg/year)	Unit price (Rs.)	Net Returns (Rs.)
NICRA	4	Year-round production Fodder crops: *Rabi*: Oats and berseem, *Kharif* season -Chari, Bajra Maize (AT), UMMB / Mineral mixture for lactating animals during the lean period	2123 l	40	64133	4000	2.5/ kg	10000
	1 unit (50 chicks)	Backyard Poultry-Palam Smridhi	6983 eggs	7	48883	-	-	44250
Non-NICRA	3	No Feeding of UMMB and Mineral mixture, Use of local varieties of fodder	1413 l	40	56506	3000	2.5/ kg	7500

In contrast, Non-NICRA farmers, who did not use UMMB or mineral mixtures and relied on local varieties of fodder, produced only 1,413 l annually at the same selling price of Rs. 40 per litre, yielding gross

returns of Rs. 56,506 per animal. It produced 3,000 kg of by-products, priced at Rs. 2.5 per kg, resulting in net returns of Rs. 7,500 per hectare. This comparison highlights the significant advantages of CRTs in enhancing livestock productivity and profitability for NICRA farmers compared to their Non-NICRA counterparts.

BY-PRODUCTS PRODUCED AND RECYCLED:

In Mohal village during 2023-24, various by-products were produced and effectively recycled within the farming system. Wheat was produced at 38.18 quintals per hectare, with a selling price of Rs. 800 per quintal. The wheat by-product was utilized as fodder, generating a total income of Rs. 30,547. Additionally, animal by-products amounted to 30.00 quintals, sold at Rs. 250 per quintal, and were used as manure in the fields, contributing Rs. 7,500 to the overall farm income (Table 7.11 c). This recycling practice not only enhanced resource efficiency but also supported sustainable farming practices in the village.

Table 7.11 c: By-products produced and recycled (Mohal)

By product produced	Quantity	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Wheat straw	38.2 q/ha	800	Used as fodder for animal	30547
Animal cow dung	30.0 q	250	Used in the field	7500

Improved Garlic variety (GHC 1): In Reri Village, NICRA farmers adopted the improved garlic variety GHC 1 as a cash crop, cultivating it on 0.48 hectares. This technology yielded an impressive productivity of 137.0 q/ha, resulting in a net return of Rs. 4,02,448 per hectare. In contrast, Non-NICRA farmers also grew garlic in the same area but achieved a lower productivity of 112.2 q/ha, leading to net returns of Rs. 3,27,400 per hectare. The adoption of GHC 1 illustrates its effectiveness in enhancing garlic production and profitability under irrigated conditions.

Drought tolerant Wheat variety (HPW 368): NICRA farmers utilized the drought-tolerant wheat variety HPW 368 on 0.32 hectares, achieving a productivity of 82.1 quintals per hectare and net returns of Rs. 2,27,819 per hectare. Conversely, Non-NICRA farmers planted the same variety on 0.28 hectares, yielding a lower productivity of 72.6 quintals per hectare and net returns of Rs. 2,01,445 per hectare. This demonstrates the significant benefits of adopting drought-tolerant varieties, particularly in improving wheat yield and financial returns in an irrigated farming system.

Table 7.12 a: Impact in FST 4 (Irrigated with animal) in Reri

Crop	Technology adopted/ demonstrated	Irrigated with animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Garlic	Improved variety of Garlic GHC 1 as a cash crop	0.48	136.96	402448	0.48	112.17	327400
Wheat	Drought-tolerant wheat variety (HPW 368)	0.32	82.10	227819	0.28	72.63	201445
Maize	Short duration composite variety of maize- Early composite	0.48	31.43	62866	0.32	29.40	58800
Total				**693133**			**587645**

Short-Duration Composite variety of Maize: For maize cultivation, NICRA farmers adopted a short-duration composite variety on 0.48 hectares, resulting in productivity of 31.4 quintals per hectare and net returns of Rs. 62,866. In comparison, Non-NICRA farmers grew maize on 0.32 hectares, achieving productivity of 29.4 quintals per hectare and net returns of Rs. 58,800 (Table 7.12 a).

In Reri Village, the impact of Climate Resilient Technologies (CRTs) on livestock productivity was significant for NICRA farmers, who adopted year-round production of fodder crops such as oat and berseem in the *Rabi* season and chari, bajra, and maize in the *Kharif* season, along with using Urea Molasses Mineral Blocks (UMMB) and mineral mixtures for lactating animals during lean periods. This approach resulted in a production of 3,107 litres per year, yielding gross returns of Rs. 62,146 per animal. Additionally, they raised backyard poultry using the Palam Smridhi variety, producing 6,967 eggs and generating Rs. 48,766 in gross returns. In contrast, Non-NICRA farmers, who relied on local fodder varieties and did not utilize UMMB, achieved lower productivity with 1,872 l, resulting in gross returns of Rs. 56,680 per animal. This highlights the advantages of adopting climate-resilient practices, leading to enhanced productivity and profitability for NICRA farmers compared to their Non-NICRA counterparts.

Table 7.12 b: Impact in Reri for FST 4 (Irrigated with animal)

Animal	No.	Technology adopted/ demonstrated	Yield/ year	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity (kg/year)	Unit price (Rs.)	Net Returns (Rs.)
NICRA	6	Year-round production Fodder crops: *Rabi*: Oat and berseem, *Kharif* season- Chari, Bajra Maize (AT), UMMB / Mineral mixture for lactating animals during the lean period	3107 l	40	62146	6100	2.5/ kg	15250
	1 unit (50 chicks)	Backyard Poultry-Palam Smridhi	6967 eggs	7/egg	48766	-	-	44133
Non-NICRA	4	No Feeding of UMMB and Mineral mixture, Use of local varieties of fodder	1872 l	40	56680	4000	2.5/ kg	10000

Demonstration on poultry farming for nutritional security

BY-PRODUCTS PRODUCED AND RECYCLED:

In Reri village during the year 2023-24, various by-products were produced and effectively recycled within the farming system. Wheat straw was produced at 39.7 quintals per hectare, and sold at Rs. 800 per quintal, generating an income of Rs. 31,766 as it was used as fodder. Similarly, maize stover amounted to 39.6 quintals per hectare and was sold at Rs. 350 per quintal, resulting in Rs. 13,866, also used as animal feed. Additionally, animal cow dung produced at 60.0 quintals per hectare, valued at Rs. 250 per quintal, was utilized in the fields, contributing Rs. 15,000 to the overall farm income (Table 7.12 c). This recycling practice not only enhances resource efficiency but also promotes sustainable agricultural practices by integrating by-products back into the farming system.

Table 7.12 c: By-products produced and recycled in Reri

By product produced	Quantity	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Wheat straw	39.7 q/ha	800	Used as fodder for animal	31766
Maize stover	39.6 q/ha	350	Used for animal	13866
Animal cow dung	60.0 q	250	Used in the field	15000

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

Custom hiring centre showed great performance of mini tractor, power sprayer, and power weeder. Mini tractor earned the CHC Rs. 30000 as rent. However, the maximum area is covered under the utilization of power sprayers by the farmers.

Table 7.13: Institutional interventions (Custom Hiring Centre)

Custom hiring centre	Implements	Amount mobilised (Rs.)	Farmers covered	Area covered (ha)
Chhoel Gaduari	Mini Tractor	30000	27	12
	Power Sprayer	5000	50	30
	Power Weeder	3000	20	7

Handing over of Power weeder to CHC

CAPACITY BUILDING:

Most of the courses were carried out on natural resource management (NRM), crop production, livestock, and home science where a number of male and female farmers showed involvement. Maximum participation of farmers was observed in the crop production programme.

Table 7.14 a: Capacity Building Programmes (HRD) for farmers

Theme	No. of training programmes	No. of beneficiaries		
		Male	Female	Total
NRM	3	26	44	70
Crop Production	10	161	235	396
Livestock	4	82	47	129
Home Science	3	42	79	121

A capacity-building workshop on coping with weather challenges in Himachal Pradesh farming was held in 2023-24, with 33 male and 15 female KVK staff. The session aimed to equip them with strategies to support farmers in dealing with weather aberrations.

Table 7.14 b: Capacity Building Programmes (HRD) for staff

Theme	No. of beneficiaries		
	Male	Female	Total
Workshop -Brainstorming Session on "Weather Aberrations in Himachal Pradesh: Challenges in Farming and Coping Strategies."	33	15	48

OTHER EXTENSION ACTIVITIES:

Extension activities were organized in NICRA villages such as field days on *Rabi* crops an awareness programme on nutritional gardens for nutrition and food security, and natural farming; where male and female farmers showed active participation during 2023-24.

Table 7.14 c: Other extension activities

Name of program	Participants
Awareness of Nutritional garden for nutrition and food security	50
Field Day on Wheat	68
Field day Black gram	40
Field day on Maize	55
Celebration of International Biodiversity Day under the theme Build Back Biodiversity	30
Awareness programme under Mission LiFE Climate resilience agriculture and rain harvesting	67
Celebration of World Environment Day and also the plantation programme	50
Celebration of ICAR Foundation Day	34
Celebration of World Breast Feeding Week	42
Awareness of a Balanced diet among the women and Aganwaris under Poshan Maah	40
Barley Day	60
Awareness program on Natural farming	30

Field Day on Wheat

Handing over of Power weeder to CHC

EXTREME WEATHER EVENTS:

During 2023-24, extreme weather events, including heavy rainfall and prolonged dry spells, significantly affected crop yields. From July 9-11, 236.2 mm of rains caused lodging in maize (8-10%) and led to fruit rot, and leaf and fruit spots in tomatoes and pomegranates, impacting marketability. Subsequently, from August to January, multiple dry spells occurred, ranging from 18 to 59 days. This delayed the sowing of *Rabi* crops, reduced tillering, and increased disease infestation in pomegranates, leading to a lower marketable yield and early leaf fall in various fruit crops. These weather extremes had adverse effects on crop health and productivity.

Table 7.15: Extreme events observed

Nature of event	Date	Impact on crop yield
Heavy rainfall during July - more than 60 mm of rainfall on 9th and 10th July 236.2 mm of rainfall was received in three days	9-11 July 2024	Lodging in Maize (8-10%),Fruit rot and diseases in Tomato, marketing of the produce were impacted,leaf and fruit spots in pomegranates,Wilting of plants and premature leaf fall
Dry spell during winter season	• Sept to Jan month • 26 Aug to 15 Sept- Dry spell of 26 days • 20 Sept to 9th Oct - Dry spell of 20 days • Oct 18 to Nov 10- Dry spell of 24 days • 12 Nov to 30 Nov - Dry spell of 18 days • Dec 3 to Jan 30 - Dry spell of 59 days	Sowing was delayed in *Rabi* crops, tillering was affected, disease-infested fruits of pomegranate reduced marketable yield, and early leaf fall in all fruit crops

AGRO ADVISORIES ISSUED:

In 2023-24, advisories were more frequent in July and November, likely due to critical agricultural activities and weather conditions. Other months have few advisories i.e. 2 to 3 issued in most months, reflecting ongoing updates. This pattern indicates that the frequency of advisories was aligned with key agricultural stages and weather-related needs, ensuring timely guidance to farmers throughout the year.

Table 7.16: Details about agro advisories issued

Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Advisories issued- WhatsApp messages	2	6	2	3	2	4	3	2	2	2	4	2

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

KVK made efforts to construct a water harvesting structure to disseminate promising technologies in Reri NICRA village. Approximately Rs. 3,50,000 was mobilized for this project to support water conservation efforts for improved farming outcomes through convergence with Department of Horticultural and Agricultural MGNREGA.

NRM INTERVENTIONS:

Repair of water storage tanks: This intervention is crucial for providing supplementary irrigation during critical stages, especially in water-scarce periods. The repaired tanks will serve as a reliable water source, helping farmers ensure their crops receive adequate moisture during vulnerable phases, ultimately improving crop productivity and income.

In-situ soil moisture conservation through mulching: In-situ soil moisture conservation was implemented during the *Kharif* and *Rabi* seasons, targeting the active growth stage from April to December. The technology was applied to 0.5 hectares of newly planted apple orchards. Mulching retains soil moisture and ensures that young apple trees receive adequate water, which is crucial for their establishment and growth.

Utilization of harvested water for garlic cultivation: During the *Rabi* season, this intervention was conducted on 11 hectares, and involved irrigation one month after sowing during the bulb formation stage. The results were highly positive, with a productivity of 187.3 quintals per hectare. The cost of cultivation was Rs.1,06,533 per hectare (Table 7.17 a), while the gross returns reached Rs. 5,62,834 per hectare. This shows the significant potential of harvested water to boost yields and profitability in high-value cash crops like garlic.

Table 7.17 a: Detailed information on interventions

NRM interventions							
Crop/ perennials	**Technology demonstrated**	**Season**	**Crop stage affected**	**Area (ha)**	**Yield (q/ha)**	**Cost of cultivation (Rs./ha)**	**Gross returns (Rs./ha)**
Apple	In-situ soil moisture conservation through mulching	*Kharif* and *Rabi*	April to December, active growth stage	0.5	Newly planted orchard	-	-
Garlic	Utilization of harvested water for Garlic cultivation	*Rabi*	One month after sowing, bulb formation	11.0	187.3	106533	562834
Specificity of technology	Water harvesting structures help in supplementary irrigation during critical growth stages and in diversification towards high-value cash crops						
Farmers' perception of technology	Water harvesting can increase the productivity of crops and farm income						

CROP INTERVENTIONS:

Wheat cultivation: NICRA farmers adopted the drought-tolerant variety HPW 368, which performed well during the *Rabi* season over 15 hectares. This variety, known for its resistance to yellow rust and drought tolerance, produced a yield of 31.1 quintals per hectare. The cultivation cost was Rs. 28,878 per

hectare, and the gross returns reached Rs. 71,831 per hectare (Table 7.17 b). In contrast, Non-NICRA farmers used the HPW 236 variety over 20 hectares, which is more susceptible to yellow rust and less tolerant to drought. It yielded 27.1 quintals per hectare, with a cultivation cost of Rs. 28,183 per hectare and gross returns of Rs. 62,616 per hectare. Although widely grown, Non-NICRA farmers faced challenges with disease and drought, leading to relatively lower yields when compared to the NICRA-adopted wheat variety.

Maize cultivation: NICRA farmers demonstrated short-duration composite varieties such as Bajaura Makka and Early Composite, which mature 10-15 days earlier than hybrids and are suited for rainfed conditions. These varieties were grown on 30 hectares during the *Kharif* season, yielding 32.6 q/ha with a

Table 7.17 b: Detailed information on Crop interventions

Crop/ perennials	Technology demonstrated	Season	Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers							
Wheat	Drought tolerant variety (HPW 368)	*Rabi*	Sowing, tillering and grain filling	15.0	31.1	28878	71831
Specificity of technology- The variety has a wider sowing window and is tolerant to drought and yellow rust							
Farmers' perception of technology- Performed well even though sowing was done very late, with No symptom of yellow rust							
Maize	Short duration composite varieties of Maize's viz. Bajaura Makka and Early composite	*Kharif*	Sowing, milking stages	30.0	32.6	29000	77463
Specificity of technology- Variety is recommended for rainfed areas and matures in 90-95 days i.e. 10-15 days earlier than the hybrid							
Farmers' perception of technology- It has better yield and fodder yield							
Apple	Low-chilling fruit crops and coloured strains of apple for low and mid hills areas	Perennial	Chilling hours during winter months	1.3	-	-	-
Specificity of technology- Specificity of technology- Low chilling new colour strains of apple are suitable for low hills where the main varieties of apple fail, high productivity and early returns							
Farmers' perception of technology- High initial cost and non-availability of irrigation facilities cannot spread this technology so HDP on seedling rootstocks and other low-chilling fruit crops like persimmon can benefit more							
Pea	Location-specific intercropping in Plum and Pomegranate orchard	*Rabi*	Intercropping during winter when plants shed their leaves	2.7	175.0	74362	244943
Specificity of technology- Additional income during winter months from the orchards and improvement of soil status							
Farmers' perception about technology- The variety Lincon has poorly yielded and has a pod-filling problem, The variety G10 is better							

CROP INTERVENTIONS:							
Crop/ perennials	**Technology demonstrated**	**Season**	**Crop stage affected**	**Area (ha)**	**Yield (q/ha)**	**Cost of cultivation (Rs./ha)**	**Gross returns (Rs./ha)**
Garlic	Diversification through Improved variety of garlic GHC 1 as a cash crop	*Rabi*	The sowing and bulb formation stage	1.0	156.6	112566	533363
Non-NICRA Farmers							
Wheat	HPW 236	*Rabi*	Sowing and maturity	20	27.1	28183	62616
Maize	Shathu – local maize and hybrid	*Kharif*	Sowing and milking	15	28.5	28537	65913
Pea	Arkel and G10	*Rabi*	-	10	141.0	72537	123481
Garlic	JK Lahsun	*Rabi*	Bulb formation, and germination	25	118.0	109016	401712
Specificity of technology	Wheat variety HPW 236 is susceptible to yellow rust and cannot tolerate drought, Mize hybrid in rainfed conditions does not perform well and has high input requirement and low fodder yield						

cultivation cost of Rs. 29,000 per hectare and gross returns of Rs. 77,463 per hectare. NICRA farmers found these varieties to have better grain and fodder yields when compared to local and hybrid varieties in rainfed areas. Non-NICRA farmers, on the other hand, grew local and hybrid maize varieties over 15 hectares, yielding 28.5 quintals per hectare. Despite the lower yields, the cultivation cost was Rs. 28,537 per hectare, and the gross returns were Rs. 65,913 per hectare. Non-NICRA farmers observed that hybrids performed poorly in rainfed conditions, requiring higher inputs with lower fodder yields when compared to the NICRA varieties.

Garlic cultivation: NICRA farmers demonstrated the improved GHC 1 variety over 1 hectare during the *Rabi* season. This diversification effort resulted in a high yield of 156.6 quintals per hectare, with a cultivation cost of Rs. 1,12,566 per hectare and gross returns of Rs. 5,33,363 per hectare, showcasing the potential of garlic as a high-value cash crop. Meanwhile, Non-NICRA farmers grew the JK Lahsun variety of garlic over 25 hectares, yielding 118.0 quintals per hectare. The cultivation cost was Rs. 1,09,016 per hectare, and gross returns reached Rs. 4,01,712 per hectare. Both groups of farmers benefitted from garlic cultivation, but the NICRA-adopted GHC 1 variety offered higher yields and greater profitability.

Pea cultivation: NICRA farmers demonstrated location-specific intercropping of pea varieties (Lincon and G10) in plum and pomegranate orchards over 2.7 hectares. This provided additional income during the winter months, yielding 175.0 quintals per hectare. The cultivation cost was Rs. 74,362 per hectare, while gross returns reached Rs. 2,44,943 per hectare. Farmers reported that the G10 variety outperformed Lincon, which had issues with pod filling. Non-NICRA farmers grew pea varieties Arkel and G10 over 10 hectares, yielding 141.0 quintals per hectare. The cost of cultivation was Rs. 72,537 per hectare, with gross returns of Rs. 1,23,481 per hectare. The G10 variety again performed better, indicating its suitability for higher yields in NICRA and Non-NICRA farming systems.

Apple cultivation: NICRA farmers adopted low-chilling, coloured strains of apples in low and mid-hill areas, covering 1.3 hectares. These strains are suited for regions where traditional apple varieties fail due to insufficient chilling hours. Farmers noted the potential for high productivity, but they faced challenges with high initial costs and the lack of irrigation, limiting the technology's widespread adoption.

LIVESTOCK INTERVENTIONS:

The Backyard Poultry technology, specifically the Palam Samridhi variety, demonstrated production of 7,050 eggs per year, with a selling price of Rs. 7 per egg, offering farmers a reliable source of income and food security through local poultry farming practices. NICRA farmers implemented a year-round production strategy using various fodder crops, including oats and berseem in the *Rabi* season and chari, bajra, and maize during the *Kharif* season. They also utilized UMMB (Urea Molasses Mineral Block) and mineral mixtures, resulted in an annual production of 1,755 litres of milk per animal. With a selling price of Rs. 40 per litre and a production cost of Rs. 54,720 per animal (Table 7.17 c), their gross returns reached Rs. 70,200 per hectare. In contrast, Non-NICRA farmers relied on local varieties of fodder without incorporating UMMB and mineral mixtures, producing 1,485 litres of milk per animal annually, with similar selling prices but slightly lower production costs leading to gross returns of Rs. 59,400 per hectare. The technology adopted by NICRA farmers proved to be highly beneficial, with reports of increased milk yield by 0.5 to 1 litre per animal per day and a reduction in cases of repeat breeding, which farmers perceived as a crucial improvement in overall milk production and animal health.

Table 7.17 c: Detailed information on Livestock interventions

Animals	Technology demonstrated	Yield/ year	Selling price (Rs./unit)	Cost of production (Rs./ animal)	Gross returns (Rs./ha)	By-products quantity (kg)	Unit price of by-product (Rs.)	Gross returns from by-products (Rs.)
NICRA	Backyard poultry- Palam Smridhi	7050 eggs	7	4633	49350	-	-	-
	Year-round production Fodder crops: *Rabi*: Oats and berseem, *Kharif* season - Chari, Bajra Maize (AT), UMMB / Mineral mixture for lactating animals during the lean period	1755 l	40	54720	70200	3200	2.5/kg	7500
Non-NICRA	No Feeding of UMMB and Mineral mixture, Use of local varieties of fodder	1485 l	40	51120	59400	2500	2.5/kg	6250
Specificity of technology	Feeding area-specific mineral mixture to lactating cows is highly beneficial as it results in an increase of 0.5 to 1 litre of milk per animal/ day while reducing the cases of repeat breeding							
Farmers perception	It helps increase milk yield							

SUCCESSFUL INTERVENTIONS:

Several interventions have been successfully adopted in NICRA villages in the context of natural resource management, crop cultivation and livestock management. Under NRM, 32 ha have been adopted for lifesaving irrigation. Crop interventions include the adoption of drought-tolerant wheat variety HPW 368 by 124 farmers in five villages, covering 36 hectares, while 50 farmers adopted the GHC 1 garlic variety as a cash crop, covering 28 hectares in six villages. Additionally, 250 farmers embraced short-duration maize composite varieties, utilizing 45 hectares, and 40 farmers cultivated low-chilling apple strains, covering 5 hectares across three villages. Area-specific intercropping with peas in plum and pomegranate orchards was practised by 124 farmers in four villages, utilizing 10 hectares. For the management of livestock, oats were utilized for the year-round production of green fodder along with the use of mineral mixtures for lactating animals during the lean period for nutrient management.

Table 7.18: Adoption of successful interventions in NICRA & adjoining villages

Successful Interventions	Crop	Variety	No. of farmers	No. of villages	Extent of adoption in ha (2023)
NRM					
Lifesaving irrigation	Garlic, Tomato and Peas	GHC 1, Hybrid PB 89	65	6	32
Crop					
Drought tolerant varieties	Wheat	HPW 368	124	5	36
Diversification through improved variety of Garlic as a cash crop	Garlic	GHC 1	50	6	28
Short duration varieties	Maize	Composite varieties of Maize's viz. Bajaura Makka and Early composite	250	5	45
Low-chilling fruit crop and coloured strains of apple for low and mid-hill areas	Apple	Gala, Jeromine, Scarlet spur	40	3	5.0
Area-specific intercropping in Plum and Pomegranate orchards	Pea	Lincoln and PB 89	124	4	10
Livestock					
UMMB / Mineral mixture for lactating animals	Area-specific Mineral Mixture	UMMB and MM	345	6	48% farmers
Demonstration on backyard poultry (Him Samridi)	Chicks	Him Simridi	104	4	-
Year-round production of fodder crops	Chari, Bajra Maize and Oat	PLP 1, African Tall	280	6	22

Focus on climate-resilient varieties of maize, wheat, garlic and oats has been given to incorporate these varieties in crop cultivation to tackle the impact of climate change on major crops where a maximum area of 800 ha was taken under Early composite maize during *the Kharif* season. During *Rabi*, 3200 hectares were taken for cultivation of rust-resistant wheat variety, HPW 368 (Table 7.19).

Table 7.19: Popularization of Climate Resilient Varieties

Crop	Climate Resilient Varieties incorporated in the *Kharif* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Kharif* 2023 (ha)	Climate Resilient Varieties incorporated in the *Rabi* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Rabi* 2023 (ha)
Maize	Early Composite	800	-	-
	Bajaura Makka	700	-	-
	Girija	400	-	-
Wheat	-	-	HPW 368	3200
Garlic	-	-	GHC 1	1700
Oats	-	-	Palampur 1	2000

Field Day on Maize

Awareness camp under 'LiFE'

Chamba

8

Chamba district is surrounded by the imposing Dhauladhar and Pir Panjal mountain ranges, offering a picturesque landscape characterized by lush green valleys and pristine rivers. The Ravi River flows through the region, contributing to the fertility of the land and supporting the district's thriving agricultural activities. Agriculture plays a pivotal role in Chamba's economy, with farmers cultivating a variety of crops such as apples, wheat, barley, and various vegetables. The terraced fields, a common sight in the region, showcase the ingenuity of traditional farming practices that optimize the use of the mountainous terrain. The apple orchards, in particular, are a hallmark of Chamba's agriculture, producing high-quality fruit that contributes significantly to the local economy. In essence, Chamba, with its diverse geography, flourishing agriculture, and strategic location, stands as a captivating region that seamlessly blends natural beauty with agricultural resilience and cultural diversity in the heart of Himachal Pradesh.

NICRA VILLAGES:

Several villages in the Chamba district of Himachal Pradesh, India, have been adopted under the NICRA program, each contributing to sustainable agricultural practices in the region. Lagga, Ghasiti, Hathla, Lathuin, Pracha, Padhruin, and Osal, among others, initiated their participation in NICRA in 2011, showcasing an early commitment to climate-resilient farming. Additionally, villages such as Banjal, Dalain, and Kiri joined the program in 2018, followed by Chacho, Khalla, and Khalnera in the same year, demonstrating a collective effort to address climate challenges and enhance agricultural sustainability. The year 2018 also marked the adoption of NICRA by Sarol and Matiara, signifying a widespread acknowledgement of the program's importance in fostering climate resilience within the agricultural practices of these communities. In 2022, Sarol and Matiara took a step forward by embracing NICRA, reinforcing the district's dedication to implementing innovative approaches for climate-resilient agriculture.

Table 8.1: Information about the NICRA villages

Villages	Lagga, Ghasiti, Hathla, Lathuin, Pracha, Padhruin & Osal	Banjal, Dalain & Kiri	Chacho	Khalla & Khalnera	Sarol	Matiara
Year adopted in NICRA	2011	2018	2018	2018	2022	2022

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of these villages are Rainfed without animal (FST 1), Rainfed with animal (FST 2), Irrigated without animal (FST 3) and Irrigated with animal (FST 4). The maximum farmers of in villages opted for Rainfed without animal farming system. Farmers of these selected NICRA villages always depend upon animal husbandry along with agriculture.

Table 8.2: Day-wise rainfall (mm) distribution

Rainfall 2023-24										
Date	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	17.4	0	0	0	0	0	7.8	0	0	2.2
2	0	0	0	0	0	0	0	0	0	47.0
3	0	0	10.7	0	0	0	0	0	0	40.0
4	0	2	0	10.8	0	0	0	0	34.5	51.8
5	0	18.4	0	20.0	0	0	0	0	0	0
6	0	2.0	0	0	0	0	0	0	0	0
7	0	0	3.8	0	0	0	0	0	0	0
8	0	0	5.0	0	0	0	0	0	0	0
9	0	100.0	0	11.0	0	0	0	0	0	0
10	0	77.0	0	0	14.8	0	0	0	0	0
11	0	0	0	0	0	6.1	0	0	0	0
12	0	0	0	0	0	0	0	0	0	10.9
13	0	0	0	0	0	0	0	0	0	0
14	0	1.2	0	0	0	0	0	0	0	24.7
15	6.4	5.0	16.3	13.2	6.0	0	0	0	0	0
16	0	14.0	0	2.6	6.5	0	0	0	0	0
17	0	2.0	0	0	8.3	0	0	0	0	0
18	4.0	0	0	8.7	5.3	0	0	0	0	0
19	4.0	28.0	0	15.9	0	0	0	0	41.0	0
20	0	10.0	0	0	0	0	0	0	76.6	0
21	0	20.0	0	1.1	0	0	0	0	20.0	5.5
22	0	11.6	10.0	0	0	0	0	0	4.5	0
23	0	4.5	2.0	0	0	0	0	0	0	0
24	0	4.0	0	0	0	0	0	0	0	0
25	2.0	83.6	0	0	0	0	0	0	0	0
26	2.4	0	0	0	0	0	0	0	0	0
27	21.1	21.6	0	0	0	0	0	0	0	0
28	11.6	0	0	0	0	0	0	0	0	0
29	3.1	0	0	0	0	0	0	0	0	0
30	0	2.0	0	3.0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	31.0	0	0

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of these villages are Rainfed without animal (FST 1), Rainfed with animal (FST 2), Irrigated without animal (FST 3) and Irrigated with animal (FST 4). The maximum farmers of these villages opted for Rainfed without animal farming system. Farmers of these selected NICRA villages always depend upon animal husbandry along with agriculture.

NATURAL RESOURCE MANAGEMENT (NRM) INTERVENTIONS:

Under Natural Resource Management (NRM) interventions, the resilient agricultural practices implemented included the installation of poly-house structures, with a total of 10 demonstrations benefiting 10 farmers.

Table 8.3: Summary of Interventions

Villages	No. of farmers involved in demonstrations			
	FST 1 (Rainfed without animal)	FST 2 (Rainfed with animal)	FST 3 (Irrigated without animal)	FST 4 (Irrigated with animal)
Village 1	25	22	10	18
Village 2	15	20	15	15
Village 3	10	10	08	10
Village 4	20	10	10	20
Village 5	15	08	08	10
Total	**85**	**70**	**51**	**73**

Table 8.4: Natural resource management interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Poly-house 105 m^2	10	10	0.1
Irrigation tanks 30,000 l capacity	03	50	35.0
Mulching with poly sheet	20	20	0.4
Micro drip irrigation systems	10	10	5.0

Additionally, the adoption of irrigation tanks, each with a 30,000-liter capacity, has been demonstrated, benefiting 50 farmers. Demonstrations on mulching with poly-sheet have reached 20 farmers and covered an area of 0.4 hectares. Lastly, the implementation of micro-drip irrigation systems has been showcased benefiting 10 farmers and covering a substantial area of 5.0 hectares (Table 8.4). These resilient practices collectively contribute to sustainable and efficient farming methods, enhancing agricultural productivity and promoting resource conservation.

CROP PRODUCTION INTERVENTIONS:

Similarly, under crop production, the promotion of low-chilling varieties of apple on seedlings has been showcased benefiting 35 farmers and covering an area of 5.0 hectares. Also, a demonstration of low-chilling varieties of apples on clonal rootstock has been showcased benefiting 61 farmers. Additionally, protective cultivation techniques have been showcased in 25 demonstrations, benefiting 25 farmers and covering a modest area of 0.1 hectares.

Table 8.5: Crop Production interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Demonstration on low-chilling varieties of apple on seedlings	35	35	5.0
Demonstration on low-chilling varieties of apple on clonal rootstock	61	61	150 plants per family
Protective cultivation	25	25	0.1

Impact of CRTs in FST 1 (RAINFED WITHOUT ANIMAL):

Apple (Spur type and high density varieties): For apple cultivation, spur-type and high-density varieties were demonstrated. NICRA farmers had better productivity of crops and net returns compared to Non-NICRA farmers. For instance, in village 1, NICRA farmers achieved 8 quintals/ha and net returns of Rs. 6,33,333/ha, while Non-NICRA farmers yielded 6 quintals/ha with Rs. 4,06,666/ha in returns.

Similarly, in village 3, NICRA farmers with high-density apples had a yield of 19 quintals/ha and net returns of Rs. 19,50,000/ha, compared to 17 quintals/ha and Rs. 17,00,000/ha for Non-NICRA farmers.

Cabbage/Cauliflower (Intercropping with Apple): The intercropping of cabbage and cauliflower with apple trees showed higher productivity and net returns for NICRA farmers. In village 1, NICRA farmers achieved productivity of 255-280 quintals/ha with net returns of Rs. 10,00,000, compared to 210-245 quintals/ha and Rs. 7,50,000 for Non-NICRA farmers. Similarly, in village 4, NICRA farmers out performed Non-NICRA farmers with 255-280 quintals/ha and Rs. 10,00,000 in net returns.

Capsicum (Protective Cultivation): For capsicum under protective cultivation, NICRA farmers consistently had higher productivity and net returns. In village 1, NICRA farmers achieved 27 quintals/ha with Rs. 14,00,000 in net returns (Table 8.6 a), while Non-NICRA farmers produced 22 quintals/ha with Rs. 10,70,000 in returns.

Tomato (Protective Cultivation): Tomato cultivation under protective conditions also showed better outcomes for NICRA farmers. In village 1, NICRA farmers produced 24 quintals/ha with net returns of Rs. 8,00,000 compared to Non-NICRA farmers who yielded 19 quintals/ha and Rs. 6,60,000 in returns.

Table 8.6 : Impact in FST 1 (Rainfed without animal)

Crop/ Perennials	Technology adopted/ demonstrated	Area impacted by climatic stress, crop and stage	Rainfed without animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Village 1								
Apple	Spur type	0.4 ha at flowering & fruit setting time	5.0	8	633333	1.5	6	406666
Cabbage/ Cauliflower	Intercropping with apple	0.5 ha at the curd formation stage	4.4	255-280	1000000	1.5	210-245	750000
Capsicum	Protective cultivation	-	0.4	27	1400000	0.4	22	1070000
Tomato		-	0.2	24	800000	0.1	19	660000
Cucumber		-	0.1	28	600000	0.1	22	450000
Village 2								
Apple	Spur type apple	0.43 ha at flowering & fruit setting time	2.3	6.5	596666	1.6	5.5	420000
Cabbage/ Cauliflower	Intercropping with apple	0.5 ha at the curd formation stage	2.3	255-280	800000	0.3	210-245	683333
Capsicum	Protective cultivation	-	0.3	26	1300000	0.3	22	1035000
Tomato		-	0.1	23	700000	0.1	19	600000
Village 3								
Apple	High density	0.1 ha at flowering & fruit setting time	2.5	19	1950000	1.0	17	1700000
Village 4								
Cabbage/ Cauliflower	Intercropping with apple	0.2 ha at the curd formation stage	1.3	255-280	1000000	0.5	210-245	750000
Capsicum	Protective cultivation	-	0.2	26	1300000	0.2	21	1035000
Tomato		-	0.1	24	800000	0.1	19	660000

Protected cultivation of Capsicum

Cauliflower cultivation

Cucumber (Protective Cultivation): For cucumber, NICRA farmers in village 1 achieved 28 quintals/ha with Rs. 6,00,000 in returns, while Non-NICRA farmers produced 22 quintals/ha with Rs. 4,50,000 in returns.

Impact of CRTs in FST 2 (RAINFED WITH ANIMAL):

Demonstration on low chilling varieties of Apple on clonal rootstock: In village 1, NICRA farmers adopted the low-chilling varieties of apples on clonal rootstock over an area of 0.4 ha during flowering and fruit-setting stages. This intervention significantly improved productivity and net returns. NICRA farmers achieved a productivity of 9 quintals/ha with net returns of Rs. 7,13,333/ha, compared to Non-NICRA farmers who cultivated on 3.3 ha and recorded a lower productivity of 7 quintals/ha with net returns of Rs. 5,78,000/ha. The adoption of clonal rootstock technology helped NICRA farmers achieve higher yields and profits despite smaller cultivation areas.

Micro drip irrigation in high density Apple: NICRA farmers also implemented micro-irrigation drip systems in high-density apple orchards over 0.3 ha, focusing on flowering and fruit-setting stages. This technology boosted productivity, with NICRA farmers achieving 18 quintals/ha and net returns of Rs. 13,00,000/ha, while Non-NICRA farmers, who cultivated 1 ha, achieved productivity of only 12 quintals/ha with net returns of Rs. 9,10,000 (Table 8.7 a). The micro-irrigation drip system provided better water management, leading to enhanced yield and profitability for NICRA farmers.

Table 8.7 a: Impact in FST 2 (Rainfed with animal)

Crop/ Perennials	Technology adopted/ demonstrated	Area impacted by climatic stress, crop and stage	Rainfed with animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Village 1								
Apple	Demonstration on low-chilling varieties of apple on clonal rootstock	0.4 ha at flowering & fruit setting time	2.8	9	713333	3.3	7	578000
Apple	Micro irrigation drip in high-density apple	0.3 ha at flowering & fruit setting time	1.1	18	1300000	1.0	12	910000
Capsicum	Protective cultivation	-	0.4	27	1400000	-	-	-
Tomato		-	0.1	24	800000	-	-	-

Protective cultivation of Capsicum: For capsicum, NICRA farmers engaged in protective cultivation over 0.4 ha, achieving high productivity of 27 quintals/ha with net returns of Rs. 14,00,000. The protective cultivation method under NICRA ensured better crop protection and maximized yield.

Protective cultivation of Tomato: NICRA farmers also adopted protective cultivation for tomatoes, helped safeguard the crop from adverse weather conditions, covering an area of 0.1 ha. This intervention led to a higher productivity of 24 quintals/ha with net returns of Rs. 8,00,000 (Table 8.7 a).

NICRA farmers who adopted technologies such as mineral mixtures, mineral blocks, and power bolus saw significantly higher production and gross returns compared to Non-NICRA farmers. For local cows, NICRA farmers achieved 900 litres of milk per year (2.5 litres/day) and gross returns of Rs. 21,000 per animal, while Non-NICRA farmers produced only 540 litres (1.5 litres/day) with returns of Rs. 10,000 per animal. Crossbred (CB) cows under NICRA produced 5,040 litres annually (14 litres/day) with gross returns of Rs. 1,70,000, compared to 2,880 litres (8 litres/day) and Rs. 80,000 for Non-NICRA farmers. Similarly, in goat and sheep meat production, NICRA farmers outperformed Non-NICRA farmers, with NICRA goats yielding 2,200 kg and Rs. 10,00,000 in net returns, compared to 520 kg and Rs. 2,20,000 for Non-NICRA goats (Table 8.7 b). NICRA sheep produced 2,400 kg of meat with gross returns of Rs. 11,00,000, while Non-NICRA sheep produced 448 kg with returns of Rs. 2,00,000. These CRTs significantly enhanced productivity and economic gains for NICRA farmers across all livestock categories.

Table 8.7 b: Impact in FST 2 (Rainfed with animal)

Animal	No.	Technology adopted/ demonstrated	Production/ year	Selling price (Rs./unit)	Gross returns (Rs./animal)
NICRA Farmer					
Local cow	55	Mineral mixture, mineral blocks & power bolus	900 (2.5 l/day)	31500	21000
Cow CB	28		5040 (14 l/day)	201600	170000
Goat meat	32		2200 kg	1100000	1000000
Sheep meat	34		2400 kg	1200000	1100000
Non NICRA farmer					
Local cow	50	-	540 (1.5 l/day)	16500	10000
Cow CB	25	-	2880 (8 l/day)	108080	80000
Goat meat	26	-	520 kg	250000	220000
Sheep meat	28	-	448 kg	224000	200000

Demonstration on low chilling varieties of Apple

Impact of CRTs in FST 3 (IRRIGATED WITHOUT ANIMAL):

Spur type Apple cultivation: In village 1, NICRA farmers adopted spur-type apple cultivation over 0.4 ha during the flowering and fruit-setting stages. This intervention led to productivity of 8 quintals/ha and net returns of Rs. 6,56,667/ha. In contrast, Non-NICRA farmers, cultivating a smaller area of 1.3 ha, achieved a lower productivity of 7 quintals/ha with net returns of Rs. 4,75,000/ha. The use of spur-type apple varieties improved yield and economic outcomes for NICRA farmers.

Intercropping Cabbage/Cauliflower with Apple: NICRA farmers implemented intercropping of cabbage/cauliflower with apple on 0.25 ha during the curd formation stage, which yielded 255-280 quintals/ha and net returns of Rs. 10,00,000/ha. Non-NICRA farmers, cultivating 0.4 ha, produced 210-245 quintals/ha and earned a net return of Rs. 7,50,000/ha. Intercropping helped optimize land use and generate higher income for NICRA farmers compared to their counterparts.

Protective cultivation of Capsicum: NICRA farmers engaged in protective cultivation of capsicum on 0.08 ha, resulting in high productivity of 27 quintals/ha and net returns of Rs. 14,00,000/ha. Non-NICRA farmers, cultivating twice the area (2 ha), achieved a lower productivity of 22 quintals/ha and net returns of Rs. 10,70,000. Protective cultivation ensured better crop protection, leading to superior yield and profitability for NICRA farmers.

Protective cultivation of Tomato: For tomato cultivation under protective conditions, NICRA farmers covered 0.1 ha and recorded a productivity of 24 quintals/ha with net returns of Rs. 8,00,000/ha. Non-NICRA farmers with the same cultivation area of 0.1 ha produced 19 quintals/ha, resulting in lower returns of Rs. 6,60,000/ha. The protective cultivation method helped NICRA farmers safeguard their crops from climatic stress and achieve better economic returns.

Table 8.8 a: Impact in FST 3 (Irrigated without animal)

Crop/ Perennials	Technology adopted/ demonstrated	Area impacted by climatic stress, crop and stage	Irrigated without animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Village 1								
Apple	Spur type	0.4 ha at flowering & fruit setting time	2.7	8	656667	1.3	7	475000
Cabbage/ Cauliflower	Intercropping with Apple		5.4	255-280	1000000	0.4	210-245	750000
Capsicum	Protective cultivation	-	0.1	27	1400000	0.2	22	1070000
Tomato		-	0.1	24	800000	0.1	19	660000

BY-PRODUCTS PRODUCED AND RECYCLED:

Crop by-products yielded 5-6 quintals per hectare with a selling price of Rs. 2800 per quintal, and the straw generated is recycled, mobilizing Rs. 12,000 (Table 8.8 b). Additionally, animal by-products, specifically cow dung, generate Rs. 15,000. This highlights the economic value of recycling agricultural by-products in the farming system.

Table 8.8 b: By-products produced and recycled

By product produced	Quantity	Selling price (Rs./q)	Amount mobilised (Rs.)
Crop straw	5-6 q/ha	2800	12000
Animal cow dung	-	500	15000

Impact of CRTs in FST 4 (IRRIGATED WITH ANIMAL):

Spur type Apple cultivation: In village 1, NICRA farmers adopted spur-type apple cultivation over 0.2 ha during the flowering and fruit-setting stages. This intervention led to a productivity of 9 quintals/ha and net returns of Rs. 6,83,333/ha. In comparison, Non-NICRA farmers, who cultivated 1 ha, achieved a lower productivity of 7 quintals/ha with net returns of Rs. 5,00,000/ha. The adoption of spur-type apples enhanced yield and profitability for NICRA farmers, highlighting the effectiveness of this technology in improving apple production.

Intercropping Cabbage/Cauliflower with Apple: NICRA farmers implemented intercropping of cabbage/cauliflower with apple over 0.2 ha during the curd formation stage, achieving a productivity range of 255-280 quintals/ha and net returns of Rs. 10,83,333/ha. Non-NICRA farmers, cultivating a slightly larger area of 1.1 ha, produced 210-245 quintals/ha, resulting in net returns of Rs. 8,16,667/ha. This intercropping strategy allowed NICRA farmers to maximize land utilization and achieve significantly higher economic returns compared to their Non-NICRA counterparts.

Protective cultivation of Capsicum: In case of Capsicum, NICRA farmers practised protective cultivation on 0.15 ha, resulting in a high productivity of 27 quintals/ha and impressive net returns of Rs. 14,00,000/ha. Non-NICRA farmers, who cultivated 0.14 ha, achieved lower productivity of 22 quintals/ha, with net returns of Rs. 10,70,000/ha. The protective cultivation method effectively safeguarded the crop from climatic stresses, leading to enhanced yield and profitability for NICRA farmers.

Protective cultivation of Tomato: For tomato cultivation, NICRA farmers employed protective cultivation techniques on 0.02 ha, resulting in productivity of 24 quintals/ha and net returns of Rs. 8,00,000/ha. Non-NICRA farmers, cultivating the same area, recorded a lower productivity of 19 quintals/ha and net returns of Rs. 6,60,000/ha (Table 8.9 a). The protective measures taken by NICRA farmers helped mitigate risks associated with climate variability, ensuring better yields and economic returns.

Protective cultivation of Cucumber: NICRA farmers also practised protective cultivation of cucumber over 0.03 ha, achieving productivity of 28 quintals/ha and net returns of Rs. 6,00,000/ha. Non-NICRA farmers, on the other hand, cultivated 0.02 ha and obtained productivity of 22 quintals/ha, yielding net returns of Rs. 4,50,000/ha. The use of protective cultivation for cucumber significantly benefited NICRA farmers, demonstrating the effectiveness of this technology in increasing both yield and profitability.

Table 8.9 a: Impact in FST 4 (Irrigated with animal)

Crop/ Perennials	Technology adopted/ demonstrated	Area impacted by climatic stress, crop and stage	Irrigated with animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Village 1								
Apple	Spur type	0.2 ha at flowering & fruit setting time	1.90	9	683333	1.00	7	500000
Cabbage/ Cauliflower	Intercropping with Apple		1.80	255-280	1083333	1.10	210-245	816667
Capsicum	Protective cultivation	-	0.15	27	1400000	0.14	22	1070000
Tomato		-	0.02	24	800000	0.02	19	660000
Cucumber		-	0.03	28	600000	0.02	22	450000

NICRA farmers utilized advanced technologies such as mineral mixtures, mineral blocks, and power boluses, resulting in higher production and gross returns. For example, 45 local cows produced 900 litres annually, generating gross returns of Rs. 21,000 per animal, while 20 crossbred cows yielded 5,040 litres, earning Rs. 1,70,000. Similarly, goat and sheep farmers experienced significant benefits, with goats producing 500 kg and sheep 480 kg, resulting in gross returns of Rs. 2,00,000 each. In contrast, Non-NICRA farmers lacked these technologies, producing lower quantities, such as 540 litres from 55 local cows (Rs. 10,000 gross return) and 600 kg of goat meat (Rs. 2,50,000 gross return) from 30 goats. This comparison underscores the economic advantages provided by adopting CRTs in livestock management.

Table 8.9 b: Impact in FST 4 (Irrigated with animal)

Animal	No.	Technology adopted/ demonstrated	Production/ year	Selling price (Rs./unit)	Gross returns (Rs./animal)
NICRA Farmer					
Local cow	45	Mineral mixture, mineral blocks & power bolus	900 (2.5 l/day)	31500	21000
Cow CB	20		5040 (14 l/day)	201600	170000
Goat meat	25		500 kg	250000	200000
Sheep meat	30		480 kg	240000	200000
Non-NICRA farmer					
Local cow	55	-	540 (1.5 l/day)	16500	10000
Cow CB	26	-	2880 (8 l/day)	108080	80000
Goat meat	30	-	600 kg	300000	250000
Sheep meat	35	-	560 kg	280000	220000

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

Concerning the performance of a Custom Hiring Centre in terms of equipment usage and its impact on farmers and agricultural areas, the Earth Auger AG.63, equipped with 12 bits and a trolley, has covered 30 farmers and impacted 5 hectares of land. The Power Sprayers NF 767, which is a power-operated 4-stroke device, has been utilized by 55 farmers, covering an area of 10 hectares. Additionally, maize cob sheller machines have made a significant impact, being used by 250 farmers and covering a total area of 25 hectares. It reflects the effectiveness and outreach of the Custom Hiring Centre in providing essential agricultural equipment to local farmers, contributing to improved efficiency and productivity in the covered areas.

Table 8.10: Institutional interventions (Custom Hiring Centre)

Implements	Farmers covered	Area covered (ha)
Earth auger AG.63 with 12 bits and trolley	30	5
Power sprayer NF 767 power operated 4 stroke	55	10
Maize cob shellers	250	25

CAPACITY BUILDING:

The capacity-building initiatives undertaken during the year 2023-24, focussed on various agricultural and environmental themes. The awareness programme on climate smart agriculture to the marginal farmers, a workshop on rainwater harvesting, awareness-cum-training programme on IFS, and a

training program on year-round fodder production to the farmers of NICRA village, where several male and female farmers participated. These capacity-building efforts contribute to enhancing agricultural practices, promoting environmental sustainability, and empowering farmers in the specified regions.

Table 8.11: Capacity Building Programmes (HRD)

Theme	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Climate smart agriculture to the marginal farmers and International Year of Millet-2023 to the farmers of NICRA village at Kiri on 23-05-2023	01	14	18	32
Rainwater harvesting and its efficient use and climate-smart Agriculture (Declamation contest and painting competition held) at GSSS Kiri on 27-05-2023	01	145	182	327
Rainwater harvesting and its efficient use-Catch the Rain under Mission LiFE in NICRA village Sarol, Kiri on 28-05-2023	01	16	22	38
IFS at NICRA village Kiri on 06-05-2023	01	24	32	56
Climate resilient agriculture in NICRA village Lagga on 28-07-2023	01	32	10	42
Year round fodder production in NICRA village Lagga on 24-25 Feb 2024	01	10	18	28

OTHER EXTENSION ACTIVITIES:

The extension activities conducted during the year 2023-24, involved exposure visits of farmers, field days with a specific focus on World Environment Day and awareness programs on Climate Smart Agriculture. These extension activities play a crucial role in disseminating knowledge, promoting sustainable agricultural practices, and raising awareness about environmental conservation and climate-smart approaches among the farming community.

Table 8.12: Other extension activities

Name of program	Participants
Exposure visits of farmers of Amb Block, Una District under Mehak Project run by DDH, Una to NICRA village Lagga on dated 20-04-2023	30 farmers
Exposure visit conducted to the farmers of Amb, Haroli and Una Blocks to NICRA village Lagga on 04-06-2023	28 farmers
World Environment Day at GSSS Kiri and NICRA village Lagga on 05-05-2023	285 students

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

In Village 1, technologies such as irrigation tanks, protective cultivation, etc. were scaled up and the convergence with the Horticulture Department, Department of IPH, and Department of Agriculture mobilized a significant amount of money. In other villages too, similar scaling-up efforts were made, resulting in substantial amounts mobilized for the implementation of these technologies. These efforts signify a comprehensive approach to technology adoption and mobilization of resources for agricultural development in the respective villages.

Table 8.13: Summary of Upscaling of technologies

Technology scaling up/out	No. of farmers	Coverage (ha)/number	Convergence	Amount mobilised (Rs.)
Village 1				
NRM/Irrigation tanks	310	120	HDP Project run by Horticulture Department	12000000
NRM/ Irrigation scheme	205	98	Department of IPH	10000000
Protective cultivation	10	0.2	Department of Agriculture	1000000
Crop production	35	25	Horticulture Department	2200000
CHC	320	110	SUVIDHA NGO	1000000
Capacity building	205	-	SUVIDHA NGO	1800000
Village 2				
NRM/Irrigation tanks	58	42	HDP Project run by Horticulture Department	-
NRM/ Irrigation scheme	58	42	Department of IPH	-
Protective cultivation	10	0.2	Department of Agriculture	-
Crop production	32	12	Horticulture Department	-
CHC	58	55	SUVIDHA NGO	-
Capacity building	249	-	SUVIDHA NGO	-
Village 3				
NRM/Irrigation tanks	18	15	HDP Project run by Horticulture Department	-
NRM/ Irrigation scheme	15	18	Department of IPH	-
Protective cultivation	07	0.1	Department of Agriculture	-
Crop production	14	08	Horticulture Department	-
CHC	28	25	SUVIDHA NGO	-
Capacity building	160	-	SUVIDHA NGO	-
Village 4				
Protective cultivation	02	0.1	Department of Agriculture	-
Crop production	15	10	Horticulture Department	-
CHC	20	10	SUVIDHA NGO	-
Capacity building	120	-	SUVIDHA NGO	-

Visit of DEE, YSPUHF, Solan to NICRA village

EXTREME WEATHER EVENTS:

Dry spells during the *Rabi* occurred in November for more than 15 days, and in November and December, it lasted for a whole month. There was no crop in the open field except apple, so these dry spells had no impact on any crop.

Table 8.14: Extreme weather events and dry spells observed

Nature of event	Date	Impact on crop yield
Dry spell	12.11.2023 to 30.11.2023	There was no crop in the open field except apple, so no impact on any crop
	01.12.2023 to 31.12.2023	
	01.01.2024 to 30.01.2024	

AGRO ADVISORIES ISSUED:

Agromet bulletins vary in number, peaking in October and January, indicating heightened weather-related guidance during those times. Other advisories remain fairly consistent, with slight dips in November and January.

Table 8.15: Details about agro advisories issued

Month	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Number of agromet bulletins issued	2	2	1	2	3	2	2	3
Other advisories issued	5	4	4	4	5	3	5	2

SIGNIFICANT ACHIEVEMENTS:

During 2023-24, a total of 31 farmers were involved in expanding the area under spur-type apple cultivation to 35 hectares and 65 farmers contributed to increasing the high-density apple plantation area to 15 hectares. Additionally, the construction of 10 new poly-houses brought the total to 125. These achievements indicate successful efforts to enhance apple production and improve farming infrastructure.

Table 8.16: Significant achievements

Description	No. of farmers	Impact
Covered 5 ha area under spur-type apple	31	The area under spur-type apple plantation increased to 35 ha.
Covered 10 ha area under high-density apple plantation	65	The area under high-density apple plantations increased to 15 ha.
10 Poly-houses constructed	10	The number of poly-houses increased to 125

NRM interventions for apple cultivation under the NICRA initiative, focus on the use of irrigation tanks during the *Kharif* season, which positively impacts the flowering and fruit-setting stages. Covering 15.0 hectares, the intervention achieves a productivity of 60 quintals per hectare, with a cultivation cost of Rs. 1,50,000 and gross returns of Rs. 11,50,000 (Table 8.17 a), indicating substantial profitability. Farmers reported higher satisfaction with the technology, benefiting from reliable water access that leads to increased yield.

Crop interventions implemented under the NICRA initiative, showcasing various technologies for apple and cabbage/cauliflower cultivation during the *Kharif* season. For spur-type apples, 15.0 hectares achieved a productivity of 60 quintals per hectare, with a cost of Rs. 1,50,000 and gross returns of Rs.

11,50,000. In an intercropping system with cabbage/cauliflower over 48.5 hectares, productivity ranges from 255 to 280 quintals, with costs at Rs. 2,50,000 and returns of Rs. 14,50,000. Additionally, a high-density apple plantation on 15.0 hectares yielded 200 quintals per hectare, costing Rs. 5,50,000 and generating Rs. 32,70,000 in returns (Table 8.17 b). Farmers report increased yield and improved irrigation access as key benefits of these technologies.

Table 8.17 a: Detailed information on NRM interventions

Crop/ perennial	Technology demonstrated	Crop stage affected	Area (ha)	Productivity (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers	Irrigation tanks	Flowering & fruit setting in apple	15.0	60	150000	1150000
Specificity of technology	Farmers are getting a good amount of water for irrigation					
Farmers' perception	We are getting high-yield					

Table 8.17 b : Detailed information on Crop interventions

Crop/ perennial	Technology demonstrated	Crop stage affected	Area (ha)	Productivity (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
Apple	Spur type apple	Flowering & fruit setting in apple	15.0	60	150000	1150000
Cabbage/ Cauliflower	Intercropping with apple	Curd formation	48.5	255-280	250000	1450000
Apple	High-density apple plantation	Flowering & fruit setting in apple	15.0	200	550000	3270000
Specificity of technology	Farmers are getting a good amount of water for irrigation					
Farmers' perception	We are getting high-yield					

SUCCESSFUL INTERVENTIONS:

Key interventions include the use of polyhouses for protected cultivation, with capsicum, tomato, and cucumber varieties covering an extensive 2.0 hectares. Mulching with poly-sheet has been widely adopted for capsicum, tomato, cucumber, and apple. Spur-type apple cultivation has seen a significant adoption across 35.0 hectares. High-density apple plantation has been embraced on 10.0 hectares. Additionally, diversification with cabbage and cauliflower has been successful with adoption extents of 48.5 hectares and 56.5 hectares, respectively (Table 8.18). These widespread adoptions indicate the positive reception and impact of these interventions in enhancing crop diversity and agricultural productivity in both NICRA and adjoining villages.

Similarly, the popularization of climate-resilient varieties has been ensured with incorporated in the *Kharif* 2023 plan by the State Department. For capsicum, tomato, and cucumber, resilient varieties such as Inspiration, Bachata, Abhilash, Naveen, Himsona, and Nalini were adopted, covering approximately 3.5 hectares (Table 8.19). In the case of apples, climate-resilient varieties including King Roat, Redlum Gala, Schnico Red, Gale Gala, and Dark Baron Gala were incorporated, bringing about 25.0 hectares under

cultivation. The State Department also popularized resilient varieties in cabbage (Saint and Varun) and cauliflower (Megha and Snowball), with adoption extents of 70 hectares and 65 hectares, respectively. This indicates a significant effort by the State Department to promote the use of climate-resilient crop varieties, contributing to increased agricultural resilience and productivity in the region during the *Kharif* 2023 season.

Table 8.18: Adoption of successful interventions in NICRA & adjoining villages

Successful interventions	Crop	Variety	Extent of adoption in ha (2023)
NRM			
Polyhouses for protected cultivation	Capsicum, Tomato & Cucumber	Inspiration, Bachata, Abhilash, Naveen, Himsona, Nalini	2.0
Mulching with poly-sheet			1.5
CROP			
Spur type Apple	Apple	King Roat, Redlum Gala, Schnico Red, Gale Gala, Dark Baron Gala	35.0
High-density Apple plantation			10.0
Diversification with Cabbage	Cabbage	Saint and Varun	48.5
Diversification with Cauliflower	Cauliflower	Megha, Snowball	56.5

Table 8.19: Popularization of Climate-Resilient Varieties

Crop	Climate Resilient Varieties incorporated in the *Kharif* 2023 plan of the State Department	Approx. area brought under the variety by the state department during the *Kharif* 2023 (ha)
Capsicum, Tomato & Cucumber	Inspiration, Bachata, Abhilash, Naveen, Himsona, Nalini	3.5
Apple	King Roat, Redlum Gala, Schnico Red, Gale Gala, Dark Baron Gala	30
Cabbage	Saint and Varun	70
Cauliflower	Megha, Snowball	65

Champawat

9

Champawat district is a district of Uttarakhand state, with the town of Champawat as its administrative headquarters. In 2006, Champawat was ranked 250th most backward district of the country by Ministry of Panchayati Raj among 640 districts. According to the 2011 census, Champawat district has a population of 259,648. It has a sex ratio of 980 females for every 1000 males and a literacy rate of 79.83%.

NICRA VILLAGE:

Tyarsoo village of this district was selected for the Technology Demonstration Component of NICRA in the year 2021. A cultivated area of 88.40 ha is under this village without any flood-prone area. The irrigated area (10.5 ha) is under this village with 97 households. Most of the area (78.35 ha) of this village is under rainfed conditions.

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of this village are Rainfed with animal, Irrigated with animal and Rainfed without animal. The maximum farmers in this village opted Rainfed with animal farming system typology.

Table 9.1: Summary of Interventions

Village	No. of farmers involved in demonstrations		
	FST 1 (Rainfed without animal)	FST 2 (Rainfed with animal)	FST 3 (Irrigated with animal)
Tyarsoo	45	60	43

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Black polythene mulch: The introduction of black polythene mulch was a resilient practice aimed at enhancing soil moisture conservation, reducing weed growth, and maintaining soil temperature. It was demonstrated to a group of 20 farmers across a total area of 0.4 hectares. The results from the demonstration indicated that the mulch significantly improved moisture retention and reduced weed competition, which in turn led to better crop yield.

Shading net: The shading net intervention was introduced to protect crops from excessive sunlight, mitigate heat stress, and improve water use efficiency. One demonstration was conducted with the participation of 20 farmers, covering an area of 0.3 hectares. The use of shading nets proved effective in reducing the stress on crops due to high temperatures, resulting in healthier growth and improved resilience in the face of climate variability.

Polytunnel: Demonstration on polytunnels provided farmers with a controlled environment for crop production, shielding crops from adverse weather conditions and extending the growing season. This practice was demonstrated to 25 farmers over an area of 0.2 hectares. The microclimate created by the polytunnel allowed better crop growth and yields, particularly benefiting high-value crops that are sensitive to environmental fluctuations.

Table 9.2: NRM interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Black polythene mulch	1	20	0.4
Shading net	1	20	0.3
Polytunnel	1	25	0.2

CROP PRODUCTION INTERVENTIONS:

Diversification through vegetable production for higher income: In 2023-24, a key intervention was focused on diversifying crop production through vegetable farming to boost farmers' income. This practice was demonstrated to 55 farmers across a total area of 2.5 hectares. The introduction of vegetable cultivation provided an alternative income source, helping farmers to diversify their cropping patterns and increase their overall profitability. This intervention proved beneficial in enhancing household income and food security.

Short duration crops: To adapt to changing climatic conditions and to make better use of available resources, short-duration crops were introduced as a resilient practice. One demonstration was conducted involving 45 farmers, covering an area of 1.0 hectares. The use of short-duration crops allowed farmers to complete crop cycles more quickly, thereby minimizing the risk of crop failure due to unexpected weather changes and enabling multiple cropping cycles within the same year.

Temperature tolerant varieties: The introduction of temperature-tolerant crop varieties aimed at mitigating the effects of extreme temperatures on crop yields. This practice was demonstrated to 10 farmers, involving the planting of 200 temperature-tolerant crop varieties. These varieties were specifically chosen for their ability to withstand high temperatures, ensuring stable production even under stress conditions, which is increasingly important in the context of global climate change.

CHC for timely planting: Custom Hiring Centers (CHC) were established to facilitate timely planting, ensuring that crops are sown at the optimal time for maximum yield. This intervention was demonstrated to 15 farmers, covering an area of 0.4 hectares (Table 9.3). The timely availability of machinery and resources through CHCs allowed farmers to adhere to best planting practices, thereby enhancing crop productivity and reducing losses due to delays in planting.

Animal health check-up camp

Custom Hiring Centre

Low water requiring crops: In response to water scarcity challenges, the introduction of low water-requiring crops was demonstrated as a sustainable practice. One demonstration was conducted involving 25 farmers, covering a significant area of 3.0 hectares. These crops were selected for their ability to thrive with minimal water, making them ideal for regions facing water shortages. This intervention not only conserved water resources but also ensured that farmers could maintain productivity even in drought-prone areas.

Table 9.3: Crop Production interventions

Resilient practice	No. of Demo	Farmers covered	Area (ha)
Diversification through vegetable production for higher income	1	55	2.5
Short duration crops	1	45	1.0
Temperature tolerant varieties	1	10	200 no.
CHC for timely planting	1	15	0.4
Low water requiring crops	1	25	3.0

LIVESTOCK INTERVENTIONS:

Animal health check-up camp: This intervention involved organizing four health check-up camps across different villages, focusing on improving livestock health. These camps provided essential veterinary services, including diagnosing and treating common health issues, administering vaccinations, and giving advice on proper animal care. The initiative directly benefited 50 farmers and covered 75 animals, ensuring that the livestock remained healthy and productive throughout the farming season.

Table 9.4: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of Animals
Animal health check-up camp	4	50	75
Control of ectoparasites & endoparasites	3	55	60
Rubber cow mat for cattle	1	10	10
Feeding mineral mixture	1	10	10

Control of ectoparasites & endoparasites: Three demonstrations were conducted to educate farmers on methods to control ectoparasites (such as ticks and lice) and endoparasites (like worms) in their livestock. This intervention is crucial because parasites can severely affect animal health, leading to reduced productivity and increased vulnerability to diseases. By implementing these practices, 55 farmers were able to treat 60 animals, reducing parasite-related issues and promoting better livestock health (Table 9.4).

Rubber cow mat for cattle: In this intervention, one demonstration was carried out to introduce the use of rubber cow mats for cattle. These mats provide a comfortable and cushioned surface for cattle, which can reduce stress and prevent injuries. This is particularly beneficial for dairy cattle, as improved comfort can lead to better milk production. Ten farmers participated in the demonstration, and the mats were provided for 10 cattle, showcasing the benefits of this practice.

Feeding mineral mixture: One demonstration was held to teach farmers about the importance of feeding mineral mixtures to their livestock. Mineral mixtures help in correcting nutritional deficiencies,

leading to better growth, reproduction, and overall health in animals. Ten farmers participated in this demonstration, and 10 animals were provided with the mineral mixture. The intervention aimed to enhance the nutritional status of the livestock, contributed to improve productivity and resilience.

CUSTOM HIRING CENTRE:

During the year 2023-24, institutional interventions through Custom Hiring Centres provided essential farming implements to local farmers, allowing them to access equipment at a lower cost. Specifically, a Chaff Cutter was made available, mobilizing Rs.1,000 and benefiting 12 farmers. Additionally, a Mandua Thresher was introduced, with Rs. 2,200 mobilized, covering 10 farmers (Table 9.5). These interventions helped farmers improve their agricultural efficiency by providing access to necessary tools and machinery, which they might not have been able to afford otherwise.

Table 9.5: Institutional interventions (Custom Hiring Centre)

Implements	Amount mobilized (Rs.)	Farmers covered
Chaff cutter	1000	12
Mandua thresher	2200	10

FODDER PRODUCTION:

Institutional interventions through fodder banks were implemented to support farmers in producing and managing livestock feed. The program involved cultivating different fodder systems, with Oat production yielding 12.5 tonnes over 0.5 hectares, benefiting 20 farmers; however, all the fodder was fed to livestock within the same season. Sorghum was grown on 0.5 hectares, producing 0.5 tonnes of fodder, and benefiting 15 farmers. Additionally, Bajra cultivation produced 2.4 tonnes of fodder over 1.5 hectares, also benefiting 15 farmers. These efforts helped ensure a steady supply of fodder for livestock, improving feed availability and supporting the farmers' livelihoods

Table 9.6: Institutional interventions (Fodder bank)

Fodder system	Fodder produced (tonnes)	Farmers covered	Area covered (ha)
Oat	12.5	20	0.5
Sorghum	0.5	15	0.5
Bajra	2.4	15	1.5

CAPACITY BUILDING PROGRAMMES:

Different training programmes were organized for the farmers of NICRA village on crop management, feed and fodder management, livestock management and pest and disease management. Similarly, NICRA awareness programmes, vegetable production, etc. were also organized.

Table 9.7: Capacity Building Programmes (HRD)

Theme	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Crop management	1	23	17	40
Feed and fodder management	1	25	15	40
Livestock management	1	28	12	40
Management of horticultural crops	1	22	18	40
NICRA awareness	1	32	08	40
Pest and disease management	1	23	17	40
Vegetable production	1	33	07	40

One training program was also conducted for KVK staff to enhance their professional skills. The training focused on "Effective Communication Skills for Extension Personnel" and was held at the Extension Education Institute in Nilokheri. This program aimed to improve the communication abilities of the KVK staff, enabling them to more effectively deliver agricultural knowledge and guidance to farmers and other stakeholders. One training session was conducted under this theme, contributing to the staff's overall development and effectiveness in their extension roles.

OTHER EXTENSION ACTIVITIES:

Several extension activities were undertaken in NICRA villages like awareness camps, field days, method demonstrations, group discussions, kisan mela and diagnostic visits.

Table 9.8: Other extension activities

Name of program	Participants
Field days	25
Method demonstrations	40
Awareness programme	20
Group discussion	65
Kisan mela	25
Diagnostic visit	56

EXTREME WEATHER EVENTS:

Extreme weather events like dry-spells resulted in low yield of standing crops, delayed sowing and low germination for next season crops, further impacting the overall productivity of the crops for the upcoming season.

Table 9.9: Dry spells observed

Nature of event	Date	Impact on crop yield
Dry spell	Feb-Mar 2023	Low yield for standing crops, delayed sowing, low germination for next season crops
	Nov 2023- Jan 2024	

NRM INTERVENTIONS:

NICRA farmers used poly-mulch, resulting in a higher productivity of 93.5 quintals per hectare compared to 82.2 quintals per hectare for Non-NICRA farmers. Despite having a higher cost of cultivation (Rs.2,55,000 per hectare) compared to Non-NICRA farmers (Rs.1,60,000 per hectare), NICRA farmers achieved greater gross returns of Rs. 4,68,000 per hectare versus Rs. 3,05,000 per hectare for Non-NICRA farmers (Table 9.10 a).

Table 9.10 a: Detailed information on NRM interventions

Farmers	Technology demonstrated	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers	Poly-mulch in Capsicum	0.5	93.5	255000	468000
Non-NICRA Farmers	Capsicum	3.5	82.2	160000	305000
Specificity of technology	Use of poly-mulch as a technique in vegetable crops				
Farmers' perception	Farmers appreciated the technology				

CROP BASED INTERVENTIONS:

NICRA farmers achieved higher productivity and net returns for finger millet and lentil crops. For finger millet, NICRA farmers had a productivity of 17.0 quintals per hectare and a net return of Rs. 48,067 per hectare, compared to Non-NICRA farmers whose productivity was 12.9 quintals per hectare and Rs. 38,184 per hectare. For lentils, NICRA farmers recorded a productivity of 17.6 quintals per hectare and a net return of Rs. 79,206 per hectare, while Non-NICRA farmers had 13.8 quintals per hectare productivity and net returns of Rs. 60,768 per hectare (Table 9.10 b). It indicates that NICRA farmers benefitted more from the technologies adopted.

Table 9.10 b: Detailed information on Crop interventions

Crop/ Perennials	Technology adopted/ demonstrated	NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Field Crops	Finger millet (VL Mandua- 376/379/380)	3.0	17.0	48067	2.8	12.9	38184
	Lentil (PL 9)	2.5	17.6	79206	1.4	13.8	60768
Specificity of technology	Varietal Improvement						
Farmers' perception	Farmers appreciated the technology						

LIVESTOCK INTERVENTIONS:

The demonstration of advanced technologies such as green fodder, mineral mixtures, and cow mats by NICRA farmers achieved higher milk production and gross returns when compared to Non-NICRA farmers who used only dry fodder. Specifically, NICRA farmers produced 1,480 to 1,552 litres of milk annually with gross returns ranging from Rs. 59,226 to Rs. 62,098 while Non-NICRA farmers produced 998 to 1,045 litres with lower gross returns of Rs. 39,938 to Rs. 41,826.

Table 9.10 c: Detailed information on Livestock interventions

Farmers	Animal No.	Technology adopted/ demonstrated	Production (l/ year)	Selling price (Rs./l)	Gross returns (Rs./animal)
NICRA farmer					
Khima Devi	03	Green fodder + Mineral Mixture	1480	40	59226
Nirmala Devi	02	Mineral Mixture + Cow Mat	1530	40	61222
Naveen Singh	03	Green fodder + Mineral Mixture + Cow Mat	1552	40	62098
Non-NICRA farmer					
Ashok Singh	03	Dry fodder	998	40	39938
Hem Singh	03		1045	40	41826
Prakash Singh	03		1023	40	40939
Specificity of technology	Use of cow mat, quality green fodder and mineral mixture				
Farmers' perception	Farmers appreciated the technology				

Tehri Garhwal

10

Tehri Garhwal, situated in the picturesque hill state of Uttarakhand, India, serves as a distinctive district with its administrative hub located in New Tehri. According to 2011 census, the district boasts a population of 618,931, reflecting a 2.35% growth over the preceding decade. Nestled in the lap of the Himalayas, Tehri Garhwal is bordered by Rudraprayag district to the east, Dehradun district to the west, Uttarkashi district to the north, and Pauri Garhwal district to the south.

NICRA VILLAGES:

The NICRA villages of Tehri Garhwal include Kaleth, Dabri, Semwalgaon, and Selur. They have been actively involved in the Technology Demonstration Component (TDC) for different years: Kaleth and Dabri since 2011-12, Semwalgaon since 2020-21, and Selur since 2022-23. The cultivated areas vary across these villages, with Kaleth at 64.48 hectares, Dabri at 124.36 hectares, Semwalgaon at 18.0 hectares, and Selur at 36.36 hectares.

Table 10.1: Information about the NICRA villages

Details	Village 1	Village 2	Village 3	Village 4
Name	Kaleth	Dabri	Semwalgaon	Selur
Year adopted	2011-12	2011-12	2020-21	2022-23
Nature of activity	NRM interventions (Water harvesting tanks, Vermicomposting, Rainwater harvesting technologies), Crop production interventions (Millet crop production, Horticulture crop production, Oilseed and pulses, Cereal crop production), Livestock interventions (Hybrid Napier, FMD and HS Vaccination, Silage making) and Upscaling in convergence with line/ state department.			

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of this village are Rainfed without animal (FST 1) and Rainfed with animal (FST 2). All the cultivated areas are rainfed, and Kaleth has an additional under-irrigation. Maximum farmers i.e. 704 farmers are involved in Rainfed without animal farming system and 471 farmers are involved in Rainfed with animal farming system.

Table 10.2: Summary of Interventions

Villages	No. of farmers involved in demonstrations			
	FST 1 (Rainfed without animal)	FST 2 (Rainfed with animal)	FST 3 (Irrigated without animal)	FST 4 (Irrigated with animal)
Kaleth	156	46	161	52
Dabri	220	177	-	-
Semwalgaon	128	76	-	-
Selur	200	172	-	-
Total	**704**	**471**	**161**	**52**

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Climate resilient demonstrations were conducted on water harvesting, vermicomposting, and rainwater harvesting technologies, and farmers showed great interest in these technologies (Table 10.3).

Table 10.3: Natural resource management interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Water harvesting tanks	4	61	4.25
Vermicomposting	23	23	-
Rainwater harvesting technologies	40	40	5.75

CROP PRODUCTION INTERVENTIONS:

The demonstrations had a significant impact, resulting in the adoption of various technologies by a considerable number of farmers. Active farmer participation was observed in demonstrations focusing on improved crop varieties, indicating the effectiveness of the interventions in promoting better farming practices (Table 10.4).

Table 10.4: Crop Production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Finger Millet (VL 352)	138	138	20
Barnyard Millet (PRJ 1)	138	138	20
Tomato (Arka Rakshak)	72	72	2.5
Okra (Arka Anamika)	140	140	5
Okra (Kashi Lalima)	140	140	5
French Bean (Arka Komal)	178	178	1.5
French Bean (Contender)	87	87	1.5
Soybean (VL 65)	103	103	1.69
Black Gram (PU 09)	107	107	7.09
Moong Bean (PM 05)	83	83	3.54
Amaranthus (VL 44)	73	73	5.73
Pea (Pusa Pragati)	17	17	0.21
Pea (PB 89)	30	30	0.30
Lemon (Pant Lemon 1)	74	74	0.49
Wheat (VL 967)	64	64	4.6
Onion (AFLR)	89	89	1.33
Vegetable Rai (Hathikan)	64	64	1.3
Pea (VLM 13)	26	26	1
Radish (Pusa Chetki)	26	26	0.05

LIVESTOCK INTERVENTIONS:

For foot-and-mouth disease (FMD) and hemorrhagic septicemia (HS), demonstrations covered 43 animals. Hybrid Napier demonstrations were organized for 85 farmers and silage-making demonstrations for 36 farmers, aiming to improve livestock health and fodder production.

Demonstration on Barnyard Millet

Field Demonstration on French beans

Table 10.5: Livestock interventions are taken up in farming system typologies

Resilient practice	No. of Demo	Farmers	No. of animals	Area (ha)
Hybrid Napier	5	85	-	2.35
FMD and HS Vaccination	43	43	43	-
Silage making	4	36	-	-

BY-PRODUCTS PRODUCED:

During 2023-24 farming system, a total of 4,600 quintals of compost were produced using tetra beds demonstrating effective recycling of organic waste.

CUSTOM HIRING CENTRE:

Various implements were used to assess their performance in agriculture under the NICRA programme where sprayer pump, power weeder, and mandua thresher attracted farmers' interest. The power tiller contributed revenue of Rs. 2500 from 30 farmers (Table 10.6), while the Power weeder generated Rs. 1700 from 35 farmers. Overall, the combined revenue from these agricultural implements amounted to Rs. 5100, involving a total area of 32.0 hectares and 202 farmers.

Table 10.6: Institutional interventions (Custom Hiring Centre)

Implements	Farmers covered	Area covered (ha)	Amount mobilised (Rs.)
Paddy Thresher	10	-	200
Mandua Thresher	35	-	700
Power Tiller	30	25.0	2500
Power Weeder	35	5.0	1700
Plough	25	2.0	-
Chaff Cutter	12	-	-
Sprayer Pump	55	-	-
Total	**202**	**32.0**	**5100**

SEED PRODUCTION:

The seed system for crop production used during CRTs demonstrations in 2023-24 showed great performance as 0.5 q of Finger millet (VL 352) was produced for 25 farmers, covering 0.25 hectares, with all seeds retained for self-use and exchange with the VCRMC members. Additionally, 3 q of Barnyard millet (PRJ 1) were produced for 120 farmers, covering 1.50 hectares, with the entire quantity retained for the next season.

Table 10.7: Institutional interventions (Seed bank)

Seed system	Seed produced (q)	Farmers	Area (ha)	Seed retained for next season (q)	Amount mobilised (Rs.)
Finger millet (VL 352)	0.5	25	0.25	0.5	Self-use and exchange with the VCRMC members
Barnyard millet (PRJ 1)	3.0	120	1.50	3.0	-

FODDER PRODUCTION:

The Hybrid Napier CO 3 system produced 220 tonnes of Hybrid Napier, involving 75 farmers and covering an area of 2.24 hectares. The entire quantity of fodder was used as livestock feed.

CAPACITY BUILDING PROGRAMMES:

During 2023-24, various capacity-building programs covered a range of topics including crop production, nursery production technologies, livestock management and fruits and vegetable production. The highest participation was in programs for Crop production technology of Okra variety and French beans at village Kaleth, reaching up to 51 participants followed by Pea variety (Pusa Pragati and PB 89) at village Kaleth with up to 47 participants, Finger millet (VL 352) and Barnyard millet (PRJ 1), each involving 44 and 42 beneficiaries, respectively. A total of 37 training programs were conducted, reaching 193 male and 768 female beneficiaries, totalling 961 participants (Table 10.8). This shows a broad effort to enhance agricultural practices across multiple crops and techniques.

Table 10.8: Capacity Building programmes (HRD) for farmers

Theme	No. of Beneficiaries		
	Male	Female	Total
Crop production technology of Apple and Kiwi at village Dabri	14	7	21
Crop production technology of Apple and Kiwi at village Selur	4	4	8
Crop production technology of Kiwi at village Kaleth	7	10	17
Crop production technology of Finger Millet variety VL 352 at village Semwalgaon	3	20	23
Crop production technology of Barnyard Millet variety PRJ 1 at village Semwalgaon	3	20	23
Crop production technology of Finger Millet variety VL 352 at village Dabri	3	12	15
Crop production technology of Barnyard Millet variety PRJ 1 at village Dabri	3	12	15
Crop production technology of Finger Millet variety VL 352 at village Dabri	13	31	44
Crop production technology of Finger Millet variety VL 352 at village Kaleth	3	39	42
Crop production technology of Barnyard Millet variety PRJ 1 at village Kaleth	3	39	42
Crop production technology of Finger Millet variety VL 352 at village Selur	2	12	14
Crop production technology of Barnyard Millet variety PRJ 1 at village Selur	2	12	14
Nursery and Crop production technology of Tomato variety Arka Rakshak at village Kaleth	1	15	16
Nursery and Crop production technology of Tomato variety Arka Rakshak at village Selur	1	15	16
Nursery and Crop production technology of Tomato variety Arka Rakshak at village Dabri and Semwalgaon	2	29	31
Nursery and Crop production technology of Tomato variety Arka Rakshak at village Dabri	2	12	14

Theme	No. of Beneficiaries		
	Male	Female	Total
Crop production technology of Okra variety Kashi Lalima and Arka Anamika at village Dabri	4	19	23
Crop production technology of Okra variety Kashi Lalima and Arka Anamika at village Semwalgaon	3	14	17
Crop production technology of Okra variety Kashi Lalima and Arka Anamika and French bean variety Arka Komal at village Kaleth	6	45	51
Crop production technology of Okra variety Kashi Lalima and Arka Anamika and French bean variety Arka Komal at village Dabri	6	34	40
Crop production technology of French bean variety Arka Komal and Contender at village Semwalgaon	7	21	28
Crop production technology of French bean variety Arka Komal and Contender at village Dabri	6	14	20
Crop production technology of Okra variety Kashi Lalima and Arka Anamika and French bean variety Contender at village Selur	6	33	39
Crop production technology and seed treatment of Soyabean, Black gram and Moong bean variety VL 65, PU 09, PM 09 at village Dabri	4	5	9
Crop production technology and seed treatment of Soyabean, Black gram, Moong bean and Amaranthus variety VL 65, PU 09, PM 09, VL 44 at village Semwalgaon	12	9	21
Crop production technology and seed treatment of Soyabean, Black gram, Moong bean and Amaranthus variety VL 65, PU 09, PM 09 and Shikha, VL 44 at village Selur	6	22	28
Crop production technology and seed treatment of Soyabean, Black gram and Amaranthus variety VL 65, PU 09, VL 44 at village Kaleth	1	14	15
Crop production technology and seed treatment of Soyabean, Black gram and Amaranthus variety VL 65, PU 09, VL 44 at village Dabri	6	20	26
Planting of Hybrid Napier for livestock fodder management at village Selur	2	16	18
Planting of Hybrid Napier for livestock fodder management at villages Dabri and Semwalgaon	2	8	10
Planting of Hybrid Napier for livestock fodder management at village Kaleth	4	19	23
Crop production technology of Pea variety Pusa Pragati and PB 89 at village Kaleth	5	42	47
Crop production technology of improved lemon variety Pant Lemon 1 at village Selur	6	18	24
Planting of Hybrid Napier for livestock fodder management at village Selur	6	18	24
Crop production technology of improved Lemon variety Pant Lemon 1 at village Selur	1	21	22
Crop production technology of improved Lemon variety Pant Lemon 1 at village Dabri and Semwalgaon	12	16	28
Crop production technology of improved Wheat, Onion, Rai variety viz., VL 967, AFLR, Hathikan at village Dabri	5	10	15
Crop production technology of improved Wheat, Onion, Rai variety viz., VL 967, AFLR, Hathikan at village Kaleth	7	26	33

Theme	No. of Beneficiaries		
	Male	Female	Total
Crop production technology of improved Wheat, Onion, Rai variety viz., VL 967, AFLR, Hathikan at village Selur	4	17	21
Crop production technology of improved Pea and Radish variety VLM 13, Pusa Chetki at village Kaleth	6	18	24
Total	**193**	**768**	**961**

OTHER EXTENSION ACTIVITIES:

The extension activities involved Kisan Chaupal with 27 participants, an awareness program on rainwater harvesting with 17 participants, and the RAWE students' attachment to NICRA village Dabri, also with 17 participants. Each program focused on different aspects of agricultural improvement and awareness.

Table 10.9: Other extension activities

Name of program	Participants
Kisan Chaupal programme by DD Kisan and KVK Tehri Garhwal	27
Awareness programme on rainwater harvesting "Catch the Rain"	17
Attachment of RAWE students of the college to the newly adopted NICRA village	17

Demonstration on Barnyard Millet

Training programme on vermicomposting

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

Climate resilient technologies such as an improved variety of barnyard millet, micro irrigation for poly-houses, and sticky traps were demonstrated in different NICRA villages with support from AICRP Potential Crops VCSGUUHF, State Horticulture Department and State Agriculture Department for upscaling of the NICRA programme.

Table 10.10: Summary of Upscaling of Technologies

Villages	Technology scaling up/out	No. of farmers	Convergence with the programme	Amount mobilised (Rs.)
Dabri, Kaleth	PRJ 1	15	AICRP Potential Crops VCSGUHF	2410
Semwalgaon, Selur	PRJ 1	21		1678
Dabri, Kaleth	Micro Irrigation for poly houses	10	State Horticulture Department	55000
Dabri, Kaleth, Semwalgaon, Selur	Sticky traps	100	State Agriculture Department	5940

EXTREME WEATHER EVENTS:

During 2023-24, these villages experienced dry spells three times. It caused stress in the seedling stage of pulses and millets along with the effect on the sowing of *Kharif* crops where supplementary irrigations by using water harvesting structures were undertaken and farmers were advised to delay the sowing to the second fortnight of May to cope up with this situation.

Table 10.11: Extreme weather events, and dry spells observed

Nature of event	Date	Impact on crop yield
Dry spell	07-06-2023 to 20-06-2023	Millets, Pigeon Pea's seedling stage for 10 days
	03-04-2023 to 19-04-2023	The sowing time of *Kharif* crops was affected for about 51 days
	05-05-2023 to 23-05-2023	

SIGNIFICANT ACHIEVEMENTS:

During the year 2023-24, farmers were engaged in various initiatives, including the adoption of innovative farming practices, participation in awareness programs, and demonstrations of improved crop varieties. Agroadvisories were issued regularly, ensuring timely sowing and proper crop management practices among farmers. Rural Agricultural Work Experience (RAWE) students actively participated in field activities, encouraging interest in modern farm practices. Programs on rainwater

Table 10.12: Significant achievements

Description	No. of farmers	Impact
Best Innovative Farmer Award	1	Adopting Innovative farming approaches under changing climatic scenarios under the NICRA project of KVK Tehri Garhwal's adopted village Kaleth
Issue of Agro-advisories (104)	87	Timely issues of Agro-advisories led to the timely sowing and adoption of appropriate intercultural practices in the crops
Attachment of RAWE students of the college to the newly adopted NICRA village Dabri	17	Great interest is shown by the farmers towards time-saving farm mechanization practices, post-harvest processing and packaging practices
Kisan Chaupal programme by DD Kisan and KVK Tehri Garhwal	27	
Awareness programme on rainwater harvesting "Catch the Rain"	17	
Planting of Hybrid Napier for livestock fodder management at all the adopted villages	75	Availability of fodder during the lean period to the animals
Demonstration of triple disease-resistant Tomato variety Arka Rakshak at all the adopted villages	75	Lower disease incidence resulting in higher yields were observed in both open field and poly-house conditions by the farmers
Introduction of coloured Okra variety Kashi Lalima at all the adopted NICRA villages	108	First-time introduction of coloured vegetables in the villages and initiation of potential marketability

harvesting and livestock fodder management improved resource use, while the introduction of new crop varieties boosted yield and market opportunities for farmers. Overall, these activities positively impacted farmer's knowledge, productivity, and sustainability.

NRM INTERVENTIONS:

Rain Water Management: Rainwater management technologies like Alkathene tanks and rainwater harvesting tanks are used to collect and store rainwater, especially in hilly regions where water availability is limited. These lightweight and durable tanks ensure a reliable water supply during dry periods, particularly in the *Kharif* season, reducing the reliance on external sources of water. The harvested water can be used for supplementary irrigation, helping crops during critical growth stages like germination, vegetative growth, and flowering. By providing a consistent water supply, these tanks contribute to better crop health and overall yield improvement.

Soil Health Management: Techniques such as vermicomposting, black polythene mulching, and weed mats are used for soil health improvement. Vermicomposting converts farm waste and surplus manure into nutrient-rich compost, which enhances soil organic matter and provides critical nutrients during important crop growth phases, leading to healthier soil and better crop yields. Black polythene mulching and weed mats help reduce weed growth, conserve soil moisture, and regulate soil temperature, further improving the productivity of crops. These practices promote sustainable agriculture by enhancing soil fertility and reducing the incidence of pests like cutworms.

Table 10.13: Detailed information on NRM interventions

Technology demonstrated	Crop stage affected	
Rainwater management	Alkathene tanks	Germination, vegetative and flowering
	Rain water harvesting tanks	
Soil health management	Vermicomposting	Soil organic matter enhancement, nutrient availability during critical growth & development stages
	Black polythene mulching and Weed Mat	Reduces weed infestation Soil moisture retention
Specificity of technology	1. **Alkathene Tanks & Rain Water Harvesting Tanks:** Durable & lightweight, LDPE tanks are ideal for harvesting and storage of rainwater in hilly regions for supplementary irrigation, reducing dependency on external water sources and ensuring a steady supply for crops during dry periods 2. **Vermicomposting:** Converts surplus cattle manure and other organic waste into nutrient-rich compost with beneficial microbes, ultimately enhancing soil fertility, improving crop yields, and promoting sustainable agricultural practices by recycling farm waste. 3. **Black Polythene Mulching:** Weed growth reduction, soil moisture conservation, soil temperature regulation, crop yield enhancement.	
Farmers' perception of technology	Farmers were excited with the Alkathene and rainwater harvesting tanks as they ensured continuous water supply during dry periods in the *Kharif* season, vermicomposting helped in the conversion of surplus manure to valuable compost and reduced the incidence of cutworms which arise in raw dung, Used of weed mat and black polythene mulching helped in better crop yields both in open field and protected cultivation.	

CROP INTERVENTIONS:

Climate resilient technologies were demonstrated for FST 1 (Rainfed without animal) under crop interventions in Dabri village by adopting an improved variety of tomatoes, finger millet and peas for better productivity and farmers' income (Table 10.14).

Table 10.14: Impact of Crop interventions in FST 1 (Rainfed without animal)

Village- Dabri											
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Tomato	Arka Rakshak + Polymulch	Indigenous varieties	0.75	425.0	135000	480260	0.05	200	120000	240680
Vegetative and Fruiting stage	Triple Disease resistant and yielding cultivar		Crop was disease and yield was much higher as compared to traditional practices.							
2. Finger millet	VL 352 + Sagarika	Indigenous seed	5.50	14.4	16500	38125	4.50	11.5	14000	30250
Grain filling stage	High-yielding and drought resistant cultivar		Better yield as compared to the Indigenous ones and crops effectively escaping drought conditions.							
3. Pea	VLM 13 + NPK Consortia	Local seed and no fertilization	1.50	95.5	70000	195500	0.50	65.3	55000	115000
Pod development stage	Higher seeds per pod and improved yield		Yield was higher with lesser infestation of disease and disorders.							

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under crop interventions in Kaleth village by adopting an improved variety of okra, barnyard millet and onion for better productivity and farmers' income.

Village- Kaleth										
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Okra	Arka Anamika+NPK Consortia	Locally available seed	0.57	110.5	75500	165000	0.10	70.5	45650	105780
Pod development stage	YVMV-resistant and high - yielding cultivar		Higher yields with disease resistance in the *kharif* season.							
2. Barnyard millet	PRJ-1+NPK Consortia	Indigenous varieties	5.90	14.5	15000	36250	4.50	11.5	13500	28750
Grain filling stage	High-yielding variety with the presence of horns		Improved yield and lesser damage by wild animals and birds.							
3. Onion	Agrifound Light Red+Smoke	Locally available seed	0.20	242.0	52220	242500	0.05	160.0	45650	165000
Crop Stage impacted	Non-Bolting and high yielding cultivar		Demonstrated variety yielded higher than local variety due to lesser premature seed set.							

Climate resilient technologies were demonstrated for FST 1 (Rainfed without animal) under crop interventions in Semwalgaon village by adopting an improved variety of okra, soybean and onion for better productivity and farmers' income.

Village-Semwalgaon											
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Okra	Kashi Lalima+NPK Consortia	Locally available seeds	0.35	125.0	75000	187500	0.20	70.5	48650	105750
Pod development stage	Red-colored variety with higher yield		Introduction of a unique cultivar to the region for the first time having a higher yield and lesser disease incidence.							
2. Soyabean	VL-65+NPK Consortia	Indigenous seeds	0.15	89.3	10525	31705	0.20	65.5	8538	21883
Pod filling stage	Drought-resistant and high-yielding cultivar		High-yielding cultivars as compared to the indigenous ones.							
3. Onion	Agrifound Light Red+ Smoke	Locally available seeds	0.27	245.0	53500	245500	0.10	165.0	45650	165500
Crop Stage impacted	Non-Bolting and high yielding cultivar		Demonstrated variety yielded higher than local variety due to lesser premature seed set.							

Climate resilient technologies were demonstrated for FST 1 (Rainfed without animal) under crop interventions in Selur village by adopting an improved variety of peas, french beans and wheat for better productivity and farmers' income.

Village- Selur										
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Pea	VLM+ Sagarika	Locally available seed	1.00	92.5	70000	192500	0.10	64.5	55000	164500
Pod development stage	More no. of seeds per pod and higher yields		More seeds per pod resulting in improved yield and higher returns per unit area as compared to traditional cultivars.							
2. French bean	Contender + NPK consortia	Indigenous seeds	0.30	150.0	16950	46500	0.05	95.5	10500	34560
Vegetative and Pod development stage	Lesser anthracnose incidence and improved yield and pod quality		The lesser disease-affected pods and good-quality pods were obtained.							
3. Wheat	VL-967+NPK consortia	Indigenous seed	1.10	13.5	33445	97450	0.10	8.3	25000	85650
Grain filling stage	Drought-resistant and higher-yielding variety		Lesser irrigation requirement during the dry spell of the *Rabi* season and improved yield and grain quality.							

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under crop interventions in Dabri village by adopting an improved variety of black gram, french bean and pea for better productivity and farmers' income. Adoption of these technologies showed better results in terms of productivity and income for NICRA farmers as compared to Non-NICRA farmers.

Table 10.15: Impact of Crop interventions in FST 2 (Rainfed with animal)

Village- Dabri										
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Black gram	PU 09 + NPK consortia	Indigenous varieties	0.60	10.9	40150	42260	0.75	9.5	38150	55300
Pod development stage	Drought-resistant and high yielding cultivar		Higher pod yield and grain quality were observed as compared to the Indigenous ones							
2. French bean	Arka Komal + Sagarika	Locally available Seed	0.30	149.7	16450	45560	0.10	105.2	10560	32500
Pod development stage	Bush type cultivar with softer edible pods		High market demand and consumer acceptability with good fodder content as well for the livestock							
3. Pea	Pusa Pragati + NPK Consortia	Indigenous seed	0.10	95.7	70000	195650	0.05	65.5	55000	165520
Pod development stage	Higher pod yield and drought tolerant variety		Lesser irrigation requirement at the time of rabi season dry spell							

Method demonstration on mulching

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under crop interventions in Kaleth village by adopting an improved variety of okra, tomato and pea for better productivity and farmers' income.

Table 10.15: Impact of crop interventions in FST 2 (Rainfed with animal)

Village- Kaleth											
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Okra	Kashi Lalima + NPK Consortia	Locally available seed	0.50	125.5	75650	188250	0.05	85.5	486550	128250
Pod development stage	Red-colored variety with higher yield		Introduction of a unique cultivar to the region for the first time having a higher yield and lesser disease incidence							
2. Tomato	Arka Rakshak+Polymulch	Locally available seed	0.50	430.0	135000	470150	0.10	22500	120000	239500
Vegetative and Fruiting stage	Triple disease-resistant and high yielding cultivar		Crop was disease-free and yield was much higher as compared to traditional practices.							
3. Pea	PB 89 + NPK Consortia	Locally available seed	0.65	96.9	70000	1996850	0.05	65.4	55000	165420
Pod development stage	Higher pod yield and drought tolerant variety		Lesser irrigation requirement at the time of rabi season dry spell							

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under crop interventions in Semwalgaon village by adopting improved variety of Amaranthus, Pea and French bean for better productivity and farmers' income.

Village Semwalgaon										
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Amaranthus	VL Chua 44 + NPK Consortia	Indigenous seed	0.65	12.4	22713	49320	0.10	8.6	18950	25650
Grain filling stage	Drought-resistant and high-yielding cultivar		Higher grain yield as compared to the Indigenous ones and lesser water requirement by the crop.							
2. Pea	VLM + NPK Consortia	Locally available seed	0.50	98.5	70000	198500	0.05	72.4	50000	172420
Pod development stage	A higher number of seeds per pod and drought-resistant cultivar		Improved pod yield a higher number of seeds per pod and crop less prone to wilting due to water stress.							

Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
3. French bean	Contender + NPK Consortia	Locally available seed	0.15	155.5	16480	46320	0.05	105.5	10350	35650
Pod development stage	Bush-type cultivar with anthracnose disease resistance		Lesser disease incidence and higher yields with good fodder content as well for the livestock.							

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under crop interventions in Selur village by adopting improved variety of tomato, onion and wheat for better productivity and farmers' income.

Village- Selur										
Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Tomato	Arka Rakshak + Polymulch	Indigenous varieties	0.50	428.0	135000	485600	0.02	210.4	120000	213650
Vegetative and Fruiting	Triple disease-resistant and high yielding cultivar		Crop was disease-free and yield was much higher as compared to traditional practices.							
2. Onion	Agrifound Light Red+ Smoke	Locally available Seed	0.13	250.5	53650	250550	0.04	165.4	45850	165400
Crop Stage impacted	Non-Bolting and high yielding cultivar		Crop avoiding premature seed set higher yield was also observed as compared to the locally available ones.							
3. Wheat	VL-967+ NPK consortia	Indigenous seed	1.05	14.5	32650	96540	0.05	9.6	25650	85540
Grain filling stage	Drought-resistant and higher-yielding variety		Lesser irrigation requirement during the dry spell of *Rabi* season and improved yield and grain quality.							

Tomato cultivation under protected conditions

Climate resilient technologies were demonstrated for FST 3 (Irrigated without animal) under crop interventions in Kaleth village by adopting an improved variety of tomatoes, peas and okra for better productivity and farmers' income (Table 10.16).

Table 10.16: Impact in FST 3 (Irrigated without animal) in Kaleth

Crop/ Perennials	Technology demonstrated	Farmers practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. Tomato	Arka Rakshak + Polymulch	Locally available seed	0.25	429.0	135000	428500	0.02	250.5	120000	249650
Vegetative and Fruiting stage	Triple disease-resistant and High yielding cultivar		Crop was disease-free and yield was much higher as compared to traditional practices.							
2. Pea	VLM + NPK Consortia	Locally available seed	0.10	100.5	70000	199000	0.05	75.6	55000	175620
Pod development stage	A higher number of seeds per pod and drought-resistant cultivar		Improved pod yield a higher number of seeds per pod and crop less prone to wilting due to water stress.							
3. Okra	Kashi Lalima+ NPK Consortia	Locally available seeds	0.50	105.5	75500	158250	0.10	72.7	48650	108975
Pod development stage	Red-colored variety with higher yield		Introduction of a unique cultivar to the region for the first time having higher yield and lesser disease incidence.							

Climate resilient technologies were demonstrated for FST 4 (Irrigated with animal) under crop interventions in Kaleth village by adopting an improved variety of French beans, soybeans and onions for better productivity and farmers' income.

Table 10.17: Impact in FST 4 (Irrigated with animal) in Kaleth

Crop/ Perennials	Technology demonstrated	Details of farmers' practice	NICRA farmers				Farmers practice			
			Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)	Area (ha)	Yield (q/ha)	CoC (Rs./ha)	GR (Rs./ha)
1. French bean	Contender+ NPK Consortia	Locally available seed	0.25	160.5	16890	45680	0.10	110.6	10560	34550
Pod development stage	Bush-type cultivar with anthracnose disease resistance		Lesser disease incidence and higher yields with good fodder content as well for the livestock.							
2. Soybean	VL-65+NPK Consortia	Indigenous seeds	0.11	14.6	11500	28840	0.15	9.4	8600	19812
Pod filling stage	Drought-resistant and high-yielding cultivar		High-yielding cultivars as compared to the indigenous ones.							
3. Onion	Agrifound Light Red+ Smoke	Locally available Seed	0.26	238.0	53650	238650	0.10	159.0	45650	159500
Crop stage impacted	Non-Bolting and high yielding cultivar		Crop avoiding premature seed set higher yield was also observed as compared to the locally available ones.							

Various technologies were demonstrated for buffalo farming, including the use of Napier grass as high-quality fodder, vaccination against Foot-and-Mouth Disease (FMD) and heat stress, and deworming for maintaining gut health.

The selling price of buffalo milk is Rs. 40 per litre, while production costs per animal range between Rs. 28,600 to Rs. 35,400 (Table 10.18). Gross returns vary across interventions, with all producing farmyard manure (FYM) as a valuable by-product. Farmers value Napier grass for its year-round availability, while vaccinations and deworming improve animal health and disease resistance, making these interventions both beneficial and sustainable. Adoption of livestock rearing by conducting animal health Camps and deworming/FMD vaccination also increased NICRA farmers' income.

Table 10.18: Livestock interventions

Animals	Technology demonstrated	Production (l/year)	Selling price (Rs./l)	Cost of production (Rs./ animal)	Gross returns (Rs.)	By products
Buffalo	Napier Rootslips Fodder Bank	1871	40	30400	74840	FYM
Buffalo	Vaccination of FMD and heat stress Animal Health Camps Deworming/FMD vaccination	1893		35400	75720	
Buffalo	Deworming	1672		29400	66880	
Buffalo	FMD vaccination	1726		28600	69040	
Specificity of technology	1. Napier Grass (Perennial): This grass is an excellent forage for dairy cattle and provides essential nutrients year-round due to its perennial growth. 2. FMD and Heat Stress Vaccination: This vaccination helps against foot and mouth disease in cattle and also mitigates the adverse effects of heat stress in cattle. 3. Deworming: It helps maintain the gut health of the buffaloes.					
Farmers' perception	Farmers appreciate Napier grasses for their hardiness year-round availability and digestive benefits. FMD and Heat stress vaccination helped to cope with foot and mouth disease in cattle. Deworming has helped to a great extent in maintaining the gut health of the buffaloes.					

Field day on Fingermillet

National Innovations in Climate Resilient Agriculture
(NICRA)
कृषि विज्ञान केन्द्र, रानीचौरी, टिहरी गढ़वाल
ICAR
प्रशिक्षण कार्यक्रम
दिनाँक 30/06/2023
ग्राम: सेलूर
वीर चन्द्र सिंह गढ़वाली उत्तराखण्ड औद्यानिकी एवं वानिकी विश्वविद्यालय
भरसार, पौड़ी गढ़वाल
NICRA

National Innovations in Climate Resilient Agriculture
(NICRA)
प्रशिक्षण कार्यक्रम

Bageshwar

11

Bageshwar district is known for its scenic environment, glaciers, rivers and temples. Its climate is characterized by relatively high temperatures and evenly distributed precipitation throughout the year. According to the 2011 census of India, Bageshwar district has a population of 2,59,900 comprising 1,24,330 males and 1,35,570 females. Males constitute approximately 47.8 % of the population and females 52.1 %.

NICRA VILLAGE:

Karalapalari village of this district was selected for the Technology Demonstration Component of NICRA in the year 2021-22. The entire cultivated area (20.05 ha) is under this village without any flood-prone area. Irrigated area is 3 ha with 62 households where 17.05 ha of this village lies under rainfed area.

Table 11.1: Rainfall (mm) distribution

Rainfall 2023-24												
Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	0	11.5	30.0	0	0	0	0	0	5.8	4.7	0	9.7
2	0	0	7.8	0	12.5	0	0	0	0	17.4	0	5.5
3	0	10.5	2.7	0	0	0	1.5	0	0	19.0	0	2.4
4	0	30.5	0	6.2	0	0	1.0	0	8.0	0	0	1.5
5	1.0	12.5	22.5	17.2	0	0	0	0	1.0	0	0	0
6	0.5	19.5	0	0	0	0	0	0	0	0	0	0
7	0	10.5	0	0	0	0	0	0	0	0	1.5	0
8	0	12.5	28.5	6.0	0	0	0	0	0	0	0	0
9	0	0	9.5	2.5	0	0	0	0	0	0	0	0
10	0	0	0	40.7	0	0	0	0	0	0	0	0
11	0	19.7	0	42.3	0	0	0	0	0	0	0	0
12	14.5	4.8	0	0.5	0	0	0	0	0	0	0	0
13	4.5	7.3	14.0	0	0	0	0	0	0	0	0	0
14	0	0	0	10.7	0	0	0	0	0	0	0	0
15	1.0	22.0	0	17.3	0	0	0	0	0	0	0	0
16	0	0	0	1.6	9.8	0	0	0	0	0	0	0
17	0	3.8	0	0	0	0	0	0	0	0	0	0
18	0	8.0	0	29.2	0	0	0	0	0	0	0	0
19	0	0	0	3.8	0	0	0	0	5.0	0	0	0
20	0	0	0	0	0	0	0	0	1.0	0	0	0

Rainfall 2023-24												
Date	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
21	0	25.0	0	0	0	0	0	0	0.5	0	4.4	0
22	0	1.0	8.1	0	0	0	0	0	0	0	0	0
23	0	55.0	2.0	0	1.0	0	0	0	0	0	0	2.5
24	9.0	14.0	0.1	0	0	0	0	0	0	0	0	2.8
25	1.0	8.8	0	0	0	0	0	0	0	0	0	2.0
26	0	19.0	0	0	0	0	0	0	0	0	0	0
27	11.5	15.0	0	0	0	0	0	0	2.0	0	5.0	0
28	0	0	6.2	0	0	0	0	0	0	0	2.0	0
29	15.8	0	0	0	0	0	0	0	-	0	0	1.0
30	12.0	0	0	0	0	0	0	0	-	0	14.7	0
31	-	0	0	-	0	-	0	0	-	0	-	4.5

FARMING SYSTEM TYPOLOGY:

The major farming system typology of this village is Rainfed with animal. The farmers opted for only one farming system- Rainfed with animal. Farmers of this village always depend on animal husbandry along with agriculture. There were 62 farmers in this village who actively participated in Rainfed with animal (FST 2) farming system typology.

NRM INTERVENTIONS:

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under natural resource management by the installation of a rain gauge for recording rainfall and a water lifting pump for this village to increase farmers' profitability.

CROP PRODUCTION INTERVENTIONS:

Demonstrations for resistant varieties of climate-resilient crops and diversification through vegetable production for higher income were undertaken in which 45 farmers benefitted through drought-tolerant varieties of crops and 25 farmers through diversification of vegetable crops.

Table 11.2: Crop production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Drought tolerant varieties	45	45	2.35
Diversification through vegetable production for higher income	25	25	0.50

LIVESTOCK INTERVENTIONS:

Demonstrations on Climate Resilient Technologies (CRTs) were conducted with active participation from 60 farmers in deworming livestock to control ecto and endo parasites in dairy animals. Mineral mixtures were provided to 45 farmers, benefiting a total of 110 animals. Additionally, shelter management was demonstrated using cow mats, with 30 farmers involved and 30 animals covered (Table 11.3).

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under crop interventions by adopting high-yielding varieties of Wheat (VL Gehun 967), Barley (VL Jau 118) and Field Pea (VL Matar 15) (Table 11.4). Adoption of these technologies showed better results in terms of productivity and income for NICRA farmers as compared to Non-NICRA farmers.

Demonstration of Cow Mats

Table 11.3: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of animals
Deworming in livestock (control of ecto & endo parasites in dairy animals)	60	60	120
Shelter management- Cow mat	30	30	30
Mitigation of mineral deficiencies in animals	45	45	110

Table 11.4: Impact of Crop production interventions in FST 2

Farmer	Technology adopted/ demonstrated	Area impacted by climatic stress, crop and stage	Rainfed with animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Famer 1	VL Gehun 967	118 days dry spell from Oct 2023 to Jan 2024	2.0	14.6	3124	2.0	11.4	2267
Farmer 2	VL Jau 118	-	0.4	12.8	2020	0.4	10.2	1052
Farmer 3	VL Matar 15	-	0.5	74.3	118524	0.5	61.8	84752

In Rainfed with animal farming system typology of Karalapalari village, the adoption of VL Poly tunnels under the natural resource management module for vegetable nurseries and production led to substantial net returns from vegetables.

Table 11.5: Impact of NRM interventions in FST 2

Village	Technology adopted/ demonstrated	Rainfed with animal					
		NICRA farmers			Non-NICRA farmers		
		Area	Yield (q/ha)	Net return (Rs./ha)	Area	Yield (q/ha)	Net return (Rs./ha)
Average of 3 farmers	VL Poly tunnels for vegetable nursery raising and production	4 m^2 Nursery area and 200 m^2 crop area	2000 seedlings out of which 1000 sold and 242 q/ ha vegetable (cabbage, cauliflower and capsicum)	384995	600 m^2	191.7	215750

For FST 2 (Rainfed with animal), animal feed supplementation after deworming in buffaloes increased milk production and farmers received better returns in terms of milk, ghee production and income.

Table 11.6: Impact of livestock interventions in FST 2 (Rainfed with animal)

Animal (NICRA)	No.	Technology adopted/ demonstrated	Production (l/year)	Selling price (Rs./l)	Cost of production (Rs./animal)	Gross return (Rs./animal)	By-products quantity	Unit price (Rs.)	Net Returns (ha.)
Buffalo	30	Animal feed supplementation after deworming	2550	50	62642	145250	Ghee - 22.0 kg (From 110 l milk)	750	82607
Buffalo	30	Use of Rubber Cow Mat as bedding material	2625	50	62642	149000			86357

BY-PRODUCTS PRODUCED:

From crop production, 28.7 q/ha by-products were generated and sold at Rs. 600 per quintal, raising Rs. 17,220. On the other hand, 80.0 quintals of by-products were produced and sold at Rs. 300 per quintal, mobilizing Rs. 24,000 in total.

Table 11.7: By products produced

By product produced	Quantity (q)	Selling price (Rs./q)	Amount mobilised (Rs.)
Crop straw	28.7/ha	600	17220
Animal dung	80.0	300	24000

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

Performance of implements used in agriculture was assessed during 2023 in NICRA villages where utilization of rain gauge and power weeder attracted farmers' interest (Table 11.8).

Table 11.8: Institutional interventions (Custom Hiring Centre)

Implements	Amount mobilised (Rs.)	Farmers covered
Power Weeder	21171	42
VL Paddy Thresher		25
Vivek Millet Thresher		22
Water Lifting Pump		10
Multi Crop Thresher		22
Rain Gauge		Whole village
Foot Sprayer		30
Weighing Machine		20
Power Digger (Post hole digger)		10
VL Shyahi Hal		05
Chaff Cutter		07
VL Garden Rake		25
VL Line Maker		26
VL Hand Hoe		22

SEED PRODUCTION:

The seed system for crop production used during CRT demonstrations in 2023-24 showed great performance in the case of paddy where a number of farmers were involved. Other crops like finger millet, soybean, onion, and vegetables were also included, with onion seeds (8.5 quintals) being retained for seed production. The total intervention covered 157 farmers across 2.7 hectares, mobilizing Rs. 24,800 from vegetable sales.

Table: 11.9 Institutional interventions (Seed bank)

Seed systems	Seed (q)	Farmers	Area (ha)	Seed for next season (q)	Amount mobilised (Rs.)
Paddy (DSR) (VL Dhan 158)	2.0	25	0.5	-	Self-use and exchange with other farmers
Finger millet (VL Mandua 380)	0.5	50	0.5	-	
Soybean (VL Soya 89)	2.5	55	1.0	-	
Onion (VL Piaz 3)	8.5	10	0.2	8.5	Kept for seed production
Vegetables (Tomato- Heemsona F1, Cucumber- Malini F1, Capsicum- CW, Cabbage- Varun F1, Cauliflower- F1)	-	17	0.5	-	Self-use and sold for Rs. 24800
Total		**157**	**2.7**	**8.5**	

FODDER PRODUCTION:

A total of 25.5 tons of Hybrid Napier grass (cv. NB 21) was produced, benefiting 55 farmers and covering 1 hectare of land. This intervention supports livestock feed availability for the farmers involved.

CAPACITY BUILDING PROGRAMMES:

Most of the training programmes for capacity building were carried out to create awareness about NICRA and conducted training on improved techniques of crop production, water-saving technology, livestock management and improved production techniques of horticultural crops where both male and female farmers participated (Table 11.10). Most of these trainings received positive response from the farmers.

Training farm women for livestock feeding management

Training programme on cultivation of temperate fruits

Table 11.10: Capacity Building Programmes (HRD) for farmers

Theme	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Crop management	2	25	31	56
Water saving technology	1	15	5	20
Livestock management	1	20	25	45
Management of horticultural crops	2	29	21	50
Total	6	89	82	171

OTHER EXTENSION ACTIVITIES:

Several extension activities, aimed to engage participants in knowledge sharing and capacity building, were conducted, including two exposure visits with a total of 22 participants (7 and 15). Additionally, 62 participants attended a meeting and discussion, while two awareness programs reached 25 and 35 participants, respectively. Also, 75 participants were involved in group discussions.

Table 11.11: Other extension activities

Name of program	Participants
Exposure visit	7
Exposure visit	15
Meeting and discussion	62
Awareness programme	25
Awareness programme	35
Group discussions	75
Total	219

EXTREME WEATHER EVENTS:

Extreme weather events such as dry spells were witnessed during the *Kharif* and *Rabi* seasons in 2023-24 was experienced where significant effect was recorded on crops as no or less germination took place. Other extreme weather event was also witnessed by crops during this course of time such as floods-water logging which resulted in poor fruit setting and low yield. Sowing dates of *Rabi* crops were modified in such a manner that the flowering period of *Rabi* crops escapes this period and flowering starts after this frost spell, adopted as an intervention to reduce the impact of these weather events.

Table 11.12: Extreme weather events

Nature of event	Date	Impact on crop yield
Dry spells during *Kharif* season 2023	20-30.09.2023	Reduce seed weight and yield
Drought/ Dry spells during *Rabi* season 2023	24-30.01.24	Poor or no seed germination and poor plant growth and grain filling / Less canopy development
Flood- Waterlogging	01- 27.07.2023 04-19.09.2023	Poor fruit setting and low yield
Frost	26.12.2023 - 15.01.2024	Sowing dates were modified in such a manner the flowering period of *Rabi* crops escapes this period and flowering starts after this frost spell.

Different interventions such as demonstration of climate-resilient crops, bio-fertilizer incorporation, animal nutrition, pest management, fruit tree diversification, and the introduction of hybrid Napier grass, cow mats, and poly-tunnels reached a total of 337 farmers through convergence with training, awareness programs, and demonstrations, showing efforts to enhance agricultural productivity and sustainability by adopting improved techniques and practices.

Table 11.13: Summary of Upscaling of Technologies

Technology scaling up/out	No. of farmers	Convergence with the programme
Demonstration of suitable resistant varieties of climate-resilient crops	62	Training and Demonstration
Incorporation of bio-fertilizers and foliar application of nutrients	40	Training, Awareness and Demonstration
Supplementing animal feeding and nutrition	56	Training, Awareness and Demonstration
Timely management of White Grub Beetle	25	Training, Awareness and Demonstration
Diversification towards temperate fruit trees	50	Training and Demonstration
Plantation of Hybrid Napier	62	Demonstration
Cow mat	25	Demonstration
Polytunnels	17	Demonstration
Total	**337**	

Farmers meeting under Mission LiFE

Animal health checkup camp

LIVESTOCK INTERVENTIONS:

In village Karalapalari, NICRA farmers adopted deworming and feed supplements and 2,550 litres of milk annually, earning Rs. 62,642 from milk and Rs. 16,500 from selling 22 kg of ghee (a by-product), making a total gross return of Rs. 1,44,000, while Non-NICRA Farmers produced 2,400 litres of milk annually, earning Rs. 58,267 from milk and Rs. 12,375 from 16.5 kg of ghee, with a total gross return of Rs. 1,33,625 (Table 11.14). The deworming and feed supplement technology was found economically feasible and easy to administer by farmers.

Table 11.14: Detailed information on livestock interventions

Animal	Technology demonstrated	Production (l/year)	Selling price (Rs./l)	Cost of production (Rs./ animal)	Gross returns (Rs./ha)	By-products quantity	Unit price (Rs.)	Gross returns (Rs.)
NICRA	Deworming and Feed supplement	2550	50	62642	144000	Ghee 22.0 kg	750/ kg	16500
Non-NICRA	Without deworming and feed supplement	2400	50	58267	133625	Ghee 16.5 kg		12375
Specificity of technology	The technology was found economically feasible because of having it in powder or tablet form.							
Farmers' perception	The technology was found very handy because of easy to administer along with daily feed. No specialized person is required.							

SUCCESSFUL INTERVENTIONS:

In 2023-24, various successful interventions were carried out on natural resource management (NRM), crop varieties, and livestock in NICRA village. It includes various practices such as the use of polytunnels for growing vegetables, drought-tolerant crop varieties, and diversification through vegetable production. Additionally, it notes that over 50% of farmers in the village have adopted deworming practices for livestock.

Table 11.15: Adoption of successful interventions in the NICRA & adjoining village

Successful interventions	Crop	Variety	Adoption in ha
NRM			
VL Poly tunnels for vegetable nursery	Tomato, Cabbage, Cucumber and Capsicum	Heemsona F1, Varun F1, Malini F1, California Wonder	2.75
CROP			
Drought tolerant varieties	Mandua	VL Mandua 380	4.00
Diversification through vegetable production for higher income	Onion	VL Piyaz 3	3.50
LIVESTOCK			
De-worming in livestock (control of ecto & endo parasites in dairy animals)	-	-	More than 50 % farmers

Uttarkashi

12

Uttarkashi district, nestled in the Garhwal region of Uttarakhand, India, is renowned for its natural beauty, spiritual heritage, and agricultural vitality. Situated at the edge of the Himalayas, it shares borders with Tibet to the north and Himachal Pradesh to the northwest. Prominent rivers like the Bhagirathi and Yamuna flow through it, nourishing the district and its diverse flora and fauna. The climate in Uttarkashi varies dramatically with altitude. Lower regions experience a temperate climate with warm summers and mild winters, while higher elevations encounter an alpine climate with cooler summers and harsh, snowy winters. Monsoon rains are moderate, primarily aiding in agricultural productivity in the valleys. Agriculture plays a crucial role in the local economy, with most of the population engaged in farming. Crops such as rice, wheat, barley, and potatoes are cultivated in the fertile river valleys, while apples and other temperate fruits are grown at higher altitudes. Organic farming has seen a rise, reflecting an interest in sustainable agricultural practices that align with the district's eco-conscious outlook. The unique blend of spiritual significance, natural splendour, and agricultural richness makes Uttarkashi a culturally vibrant and ecologically important region in Uttarakhand.

NICRA VILLAGES:

Dunda, Bhadkot, Neri, and Anole villages of this district were selected for the Technology Demonstration Component of NICRA in the years 2011, 2016, 2022, and 2023, respectively.

Table 12.1: Information about the NICRA villages

Details of Villages	Village 1	Village 2	Village 3	Village 4
Name	Dunda	Bhadkot	Neri	Anole
Year adopted	2011	2016	2022	2023

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of these villages are Rainfed with animal and Irrigated with animal. The maximum farmers of these villages adopted these farming systems as the whole area of these villages is totally dependent on irrigation. Farmers of these selected NICRA villages always depend on animal husbandry along with agriculture.

Table 12.2: Summary of Interventions

Villages	No. of farmers involved in demonstrations	
	FST 2 (Rained with animal)	FST 4 (Irrigated with animal)
Dunda	67	20
Bhadkot	70	12
Neri	35	10
Anole	05	05
Total	**177**	**47**

TECHNOLOGY DEMONSTRATIONS:

NRM INTERVENTIONS:

In FST 2 (Rainfed with animal), interventions included vermicompost preparation, *Beejamrit* & *Jeevamrit*, and LDPE tanks, benefiting varying numbers of farmers across villages like Dunda, Bharkot, Neri, and Anole. In FST 4 (Irrigated with animal), similar practices were implemented, with fewer demonstrations and farmers covered, in villages like Neri and Anole. Overall, the focus was on composting and organic preparations to enhance soil health and farming resilience.

Table 12.3: Natural resource management interventions

Village	Resilient practice	No. of Demo	Farmers
FST 2 (Rainfed with animal)			
Dunda	Vermicompost preparation	1	30
	Beejamrit & *Jeevamrit*	2	
Bharkot	LDPE tanks	1	40
	Vermicompost preparation	2	
Neri	Vermicompost preparation	3	15
	Beejamrit & *Jeevamrit*	2	
Anole	Vermicompost preparation	2	01
	Beejamrit & *Jeevamrit*	3	
FST 4 (Irrigated with animal)			
Neri	Vermicompost preparation	1	5
	Beejamrit & *Jeevamrit*	2	
Anole	Vermicompost preparation	1	1
	Beejamrit & *Jeevamrit*	1	

Demonstration on use of *Jeevamrit* in Strawberry

CROP PRODUCTION INTERVENTIONS:

Climate resilient technologies were demonstrated for FST 2 (Rainfed with animal) under crop production interventions by adopting contingent crops and specific varieties of Mandua and Gehun across various villages. In FST 4 (Irrigated with animal), interventions focused on improved variety of pea, okra and fruit plantations like apple, mango, and nectarine, reaching more farmers and covering similar or slightly larger areas compared to rainfed interventions. Overall, the interventions aimed to improve crop variety and productivity in both systems.

Table 12.4: Crop Production interventions

Village	Resilient practice	No. of Demo	Farmers	Area (ha)
FST 2 (Rainfed with animal)				
Dunda	Contingent crop (PU 31/40)	1	37	1.0
	VL Mandua 382	1		
	VL Gehun 3004/829	1		
Bhadkot	Contingent crop (PU 31/40)	1	30	1.0
	VL Mandua 382	1		
	VL Gehun 3004/829	1		
Neri	VL Mandua 382	1	10	1.0
	VL Gehun 3004	1		
Anole	VL Mandua 382	1	02	1.0
	VL Gehun 3004	1		
FST 4 (Irrigated wih animal)				
Dunda	Okra (V L Bhindi 2)	1	20	1.0
	Pea (Vivek M 1, Arkel, SS 10)	1		
Bhadkot	Okra (V L Bhindi 2)	1	12	1.0
	Pea (Vivek M 1, Arkel, SS 10)	1		
	Fruit plantation (Apple, Mango, Nectarine)	1		
Neri	Okra (V L Bhindi 2)	1	3	1.0
	Pea (Vivek M 1, Arkel, SS 10)	1		
	Fruit plantation (Apple, Mango, Nectarine)	1		
Anole	Okra (V L Bhindi 2)	1	2	1.0
	Pea (Vivek M 1, Arkel, SS 10)	1		
	VL Gehun 3004/ VL Gehun 892	1		

LIVESTOCK INTERVENTIONS:

In FST 2 (Rainfed with animal), practices such as providing rubber mats, liquid calcium, and hybrid Napier grass were introduced, impacting a number of farmers and covering small areas. In FST 4 (Irrigated with animal), similar interventions were made, with the participation of 2 farmers in each intervention. These efforts aimed to enhance livestock management and feed resources.

Table 12.5: Livestock interventions

Village	Resilient practice	No. of Demo	Farmers	Area (ha)
FST 2 (Rainfed with animal)				
Neri	Rubber Mats, Liquid Calcium, Conc, Feed	5	10	0.3
	Hybrid Napier	2		
Anole	Rubber Mats, Liquid Calcium	2	2	0.2
	Hybrid Napier	1		
FST 4 (Irrigated with animal)				
Neri	Rubber Mats, Liquid Calcium, Conc, Feed	4	2	0.5
	Hybrid Napier	4		
Anole	Rubber Mats, Liquid Calcium	4	2	0.2
	Hybrid Napier	4		

Plastic mulching for strawberry cultivation

BY-PRODUCTS PRODUCED:

In Rainfed with animal farming system typology (FST 2), interventions included eight demonstrations of compost preparation using tetra beds, ten demonstrations of compost from FYM using worms, and four demonstrations of *Beejamrit* & *Jeevamrit*, covering 1.5 hectares for compost from FYM and 2.0 hectares for *Beejamrit* & *Jeevamrit*, with a total of 20 farmers involved. Similar practices were adopted in FST 4. These practices aimed to enhance soil health and productivity through various composting and organic methods.

Table 12.6: By-products produced

Resilient practice	No. of Demo	Farmers	Area (ha)
FST 2 (Rainfed with animal)			
Preparation of compost using tetra beds	8	20	-
Compost from FYM using worms	10	20	1.5
Beejamrit & *Jeevamrit*	4	55	2.0
FST 4 (Irrigated with animal)			
Preparation of compost using tetra beds	5	10	-
Compost from FYM using worms	5	10	-
Beejamrit & *Jeevamrit*	2	20	-

Demonstration on vermicomposting

Demonstration on Napier grass cultivation

INSTITUTIONAL INTERVENTIONS:

SEED PRODUCTION:

Seed system for crop production used during CRTs demonstrations in 2023-24 showed great performance in the case of wheat, urd bean, okra, vegetable pea and fruit trees. Wheat was cultivated over 5 hectares involving 20 farmers, yielding 14 quintals and generating revenue of Rs. 70,000. Urd Bean (PU 31/40) was grown on 1 hectare with 10 farmers, producing 10.5 quintals, and generating revenue of Rs. 23,450. Okra (VL Bhindi 2) covers 1 hectare with 20 farmers, producing 85 quintals, and generating revenue of Rs. 60,000. Vegetable peas (Arkel/ Vivek Matar 13) were cultivated on 0.5 hectares with 25 farmers, resulting in 80 quintals and revenue of Rs. 1,82,000 (Table 12.7). Fruit Trees (Strawberry Runners, Mango, Nectarine, Lemon) cover 0.70 hectares involving 8 farmers, with estimated revenue of around 8 lakhs through the sale of strawberry runners to the State Horticulture Department.

Table 12.7: Institutional interventions (Seed bank)

Seed system	Seed (q/ha)	Farmers	Area (ha)	Amount mobilised (Rs.)
Wheat	14.0	20	5.0	70000
Urd Bean	10.5	10	1.0	23450
Okra	85.0	20	1.0	60000
Vegetable Pea	80.0	25	0.5	182000
Fruit Trees	-	8	0.7	800000

FODDER BANK:

A total of 2,000 tonnes of Napier grass fodder was produced, benefiting 25 farmers across 2 hectares of land. Additionally, an amount of Rs. 51,500 was mobilized for this initiative.

CAPACITY BUILDING:

Most of the training programmes for capacity building were carried out for crop production, integrated nutrient management (INM), horticultural crop management and moisture conservation where both male and female farmers showed involvement. Most of these trainings received positive response from the farmers.

Table 12.8: Capacity Building Programmes (HRD) for farmers

Theme	No. of training programmes	No. of Beneficiaries		
		Male	Female	Total
INM	Training on the preparation *Jeevamrit* & its application	17	8	25
	Training on the preparation of vermicompost through vermi bed	16	10	26
	Integrated nutrient management in *Rabi* season crops and fruit crops	19	10	29
	Minimizing fertilizer dependency through compost & biofertilizer for climate resilience agriculture	22	-	22
Horticulture	Protective nursery raising and scientific cultivation of *Rabi* season crops	10	8	18
Moisture Conservation	Importance of moisture conservation & management of LDPE tank for rainwater harvesting at KVK	21	50	71
Crop Production	Training on oyster mushroom cultivation	08	14	22
	Seedling distribution of farmers of the adopted village under NICRA	16	9	25
	FLD - *Rabi* season (2023-24) under NICRA project	15	5	20
Others	Exposure visit of RAWE trainees to adopted NICRA village & field day on millets	36	22	58

OTHER EXTENSION ACTIVITIES:

The extension activities involved exposure visits, *Parthenium* eradication, Krishi Chapel Charkha, Mission LiFE and VBSY campaign in adopted villages, where both male and female farmers participated.

Table 12.9: Other extension activities

Name of program	Details of Activity	Participants
Exposure visit	Exposure visit of B.Sc Agriculture students to NICRA village	46
Parthenium eradication	RAWE trainees eradicated *Parthenium* in adopted villages	50
Krishi Chapel Charkha (by DD Kisan)	Covered ongoing activities by KVK in adopted villages	50
LiFE (Mission Lifestyle for the environment)Tree Plantation Drive	Distribution of planting materials and seed kits	47
VBSY campaign in the adopted village	Awareness regarding soil health and the importance of soil testing and natural farming	39

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

Climate resilient technologies such as resource management, poly house establishment, mushroom cultivation and high-yielding varieties were demonstrated in different NICRA villages with support from NABARD and the State Agriculture/Horticulture Departments for upscaling of the NICRA programme.

EXTREME WEATHER EVENTS:

During 2023-24, one dry spell was experienced in these villages from 25th July 2023 to 12th August 2023, which caused low germination, less water availability during a critical growth period and low yield of crops.

Table 12.10: Summary of scaling of technologies

Village	Technology scaling up/out	No. of farmers	Convergence with the programme
Village 1 (Dunda)	Resource management technologies	25	State Horticulture Department
	Poly house establishment	03	NABARD
	Mushroom cultivation	05	NABARD
	High yielding varieties	20	State Agriculture Department
Village 2 (Bhadkot)	Resource management technologies	25	State Horticulture Department
	Poly house establishment	02	NABARD
	Mushroom cultivation	12	NABARD
	High yielding varieties	40	State Agriculture Department
Village 3 (Neri)	Resource management technologies	05	State Horticulture Department
	Poly house establishment	02	NABARD
	Mushroom cultivation	05	NABARD
	High yielding varieties	20	State Agriculture Department

SIGNIFICANT ACHIEVEMENTS:

The influence of technology demonstrations on farmers in NICRA villages was evident from the adoption of integrated farming systems by farmers, the successful implementation of vermicompost production, and the multiplication and sale of high-value crops like strawberries. These efforts have led to improved resource management and generated significant income through sales to government programs.

Table 12.11: Significant achievements

Description	Impact
Demonstration on IFS (Integrating Gantry, Cattle, Poultry, Dockery, Fisheries' and Rabbits along with main crops)	2 farmers from NICRA villages adopted IFS in their fields
Vermicompost Trainings	Farmer from village Neri supplying vermin compost to 3-gram panchayats
Mulching in Strawberry	A farmer from village Bharkote provided seedlings for Rs. 8 lakh to state departments after multiplication

Poultry demonstration unit

CROP INTERVENTIONS:

Vivek Sabji Matar 13: This is an early cultivar of green peas (matar), chosen for its quick growth and high yield. It covers an area of 1 hectare with a productivity rate of 8.8 tonnes of pods per hectare. The cost of cultivation is Rs. 57,100, and the gross returns are Rs. 2,21,100, indicating high profitability due to its early market arrival.

VL Bhindi 2: This variety of okra (bhindi) is resistant to the Yellow Vein Mosaic Virus (YMV), a common disease affecting okra crops. With a productivity of 90 quintals per hectare over 1 hectare, it offers strong gross returns with a gross profit of Rs. 3,15,070 and a cultivation cost of Rs. 67,700, making it a profitable and resilient option for farmers.

Rai (Hathikan): Known for its high productivity in green leaves, this variety covers 0.2 hectares with a yield of 8.4 quintals per hectare. The cost of cultivation is Rs. 26,300, while the gross returns are Rs. 59,300, reflecting moderate profitability, mainly due to the green leaves being a valued product for local consumption.

French Beans (Moraleda): This variety extends the harvest window, providing farmers with the flexibility to harvest over a longer period, which stabilizes market prices. With an impressive productivity of 120 quintals of green beans per hectare over 0.2 hectares, the high cost of cultivation (Rs. 1,39,400) is justified by the substantial gross returns of Rs. 3,40,800.

VL Gehun 3004/829: Two varieties of wheat (gehun) are demonstrated here: VL G 3004, which is ideal for late sowing under irrigated conditions, and VL G 829, a multicut variety. Covering 2 hectares with a productivity of 26.5 quintals per hectare, the cost of cultivation is Rs. 22,600, while the gross returns are Rs. 58,400 (Table 12.12 a). These varieties offer flexibility in planting schedules, especially under challenging climatic conditions.

Table 12.12 a: Detailed information on Crop interventions

Crop/ perennials	Technology demonstrated	Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
Vegetables	Vivek Sabji Matar 13	Early cultivar	01	88 (pods)	57100	221100
	VL Bhindi 2	YMV resistant	1	90	67700	315070
	Rai (Hathikan)	High productivity green leaves	0.2	8.4	26300	59300
	French Beans (Moraleda)	Extended harvest window	0.2	120 (green beans)	139400	340800
Cereals	VL Gehun 3004/829	VL G 3004- Late sown under irrigated condition. VL G 829- Multicut	2.0	26.5	22600	58400
Millets	VL Mandua 382	White seeded		22.4	21220	81340
Specificity of technology	High yielding, stress tolerating and with large window period for harvest					
Farmers' perception	Acceptability is good					

VL Mandua 382: This is a white-seeded variety of finger millet (mandua) known for its high-yielding capacity. With a productivity rate of 22.4 quintals per hectare and a low cultivation cost of Rs. 21,220, farmers achieve a gross return of Rs. 81,340. This makes it a reliable and profitable choice, particularly for areas where millets are a staple food source.

LIVESTOCK INTERVENTIONS:

Village Dunda: NICRA farmers in Dunda benefit from the Napier root slips and fodder bank, producing 12,700 litres of milk from cows and 16,720 litres from buffaloes. Their gross returns reach Rs. 14,74,000, significantly higher than Non-NICRA farmers, who produce only 6,362 litres of cow milk and 8,360 litres of buffalo milk with gross returns of Rs. 4,18,000. The use of advanced technologies, particularly in fodder management, accounts for this disparity.

Village Bharkote: NICRA farmers in Bharkote, using a combination of wheat straw, concentrate feed, and liquid calcium, achieve 12,315 litres of cow milk and 14,320 litres of buffalo milk, with gross returns of Rs. 14,36,000. Non-NICRA farmers, relying on traditional fodder blocks, produce 6,120 litres of cow milk and 7,145 litres of buffalo milk, with gross returns of Rs. 3,67,200 (Table 12.12 b). The gap in milk production and returns highlights the effectiveness of NICRA technologies in improving cattle productivity.

Village Neri: In Neeri, NICRA farmers produce 6,380 litres of cow milk and 6,412 litres of buffalo milk, generating gross returns of Rs. 7,04,100. Non-NICRA farmers, on the other hand, produce only 2,855 litres of cow milk and 3,357 litres of buffalo milk, with returns of Rs. 1,71,300. The introduction of concentrate feed and other supplements significantly boosts NICRA farmers' productivity compared to their Non-NICRA counterparts.

Village Anole: NICRA farmers in Anole produce 3,550 litres of cow milk and 5,245 litres of buffalo milk, generating gross returns of Rs. 5,01,500. Non-NICRA farmers, with traditional fodder practices, produce only 1,980 litres of cow milk and 2,425 litres of buffalo milk, with gross returns of Rs. 1,18,800. The use of modern technologies, such as rubber mats and liquid calcium, explains the difference in productivity and gross returns between the two groups.

Diagnostic visit

Table 12.12 b: Detailed information on Livestock interventions

Animals	Technology demonstrated	Production (l/year)	Selling price (Rs./l)	Gross returns (Rs./animal)	By-products quantity
NICRA					
Cow & Buffalo (Dunda)	Napier rootslips fodder bank	Cow:12700 Buffalo:16720	Cow: 60 Buffalo: 50	1474000	FYM
Cow & Buffalo (Bharkote)	Wheat straw concentrate feed CO-3/NB 12 Liquid calcium rubber mats	Cow:12315 Buffalo:14320		1436000	FYM
Cow & Buffalo (Neri)		Cow:6380 Buffalo:6412		704100	FYM
Cow & Buffalo (Anole)		Cow: 3550 Buffalo:5245		501500	FYM
Total		**77642**		**4115600**	
Non- NICRA					
Cow & Buffalo (Dunda)	Personal fodder blocks Green-grass from local forest	Cow: 6362 Buffalo: 8360	Cow: 60 Buffalo: 50	381720 418000	FYM
Cow & Buffalo (Bharkote)		Cow: 6120 Buffalo:7145		367200 357250	FYM
Cow & Buffalo (Neri)		Cow: 2855 Buffalo: 3357		171300 167850	FYM
Cow & Buffalo (Anole)		Cow: 1980 Buffalo: 2425		118800 121250	FYM
Total		**38604**		**2103370**	
Specificity of technology	**1. Wheat straw**: Provides bulk and fibre, aiding in digestion and rumen function. It's a cost-effective roughage, though low in nutrients **2. Concentrate feed:** High in energy, protein, and essential nutrients, concentrate feed boosts milk production and overall cattle health, complementing roughage in a balanced dairy cattle diet **3. Napier grass (Perennial):** High-yielding and nutrient-rich, Napier grass is an excellent forage for dairy cattle, and provides essential nutrients year-round due to its perennial growth **4. Liquid calcium:** Essential for bone health and milk production, liquid calcium supplements help prevent milk fever and other calcium deficiency-related issues in dairy cattle **5. Rubber mats:** Enhance comfort and reduce injuries in dairy cattle by providing a soft, non-slip surface, improving welfare and potentially increasing milk yield					
Farmers' perception	Farmers appreciate wheat straw for its affordability and digestive benefits, concentrate feed for boosting milk yield and vitality, and Napier grass for its reliable, year-round nutrition. Liquid calcium is valued for preventing deficiencies, while rubber mats enhance cattle comfort and welfare				

Leh

13

Leh is the largest district in the Union Territory of Ladakh, located in the northern part of India. It is known for its breathtaking landscapes, high mountain ranges, and unique culture. Leh is situated at high altitudes, with the maximum terrain above 3,000 meters. Leh has a cold desert climate with long, cold winters from late November to early March, with minimum temperatures below freezing for most of the winter. Average annual rainfall is only 35 mm (1.37 inches). The region faces challenges related to its geographical isolation, harsh climate, and limited agricultural activities due to the extreme conditions.

Agriculture in Leh, Ladakh, faces significant challenges due to its high-altitude desert environment and extreme climatic conditions. Despite these challenges, agriculture is an essential part of the local economy, and the people of Leh have developed unique agricultural practices adapted to the harsh terrain. Arable land in Leh is limited, and the growing season is short, primarily during the summer months. The availability of irrigation is also a challenge due to the arid climate. Traditional crops include barley, wheat, peas, and vegetables suited to the harsh climate. Barley is a staple crop in Leh due to its suitability for high-altitude conditions. Buckwheat is also commonly grown. Alongside crop cultivation, livestock farming is an integral part of agriculture in Leh. Yaks, dzos, sheep, and goats are reared for milk, meat, and wool. Animal dung is used for fuel and organic fertilizer.

NICRA VILLAGE:

Chuchot Shamma village of this district was selected for the Technology Demonstration Component of NICRA in 2021 (December). A cultivated area of 196 ha is under this village without any rainfed and flood-prone area.

Table 13.1: Rainfall (mm) distribution

Rainfall 2023-24												
Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	-	-	-	-	-	-	-	-	-	-	-	2.0
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	0.5	-	-	-	-	-	-	-	0.3	-	-	-
5	0.1	-	-	-	-	-	-	-	-	-	-	-
6	-	-	0.2	-	-	-	-	-	-	-	-	-
7	-	1.5	-	-	-	-	-	-	-	-	-	-
8	-	19.0	-	-	-	-	-	-	-	1.0	-	-
9	-	14.0	-	-	-	-	-	-	-	1.0	-	-
10	-	2.5	-	-	-	-	-	-	-	-	-	-

Rainfall 2023-24												
Date	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
11	1.0	-	-	-	-	-	-	-	-	1.0	-	-
12	-	-	-	-	-	-	-	-	-	5.0		2.0
13	-	-	-	-	-	1.1	-	-	-	-	-	4.0
14	-	-	-	-	-	-	-	-	-	-	-	2.0
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-
19	-	2.5	-	-	-	-	-	-	0.2	-	-	-
20	-	2.0	-	-	-	-	-	-	0.2	-	-	-
21	-	7.0	-	-	-	-	-	-	-	-	-	-
22	-	3.5	-	-	-	-	-	-	-	-	-	-
23	-	3.0	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-
27	1.0	-	-	-	-	-	-	-	-	-	-	-
28	-	3.6	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	2.0	-
31	-	-	-	-	-	-	-	-	-	-	-	-

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of these villages are FST 3 (Irrigated without animal) and FST 4 (Irrigated with animal). The maximum number of farmers in these villages opted for a farming system-FST 4. Farmers of this selected NICRA village always depend on animal husbandry and agriculture. As many as 34 farmers were involved in the demonstrations under FST 4; however, only six adopted FST 3.

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Climate resilient technologies were effectively showcased within FST 4 (Irrigated with animal), focusing on natural resource management technologies like vermicomposting, natural farming and mulching (Table 13.2), with 40 farmers participating in each demonstration.

Protected cultivation of vegetables

Table 13.2: NRM interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Vermicompost	3	40	1.00
Natural Farming	3	40	2.00
Mulching	2	40	0.04

CROP PRODUCTION INTERVENTIONS:

The demonstrations had a significant impact, resulting in the adoption of various technologies by a considerable number of farmers. Active farmer participation was observed in demonstrations focusing on quality seeds of vegetables, apple saplings, vermicompost, peas and power tiller. Numerous farmers embraced these technologies to improve income and achieve greater yield profitability. The dissemination of these technologies was facilitated through demonstrations and training sessions, contributing to widespread adoption among the farming community.

Table 13.3: Crop Production interventions

Resilient practice	No. of Demo	Farmers covered	Area covered (ha)
Quality seeds of vegetables	2	40	2.10
Apple sapling	1	4	0.20
Vermicompost	4	40	0.50
Pea	1	40	0.35
Power tiller	1	40	-

LIVESTOCK INTERVENTIONS:

Climate resilient technologies were demonstrated for FST 4 (Irrigated with animal) under livestock management by adopting feed and fodder, alfalfa poultry model, and mineral mixture, which proved beneficial for selected NICRA farmers.

Table 13.4: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of animals
Feed and fodder	1	34	65
Alfalfa Poultry model	2	25	200
Mineral mixtures	2	34	98

FST 3 (Irrigated without animal):

Quality vegetable seeds and Vermicompost: Farmer 1 adopted quality vegetable seeds and vermicompost to enhance both productivity and sustainability. The use of quality vegetable seeds boosts crop yields, as these high-yielding and disease-resistant varieties require less seed per hectare, resulting in significant input savings of up to 520 grams of seed (Rs. 10,400 saved in the NICRA system). Alongside this, vermicompost is used as an organic fertilizer, improving soil fertility and structure. Together, these technologies lead to higher productivity and reduced input costs, significantly increasing profitability and promoting environmental sustainability.

Improved wheat cultivation practices and Natural farming: Farmer 2 used improved wheat cultivation practices and adopted natural farming practices to optimize resource use and reduce dependency on external inputs. The improved wheat variety requires fewer seeds and less pesticide, saving 130 kg of seed (Rs. 5,850 saved in the NICRA system). These technologies not only reduce input costs but also improve soil health and sustainability, making the farming system more resilient and cost-efficient in both NICRA and Non-NICRA system.

Mulching and Vermicompost: Farmer 3 implemented mulching and vermicompost to enhance soil health. The use of vermicompost provides a natural alternative to chemical fertilizers, making it a highly efficient technique for improving crop performance. Additionally, vermicompost improves soil fertility, enhances microbial activity, and increases the soil's capacity to retain moisture, leading to healthier plants and better yield.

Table 13.5 a: Impact in FST 3

Village Chuchot	Technology adopted/ demonstrated		Area (ha)	Irrigated without animal			
				NICRA farmers		Non-NICRA farmers	
				Yield (q/ha)	Net return (Rs./ha)	Yield (q/ha)	Net return (Rs./ha)
Famer 1	Crop based	Quality vegetable seeds	0.025	300	91250	200	558000
	NRM based	Vermicompost					
Farmer 2	Crop based	Improved Wheat cultivation practices	0.080	20	90000	12	5400
	NRM based	Natural farming					
Famer 3	Crop based	Mulching	0.001	380	972500	200	558000
	NRM based	Vermicompost					

Table 13.5 b: Input saving due to technologies

Village Chuchot	Technology adopted/ demonstrated	Irrigated without animal				
		Input	NICRA farmers		Non-NICRA farmers	
			Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Farmer 1	Quality vegetable seeds	Seed rate	520 g	10400	720 g	14400
Farmer 2	Improved Wheat cultivation practices	Seed rate, Pesticides	130 kg	5850	250 kg	11250

FST 4 (Irrigated with animal):

Quality vegetable seeds, vermicompost and feed and fodder: The adoption of quality vegetable seeds by Farmer 1 led to a significant increase in productivity, with NICRA farmers achieving 300 q/ha compared to 200 q/ha by Non-NICRA farmers. This resulted in higher net returns of Rs. 9,12,500/ha compared to Rs. 5,58,000/ha. In livestock, NICRA interventions improved milk production to 1020 litres per cow, yielding Rs. 26,925/cow compared to 750 litres and Rs. 2,870/cow for Non-NICRA farmers (Table 13.6 a). Input-saving technologies such as using quality seeds reduced the seed rate by 520 g, saving Rs. 10,400. Improved fodder practices halved daily fodder use to 3 kg, cutting costs by Rs. 60/day.

Improved wheat cultivation practices, natural farming and alfalfa poultry model: Farmer 2 adopted improved wheat cultivation practices, increasing productivity to 20 q/ha with NICRA farmers versus 12 q/ha for Non-NICRA farmers. Net returns were Rs. 90,000/ha compared to Rs. 54,000/ha. Additionally, NICRA's alfalfa poultry model enhanced egg production, reaching 250 eggs/year per bird (Rs. 2459/bird) versus 180 eggs/year (Rs. 1587/bird) for Non-NICRA farmers. Input savings included a reduced seed rate and pesticide use, saving 130 kg of seeds and Rs. 5,850.

Mulching, vermicompost and mineral mixture: The use of mulching for Farmer 3 boosted crop productivity to 380 q/ha with NICRA interventions, compared to 200 q/ha for Non-NICRA farmers, yielding higher net returns of Rs. 972,500/ha versus Rs. 5,58,000/ha. Mineral mixture supplementation increased milk production to 1,030 litres/cow.

Table 13.6 a: Impact in FST 4

Village Chuchot	Technology adopted/ demonstrated		Irrigated with animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield	Net return (Rs.)	Area (ha)	Yield	Net return (Rs.)
Famer 1	Crop based	Quality vegetable seeds	0.025	300 q/ha	912500/ ha	0.025	200 q/ha	558000/ha
	NRM based	Vermicompost						
	Animal-based	Feed and Fodder	4 cows	1020 l/cow	26925/ cow	4 cows	750 l/cow	2870/cow
Farmer 2	Crop based	Improved Wheat cultivation practices	0.08	20 q/ha	90000/ ha	0.08	12 q/ha	54000/ ha
	NRM based	Natural farming						
	Animal-based	Alfalfa poultry model	125 birds	250 eggs /year/bird	2459/ bird	125 birds	180 eggs/ year/ bird	1587/ bird
Farmer 3	Crop based	Mulching	0.001	380 q/ha	972500/ ha	0.001	200 q/ha	55800/ ha
	NRM based	Vermicompost						
	Animal-based	Mineral mixture	3 cows	1030 l/cow	-	3 cows	750 l/cow	2870/ cow

Table 13.6 b: Input saving due to technologies

Village Chuchot	Crop/ Perennials	Technology adopted/ demonstrated	Irrigated with animal				
			Input	NICRA farmers		Non-NICRA farmers	
				Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Famer 1	Crop based	Quality vegetable seeds	Seed rate (g)	520	10400	720	14400
	Animal-based	Feed	Fodder (kg)	3	60/day	6	120/day
Farmer 2	Crop based	Improved Wheat variety	Seed rate, Pesticides (kg)	130	5850	250	11250

Climate resilient technologies were demonstrated for FST 4 (Irrigated with animal) under livestock management by adopting feed, alfalfa poultry and alfalfa and mineral mixture, which proved beneficial for selected NICRA farmers as it increased their gross returns.

For cows, two types of feeding technologies are adopted: one with feed and the other with alfalfa + mineral mixture. In both cases, each cow produces around 1,020 litres of milk per year, with a selling price of Rs. 50 per litre, yielding Rs. 51,000 in gross returns per cow. Additionally, both cows produce 5 kg of manure per day, which is sold for Rs. 3 per kg, generating an additional Rs. 26,925 per cow (Table 13.7). For poultry, alfalfa poultry feed is used, resulting in 250 eggs per bird annually, with a selling price of Rs. 10 per egg (gross returns of Rs. 2,500 per bird). These technologies improve both milk and egg production, while also generating additional income from by-products like manure.

By-products like wheat straw and manure are monetized and recycled for additional benefits. Wheat straw is produced at 105 quintals per hectare and used as fodder, generating Rs. 31,500 per hectare at Rs. 300 per quintal. Manure yields 18.25 quintals per hectare and with a selling price of Rs. 3 per kg, it generates Rs. 5,475 per cattle.

Demonstration on Power operated Hand Rotavator

Table 13.7: Impact in FST 4 (Irrigated with animal)

Animal	No.	Technology	Production/ year	Selling price (Rs.)	Gross returns (Rs./animal)	By-products quantity	Unit price (Rs.)	Net Returns (Rs.)
Cow	4	Feed	1020 l/cow	50/l	51000	5 kg/day	3/kg	26925/ cow
Poultry	50	Alfafa poultry	250 eggs/bird	10/egg	2500	100 g/day	4/kg	2459/ bird
Cow	4	Alfalfa+ Mineral mixture	1010 l/cow	50/l	50500	5 kg/day	3/kg	-

Table 13.8: By-products produced and recycled

By product produced	Quantity	Selling price (Rs.)	Recycling of by-products	Amount mobilised (Rs.)
Wheat straw	105 q/ha	300/q	Fodder	31500
Manure	1825 kg	3/kg	-	5475

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

The CHC plays a pivotal role in ensuring that these farmers can commence their farming activities on schedule, without the financial burden of purchasing costly machinery. The CHC model involves the active collaboration of farmers, entrepreneurs, and societies, all working together to enhance agricultural productivity and improve the livelihoods of rural communities.

In Leh district, the performance of the CHC was assessed during 2023-24, revealing active farmer participation in the utilization of Power Tiller highlighting the machine's potential and its impact on farmers. A Power Tiller worth Rs. 6,000 was mobilized, benefiting 10 farmers, and covering 0.7 hectares of agricultural land for soil preparation or related activities.

CAPACITY BUILDING:

The capacity-building programs in 2023-24 had the same number of beneficiaries in vocational training (food processing and value addition), organic and natural farming, and hygienic milk production in which women actively participated (Table 13.9).

Vocational Training on food processing and value addition

Table 13.9: Capacity Building Programmes (HRD)

Theme	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Food processing and value addition	1	-	10	10
Organic and Natural Farming	1	-	10	10
Hygenic milk production	1	-	10	10

OTHER EXTENSION ACTIVITIES:

The extension activities conducted over time revealed that the highest numbers of beneficiaries were reported in demonstration of protected nursery raising, followed by climate change effect on agriculture. Awareness programs on climatic resilient agriculture and rainwater harvest, value addition of local agricultural produce to enhance farmers' income, health benefit of dandelions, alfalfa poultry model, and the role of honey bees in agriculture also had a significant number of participants (Table 13.10).

Table 13.10: Other extension activities

Name of program	Participants
Awareness of climatic resilient agriculture and rainwater harvest	34
Value addition of local agricultural produce to enhance farmers' income	27
Effect of climate change on agriculture	40
Health benefits of dandelions	15
Alfalfa Poultry model	15
Role of honey bees in agriculture	15
Demonstration of protected nursery raising	46

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

Demonstration of Climate Resilient Technologies (CRTs) on grafted apple saplings, with active participation from 4 farmers converged with the Integrated Horticulture Development Mission, with an approximate mobilization of Rs. 8,100, highlights program convergence to support horticultural advancements.

EXTREME WEATHER EVENTS:

In the period of June 2023, the NICRA village within Leh district encountered extreme weather events, which had a profound impact on the crops cultivated in these areas. Frost during June 2023 resulted in stand loss, bolting issues in crops and a reduction in yield by 20%.

AGRO ADVISORIES ISSUED:

From June to January, a total of 8 advisories were issued each month, during this period. These advisories likely provided farmers with important agricultural guidance, such as crop management, weather updates, pest control measures, and best practices for cultivation, aligned with seasonal changes and farming needs throughout the year.

SIGNIFICANT ACHIEVEMENTS:

The influence of technology demonstrations on farmers in NICRA villages was evident, with a notable impact observed (Table 13.11). A number of farmers adopted the improved wheat variety seeds, poultry birds, and power tillers.

Table 13.11: Significant achievements

Description	No. of farmers	Impact
Improved Wheat variety seeds	4	Additional income
Poultry birds	10	Additional income
Power tiller	-	Economic empowerment of the NICRA farmers

NRM INTERVENTIONS:

Climate resilient technologies were demonstrated under natural resource management by adopting mulching and vermicomposting technology which proved beneficial for selected NICRA farmers as compared to Non-NICRA farmers. It significantly improved productivity to 380 q/ha, with a gross return of Rs. 15,20,000 per hectare, despite a high cultivation cost of Rs. 5,47,500 (Table 13.12 a). In contrast, Non-NICRA farmers, who did not adopt this technology, had a lower productivity of 200 q/ha and gross returns of Rs. 8,00,000 per hectare, with a cultivation cost of Rs. 2,42,000.

Table 13.12 a: Detailed information on NRM interventions

Crop/ perennials	Technology demonstrated	Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers	Mulching and vermicompost in vegetable	Early harvesting	0.01	380	547500	1520000
Non-NICRA Farmers	Conventional	Yield	0.01	200	242000	800000
Specificity of technology	It improves soil temperature, soil health and drudgery reduction, and conserves soil moisture					
Farmers' perception	Saves a lot of time and energy, reduces irrigation frequency, and gives early and better yield					

NICRA farmers achieved a productivity of 20 q/ha, significantly higher than the 12 q/ha recorded by Non-NICRA farmers. This increased yield led to gross returns of Rs. 90,000/ha for NICRA farmers, compared to Rs. 32,000/ha for their counterparts. Additionally, the cost of cultivation for NICRA farmers was slightly lower at Rs. 33,250/ha (Table 13.12 b), showcasing both economic efficiency and better yield outcomes due to the improved technology and sustainable practices.

LIVESTOCK INTERVENTIONS:

Climate resilient technologies were demonstrated for FST 4 (Irrigated with animal) under livestock management by adopting feed, which proved beneficial for selected NICRA farmers. For NICRA farmers,

cows fed with the feed produced 1020 litres of milk per cow annually, resulting in gross returns of Rs. 51,000. In contrast, Non-NICRA farmers employ different practices. Cows are managed with dry fodder alone, producing 750 litres of milk annually and resulting in gross returns of Rs. 37500.

Table 13.12 b: Detailed information on Crop interventions

Crop/ perennials	Technology demonstrated	Crop stage affected	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers	Quality wheat seed and natural farming	Yield	0.08	20	32000	90000
Non-NICRA Farmers	Locally available seeds	Yield	0.08	12	33250	54000
Specificity of technology	Quality seeds ensure quality produce and better yield ultimately ensuring food security and a healthy environment					
Farmers' perception	Good yield and quality produce					

Table 13.12 c: Detailed information on Livestock interventions

Animals	Technology demonstrated	Production /year	Selling price (Rs./l)	Cost of production (Rs./ animal)	Gross returns (Rs./animal)	By-products quantity	Unit price (Rs.)	Gross returns (Rs./animal)
NICRA Farmers	Feed	1020 l/cow	50	29550	51000	5kg/ day	3/kg	5475
Non-NICRA Farmers	Fodder	750 l/cow	50	41200	37500	6 kg/day	3/kg	6570
Specificity of technology	Increase in milk production							
Farmers' perception	Good health and good income							

SUCCESSFUL INTERVENTIONS IN NICRA VILLAGE:

In 2023-24, various successful interventions were carried out on natural resource management (NRM), crop varieties, and livestock in NICRA village for low tunnel technology, vermicompost, Natural Farming, quality seeds of vegetables, silage and mineral mixture has been adopted in the village.

Table 13.13: Adoption of successful interventions in the NICRA village & the adjoining villages

Successful interventions	Technology adopted	Adoption in ha (2023)
NRM	Low tunnel technology in improved vegetable varieties	0.5
	Vermicomposting	2.0
	Natural Farming	2.0
Crop	Quality seeds of vegetables- Red Coral, Liberty, Early White Viena, Khanyari, Shewta, Lucky, Fantasy, Arka Samrat etc.	2.0
Livestock	Silage	-
	Mineral mixture	-

TOO
YUMM!

Kathua

14

Kathua is one of the districts in the Jammu region of Jammu and Kashmir. It is situated in the southern part of the union territory and shares borders with Punjab and Himachal Pradesh. The district is known for its diverse cultural heritage, historical significance, and picturesque landscapes. Kathua is located at 32.37°N 75.52°E. It has an average elevation of 393 metres (1,289 ft). The city is surrounded by three rivers. According to 2011 census, total population of the district is 6,16,435 with 3,26,109 males and 290,326 females.

NICRA VILLAGES:

The villages, namely Said-Sohal, Badholi, Loukhali, Kootah, Kanah, Maya, and Parngoli became involved in TDC in the years 2011, 2017, 2018, 2018, 2020, 2022, and 2023 respectively. All of the villages are rainfed.

Table 14.1: Information about the NICRA villages

Details	Village 1	Village 2	Village 3	Village 4	Village 5	Village 6	Village 7
Name	Said/Sohal	Badholi	Loukhali	Kootah	Kannah	Maya	Parngoli
Year adopted	2011	2017	2018	2018	2020	2022	2023

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of these villages are Rainfed without animal (FST 1) and Rainfed with animal (FST 2). The maximum farmers of these villages adopted these farming systems as the whole area of these villages is mostly dependent on rain. Farmers of this selected NICRA village depend on animal husbandry and agriculture. A maximum number of farmers (165) from selected NICRA villages actively participated in the FST 2 (Rainfed with animal) system followed by 60 farmers participating in FST 1 (Rainfed without animal) for demonstrations of climate resilient technologies.

Table 14.2: Summary of Interventions

Villages	No. of farmers involved in demonstrations	
	FST 1 (Rainfed without animal)	FST 2 (Rainfed with animal)
Village 1 (Said/Sohal)	10	40
Village 2 (Badholi)	15	32
Village 3 (Loukhali)	10	20
Village 4 (Kootah)	8	20
Village 5 (Kannah)	6	15
Village 6 (Maya)	5	12
Village 7 (Parngoli)	6	26
Total	**60**	**165**

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Demonstrations in these villages were conducted for two farming systems i.e. Rainfed without and with animal where the focus was imposed on promoting sustainable farming: in-situ moisture conservation, water harvesting and recycling, conservation tillage, water-saving irrigation methods, and summer deep ploughing. A total of 164 demonstrations were conducted, covering 164 farmers and an area of 177.3 hectares. The practices were focused on optimizing water usage, improving soil health, and enhancing crop resilience. Among these, summer deep ploughing covered the largest area (87.5 ha), and the highest number of demonstrations (70), contributing to sustainable agricultural development.

Table 14.3: NRM interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
In-situ moisture conservation	48	48	74.0
Water harvesting and recycling for supplemental irrigation	16	16	3.8
Conservation tillage where appropriate	14	14	7.9
Water-saving irrigation methods	16	16	4.1
Summer deep ploughing	70	70	87.5
Total	**164**	**164**	**177.3**

CROP PRODUCTION INTERVENTIONS:

Climate resilient technologies were demonstrated under crop improvement by adopting drought-tolerant varieties, short-duration varieties, diversification through vegetable production for higher income, intercropping, water-saving paddy cultivation methods (direct seeding), custom hiring centres for timely planting, pests and diseases management and weeds management. A total of 435 demonstrations were conducted, covering an area of 126.3 hectares and involving 435 farmers.

Table 14.4: Crop Production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Drought tolerant varieties	277	277	59.4
Short duration varieties	52	52	21.5
Diversification through vegetable production for higher income	6	6	1.0
Intercropping	25	25	4.2
Water-saving paddy cultivation methods (Direct seeding)	23	23	18.6
Custom hiring centres for timely planting	12	12	5.4
Pest and disease management	25	25	10.1
Weed management	15	15	6.1
Total	**435**	**435**	**126.3**

LIVESTOCK AND FISHERIES INTERVENTIONS:

Climate resilient technologies were demonstrated under livestock management, in which 41 demonstrations were carried out, benefiting 41 farmers. Key practices included improved fodder storage methods which aimed at enhancing livestock feed availability. Additionally, efforts were made to promote backyard poultry and goat farming as sustainable livelihood options. Only 2 demonstrations focused on the management of fish ponds, indicating targeted support for small-scale fisheries. These interventions aimed to improve resilience, diversify income sources, and strengthen food security for farmers.

Demonstration on Wheat

Diagnostic visit to Wheat field

Table 14.5: Livestock and fisheries interventions

Resilient practice	No. of Demo	Farmers
Improved fodder storage methods	24	24
Management of fish ponds	2	2
Popularization of backyard poultry	5	5
Popularization of goat farming	10	10
Total	**41**	**41**

BY-PRODUCTS PRODUCED:

A total of 28 quintals per hectare of paddy straw is produced and sold for Rs. 700 per quintal, while for wheat straw, 30 quintals per hectare are produced and sold at Rs. 500 per quintal.

Table 14.6: By-products produced

By product produced	Quantity (q/ha)	Selling price (Rs./q)
Paddy straw	28	700
Wheat straw	30	500

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

The performance of implements used in agriculture was assessed during 2023-24 in these NICRA villages where the utilization of power sprayers particularly attracted farmers' interest. Maize sheller covering 10.0 hectares with 22 farmers, generating Rs. 1,250 and the seed cum fertilizer drill and maize planter covering 5.7 hectares and 10 hectares, generating a substantial revenue of Rs. 2,500 and Rs. 1,250 respectively (Table 14.7).

Diagnostic visit to Mustard field

Table 14.7: Institutional interventions (Custom Hiring Centre)

Implements	Amount mobilised (Rs.)	Farmers	Area (ha)
Maize planter	1250	20	10.0
Line harrow	400	16	2.0
Power tiller	380	16	4.5
Knapsack sprayer	190	13	2.0
Maize sheller	1250	22	10.0
Wheel hoe	180	16	1.7
Bund maker	200	16	2.5
Seed treatment drum	400	15	4.0
Seed fertilizer /drill	2500	20	5.7
Power sprayer	2450	33	21.0
Total	**9200**	**187**	**54.4**

SEED BANK:

The seed system for crop production used during CRT demonstrations in 2023-24 showed great performance in the case of paddy and wheat where a number of farmers were involved. Wheat variety HD 3237, involving 20 farmers, produced 5 tonnes of seed, and generated revenue of Rs. 1,17,500. Similarly, paddy variety Pusa 1509, involving 10 farmers, produced 3.1 tonnes, and generated revenue of Rs. 1,02,300.

Table 14.8: Institutional interventions (Seed bank)

Seed system	Area covered (ha)	Seed produced (tonnes)	Farmers	Amount mobilised (Rs.)
Paddy (Pusa 1509)	0.80	3.1	10	102300
Black gram (PU 31)	0.61	0.5	17	45000
Gram (HC 7)	0.37	0.3	16	16500
Wheat (HD 3237)	1.38	5.0	20	117500
Total	**3.16**	**8.9**	**63**	**281300**

FODDER BANK:

The plantation of Napier and Setaria grass on bunds produced 10 tonnes of fodder, covering 17 farmers across an area of 3.5 hectares. These grasses, grown on bunds, provide valuable fodder for livestock while maximizing the use of available land, contributing to both farm productivity and sustainable livestock management.

CAPACITY BUILDING:

Most of the training programmes for capacity building were carried out for conducted training on awareness programmes on climate resilient agriculture, rainwater harvesting, maize production technology, scientific cultivation of oilseeds under rain-fed conditions and insect pests management of *Kharif* crops, where both male and females farmers were participated. Additionally, training on agronomic practices of *Rabi* crops and Farmer-Scientist Interaction Programs were conducted, covering a diverse range of farming topics to enhance knowledge and skills in sustainable agricultural practices.

OTHER EXTENSION ACTIVITIES:

Several extension activities were taken up in NICRA villages such as exposure visits to farmers, field days, awareness programmes, and World Soil Day.

Table 14.9: Capacity Building Programmes (HRD) for farmers

Theme	No. of course	No. of beneficiaries		
		Male	Female	Total
Climate resilient agriculture	2	36	8	44
Rainwater harvesting (catch the rain)	2	52	16	68
Maize production technology	1	16	3	19
Centrally sponsored schemes in agriculture & allied sector	1	18	0	18
Scientific cultivation of oilseeds under rain-fed conditions	1	17	0	17
Insect pest management of *Kharif* crops	1	16	4	20
Agronomic practices of *Rabi* crops	1	18	4	22
Farmer's Scientist Interaction Programme	2	35	8	43

Table 14.10: Other extension activities

Theme	Name of program	Participants
Field Day	Field day on Maize	85
	Field day on Paddy	55
	Field day on Gram	34
	Field Day on Wheat	62
Exposure visits of farmers	Exposure visit to KVK Kathua	46
	Exposure visit to KVK Jammu	23
Awareness programmes	Climate change and Agro met Advisory	32
	Rainwater harvesting	68
	Organic farming	26
World Soil day	Soil Day	130

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

A huge amount was mobilized for the spread of resilient technologies in selected NICRA villages. Noteworthy interventions include the Renovation of Village Ponds, involving 40 farmers, with an amount mobilized of Rs. 20.0 lakh converged with the Department of Rural Development and MGNERGA. Additionally, the construction of water harvesting structures for water collection collaborates with the Department of Agriculture, covering 31 farmers and mobilizing approximately Rs. 12.5 lakh. In Loukhali village, 20 farmers participated in tree plantation with the Department of Forestry, mobilizing Rs. 8 lakhs.

Table 14.11: Summary of Upscaling of technologies

Village	Technology scaling up/out	No. of farmers	Convergence with the programme	Amount mobilised
Said-Sohal	Renovation of ponds	40	Department of Rural Development and MGNERGA	2000000
Sohal	Water harvesting structures	31	Department of Agriculture	1250000
Loukhali	Plantation of trees	20	Department of Forestry	800000
Maya	Pond lining of the pond	09	-	-

The introduction of short-duration varieties (Pusa 1509) benefitted 52 farmers, covering 21.5 hectares and resulting in significant yield improvements. Additionally, the adoption of drought-tolerant varieties

reached 277 farmers, leading to significantly increased income for both farmers and farm women. The implementation of mixed cropping involved 25 farmers, enhancing cropping intensity, while diversification through vegetable production provided additional income for 21 farmers and farm women. These initiatives collectively contribute to improved agricultural productivity and economic stability for the farming community.

Table 14.12: Significant achievements

Description	No. of farmers	Impact
Introduction of short-duration varieties	52	Pusa 1509 demonstrated to 52 farmers covered an area of 21.5 ha resulting in a significant yield
Introduction of drought tolerance varieties	277	Significant increase in the income of farmers/farm women
Introduction of mixed cropping	25	Cropping intensity increase
Diversification through vegetable production for higher income	21	Additional income for farmers/farm women

EXTREME WEATHER EVENTS:

A prolonged drought from December 1, 2023, to January 29, 2024, negatively affected wheat crops, causing delays in booting and anthesis stages. Additionally, water stress from January 1 to January 29, 2024, impacted citrus and mango orchards, potentially leading to significant yield losses.

Table 14.13: Extreme events observed

Nature of event	Date	Impact on crop yield
Drought stress (A long spell of drought was seen during the months of Dec and Jan	1st Dec 2023 to 29th Jan 2024	Effect on wheat crop (Delay in booting and anthesis stage)
Water stress	1- 29th Jan 2024	Effect on citrus and mango orchards and lead to significant yield losses

NRM INTERVENTIONS:

NICRA farmers implemented technologies such as in-situ moisture conservation, ploughing across slopes, water harvesting and recycling for supplemental irrigation, and deep summer ploughing, covering an area of 22 hectares in the *Rabi* and *Kharif* seasons. In contrast, Non-NICRA farmers relied on their traditional practices, managing 15 hectares. The adoption and implementation of these technologies by farmers indicate their relevance and effectiveness.

Table 14.14 a: Detailed information on NRM interventions

Crop/ perennials	Technology demonstrated	Season	Area (ha)
NICRA Farmers	In-situ moisture conservation, ploughing across slopes, water harvesting and recycling for supplemental irrigation, deep summer ploughing	*Rabi* & *Kharif*	22
Non-NICRA Farmers	Farmer's practices	*Rabi* & *Kharif*	15
Specificity of technology	Technologies were adopted and implemented by the farmers		
Farmers' perception	Satisfied with the performance of different interventions implemented in the NICRA cluster		

CROP INTERVENTIONS:

For paddy, NICRA farmers used Puddled Direct Seeded Rice (DSR) technology, which involves sowing seeds directly in the field without the need for transplanting. This method improved productivity to 38.5 q/ha compared to 32.5 q/ha for Non-NICRA farmers using traditional methods. As a result, NICRA farmers earned gross returns of Rs. 1,23,200/ha, significantly higher than the Rs. 81,250/ha earned by Non-NICRA farmers.

In wheat, NICRA farmers implemented Resource Conservation Technologies (RCT), which includes practices such as zero tillage and efficient water use. Despite delays in booting and anthesis, these methods helped achieve a yield of 38.0 q/ha, outperforming the 33.0 q/ha of Non-NICRA farmers. This resulted in better returns of Rs. 85,500/ha compared to Rs. 74,250/ha for those using traditional methods.

For maize, improved seed varieties were introduced to NICRA farmers, leading to a productivity of 37.0 q/ha, while Non-NICRA farmers using local varieties only achieved 31.0 q/ha. This technological intervention provided NICRA farmers with higher economic returns of Rs. 77,700/ha, compared to Rs. 62,000/ha for Non-NICRA farmers.

Table 14.14 b: Detailed information on Crop interventions

Technology demonstrated	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers				
Puddled DSR	2.0	38.5	33000	123200
RCT in Wheat	2.5	38.0	31000	85500
Improved variety of Maize	1.0	37.0	32000	77700
IPM/IDM in Gram	0.3	16.0	14500	86400
IPM/IDM n Black gram	0.5	14.5	16000	98600
Improved variety of Sesame	0.5	3.4	20000	29240
IPM/IDM in Gobhi sarson	0.2	9.5	24000	53200
IPM/IDM in Toria	0.1	7.4	24000	40700
Non-NICRA Farmers				
Traditional method in Paddy	2.0	32.5	30000	81250
Traditional method in Wheat	2.0	33.0	28000	74250
Local variety of Maize	2.5	31.0	28000	62000
Sowing of farm seed only (Gram)	0.5	7.5	12000	40500
Sowing of farm seed only (Black gram)	0.5	6.5	14000	44200
Local variety of Sesame	0.3	2.0	14000	20000
Sowing of farm seed only (Gobhi sarson)	0.1	7.1	20000	39050
Sowing of farm seed only (Toria)	0.2	5.5	20000	29700
Specificity of technology	Technologies were adopted and implemented by the NICRA farmer			
Farmers' perception	Satisfied with the performance of the different interventions implemented in the NICRA cluster			

In the case of Gram, NICRA farmers utilized Integrated Pest Management (IPM) and Integrated Disease Management (IDM) techniques to control pests and diseases without relying heavily on pesticides. This

allowed them to achieve a much higher yield of 16.0 q/ha, compared to the 7.5 q/ha yield for Non-NICRA farmers who used traditional farm-saved seeds. This intervention led to returns of Rs. 86,400/ha, more than double the Rs. 40,500/ha for Non-NICRA farmers.

Similarly, black gram also benefited from IPM/IDM interventions, with NICRA farmers achieving a yield of 14.5 q/ha compared to 6.5 q/ha for Non-NICRA farmers. This resulted in significant economic gains, with NICRA farmers earning Rs. 98,600/ha versus Rs. 44,200/ha for Non-NICRA farmers.

For sesamum, NICRA farmers adopted improved seed varieties, which resulted in a yield of 3.4 q/ha, compared to 2.0 q/ha for Non-NICRA farmers using local varieties. This improvement increased returns to Rs. 29,240/ha, compared to Rs. 20,000/ha for Non-NICRA farmers.

In **g**obhi sarson and toria, both mustard crops, NICRA farmers used IPM/IDM methods. This resulted in higher productivity for gobhi sarson (9.5 q/ha compared to 7.1 q/ha) and toria (7.4 q/ha compared to 5.5 q/ha) when compared to Non-NICRA farmers. The interventions led to increased returns of Rs. 53,200/ha and Rs. 40,700/ha for gobhi sarson and toria, respectively, compared to Rs. 39,050/ha and Rs. 29,700/ha for Non-NICRA farmers using traditional sowing methods. Overall, NICRA farmers expressed satisfaction with the technologies implemented, citing improvements in both productivity and profitability.

Table 14.14 c: Detailed information on Livestock interventions

Technology adopted/ demonstrated		Production /year	Selling price (Rs./unit)	Gross returns (Rs./animal)	By-products quantity	Unit price (Rs.)	Gross returns (Rs./ha)
NICRA Farmers							
Cow (2)	Silage, Mineral mixture	1750 l	50/ l	87500	FYM - 200 q	5 /kg	10000
Buffalo (2)		1050 l	55/ l	57750	FYM - 200 q	5 /kg	10000
Goat (7)		400 l	60/ l	28000	-	-	-
Poultry (100)		100 kg	210	21000	Eggs - 400	5/egg	2000
Non-NICRA Farmers							
Cow (2)	-	1350 l	45/ l	60750	FYM - 100 q	5/kg	5000
Buffalo (1)	-	800 l	50/ l	40000	FYM - 100 q	5/kg	5000
Goat (3)	-	250 l	60/ l	15000	-	-	-
Specificity of technology	Technologies were adopted and implemented by farmers.						
Farmers' perception	Satisfied with the performance of different interventions implemented in the NICRA cluster						

NICRA farmers utilized technologies like silage and mineral mixture, resulting in higher production outputs and gross returns. For example, NICRA cows produced 1,750 litres of milk annually, earning Rs. 87,500, while Non-NICRA cows produced 1,350 litres, earning Rs. 60,750. NICRA farmers also generated higher returns from by-products such as farmyard manure (FYM) and eggs.

Poonch

15

Poonch is a district of the Jammu division of Jammu and Kashmir. It is bounded by the Line of Control on three sides (north, west and south). Poonch district has a total area of 1,674 square kilometres. According to 2011 census, Poonch district has a population of 476,820 with a sex ratio of 893 females for every 1000 males and a literacy rate of 68.69%.

NICRA VILLAGE:

Mangnar village of this district was selected for the Technology Demonstration Component of NICRA in 2021. Most of the area of this village is totally dependent on rain depending on the various farming system typologies (FSTs).

Table 15.1: Rainfall (mm) distribution

Rainfall 2023-24												
Date	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
1	10.0	7.0	11.1	0	0	0	0	0	0	0	7.1	0
2	13.0	8.0	0	0	0	0	0	0	0	0	0	50.0
3	20.0	13.0	0	0	33.0	0	0	0	0	0	0	70.0
4	0	0	0	13.0	0	20.0	0	0	0	0	8.1	0
5	8.1	16.0	0	20.0	0	0	0	0	0	0	2.0	0
6	0	20.0	0	0	0	0	0	0	0	0	0	0
7	0	10.0	17.0	90.0	19.0	0	0	0	0	0	0	0
8	0	0	0	38.0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	20.0	30.0	0	0	0	0
10	0	0	0	0	0	0	0	25.0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	6.1	0	8.0	0	0	0	0	0	0	0	23.1
14	0	0	0	0	24.0	16.1	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	7.5	0	26.1	0	0	30.0	0	0	0	0	0
17	0	0	0	0	0	0	52.1	0	0	0	0	0
18	30.0	0	20.0	0	0	0	0	0	0	0	39.0	0
19	29.0	0	0	26.0	0	0	0	0	0	0	69.0	0
20	7.1	0	0	0	0	0	0	0	0	0	7.0	0

Rainfall 2023-24												
Date	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
21	8.1	0	0	0	0	0	0	0	0	0	0	13.0
22	0	0	0	35.0	0	0	0	0	0	0	0	0
23	0	12.1	0	20.0	0	0	0	0	0	0	0	0
24	0	28.0	20.0	35.0	0	31.0	0	0	0	0	0	0
25	0	25.0	20.0	0	0	0	0	0	0	0	0	0
26	23.1	0	27.1	4.0	0	0	0	0	0	0	0	0
27	10.0	0	0	12.0	0	0	0	0	0	0	0	0
28	20.0	0	0	0	0	0	0	0	0	0	0	0
29	0	28.0	0	0	0	0	0	0	0	0	0	0
30	0	0	12.0	0	0	0	0	35.0	0	10.0	0	49.0
31	0	30.0	0	0	0	0	0	0	0	39.0	0	0

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of this village are Rainfed with animal, Rainfed without animal, Irrigated with animal and Irrigated without animal. The farmers had opted majorly two farming systems- Rainfed with animal and Irrigated with animal. Farmers of this village always depend on animal husbandry and agriculture. Maximum farmers i.e. 471 farmers were involved in the rainfed with animal farming system typology. The rest of the area of this village lies under other farming systems.

Table 15.2: Summary of Interventions

Village	No. of farmers involved in demonstrations			
	FST 1 (Rainfed without animal)	FST 2 (Rainfed with animal)	FST 3 (Irrigated without animal)	FST 4 (Irrigated with animal)
Mangnar	24	471	16	274

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Climate resilient technologies demonstrated under natural resource management intervention focused on rainwater harvesting. Specifically, the intervention involves the construction of farm tanks lined with HDPE (High-Density Polyethylene) sheets to support vegetable production. Two demonstrations were conducted, covering 25 farmers, and a total area of 1 hectare was included in the project. This practice aims to improve water availability for farming by capturing rainwater and enhancing resilience in agricultural production, particularly for vegetable cultivation. The initiative highlights sustainable water management as a key component of farming system typologies.

CROP PRODUCTION INTERVENTIONS:

Climate resilient technologies demonstrated during the year, aimed at improving climate adaptability and farm productivity. The interventions include drought-tolerant wheat varieties, covering 78 farmers and 15 hectares, and promoting oats for fodder security with 40 farmers over 8 hectares. Millets were reintroduced into cropping systems to enhance resilience, involving 78 farmers on 2.5 hectares. A niche crop, high-value pecan nuts, was promoted for climate mitigation and additional income, covering 10 farmers and 0.5 hectares. KCl application was demonstrated to manage abiotic stress in wheat across 14 farmers and 2.2 hectares, while low-cost polyhouse sheets were used to raise vegetable nurseries, involving 13 farmers. These practices aim to mitigate climate risks and improve farm sustainability.

Demonstration of low cost polyhouse sheets for nursery raising

Table 15.3: Crop Production interventions

S.No.	Resilient practice	No. of Demo	Farmers	Area (ha)
1.	Demonstration of drought tolerant varieties in Wheat	78	78	15.0
2.	Increasing fodder security through the promotion of Oat	40	40	8.0
3.	Reintroduction of Millets in cropping system for enhancing resilience to changing climate	78	78	2.5
4.	Promotion of high value Pecan nut (Niche crop) for climate mitigation cover and additional income	10	10	0.5
5.	Application of KCl for managing abiotic stress in Wheat	14	14	2.2
6.	Demonstration of low-cost polyhouse sheets for nursery raising of vegetables	13	13	-

Impact of CRTs in FST 1 (Rainfed without animal):

For NICRA farmers, two key interventions were demonstrated: the use of drought-tolerant wheat varieties and the application of potassium chloride (KCl) to manage abiotic stress. These interventions resulted in higher wheat productivity and increased net returns. NICRA farmers achieved 24.0 q/ha of grain with the drought-tolerant variety, increasing to 28.5 q/ha of with KCl application, leading to higher net returns of Rs. 34,294 and Rs. 47,131 (Table 15.4 a), respectively. In comparison, Non-NICRA farmers, without these interventions, had lower productivity (21.5 q/ha and 22.0 q/ha) and lower net returns (Rs. 19,098 and Rs. 20,661). NICRA farmers used tractors for 6 days (costing Rs. 12,000), while Non-NICRA farmers used bullocks for 10 days (costing Rs. 20,000), resulting in higher input costs for the latter.

Demonstration on application of KCl in Wheat

Table 15.4 a: Impact of Crop production interventions in FST 1

Crop	Technology demonstrated	Rainfed without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Wheat	Drought tolerant varieties	6	24.0 (Grain) + 28.7 (Straw)	34294	24	21.5 (Grain)+ 27.0 (Straw)	19098
	KCl for managing abiotic stress	3	28.5 (Grain) + 31.7 (Straw)	47131		22.0 (Grain) + 27.3 (Straw)	20661

Table 15.4 b: Input saving in FST 1

Technology demonstrated	Rainfed without animal				
	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Drought tolerant varieties	Tractor/ Bullocks	Tractor-6 days	12000	Bullocks-10 days	20000
KCl for managing abiotic stress		Tractor-6 days	12000	Bullocks-10 days	20000

Impact of CRTs in FST 2 (Rainfed with animal):

NRM intervention involves the use of on-farm rainwater harvesting through farm tanks lined with HDPE sheets, specifically for vegetable cultivation. For NICRA farmers, this technology was applied over 1 hectare, leading to a high productivity of 460 q/ha and a net return of Rs. 5,20,000. In contrast, Non-NICRA farmers, who did not use this rainwater harvesting method, managed 215 q/ha with a significantly lower net return of Rs. 2,20,000.

Drought-tolerant wheat varieties: NICRA farmers applied this intervention over 35.4 hectares and saw a notable increase in productivity and returns compared to Non-NICRA farmers. With this technology, NICRA farmers achieved a grain yield of 24.3 q/ha and straw yield of 28.0 q/ha, resulting in a net return of Rs. 41,911 per hectare. In contrast, Non-NICRA farmers, who did not adopt this technology, produced only 21.8 q/ha of grain and 26.4 q/ha of straw, with a lower net return of Rs. 27,118 per hectare.

Application of potassium chloride (KCl): This intervention further improved the performance of NICRA farmers, who saw grain yields rise to 27 q/ha and straw yields to 31 q/ha, along with a substantial increase in net returns to Rs. 50,919 per hectare. Non-NICRA farmers, who did not apply KCl, recorded lower yields of 22.6 q/ha for grain and 26.7 q/ha for straw, with a net return of Rs. 29,217 per hectare (Table 15.5 a).

Table 15.5 a: Impact of Crop production interventions in FST 2

Crop	Technology demonstrated	Rainfed with animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Wheat	Drought tolerant varieties	35.4	24.3 (Grain)+ 28.0 (Straw)	41911	315	21.8 (Grain)+ 26.4 (Straw)	27118
	KCl for managing abiotic stress	3.6	27 (Grain)+ 31.0 (Straw	50919		22.6 (Grain)+ 26.7 (Straw)	29217

Table 15.5 b: Input saving in FST 2

Technology demonstrated	Rainfed with animal				
	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Drought tolerant varieties	Tractor/ Bullocks	Tractor-6 days	12000	Bullocks-10 days	20000
KCl for managing abiotic stress		Tractor-6 days	12000	Bullocks- 10 days	20000

NICRA farmers adopting this technology on 8 hectares achieved significantly higher productivity of 278 q/ha and net returns of Rs. 32,235 compared to Non-NICRA farmers, who cultivated oats on 47 hectares with lower productivity (203.7 q/ha) and net returns (Rs. 18,354). NICRA farmers used tractor (6 days, Rs. 12,000), while Non-NICRA farmers relied on bullocks (10 days, Rs. 20,000), indicating saving in input cost.

NICRA farmers cultivating sorghum on 8.4 hectares achieved higher productivity of 465 q/ha of green fodder and 32.3 q/ha of grain and net returns of Rs. 41,001 compared to Non-NICRA farmers who produced a lower quantity of green fodder (450 q/ha fodder) and net returns. Similarly, for Bajra, NICRA farmers experienced better outcomes with 360 q/ha of green fodder and Rs. 16,851 in net returns. In terms of input savings, both groups used the same amounts of fertilizer (1.7 q), water, and farmyard manure (150 q), but NICRA farmers saved significantly on labour (3 days at Rs. 1,800) compared to 30 days of labour for Non-NICRA farmers (Rs. 18,000). There were also cost savings in the use of weedicides, pesticides, and seeds for NICRA farmers.

Table 15.6 a: Impact of Livestock interventions in FST 2

Crop	Technology demonstrated	Rainfed with animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Oat	Increasing fodder security through the promotion of Oat	8.0	278	32235	47	203.7	18354
Sorghum		8.4	465	41001	450	32.3 (Grain) + dry Fodder	-
Bajra			360	16851			37333

Drought tolerant variety of Oat (VL-907)

Table 15.6 b: Input saving in Livestock interventions

Crop	Input	NICRA farmers		Non-NICRA farmers	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
Oat	Fertilizer (q)	1.9	2755	1.7	2189
	FYM (q)	150	10000	150	10000
	Labour	25	16000	25	16000
	Weedicide (kg)	0.4	850	0.4	850
	Seed (q)	1.0	4000	1.0	10000
	Tractor/Bullocks	Tractor- 6 days	12000	Bullocks- 10 days	20000
Sorghum	Fertilizer (q)	1.69	2189	1.69	2189
	FYM (q)	150	10000	150	10000
	Labour	3	1800	30	18000
	Weedicide (kg)	0	0	-	500
	Pesticide (kg)	0	0	-	1000
	Seed (q)	0.6	2760	0.6	4800
	Tractor/Bullocks	Tractor- 6 days	12000	Bullocks- 6 days	12000
Bajra	Fertilizer (q)	1.7	2189	1.7	2189
	FYM (q)	150	10000	150	10000
	Labour	3	1800	30	18000
	Weedicide (kg)	0	0	-	500
	Pesticide (kg)	0	0	-	1000
	Seed (q)	0.3	2520	0.6	4800
	Tractor/Bullocks	Tractor- 6 days	12000	Bullocks- 6 days	12000

BY-PRODUCTS PRODUCED AND RECYCLED:

Farmyard Manure (FYM): was produced at a quantity of 4.0 quintals per hectare, with a selling price of Rs. 1,000 per quintal. Instead of selling it, the by-product was recycled through vermicomposting, which involves converting FYM into organic fertilizer using worms. This recycling process mobilized an additional amount of Rs. 40,000, highlighting the value-added benefit of recycling agricultural by-products rather than direct sales, contributing both to income and sustainable farming practices.

FST 4 (Irrigated with animal):

Drought Tolerant Wheat Varieties: In Mangnar village, NICRA farmers cultivated 1.2 hectares, achieving total productivity of 32.4 q/ha for grain and 38.0 q/ha for straw, leading to net returns of Rs. 69,608 per hectare. In contrast, Non-NICRA farmers had lower productivity (27.7 q/ha grain and 33.5 q/ha straw) with net returns of Rs. 46,459 per hectare.

BY-PRODUCTS PRODUCED:

NICRA farmers produced 4.0 quintals of vermicompost per hectare. With a selling price of Rs. 1,000 per quintal, the total amount mobilized from the sale of vermicompost reached Rs. 40,000. This highlights the potential of vermicompost not only as an effective soil amendment for enhancing soil fertility and agricultural productivity but also as a profitable by-product for farmers, contributing to their overall income and promoting sustainable farming practices.

INSTITUTIONAL INTERVENTIONS:

CUSTOM HIRING CENTRE:

Performance of various implements used in agriculture was assessed during 2023-24 in this NICRA village where utilization of power tiller, brush cutter and chaff cutter, attracted farmers' interest. Maximum farmers (48) utilized this implement which generated Rs. 11,248 as revenue.

SEED BANK:

A total of 15.32 q of wheat seed was produced through this seed bank initiative, which effectively supported 57 farmers, enhancing seed availability for local farmers. The retained seeds are planned for use in the upcoming *Rabi* sowing season, emphasizing sustainable agricultural practices and supporting food security in the region.

FODDER BANK:

A total of 27.5 tonnes of Oat fodder was produced, benefiting 30 farmers and covering 4.7 hectares, primarily for domestic use. Additionally, 36 tonnes of Bajra were produced for 78 farmers, covering 2.8 hectares, while 46.5 tonnes of Sorghum were also produced. This initiative enhances livestock nutrition and supports local farmers by ensuring a consistent supply of fodder.

Table 15.7: Institutional interventions (Fodder bank)

Fodder systems	Fodder produced (tonnes/ha)	Farmers covered	Area covered (ha)	Amount mobilised
Oat	27.5	30	4.7	Mainly used for domestic purposes only
Bajra	36.0	78	2.8	
Sorghum	46.5			

CAPACITY BUILDING:

Most of the training programmes for capacity building were carried out to create demonstrations of NRM and crop protection, where both male and female farmers were participated. Most of these trainings received positive response from the farmers.

Table 15.8: Capacity Building Programmes (HRD) for farmers

Theme	No. of training programmes	No. of beneficiaries		
		Male	Female	Total
Crop Protection	1	17	10	27
NRM	1	9	5	14
NRM	1	7	30	37
Crop Protection	1	11	19	30
NRM	2	70	33	103
Crop Production	1	20	29	49

OTHER EXTENSION ACTIVITIES:

A number of extension activities were taken up in NICRA village such as an awareness programme on rainwater harvesting and its efficient use, climate resilient agriculture and soil health management, IPM, IDM, sensitization programme on fall armyworm, role of Natural Farming under climate resilient agriculture, etc., where male and female farmers were participated.

NICRA awareness program

Table 15.9: Other extension activities

Name of program	Participants
Creating awareness for rainwater harvesting and its efficient use	66
Awareness programme on Climate Resilient Agriculture and Soil Health Management	37
Sensitization programme on Fall Armyworm	41
Awareness programme on Climate Resilient Technologies	35
Awareness programme on *Parthenium*	40
Awareness programme on IPM and IDM in vegetables	38
Awareness programme on Rainwater Harvesting Tanks	41
Role of Natural Farming under Climate Resilient Agriculture	40

TECHNOLOGIES UPSCALED THROUGH CONVERGENCE:

A total of 200 farmers have been reached through the implementation of technologies such as line sowing, seed rate adjustments, and balanced fertilization in maize cultivation. This initiative reflects a convergence with the Agricultural Department's programs, aimed at improving productivity and sustainability in farming practices.

EXTREME WEATHER EVENTS:

The selected NICRA village experienced one dry spell for more than 60 days (31.11.2023 to 29.01.2024) during the year 2023-24, where significant effect was recorded on crops as yellowing, stunted growth, wilting and reduction in yield occurred.

AGRO ADVISORIES ISSUED:

The number of advisories issued each month, with notable peaks in July for agro-met bulletins and a consistent but lower issuance of other advisories across several months.

Table 15.10: Details about agro advisories issued

Month	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan
Number of agro-met bulletins issued	0	7	5	3	0	4	3	5
Other advisories issued	0	4	2	4	0	3	2	2

IMPACT OF CONTINGENCY MEASURES:

Interventions such as potassium chloride application for wheat during a 61-day dry spell and rainwater harvesting for vegetables, involving multiple farmers and leading to significant yield increases to 29.59% for wheat and a 113.9% increase for vegetables.

Table 15.11: Impact of contingency measures

Duration	Crop name	Crop stage affected	Intervention	Farmers	Impact on yield (q/ha)		
					Farmers' practice	Demo	Increase (%)
Dry spell from 31.11.2023 to 29.01.2024 (61 days)	Wheat	Vegetative stage	Application of KCl	13	22.0 (Grain) + 27.3 (Straw)	28.5 (Grain) + 31.7 (Straw)	29.59
	Vegetables	Vegetative as well as reproductive stage	On farm rainwater harvesting	25	215	460	113.9

SIGNIFICANT ACHIEVEMENTS:

Various initiatives, such as the demonstration of drought-tolerant wheat varieties, benefited 78 farmers by ensuring better crop returns despite drought conditions. The promotion of oats improved fodder security for 40 farmers, while the reintroduction of millets provided regular fodder availability to 78 farmers. Additionally, the application of KCl in wheat farming enhanced yield by 29.59% for 14 farmers and mitigated water stress. Other notable efforts included using low-cost polyhouse sheets for 13 farmers to raise vegetable nurseries effectively and implementing rainwater harvesting techniques, which increased vegetable yield by 136% for 25 farmers.

Table 15.12: Significant achievements

Description	Farmers	Impact
Demonstration of drought-tolerant varieties in Wheat	78	Drought-tolerant varieties ensure better crop returns without any economic loss
Increasing fodder security through the promotion of Oat	40	Higher fodder availability for livestock
Reintroduction of Millets in cropping system for enhancing resilience to changing climate	78	Regular fodder availability through M.P.CHARI
Promotion of high-value Pecan nut (Niche crop) for climate mitigation cover and additional income	10	Potential crop under changing climate
Application of KCl for managing abiotic stress in wheat	14	Application of KCl has improved yield by 29.59 % and saved the crop from water stress
Demonstration of low-cost polyhouse sheets for nursery raising of vegetables	13	Timely raising of vegetable nurseries for early crop production and better economic returns
On-farm rainwater harvesting through farm tanks lined with HDPE sheet	25	On-farm rainwater harvesting has increased the vegetable yield by 136%

NRM INTERVENTIONS:

NICRA farmers utilized rainwater harvesting through farm tanks lined with HDPE sheet technology, cultivated crops/perennials over 1 hectare and achieved productivity of 460 quintals per hectare, with a cultivation cost of Rs. 4,00,000/ha and gross returns of Rs. 9,20,000/ha. In contrast, Non-NICRA farmers, who relied solely on rainfall over 215 hectares, had a lower productivity of 310 quintals/ha with the same cultivation cost but earned only Rs. 6,20,000/ha in gross returns (Table 15.13 a). This technology enabled significant water storage, especially beneficial for vegetable cultivation and livestock drinking, particularly in areas with undulated terrain and water scarcity, where farmers typically travel 2-3 kilometres for water. Now, over 25 farmer households use the stored water for their livestock, enhancing water access and reducing travel burdens.

Table 15.13 a: Detailed information on NRM interventions

Crop/ perennials	Technology demonstrated	Season	Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers	Rainwater harvesting through farm tanks lined with HDPE sheet	*Rabi/ Kharif*	1	460	400000	920000
Non-NICRA Farmers	Rainfed		215	310	400000	620000
Specificity of technology	Water storage in rainwater harvesting tanks					
Farmers' perception	Good for vegetable cultivation and drinking of animals (Due to undulated land and hilly terrain, as well as a paucity of water, farmers must travel 2–3 kilometres for drinking water for animals. Currently, more than twenty-five farmer households now utilize the stored water for their livestock as well)					

Drought tolerant varieties in Wheat: NICRA farmers demonstrated drought-resistant wheat varieties during the 2023 *Rabi* season, specifically targeting the vegetative stage. On 2 hectares, these farmers achieved a productivity of 24.0 quintals of grain and 28.7 quintals of straw, with a cultivation cost of Rs. 54,439/ha and gross returns of Rs. 88,392/ha. In comparison, Non-NICRA farmers used household seeds on 8 hectares, yielding lower productivity (21.5 quintals of grain and 27.0 quintals of straw) despite higher cultivation costs of Rs. 61,639/ha, with gross returns of Rs. 80,730/ha. The technology, suitable for rainfed and irrigated conditions, is perceived by farmers to improve crop returns without economic loss.

Increasing fodder security through promotion of Oat: In the *Rabi* season, NICRA farmers cultivated oat on 8 hectares, yielding 278 quintals/ha of fodder, with a cost of Rs. 45,605/ha and gross returns of Rs. 77,840/ha. Meanwhile, Non-NICRA farmers grew moong wheat on 47 hectares, yielding 203.7 quintals/ha with a higher cultivation cost of Rs. 59,039/ha but slightly lower returns of Rs. 77,390/ha. Oat are recommended for high-altitude areas, providing dual-purpose (green fodder and grain), and farmers find that it ensures higher fodder availability for livestock.

Application of KCl for managing abiotic stress in Wheat: NICRA farmers applied KCl in wheat cultivation during the *Rabi* season, targeting the vegetative stage on 1 hectare. This intervention resulted in higher yields of 28.5 quintals of grain and 31.7 quintals of straw, with a cultivation cost of Rs. 52,031/ha and gross returns of Rs. 1,02,107/ha. In contrast, Non-NICRA farmers, using household seeds without any drought intervention, cultivated 9 hectares and achieved lower yields (22.0 quintals of grain and 27.3 quintals of straw), with a cultivation cost of Rs. 58,639/ha and gross returns of Rs. 82,296/ha. Farmers noted a 29.59% yield improvement from KCl, which helped the crop withstand water stress.

Reintroduction of Millets in cropping system for enhancing resilience: NICRA farmers reintroduced sorghum and bajra on 2.8 hectares during the *Kharif* season, producing 465 quintals/ha with a cultivation cost of Rs. 28,749/ha and gross returns of Rs. 69,750/ha. Non-NICRA farmers grew maize over 150 hectares, yielding 32 quintals of grain and fodder, with a higher cultivation cost of Rs. 48,489/ha and gross returns of Rs. 80,000/ha. The technology, through MP Cherri, ensures regular fodder availability, and farmers appreciate the steady fodder supply during the lean period.

Table 15.13 b: Detailed intervention on Crop production interventions

Crop/ perennials	Technology demonstrated	Area (ha)	Yield(q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA Farmers	Drought-tolerant varieties in Wheat	2	24.0 (Grain) + 28.7 (Straw)	54439	88392
Non-NICRA	-	8	21.5 (Grain) + 27.0 (Straw)	61639	80730
Specificity of technology	Varieties are recommended for rainfed and irrigated conditions.				
Farmers' perception	Drought-resistant varieties ensure better crop returns without any economic loss.				
NICRA Farmers	Fodder Oat	8	278.0	45605	77840
Non-NICRA	Moond Wheat	47	203.7	59039	77390
Specificity of technology	Recommended for high altitude areas of Jammu and suitable for dual purpose (green fodder-cum-grain)				
Farmers' perception	Higher fodder availability for livestock				
NICRA Farmers	KCl for abiotic stress in Wheat	1	28.5 (Grain) + 31.7 (Straw)	52031	102107
Non-NICRA	-	9	22.0 (Grain) + 27.3 (Straw)	58639	82296
Specificity of technology	Improve the tolerance of crop plants to various types of abiotic stresses				
Farmers' perception	Application of KCl has improved yield by 29.59 % and saved the crop from water stress.				
NICRA Farmers	Millets (Sorghum, Bajra)	2.8	465.0	28749	69750
			360.0	28509	45475
Non-NICRA	Maize	150	32.0 (Grain + Fodder)	48489	80000
Specificity of technology	Regular fodder availability through MP Cherri				
Farmers' perception	Regular fodder availability during the lean period				

SUCCESSFUL INTERVENTIONS:

Key interventions include the use of low-cost polyhouse sheets, which were adopted across 50 hectares in NICRA villages and 30 hectares in neighbouring areas. Additionally, climate-resilient fruit crops like pecan nuts were demonstrated, covering 22 hectares in NICRA villages and 200 hectares in nearby villages. Fodder crop promotion reached 500 farmers, particularly with the "Sabzaar" variety, while three farmers adopted Pakka vermicompost sheds. Moreover, five farmers embraced mechanization, utilizing power tillers and brush cutters to improve efficiency in their farming operations.

POPULARIZATION OF CLIMATE-RESILIENT VARIETIES:

During the *Kharif* 2023 season, approximately 100 hectares were allocated for cultivating resilient varieties of sorghum and bajra. For the *Rabi* 2023 season, the State Department incorporated the VL 907 variety over an estimated 40 hectares. These efforts demonstrate the department's commitment to promoted climate-resilient agriculture to enhance crop sustainability and productivity in the face of changing climate conditions.

Table 15.14: Adoption of successful interventions in NICRA & adjoining villages

Successful interventions	Extent of adoption in village in ha/farmers
Low-cost polyhouse sheets	50 (NICRA) + 30 (Adjoining Villages)
Demonstration of climate-resilient fruit crops (Pecan nut)	22 (NICRA) +200 (Adjoining Villages)
Promotion of fodder crop (Sabzaar)	500 farmers
Pakka vermicompost sheds	3 farmers
Farm mechanization (Power tillers + Brushcutter)	5 ha

Anantnag

16

Anantnag is the administrative headquarter of the Anantnag district of Jammu and Kashmir. It is located at a distance of 53 kilometres (33 miles) from the union territory's capital Srinagar. It is the third largest city in Jammu and Kashmir after Srinagar and Jammu with an urban agglomerate population of 159,838 and a municipal limit population of 109,433. Anantnag is located at 33.73°N 75.15°E at an elevation of 5,300 feet (1,600 m) above sea level.

NICRA VILLAGE:

Shangrin village of this district was selected for the Technology Demonstration Component of NICRA in the year 2022. The cultivated area (92.70 ha) is under this village without any flood-prone area.

Table 16.1: Rainfall (mm) distribution

Rainfall 2023-24												
Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	16.6	0	0	0	0	0	19.4	0	19.8	1.0	0	0
2	4.6	0	0	0	0	0	0	0	8.0	18.6	0	0
3	4.8	0	7.0	0	0	1.0	0	0	0	40.0	0	0
4	0	0	0	0	0	0	0	0	11.6	1.8	7.6	0
5	0	0	0	9.4	0	0	0	0	3.6	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	5.0	1.0	0	0	0	0	0	0	0	0	0	0
8	0	27.4	0	0	0	0	0	0	0	1.2	0	0
9	0	1.0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	16.4	21.0	0	0	0	0	0	0
11	1.2	0	0	0	0	8.0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	1.5	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	4.4	0	0	0	1.8	0	0	0	0	15.0	21.0	0
15	0	0	5.8	0	1.0	0	0	0	0	0	40.4	0
16	1.2	4.0	0	4.6	0	0	0	0	0	0	32.4	0
17	0	9.8	0	0	35.8	0	3.6	0	0	0	0	0
18	0	0	0	0	4.4	0	0	0	0	0	1.0	0
19	0	0	0	2	0	0	0	0	24.0	0	7.0	0
20	0	47.0	0	0	0	0	0	0	38.4	0	26.2	0

Rainfall 2023-24												
Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
21	0	2.2	0	0	0	0	0	0	16.0	0	4.2	0
22	0	28.0	0	0	0	0	0	0	0	9.0	0	0
23	0	7.6	0	0	0	0	0	0	0	0	3.4	0
24	0	4.0	0	0	0	0	0	0	0	0	0	0
25	2.0	14.2	0	21.4	0	0	0	0	2.4	0	5.6	0
26	35.0	0	0	0	0	0	0	0	0	0	0	0
27	2.2	3.2	0	0	0	0	0	0	3.2	0	7.0	0
28	14.0	26.0	0	0	0	0	0	0	0.8	0	31.0	0
29	1.6	31.2	0	0	0	0	0	4.0	0	26.0	57.6	0
30	0	0	0	0	0	1.5	0	1.5	0	30.8	25.6	0
31	0	0	0	0	0	0	0	2.0	0	24.2	0	0

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of this village are Rainfed with animal and Irrigated with animal. The farmers opted for only two farming systems- Rainfed with animal and Irrigated with animal. Farmers of this village always depend on animal husbandry and agriculture. Maximum farmers i.e. 197 farmers are involved in the rainfed with animal farming system typology. The rest of the 86 farmers of this village lie under irrigated with animal farming system.

TECHNOLOGY DEMONSTRATIONS:

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Climate resilient technologies were demonstrated under natural resource management by adopting the System of Rice Intensification (SRI) with improved paddy varieties, intercropping, year-round fodder production, and protected cultivation under changing climate conditions. Efforts also focus on sustainable practices like vermicomposting, mulching for moisture conservation, and using natural farming inputs like *Jeevamrit* and *Beejamrit*. Additionally, specific technologies, such as anti-hail net installation for apple orchards, were showcased. These initiatives aimed to improve farming resilience by covering a wide range of practices and engaging numerous farmers across varying land areas.

Table 16.2: NRM interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
System of rice intensification using improved varieties of Paddy	3	25	3.00
Intercropping for better returns	7	10	2.00
Year-round fodder production	4	60	12.00
Demonstration on protected cultivation of crops under changing climate conditions	10	50	0.25
Establishment & renovation of vermicompost units-a sustainable tool under changing climate	1	30	0.15
Awareness programme on Natural Farming	5	290	-
Field demonstration on *Jeevamrit* & *Beejamrit*	2	08	0.10
Mulching techniques for moisture conservation	1	20	0.15
Harnessing anti-hail net installation for resilient apple orchard management	1	1	0.25

CROP PRODUCTION INTERVENTIONS:

The demonstrations had a significant impact, resulting in the adoption of various technologies by a considerable number of farmers. Active farmer participation was observed in demonstrations focusing on crop yields, sustainability, and climate adaptation. These practices included the System of Rice Intensification (SRI) for better yield and water conservation, intercropping, and protected cultivation. Demonstrations also focused on increasing fodder production, introducing high-yielding and drought-tolerant varieties of crops like rajmash and frost-tolerant oilseeds, and utilizing disease-resistant rice varieties. Additionally, crop diversification through grafting superior genotype plants was promoted as a means to increase farmers' income and contribute to carbon sequestration. These demonstrations engaged numerous farmers across varying land areas to enhance agricultural resilience.

Table 16.3: Crop Production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
SRI Technique in Rice	3	25	3.00
Intercropping	7	10	2.00
Protected cultivation	10	50	0.25
Fodder production	4	60	12.00
High-yielding and drought-tolerant Rajmash	1	148	15.00
Frost tolerant oilseed	1	26	5.40
High yield rice varieties with disease tolerance	1	56	10.80
Crop diversification through grafted plants of superior genotype	11	11	2.00

LIVESTOCK INTERVENTIONS:

For farming system typology with animal, fodder preservation through hay & silage making, animal clinical camps, and introduction & popularization of improved chicks (Keystone birds) were conducted for the benefit of NICRA farmers as they adopted animal husbandry along with agriculture.

Table 16.4: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of animals
Fodder preservation through Hay & Silage making	2	58	134
Popularization of improved chicks (Keystone birds)	1	28	200
Animal clinical camps	1	98	402

High yielding varieties of temperate fruits

Demonstration of Shalimar Rice 4 variety in farmer's field

Animal health checkup camp

Maize (KDFM 1 variety): The maize variety KDFM 1 was introduced to tackle issues related to fodder shortages and to increase green fodder availability. This variety is known for its adaptability to rainfed conditions and climatic variability. By using this variety, NICRA farmers were able to cultivate maize across 15 hectares, yielding 462 quintals of green fodder per hectare. Not only did NICRA farmers achieve significantly higher net returns, but they also realized input savings, spending Rs. 33,520/ha on inputs such as fertilizer, seeds, water, labour, and pesticides, compared to the Rs. 35,900/ha spent by Non-NICRA farmers. These savings further contributed to improved profitability, demonstrating how the use of improved seed varieties, alongside efficient input use, can boost productivity and reduce costs even in challenging climatic conditions.

Oat (Sabzar variety): Oat is important for green fodder production, especially in rainfed systems where livestock is a key component. The Sabzar variety was selected for its better adaptability to changing climate conditions, including irregular rainfall patterns. By adopting this variety, NICRA farmers achieved 343 quintals of green fodder per hectare, benefitting Rs. 2,05,800 as compared to Non-NICRA farmers. The improved fodder productivity led to better returns for the NICRA farmers, showing how selecting climate-tolerant varieties can have significant economic benefits for farmers dependent on livestock.

Rajmash (Drought-tolerant bush type): Rajmash is a high-value crop, but it is particularly vulnerable to drought stress. The introduction of a drought-tolerant, bush-type variety of Rajmash helped NICRA farmers maintain yields even during periods of water scarcity. This variety is bred to withstand dry spells and requires less water compared to traditional varieties. NICRA farmers reported a yield of 12.8 quintals per hectare and earned higher net returns than Non-NICRA farmers, who experienced a yield drop to 8.1 quintals per hectare. Moreover, the input costs for NICRA farmers were lower at Rs. 28,546/ha compared to Rs. 32,500/ha for Non-NICRA farmers. This reduction in input costs, due to the efficient use of fertilizer, water, and labour, demonstrates how drought-tolerant varieties not only protect farmer incomes during adverse weather events but also reduce production costs.

Vermicomposting: Vermicomposting was adopted to improve soil health and enhance crop productivity. On 0.1 hectares, NICRA farmers engaged in vermicomposting, saw a production of 214 q/ha, and generated substantial returns of Rs. 1,24,700 per hectare (Table 16.5). Non-NICRA farmers, using traditional methods, produced only 120 q/ha and earned significantly lower returns. Vermicomposting not only provides a sustainable method of waste management but also enriches the soil, leading to better crop yields and reduced dependency on chemical fertilizers, which further contributes to input saving.

Popularization of improved chicks (Keystone): In FST 2, the demonstration has been also conducted on poultry birds on the popularization of improved chicks (Keystone). The birds have yet to lay eggs, but the body weight of the birds has significantly increased.

Table 16.5: Impact in FST 2 (Rainfed with animal)

Crop	Technology demonstrated	Area impacted (ha)	Rainfed with animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Maize	KDFM 1	15	3.0	462 (Green Fodder)	45000	5.0	330 (Green Fodder)	33000
Oat	Sabzar	30	18.0	343 (Green Fodder)	205800	12.0	318 (Green Fodder)	174900
Rajmash	Drought tolerant bush type	15	15.0	12.8	312000	7.0	8.05	209300
Vermicomposting		0.1	0.1	214	124700	0.1	120	76000

Table 16.6: Input saving due to technologies

Technology demonstrated	Rainfed with animal		
	Input	Cost (Rs.)	
		NICRA farmers	Non-NICRA farmers
High yielding Rajmash	Fertilizer, seed water, labour, pesticide	28546/ha	32500/ha
Fodder Maize		33520/ha	35900/ha

Rice (SR 4)- High yielding and disease resistant variety): In FST 4, SR 4 variety of rice was introduced due to its high yield potential and resistance to diseases like blast, which are common in irrigated systems. NICRA farmers cultivated 20 hectares of rice using this variety, yielding 79.8 quintals/ha and achieving net returns of Rs. 1,51,620/ha. In comparison, Non-NICRA farmers, who cultivated only 10 hectares using traditional varieties, saw significantly lower yields at 63 quintals/ha and net returns of Rs. 1,19,700/ha (Table 16.7 a). Furthermore, NICRA farmers benefitted from input savings, spending Rs. 35,246/ha on inputs like fertilizer, seed, water, labour, and pesticides, while Non-NICRA farmers spent Rs. 37,270/ha. These savings, alongside the improved productivity, demonstrate the economic advantage of adopting high-yielding, disease-resistant rice varieties (Table 16.7 b).

Oilseed (SS 2)- Frost tolerant high yielding variety: The SS 2 variety of oilseed, known for its high yield and cold tolerance, was introduced to NICRA farmers to improve resilience under varying climatic conditions, particularly cold stress. NICRA farmers cultivated 20 hectares of this variety, achieving productivity of 5.4 quintals/ha and net returns of Rs. 1,25,000/ha. In contrast, Non-NICRA farmers cultivated only 7 hectares, yielding 8.9 quintals/ha and earning Rs. 88,700/ha. The adoption of SS 2 also resulted in input savings for NICRA farmers, with input costs at Rs. 35,300/ha compared to Rs. 38,000/ha for Non-NICRA farmers. This cost reduction was achieved through more efficient use of inputs like fertilizer, water, labour, and pesticides, alongside the benefits of frost-tolerant crop varieties.

Oat (Sabzar variety)- Better adaptability under changing climate): Similar to rainfed systems, oat play a critical role in providing green fodder in irrigated systems. The Sabzar variety, which has shown

better adaptability to changing climate conditions, was adopted by NICRA farmers. They cultivated 20 hectares and achieved a yield of 12 quintals/ha, translating into 343 quintals of green fodder and net returns of Rs. 2,05,800/ha. Non-NICRA farmers, with 12 hectares under cultivation, managed a yield of 318 quintals of green fodder and earned Rs. 1,74,900/ha. The increase in productivity and net returns suggests that NICRA farmers benefitted from better resource management and efficient input use, contributing to their profitability.

Winter Chocolates (Dairy management innovation): In an innovative approach to dairy management, NICRA farmers adopted the use of Winter Chocolates in their dairy cows' feed, which significantly improved milk production. This intervention resulted in the production of 2,920 l and net returns of Rs. 65,700/ha (Table 16.7 a).

Popularization of improved chicks (Keystone): The demonstration has been also conducted on poultry birds on the popularization of improved chicks (Keystone). The birds have yet to lay eggs, but the body weight of the birds has significantly increased.

Table 16.7 a: Impact in FST 4 (Irrigated with animal)

Crop	Technology demonstrated	Area impacted (ha)	Irrigated with animal					
			NICRA farmers			Non-NICRA farmers		
			Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Rice	SR 4 (Disease resistant)	20	10.8	79.8	151620	10.0	63.0	119700
Oilseed	SS 2 (Frost tolerant)	20	5.4	12.5	125000	7.0	8.87	88700
Oat	Sabzar	20	12.0	343 (Green Fodder)	205800	12.0	318 (Green fodder)	174900
Winter Chocolates	-	-	-	2920 l milk	65700	-	-	-

Table 16.7 b: Input saving due to technologies

Technology demonstrated	Input	Cost (Rs.)	
		NICRA farmers	Non-NICRA farmers
Blast resistant Rice	Fertilizer, seed water, labour, pesticide	35246/ha	37270/ha
High yielding oilseed		35300/ha	38000/ha

During 2023-24, various by-products like crop residue, dung, paddy straw, and litter were produced and recycled across Shangrin village, contributing both economically and ecologically to the farming systems. A total of 2000 quintals of crop residue and dung were produced, with 1500 quintals recycled and Rs. 5,00,000 generated from sales. Additionally, 960 bundles of paddy straw were fully recycled,

Table 16.8: By-products produced and recycled

By-products	Quantity (q/ha)	Selling price (Rs./q)	Recycling of by-products	Amount mobilised (Rs.)
Crop residue and dung	2000 q	1000	1500 q	500000
Paddy straw	960 bundle	20/ bundle	960 bundle	-
Litter	45 q	800	6 q	35700

each sold for Rs. 20, and 45 quintals of litter were produced, with 6 quintals recycled and Rs. 35,700 earned from sales. The recycling of these by-products supports waste management, improves soil fertility, and provides supplementary income for farmers.

INSTITUTIONAL INTERVENTIONS:

SEED AND FODDER BANK:

Notably, Rice (SR 4) covered an area of 10.8 hectares, involving 56 farmers and yielding 86.18 q. The seed system for fodder production used during CRT demonstrations in 2023-24 showed great performance in the case of Oat (Sabzar) as 34.3 tonnes of fodder were produced and 60 farmers were involved.

CAPACITY BUILDING:

Most of the training programmes for capacity building were carried out for seed production technology and nursery management in Rice, the role of farm mechanization in crop production, water harvesting, Training and pruning to improve quality and productivity in apple with special reference to HDP Apple, Post-harvest management of fruits and vegetables, protected cultivation in vegetables, Demonstration on preparation of UMMB, Scientific management of commercial poultry farming (broiler production), Scientific Sheep farming, Importance of Mulching in Rain-fed orchards, where mostly male farmers showed involvement. Maximum farmers showed involvement in demonstrations conducted for water harvesting. Most of these trainings received positive response from the farmers.

Table 16.9: Capacity Building Programmes (HRD) for farmers

Theme	No. of Courses	No. of Beneficiaries		
		Male	Female	Total
Seed production technology and nursery management in Rice	1	32	8	40
Role of farm mechanization in crop production	1	42	4	46
Water harvesting	1	87	11	98
Training and pruning to improve quality and productivity in Apple with special reference to HDP Apple	1	46	0	46
Post-harvest management of fruits and vegetables	1	14	35	49
Protected cultivation of vegetables	1	17	33	50
Demonstration on the preparation of UMMB	1	28	7	35
Scientific management of commercial poultry farming (Broiler production)	1	13	47	60
Scientific sheep farming: A profitable enterprise	1	27	0	27
Importance of mulching in rainfed orchards	1	43	1	44
Farm mechanization	1	36	5	41

OTHER EXTENSION ACTIVITIES:

Various extension activities were conducted on topics like nursery raising, livestock management, and vegetable production, which are aimed at improving profitability and sustainability in farming. Awareness initiatives like those on NICRA and Self-Help Group (SHG) strengthening are geared towards building resilience and empowering rural communities. Method demonstrations and exposure visits, such as those to Kisan Melas, are practical approaches used to provide hands-on learning experiences. Other programs focus on increasing general awareness, such as those on crop techniques, animal health, and silage-making.

Meeting with NICRA village committee

Diagnostic visit to farmers field in NICRA village

Table 16.10: Other extension activities

Name of program	Participants
Fruit nursery raising as a profitable business	37
Prevention and control of milk fever in dairy animals	50
Protected cultivation of vegetables under polyhouses	50
Livestock management	20
NICRA awareness	167
Exposure visits to Kisan Mela	83
Vegetable production	50
Strengthen - SHG	42
Method demonstrations	192
Women awareness	83
General awareness of the importance and concept of the SRI Technique	46
Silage making in repol polypropylene bags	29
General awareness of oilseed & oat production	63

Climate resilient technologies include the SRI Technique, intercropping, protected cultivation, fodder production, high-yielding and disease-resistant Rajmash, frost tolerant oilseed, high-yielding rice, and grafted plants of superior genotype. Each intervention scaled up to improve productivity, resilience, or efficiency in different agricultural areas, benefiting a total of 346 farmers in the village.

Field day on SR 4 Rice

Field day on SS 2 Oilseed

Table 16.11: Summary of Upscaling of technologies in Shangrin village

Technology scaling up/out	No. of farmers reached
SRI Technique	25
Intercropping	10
Protected cultivation	10
Fodder production	60
High-yielding and disease-resistant Rajmash	148
Frost tolerant oilseed	26
High yielding rice	56
Grafted plants of superior genotype	11

AGRO ADVISORIES ISSUED:

During 2023-24, four agromet bulletins were consistently released each month from June to January, providing weather-based agricultural guidance. Additionally, various other advisories were issued to support farmers with timely agricultural practices. The highest number of other advisories were issued in August (6), likely to address critical monsoon-related farming activities, while fewer were issued in October (1), during the post-harvest period.

Table 16.12: Details about agro advisories issued

Month	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Number of agromet bulletins issued	4	4	4	4	4	4	4	4
Other advisories issued	3	2	6	2	1	3	3	3

NICRA farmers used high-yielding and frost-tolerant varieties and generally saw higher productivity, lower cost of cultivation, and greater gross returns across crops like rice, oilseeds, oats and rajmash. For example, NICRA farmers achieved a rice yield of 79.8 q/ha compared to 68.3 q/ha for Non-NICRA farmers. By using frost-tolerant and high-yield varieties of oilseeds, NICRA farmers recorded a

Table 16.13: Detailed information on Crop interventions

Technology demonstrated		Area (ha)	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)
NICRA farmers	High-yielding variety of Rice	10.8	79.8	35246	93541
	High-yielding and frost-tolerant variety of oilseed	5.4	12.5	35300	75000
	High yield Oat	12.0	343.0	35900	81250
	Bush-type yielding and drought-tolerant Rajmash	15.0	12.8	28546	75324
Non-NICRA farmers	Rice	5.0	68.3	43890	71715
	Oilseed	-	9.8	37800	58800
	Oat	-	298.0	38350	68540
	Rajmash	-	9.3	31800	55800
Specificity of technology	Adopting practices that enhance the resilience to climate change, such as conservation tillage, cover cropping				
Farmers' perception	The perception of technology for oats' adaptability among farmers is likely to be influenced by a combination of factors, including their individual experiences, socioeconomic context, and the perceived benefits and drawbacks of the technologies available				

productivity of 12.5 q/ha with gross returns of Rs. 75,000/ha, while Non-NICRA farmers had lower yields of 9.8 q/ha and returns of Rs. 58,800/ha. NICRA farmers growing rajmash, using drought-tolerant varieties, achieved higher gross returns of Rs. 75,324/ha compared to Non-NICRA farmers who earned Rs. 55,800/ha. These technologies enhanced productivity and reduced costs, showing significant benefits across different crops.

SUCCESSFUL INTERVENTIONS:

Key interventions in natural resource management (NRM) include the use of protected cultivation for vegetables, covering 1.0 ha, and vermicompost unit renovations over 1.5 ha. In fruit cultivation, grass and polythene mulching were applied around the canopy of apple trees over 10.0 ha. Crop interventions include high-yielding varieties like SR 4 rice (10.8 ha), SS 2 oilseed (5.4 ha), Sabzar oats (12 ha), and Shalimar rajmash (12 ha), contributing to improved resilience and productivity. The introduction of hardy Keystone birds also indicates efforts to enhance livestock resilience.

Table 16.14: Adoption of successful interventions in NICRA & adjoining villages

Successful interventions	Crop	Variety	Adoption in ha (2023)
NRM			
Protected cultivation	Vegetable	-	1.0
Renovation of vermicompost units	-	-	1.5
Grass and polythene mulching around tree canopy	Apple	-	10.0
CROP			
High-yielding variety of Rice	Rice	SR 4 (Shalimar Rice 4)	10.8
High-yielding and frost-tolerant variety of oilseed	Oilseed	SS 2 (Shalimar Sarson 2)	5.4
High yielding Oat	Oat	Sabzar	12.0
Bush-type yielding and drought-tolerant Rajmash	Rajmash	Shalimar Rajmash	12.0
Fruits	Apricot & Plum	Amba & Black Amber	-
LIVESTOCK			
Popularization of hardy birds (Keystone)	-	-	-

Bandipora

17

Bandipora is the headquarter of the district of Bandipora in the union territory of Jammu and Kashmir, India. It is bound by mountains on three sides and by Wular Lake on the fourth. As of the 2011 Indian census, Bandipora had a population of 3,92,232. Males constitute 52.94 % of the population, and females 47.05 %. Bandipora has an average literacy rate of 57.32 %, lower than the national average of 74.04 %, with 82.14 % of the males and 65.46 % of females literate.

NICRA VILLAGES:

Sumlar, Kootasatri, Surinder, and Shokbaba villages in this district were selected for the Technology Demonstration Component of NICRA in 2016, 2018, 2020, and 2022, respectively. Kudara and Palpora villages in Bandipora were involved in the Technology Demonstration Component of NICRA in 2019 and 2022, respectively.

Table 17.1: Day wise rainfall (mm) distribution

Rainfall 2023-24												
Date	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	16.6	0	0	0	0	0	19.4	0	0	1.8	2.4	0
2	4.6	0	0	0	0	0	0	0	0	1.4	14	1.5
3	4.8	0	7.0	0	0	1.0	0	0	0	1.0	-	6.4
4	0	0	0	0	0	0	0	0	0	1.2	9.4	0
5	0	0	0	9.4	0	0	0	0	0	0	12.0	0
6	0	0	0	0	0	0	0	0	0	0	7.2	0
7	0	1.0	0	0	0	0	0	0	3.2	0	0	7.2
8	0	27.4	0	0	0	0	0	0	0	0	0	5.2
9	0	1.0	0	0	0	0	0	0	0	0	0	9.2
10	0	0	0	0	16.4	21.0	0	0	0	0	0	0
11	11.2	0	0	0	0	8.0	0	0	27.4	0	0	0
12	0	0	0	0	0	0	0	5.8	1.8	0	0	0
13	0	0	0	0	1.8	0	0	38.6	2.6	1.0	0	0
14	4.4	0	0	0	0	0	0	0	0	0	0	0
15	0	0	5.8	0	1.0	0	0	0	0	0	0	2.8
16	1.2	4.0	0	4.6	0	0	0	0	0	0	0	0
17	0	9.8	0	0	35.8	0	3.6	0	0	0	2.6	0
18	0	0	0	0	4.4	0	0	0	0	1.0	19.0	1.0
19	0	0	0	2.0	0	0	0	1.2	0	0	19.0	0
20	0	47.0	0	0	0	0	0	1.4	0	4.3	48.4	0

Rainfall 2023-24												
Date	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
21	0	2.2	0	0	0	0	0	3.6	1.0	0	1.0	0
22	0	28.0	0	0	0	0	0	1.0	0	0	0	0
23	0	7.6	0	0	0	0	0	0	0	0	0	0
24	0	4.0	0	0	0	0	0	0	0	0	0	20.0
25	2.0	14.2	0	21.4	0	0	0	6.2	0	10.6	0	13.0
26	35.0	0	0	0	0	0	0	9.6	0	3.4	0	2.4
27	2.2	3.2	0	0	0	0	0	2.6	0	0	39.6	14.4
28	14.0	26.0	0	0	0	0	0	0	0	0	20.0	0
29	1.6	31.6	0	0	0	0	0	0	0	0	7.2	0
30	0	0	0	0	0	1.5	0	30.0	0	0	0	0
31	0	0	0	0	0	0	0	25.4	0	0	0	0

FARMING SYSTEM TYPOLOGIES:

Major farming system typologies of these villages are Rainfed without animal, Rainfed with animal, Irrigated without animal and Irrigated with animal.

Table 17.2: Summary of Interventions

Villages	No. of farmers involved in demonstrations			
	FST 1 (Rainfed without animal)	FST 2 (Rainfed with animal)	FST 3 (Irrigated without animal)	FST 4 (Irrigated with animal)
Sumlar	37	24	31	11
Kootasatri	14	18	18	8
Surinder	21	25	20	7
Shokbaba	15	22	20	26
Total	**87**	**89**	**89**	**52**

NATURAL RESOURCE MANAGEMENT INTERVENTIONS:

Demonstrations under natural resource management such as in-situ moisture conservation, water harvesting and recycling for supplemental irrigation and RCT (resource conservation technologies e.g. mulching) were undertaken for selected NICRA villages to increase farmers' profitability.

Table 17.3: NRM interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Water harvesting and recycling for supplemental irrigation	20	45	1.45
RCT (Mulching)	18	37	0.95
In-situ moisture conservation	10	22	0.50

CROP PRODUCTION INTERVENTIONS:

Demonstrations for various farming systems under crop production interventions such as drought-tolerant maize, cold-tolerant fodder oat, crop diversification through vegetable cultivation, contingency crop planning and water-saving paddy cultivation were undertaken for selected NICRA villages to increase farmers' profitability

Table 17.4: Crop Production interventions

Resilient practice	No. of Demo	Farmers	Area (ha)
Drought tolerant Maize (SMC 3)	40	85	4.0
Frost tolerant fodder Oat	9	19	0.7
Crop diversification through vegetable cultivation	4	4	0.2
Contingency crop planning	8	30	0.8
Water saving paddy cultivation	5	5	0.2

LIVESTOCK INTERVENTIONS:

Various demonstrations under livestock interventions which include urea molasses mineral blocks for dairy cows, covering 40 farmers and 60 animals. Backyard poultry interventions involved 22 farmers and 220 birds. Additionally, improved fodder production practices were demonstrated to 44 farmers, covering 82 animals and an area of 2 hectares. The interventions aimed to enhance resilience in livestock management.

Table 17.5: Livestock interventions

Resilient practice	No. of Demo	Farmers	No. of animals	Area (ha)
Urea molasses mineral blocks for dairy cows	40	40	60	-
Backyard Poultry	22	22	220	-
Improved fodder production	16	44	82	2.0

Onion demonstration plot at Sumlar village

Diagnostic visit to Trout farmer at Sumlar village

FST 1 (RAINFED WITHOUT ANIMAL):

Drought tolerant Maize (SMC 3): Farmer 1 adopted drought-tolerant maize for coping with cob formation issues. The area impacted was 0.8 ha for NICRA farmers and 0.5 ha for Non-NICRA farmers. NICRA farmers achieved a productivity of 42 q/ha and a net return of Rs. 60,000/ha, while Non-NICRA farmers had lower productivity of 34 q/ha and a net return of Rs. 44,000/ha.

Frost tolerant fodder Oat: Farmer 2 demonstrated cold-tolerant fodder oats at the vegetative stage. NICRA farmers covered 0.2 ha, yielding 370 q/ha and generating Rs. 52,000/ha while Non-NICRA farmers, with a larger area of 0.5 ha, achieved lower productivity of 280 q/ha and net returns of Rs. 35,000/ha (Table 17.6).

Frost tolerant vegetable varieties: Farmer 3 adopted cold-tolerant vegetable varieties at the root formation stage. NICRA farmers worked on 0.5 ha, with productivity reaching 224 q/ha and net returns of Rs. 76,000/ha whereas Non-NICRA farmers, on 1.5 ha, achieved lower productivity of 161 q/ha and net returns of Rs. 37,000/ha.

Table 17.6: Impact in FST 1 (Rainfed without animal)

Technology demonstrated	Crop stage impacted	Rainfed without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Drought tolerant Maize (SMC 3)	Cob formation	0.8	42	60000	0.5	34	44000
Frost tolerant fodder Oat	Vegetative stage	0.2	370	52000	0.5	280	35000
Frost tolerant vegetable varieties	Root formation	0.5	224	76000	1.5	161	37000

FST 2 (RAINFED WITH ANIMAL):

Frost tolerant fodder Oat: NICRA farmers covered 0.2 ha with frost tolerant fodder Oat Sabzaar, yielding 370 q/ha and generating Rs. 30,500 /ha while Non-NICRA farmers, with a larger area of 0.5 ha, had lower productivity of 280 q/ha and net returns of Rs. 19,000/ha.

Urea Molasses Mineral Block (UMMB): Climate-resilient technology urea molasses mineral block demonstrated in rainfed systems with animals during 2023-24 where NICRA farmers achieved a production of 1,200 litres of milk per animal per year, sold at Rs. 35 per litre, resulting in gross returns of Rs. 42,000 per animal (Table 17.7). In contrast, Non-NICRA farmers, though adopting the same technology, produced 850 litres per animal, earning gross returns of Rs. 29,750. The technology led to higher production and financial returns for NICRA farmers compared to Non-NICRA farmers.

Table 17.7: Impact in FST 2 (Rainfed with animal)

Animal	No.	Technology demonstrated	Production (l/ year)	Selling price (Rs./l)	Gross returns (Rs./animal)
NICRA	5	Urea Molasses Mineral Block	1200	35	42000
Non-NICRA	-		850	35	29750

FST 3 (IRRIGATED WITHOUT ANIMAL):

Crop diversification (Radish): Farmer 1 adopted crop diversification by planting radish to manage issues related to germination and root development. NICRA farmers achieved a productivity of 181 q/ha and a net return of Rs. 1,37,000/ha. In comparison, Non-NICRA farmers achieved lower productivity of 106 q/ha and net returns of Rs. 66,000/ha.

Crop diversification (Turnip): Farmer 2 adopted crop diversification by growing turnip. NICRA farmers yielded 228 q/ha and net returns of Rs. 1,19,600/ha while Non-NICRA farmers saw productivity of 161 q/ha and net returns of Rs. 75,200/ha.

Table 17.8: Impact in FST 3 (Irrigated without animal)

Technology demonstrated	Crop stage impacted	Irrigated without animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Crop diversification (Radish)	Germination, root development	0.2	181	137000	0.3	106	66000
Crop diversification (Turnip)	Germination, root development	0.1	228	119600	0.2	161	75200

FST 4 (IRRIGATED WITH ANIMAL):

NRM INTERVENTION:

Water harvesting and recycling for supplemental irrigation (Maize): Farmer 1 used water harvesting and recycling techniques for supplemental irrigation during the vegetative growth stage of maize. NICRA farmers covered 0.4 ha, with productivity of 45 q/ha and net returns of Rs. 63,000/ha, while Non-NICRA farmers on 0.5 ha achieved 37 q/ha and net returns of Rs. 40,000/ha.

CROP PRODUCTION INTERVENTIONS:

Crop diversification (Radish): Farmer 1 adopted crop diversification by planting radish to cope with germination and root development issues. NICRA farmers worked on 0.2 ha, achieving productivity of 181 q/ha and net returns of Rs. 1,37,000/ha. Non-NICRA farmers, covering 0.3 ha, had lower productivity (106 q/ha) and net returns of Rs. 66,000/ha.

Crop diversification (Turnip): Farmer 2 adopted diversification by growing turnips, focusing on germination and root development stages. NICRA farmers reached productivity of 228 q/ha and net returns of Rs. 1,19,600/ha, while Non-NICRA farmers produced 161 q/ha and net returns of Rs. 75,200/ha (Table 17.9 a).

Integrated Nutrient Management in Brown Sarson: Farmer 3 implemented integrated nutrient management in brown sarson during the germination stage. NICRA farmers achieved productivity of 12.5 q/ha and net returns of Rs. 33,500/ha, while Non-NICRA farmers had lower productivity of 8 q/ha and net returns of Rs. 15,000/ha.

Table 17.9 a: Impact in FST 4 (Irrigated with animal)

Technology demonstrated	Crop stage impacted	Irrigated with animal					
		NICRA farmers			Non-NICRA farmers		
		Area (ha)	Yield (q/ha)	Net return (Rs./ha)	Area (ha)	Yield (q/ha)	Net return (Rs./ha)
Water harvesting and recycling for supplemental irrigation (Maize)	Vegetative growth stages	0.4	45	63000	0.5	37	40000
Crop diversification (Radish)	Germination, Root Development	0.2	181	137000	0.3	106	66000
Crop diversification (Turnip)	Germination, Root Development	0.1	228	119600	0.2	161	75200
Integrated Nutrient Management in Brown Sarson	Germination	0.4	12.5	33500	0.5	8	15000

Table 17.9 b: Impact in FST 4 (Irrigated with animal)

Animal	No.	Production (kg/unit)	Selling price (Rs./kg)	Gross returns (Rs./bird)	By-products quantity	Unit price (Rs.)	Net Returns (Rs./bird)
Kuroiler birds (NICRA)	10	1.5-1.8	250	350	120 eggs	6	720
Local birds (Non-NICRA)	7	0.5	250	125	65 eggs	6	390

NICRA farmers raised 10 Kuroiler birds (dual purpose) in their backyard, each producing 1.5-1.8 kg meat, sold at Rs. 250 per kg, generating gross returns of Rs. 350 per bird/season, with by-products (eggs) sold at Rs. 6 per egg, resulting in net returns of Rs. 720 per bird. In contrast, Non-NICRA farmers raised 7 local birds, each producing 0.5 kg meat, also sold at Rs. 250 per kg, with gross returns of Rs. 125 per bird and eggs fetching Rs. 6 per egg, resulting in a lower net return of Rs. 390 per bird.

CUSTOM HIRING CENTRE:

Performance of various implements used in agriculture was assessed during 2023-24 in this NICRA village where utilization of power tiller attracted farmers' interest. Maximum farmers utilized power tiller and irrigation pump sets which generated Rs. 8500 and Rs. 2600, respectively as revenue.

Table 17.10: Performance of Custom Hiring Centre

Equipment	Farmers covered	Area covered (ha)	Amount of rent obtained (Rs.)
Power Tiller	62	2.5	8500
Irrigation Pump Set	31	8.5	2600
Power Sprayer	8	2.0	2500
Brush Cutter	12	1.0	2450

SEED PRODUCTION:

The seed system for crop production used during CRTs demonstrations in 2023-24 showed great performance in the case of the SMC 3 variety of maize where 28 farmers were involved. A total of 12.2 quintals of seeds were produced, with each farmer earning Rs. 15,500 from its cultivation, reflecting the system's economic success.

FODDER PRODUCTION:

Adoption of an improved variety of fodder oats Sabzaar and fodder maize (African Tall) for fodder production was done by 45 and 8 NICRA farmers, respectively as they performed well during interventions opted during 2023-24.

Table 17.11: Performance of fodder system

Fodder crop & variety	Fodder (tonnes)	Farmers	Area (ha)	Revenue obtained (Rs.)
Fodder Oat (Sabzaar)	501.5	45	15.2	304000
Fodder Maize (African tall)	77.5	8	2.5	50000

Awareness programme on climate resilient technologies at Kootasatri village

CAPACITY BUILDING:

Most of the training programmes for capacity building were carried out for conducted training on natural resource management, crop production, management of horticultural crops, handling of farm implements and machinery, livestock management, skill development, nutritional garden, etc. where both male and female farmers participated.

Table 17.12: Capacity Building (HRD)

Title of the program	Beneficiaries		
	Male	Female	Total
Crop production	50	10	60
Resource Conservation Technology	27	8	35
Farm machinery	20	2	22
Fodder and feed management	10	6	16
Irrigation management	15	2	17
Livestock management	15	9	24
Poultry production	28	5	33
Enterprises for self-employment	18	5	23
Management of horticultural crops	13	0	13
Skill development	0	16	16
Natural resource management	11	6	17
Nutritional garden	2	7	9

OTHER EXTENSION ACTIVITIES:

A number of extension activities were taken up in NICRA village such as exposure visits of farmers, IFS, field day demonstrations, method demonstrations for line sowing, awareness camps for climate resilient technologies, soil health day, etc. done where male and female farmers showed active participation during 2023-24.

Table 17.13: Other extension activities

Name of the activity	Details	No. of programmes	No. of Beneficiaries	
			Male	Female
Exposure visit of farmers	Exposure visit to Shalimar	1	10	0
IFS	Integrated farming system	1	8	4
Field days	Maize (2), Pea (1), Fodder Oat (1)	4	28	12
Method demonstrations	Line sowing, mulching, fertilizer application, seed treatment, spraying of pesticides	11	35	10
Awareness	Climate Resilient Technologies	5	381	42
Women awareness	Empowerment, entrepreneurship	1	0	14
Group discussion	Women empowerment, CRTs	4	24	15
Agro advisory services	Crop weather	32	112	25
Soil Health Day	World Soil Day	1	24	11

EXTREME WEATHER EVENTS:

These villages experienced one dry spell for 30 days (from 5th August to 4th September, 2023) during which the yield of maize and pulses decreased. The fruit size of horticultural crops was also reduced.

AGRO ADVISORIES ISSUED

The agromet bulletins were issued consistently throughout the year, with a slight increase during the later months. Specifically, the bulletins ranged from 2 to 6 per month, with the highest frequency observed in January. On the other hand, other advisories were issued sporadically, with only two instances in June and September.

Table 17.14: Details about agro advisories issued

Months	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Number of agromet bulletins issued	2	3	2	3	3	3	4	6
Other advisories issued	1	-	-	1	-	-	-	-

TECHNOLOGIES UPSCALED:

The adoption of drought-tolerant maize varieties and frost tolerant oats by farmers in different areas upscaled the technologies. A number of farmers were reached in each village, and a specific number of hectares were covered for each technology. The scaling-up process indicates the broader adoption of these resilient crop varieties to cope with climatic stress, improving agricultural productivity across multiple villages.

Table 17.15: Summary of Upscaling of Technologies

Village name	Technology scaling up/out	No. of farmers	Coverage (ha)
Sumlar	Drought tolerant Maize variety	22	3.5
Kootasatri		12	1.5
Surinder		26	2.2
Sumlar	Frost tolerant Oat	18	2.5
Kootasatri		14	1.75
Surinder		18	2.1

SUCCESSFUL INTERVENTIONS:

The impact of these demonstrations led to the adoption of these technologies by a number of farmers where farmers actively participated in demonstrations conducted for suitable drought-resistant varieties of climate-resilient crops in maize (SMC 3) and fodder oats (Sabzaar) on 22 ha and 16 ha respectively.

POPULARIZATION OF CLIMATE-RESILIENT VARIETIES:

The efforts made by the State Department to promote climate-resilient crop varieties in response to changing climatic conditions, resulted in the introduction of a climate-resilient maize variety covering 22 hectares during *Kharif* 2023 and the incorporation of the Shalimar Fodder-111 Oats variety over 16 hectares during *Rabi* 2023, demonstrating a commitment to enhancing agricultural productivity and sustainability.

Zonal Workshop

ICAR-ATARI, Ludhiana organized a Review-cum-Action Plan Workshop under the Technology Demonstration Component of National Innovations in Climate Resilient Agriculture (TDC-NICRA) project at Krishi Vigyan Kendra, Kathua (Jammu & Kashmir) on 12-13 August 2023. A total of 35 Scientists from 17 KVKs of Punjab, Himachal Pradesh, Uttarakhand, Jammu & Kashmir and Ladakh participated, and deliberated upon important issues for the successful implementation of the project activities.

Dr. Rajbir Singh, ADG (AAF&CC), ICAR and Chief Guest of the Inaugural Session stressed upon the documentation of success stories and key learnings attained during the project implementation. He emphasized the need to work in tandem with line departments and ensure suitable convergence with all stakeholders. He further outlined the salient achievements of NICRA attracting policymakers' attention at the National/International platforms.

Dr. V.K. Singh, Director, ICAR-CRIDA, Hyderabad and Guest of Honour appreciated the commendable work being carried out by different KVKs while improving the adaptive capacity of farmers in adopted villages under the TDC-NICRA project. He talked about the indicators-based evaluation of demonstrated technologies and emphasized the need for a paradigm shift to achieve agricultural resilience following a typological approach. He specifically pointed out towards achieving climate resiliency while adopting energy-saving, soil and water conservation, and carbon sequestration practices.

Dr. Dileep Kachroo, Former Registrar SKUAST, Jammu and Chairman of NICRA Zonal Monitoring Committee (ZMC) shared his field experiences and emphasized the need for Integrated Farming System (IFS) approach to build climate resilience in agriculture. Dr. S. K Gupta, DEE, SKUAST, Jammu appraised different animal-based technological interventions focusing on breeding, feeding and shelter management aspects.

Earlier, Dr. Parvender Sheoran, Director, ICAR-ATARI, Ludhiana informed the house about the overall achievements of TDC-NICRA. He urged the KVK Scientists to generate evidence-based scientific outputs and correlate them with climatic variability while assessing the impact of demonstrated technological interventions with large impact at scale. He advised the KVKs to mobilize funding from ongoing National and State government schemes and emphasized the withdrawal strategy to have a long-lasting impact of project outcomes.

A publication entitled “Fostering Climate Resilient Agriculture through Technological Interventions” was also released during the workshop. The workshop also included a field visit to NICRA villages Saida and Sohal of Kathua district, where a Farmer-Scientist Interaction was also organized. Dr. JVNS Prasad, Programme Leader (TDC-NICRA), Dr. Ashish S. Murai, (Nodal officer, Zone-1), Dr. Simerjeet Kaur (ZMC member), Dr. Vishal (In charge, KVK Kathua) and others were also present

On August 13, 2023, the Zonal Monitoring Committee (ZMC) of the National Innovations in Climate Resilient Agriculture (NICRA) project visited adopted villages in the Kathua district of Jammu & Kashmir. The committee assessed various interventions conducted in the village by the KVK using different approaches such as natural resource management, crop production, livestock and fisheries, and institutional measures. During their visit, they engaged with farmers, the VCRMC (Village Climate Risk Management Committee) secretary, and members to gauge the community's response to NICRA's efforts. The ZMC reviewed financial advancements, VCRMC meetings, the collection of fees by the custom hiring center, and other related matters. They also observed the processes and products developed and promoted by local farmers as part of the project. The ZMC acknowledged the contributions of the KVKs and recommended expanding successful NICRA interventions to neighboring villages for wider dissemination.

The following action points emerged during the workshop

1. Prioritize technological interventions under TDC-NICRA to achieve 100% saturation in the adopted villages. More emphasis should be on selecting pertinent practices and technologies (energy-saving, soil and water conservation, carbon sequestration, etc.) that help achieve climate resiliency as per the objectives of the project. Livestock-oriented interventions should focus more on breeding, feeding, and shelter management as a coping strategy for climate change.

2. Demonstrating typology-based interventions to manage climatic vulnerability in adopted NICRA villages serves as a purposive sampling framework to assess the overall impact holistically. This impact may be extrapolated for the entire village based on evidence-based outputs. Concerted efforts be put forth for wider dissemination and up-scaling/out-scaling successful technologies in association with line departments representing similar ecologies at the district/state level.
3. Geo-tagging or color coding may be adopted for project activities to prevent duplication of work with other agencies.
4. Partnership building is quite crucial for suitable convergence and mobilizing diverse funding for NICRA project activities. Therefore, there is a need to work in close association with line departments for wider adoption and sustainable progress of the project in the long run.
5. Documenting and correlating successful outcomes and other relevant data with climatic parameters is of utmost importance to showcase the impact of NICRA activities. Each KVK should compile success stories of 50-100 farmers in the form of an impactful document or publication. These publications must be shared with line departments and other agencies to increase visibility. Similarly, visits of policymakers, government officials, etc. to NICRA villages may be ensured to further increase the visibility of project activities.
6. Successful project activities and achievements must be thoroughly documented. Prepare short films/videos/documentaries seeking professional help, and copyright them. Efforts should be made to target awards/recognitions from different agencies/organizations, such as the Ministry of Jal Shakti, etc.
7. Popularize community seed bank system, wherein farmers produce and preserve seeds for themselves. Focus on establishing Farmers' Interest Groups (FIGs) to facilitate the easy availability of high-cost inputs and also encourage farmers to contribute 50% of the farm inputs to reduce dependency.
8. Old NICRA-implementing KVKs that were discontinued after the first phase may also be invited to the workshop. This will help them understand continuing outcomes, and impacts, and learn from their experiences.

9. A virtual meeting may be organized by ICAR-CRIDA, Hyderabad for enriching knowledge and discuss the fundamentals of climate change vis-a-vis NICRA for better understanding among stakeholders.
10. All KVKs personnel (Heads, SMSs, and NICRA staff) engaged in the NICRA project should critically review respective District Contingency Plans to prioritize field activities and provide feedback accordingly. ICAR-ATARI may provide KVKs with documents regarding the risks and vulnerabilities of agriculture to climate change.
11. Performance-based budgeting may be applied to encourage healthy competition and support better-performing KVKs.
12. Each KVK must ensure the timely submission of Annual Utilization Certificates (AUCs) to facilitate the timely release of funds. More funds may be provided under the Capital head, particularly to the newly selected KVKs for establishing Custom Hiring Centres (CHCs). Funds to KVK Leh-I may be released early to ensure effective utilization, given the limited growing season.

Annexure - I

ICAR-Central Research Institute for Dryland Agriculture
Technology Demonstration Component
National Innovations in Climate Resilient Agriculture
Santoshnagar, Hyderabad-500 059

F.No.NICRA-TDC/Budget/2023-24 **Date: 14.03.2024**

To
The Director
ICAR-ATARI (Zone-I)
PAU Campus
Ludhiana, PUNJAB-141004

Dear Sir,

Please find enclosed the reallocation of **Revised Budget Estimates (RE)** 2023-24 for the Technology Demonstration Component of NICRA for ATARI and KVKs. Kindly advise the KVKs to fully utilize the budget as per the allocation.

With best regards,

Yours Sincerely,

(G PRATIBHA)
PI, TDC-NICRA

Copy to:

1. All KVKs concerned

Cont.....

ICAR-Central Research Institute for Dryland Agriculture
Technology Demonstration Component
National Innovations in Climate Resilient Agriculture
Santoshnagar, Hyderabad-500 059

F.NO.NICRA-TDC/Budget/2023-24 **Date: 14.03.2024**

REVISED KVK-WISE BUDGET ESTIMATES FOR THE YEAR 2023-24 (RE)

(Rupees)

Sno	Name of the KVK / ATAI	Operational_GENERAL	TA_GENERAL	Equipment_CAPITAL	SCSP_GENERAL	SCSP_CAPITAL	Total
1	**ATARI**	462863	47137	0	0	0	**510000**
2	Bandipora	919241	100000	80000	0	0	**1099241**
3	Bathinda	949225	22000	80000	0	0	**1051225**
4	Chamba	902759	20000	80000	0	0	**1002759**
5	Kathua	770000	75000	80000	0	0	**925000**
6	Tehri Garhwal	770000	55000	80000	0	0	**905000**
7	Uttarkhashi	827000	18000	80000	0	0	**925000**
8	Mandi	810000	35000	80000	0	0	**925000**
9	Bilaspur	839110	5890	80000	0	0	**925000**
10	Moga	830855	14145	80000	0	0	**925000**
11	Leh_Ladakh	770000	120000	85000	0	0	**975000**
12	Poonch	733000	20000	79000	0	0	**832000**
13	Bageshwar	870000	75000	79000	0	0	**1024000**
14	Champawat	770000	42000	79000	0	0	**891000**
15	Anantnag	908000	100000	79000	0	0	**1087000**
16	Faridkot	0	0	0	2450000	500000	**2950000**
17	Kullu	0	0	0	2300000	500000	**2800000**
18	Gurdaspur	0	0	0	525000	139000	**664000**
	Total	**12132053**	**749172**	**1121000**	**5275000**	**1139000**	**20416225**

With best regards,

Yours Sincerely,

(G PRATIBHA)
PI, TDC-NICRA

Cont.....

/29/24, 12:53 PM Gmail - Re-appropriation of funds in respect of KVK-Anantnag for the FY 2023-24 -reg.

Gmail NICRA, ICAR-ATARI ZONE-1 <nicra.atari1@gmail.com>

Re-appropriation of funds in respect of KVK-Anantnag for the FY 2023-24 -reg.

TDC-Coordinator-NICRA <nicra2.crida@gmail.com> 29 March 2024 at 12:45
To: KVK ANANTNAG <anantnagkvk@gmail.com>, "NICRA, ICAR-ATARI ZONE-1" <nicra.atari1@gmail.com>

Dear Dr Khan,
You can convert TA amount Rs 40,000 and utilise it in operational expenses.
With regards
Pratibha
[Quoted text hidden]
--

Dr G. Pratibha

PI, Technology Demonstration Component of NICRA

National Innovations in Climate Resilient Agriculture

ICAR-Central Research Institute for Dryland Agriculture,
Santoshnagar, Hyderabad-500059, India

Telefax: +91 40 24535336

Phone No.: 040-24535336

Mobile: 9246208478

E-mail: g.pratibha@icar.gov.in; nicra2.crida@gmail.com

3/29/24, 1:59 PM Gmail - Revalidation of left over TA to Contingency

Gmail NICRA, ICAR-ATARI ZONE-1 <nicra.atari1@gmail.com>

Revalidation of left over TA to Contingency

TDC-Coordinator-NICRA <nicra2.crida@gmail.com> 29 March 2024 at 13:06
To: Senior Scientist & Head <kathuakvk@gmail.com>, "NICRA, ICAR-ATARI ZONE-1" <nicra.atari1@gmail.com>

Dear Sir,
U can convert the balance TA amount of Rs 3586 to operational and can spend it
With regards
Pratibha
[Quoted text hidden]
--

Dr G. Pratibha

PI, Technology Demonstration Component of NICRA

National Innovations in Climate Resilient Agriculture

ICAR-Central Research Institute for Dryland Agriculture,
Santoshnagar, Hyderabad-500059, India

Telefax: +91 40 24535336

Phone No.: 040-24535336

Mobile: 9246208478

E-mail: g.pratibha@icar.gov.in; nicra2.crida@gmail.com

Cont.....

Gmail

COORDINATOR CRIDA <nicra2.crida@gmail.com>

Reappropriation of Revised Estimate of NICRA Project 2023-24

1 message

KVK Tehri Garhwal <kvktehrigarhwal@gmail.com> Sat, Mar 23, 2024 at 4:37 PM
To: "NICRA, ICAR-ATARI ZONE-1" <nicra.atari1@gmail.com>, TDC-Coordinator-NICRA <nicra2.crida@gmail.com>

Respected Madam/Sir,

It is submitted that kindly reappropriate the Revised Estimate of NICRA Project 2023-24 headwise as follows.

S.No	Particulars	RE for the 2023-24	Final RE 2023-24
1	2	3	4
A	**A. REVENUE**		
1.	Operational expenses	770000.00	**781000.00**
2.	TA	55000.00	**44000.00**
3.	SCSP	0.00	0.00
	Sub-total of A (1-3)	825000.00	**825000.00**
B	**CAPITAL**		
4.	Equipment	80000.00	**80000.00**
5.	SCSP	0.00	0.00
	Sub-total B (4-5)	80000.00	**80000.00**
	Grand Total (A+B)	905000.00	**905000.00**

The inconvenience is regretted.

It is for your kind information and necessary action, please.

Thanks and Regards
Dr. Aalok Gulabrao Yewale
Officer-In- Charge
Krishi Vigyan Kendra, Ranichauri, Tehri Garhwal
VCSG Uttarakhand University of Horticulture and Forestry, Bharsar
Contact No. 01376- 252101

"Go Green, Go paperless"

Approved
Prabhat

Annexure - II

GFR 12 - A

(See Rule 238(1))

FORM OF UTILISATION CERTIFICATE

AUDIT UTILISATION CERTIFICATE FOR THE YEAR from 01-04-2023 to 31-03-2024 in respect of recurring/non recurring GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS

1. **Name of the Scheme** : **NICRA 2023-24**
2. **Whether recurring or non-recurring grants** : **Recurring/Non-recurring grants**
3. **Grants position at the beginning of the Financial year** :

(i)	Cash in Hand/Bank	:	164342
(ii)	Unadjusted advances	:	0
(iii)	Total	:	**164342**

4. **Details of grants received, expenditure incurred and closing balances:**

(Actuals) Rs.

Unspent Balances of grants received years (Figure as at Sl. no 3(iii)	Interest earned thereon	Interest deposited back to the Government	Grant received during the year			Total available Fund (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
1	2	3	4			5	6	7
			Sanction No. (i)	Date (ii)	Amount (iii)			
	0	0	F.No. NICRA - TDC/Budget/ 2023-24	06.06.2023 02.09.2023 17.11.2023 26.02.2023	20416225	20416225	20375651	40574
164342	0	0	Refund of opening balance				164342	0

5. **Component wise utilization of grants:**

Rs.

Grant-in-aid - General	Grant-in-Aid -Salary	Grant-in-aid - creation of capital assets	Total [figures as at column of table above]
18116775	00	2258876	20375651

6. **Details of Grant position at the end of the year 2023-24 up to 31-3-2024**

(i)	Cash in Hand/Bank	:	40574
(ii)	Unadjusted advances	:	0
(iii)	Total	:	40574

26/06/2024
ASHISH SANTOSH MURAI
Scientist (AE)
Indian Council of Agricultural Research
Agricultural Technology Application
Research Institute, Zone-1
PAU Campus, Ludhiana-141004

1 26/6/24
Assistant Finance & Accounts Officer
Indian Council of Agricultural Research
Agricultural Technology Application Research Institute
Zone-1, PAU Campus, Ludhiana- 141004

26/06/
निदेशक/Director
भा.कृ.अनु.प.-कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान
ICAR-Agricultural Technology Application Research Institute
जोन-1, पं.कृ.वि.परिसर, लुधियाना-141004, पंजाब
Zone-1, PAU Campus, Ludhiana-141004, Punjab

Cont.....

Certified that I have satisfied myself that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

(i) The main accounts and the other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mentioned the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.

(ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, insuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.

(iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/Standing instructions and scheme guidelines, agreements (Tripartite Agreement), sanction letters, contract agreements/LoAs/amendments in LoAs and agreements.

(iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.

(v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.

(vi) The expenditure on various components of the scheme was in proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.

(vii) It has been ensured that the physical and financial performance under **NICRA 2023-24** has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance /targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at **Annexure-I** duly enclosed.

(viii) The utilization of the fund resulted in outcomes given at Annexure-II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

(ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-II(to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date: 26.06.2024
Place: Ludhiana

26/06/2024

Principal Investigator
ASHISH SANTOSH MURAI
Scientist (AE)
Indian Council of Agricultural Research
Agricultural Technology Application
Research Institute, Zone-1
PAU Campus, Ludhiana-141004

26/6/24

Finance & Accounts Officer
Assistant Finance & Accounts Officer,
Indian Council of Agricultural Research
Agricultural Technology Application Research Institute
Zone-I, PAU Campus, Ludhiana- 141004

26/06/24

Director
2
निदेशक/Director
भा.कृ.अनु.प.-कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान
ICAR-Agricultural Technology Application Research Institute
क्षेत्र-1, पं.कृ.वि.परिसर, लुधियाना-141004, पंजाब
Zone-1, PAU Campus, Ludhiana-141004, Punjab

Cont.....

ICAR-Agricultural Technology Application Research Institute, Zone-I, Ludhiana

Audit Utilization Certificate in respect of National Innovations in Climate Resilient Agriculture (NICRA) for the year 2023-24

(Rupees)

Opening balance as on 1st April, 2023	Remittance by CRIDA during the year 2023-24	Council's share of receipts realized from the scheme during the year 2023-24	Total (Col 1+2+3)	Council's share of sanctioned grant for the year 2023-24	Refund	Actual expenditure for the year 2023-24	Council's share of expenditure actually incurred and audited during the year 2023-24	Closing balance as on 31st March, 2024
1	2	3	4	5	6	7	8	9
164342	20416225	100%	20580567	100%	164342	20375651	100%	40574

Certified that:

1. The grant has been utilized for the purpose for which it was made by the Council.

Certified that the accounts of the scheme/project as summarized above have been audited.

Principal Investigator

Finance & Accounts Officer

Assistant Finance & Accounts Officer,
Indian Council of Agricultural Research
Agricultural Technology Application Research Institute
Zone-I, PAU Campus, Ludhiana-141004

Director

निदेशक/Director
भा.कृ.अनु.प.-कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान
ICAR-Agricultural Techaology Application Research Institute
क्षेत्र-1, पं.कृ.वि.परिसर, लुधियाना-141004, पंजाब
Zone-1, PAU Campus, Ludhiana-141004, Punjab

Cont.....

KVK-wise Statement of Expenditure in respect of NICRA project for the year 2023-24

(Amount in Rupees)

KVK/ ATARI			ATARI	Bathinda	Faridkot	Gurdaspur	Moga	Total PAU	Chamba	Total YSPUHF	Kullu	Bilaspur	Mandi	Total CSKHPKV	Kathua	Poonch	Total SKUAST-J	Bandipora	Anantnag	Leh-I	Total SKUAST-K	Tehri Garhwal	Total VCSGUHF	Uttarkashi	Bageshwar	Total VPKAS	Champawat	Total GBPUAT	KVK Total	Grand Total
Revised Budget Estimate 2023-24	GENERAL	Operational	462863	949225	0	0	830855	1780080	902759	902759	0	839110	810000	1649110	773586	733000	1506586	919241	948000	770000	2637241	781000	781000	827000	870000	1697000	770000	770000	1172376	1218663 9
		TA	47137	22000	0	0	14145	36145	20000	20000	0	5890	35000	40890	71414	20000	91414	100000	60000	120000	280000	44000	44000	18000	75000	93000	42000	42000	647449	694586
		SCSP	0		2450000	525000	0	2975000	0	0	2300000	0	0	2300000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5275000	5275000
		Total	510000	971225	2450000	525000	845000	4791225	922759	922759	2300000	845000	845000	3990000	845000	753000	1598000	1019241	1008000	890000	2917241	825000	825000	845000	945000	1790000	812000	812000	1764622 5	1815622 5
	CAPITAL	Equipment	0	80000	0	0	80000	160000	80000	80000	0	80000	80000	160000	80000	79000	159000	80000	79000	85000	244000	80000	80000	80000	79000	159000	79000	79000	1121000	1121000
		SCSP	0	0	500000	139000	0	639000	0	0	500000	0	0	500000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1139000	1139000
		Total	0	80000	500000	139000	80000	799000	80000	80000	500000	80000	80000	660000	80000	79000	159000	80000	79000	85000	244000	80000	80000	80000	79000	159000	79000	79000	2260000	2260000
		TOTAL	510000	1051225	2950000	664000	925000	5590225	1002759	1002759	2800000	925000	925000	4650000	925000	832000	1757000	1099241	1087000	975000	3161241	905000	905000	925000	1024000	1949000	891000	891000	1990622 5	2041622 5
Opening Balance as on 1.04.2023			16026	6138	39564	0	1108	46810	46037	46037	0	40	186	226	161	13302	13463	0	0	0	0	17902	17902	1961	1917	3878	20000	20000	148316	164342
Refund during 2023-24			16026	6138	39564	0	1108	46810	46037	46037	0	40	186	226	161	13302	13463	0	0	0	0	17902	17902	1961	1917	3878	20000	20000	148316	164342
Expenditure during the Year 2023-24	GENERAL	Operational	462855	949225	0	0	830855	1780080	901810	901810	0	839110	810000	1649110	769436	728672	1498108	919241	948000	770000	2637241	762364	762364	820901	867043	1687944	770000	770000	1168665 7	1214951 2
		TA	47137	22000	0	0	14145	36145	20000	20000	0	5890	34916	40806	70839	19100	89939	100000	60000	120000	280000	43776	43776	17489	74974	92463	42000	42000	645129	692266
		SCSP	0	0	2450000	524997	0	2974997	0	0	2300000	0	0	2300000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5274997	5274997
		Total	509992	971225	2450000	524997	845000	4791222	921810	921810	2300000	845000	844916	3989916	840275	747772	1588047	1019241	1008000	890000	2917241	806140	806140	838390	942017	1780407	812000	812000	1760678 3	1811677 5
	CAPITAL	Equipment	0	80000	0	0	80000	160000	80000	80000	0	80000	80000	160000	80000	79000	159000	80000	79000	83999	242999	80000	80000	79948	78929	158877	79000	79000	1119876	1119876
		SCSP	0	0	500000	139000	0	639000	0	0	500000	0	0	500000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1139000	1139000
		Total	0	80000	500000	139000	80000	799000	80000	80000	500000	80000	80000	660000	80000	79000	159000	80000	79000	83999	242999	80000	80000	79948	78929	158877	79000	79000	2258876	2258876
		TOTAL	509992	1051225	2950000	663997	925000	5590222	1001810	1001810	2800000	925000	924916	4649916	920275	826772	1747047	1099241	1087000	973999	3160240	886140	886140	918338	1020946	1939284	891000	891000	1986659	2037651
Closing Balance	GENERAL	Operational	8	0	0	0	0	0	949	949	0	0	0	0	4150	4328	8478	0	0	0	0	18636	18636	6099	2957	9056	0	0	37119	37127
		TA	0	0	0	0	0	0	0	0	0	0	84	84	575	900	1475	0	0	0	0	224	224	511	26	537	0	0	2320	2320
		SCSP	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
		Total	8	0	0	3	0	3	949	949	0	0	84	84	4725	5228	9953	0	0	0	0	18860	18860	6610	2983	9593	0	0	39442	39450
	CAPITAL	Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1001	1001	0	0	52	71	123	0	0	1124	1124
		SCSP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1001	1001	0	0	52	71	123	0	0	1124	1124
		TOTAL	8	0	0	3	0	3	949	949	0	0	84	84	4725	5228	9953	0	0	1001	1001	18860	18860	6662	3054	9716	0	0	40566	40574

26/06/2024
Principal Investigator
ASHISH SANTOSH MURAI
Scientist (AE)
Indian Council of Agricultural Research
Agricultural Technology Application
Research Institute, Zone-1
PAU Campus, Ludhiana-141004

26/6/24
Finance & Accounts Officer
Assistant Finance & Accounts Officer
Indian Council of Agricultural Research
Agricultural Technology Application Research Institute
Zone-1, PAU Campus, Ludhiana- 141004

26/06/24
Director
निदेशक/Director
भा.कृ.अनु.प.-कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान
ICAR-Agricultural Technology Application Research Institute
क्षेत्र-1, पं.कृ.वि.परिसर, लुधियाना-141004, पंजाब
Zone-1, PAU Campus, Ludhiana-141004, Punjab

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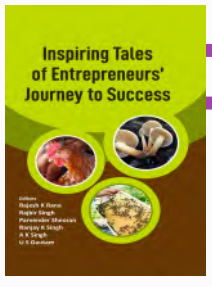

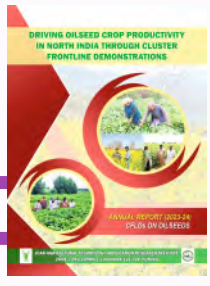

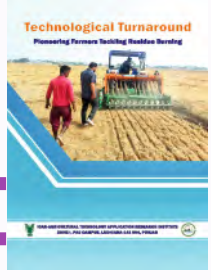

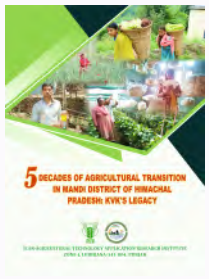

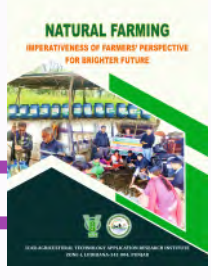

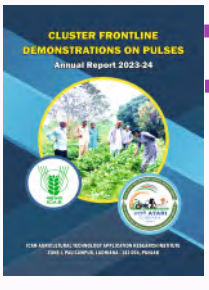

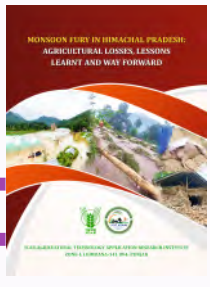

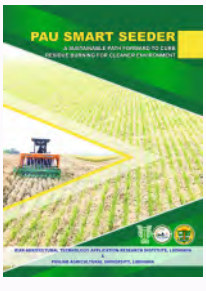

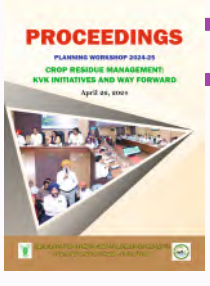

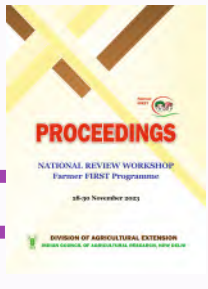

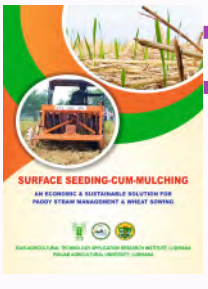

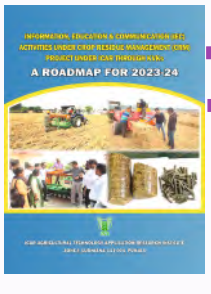

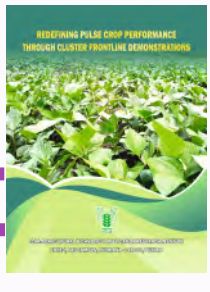

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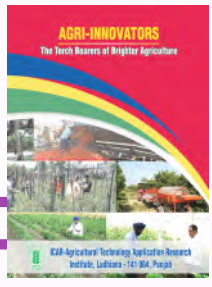

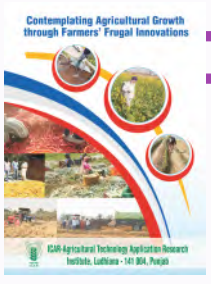

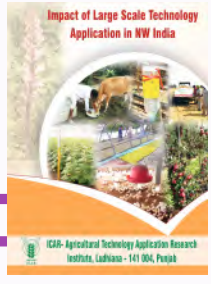

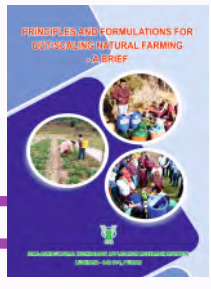

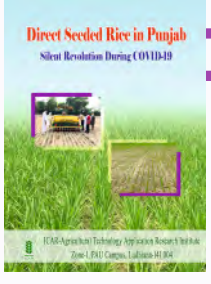

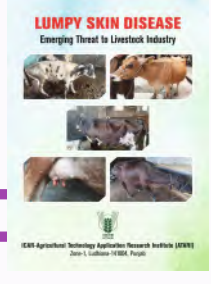

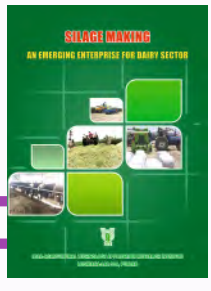

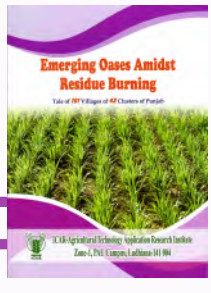

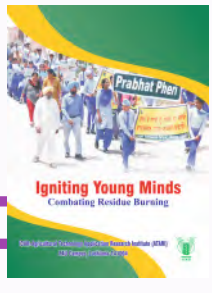

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