Promoting Climate Resilient Agriculture

Journey of 51 Climate Smart Villages

ICAR- Agricultural Technology Application Research Institute,
Zone-I, Ludhiana, Punjab

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

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PREFACE

Climatic phenomenon play significant role in India's food security and economy. The changes in these phenomenons affect agriculture and threaten food and nutritional security of the Indian population. Thus, it is very important to develop adaptation strategies to tackle the problems arising because of climate change. Looking into which, Indian Council of Agricultural Research (ICAR) initiated its network project called National Innovations in Climatic resilient Agriculture (NICRA) during February 2011 with the objectives to enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies.

Under NICRA project, Technology Demonstration Component (TDC) was implemented in climatically vulnerable districts across the nation to demonstrate package of proven technologies in agriculture and allied sciences for developing climate resilient agriculture in respective villages. Thus, ICAR-ATARI, Zone-I, Ludhiana executed the project through its Krishi Vigyan Kendras (KVKs) in a participatory mode in order to adapt and mitigate the climatic risks. The project activities were carried out in 13 districts of the Zone where location specific interventions were undertaken and capacity building of the farming community was also given equal concern.

Various technological interventions like in-situ moisture conservation measures, water harvesting, introduction of drought and temperature tolerant varieties, introduction of heat tolerant livestock species, capacity building of different stakeholder, establishment of community seed/fodder banks, communities' nurseries, etc. popularized among the farmers and farm women to deals with the issues of low productivity and profitability of agriculture and allied activities in wake of climate change. Above all, the vulnerability of agriculture to climatic vulnerability was to be addressed by these interventions. These interventions have been reported to bring about noticeable changes in the state of agriculture in the adopted villages under the project. Not just the production and productivity of the crops and livestock have improved significantly but also the community level interactions between the members for sharing scare resources and benefits have developed.

It is our privilege to put before you the salient achievement of TDC-NICRA project during 2016-17 to 2018-19 in this publication. We extend our sincere thanks Dr. Trilochan Mahapatra, Secretary, DARE and Director General, ICAR; Dr. A.K. Singh, Deputy Director General (Agricultural Extension), ICAR and officials of (NICRA-TDC) CRIDA for providing guidance and helping in bringing out this publication.

We also acknowledge the assistance received from Directors of Extension Education of various State Agricultural Universities of Zone-1; Programme Coordinators of NICRA KVKs and the most importantly the end-user of these technologies i.e. the farming community. We congratulate and duly acknowledge the sincere inputs of the dedicated team of Scientists of ATARI and the project staff for bringing this document in usable form.

We are sure that the efforts under this project will bear fruits in near future with the perceptions that farmers' will adopt these technologies for minimizing the losses and reducing the risk due to changing climate and variability.

Authors

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INTRODUCTION

Climate change has far serious implications concerning the food and nutritional security of nations like India where agriculture is the backbone of nation's economy and growing population is the biggest reason to worry. Rural India largely depends on its natural resources and farming for earning its livelihood and food security and climate change affects the natural ecosystem progressively. In future, it will be even more difficult to predict occurrences of phenomena such as droughts, floods, cloud bursts, etc. due to climate change. Consequently, farmers must adapt to the changing climate to ensure optimum crop yields and farm income. Farmers in general and small and marginal farmers in particular must enhance the resilience of agriculture to face the upcoming challenges. Transforming agriculture through adoption of climate resilient practices and technologies would be inevitable to stabilize agricultural production and enhance farmer's income.

Participatory demonstration of location specific and climate smart technologies is necessary for enabling farmers to cope climatic variability and extreme weather phenomenon. Adoption and spread of these climate resilient technologies would help farmers fetch adaption gains and reduce the Green House Gas (GHG) emissions alongside. Considering the urgent need to address the issue of climate change at the farm level, Indian Council of Agricultural Research (ICAR) launched National Initiatives in Climate Resilient Agriculture (NICRA) in February, 2011, which was renamed as National Innovations in Climate Resilient Agriculture (NICRA) to emphasize the role of evolving innovations. Resilience is the capability of the production system to resist negative impacts of climate change and also the capacity to recover quickly after the damage. Therefore, National Innovations in Climate Resilient Agriculture (NICRA) was formulated to develop and demonstrate region specific improved technologies that would enhance the resilience of Indian agriculture to climate change thereby addressing climate vulnerability and its negative impacts. The emphasis on adaptation to climate variability necessitates appropriate responses to contingency situations. Considering the need to enhance the resilience of Indian agriculture production system to climate variability and climate change, the center theme should be the Sustainability of the production systems facing natural resource degradation. Thus, the centre of attraction in NICRA is not the enhancement of productivity but the ability of the existing system to cope with the vulnerability and to improve the natural resource use efficiency for sustaining the productivity gains that have been achieved already. The project aimed to enhance resilience of Indian agriculture to climate change and climate variability through its different components namely Strategic Research, Technology Demonstration, Capacity Building and Sponsored/Competitive Grants.

TECHNOLOGY DEMONSTRATION COMPONENT (TDC-NICRA)

The Technology Demonstration Component of National Innovations in Climate Resilient Agriculture (NICRA) is meant for organizing the participatory demonstrations on climate coping technologies on the farmer's fields. These demonstrations were supported with capacity building programs and extension activities to popularize selected technologies and enable there adoption in the adopted as well as the nearby villages. Integrated packages of proven technologies are demonstrated in the villages for adaptation and mitigation of the crop and livestock production systems to climate variability. The component was initiated as a part of the NICRA project in 2011 for XII Five Year Plan and was subsequently extended up to March 2020 (Phase II) and the KVKs were now to extend their activities in nearby villages.

Objectives of TDC-NICRA Project

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and change through development and application of improved production and risk management technologies.
- To demonstrate site specific technology interventions on farmers fields for coping climatic variability in vulnerable districts.
- To create awareness and build capacity among farmers and stake holders on resilient agriculture.

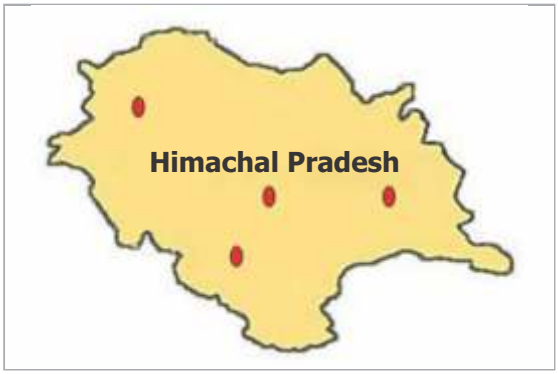
The KVKs and the respective villages covered under NICRA in the Zone-I for demonstration of climate resilient technologies are listed below:

Table 1: Details of Climate Smart adopted villages under NICRA in Zone-I

District/ KVK	Adopted Village	Additional villages	Climatic Vulnerability	Soil type
PUNJAB				
Bathinda	Kill Nihal Singh	Deon, Burj Mehma & Mehma Sarja	Drought / heat wave	Loamy
Faridkot	Pindi blochan	Ghuduwala and Veerewala	High temperature	Sandy loam
Fatehgarh Sahib	Badauchhi kalan	Attapur, Pandrali, Chaurwala and Bhitaunda	Frost / cold wave	Loam/sandy loam
Ropar	Rasidpur	Rampur Fasse, Mohan majra, Fatehgarh Viran and Behrampur Bet	Frost / cold wave	Sandy loam

District/ KVK	Adopted Village	Additional villages	Climatic Vulnerability	Soil type
HIMACHAL PRADESH				
Chamba	Lagga	Khalla, Khalnera, Banjar & Chacho	Cold wave / Drought/ Frost	Sandy loam
Hamirpur	Mann	Tareti, Ghumarta, Janglu-1, Janglu-2, Kuthera, Ranghar & Marhun	Drought	Sandy clay loam
Kinnaur	Telangi	Shudarang, Khwangi & Kohti	Cold wave / drought	Sand to loamy sand
Kullu	Chhoel Gaddauri	Seriber and Teguber	Drought / cold wave	Coarse loamy
JAMMU & KASHMIR				
Kathua	Said-sohal	Loukhali & Badholi	Drought	Sandy loam
Bandipora	Sumlar	Surrinder, Kudara, & Chountimulla	Drought	Silty clay loam
Pulwama	Wakherwan	Banderpora, Baderwan, Koil & Renzipora	Frost / cold wave	Silty clay loam
UTTARAKHAND				
Tehri Garhwal	Kaleth	Dabri & Indargaon	Cold Wave / Hail Storm / Drought	Sandy loam
Uttarkashi	Dunda	Asthal & Bharkot	Drought / Long dry spells	Sandy loam
HARYANA				
Yamunanagar	Radauri	-	Frost	Sandy loam
Sirsa	Rupana	-	Drought / heat wave	Sandy loam

During the second phase of NICRA, Haryana was shifted out and Uttarakhand was attached to the Zone. Thus, Zone-I has four states namely Punjab, Himachal Pradesh, Jammu and Kashmir and Uttarakhand.



Steps in demonstrating the climate resilient technologies:

- Analysis of climatic constraints of village based on long term data
- Assessment of natural resources status of the village
- Identification of major production systems
- Studying existing institutional structures and identity gaps
- Focus group discussion with the community to finalize the interventions

In order to address the climatic vulnerabilities of the selected villages, different interventions were planned under four modules, i.e. natural resource management, crop production, livestock and fisheries, and institutional interventions. Besides, capacity building to participating farmers on the tools and new technologies to be adopted to mitigate the climate related adversaries in crop production and animal husbandry is also being addressed. However, specific interventions

under each module for a particular village were need based and decided based on climatic vulnerability and resource situation of that village. The module wise achievements of KVKs during the year are detailed as under:

TECHNOLOGY MODULES

The module wise achievements of KVKs during the period under TDC-NICRA are detailed as below:

Module I: Natural Resource Management

This module consisted interventions related to in-situ moisture conservation; water harvesting and recycling for supplemental irrigation; water saving irrigation methods; green manuring for soil health and fertility improvement; urea application based on Leaf Color Chart (LCC) in paddy; laser leveling; paddy straw management through baler cum-knotter; vermi-composting, and alternate energy source (Bio-gas plant).

Module II: Crop production

During the period, crop production module consisted interventions such as demonstrations on drought/temperature tolerant varieties , short duration varieties in pulses and oil seeds; high yielding varieties; salt tolerant varieties of wheat; frost tolerant varieties; water saving paddy cultivation methods; zero tillage in wheat; location specific inter-cropping systems with high sustainable yield index; amelioration of manganese (Mn) deficiency; advancement of planting dates to reduce terminal heat stress; variety and disease management practices; crop diversification; integrated nutrient management etc.

Module III: Livestock & Fisheries

This module consists of use of community lands for fodder production during drought/floods, improved fodder/ feed storage methods, preventive vaccination, animal health check up camps, improved shelters for reducing heat stress in livestock, mitigation of mineral deficiencies in animals etc.

Module IV: Institutional Interventions

This module consists of institutional interventions such as seed bank, fodder bank, commodity groups, custom hiring centres, climate literacy through weather station etc.

NATURAL RESOURCE MANAGEMENT (NRM)

Interventions related to *in-situ* moisture conservation; water harvesting and recycling for supplemental irrigation; water saving irrigation methods; green manuring for soil health improvement; urea application based on leaf colour chart (LCC), happy seeder sown wheat, zero till cultivation, direct seeded rice, etc.

HAPPY SEEDER SOWING OF WHEAT FOR CROP RESIDUE MANAGEMENT

Paddy-wheat cropping sequence is prevalent in the states of Punjab and Haryana. Generally, in the region, farmers harvest the paddy crop with combine harvester and the residues left behind is burnt to clear the field for the next crop. During the period, KVKs of Bathinda, Fatehgarh Sahib, Faridkot, Ropar and Yamunanagar demonstrated the technology of happy seeder / zero tillage sowing of wheat in the standing paddy residues, which provides an alternative to the residue burning. Moreover, the recovery of lodged plants in happy seeder/zero till sown plots was less due less water stagnation. The conventionally sown fields suffered water logging up to 7 days, which has caused significant damage to the crop.

In Bathinda, sowing of wheat crop with Happy Seeder machine in the standing stubbles of rice without any tillage was demonstrated in the adopted village under the NICRA project. This technique saves labor and diesel and wheat crop is sown in the moisture which is already present in the soil which saves one irrigation (*rauni*) and time of 7-10 days. As per PAU, Ludhiana wheat crop sown one week later reduces 1.5 q/acre wheat yields. The KVK provided happy seeder drill and other inputs like Wheat seed (var. HD-3086/Unnat PBW-343), Raxil 6 FS (Tebuconazole), Tilt (propaconazole) & Topik (Weedicide) to farmers conducting demonstrations. Now the farmers are satisfied with the technology of wheat sown with happy seeder.

Demonstration on Wheat sown with Happy Seeder at Deon, Bathinda

Germinated Wheat between the Paddy residue

Table 2: Performance of demonstrations on wheat sown with Happy Seeder

District	Year	Variety	No. of Farmers	Area (ha)	Demo	Check	% Increase	Economics of demonstration (Rs./ha)			
								Gross Cost	Gross Return	Net Return	BCR
Bathinda	2016-17	PBW-725	9	7	52.6	51.2	2.7	28750	79910	51160	1.7
Bathinda	2017-18	PBW-725 &HD-3086	25	12	53.7	51.5	4.2	22500	93169	70669	3.1
Bathinda	2018-19	HD-3086 & Unnat PBW-343	29	15	58.7	54.6	7.5	23295	108008	84713	3.6
Faridkot	2016-17	PBW-725	5	6.5	51.4	50.6	1.6	31250	89179	57929	2.8
Faridkot	2017-18	PBW-725	72	28.8	55.9	53.9	3.7	34085	102856	68771	3.0
Fatehgarh Sahib	2016-17	HD-2967	18	20	50.63	49.6	2.0	32915	75945	43030	2.3
Fatehgarh Sahib	2017-18	PBW-725	22	55	55.00	51.78	6.2	50223	95425	45202	1.9
Fatehgarh Sahib	2018-19	PBW-725	23	75	53.00	50.2	5.5	26223	92750	66527	2.5
Ropar	2016-17	HD-2967 & PBW-725	30	28.8	47.5	47.1	0.8	29700	90000	60300	3.0
Ropar	2017-18	HD-2967 & PBW-725	35	37.5	48.0	47.5	1.0	30100	94500	64400	3.1
Ropar	2018-19	HD-2967 & PBW-725	80	85	53.1	48.7	9.0	30875	97700	66825	3.1
Yamunagar	2016-17	HD-2967	105	115	56.30	53.26	5.7	29600	91487	61887	3.0

Similarly in Faridkot, before initiation of the project, farmers of the village were practicing traditional methods of wheat sowing after harvesting of paddy crop i.e. burning of paddy straw followed by irrigation then harrowing, cultivators, planking and then sowing with seed cum fertilizer drill. Happy seeder sowing of wheat prevents late sowing that otherwise may lead to reduction in yield to the tune of 0.4 to 1.5 q/acre. To promote this technology KVK has organized awareness camps, imparted training, provided machines etc. The KVK provided happy seeder drill

along with other inputs like wheat seed (PBW-725), Raxil 6 FS (Tebuconazole), Tilt (propaconazole) and Topik (weedicide) to conduct demonstrations. During the period, demonstrations on happy seeder were conducted on the fields of 77 farmers covering 35.3 ha. As a result, about 116 ha have been brought under this technology in the adopted village under NICRA. Farmers were also satisfied with the crop yield they achieved sown with this technology.

In Fatehgarh sahib, wheat sowing with happy seeder has been promoted by demonstrating it in NICRA village Badhouchhi Kalan and adjoining villages Attapur, Pandrali, Chaurwala on 150 ha with 63 farmers. The results have been very encouraging for the farmers. Alongside, 22 demonstrations were also conducted on rodent control in wheat sown with Happy Seeder. Thus, Bromodialone application was demonstrated in the farmer's field, which reported about 90 percent control in terms of rodent attack. Similarly, seed inoculation with Seedax was also demonstrated during 2018-19. Likewise, Krishi Vigyan Kendra, Ropar encouraged the farmers to sow wheat with happy seeder. Two happy seeder machines with press wheels were provided for sowing of wheat in NICRA adopted villages.

In Yamunagar (Haryana), during 2016-17, 180 demonstrations on cultivation of wheat variety HD-2967 using Happy Seeder were organized on 105 farmers' fields covering an area of 115 ha. The results shown that in demonstrations, the yield obtained was 56.30 q/ha, which was only 54.10 q/ha for the conventional sowing of wheat. Moreover, the net return was Rs. 61887/ha for happy seeder sown wheat as compared to that of Rs. 51172/ha of conventional sown wheat. Thus, the BC ratios were 3.09 and 2.39 for happy seeder sown and conventional wheat respectively.

Zonal Monitoring Committee visits a plot in Faridkot

Diagnostic visit in Fatehgarh Sahib

Zero Tillage for sowing wheat:

Zero tillage is the process where the crop seed will be sown through drillers without prior land preparation and disturbing the soil where the previous crop stubbles are present. Sowing wheat with

Zero Till Drill was demonstrated in the farmer's field to residue cost of cultivation in terms of land preparation and sowing. Thus, in Bathinda, demonstrations were organized in 41 farmers' fields.

Similarly, in Faridkot, demonstrations on sowing wheat variety HD-3086 with zero till drill were conducted in 62 ha during the period. The demonstration recorded nearby 5 per cent yield increase over conventional sowing of wheat and significant reduction in cost of cultivation.

Table 3: Performance of demonstrations on wheat sown with zero till drill

District	Variety	Year	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)			
					Demo	Check		Gross Cost	Gross Return	Net Return	BCR
Bathinda	PBW-725	2016-17	05	12	45.5	45.2	0.6	25200	75030	49830	1.9
Bathinda	PBW-725 HD -3086	2017-18	36	16	52.7	47.5	10.9	25200	91434	66234	2.6
Faridkot	HD-3086	2016-17	68	16.6	54.9	52.3	5.0	30000	89261	59261	2.97
Faridkot	HD-3086	2017-18	82	16.6	54.6	52.8	5.6	30350	94731	64381	3.12
Faridkot	HD-3086	2018-19	72	28.8	55.9	53.9	3.7	34085	102856	68771	3.02

Management of paddy residue with Baler-cum-knotter:

Paddy straw burning has been resulting in respiratory and allergic problems in both human as well as animals due air pollution in a short span. Thus, Baler-cum-knotter was demonstrated in the NICRA villages as an option for paddy straw management. In this technology, paddy crop is harvested with combine without SMS followed by cutting of the straw by ordinary reaper. There after raking is done to windrow the straw in the field and then baler forms the bales which are collected manually and then transported to the thermal plant or the place where they are to be used. After the operation, wheat was sown with zero till drill in the clear fields. Approximate weight of one bale is 15-25 kg depending upon the size of bale and moisture content of the straw. It takes about 1.0-1.5 hour for making bales from one acre area and about 1.25- 1.5 kg twine for making bales from an acre. This plastic twine is different from ordinary thread and is easily available at registered firms. One baler can covers about 8-10 acres per day. About 150-200 bales were made from one acre area. A baler consumes about 45-50 litre of fuel in a day. The KVKs managed the inputs like tractor, diesel and twine for conducting these demonstrations. So, this machine can prove to be a boon for farmers as it prevents environmental pollution caused by burning of straw.

KVK, Bathinda used this machine at its adopted village Kili Nihal Singh to make bales from 178 ha area belonging to 136 farmers during the period, which were marketed at Malwa Powers,

Gulabewala (Sri Muktsar Sahib). About 20 to 30 q of straw was baled from one acre land. The bundles of straw were sold @ Rs. 50/q from the farmers' field and Rs. 110/q at the factory site. In this way, farmers got Rs. 1000 to 1500 per acre as an additional income. The farmers are able to sow their wheat crop one week earlier as compare to traditional practices followed by farmers as burning of paddy straw and tillage etc.

Raking and Baling of Paddy straw in Bathinda

District Collector, Bathinda interacting with the KVK Staff & Farmers

Likewise, the technology was readily adopted in KVK, Faridkot's village under NICRA project i.e. Pindi Blochan where more than 75% of area under paddy crop is baled, and has widely spread in other operational villages (Ghuduwala, Veerwala and Kingra) and neighboring villages (Marar, Behlewala, Kaniawali etc.). The farmers are earning good amount by selling the bales to the thermal plant, briquetting units, cardboard factory etc. The numbers of machine are increasing in the area year after year. Earlier, baler owner used to make bales free of cost, but during previous year they have started charging Rs 500/- from the farmers. The KVK has made available one zero till drill machine in the village (Pindi Blochan) and looking at the advantage of the machine at present 15 machines are operational the village. Similarly, in Ropar, the use of baler is getting popular amongst the farmers.

OTHER CROP RESIDUE MANAGEMENT OPTIONS

Chopper cum shredder for paddy straw management: During 2016-17, 15 demonstrations on use of chopper cum shredder were organized on 15 ha area in Bathinda, which were then increased to 58 demonstrations on 50 ha during 2017-18 and 2018-19. Similarly, in Ropar, the demonstrations on 2 ha area revealed a marginal yield increase in wheat crop.

Table 4: Performance of demonstrations on wheat sown after Paddy Straw Management with Chopper cum shredder

District	Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% In-crease	Economics of demonstration (Rs./ha)			
					Demo	Check		Gross Cost	Gross Return	Net Return	BCR
Ropar	HD-2967	2018-19	05	02	48.0	47.2	1.6	30500	88000	57500	2.88

Demonstration on Chopper in Bathinda

Field after an operation of Chopper

Incorporation of paddy straw with disc harrow:

Incorporation of straw is one residue management option which was demonstrated in Ropar on 25 ha during 2017-18 and 2018-19. The paddy straw was mixed in soil with disc harrow and sowing of wheat was done using traditional seed drill.

Table 5: Performance of demonstrations on wheat sown after paddy straw management with disc harrow

District	Variety	Year	No. of Farmers	Area (ha)	Yield (q/ ha)		% Increase	Economics of demonstration (Rs./ha)			
					Demo	Check		Gross Cost	Gross Return	Net Return	BCR
Ropar	HD-2967	2017-18	20	5	48.0	47.0	2.12	31500	91000	59500	2.88
Ropar	HD-2967	2018-19	30	20	48.8	47.2	3.38	32220	92750	60530	2.89

Laser Land Leveling for Resource Conservation:

Declining water table and degrading soil health are the major concerns for sustainability of the Indian Agriculture. Therefore, emphasis is being given on the efficient use of irrigation water and optimum utilization of other natural resources. Laser Land Leveler is one such technology which helps in uniform application of irrigation water thereby saving irrigation water up to 10-15 percent and resulting in 2-5percent increase in yield. Under NICRA project, demonstrations were conducted on laser land leveling on farmers' fields in rice –wheat systems to promote this resource conservation technology and inculcate a habit of optimum resource utilization among the farmers of Punjab and Haryana.

In all the NICRA villages of Punjab and Haryana, the entire farming area laser leveled and every year about 1/3 area is laser leveled, as it is recommended to get the field laser leveled after every three years. Moreover, in Faridkot, due to the efforts of KVK and the line department about 90 percent cultivable area is leveled by this machine in the district. The KVK demonstrated cultivation of paddy variety PR-114 on a leveled field which gave following results:

Table 6: Performance of demonstrations in Laser leveled fields

District	Crop /Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% Increase	% Water Saving	Economics of demonstration (Rs. / ./ha)			
					Demo	Check			Gross Cost	Gross Return	Net Return	BCR
Faridkot	Paddy (PR-114)	2016-17	93	281	76.7	76.2	0.6	26	39100	111215	72115	2.84
Faridkot	Paddy (PR-114)	2017-18	127	248	77.2	76.5	0.9	29	42200	119660	77460	2.83
Faridkot	Paddy (PR-114)	2018-19	46	263	76.6	76.1	0.6	28	42850	134050	91200	3.12
Yamuna-gar	Paddy (PR-01)	2016-17	10	4.5	48.7	48.5	0.4	27	34600	107140	72540	3.09
Yamuna-gar	Wheat (HD-2967)	2016-17	10	6.0	54.6	54.6	0	17	32600	91650	61253	2.81

Likewise, the demonstrations in Yamunagar in 2016-17 revealed 27 percent irrigation water saving in paddy crop and 17 percent in wheat crop due to laser land leveling.

Direct Seeded Rice (DSR) for increased water use efficiency:

It is an irrigation water saving alternatives to the transplanted paddy in which problems like labour

shortage during peak demand can be avoided. DSR gives the flexibility to take up direct sowing of paddy with a suitable duration variety to fit into the left over monsoon season. This allows timely sowing of wheat in the next season as well. Moreover, the energy demand for pumping of irrigation water is also less and saving can be much higher during deficit rainfall situations compared to the transplanted rice. Rice can be directly seeded either through dry or wet seeding. Dry seeding of rice can be done by drilling the seed into a fine seedbed at a depth of 2-3 centimeters. Wet seeding requires leveled fields to be harrowed and then flooded. The field is left for 12-24 hours after flooding, and then germinated seeds (48-72 hours) are sown using drill. Weed management is a critical factor in direct seeding. Timely application of herbicides provides effective control, spray 1 litre Stomp/Bunker 30 EC per acre in moist soil within 2 days of sowing.

KVK, Bathinda conducted demonstrations on direct seeding rice in which farmers were provided with seed (Var. PR-127 and Basmati-1121), Stomp 30 EC (Pre-emergence weedicide) and Tilt (Fungicide). In Faridkot, during last few years, the availability of migratory laborers has reduced and farmers are facing labour shortage for transplanting of paddy, thereby increasing the cost of transplanting to Rs. 3000-3500/- per acre. Under direct seeding of paddy, a yield up to 30q per acre was obtained which was comparable to yield obtained in conventional transplanting of paddy. Moreover, there was saving of Rs. 3000/- per acre and saving of 15-20 per cent of irrigation water. By seeing the success of direct seeding in trials and demonstrations farmers have adopted this technique on large scale. During kharif 2018, 64 ha were sown by direct seeding in the NICRA village.

In Fatehgarh Sahib, the demonstrations were conducted on water saving paddy cultivation method i.e. direct seeding of paddy during 2016-17 by cultivating Pusa Basmati-1509. In Yamunanagar (Haryana), during 2016-17, demonstrations on DSR which helped farmers in saving precious irrigation water.

Direct seeded rice sowing in Bathinda

Table 7: Performance of demonstrations on Direct Seeded Rice (DSR)

District	Year	Variety	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)			
					Demo	Check		Gross Cost	Gross Return	Net Return	BCR
Bathinda	2016-17	PB-1121	10	08	23.8	23.2	2.5	36250	41650	5400	0.1
Bathinda	2016-17	PR-124	10	20	46.8	43.2	8.3	34000	131040	97040	2.8
Bathinda	2017-18	PR-124	20	10	46.1	44.2	4.2	34300	142910	108610	3.1
Bathinda	2018-19	PR-127	33	12	50.8	49.2	3.2	35550	157480	121930	3.4
Faridkot	2016-17	PR-126	5	2	51.6	50.1	2.9	32000	82850	50850	2.5
Faridkot	2017-18	PR-126	25	10	52.4	50.6	3.6	32300	90957	58657	2.8
Faridkot	2018-19	PR-126	15	6.6	74.5	72.6	2.6	36250	130375	94125	3.5
Faridkot	2016-17	PB-1121	5	2	52.1	51.2	1.7	32000	84662	52662	2.6
Faridkot	2017-18	PB-1121	5	2	52.8	51.4	2.7	32300	91608	59308	2.8
Faridkot	2018-19	PB-1121	6	2	53.75	52.6	2.19	34875	98900	64025	2.8
Fatehgarh Sahib	2016-17	PB-1509	5	2	32.5	32.5	0	23329	47125	23796	2.0
Yamunanagar	2016	Sava-127	3	1.2	79.34	78.73	0.8	29800	118882	89082	3.9
Yamunanagar	2016	PR-116	5	2	77.50	75.73	2.3	30370	114352	883892	3.7
Yamunanagar	2016	NK-3325	11	4.4	65.83	65.08	1.2	30420	98270	67850	3.2
Yamunanagar	2016	PB-1121	1	0.4	50.25	50.10	0.3	33500	110220	76720	3.2
Yamunanagar	2016-17	PB-1	3	1.2	47.20	46.30	1.9	33100	101860	68760	3.0

In-situ moisture conservation through mulching:

Mulching in Sugarcane: Demonstrations on mulching in sugarcane were organized for in-situ moisture conservation measure in Faridkot. Demonstrations revealed that the mulching saves 2-3 irrigations in the farmers' fields along with as much as 40 percent reduction in the weed infestation.

Table 8: Performance of demonstrations on mulching in sugarcane

Year	No. of Farmers	Area (ha)	Economics of demonstration (Rs./ha)		
			Gross Cost	Net Return	BCR
2016-17	2	4.0	104737 (main crop) 65738 (ratoon)	153588 163157	2.46 3.48
2017-18	3	5.5	104737 (main crop) 65738 (ratoon)	153588 163157	2.46 3.48
2018-19	2	7.5	121487 (main crop) 82488 (ratoon)	172195 203759	2.42 3.46

Mulching in Pomegranate and capsicum: Use of black polythene sheet for mulching was demonstrated in pomegranate and capsicum crops to overcome the drought like situation in the NICRA village in Kullu.

Table 9: Performance of demonstrations on mulching in pomegranate and capsicum

Crop	Year	No. of Farmers	Area (ha)	Yield (q)	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Pomegranate	2016-17	10	3.5	10560/ha	98250	316800	218550	3.22
	2018-19	2	4.1	10230/ha	115000	360000	245000	3.13
Capsicum	2018-19	1	0.04	2804/250m	13500	70100	56600	5.19

Mulching in Pomegranate

Black Ploythene mulching in Capsicum

Mulching in Colocasia: Biomass mulching for in-situ soil moisture conservation was demonstrated in 43 farmers' fields cultivating Colocasia in Hamirpur, which have reported reduction in the number of irrigation applied to just four and number of weeding and hoeing operations performed to just two.

Table 10: Performance of demonstrations on mulching in colocasia

Year	No. of Farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs./ha)			
				Gross Cost	Gross Return	Net Return	BCR
2016-17	13	1.0	200	8000	20000	12000	2.3
2017-18	15	1.2	214	80000	264000	184000	3.3
2018-19	15	1.2	220	100000	308000	208000	3.08

Mulching in apple: Demonstrations of mulching in apple orchards were organized by KVK, Chamba.

Table 11: Performance of demonstrations on mulching in apple in Chamba

Year	No. of Farmers	Area (ha)	Yield (q/ha)		Economics of demonstration (Rs./ha)			
			Demo	Check	Gross Cost	Gross Return	Net Return	BCR
2017-18	4	0.2	4000	3400	80000	252000	172000	2.15
2018-19	4	0.2	4200	3400	90000	252000	172000	1.91

Similarly, the demonstrations on use of black lining poly mulch under Apple basin to conserve the moisture and management of basin were conducted in the farmers' fields in Kinnaur.

Table 12: Performance of demonstrations on mulching in apple in Kinnaur

Year	No. of Farmers	Area (ha)	Yield (q/ha)		Economics of demonstration (Rs./ha)			
			Demo	Check	Gross Cost	Gross Return	Net Return	BCR
2017-18	5	0.5	120.0	86.78	120000	576000	456000	3.8
2018-19	4	0.8	165.7	138.1	198840	795360	596520	3.0

Likewise, in Uttarkashi, mulching with black polythene was demonstrated in 2ha area.

Mulching in tomato and Capsicum: Mulching with Check grasses in tomato in 2 ha of 39 farmers and capsicum in 2 ha of 40 farmers was demonstrated in Tehri garhwal.

Green manuring for improving soil health:

Green manuring is the practice of ploughing or turning of un-decomposed green plant tissues into the soil for purpose of improving physical condition as well as fertility status of soil. During the

period, four KVKs of Punjab and Haryana (Bathinda, Fatehgarh Sahib, Faridkot and Yamunanagar) conducted demonstrations on Sunhemp/dhaincha as green manuring crops at the farmer's fields. After harvesting of the preceding crop, pre-sowing irrigation (rauni) is given and 20 kg dhaincha seed is sown which is pre-soaked in water for 8 hours up to the first week of May. Six to eight weeks old dhaincha is buried in soil one day before transplanting of paddy. Dhaincha is preferred in kallar and recently reclaimed soils. This practice results in saving of 25 kg of N (55 kg urea) per acre. KVK, Bathinda provided seed of dhaincha to farmers of the adopted villages for green manuring. Every year 30 demonstrations on green manuring of Jantar variety of dhaincha is organized in 20 ha area of 30 farmers of the NICRA village.

In Faridkot, the KVK has conducted demonstration on cultivating dhaincha on area of 98 ha at 68 farmers' fields of the operational villages. Viewing the benefits of dhaincha demonstrations, farmers of the operational villages and other nearby villages have taken up dhaincha as green manuring on area of more than 250 ha at their own levels, which was practiced by very few progressive farmers in these villages before the commencement of NICRA Project. In Ropar, total 90 demonstrations were conducted on green manuring in which 56 farmers participated. These demonstrations, in 2016-17 and 2017-18, were laid in 36 ha area. Similarly, in Badauchhi village of Fatehgarh Sahib, cultivation of sunhemp as a green manuring crop was demonstrated in 52 ha with 55 farmers, which was reported to save 1/3rd nitrogen in cultivation of rice and 1/2 nitrogen in basmati rice.

Moreover, in Yamunanagar, demonstrations were organized on green manuring with dhaincha to improve soil health & fertility before cultivating paddy.

Table 13: Performance of demonstrations of effect of green manuaring

Variety	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Check		Gross Cost	Gross Return	Net Return	BCR
PB- (Paddy)	10	36	54.25	53.89	0.6	36662	111212	74550	3.03

Leaf Colour Chart for application Nitrogenous fertilizer:

Nitrogen (N) is the most important nutrient which is essential for photosynthesis and the yield. Leaf Colour Chart (LCC) is a cheap, fast, and handy field instrument to measure green color intensity of

leaf, which is related to the plant's nitrogen content and N can be managed effectively at real time during all the stages of crop growth by using LCC. The demonstrations were conducted at the farmer's field in Faridkot. Total 58 farmers participated in the demonstrations covering 25.6 ha area.

Table 14: Performance of demonstrations on N application using Leaf colour chart

Crop and Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)			
				Demo	Check		Gross Cost	Gross Return	Net Return	BCR
Wheat (PBW-1)	2016-17	4	1.6	52.4	52.2	0.4	34875	96416	61541	2.76
Wheat (Unnat PBW-343)	2017-18	2	0.8	51.8	50.9	1.8	34875	95312	60437	2.73
Wheat (HD-3086)	2018-19	39	15.6	55.8	54.2	2.95	35480	104512	69032	2.94
Paddy (PR-114)	2016-17	5	2	75.6	74.4	1.60	38250	109620	71370	2.86
	2017-18	8	5.6	55.4	53.2	4.14	31500	96119	64619	3.0

Table 15: Results of application of urea with Leaf Colour Chart (LCC)

Technology demonstrated	Urea (kg/ha)	% Saving of Urea	Yield (q/ha)
Fertilizer application using Leaf Colour Chart in Paddy	250	9.1	72.4
Without use of Leaf Colour Chart in paddy	275	--	62.0

Tensiometer for scheduling irrigation in paddy:

Use of Tensiometer was demonstrated for scheduling irrigation to the paddy (PR-114) crop in the farmers' fields of NICRA village of Faridkot. The demonstration fields reported saving of 4-6 irrigations during 2016-17 and 2017-18 and 3-4 irrigations in 2018-19.

Table 16: Performance of demonstrations on use of Tensiometer for scheduling irrigation

Year	Variety	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)			
				Demo	Check		Gross Cost	Gross Return	Net Return	BCR
2016-17	PR-114	2	10.4	75.6	75.2	0.5	38250	109620	71370	2.86
2017-18	PR-114	4	14.8	76.4	75.7	0.9	41500	118420	77460	2.84
2018-19	PR-114	4	15.2	76.5	75.6	1.1	42250	133875	91625	3.17

Farm Yard Manure (FYM) and Vermicomposting:

Farm Yard Manure pits were established in NICRA villages to provide quality manure for the farmer's field for improving soil health and fertility. During 2016-17, KVK, Bathinda organized 10 demonstrations on FYM. In Fatehgarh sahib, farmers were trained and helped to establish the vermi-compost unit. These effects have augmented the availability of organic resources within the village and are playing major role in improving soil health and productivity. Four such units were established benefitting 8 farmers.

During the period, 55 units were established for the production of vermicompost in the NICRA village in Hamirpur, which helped the farmers produce 1.25q (dry basis) vermicompost from each units in a season. The use of this vermicompost has reported reduction in nutrient application by 15-20 percent. KVK, Bandipora also organized 30 demonstrations during the period reporting similar results. KVK, Uttarkashi demonstrated vermicomposting with Tetra Vermi Beds with 30 units, which produced 315 q compost in 2016-17 and 330 q compost in 2018-19.

Biogas as an alternate energy source:

Earlier, families of the NICRA villages were dependent on the LPG and other traditional sources of energy for cooking. Generally, dung is available in abundance and it is disposed in open heaps, producing Methane – the major green house gas (GHG) responsible for climate change. Therefore, KVKs under NICRA project installed biogas plants for alternate source of energy. After the start of NICRA project and subsequent motivation of the farmers, the villagers started tilting towards Biogas.

Fuel (energy) requirement is increasing day by day and the sources of energy are depleting at very fast pace. To meet the daily requirement of fuel, the KVKs are guiding farmers regularly to adopt the systems like a biogas plant. Expenditure incurred on construction of a biogas plant is Rs.26500/-. This in turn helps saving of 7-8 LPG cylinders every year worth Rs. 5600-6400/-. It also reduces the usage of fuel wood, kerosene etc. The technology also leads to production of quality organic manure, helps in environmental sanitation, reduction in drudgery, lowers the greenhouse emissions

etc. Now, there are at least 18 biogas plants in Badauchhi Kalan, 35 in Killi Nihal Singh, 6 in Fatehgarh Viran and 12 biogas plants in Pindi Blochan are functional.

In Pulwama, 9 units of portable biogas plant were established to demonstrate biogas as an alternate source of energy. The farmer use biogas for household cooking purposes and the slurry is used in apple orchards as organic manure. Establishing each unit of 1 m3 costs about Rs. 23500/- which produces gas enough for nearly two hours of cooking and saves one LPG cylinder worth Rs. 800/- in a year.

Water harvesting and recycling for supplemental irrigation and water saving irrigation methods:

In Kullu, four water harvesting structures were constructed with the capacity of 1.1 lakh liter and demonstration on cultivation of vegetable crops in rained area of the village by providing life saving irrigation during dry spells were organized. Looking at the success of the intervention, 31 similar structures were established under MGNREGA of 6.4 lakh liter and eight tanks of 2.3 lakh liter capacity by Department of Agriculture. Now, the total capacity has reached to 9.8 lakh liter with the command area of 20 ha. This in turn, has increased the gross irrigated area of the NICRA village from just 15 percent to 35 percent; thereby triggering the shift from cultivating traditional crops (wheat, maize) to vegetable crops (tomato, garlic) fetching net return of Rs. 280,000/ha which was only Rs. 150,000/ha. During the period, KVK, Kullu organized demonstration on cultivation of crops by providing life saving irrigation during dry spells. Total three life-saving irrigations were given to crops like tomato during the season. The cost benefit ratio was as high as 4.31 in case of tomato crop as compared to that of just 1.2- 1.5 in case of maize.

Table 17: Performance of demonstrations on irrigation water saving methods

Technology demonstrated	Year	No. of Farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Life saving irrigation through water carrying pipes in tomato	2016-17	35	4.6	33650	98250	403800	305550	4.10
	2018-19	20	5.8	34520	120000	517800	397800	4.31
Micro irrigation in Pomegranate	2016-17	2	0.40	94400	93594	283200	189606	3.02
Micro irrigation in Tomato	2016-17	2	0.16	38060	110250	456720	346470	4.14
	2018-19	2	0.32	38280	125000	574200	449200	4.60
Micro irrigation in Tomato	2016-17	42	6.0	11956	85600	85600	273080	4.19
	2018-19	40	8.5	13100	78500	78500	249000	4.17

Water storage structures

Sprinkler irrigation in Garlic

During the period, in Uttarkashi, 85 forest trenches were restored to stop the water runoff and to recharge available water resources. Eight existing LDPE tanks were renovated and 10 new tanks were constructed to provide live saving irrigation for off-season vegetable crops. The demonstrated crops have reported about 30 percent yield increase as compared to the Check check.

Table 18: Performance of demonstrations on irrigation water saving methods

Crop/ Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)			
				Demo	Check		Gross Cost	Gross Return	Net Return	BCR
Cabbage (NS-138)	2017-18	21	1.0	250.0	192.5	29.8	36345	250000	213655	6.87
Pea (Arkel)	2017-18	28	1.0	110.5	80.25	37.6	31200	276650	245450	8.86

Construction of LDPE tanks at village Bharkote in Uttarkashi

Water filled LDPE tanks at village Bharkote in Uttarkashi

In Kathua, ploughing across the slope was demonstrated to provide stiff resistance to the runoff and amplify the time of concentrations for percolation of water. Similarly, deep summer ploughing was also demonstrated to reduce the velocity of runoff water and its erodability. It also reduced incidence of pests & diseases infestation. Moreover, rain water harvesting has helped farmers of the area grow upland Paddy. New variety Pusa-1509 was introduced in the area and the critical irrigation required towards crop maturity was provided through renovated ponds. Strengthening of farm bunds and growing high yielding grasses (Napier sp. Steria) on community lands was also demonstrated. It helped to ensure availability of fodder during lean period, soil binding and strengthening of the slopes. Cultivation of fodder trees (Bauhinia, Bamboo, Terminalia chebula, Terminalia bellirica, E. Officinalis etc.) were demonstrated for strengthening farm bunds, arresting of soil and checking soil erosion.

Orchard floor management in Apple:

Clear basin management in apple was demonstrated to reduce the competition between the apple plants and other agricultural crops in Kinnaur. The demonstrations reported about 11.5 percent yield increase as compared to the Check check.

Table 19: Performance of demonstrations on Orchard floor management in Apple

Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Check		Gross Cost	Gross Return	Net Return	BCR
2017-18	10	6.4	153.0	137.1	11.5	159180	734400	575220	3.6
2018-19	10	6.4	155.0	139.0	11.5	150800	754500	603700	4.0

CROP PRODUCTION

During the period, crop production module consisted interventions such as demonstrations on drought/temperature tolerant varieties; short duration varieties of pulses and oil seeds; high yielding varieties; salt tolerant varieties of wheat; frost tolerant varieties; water-saving paddy cultivation methods; zero-tillage in wheat; location specific inter-cropping systems with high sustainable yield index; advancement of planting dates to reduce terminal heat stress; variety and disease management practices; crop diversification and integrated nutrient management etc.

DROUGHT/TEMPERATURE TOLERANT VARIETIES

KVK, Faridkot demonstrated temperature tolerant wheat varieties HD-3086, HD-725, Unnat PRW-343, Unnat PBW-550, in farmers' fields in 16.2 ha area. During 2016-17, temperature tolerant variety HD-3086 covered 4 ha area and produced 3 percent higher yield than the Check check. Similarly, HD-725 gave 2.4 percent, Unnat PBW-550 and Unnat PBW-343 gave 0.6 percent and 1.4 percent higher yields over the Check checks respectively. Likewise, KVK, Bandipora organized demonstrations on temperature tolerant varieties of crops like sorghum, tomato, brinjal etc.

Table 20: Performance of demonstrations on drought/temperature tolerant varieties

District	Crop/ Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Faridkot	Wheat (HD-3086)	2016-17	10	4	54.2	52.3	3.0	2.75	2.65
Faridkot	Wheat (HD-725)	2016-17	25	10	51.3	50.1	2.4	2.60	2.54
Faridkot	Wheat (Unnat PBW-343)	2017-18	2	5	51.1	50.8	0.6	2.70	2.46
Faridkot	Wheat (Unnat PBW-550)	2018-19	4	1.6	52.5	51.8	1.4	2.77	2.56
Bandipora	Sorghum (M.P.Cherry)	2016-17	11	3.53	390.0	280.0	35	1.54	0.82
		2017-18	09	2.5	391.0	281.0	39	1.57	0.82
Bandipora	Tomato (Marglobe)	2018-19	21	0.4	198.0	125.0	58	2.09	1.08
Bandipora	Brinjal (PPL)	2018-19	11	0.25	165.0	105.0	57	2.92	1.62

Similarly, KVK, Kullu demonstrated drought tolerant varieties (HPW-349, HPW-155, HPW-368, HS-542) covering 75 ha area. KVK, Tehri garhwal demonstrated drought tolerant varieties of finger millet, soybean, barnyard millet etc. Demonstrations on drought tolerant varieties of maize and sesame paddy were organized in NICRA village of Kathua covering 27.3 ha area.

Demo plot of HPW-368 in Kullu

Comparison between demo (HPW-368) and farmers' practice in Kullu

Table 21: Performance of demonstrations on drought/temperature tolerant varieties

District	Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Kullu	Wheat (HPW-349)	2016-17	27	5.0	32.3	26.9	20.07	1.72	1.43
		2017-18	70	10.4	29.60	26.0	13.84	1.53	1.37
Kullu	Wheat (HS-542)	2017-18	18	3.0	30.90	25.80	19.76	1.59	1.36
Kullu	Wheat (HPW-155)	2017-18	35	10.0	31.1	26.9	15.61	1.64	1.43
Kullu	Wheat (HPW-368)	2016-17	14	5.0	33.4	26.9	24.15	1.77	1.43
		2017-18	31	6.6	31.00	25.40	22.04	1.60	1.34
		2018-19	126	30.0	36.50	28.40	28.48	1.74	1.42
Tehri Garhwal	Finger Millet (PRM-1)	2016-17	55	5.5	10.2	8.5	20.0	1.89	1.45
Tehri Garhwal	Soybean (PS-1225)	2016-17	106	5.0	6.20	5.80	6.8	1.18	1.19
Tehri Garhwal	Bamyard Millet (PRJ-1)	2016-17	60	6.0	12.0	0.95	26.3	2.25	1.45
Tehri Garhwal	Wheat (HS-507)	2016-17	46	1.0	13.5	9	50.0	1.56	1.29
		2017-18	43	2.0	12.5	9.50	31.5	1.58	1.38
		2018-19	60	3.0	13.0	10.00	30.0	1.65	1.35
Tehri Garhwal	Wheat (VL907/VL-892)	2016-17	34	6.0	14.5	11	32.0	1.61	1.5
		2017-18	40	2.0	13.0	9.50	36.8	1.68	1.38
		2018-19	60	3.0	13.5	10.00	35.0	1.70	1.35
Tehri Garhwal	Wheat (UP 2572)	2017-18	40	2.0	12.0	9.50	26.3	1.48	1.38
		2018-19	32	2.0	13.5	10.00	35.0	1.70	1.35
Tehri Garhwal	Wheat (PL 08)	2018-19	35	2.0	11.5	8.50	35.2	2.37	1.92
Kathua	Maize (Double Dekalb)	2016-17	25	6.0	32.5	23.7	37.0	3.37	2.46
		2017-18	29	7.2	36	25.5	41.17	3.68	2.60
		2018-19	30	7.6	36.2	27.2	33.08	3.81	2.86
Kathua	Maize (PMH-1)	2018-19	10	2.5	38.2	27.2	36.76	3.84	2.86
Kathua	Seasmum	2017-18	15	2.0	3.2	2.0	60.0	4.57	2.85

Demonstration on Maize variety (Double Dekalb) in Kathua

Demonstration on Sesamum variety (Punjab Til-02) in Kathua

Similarly, 113 apple plants have been planted in Kinnaur as demonstration on drought tolerant clonal rootstocks and seedling to compare the survival rate. In 2017-18, seedlings (Well spur and Red spur) and clonal root stock MM-111 (Super chief) were planted in 0.02 ha each under high density plantation. Likewise, during 2018-19, drought tolerant rootstocks seedling (Well spur & Red spur) and Clonal rootstock MM-111,106 and 743 (Red spur, Well spur, Vans delicious) were bench grafted under HDP.

Table 22: Performance of demonstrations on drought tolerant apple rootstock

Technology	Year	No. of Farmers	Area (ha)	% Survival rate in new plantation		% yield increase
				Demo	Check	
Seedling (cv. Well spur & Red spur under HDP) Bench grafted	2018-19	03	0.06	60	50	10
Clonal rootstock MM-111,106 and 743 (cv Red spur, well spur, vans delicious under HDP) Bench grafted	2018-19	01	0.02	100	50	50

KVK, Bandipora, during the period, organized demonstrations on drought tolerant varieties on crops like pea, fodder maize, lentil and cow pea. KVK, Pulwama demonstrated drought tolerant varieties of green gram and rajmash during 2017-18 and 2018-19 in 2.1 ha area where these crops have never been cultivated before. Demonstration on drought tolerant variety of Guar (HG 2-20) was organized in Sirsa NICRA village in 5 ha area resulting into 30 percent increase in yield over that of the Check check.

Table 23: Performance of demonstrations on drought/temperature tolerant varieties

District	Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Bandipora	Pea (Parkash)	2016-17	19	02	34.0	31.9	6.5	1.62	1.18
Bandipora	Maize (African Tall)	2016-17	46	11.97	411.0	280.0	46.42	1.68	0.82
		2017-18	58	15.0	412.0	280.0	47	1.68	0.82
		2018-19	58	10.0	412.0	280.0	47	1.68	0.82
Bandipora	Maize (C-15)	2017-18	12	6.5	42.0	34.0	23	1.62	1.18
		2018-19	3	1.5	42.0	34.0	23	1.62	1.18
Bandipora	Cowpea (UPC-9202)	2017-18	20	2.0	227.0	15100	51	1.48	0.68
Bandipora	Maize (C-3)	2018-19	10	5	43.5	34.0	27	1.66	1.18
Bandipora	Maize (C-4)	2018-19	12	6	44.0	34.0	29	1.67	1.18
Bandipora	Maize (C-7)	2018-19	5	2	45.0	34.0	32	1.70	1.18
Pulwama	Green gram (Shalimar MoongI)	2017-18	06	1.0	10.25	21000	71750	50750	2.42
		2018-19	01	0.1	9.00	2500	7175	4675	2.87
Pulwama	Rajmassh (Shalimar Rajmash-I)	2017-18	10	1.0	14.00	25000	84000	59000	2.36
Sirsa	Guar (HG 2-20)	2016-17	12	5	13	10	30	1.98	1.68

Short duration varieties:

Summer green gram is a short duration crop which fits well in paddy-wheat rotation, after harvesting wheat and before transplanting paddy. Green gram not only give an additional income to the farmer but also helps in improving soil health through incorporation of crop residue and fixing atmospheric nitrogen. KVK, Bathinda conducted demonstrations on green gram (SML-668) at the farmer's field to provide an additional income source as short duration varieties can fit well in summer season. KVK, Faridkot conducted demonstrations of the cultivation summer moong (SML-668) on 23.8 ha area at 83 farmers' fields during the period.

Similarly, demonstrations on low water requiring short duration varieties of paddy namely Pusa Basmati- 1509 and PR-126 were conducted by KVK, Fatehgarh sahib. The short duration varieties also provide a little wider window between paddy harvesting and wheat sowing, thereby help farmers to shy away from burning crop residues.

Table 24: Performance of demonstrations on short duration varieties

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Bathinda	Green gram (SML-668)	2016-17	12	04	10.2	9.7	5.1	0.79	0.70
		2017-18	19	12	10.32	9.8	5.3	0.73	0.65
		2018-19	20	12	11.5	10.3	11.6	1.07	0.85
Faridkot	Green gram (SML-668)	2016-17	20	4	8.4	7.2	16.6	1.79	1.52
		2017-18	37	7.5	9.4	8.5	10.6	1.79	1.52
		2018-19	26	12	9.25	8.2	12.8	2.0	1.73
Fatehgarh Sahib	Paddy (PR-126)	2018-19	16	20	75.0	72.4	75	2.9	2.5
Fatehgarh Sahib	Paddy (PB-1509)	2017-18	27	20	40.0	38.6	40	1.9	1.6
Ropar	Green gram (SML-668)	2016-17	50	14	11	10.5	4.8	2.48	2.24
		2018-19	30	16.5	11.15	9.73	14.6	2.36	1.95
Ropar	Black gram (Mash 1008)	2017-18	10	4	8.64	7.75	11.5	2.9	2.5
		2018-19	15	4	10.1	8.5	19	2.36	1.7
Ropar	Lentil (LL-931)	2016-17	5	2	40	37	8.1	1.96	1.81
Sirsa	Barley (BH-393)	2016-17	2	0.133	13.50	9.50	42.10	2.48	1.74
Kullu	Soybean (Harit soya)	2016-17	29	3.0	28.80	22.50	28	1.52	1.42
Kullu	Soybean (Girija)	2017-18	3	21	29.26	24.30	20.41	1.76	1.60
		2018-19	53	10.75	27.80	23.50	18.29	1.52	1.40
		2016-17	8	2.0	28.50	22.50	26.66	1.51	1.42
Kullu	Soybean (Early Composite)	2017-18	5	21	29.90	24.52	21.91	1.80	1.50
		2018-19	38	8.75	29.70	26.80	10.82	1.62	1.59
Chamba	Gobhi Sarson (HPN-3)	2016-17	30	3	4.5	3.2	40.6	1.2	1.1

Likewise, the demonstrations on short duration varieties on Gobhi Sarson (HPN-3) were organized in Chamba covering 3ha area. HPN-3 yielded 40.6% more yield as compare to local variety. Farmers earned a net return of Rs 29500 with B: C ratio 1.2 over the Local control (Rs 19900 with B: C ratio 1.1). KVK, Kinnaur demonstrated cultivation of short duration local selection varieties of Buck wheat (Fagopyrum esculentum) varieties for yield performance. KVK, Tehri garhwal organized demonstrations on short duration varieties to escape terminal stress and maximize yield of vegetable crops, capsicum (California Wonder), tomato (Sioux) and onion (AFLR) in which 264 farmers participate and covered 18.1 ha area.

Table 25: Performance of demonstrations on short duration varieties

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Kinnaur	Buck wheat (Phafra-Local)	2016-17	05	0.1	7.57	9.7	6.52	1.57	1.53
		2017-18	04	0.2	8.26	9.8	7.17	1.81	1.54
		2018-19	04	0.16	8.40	10.3	7.11	1.52	1.14
Kinnaur	Buck wheat (Ogla-Local)	2016-17	05	0.1	8.80	7.2	7.24	1.83	1.50
		2017-18	04	0.2	9.12	8.5	8.2	2.10	1.91
		2018-19	04	0.16	9.60	8.2	8.04	1.50	1.45
Tehri garhwal	Pea (PSM-1)	2016-17	66	2.6	1.10	72.4	0.75	1.57	1.21
Tehri garhwal	Onion (AFLR)	2016-17	29	1.0	170	38.6	120	2.00	1.30
		2017-18	29	2.5	22.0	10.5	16.0	2.61	2.27
		2018-19	60	3.0	23.0	9.73	18.0	1.96	1.88
Tehri garhwal	Capsicum (California Wonder)	2018-19	40	5	1.35	7.75	0.95	2.05	1.64
Tehri garhwal	Tomato (Sioux)	2018-19	40	5	90	8.5	125	1.71	1.34
Kathua	Paddy (NDR-97)	2016-17	27	5.0	32	37	22	2.07	1.42
		2017-18	35	7.2	32.5	9.50	26	2.02	1.82
		2018-19	28	6.3	30.5	22.50	24	2.28	1.79
Kathua	Paddy (Pusa-1509)	2016-17	2	1.2	38	24.30	24	3.28	1.52
		2017-18	5	2.6	37.5	23.50	28	3.34	2.42
		2018-19	9	3.2	38.5	22.50	26	3.39	2.29
Bandipora	Wheat (Shalimar Wheat-1)	2017-18	38	3.9	35.60	24.52	25.00	1.68	1.25
Bandipora	Wheat (Shalimar Wheat-2)	2016-17	88	8.0	35.00	26.80	25.00	1.65	1.27
Bandipora	Brown Sarson (KS-101)	2018-19	08	0.4	11.50	3.2	8.0	1.52	1.21
Bandipora	Oats (Sabzaar)	2017-18	228	12.5	315.00		204.00	1.52	0.77

Crop diversification:

KVK, Bathinda organized demonstrations on cultivation of mustard (GSC-7, PBR-357), gram (GPF-2, PBG-7) and summer green gram (SML-668) to popularize crop diversification in the NICRA villages. Farmers have appreciated the better yield performances of improved varieties of pulses and oilseeds and started considering them to be part of traditional cropping system. Similarly, KVK, Fatehgarh sahib promoted cultivation of summer green gram (SML-668) through demonstration in 36.4 ha as a source of additional income. Similarly, KVK, Chamba, under crop

diversification, organized demonstrations on Apricot (New castle), Pear (Red Barlet) and Kiwi (Allison).

Table 26: Performance of demonstrations on crop diversification

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Bathinda	Mustard (GSC-7)	2017-18	32	08	22.5	21.2	6.13	1.81	1.65
Bathinda	Gram (GPF-2)	2017-18	03	01	17.6	16.8	4.76	1.97	1.83
Fatehgarh Sahib	Green Gram (SML-668)	2018-19	70	36.4	9.5	7.5	26.6	2.40	1.92
Kullu	Wheat (GHC-1)	2016-17	2	0.16	29.5	27.5	7.27	3.31	1.51
Kinnaur	Tomato (Kanchan)	2016-17	10	.243	6.15	5.17	18.8	1.5	1.1
Kathua	Black Gram (Him mash-1)	2016-17	7	1.0	6.75	4.90	37.75	7.10	5.15
		2017-18	9	1.5	5.25	3.80	38.15	5.46	3.95
		2018-19	13	1.9	6.7	3.85	42.15	4.4	2.55
Kathua	Black Gram (PU-31)	2016-17	39	6.5	7.25	5.10	42.21	7.63	5.36
		2017-18	45	7.3	6.35	4.20	51.19	6.74	4.46
		2018-19	52	7.9	7.8	4.8	52.5	5.1	3.18
Kathua	Gobhi Sarson (DGS-1)	2016-17	25	5.0	14.0	10.0	40.0	4.9	3.5
		2017-18	35	4.0	16.0	12.3	30.0	5.6	4.30
		2018-19	30	3.7	15.5	12.2	27.04	5.32	4.18
Kathua	Gram (GNG-1581)	2016-17	33	3.0	7.4	5.3	39.62	3.52	2.65
		2018-19	46	4.2	6.1	4.6	32.6	3.10	2.34
Kathua	Gram (PBG-5)	2017-18	42	3.8	6.3	4.4	43.18	3.18	2.22

Demonstration plot of Blackgram (PU-31) in Kathua

Demonstration on Chickpea in Kathua

Location specific intercropping systems with high sustainable yield index:

The demonstrations on intercropping of mustard in sugarcane were conducted in Faridkot.

Table 27: Performance of demonstrations on location specific intercropping systems

District	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
				Demo	Check			
Faridkot	2016-17	1	0.8	945(cane) + 18.4	880	9.47	3.28	2.48
Faridkot	2017-18	1	0.8	987 (cane) + 18.6	925	8.7	2.44	1.7
Faridkot	2018-19	1	0.8	987 (cane) + 16.8	975	2.95	2.92	2.38

Similar demonstrations in Chamba were organized on intercropping of apple and cauliflower and in Kinnaur on apple and rajmash.

Table 28: Performance of demonstrations on location specific intercropping systems

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Chamba	Apple + Cauliflower	2017-18	45	3.6	280	260	7.7	5.1	2.5
Chamba	Apple + Cauliflower	2018-19	45	3.6	280	260	7.7	5.1	2.5
Kinnaur	Apple+Rajmash (Jawala)	2017-18	01	0.1	6.0	5.3	11.6	3.43	2.55
Kinnaur	Apple+Rajmash (Jawala)	2018-19	02	0.3	6.85	5.50	31.7	1.40	0.67
Kinnaur	Apple+Pea (AP-1)	2018-19	08	0.4	20	12	40	1.90	1.27

Demonstration on intercropping of Rajmash with apple in Kinnaur

Cold/Frost tolerant varieties:

Demonstrations on cultivation cold tolerant varieties of crops like paddy, brown sarson, turnip, radish, carrot, cabbage, capsicum, knol khol, khale, spinach and beet were organized by KVK, Bandipora. Similarly, KVK, Sirsa demonstrated mustard variety RH-0749 for frost tolerant.

Table 29: Performance of demonstrations on cold/frost tolerant varieties

District	Crop & Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Bandipora	Paddy (SR-3)	2016-17	66	9.3	65.0	57.0	14	1.51	1.23
Bandipora	Brown Sarson (KS-101)	2016-17	36	5.2	11.0	8.0	37.5	1.45	1.21
Bandipora	Turnip (PTWG)	2016-17	150	1.25	22400	16100	39	2.92	2.00
Bandipora	Radish (White Round)	2016-17	144	0.75	176.0	106.0	66	3.19	1.65
Bandipora	Carrot (Early Nantes)	2016-17	135	0.75	161.0	96.0	67	2.83	1.46
Bandipora	Beet (DDR)	2016-17	7	0.1	171.0	90.0	90	2.04	0.69
Bandipora	Paddy (K-332)	2017-18	92	8.50	75.0	55.0	36	1.38	1.07
Bandipora	Spinach (Shalimar green)	2017-18	6	0.1	96.0	70.0	34	1.13	0.64
Bandipora	Cabbage (Rareball)	2018-19	32	0.5	176.0	96.0	83	2.2	1.04
Bandipora	Capsicum (California Wonder)	2018-19	12	0.25	86.0	60.0	43	1.58	0.85
Bandipora	Knol Khol (EWV)	2018-19	28	0.5	156.0	90.0	73	1.6	0.54
Bandipora	Kale (Khanyari)	2018-19	35	0.6	166.0	85.0	95	1.76	0.46
Bandipora	Oats (Sabzaar)	2018-19	20	2.20	310.0	200.0	55	1.69	0.73
Sirsa	Mustard (RH-0749)	2016-17	5	2	23.0	21.0	9.5	3.35	3.15

Yellow rust tolerant wheat varieties:

Demonstration of wheat varieties with adequate tolerance against yellow rust under rainfed conditions were organized by KVK, Kathua.

Table 30: Performance of demonstrations on yellow rust tolerant wheat varieties

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Kathua	Wheat (Raj-3765)	2016-17	11	4.5	17.5	14.4	21.52	2.24	1.92
	Wheat (WH-1021)		23	5.0	19.7	15.5	27.09	2.52	2.06
Kathua	Wheat (HS-507)	2014-18	8	3.2	22	15.7	40.1	1.53	2.03
Kathua	Wheat (JAUW-598)		10	0.5	20	17.3	15.6	2.75	2.38
Kathua	Wheat (WH-1142)		8	2.5	29	19	52.63	3.96	2.72
Kathua	Wheat (WH-1080)	2017-18	13	5.0	23	17.3	30.05	2.98	2.17
		2018-19	13	5.0	25	18.2	37.3	3.24	2.36
Kathua	Wheat (WH-1105)	2018-19	12	5.0	22	16.1	36.6	2.85	2.09
Kathua	Wheat (HD-3059)		15	5.0	26	16.5	57.5	3.37	2.14

LIVESTOCK AND FISHERIES

Livestock production system is essential for livelihood and nutritional security of the nation. Demonstrations related to growing of maize, oats and sorghum for fodder production, especially during drought/ flood situations; silage making for storage of green fodder and feeding during the dry season; de-worming of animals, mineral mixture supplementation; animal health check-up; artificial insemination; mitigation of mineral deficiencies in animals; breed up gradation and backyard poultry were the activities carried out under the project.

FODDER PRODUCTION

Good quality fodder production with high yielding improved cultivars is being promoted in most of the NICRA villages to fulfill the requirement of availability of fodder for both at household level and village level. With the increased quality fodder availability and extended availability up to summer season has resulted in milk production in dairy animal to the tune of 12-13lt/day as compared to 10-11 lit/day of without intervention.

Demonstration on Berseem in Kullu

Demostration on Oat (Palampur-1) in Kullu

Berseem: Berseem gives a highly nutritious and palatable fodder in repeated cuttings during November to mid-June. BL-10 is a longer duration variety and supplies green fodder up to mid June which was demonstrated by KVK, Bathinda. It is moderately tolerant to stem rot disease. Its nutritive value and voluntary intake are high. It yields about 410 quintals per acre green fodder. Similarly, berseem variety demonstrated by KVK, Faridkot i.e. BL-42 gives a highly nutritious and palatable fodder. BL-42 is a longer duration variety and supplies green fodder upto the first week of June. It yields about 440 quintals per acre green fodder.

Maize: In Faridkot, Maize (J-1006) was demonstrated, as it can be cultivated from mid of April to October. The other advantage of this variety is that it is high yielding and good for making silage that can be utilized as good source of fodder during the lean period. Similar demonstrations organized by KVK, Fatehgarh sahib reported 24 percent increase in the fodder yield over that of the check.

Table 31: Performance of demonstrations on cultivation of Fodder Maize

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Fatehgarh Sahib	Maize (J-1006)	2016-17	50	5.6	398	302.6	23.9	2.4	1.5
Fatehgarh Sahib	Maize (J-1006)	2017-18	50	5.6	405	326	24.2	3.3	2.6
Ropar	Maize (J-1006)	2017-18	30	6.6	345	310	11.2	2.88	2.4
Ropar	Maize (J-1006)	2018-19	30	6.6	360	300	20	2.8	2.2

White clover: KVK, Chamba organized demonstrations on introduction of white clover in apple orchard on 3 ha area. The net return obtained from the demonstration was Rs. 27000/ha with B: C Ratio 2.8, which was only Rs.8000/ha with B: C ratio 1.33 in case of check.

Table 32: Performance of demonstrations on cultivation of White Clover

District	Crop	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Chamba	White Clover	2018-19	15	3	38200	14000	172.8	2.8	1.33

Berseem and Rye grass: Barseem is highly palatable fodder and it contains 17 percent crude protein and 25 percent crude fiber. Rye grass is a leaf grass that is highly palatable forage that offers 70 percent digestible dry matter and 16-20 percent crude protein. Due to its excellent nutritional quality it is commonly used as pasture for lactating dairy cows. Sprouted rye grass fodder contains many of the benefits of its more mature, pasture-grown counterpart. Moreover, the feed value of rye grass fodder is highly beneficial to corn. Thus, berseem (BL-10) with rye grass (PBRG-1) was demonstrated in the farmers' fields by KVK, Fatehgarh sahib and KVK, Ropar.

Table 33: Performance of demonstrations on cultivation of Berseem and Rye Grass

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Fatehgarh Sahib	Berseem (BL-10) + Rye grass (PBRG-1)	2017-18	42	5	360	280	28.5	2.0	1.5
Fatehgarh Sahib	Berseem (BL-10) + Rye grass (PBRG-1)	2018-19	42	5	360	280	28.5	1.64	1.28
Ropar	Berseem (BL-10) + Rye grass (PBRG-1)	2018-19	70	10	800	280	14.2	3.4	3.1

Demonstration on Barseem + Rye Grass in Fatehgarh Sahib

Intercropping of Berseem and Rye Grass in Ropar

Silage making for preservation of green fodder:

Ensuring fodder availability during lean periods is an issue livestock farmers must address for developing sustainable climate resilience agriculture. Moreover, deferred onset and deficit rainfall conditions made KVK promote silage making of green fodder in NICRA villages. Cultivation of fodder maize, sorghum and oats were demonstrated to prepare silage using plastic drums and silo pits.

Table 34: Performance of demonstrations on Feeding silage

District	Year	No. of Farmers	Animals (No.)	Milk Yield (liter/day)		% increase	Demo BCR	Check BCR
				Demo	Check			
Fatehgarh Sahib	2018-19	40	40	9.3	8.4	13.8	2.3	1.9
Ropar	2017-18	10	10	6	5.5	9	3.2	2.75
Ropar	2018-19	10	10	6	5.5	9	2.9	2.75
Kathua	2017-18	05	05	7.9	7.0	11	1.85	1.40
Kathua	2018-19	22	22	9.5	8.4	13.09	2.07	1.68
Pulwama	2017-18	10	10	7.5	6.0	20	2.08	1.53


Demonstration on Silage making in Said-sohal, Kathua


Demonstration on Silage making in Kullu

Feed supplementation to combat nutrients deficiency in dairy animals:

Mineral mixture and uromin licks prevent the deficiency of different minerals in dairy animals. The results of theses feeding reveal improvement in both the production as well as reproductive health of the dairy cows. Protein and minerals are essential for proper metabolic function. Proper metabolic functions ensure better utilization of absorbed nutrients to improve growth of calves, increase milk production, improve reproductive efficiency and reduce calving interval, increase productive life of animals and improve immunity status and help animals overcome heat stress. Demonstrations on feeding mineral mixture in Fatehgarh sahib and Pulwama reported increase in milk production to the extent of 2 kg/day.

Table 35: Performance of demonstrations on feed supplementation

District	Year	No. of Farmers	Animals (No.)	Milk Yield (liter/day)		% increase	Demo BCR	Check BCR
				Demo	Check			
Fatehgarh Sahib	2018-19	100	220	8	6	33	1.45	1.33
Pulwama	2017-18	100	100	8.	6	25	1.50	1.24
Kathua	2017-18	50	50	7.5	6.8	10	1.66	1.2
Kathua	2018-19	75	5	7.4	8.2	9.75	1.24	1.44

Demonstration on UMMB in Kullu

Feeding mineral mixture in Kinnaur

Backyard Poultry:

Backyard poultry has an important to role in the economic status and fulfilling the nutritional requirement of rural families. Backyard poultry production was popularized through demonstrations considering nutritional value of poultry egg and meat. Resilience and impact of introduction of improved breeds of poultry on farmers' income was assessed at different locations. KVK, Bathinda organized demonstrations on backyard poultry as a source of additional income, as brown shell eggs are sold on almost double price than the white shell eggs. Similar demonstrations were organized by KVK, Pulwama in which hardy and disease resistant poultry breed Vanraja was popularized.

Table 36: Performance of demonstrations on Backyard Poultry rearing

Breed	Year	No. of Farmers	Unit	Av. Weight (kg)		Egg weight (gm)	Mortality (%)	Consumed for meat (%)	Eaten by Predator (%)	Live (%)
				Hen	Cock					
Vanraja	2017-18	100	500	2.27	4.2	96	16	12	22	50
	2018-19	100	500	2.27	4.2	96	16	5	6.5	72.5

Similarly, KVK, Bandipora demonstrated improved poultry breeds like Golden key stone, Kroiler and Vanraja.

Table 37: Performance of demonstrations on Backyard Poultry rearing

District	Year	No. of Farmers	Animals (No.)	Yield		% increase	Demo BCR	Check BCR
				Demo	Check			
Golden Key stone	2018-19	10	10	260 eggs, 2kg meat/bird	90 eggs, 1kg meat/bird	188, 100	2.29	1.1
Kroiler	2018-19	05	10	230 eggs, 3kg meat/bird	90 eggs, 1kg meat/bird	155, 200	2.25	1.1
Vanraja	2018-19	05	10	210 eggs, 2.5kg meat/bird	90 eggs, 1kg meat/bird	133, 150	1.93	1.1

Backyard Poultry in Bandipora

Assessment of different breeds in Bandipora

Animal health check-up/Vaccination/De-worming:

De-worming camps of domestic animals, particularly the young calves and heifers, to reduce the infestation of internal parasites were organized by all the NICRA KVKs in respective villages. De-worming in milking cows in Kathua has resulted in improved health of animals thereby increasing the milk yield.

Table 38: Performance of demonstrations on De-worming in Milking Cows

District	Year	No. of Farmers	Animals (No.)	Milk Yield (liter/day)		% increase	Demo BCR	Check BCR
				Demo	Check			
Kathua	2018-19	40	140	8.4	7.9	6.32	3.0	2.8

Similarly, health check-up camps and vaccinations are also organized at proper interval. Preventive vaccination against Foot and Mouth Disease (FMD) is must organized activity in NICRA villages across the states. Animal were treated for various ailments/ diseases including parasitic infestation mastitis repeat breeding and production. Antibiotics and dietary inclusion of B-complex vitamin were recommended for control of these diseases.

Animal Health check-up in Kathua

Vaccination Camp in Bandipora

Introduction of improved breeds:

KVK, Kinnaur demonstrated improved goat breeds like Jamunapari/Barbari for the adoption to the farmers.

Table 39: Performance of demonstrations on improved Breed of Goat

District	Year	No. of Farmers	Animals (No.)	Milk Yield (liter/day)		% increase	Demo BCR	Check BCR
				Demo	Check			
Kinnaur	2017-18	1	3	547.5	438	25	0.84	0.47

Azolla Production:

KVK, Hamirpur is demonstrating cultivation of azolla as an alternative fodder during lean period (April-June). Azolla is rich in protein and particularly during lean periods, it helps provide balanced nutrition to the livestock. Hence, azolla production units have been established to cope with scarcity of green fodder in NICRA village and adjoining villages. Thus, about 35-40 percent livestock rearers have been reported to have adopted the technology and it has helped them increase the milk production by 10-15 per cent.

Fodder Grass in Chamba

Fodder Maize (African tall) in Kullu

INSTITUTIONAL INTERVENTIONS

This module consists of interventions such as seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing, introduction of weather index based insurance and climate literacy through a village level weather station, nutritional gardening etc.

NUTRITIONAL GARDEN

A concept of nutritional gardening is to meet the daily nutritive requirement of the family by planting different vegetables in the backyard of one's home. Nutrition/kitchen gardens were demonstrated by planting different vegetables in the backyard of farmers' houses or around the NICRA village. The purpose of these demonstrations units was to popularize nutritional gardens as means to fulfill the nutritional requirement of the family for better health. All the KVKs of Punjab, have established 100 to 200 live demonstrations on nutritional kitchen gardening each in 6 X 6 sq. meter area every year. Now, the farmers of the villages have adopted this technique and are regularly growing summer and winter vegetables. After seeing the impact of these demonstrations the farmers of the neighboring villages have also started to establish nutritional kitchen gardens in their homes' backyards.

Nutritional Gardening in Badauchi Kalan, Fatehgarh Sahib

Nutrional Kitchen Garden NICRA, Village Ropar

Custom Hiring Center (CHC):

One of the major objectives of NICRA project is development of custom hiring centre in the operational village to meet the machinery requirement for timely farm operations at marginal rates. Thus, a Custom Hiring Center (CHC) is developed by the KVK under NICRA project for adopted villages to provide the agricultural machinery to the farmers. These Custom Hiring Centres for farm implements have empowered farmers to tide over the shortage of labour and improve efficiency of agricultural operations. A Village Climate Risk Management Committee (VCRMC) manages the custom hiring centre and decided the rates for hiring the machines. This committee also uses the

revenue generated from hiring charges for repair and maintenance of the implements and remaining amount goes into the revolving fund.

Power tiller in Bandipora

Tractor of CHC in Kullu

The most popular machines in the villages of Punjab are DSR Machine, Happy seeder, Bund maker, Power sprayer, Chopper cum shredder, Multi-crop planter, Rotavator, Zero till drill, Straw reaper, Seed cleaner, Spike tooth harrow, Disc harrow, Chiseler, Reversible MB Plough, Forage chopper, Power weeder and Semi-automatic planter. Similarly, popular machines in Himachal Pradesh are Pruning secateurs, Grafting knifes, Power weeder, Power sprayer, Chain saw, Apple harvester, Seed drill, Seed storage container, Knapsack sprayer, Mist blower, etc.

CHCs in Haryana had Rotavator, Seed cum fertilizer drill, Spray pump, Happy seeder, Zero till drill, Laser land leveler, DSR machine, Bed Planter, etc. Likewise, villages in Uttarakhand were provided with Seed cum fertilizer drill, Wheel hand hoe, Power tiller, Wheat Thresher, Power tiller, Power weeder, Paddy Thrasher, Knapsack sprayer, Foot Sprayer, Chaff cutter, Bullock drawn implement (Seed drill, plough, cultivator, potato digger, etc.), Millet thresher, etc. In Jammu and Kashmir, Zero till drill, Maize Planter, Knap Sack Sprayer, Maize Sheller, Foot Sprayer, Bund Maker, Seed Fertilizer/ drill, mini tractor, power sprayer, irrigation pump tiller, leveler.

Mulcher in Killi Nihal Singh Wala, Bathinda

Power tiller in Mann, Hamirpur

Climate literacy through a village level weather station:

A weather station is installed in all the NICRA villages for recording weather parameters and conveying to the farmers. Farmers are helped to understand the changes in weather and climate phenomenon over the time period. They are also informed about the weather predictions through advisories by contacting key persons of VCRMC or by using mKisan portal.

VC, YSPUHF, Solan observing weather station in Telangi, Kinnaur

Seed Bank:

Seed banks are developed in all NICRA villages to store some quality seed for contingency, so that during critical conditions this seed can be used for sowing. For example, in Ropar, 461 q seed of wheat varieties namely Unnat PBW 343, Unnat PBW 550 and PBW 725 were produced and stored during the period. Similarly, in Kathua, 7 q seed of paddy varieties NDR-97 and Pusa Basmati-1509, and 21 q seed of wheat variety WH-1142 were stored in the seed bank. This seed was shared by the farmers for dissemination of improved and climate resilient variety on barter basis and the rest was sold by the farmers at market price.

Fodder Bank:

Similar to the concept of seed bank, fodder banks were also developed in all the NICRA villages to provide fodder to the domestic animals during lean periods. For example, in NICRA village of Tehri Garhwal, root slips of hybrid napier (CO-3) are planted on farm bunds and community lands involving about 60 farmers every year to store surplus fodder to be used during critical times. Likewise, in NICRA village of Pulwama, community sowing of Oat (Sabzar) is done for fodder production. This fodder is further stored in a fodder bank structure of 20'x18' to be used as and when contingency arises. KVK, Bandipora established a bank for storing fodder of sorghum, maize and oat.

CAPACITY BUILDING

In this module, training programs were organized for farmers / farm women on different need based aspects to make them acquainted about new initiatives that are being used in the present era of crop cultivation and subsidiary occupation and so that they can increase their income. They were also made aware about the activities undertaken and various climate resilient technologies demonstrated under the project.

Training programme on Crop Diversification at Chhoyel, Kullu

Training on Low Cost Pheromone Trap in Mann, Hamirpur

The capacity building programs were conducted in different thematic areas viz., natural resources management, crop management, crop diversification, nursery raising, fodder and feed management, livestock management, nutrient management, pest and disease management, rodent control, weed control, resource conservation technology, etc. During the period, 377 capacity building programs were organized covering different aspects of NICRA.

Table 40: Theme-wise capacity building programs organized under TDC-NICRA

Theme	No. of Courses	Number of beneficiaries		
		Male	Female	Total
Natural resource management	46	962	279	1241
Crop management	30	758	255	1013
Crop Diversification	11	315	131	446
Fodder and feed management	37	867	370	1237
Livestock management	33	710	293	1003
Nutrient management	10	225	47	272
Pest and disease management	38	891	212	1103
Weed control	7	92	26	118

Theme	No. of Courses	Number of beneficiaries		
		Male	Female	Total
Nursery raising	13	122	115	237
Home science	4	48	226	274
Enterprises for self employment	3	29	2	31
Farm implements and machineries	14	291	67	358
NICRA awareness	10	223	120	343
Nutritional Gardening	14	319	145	464
Post harvest technology	16	23	284	307
Resource conservation technology	12	248	10	258
Seed production	5	130	29	159
Soil health management	15	648	105	753
Water saving technology	5	108	7	115
Awareness on abuse/ social issues	7	52	72	124
Vegetable production	18	331	121	452
Seed Processing and storage	4	124	27	151
Plant Protection Measures	2	27	0	27
Value Addition	3	12	62	74
Forest tree/ agro forestry plantation	1	153	45	198
Self Employment	9	277	83	360
Animal Health Management	2	20	6	26
Management of horticultural crops	8	209	49	258
Total	**377**	**8214**	**3188**	**11402**

Skill Development Training on Plastic Mulching

Capacity Building on Mushroom cultivation

EXTENSION ACTIVITIES

KVKs have organized different extension activities for the benefit of farmers of the NICRA villages of the states of Zone-I. Extension activities like exposure visit, field day, method demonstration, awareness camp, kisan mela, women awareness, agro-advisory services, etc. to sensitize farmers and farm women about the issues of agriculture particularly pertaining to the changes in climatic phenomenon and their effect on crop and animal husbandry.

Table 41: Extension activities organized under TDC-NICRA

Name of the activity	No. of Program	Number of beneficiaries		
		Male	Female	Total
Exposure visit	88	1765	567	2332
Field days	112	4264	1223	5487
Method demonstration	262	3286	1406	4692
Awareness camp	315	6090	2226	8316
Group dynamics/ Discussion	244	3031	881	3912
Agro advisory service	240	2054	603	2657
Strengthening SHGs	9	24	181	205
Integrated farming system	12	117	31	148
Protected cultivation	2	41	10	51
Others	72	519	488	1007
Total	**1356**	**21191**	**7616**	**28807**

Exposure visit of Farmers from Fatehgarh Sahib

Harvest Field Day in Fatehgarh Sahib

Field day on Gobhi Sarson in Pindi Blochan, Faridkot

Field Day on Happy Seeder sown wheat in Bathinda

Field day on Wheat in Kullu

Pigeon Pea Day at Village Bharkote, Uttarkashi

VCRMC meeting in Telangi, Kinnaur

SUCCESS STORIES

Proponent of Happy Seeder
S. Gursewak Singh (bathinda)

S. Gursewak Singh S/o S. Balvir Singh resident of village Deon belongs to a small farming family, He cultivates 2.5 acre of owned land and 35 acre of leased-in land every year. He is regularly in touch with the KVK for last three years and participates in every activities of the KVK. He sows the wheat crop only with happy seeder and rice crop with DSR machine to reduce the cost.

He successful manages the paddy straw by using happy seeder and other techniques from last three years. Mr. Gursewak Singh visited the demonstrations of paddy straw conducted by KVK Bathinda under NICRA project. After getting highly impressed from these demonstrations, he started managing paddy straw in 36 acres land and motivated the other farmers of village to do the same and managed paddy straw from 100 acres of land of rest of farmers of the village with happy seeder. The farmers of neighboring villages also started the sowing of wheat with happy seeder during this year. He has sown the wheat crop with happy seeder free of cost in the fields of 20 farmers. The farmers of village appreciate him for his social awareness and now, he is commonly known as 'Gora happy seeder wala' in the village and the vicinity.

Experience of the farmer:

1. According to Mr. Gursewak Singh only 5-6 liter diesel is required for sowing wheat crop in one acre with happy seeder while 25-30 liter diesel is required for sowing of wheat by using different operations of traditional method.
2. No emergence of weeds, especially the Phalaris minor and Chenopodium album, in the fields where the wheat was sown with happy seeder and hence saved money, labour and time.
3. The environment and natural resources can be saved by using happy seeder for sowing of wheat.
4. Saving of irrigation water, as first irrigation has to be applied after 55 days of sowing.
5. The paddy straw remains in the soil and promotes the beneficial micro organisms which increase the soil fertility and organic carbon.

He motivates other farmers to sow only PAU recommended varieties of rice especially the short duration varieties like PR-126, PR-121, PR-122 and PR-124.

Ambassador of in-situ Crop Residue Management
Mr. Jagtar Singh Brar (Bathinda)

S. Jagtar Singh Brar, a progressive farmer of Bathinda district has decided that he will not burn the standing as well as loose straw of paddy. From last six years, he chops the straw and stubbles with 'Chopper cum Spreader' and incorporates it into soil with 'Soil Stirring Plough' followed by Disc harrowing or Rotavator or MB Plough. It is pertinent to mention that an operation of MB plough allows the sowing of potato with potato planter without any hindrance.

Incorporation of paddy straw into soil has greatly improved the soil organic matter and nutrient status of the soil. As a result, in spite of increasing cropping intensity per acre requirement of nitrogenous fertilizer has decreased. He also guided other farmers of the region regarding the nutrient value of potato and judicious use of irrigation water and improving the aesthetic value after rice residue incorporation and increases yield also. In this way, S. Jagtar Singh Brar not only saves the soil, water and environment but he also helps in decreasing the air pollution.

He motivates rest of farmers to adopt eco-friendly paddy straw management techniques. For which he provides his own management implements to be used by the farmers free of cost. He has motivated about 30-35 farmers to adopt better paddy straw management instead of burning. He cultivates 80 acres of paddy every year and incorporates the entire straw into the soil with the help of mulcher and MB plough. He uses PAU recommended varieties of paddy like PR-126, PR-122, and PR-124 and wheat varieties like HD-3086, HD-2967 and PBW-725. Apart from the main cereal crops, he also cultivates potato, garlic, chilli and other vegetables. He also uses a part of paddy straw as a mulching material for crops like garlic, chilli and other vegetables.

He has been facilitated by different organizations for his scientific management of paddy straw. He is an active member of various agricultural and social committees. He has been awarded for adopting crop diversification, kinnow cultivation and adopting latest agricultural techniques. He has been awarded with 'Innovative Farming' award by Punjab Agricultural University, Ludhiana. He is well respected among masses for being a progressive farmer of Bathinda district.

Progressive Dairy Farmer
Sh. Balkaran Singh (Bathinda)

Dairy farming was the prime subsidiary agricultural occupations in Punjab but with the passage of time it became a commercial business. Dairy farm became the dairy industry with the

establishment of hi-tech and mechanized units. A progressive dairy farmer S. Balkaran Singh s/o S. Bhola Singh has 3.5 acre of parental land. He followed the traditional farming for a long time. As a social and active member of the family, S. Balkaran Singh connected with the KVK after implementation of NICRA project at Killi Nihal Singh Wala in the year 2011.

In the year 2012 he attended training on dairy farming and started a dairy unit with 5 cross-breed cows. He is produces clean milk and collects the raw milk from his village.

He sells the milk to a nearby Air Force Station at Bhisiana and earns a better profit as compared to the traditional milkmen. Now, he has total 10 cross-breed and 4 Sahiwal cows in his dairy farm and he earns Rs. 50,000/- per month from selling milk. He also got trained on balanced feeding from the KVK and started preparing the feed formulation at the farm level and store green fodder as silage for feeding to dairy animals. He mixes the paddy straw with green fodder while chopping and uses it as feed for the dairy animals. In this way, he saves the wheat straw (Turhi) and produces milk with low cost. He has diversified his farm by growing crops like maize for silage, berseem and oats for fodder, cotton, wheat, moong and sarson. He also adopted agricultural mechanization at his farm and he regularly levels his field with laser leveler after every three years to save water.

He is helping in improving the socio-economic status of the farmers by purchasing the raw milk at higher rates than the market rate and even then he is earning a better income. He is a motivational personality for unemployed youth who are interested in start ups.

S. Manjinder Singh
A Pioneer in Resource Conservation Agriculture (Bathinda)

S. Manjinder Singh S/o Sh. Major Singh resident of village Killi Nihal Singh Wala belongs to a farm family having 22 acres of owned land. He is in touch with the KVK since 2011 and participates in every activity. He was the first farmer of NICRA village to adopt the latest agriculture techniques like rice residue management, diversified farming by involving potato, moong, sarson and cotton in the traditional cropping system. He was also the first man in the area to adopt direct seeding rice technology.

He used the baler-cum-knotter for recycling of paddy straw/ management of paddy straw and became the leader among the farmers for selling bales of paddy straw. He also motivated the farmers of village to adopt latest technologies i.e. use of tensiometer in rice and leaf colour chart (LCC). When the NICRA project was first time introduced in the village, none of the farmers in the village was ready to use happy seeder machine for sowing wheat crop in standing stubbles of rice crop because they feared that it will yield less as compared to the traditional sowing. It was Manjinder who agreed to use happy seeder, chopper cum spreader, baler cum knotter at his own field. He is known as the role model in the NICRA village as well as the adjoining villages. He is a one of the farmers who have purchased happy seeder and DSR machine. Now, Manjinder along with other progressive farmers of the

village and adjoining villages is motivating the rest of the farmers to adopt resource conservation technologies.

Significant achievements:

- Diversified agriculture by introduction of summer moong for 5 acres for increasing income and improvement of soil health.
- Diversified his farm by sowing potato in 3 acres.
- No burning of rice residue: sowing wheat with happy seeder (5 acres) and in rest of the field he incorporate the rice residue in the field by using chopper cum spreader, mulcher and MB plough.
- Using Direct Seeded Rice (DSR) technique for last 5 years
- He has laser levelled the entire field to save water and energy and repeating this practice after every three years.
- He has constructed a silo trench for making hay/ silage for better animal health and nutrition management of livestock
- Constructed a gobar gas plant to utilize animal dung as an alternate source of energy.

Farmer Neglecting the Trend of Straw Burning
Amandeep Singh (Faridkot)

Amandeep Singh S/o Dharampal Singh is a progressive farmer of village Ghuduwala of district Faridkot. He owns 30 acres of land and follows paddy-wheat rotation. He was practicing traditional methods for cultivation of paddy and wheat and found them not profitable enough. He came in contact with KVK, Faridkot about 4-5 years back. During discussions with the KVK scientists, he realized the gaps in his method of farming. Soon after that, he started using the recommended technologies like recommended varieties, dose of pesticides and fertilizers etc. He started getting more profit from the same piece of land by adopting scientifically recommended technologies.

For last 2-3 years, a campaign to protect natural resources and reduce pollution by stopping straw burning was initiated by the KVK on a large scale. He made his mind to contribute his share in the campaign. For this, he contacted KVK scientists to get himself acquainted about the technologies that were available to be used for sowing wheat in the field without burning paddy straw. He visited the NICRA village Pindi Blochan to get thoroughly acquainted with the technologies. He witnessed the wheat crop sown in the fields without burning of paddy straw. He was made a member of "Jai Jawan and Jai Kisan" Whats app group, though which he was also

motivated by the farming methods followed by the other group members. During 2017-18, to get firsthand experience, he has sown 3 acres land with wheat using happy seeder without burning paddy straw and paddy straw baled 26 acres with conventional seed drill. After seeing the yield and reduction in cost of cultivation through happy seeded, he has sown wheat crop on 28 acres through happy seeder during 2018-19. Before sowing he has harvested the 15 acres of paddy crop with combine with SMS and rest with normal combine. Now, he has become one of the frontier farmers in the area for sowing wheat with happy seeder in the standing stubbles. He has motivated some of the farmers of the nearby area to sown their wheat crop using happy seeder technology. He attended training at the KVK on in-situ residue management and now he informally trains others too. He has also helped his relatives in getting custom hiring centre from the government, though which they have sown wheat in 120 acres using happy seeder.

KVK scientists interacting with farmer and inspecting the field

THE CLIMATE SMART VILLAGE LAGGA (CHAMBA): A CASE STUDY

NICRA village Lagga in district Chamba lies in elevation ranging between 1500-2000m height. The average annual rainfall is about 1100 mm. During winters, this area receives moderate to high snowfall. Maize, cabbage, cauliflower, apple, beans and potato are major crops grown in this area. Farmers of this area have very small land holding, that too without irrigation facilities. Before the start of NICRA, the farmers were producing small amount of maize to meet their domestic requirements and were poor.

The area is highly rugged hilly terrain, so most of the rain water is lost by surface runoff resulting in very limited ground water storage. At present there are 11 water harvesting structures, capacity ranges from 60,000-80,000 liter capacity, helps the farmers for their irrigation to various crops in whole village.

Shift in Cropping Pattern (Area in ha) in Village Lagga after NICRA interventions

Crops	Pre-NICRA	Post-NICRA	% increase/decrease
Maize	57.68	35.00	39.30 (-)
Potato	7.40	12.60	70.30 (+)
Apple	5.12	18.00	251(+)
Cabbage	0.30	8.00	2566(+)
Cauliflower	0.40	6.00	1400(+)

Achievements under NICRA Project

- Spur type apple cultivation has been introduced on about 20 hectare in the village. In order to scale up this intervention, demonstrations have been laid out in other areas of the district.
- Intercropping (Apple + Cabbage/cauliflower) is also one of the major and successful interventions in the NICRA village which is also being adopted by farmers of other village in the district with same climatic condition.
- Initially two polyhouse were constructed in the NICRA village but now more than 38 polyhouses have been constructed, as result the farmers of other villages are also adopting this technology.

Integrated Farming System Module: IFS module was started in NICRA village in the year 2017-2018 to enhance the farm income of marginal and small land holding farmers against extreme weather conditions viz. cold and frost. Dependency on single farm enterprise sometimes may not work adequately or fails. IFS involve more than one crop in limited area in which residue of one is used as input for another enterprise to minimize the cost of cultivation and to get the sustainable yield.

Components of integrated modules are fruit crops (apple), vegetable crops (cabbage, cauliflower, potato), Polyhouses (protected cultivation of capsicum), Vermicompost (earthworms are used for compost preparation), Dairy (milk, meat, cow dung).

Three programmes on doubling of farmers income under IFS was conducted in NICRA village with 20 number of farmers with the objective of growing fruit crops such as apple with the intercropping of cabbage and cauliflower+ rearing of animals (livestock) for milk, meat and the waste of animals and earthworms can be used as manure in the fields. This will improve the socio-economic status of rural people.

Protected Cultivation: Protected cultivation has significantly helped the farmers in reducing dependency on rainfall and efficient utilization of land and water resources. Under protected cultivation, the construction of polyhouse in the village started in the year 2011 onwards for the betterment of the farmers. Only 0.02 ha area was covered by protected cultivation in the year 2013-2014 with 2 number of polyhouses. In 2015, 0.03 ha area was under this and increased by 0.13 ha in 2016. At present, there are 38 numbers of polyhouses in 0.3 ha area and more will be coming soon. Capsicum cultivation was taken up in the polyhouses with the support of micro-irrigation system (sprinkler system). Average yield of capsicum under protected cultivation was realized up to 545 Q/ha with 3.28 BCR.

CROP DIVERSIFICATION

1) Cauliflower: The demonstration on crop diversification with cauliflower was conducted over past few years in NICRA village. In 2012, only 1.8 ha area was covered this intervention which is increased about 12 ha in 2017.

2) Cabbage: Cabbage was demonstrated over 2.5 ha area in 2012 indicated the adoption of successful intervention of inter-cropping in the orchard. In 2017, 11.5 ha area was under this crop.

Before NICRA only 0.7 ha area was under cabbage and cauliflower and after NICRA, 23.5 ha area was taken up by these two crops. By adopting these interventions of inter-cropping and off-season vegetable cultivation, farmers of NICRA village were able to increase their socio-economic status and getting high net return per year. 22 kg seed of hybrid varieties of cabbage and cauliflower was sown in the year 2017 for the enhancement of area and yield.

3) Apple: Demonstration on crop diversification with the introduction of spur type variety of apple was successfully conducted over an area of 1.25 ha with twenty numbers of farmers. Before NICRA, only 5.12 ha area was under apple cultivation but after NICRA, the area increased tremendously and reached up to 17.9 ha. At present, the total area under apple cultivation in NICRA village is 23.02 ha and more farmers are interested for growing apple in their orchards.

Low Cost Pheromone Traps for Controlling Fruit Fly Damage in Cucurbits (Hamirpur)

KVK, Hamirpur has been organizing demonstrations on control of fruit fly damage in cucurbits using low cost pheromone traps in the NICRA village. The technology of pheromone trap results in decline in male population of fruit fly by employing Male Annihilation Technique (MAT). The combination of MAT and Bait application technique (employing insecticide in combination of gur/ jaggery/ sugar as bait) has proven successful in fruit fly management. The results of demonstrations conducted during the period are as follows:

Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
			Demo	Local			
2016-17	19	2.6	260	220	27.3	2.28	1.92
2017-18	29	1.2	220	180	22.2	2.8	2.2
2018-19	83	8.0	220	180	22.2	2.8	2.2

Impact: Earlier farmers resorted to indiscriminate application of insecticides for control of fruit fly in cucurbits. Spray applications of 5 to 7 numbers were applied under cucurbit cultivation. However, with the adoption of pheromone trap of fruit fly, numbers of spray applications were reduced to 2 to 3 only. Some of the farmers have stopped the use of synthetic insecticides all together.

Economics: The use of eco-friendly method of management of fruit fly resulted in about 25 per cent increase in yield over control. The benefit cost ratio of 2.8 was received over 2.2 in control.

Extent of Adoption: About 60-65 percent famers have adopted this technology. As far as progressive farmers are concerned, the adoption rate is above 90 per cent.

Button Mushroom Cultivation: A Success Story of NICRA Village Telangi (Kinnaur, HP)

Chatter Singh a farmer of NICRA village Telangi was sensitized for mushroom production in year 2017-18 and trained with the technology for the commercial production of mushroom as the cultivation of button mushroom is rare in the district. In year 2018-19, Chatter Singh constructed his own mushroom room having the capacity of approximately 400 bags consisting of stacked racks, windows covered with the finely meshed cloths and isolated to avoid the contamination. As his first step toward the production he kept 350 bags each of 10 kg in the room. Around 1.5-2 quintals of mushroom he produced and marketed it easily in the local market of Reckong peo. His initiative inspired other farmers of the village and adjoining villages. He has shown the path to other to get benefitted from economically attractive option of cultivating button mushroom.

Cultivation of button mushroom can be up scaled so as to increase domestic income of the households. There is increasing demand of the button mushroom and to meet this demand the local

traders import it from adjoining districts. The up scaling of this activity in NICRA village will not only met the local demand but will encourage the farmers to adopt this practice as an additional income generation activity. Further the spent mushroom is good for agriculture e fields and is converted to vermicompost after mixing with dung. This helps in increasing the soil fertility.

ZONAL MONITORING COMMITTEE (ZMC) VISITS

The Zonal Monitoring Committee (ZMC) constituted under National Innovation in Climate Resilient Agriculture (NICRA) for its Technology Demonstration Component (TDC) in Zone-I visited Ropar and Fatehgarh Sahib on 01.02.2018 and Faridkot and Bathinda on 02.02.2018 to review the technical and financial progress by these Krishi Vigyan Kendras (KVKs) under TDC of NICRA. The committee visited the NICRA as well as non-NICRA villages, interacted with the farmers, verified the VCRMC meeting registers, custom hiring centres income registers etc.

Constitution of ZMC		
Dr. Ashok K. Mehta	Former ADG (Ext.), ICAR	Chairman
Dr. Rajbir Singh	Director, ICAR-ATARI, Zone-1, Ludhiana	Vice Chairman
Dr. G.S. Butter	Nominee, Director of Extension Education, PAU, Ludhiana	Member Member
Dr. Rakesh Sharda	Nominee, DDG (NRM)	Member
Dr. Santanu Kumar Bal	Nominee, ICAR-CRIDA, Hyderabad	Member Secretary
Dr. Ashish Santosh Murai	NICRA Nodal Scientist, ICAR-ATARI, Zone-1, Ludhiana	

Technical progress of interventions

The ZMC reviewed the progress under the project through I) presentation and interaction on achievements under NICRA at KVKs, ii) review of progress reports and different project records at KVKs, iii) observations of activities done at village level, iv) interaction with members of Village Climate Risk Management Committee (VCRMC) and participating as well as non-participating farmers, and v) review of project records at village level. The interventions made under all the four modules namely, Natural Resource Management, Crop Production, Livestock & Fisheries, and Institutional Intervention were reviewed.

KVK, ROPAR

The NICRA program is operating in Rasidpur, Fatehgarh Viran, Rampur fassae and Mohanmajra villages. Total cultivated area of NICRA villages is 561 ha. About 70% of farmers belong to small-marginal category (less than 2ha).

Happy Seeder is one of the unique techniques used for sowing wheat without burning of rice residue. Progressive increase in area covered under Happy Seeder adoption along with number of farmers was noticed in village Fatehgarh Viran since 2013. Since then, the number of adopted farmers and area under adoption has increased from 14 to 32 and from 5.5 ha to 35 ha, respectively. Average yield with happy seeder sown wheat was 47.5 q/ha as compared to conventional method of

sowing of wheat (45 q/ha). In case of Happy Seeder sown wheat the report of saving of irrigation, saving of nitrogen fertilizer and lesser weed infestation was reported. A net saving of Rs. 4735/- per hectare (Fuel, herbicides and labour charges etc) was also reported in wheat sown with Happy Seeder.

The adoption of Laser Land Leveler by farmers has increased from 17 farmers in 2012-13 to 52 farmers in the year 2015-16. There was progressive increase in area covered under this technology from 9.5 to 58 ha.

Demonstrations on poplar nursery were laid out at farmer's fields to popularize the number of elite poplar clones for diversification purpose to bring higher area under agro- forestry for carbon sequestration. Three clones each from Wimco Pvt Ltd and PAU, Ludhiana were tested for this purpose. Improved varieties of lentil, sarson and canola are being demonstrated in the villages which are being adopted by the farmers. During the year 2017 demonstrations on the seed treatment with Raxil and biofertilizer in wheat were also conducted.

To control problem of Anoestrus and Repeat Breeding in heifers, mineral mixture was provided to farmers to feed their animals. It was reported that there was increase in number of animals fed with mineral mixture from 125 in 2015-16 to 160 in 2016-17. Seeing the decrease in anoestrous breeding problem of animals farmers are feeding the mineral mixture by purchasing from the market. Demonstration have been laid at farmer's fields for growing nutritious fodder including barseem and Rye grass and fed as a mixture to the animals. This has resulted in increase in the milk yield.

In year 2011-12, revenue generated through custom hiring was Rs. 16700 which increased to Rs. 30230 in 2016-17.

Recommendations of the Zonal Monitoring Committee visit to KVK, Ropar

- Permission may be given by the NICRA headquarter to use the income generated by Custom Hiring Centres (CHCs) for repairing the existing implements, purchase of new implements and construction of sheds for these implements.
- Funds may be provided for procuring equipment for preparation of meal mixtures (nutritional/mineral supplements) for animals.
- Looking into the huge demand for Happy Seeders, provision may be made in the NICRA project for procurement of additional equipment.
- The custom hiring rate card should be placed at the prominent place in the village so that it can be accessed by any villager.
- Farmer-to-farmer seed exchange of new improved varieties may be promoted in the NICRA villages.
- Demonstrations on use of biogas for electricity generation for domestic consumption may be conducted.
- Demonstrations and trainings on paddy straw based biogas plants for the benefit of the villagers may be organized.
- The village institutions such as CHC and seed banks are to be strengthened and farmers may be encouraged to use them.
- As the KVKs are addressing the climate vulnerabilities of heat and cold stress, the performance of interventions needs to be assessed against these climatic vulnerabilities.
- Efforts are to be made for quantification of the impact of the resilient practices during the crop growing season.

KVK, FATEHGARH SAHIB

In NICRA village Badauchhi Kalan, the area covered under wheat sowing with Happy Seeder was 4 acres in the year 2011-12 which increased to 48 acres in the year 2017-18 and future target is to achieve 100 acres in the coming years. The village co-operative society has purchased its own happy seeder machine which may further result in increase in the area under happy seeder in future. Approx. 56 kg of CO2 is produced by burning 1 ton of paddy straw and 1 acre produces 2 tonnes of paddy straw. Thus this intervention has saved approx. 4480 kg of CO2 emission from 50 acres of paddy area. In the village about 10 percent famers have adopted this technology.

Extent of adoption for green manuring with Sunhemp crop (Sesbania) varies from 45-50 percent of in the NICRA village farmers as Sunhemp is popular as a green manure in many tropical and sub-tropical areas in the world as an excellent organic N-source, for increasing soil organic matter for controlling root knot, nematode, for loosening sub-soil. As it grows very fast so it suppresses the weed growth. Green manures are plants which are grown mainly for the benefit of soil; they can be grown in an intercropping system to build soil fertility or as a cover crop to protect their soil from erosion. When it is ploughed down under at early bloom stage, N recovery is highest.

Around 90% of land has already been laser leveled in the NICRA village. Presently there are 3 laser levelers running in the village through cooperatives society and their own purchased machines. This technology will ultimately prove a boon to farmer community and for state agriculture and will also motivate other farmers for adopting proper water management measures to use water more efficiently and judiciously, thus saving the depleting natural resource water. Results in technologically advanced countries have indicated that it saves water to the tune of 25-30% and time by 30% and also improves production and productivity by 15-20%. It has also been noticed that 2-3% effective cropped area in flat fields and even more in ridge sown fields is increased under the crops, as the number of bunds and irrigation channels get reduced considerably. Laser leveler is trailed type equipment used for achieving precise fine leveling with desired grade. The field with variation of 8-10 cm can be leveled in 2.5-3.5 hours per acre.

Direct Seeded Rice was promoted among the farmers under the NICRA programme under which 4.4 hectares of land covered with 11 beneficiaries. DSR has an excellent potential for water savings provided alternate wetting and drying system is used for irrigation scheduling. DSR creates anaerobic soil system which is beneficial for root growth and productivity of subsequent crops in the system. Labour and water savings are the major drivers of DSR adoption. Absence of puddling reduces cost of production and improves soil structure over puddle transplanted rice.

Recommendations of the Zonal Monitoring Committee visit to KVK, Fatehgarh Sahib

- Permission may be given by the NICRA headquarter to use the income generated by Custom Hiring Centres (CHCs) for repairing the existing implements, purchase of new implements and construction of sheds for these implements.
- Funds may be provided for procuring equipment for preparation of meal mixtures (nutritional/mineral supplements) for animals.
- Looking into the huge demand for Happy Seeders, provision may be made in the NICRA project for procurement of additional equipment.
- The custom hiring rate card should be placed at the prominent place in the village so that it can be accessed by any villager.
- Farmer-to-farmer seed exchange of new improved varieties may be promoted in the NICRA villages.
- Demonstrations on use of biogas for electricity generation for domestic consumption may be conducted.
- Demonstrations and trainings on paddy straw based biogas plants for the benefit of the villagers may be organized.
- The village institutions such as CHC and seed banks are to be strengthened and farmers may be encouraged to use them.

- As the KVKs are addressing the climate vulnerabilities of heat and cold stress, the performance of interventions needs to be assessed against these climatic vulnerabilities.
- Efforts are to be made for quantification of the impact of the resilient practices during the crop growing season.

KVK, FARIDKOT

Pindi Blochan village of district Faridkot is having 1060 ha of cultivable land out of which 911 ha is under paddy and Basmati cultivation (705 ha paddy, 205 ha basmati). In 2012 demonstration on zero tillage/ happy seeder were demonstrated in about 8 ha after harvesting of paddy.

Slowly and steadily, the areas under ZT/HS increased and reached to 460 ha in the village by 2017. Field days and other extension activities were conducted consistently in the village. Now the area under ZT/HS is further increasing as more and more farmers are adopting this technology as shown in Fig.1 Similarly, demonstration of Baler was exhibited in 17 hectares in 2013 which increased to 693 ha in 2017 as shown in Fig. In capacity building programs, farmers were made aware about the ill effects of residue burning and farmers are now very well aware about the in -situ management of residue and incorporate the residue in field with the help of rotavators. In Pindi Blochan village at present around 230 hectares is under incorporation of residue.

The farmers of village Pindi Blochan are very much aware about various techniques available for residue management. The machinery provided through NICRA project is showing good results and now some farmers have some came forward to purchase their own machinery, at present in the village about 13 zero till drill are in operation, out of which twelve are procured by farmers themselves, and some are also using these machines on custom hiring basis.

In 2016, the whole village came forward and declared that Pindi Blochan will not burn any residue and later on Sarpanch of the village was declared it burning free village as there was no burning in

the village. Further, the farmers from adjoining villages are also visiting this village to observer the affect of these technologies and also following the footsteps of Pindi Blochan. Around 5 villages adjoining Pindi Blochan viz., Ahel, Marar, Verewala Khurd and Ghuduwala are also using straw baler for managing the paddy straw. Few other villages which are in close link with KVK, namely Mehmuana, Aulakh, Sikhanwala, Bhagthalan, Chahal, Kot Sukhia, Matta, Sukhanwala, Pacca and many more are also using ZT/HS for sowing of wheat in standing residue. Moreover KVK, Faridkot is also demonstrating these technologies in these villages and the area under ZT/HS is increasing day by day. During field days, awareness camps organized by KVK, farmers from these villages also participate. Now farmers to farmers extension is taking place and more and more villages are convinced about the beneficial uses of climate resilient technologies.

During 2011-12 only few big progressive farmers were using laser level technology at their fields and area under this technology was only 150 ha. Farmers were guided about importance of this technology and as result whole area of the village is laser leveled and about 250 ha area is laser leveled every year. Farmers themselves have reported the advantage of this technology to the ZMC team that their yield has increased up by 2-3%. It has is also been shared by them that theyare now irrigating more land with same amount of water (increase in irrigation efficiency).

Green manuring with dhaincha was also done by few farmers of the village and during 2011-12 the area under this technology was only 32.4 ha which has now increased to the tune of 248 ha during 2017. It has also been shared by the farmers that they have reduced the application of urea up to 40% in the fields where green manuring was done. The major constrains in up scaling up of this in the area is 1) Non- availability of electricity, for running of tube well for irrigation, 2) Attack of tobacco caterpillar at initial stage and 3) Non availability of quality seeds of green manuring crops. In spite of these hindrances at NICRA village KVK team through all efforts have motivated farmers about the importance of the green manuring and as result the area has increased upto 248 ha during *kharif* 2017.

At the initiation of the project i.e. during 2011-12, farmers of the village were not aware about this technology, one farmer namely Gurpreet Singh S/o S. Darshan Singh was motivated by guidance and assurance given by KVK about this technology and has gone for cultivation of 6 ha during 2011-12 through technology . He shared his views about the technology that he has got at par yield as with transplanted method and have saved about Rs. 1000/- per acre, he also informed the team that he has applied 3-4 irrigation less in DSR plot as compared to the transplanting. Seeing, the advantage of the technology the other farmers of the village and adjoining villages have also come up to sown some area with this technology and as a result the area under this technology has increased up to 67 ha during 2017, as shown in figure. Successes story of the farmers is also published at Zonal level.

Farmers of the village were having knowledge / importance of soil and water testing but they were reluctant in taking the soil and water samples to the lab. Through KVK intervention the soil and water sample campaign was organized and samples were collected at village itself. Till date 289 soil samples and 234 water samples were of the village were tested and reports were given to the farmers. Farmers were advised to apply fertilizer on the basis of the soil test based report; as a result urea application has reduced to the tune of 10-15 %.

At the inception there was monoculture of PBW-343, but this was susceptible to the incidence of yellow rust apart from variety were HD-2733 and HD-2932, both varieties were susceptible to yellow rust. Since then KVK has introduced varieties PBW-621, PBW-677, HD-2967, HD-3086, and PBW-725. Amongst these varieties, HD-3086, HD-2967 and PBW-725 and have performed well under the climate change scenario. In case of paddy major acreage was under variety PUSA-44, which was susceptible to bacterial blight and was of long duration crop. The area has now shifted to PR-121, PR-122, PR-114 and PR-126. KVK introduced basmati cultivation in NICRA village.

Earlier the farmers were using non descriptive and low yielding varieties of sarson. None of the farmers were exploiting sarson cultivation on commercial scale. KVK Faridkot introduced Gobhi Sarson canola varieties viz GSC-6, GSC-7. Apart from this high yielding African sarson variety namely PC-6 was also introduced in NICRA village. There were only few takers for gram cultivation in the village KVK introduced new and high yielding desi gram variety PBG-7 in the village. Slowly the farmers are now taking up vegetable cultivation on commercial scale. Three farmers from the village cultivated pea's var: Pb-89. Apart from that, two farmers opted for low tunnel cultivation of capsicum and summer squash. Potato cultivation was taken up on 8 ha of area. Farmers have tied up with Rana Sugar mill and now cultivating beet root on the pattern of contract farming on an area of 26 ha.

During 2011-12 only few farmers were practicing kitchen garden. KVK team guided them about the importance of vegetables grown at house hold level in comparison to that are procured from the market. Vegetable kits were demonstrated to selected farm families at their house hold level. The result of which is that 65 farm families have established kitchen garden at their house, to meet the daily nutritive requirement of their family. In addition to these fruits plants that can grow well in the area were also given and being maintained by the farmers.

Before adoption of the village under NICRA project only one or two farmers are using mineral mixture that also not on regular basis. But after initiation of the project farmers were guided about the importance of mineral mixture which is being prepared by GADVASU. Initially only two or three farmers came forward. KVK scientist advised farmer who were using to share their views

about the effect of mineral mixture and as result at present 59 farm families have started using mineral mixture. It has been reported by farmers that the use of this has not only help in increasing the milk yield but also alleviated problems of Anoestrus and Repeat Breeding to a large extent.

Earlier Jowar and Bajra were the major fodder crops of the village and no one was use to grow maize (J-1006). After the initiation of the project farmer were guided about maize fodder that this fodder crop can be grown till September-October and is also good for silage making and fodder yield is also higher. Initially during only 4 ha could be brought under this fodder crop. At present, 47 ha area has come up under this fodder crop. Other activities taken up under Livestock and fisheries module are as under:

Intervention	No. of Animals / Units
Preventive Vaccination	942 animals
Animal Health Check up	918 animals
Breed Up-gradation	96 animals
De-worming	407 animals
Artificial Insemination	29
Mitigation of mineral deficiency	176

These activities have become regular feature of the village. As such in the villages no extreme disease epidemic was recorded in the village. Even though farmers are educated and motivated to get their animals vaccinated and de-worm at regular interval. To make it practically applicable KVK and State department of Animal Husbandry have joined hands together and organizes camps at regular interval, in which the animals of the villages are vaccinated and de-wormed.

A custom hiring centre was developed at the village, as there is no such centre in the village from where the farmer can take machines. The machines that are kept at the centre which were procured by the KVK under project after discussions with the farmers, these machines were provided to them on rent basis. For proper implementation of the project activities, smooth running of the custom hiring centre and planning of requirement of other things under climate change scenario, a Village Climate Risk Management Committee (VCRMC) has also been formed as per the guidelines of the project.

A Kisan Hut was established at village Ghuduwala for making animal feed. The farmers got registered under the Group "Progressive Kisan Bhalai Society, Punjab". They are moving into processing of cereals and pulses and they are on the way of setting up a jaggery production unit at their centre.

Recommendations of the Zonal Monitoring Committee visit to KVK, Faridkot

- Permission may be given by the NICRA headquarter to use the income generated by Custom Hiring Centres (CHCs) for repairing the existing implements, purchase of new implements and construction of sheds for these implements.
- Funds may be provided for procuring equipment for preparation of meal mixtures (nutritional/mineral supplements) for animals.
- Looking into the huge demand for Happy Seeders, provision may be made in the NICRA project for procurement of additional equipment.
- The custom hiring rate card should be placed at the prominent place in the village so that it can be accessed by any villager.
- Farmer-to-farmer seed exchange of new improved varieties may be promoted in the NICRA villages.
- Demonstrations on use of biogas for electricity generation for domestic consumption may be conducted.
- Demonstrations and trainings on paddy straw based biogas plants for the benefit of the villagers may be organized.
- The village institutions such as CHC and seed banks are to be strengthened and farmers may be encouraged to use them.
- As the KVKs are addressing the climate vulnerabilities of heat and cold stress, the performance of interventions needs to be assessed against these climatic vulnerabilities.
- Efforts are to be made for quantification of the impact of the resilient practices during the crop growing season.

KVK, BATHINDA

Killi Nihal Singh Wala Village of Bathinda having 810 ha of cultivable land out of which 575 hectares is under paddy was adopted. Traditionally, farmers in this village are burning residue after harvest of paddy; however, some farmers were incorporating the residue in soil and cultivate wheat and some other crops. Efforts were made to demonstrate the technologies which can be adopted by farmers and technologies of happy seeder and balers were demonstrated in the villages. In 2012, demonstrations on happy seeder were demonstrated in about 10 ha area after harvesting of paddy. In some of the, trials the yield of wheat was at par with traditional method, however, in some demonstrations, the production was 4.7% higher in happy seeder sown wheat.

Field days and other capacity development programmes were conducted and farmers were convinced about the positive results of happy seeder but availability of happy seeder is the major constraints in increasing area under this technology. Looking into the benefits, the area in successive years reached to more than 55 hectares in 2016.Similarly, area under zero till drill increased to more than 106 ha. Demonstration of Baler-cum-knotter and chopper-cum-spreader were demonstrated in 45 and 10 hectares respectively, which increased to 105 and 95 ha in 2016 as presented in figure. Earlier, few farmers (22 ha area) of Killi Nihal Singh wala were incorporating the residue with the help of disc ploughs or rotavator which now has increased to more than 125 ha.

During various extensions programmes conducted by KVK Bathinda, many farmers from adjoining villages attended these programmes and influenced by methods used by farmers of this village. On request of farmers of adjoining villages, KVK Bathinda has also laid some method demonstrations in nearby villages like Naruana, Jai Singh wala, Kot Shamir, Katar Singhwala and many farmers are coming forward to adopt these technologies. In 2016, the sarpanch of village Killi Nihal Singh Wala declared that village will not burn any residue and penalty will be imposed if anybody is indulged in burning residue. Consequently, farmers in the village didn't burn residue and efforts were made to use the residue in one or other form like baling, chopping and incorporating into the soil with the help of soil stirring plough.

Recommendations of the Zonal Monitoring Committee visit to KVK, Bathinda

- Permission may be given by the NICRA headquarter to use the income generated by Custom Hiring Centres (CHCs) for repairing the existing implements, purchase of new implements and construction of sheds for these implements.
- Funds may be provided for procuring equipment for preparation of meal mixtures (nutritional/mineral supplements) for animals.
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- The village institutions such as CHC and seed banks are to be strengthened and farmers may be encouraged to use them.
- As the KVKs are addressing the climate vulnerabilities of heat and cold stress, the performance of interventions needs to be assessed against these climatic vulnerabilities.
- Efforts are to be made for quantification of the impact of the resilient practices during the crop growing season.

GENERAL OBSERVATIONS

- *Happy seeder* - Wheat sowing by happy seeder is being accepted by farmers as the best option for getting away with the problem arising out of burning of rice residue. This technique besides alleviating the emission problem also saving 1to 2 irrigations, reduces weed problem and also saving of N-fertilizer by 10-20%. The increase in Organic content and improvement in soil structure also strengthening the root establishment and penetration and giving resistance to the plants against lodging.
- *Animal nutrition* - Introduction of mineral mixture, bypass fat and fodders like Berseem and Rye grass has reported increase in milk yield and fat percentage in the milk.
- *Solar Cooker* - Introduction of solar cooker in rural areas has led to saving of 5-6 LPG cylinders in a household.
- *Kitchen garden* - Introduction of kitchen garden in each household has improved the nutritional as well as health aspects of rural community
- *Custom Hiring centre* - The custom Hiring centres are generating lot of revenue.

GENERAL RECOMMENDATIONS

- Permission may be given by the NICRA headquarter to use the income generated by Custom Hiring Centres (CHCs) for repairing the existing implements, purchase of new implements and construction of sheds for these implements.
- Funds may be provided for procuring equipment for preparation of meal mixtures (nutritional/mineral supplements) for animals.
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- Demonstrations and trainings on paddy straw based biogas plants for the benefit of the villagers may be organized.

ZONAL REVIEW-CUM-ACTION PLAN WORKSHOP

ICAR-ATARI, Ludhiana organized the Zonal Review-cum-Action Plan workshop of Technology Demonstration Component of National Innovations in Climate Resilient Agriculture (NICRA) project on August 18th, 2017.

Dr. A. K. Mehta, Former ADG (Agri. Ext.) and the Chief Guest of the workshop, shared his experiences in implementing NICRA at the national level and urged KVKs to work in tandem with all the stakeholders for better implementation of the project. He termed participatory approach as the key to success and asked the KVKs for all out efforts for involving farmers groups at grass root level.

Dr. Rajbir Singh, Director, ICAR-ATARI, Ludhiana appreciated the work done in the project particularly in addressing the issue of residue burning in NICRA villages and its impact on adjoining villages. While talking on the report of Parliamentary Standing Committee on Agriculture, he mentioned future predictions of decrease in yield in major crops in north India with respect to the impact of climate change on agriculture which requires a holistic strategy to address the issue of climate change. He specifically urged the KVKs to showcase their efforts and achievements to the line departments and rope them in to obtain effective convergence.

Dr. Ashok Kumar, Director (Extension), PAU, Ludhiana shared facts about changing climate and its impact on contemporary Indian agriculture. He highlighted the role KVKs can play in spreading awareness among farmers with respect to climate resilient agricultural technologies for sustainable agriculture.

Dr. R. K. Arora, Associate Director (Extension) stressed on the need of publishing salient achievements of the first phase of NICRA (2011-2017) and emphasized on the need of experiential learning.

Dr. J.V.N.S. Prasad Co-PI, NICRA from ICAR-CRIDA, Hyderabad highlighted the action points that are to be taken care while implementing NICRA in the second phase. He appreciated the efforts

of KVKs of Zone-I in transforming villages into Climate Smart villages and emphasized on spreading the accepted technologies in nearby villages with similar conditions.

Nearly 50 participants including Programme Coordinators and Nodal Scientist from NICRA KVKs, Scientists from organizing institute and farmers from NICRA villages have also participated. Detailed discussions were held among the participants and the action plans for all the KVKs were chalked out.

Recommendations/Action Points

1. All KVK will submit hard copy of Consolidated Progress Report of the project since inception; Action Taken Report on the recommendations of last workshop of NICRA Project held during 02.06.2016 at ICAR-NDRI, Karnal; and Revised Action Plan 2017-18 to the ICAR- ATARI, Ludhiana within 15 Days.
2. Data Collection on impact of past efforts in NICRA Villages is to be done in the format provided by ICAR-CRIDA, Hyderabad. Data collection should be more scientific and climate smart technologies should be evaluated based on carbon foot print.
3. The technologies which have shown good results in NICRA villages should be out-scaled to at least two-five (2-5) adjacent villages. Villages should be immediately identified and their resource mapping or PRA should be done. Divide the village in to farming situations and cropping sequences, identify the resilient practices for each of the farming situation, spread the resilient practices in each of the farming situation, every household is to be covered with resilient practice and assess the impact of interventions and extent of resilience achieved. Water availability based crop planning for maximizing returns should be encouraged. Soil Fertility (health) map of NICRA villages to be prepared and its digitization to be done. Nutrient application should be based on soil health card.
4. Identify and target basket of proven resilient technology options based on farming system, cropping pattern, contingency situations and constraints in achieving resilience. Spread of low cost technologies like ploughing across the slope, line sowing etc. should be prioritized.
5. Strong liaisons and convergence with line departments, government schemes etc. must be established for implementing NICRA and saturating villages with promising climate resilient technologies.
6. Farmers should be sensitized and motivated to enroll in new government schemes like PMFBY, PMKSY etc. Strong campaigning for residue management in NICRA villages and adjoining villages to develop islands of burning free villages. Demonstrations on sowing with happy seeder must be emphasized covering maximum area.
7. Efforts should be made for cleanliness and hygiene in NICRA villages. Vermicomposting

should be promoted for transforming NICRA villages into "Swachh villages" Special lecture should be arranged to sensitize different schemes of the government.

8. Information and Communication Technologies (ICTs) should be intensively exploited to spread awareness about climate resilient technologies and convey agro-advisories. Farm families with smart-phones should be engaged in NICRA project through social media like whatsapp groups etc.
9. Record the impact of weather variability on crop conditions and yield improvements. (e.g. better wheat yield during 2014 due to prolonged winter and yield penalty due to untimely rains during the month of April 2015)
10. Inventory of climate resilient technologies should be prepared for each district. Integrate Action Plan of NICRA village for 2017-18 with the district plan, district irrigation plan and district contingency plan.
11. Farm women of the village must be sensitized and motivated for adopting climate smart technologies.
12. Feedback of climate resilient technologies should be transferred to researches for the refinement of technologies.
13. Custom hiring centre should be strengthened further. Similarly, meetings of VCRMC should be held regularly. The services of the custom hiring centres should be extended to selected adjoining villages.
14. Research articles/ popular articles on successful technologies in NICRA Villages should be submitted for publication in magazines/journals. Publications based on interventions on the village should be published with forward from the Sarpanch of the village.
15. The details of activities organized under NICRA project should be regularly communicated to ICAR-ATARI, Ludhiana for publication as news on website and KVK Portal.
16. SRFs should be recruited immediately and they should be engaged in the field for intensive data collection.

High Yielding Varieties demonstrated under Integrated Crop Management

Punjab

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Faridkot	Gram (PBG-7)	2016-17	20	4.4	10.75	9.5	13.15	1.70	1.67
		2017-18	10	2	10.8	9.7	11.34	1.72	1.63
		2018-19	23	4	11.4	9.8	16.3	1.96	1.75
Faridkot	Gobhi sarson (GSC-7)	2016-17	25	4	18.1	15.8	14.55	2.81	2.57
		2017-18	18	3	19.6	17.2	13.95	2.96	2.75
		2018-19	40	12	19.8	17.6	12.5	3.1	2.9
Faridkot	Wheat (HD-3086)	2016-17	5	2	54.9	52.3	4.47	2.78	2.65
		2017-18	10	4	54.4	52.8	3.4	2.92	2.72
		2018-19	10	4	55.6	53.9	3.15	2.93	2.66
Faridkot	Wheat (WH-1105)	2016-17	5	2	53.4	51.8	3.08	2.71	2.63
		2017-18	5	2	51.8	50.6	2.4	2.78	2.61
Faridkot	Wheat (PBW-725)	2016-17	5	2	51.6	50.1	2.99	2.58	2.54
		2017-18	25	10	52.4	50.6	3.6	2.82	2.61
		2016-17	5	2	52.1	51.2	1.75	2.64	2.6
Faridkot	Wheat (HD-2967)	2017-18	5	2	52.8	51.4	2.7	2.84	2.65
		2018-19	6	2	53.75	52.6	2.19	2.83	2.59
Ropar	Gobhi sarson (GSC-7)	2016-17	15	05	19.4	15.1	28	2.9	1.9
		2017-18	27	11	19.8	15.4	28.6	2.47	1.87
		2018-19	12	5	20.9	18.6	12.4	2.8	2.49
Ropar	Wheat (PBW-725)	2016-17	10	4	54	51	6	2.98	2.82
		2017-18	20	8	55	50	10	3.0	2.78
Ropar Ropar	Wheat (Unnat PBW-343)	2018-19	60	24	53.2	50.8	4.7	2.93	2.79
	Mango (Dasheri)	2016-17	1	0.4	145	127	14.1	3.91	3.27

Haryana

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Sirsa	Wheat (HD-2967)	2016-17	10	4	50	47.5	5	2.44	2.36
	Wheat (WH 1105)	2016-17	10	4	47.0	45.0	4	2.31	2.26
Yamunanagar	Paddy (PB-1)	2016-17	55	22	52.00	47.70	9.01	2.80	2.55
Yamunanagar	Wheat (HD-2967)	2016-17	50	20	55.93	53.56	4.42	2.47	2.38

Himachal Pradesh

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Kullu	Black gram (P-93)	2016-17	17	1.0	8.50	6.84	24.26	3.76	3.12
		2018-19	46	5.0	7.30	6.20	17.74	2.76	2.57
Kullu	Black gram (UG-218)	2016-17	12	1.0	7.95	6.84	16.22	3.52	3.12
		2017-18	1.5	14	7.18	6.24	15.06	3.49	3.13
Kullu	Black gram (HimaMash-1)	2018-19	3.5	23	6.84	5.95	14.96	3.20	2.99
Chamba	Capsicum (Indira)	2016-17	9	0.13	560	360	55.5	4.25	2.98
		2017-18	3	0.05	545	320	70.31	3.28	2.98
		2018-19	5	0.08	545	320	70.31	3.28	2.98
Hamirpur	Wheat (HS 542)	2016-17	2	1.0	25	22	13.6	1.9	1.8
	Wheat (HPW 360)	2017-18	9	1.0	20.5	15.5	32.3	1.54	1.20
		2018-19	2	0.32	24.2	15.5	56.1	1.64	1.20
Hamirpur	Wheat (HPW 368)	2016-17	17	2.0	28	22	27.3	1.9	1.85
		2017-18	21	3.0	22.0	15.5	41.9	1.65	1.20
		2018-19	33	3.5	23.0	15.5	48.4	1.63	1.20
Hamirpur	Maize (Polo gold)	2016-17	16	2.5	22.0	20	10.0	1.5	1.3
	Maize (KH517)	2018-19	16	4.0	28.8	21.4	34.6	1.85	1.38
Hamirpur	Toria (Bhawani)	2016-17	21	0.83	6.0	5.0	20.0	1.6	1.5
		2018-19	2	0.8	6.2	5.4	12.5	1.56	1.28
Hamirpur	Bitter gourd (Chaman/Pali)	2016-17	7	2.0	230	190	15.79	3.33	3.01
		2017-18	5	1.5	245	210	16.67	3.40	3.0
Hamirpur	Bottle gourd (Sharda)	2016-17	5	0.16	220	195	12.82	3.38	3.19
		2017-18	7	1.0	255	220	15.90	3.75	3.33
		2018-19	63	0.16	230	205	12.20	3.54	3.31
Hamirpur	Cucumber (NS 404)	2016-17	10	1.0	150	125	20.0	2.90	2.5
	Cucumber (Malav)	2017-18	6	0.5	165	140	17.85	3.6	3.22
		2018-19	63	0.18	160	130	23.07	2.74	2.36
Hamirpur	Gobhi sarson (ONK-1)	2016-17	19	1.0	7.5	6.0	25.0	1.5	1.3
Hamirpur	Brown sarson (KBS-3)	2016-17	18	2.0	6.5	5.5	18.2	1.3	1.2
Hamirpur	Sponge gourd (Nutan)	2018-19	37	0.14	180	150	20.0	2.4	2.10
Hamirpur	Pumpkin (Surya)	2018-19	45	0.6	220	190	15.78	2.70	2.45
Hamirpur	Bottle gourd round (MGH 1/ Marvi)	2018-19	63	0.12	250	220	13.64	3.84	3.54
Hamirpur	Okra (Palam Komal/ P-8)	2018-19	56	0.5	145	116	25.0	3.6	3.16

Uttarakhand

District	Crop & Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Uttarkashi	Maize (Vivek Sankul Makka-35)	2016-17	25	4.0	42.0	31.0	26.19	5.72	4.98
Uttarkashi	Maize (VL Maize-31)	2018-19	15	2.0	20.5	10.5	48.78	2.32	1.41
Uttarkashi	Pigeon pea (VL Arhar -1)	2016-17	45	7.0	19.25	11.0	42.85	4.52	3.12
Uttarkashi		2018-19	74	5.0	10	7	30.00	2.57	2.24
Uttarkashi	Mandua (VL Mandua-324)	2016-17	25	4.0	20.25	14.10	30.37	3.44	3.24
Uttarkashi		2018-19	10	1.0	10.0	7.0	30.00	1.57	1.33
Uttarkashi	Black gram (Pant Urd-35)	2016-17	35	3.0	13.50	9.10	32.59	3.87	2.77
Uttarkashi		2018-19	20	2.0	12.3	9.03	26.59	3.69	3.10
Uttarkashi	Okra (VL Bhindi-2)	2016-17	30	1.5	110.0	85.0	22.72	6.02	5.41
Uttarkashi		2018-19	20	2.0	111.4	81.6	26.75	8.11	6.53
Uttarkashi	Amaranth (VL Chuwa-44)	2016-17	10	4.0	10.0	6.0	40.00	4.06	2.85
Uttarkashi	Madira (VL Madira-207)		25	2.0	16.0	9.30	41.87	2.87	2.33
Uttarkashi	Ground Nut (VL GN-1)		10	0.35	25.5	13.24	48.07	4.06	2.46
Uttarkashi	Paddy (Vivek Dhan-154)		20	0.35	28.0	20.5	26.78	3.10	2.62
Uttarkashi	Green gram (Pant Moong-5)		15	1.5	11.25	8.10	28.00	4.32	3.76
Uttarkashi	Popcorn (VL Amber popcorn)		25	5.0	25.00	14.50	42.00	4.13	2.77
Uttarkashi	Hybrid Napier (CO3)		25	2.0	2000	1750	12.5	27.03	28.78
Uttarkashi	Bean (Pant Anupama)		20	1.0	170	135	20.59	17.76	16.55
Uttarkashi	Wheat (VLGehun -829/ 907)	2016-17	60	4.5	39.1	24.62	54.39	2.60	2.01
Uttarkashi	Wheat (VLG-829)	2018-19	30	3.5	30.8	19.7	36.04	4.12	3.41
Uttarkashi	Wheat (VLG-907)		30	0.5	31.1	19.8	36.33	4.16	3.42
Uttarkashi	Wheat (VLG-892)		30	2.5	30.9	19.63	36.47	4.14	3.40
Uttarkashi	Lentil (VLM- 125/ 126/ 129)	2016-17	65	2.5	14.68	9.85	49.032	2.76	2.04

District	Crop & Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Uttarkashi	Lentil (VLM-126)	2018-19	40	1	15.03	9.94	33.87	2.97	2.17
Uttarkashi	Lentil (VLM-514)		20	0.6	14.93	9.72	34.90	2.95	2.12
Uttarkashi	Cabbage (Varun)	2016-17	15	0.3	238.9	174.5	26.96	5.65	4.79
Uttarkashi		2018-19	10	0.3	253.1	194.2	23.27	6.39	5.09
Uttarkashi	Pea (Arkel)	2016-17	45	1.0	99.65	75.0	32.86	4.79	3.96
Uttarkashi	Chick pea (JG-11)	2016-17	12	0.24	17.25	9.25	46.37	2.71	1.68
Uttarkashi	Cauliflower (Madhuri)	2018-19	25	0.5	204.5	158.0	22.74	4.11	3.46
Uttarkashi	Radish (Japanese white)		25	0.5	210.5	148.5	29.45	5.19	4.46
Uttarkashi	Onion (VL Piaz-3)		10	0.2	240	208	13.33	5.71	5.01
Tehri garhwal	Rice (VL Dhan-65)	2016-17	64	2.25	16.4	14.2	15.28	1.26	1.24
Tehri garhwal	Onion (AFLR)	2018-19	60	3.0	23.0	18.0	27.78	1.96	1.88

Jammu & Kashmir

District	Crop/Variety	Year	No. of Farmers	Area (ha)	Yield (q/ha)		% increase	Demo BCR	Check BCR
					Demo	Check			
Kathua	Wheat (Raj-3765)	2016-17	11	4.5	17.5	14.4	21.52	2.24	1.92
Kathua	Wheat (WH-1021)	2018-19	23	5.0	19.7	15.5	27.09	2.52	2.06
Kathua	Wheat (Raj-3765)	2016-17	20	20	22.5	17.0	32.30	2.32	1.87
Kathua	Wheat (WH-1080)	2017-18	10	5.0	31.5	26.5	18.86	3.78	3.18
Kathua	Black Gram (Mash-1008)	2016-17	10	2.0	8.0	6.0	40	5.30	4.40
		2017-18	22	4.2	9.0	7.0	28.57	6.17	5.3
		2018-19	29	4.9	9.2	6.8	35.29	6.19	4.57
Kathua	Okra (Varsha Uphar)	2016-17	18	1.0	118.5	84.5	40.2	3.08	2.0
		2017-18	20	1.3	12.5	78.5	43.31	2.86	2.03
		2018-19	20	1.3	12.5	78.5	43.31	2.86	2.03
Kathua	Gram (PBG-7)	2017-18	15	1.5	6.8	4.4	54.5	3.05	1.97
		2018-19	15	1.5	6.8	4.4	54.5	3.05	1.97
Bandipora	Paddy (K-332)	2017-18	92	8.50	75.0	55.0	36	1.38	1.07

Annexure-I

ICAR-Central Research Institute for Dryland Agriculture
National Innovations in Climate Resilient Agriculture (NICRA)
Saidabad:: Hyderabad-500 059

HEAD-WISE REVISED BUDGET SANCTION FOR 2016-17 (RE)

(Rupees in lakhs)

Sno	Name of the ZPD/KVK	BE				Revised RE			
		Operational expenses (Labour, skilled staff, POL, Supplies etc.,) Contractual Services including RA/SRF etc.	TA	NRC	Total	Operational expenses (Labour, skilled staff, POL, Supplies etc.,) Contractual Services including RA/SRF etc.	TA	NRC	Total
1	**ATARI, ZONE-I, Ludhiana**	7.50	1.50	0.50	**9.50**	8.15	0.35	0.00	**8.50**
2	Bathinda	11.00	0.50	0.70	**12.20**	13.20	0.15	0.00	**13.35**
3	Chamba	8.00	0.50	0.70	**9.20**	7.75	0.45	0.00	**8.20**
4	Faridkot	16.00	0.50	0.70	**17.20**	16.40	0.50	0.00	**16.90**
5	Fatehgarh Shaib	12.00	0.50	0.80	**13.30**	10.65	0.45	0.00	**11.10**
6	Hamirpur_HP	9.00	0.50	0.80	**10.30**	8.75	0.45	0.00	**9.20**
7	Kathua	9.00	0.50	0.80	**10.30**	8.75	0.50	0.00	**9.25**
8	Kinnaur	9.00	0.50	0.70	**10.20**	8.75	0.45	0.00	**9.20**
9	Kullu	15.00	0.50	0.70	**16.20**	14.75	0.20	0.00	**14.95**
10	Phulwama	13.00	0.50	0.70	**14.20**	14.50	0.65	0.11	**15.26**
11	Ropar	10.50	0.50	0.80	**11.80**	10.00	0.45	0.00	**10.45**
12	Sirsa	10.00	0.50	0.70	**11.20**	3.70	0.45	0.00	**4.15**
13	Yamunanagar	16.00	0.50	0.70	**17.20**	15.20	0.75	0.00	**15.95**
14	Bandipora	10.00	0.50	0.70	**11.20**	9.70	0.45	0.00	**10.15**
	Total	**156.00**	**8.00**	**10.00**	**174.00**	**150.25**	**6.25**	**0.11**	**156.61**

(JVNS Prasad)
Co-PI

Annexure-II

National Innovations in Climate Resilient Agriculture (NICRA)
Technology Demonstration Component (NICRA)
ICAR-Central Research Institute for Dryland Agriculture
Saidabad, Hyderabad-500 059

HEAD-WISE REVISED BUDGET SANCTION FOR 2017-18 (RE)

(Rupees in lakhs)

Sl. No.	Name of the ATARI/KVK	BE for 2017-18			Grants for creation of capital assets (CAPITAL)	Revised RE for 2017-18			Grants for creation of capital assets (CAPITAL)
		Grant-in-Aid General (REVENUE)				Grant-in-Aid General (REVENUE)			
		Operational Expenses	TA	Total		Operational Expenses	TA	Total	
1	ATARI, ZONE-I, Ludhiana	7.00	1.00	8.00	0.00	6.00	0.50	6.50	0.00
2	Bandipura	7.00	0.30	7.30	0.00	10.58	0.95	11.53	0.00
3	Bathinda	8.50	0.50	9.00	0.00	8.80	0.30	9.10	0.00
4	Chamba	8.50	0.50	9.00	0.00	4.00	0.40	4.40	0.00
5	Faridkot	9.30	0.40	9.70	0.00	9.30	0.40	9.70	0.00
6	Fatehgarh Shaib	7.50	0.30	7.80	0.00	7.50	0.30	7.80	0.00
7	Hamirpur	7.50	0.40	7.90	0.00	3.75	0.35	4.10	0.00
8	Kathua	8.50	0.40	8.90	0.00	8.40	0.40	8.80	0.00
9	Kinnaur	6.95	0.40	7.35	0.00	8.00	0.40	8.40	0.00
10	Kullu	7.75	0.50	8.25	0.00	7.75	0.50	8.25	0.00
11	Phulwama	7.00	0.30	7.30	0.00	10.00	0.40	10.40	0.00
12	Ropar	7.58	0.30	7.88	0.00	7.58	0.30	7.88	0.00
13	Tehri Garhwal	7.18	0.40	7.58	0.00	6.00	0.30	6.30	0.00
14	Uttarkhashi	8.40	0.40	8.80	0.00	11.00	0.60	11.60	0.00
	Total	108.66	6.10	114.76	0.00	108.66	6.10	114.76	0.00

CO-PI, TDC 31/3/18

Director 31/3/18

DIRECTOR
Central Research Institute
for Dryland Agriculture
P.O. Saidabad, Hyderabad-500659

Annexure-III

National Innovations in Climate Resilient Agriculture
Technology Demonstration Component
ICAR-Central Research Institute for Dryland Agriculture
Santoshnagar, Hyderabad-500059

Zone-wise Revised RE for the FY 2018-19 under TDC-NICRA

(Rupees)

Sno	Name of the ATARI /KVK	Grants-in-Aid-General (REVENUE)				Grants for creation of capital assets (CAPITAL)				Grand total
		Operational	TA	SC Sub-Plan	Total	Equipment	IT	SC Sub-Plan	Total	
1	ATARI, ZONE-I, Ludhiana	550000	30000	0	580000	21000	5000	0	26000	606000
2	Bandipora	720000	45000	0	765000	29100	5000	0	34100	799100
3	Bathinda	820000	25000	0	845000	100000	5000	0	105000	950000
4	Chamba	830000	30000	0	860000	0	5000	0	5000	865000
5	Faridkot	0	24000	1500000	1524000	0	5000	360000	365000	1889000
6	Fatehgarh Shaib	950000	30000	0	980000	100000	5000	0	105000	1085000
7	Hamirpur	570000	30000	0	600000	20000	5000	0	25000	625000
8	Kathua	810000	40000	0	850000	13900	5000	0	18900	868900
9	Kinnaur	720000	10000	0	730000	4000	5000	0	9000	739000
10	Kullu	0	35000	1500000	1535000	0	5000	360000	365000	1900000
11	Pulwama	670000	40000	0	710000	5000	5000	0	10000	720000
12	Ropar	650000	30000	0	680000	0	5000	0	5000	685000
13	Tehri Garhwal	550000	15000	0	565000	4000	5000	0	9000	574000
14	Uttarkhashi	745000	30000	0	775000	14000	5000	0	19000	794000
	Total	8585000	414000	3000000	11999000	311000	70000	720000	1101000	13100000

CO-PI, TDC-NICRA
20/3/19

DIRECTOR
DIRECTOR
Central Research Institute
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