2015-16

Annual Report

Technology Demonstration Component

NATIONAL INNOVATIONS IN CLIMATE RESILIENT AGRICULTURE

ICAR-Agricultural Technology Application Research Institute,
Zone-I, PAU Campus, Ludhiana-141 004

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Indian Council of Agricultural Research
Agricultural Technology Application Research Institute,
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PREFACE

Over the past few decades significant changes in climate are taking place and their impacts are being witnessed by all over the world. In developing countries like India where agriculture plays a major role in nation's food security and economy, weather plays an important role in agricultural productivity. There has been considerable concern in recent years where agriculture is one of the most venerable sectors, which is immediately affected by climate change, which varies across regions. Climate change and its impact on agricultural production system has become the most important area of concern for India to ensure food and nutritional security for growing population.

Therefore, along with developing appropriate adaptation strategies, creating public awareness on climate change and measuring its impacts on various agricultural production systems, the economy and the livelihoods of rural population is of immense important. Looking into the current scenario, the government of India has accorded high priority on research and development to cope with climate change in agriculture sector. The Prime Minister's National Action Plan on Climate Change has also identified Agriculture as one of the eight national missions. In this endeavour, the Indian Council of Agricultural Research (ICAR) has launched a mega network of project in the form of *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.

A part of this project as Technology Demonstration Component (TDC) of NICRA was aimed to carry out in the zone-1 through ATARI Ludhiana in the climatically challenged 13 districts of Punjab, Haryana, Himachal Pradesh and Jammu& Kashmir. In this component

various integrated package of proven technologies in agriculture and allied sciences were demonstrated in the NICRA villages through location specific interventions by Krishi Vigyan Kendras in a participatory mode in order to adapt and mitigate the climatic risks.

The problem of poor productivity, profitability and above all the proneness of agriculture to climate variability are addressed by implementing an array of technological interventions viz. Natural Resource Management, in-situ moisture conservation, 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 etc. There are noticeable changes in the state of agriculture in the villages adopted under the NICRA project, the production and productivity of the crops and livestock have significantly enhanced and the community based interventions such as communities' nurseries, community seed/fodder bank, farmers groups etc. have marked a new beginning in sharing scare recourse.

It is my privilege to put before you the salient achievement of NICRA project during 2015-16 in this Annual Report. I extend my sincere thanks Dr. Trilochan Mahapatra, Secretary, DARE and Director General, ICAR, Dr. A.K. Singh, Deputy Director General (Agricultural Extension) and officials of (NICRA-TDC) CRIDA for providing guidance and help in bringing out this publication.

I 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 import the end-user of these technologies the farming community. I congratulate and duly acknowledging the sincere inputs of the dedicated team of scientists of ATARI and the editorial board for bringing this important document in usable form.

I am 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.

Ludhiana **(RAJBIR SINGH)**

Date :

Contents

Executive Summary

The Government of India sanctioned a network project namely, "National Innovations in Climate Resilient Agriculture" (NICRA) to the Indian Council of Agricultural Research (ICAR) in February, 2011 to develop and promote climate resilient technologies in agriculture. Now, it is being executed by ICAR-CRIDA, Hyderabad. The project has four components namely, Strategic Research, Technology Demonstration, Capacity Building and Sponsored /Competive Grants .

Thirteen (13) KVKs of Zone-I were selected during 2015-16 under the project for coping up the climatic vulnerabilities. Each KVK under the project selected a village/cluster of villages representing the climatic vulnerability of the district. To start with, the benchmark survey and soil sampling were done and inventory of organic resources was prepared in the selected villages. The interventions are planned and implemented with participation of farmers under the four modules viz. Natural Resource Management, Crop production, Livestock and fisheries and Institutional Interventions under the Technology Demonstration Component (TDC) of NICRA.

In Natural Resource Management, interventions related to in-situ moisture conservation (sowing of wheat with Happy Seeder/Zero Tillage), water harvesting structures , water saving irrigation methods; green manuring for soil health and fertility improvement; urea application based on leaf Colour Chart (LCC) in paddy; laser leveling; paddy straw management through baler cum-knotter; vermi composting and alternate energy source (Bio-gas plant), etc.

Under Crop production module, introduction of drought/ temperature tolerant varieties, short duration varieties; salt tolerant varieties; crop diversification; location specific intercropping 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. were demonstrated in the selected NICRA villages. Drought tolerant varieties were demonstrated in 48.5 ha area of 226 farmers. Under short duration varieties, 169 farmers were benefitted 39.1 ha area. High yielding varieties were also demonstrated in 21 ha area benefitting 131 farmers. During the year 2015-16, these technologies were demonstrated over an area of 4558.52 ha and benefitted 513 farmers. In Rupana village of Sirsa district, introduction of new salt tolerant variety of wheat (KRL-19) resulted in good crop yield. KRL- 10 were also demonstrated during this year but the performance of KRL-19 was better than the other variety of wheat. Location specific inter- cropping system with high yield index resulted in 21.43 percent increase in yield over the local check. Demonstrations were conducted in advancement in date of sowing to reduce terminal heat stress on 13 farmers' field on 1.5 ha.

Livestock and fisheries module consists of various interventions viz. demonstrations were carried out on maize, oats and sorghum for fodder production especially during drought/flood situations, silage making for storage the dry season; de-worming of animals; mineral mixture supplementation; and animal health check-up; artificial insemination; mitigation of mineral deficiencies in animals; breed up gradation and backyard poultry are the activities carried under the project. A total of 1289 animals and birds, 119 units of silage/ hay making with 193.4 ha area of fodder production were covered benefitting 290 farmers. Azolla production as protein rich fodder to livestock during lean period.

Institutional intervention module consists of custom hiring for timely operations of activities were conducted. The revenue generated from thease implements during 2015-16 was Rs.117505/-. These activities benefitted 712 farmers.

Under Capacity Building a total of 276 courses were conducted on various themetic areas during 2015-16., in which 4275 farmers and farm women (3359 male and 916 female) wholeheartedly participated. The capacity building programmes were organised in different areas viz., activities, programmes conducted/organized on different need based aspects for mitigating climate related adversaries in crop production/management/diversification, pest and disease management in crops, nutrition management in crops, resource conservation technology, livestock management, value addition, organic farming , fish farming etc.

Numerous extension activities were also organized by KVKs under NICRA at the KVK farms and in the NICRA villages. There were 495 different type of extension activities conducted like method demonstration, field day, awareness programmes , kisan Mela, field visit kisan gosti, group discussion etc were carried out which has benefitted 11669 farmers and farm women.

1. Introduction

A large part of Indian population still resides in rural areas and largely depends on natural resources and farming for earning its livelihood. Thus, changing climatic patterns largely affect natural ecosystems; consequently the human economies and cultures. Increased frequency of droughts, floods, cloud bursts etc. suggest that the climate change is progressing fast and predicting such occurrence of phenomena will be even more difficult in future. Therefore, in order to obtain optimum crop yields and earn reasonably, Indian farmers will have to adapt to the changing climate so intelligently that their livelihood is not affected. Particularly, for small and marginal farmers, it would be vital to enhance resilience of agriculture to the risks posed by climate change. Adopting climate resilient practices and technologies would be necessary to stabilize agricultural production.

On-farm demonstration of location specific technologies in participatory mode is necessary to enable farmers in coping with climatic variability. Adaptation gains to the farmers can be ensured with such an approach; additionally, it would result in reduced GHG emissions. Keeping this information in view, National Innovations in Climate Resilient Agriculture (NICRA) is launched in February, 2011. 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. Thus, to combat every climate related eventuality and to address its negative impacts on agriculture, National Innovations in Climate Resilient Agriculture (NICRA) has been formulated to develop and demonstrate region specific improved technologies that would enhance the resilience of Indian agriculture to climate change. It is extremely important that we should enhance the resilience of Indian agriculture production system to climate variability and climate change. Thus, the focus on adaptation to climate variability entails appropriate responses to contingency situations. Sustainability is the immediate goal in highly intense production systems facing natural resource degradation. Therefore, the main focus of technology demonstrations in such regions is not on enhancing productivity but on interventions related to coping with vulnerability as well as improvement in natural resource use efficiency for sustaining the productivity gains already achieved. The project aims to enhance resilience of Indian agriculture to climate change and climate variability through Strategic Research, Technology Demonstration, Capacity Building and Sponsored/Competitive Grants.

2. Technology Demonstration under NICRA

Under Technology Demonstration Component of NICRA, participatory demonstrations of climate coping technologies are being conducted on farmer's fields. An integrated package of proven technologies is being demonstrated in one village in each of the selected districts for

adaptation and mitigation of the crop and livestock production system to climate variability based on the available technologies. The KVKs and the respective villages covered under NICRA in the Zone-I for demonstration of climate resilient technologies are given in Table 1.

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

Selected district	Name of adopted village	Climatic Vulnerability	Soil type	Rainfall (mm)
Punjab				
Bathinda	Kill Nihal Singh	Drought/heat wave	Loamy	292
Faridkot	Pindi blochan	High temperature	Sandy loam	433
Fatehgarh sahib	Badauchhi kalan	Frost/ cold wave	Loam/sandy loam	877
Ropar	Fatehgarh Viran		Sandy loam	750
Haryana				
Yamunanagar	Radauri	Frost in winter	Sandy loam	1107
Sirsa	Rupana	Drought/heat wave	Sandy loam	300
Himachal Pradesh				
Chamba	Lagga	Coldwave/Drought/frost	Sandy loam	1590
Hamirpur	Mann	Drought	Sandy clay loam	1025
Kinnaur	Telangi	Cold wave/drought	Sand to loamy sand	672
Kullu	ChhoelGaddauri	Drought/ cold wave	Coarse loamy	919
Jammu & Kashmir				
Kathua	Said-sohal	Drought	Sandy loam	1168
Bandipora	Sumlar	Drought	Silty clay loam	1476
Pulwama	Wakherwan	Frost/ cold wave	Silty clay loam	305

The steps followed to demonstrate the climate resilient technologies by selected centre at district level were :

- 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.

Interventions Modules:-

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 was 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 year 2015-16 under 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 year 2015-16, 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 and 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 like seed bank, fodder bank, commodity groups, custom hiring centres, climate literacy through village weather station etc.

Objectives of 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.

Rainfall Analysis

During the year 2015-16, in following NICRA villages deficit rainfall was recorded along with disturbed distribution.

Table 2: Details of deficit seasonal rainfall in NICRA villages

Name of Village	District	Actual (mm)	Normal (mm)	Deficit over normal(mm)	Departure from normal (%)
Punjab	Bathinda	252	321	-69	-21
Punjab	Ropar	570	728	-159	-22
Haryana	Sirsa	177	242	-66	-27
Haryana	Yamunanagar	608	892	-284	-32
Himachal Pradesh	Chamba	764	1406	-643	-46
Himachal Pradesh	Kinnaur	140	264	-124	-47

I. Natural Resource Management

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

Happy Seeder/Zero till cultivation 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. During the year 2015-16, six KVKs (Bathinda, Fatehgarh Sahib, Faridkot, Sirsa, 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 to less water stagnation. The conventionally sown fields suffered water logging upto 7 days, which has caused significant damage to the crop.

Sowing wheat with happy seeder

Crop stand of wheat in standing paddy stubbles

In, Killi Nihal Singh Wala, NICRA village of Bathinda district, before the starting of the project, the farmers of the village were not aware about the happy seeder technology. This technology/machine enables sowing of wheat in standing stubbles field without burning of paddy straw. During 2015-16, sowing wheat with happy seeder was demonstrated in 32 farmers' field in 24.8ha area with yield advantage of 50.0q/ha as compared to the conventional (48.7q/ha) practice and allowed incorporation of paddy straw into the soil. Now, the farmers of the village

are demanding for more number of happy seeder machines, as one machine can sow the wheat crop only in 2 ha area in a day but the total area under wheat is about 625 ha in the village.

In Badhauchhi Kalan village of Fatehgarh Sahib, burning of paddy stubbles was generally practiced by farmers, which caused environmental pollution along with nutrient loss. Demonstration of wheat (HD-2967) sowing with happy seeder was laid in 20 ha area covering 50 farmer's fields during 2015-16. The yield obtained in demonstration plot was 50.63q/ha compared to farmers' practice (44.8q/ha); thus, an additional yield of 5.8 q/ha (13.5%) obtained from the laid demonstration.

In Rasidpur village of Ropar, wheat sowing with happy seeder technology provided an effective alternative to burning of rice residues. Initially, the happy seeder was demonstrated on 5.8 ha, which has now reached to 50 ha. During the year, sowing of wheat (HD-1105) with happy seeder was demonstrated on 15 farmers' fields with resulted yield as 51.89q/ha compared to farmers practice of conventional tillage (48.5q/ha). Further, crop lodging damage due to unseasonal rainfall (40 mm) during March, 2015 was lower in happy seeder sown wheat field. In addition, incidence of yellow rust was more in lodged crop than in happy seeder sown wheat crop.

In Pindi Blochan village of Faridkot, demonstration of wheat (HD-2967) with zero till drill was demonstrated in 59 farmers's fields in 232 ha area. The net return of Rs. 37000 per ha was obtained with zero till method as compared to farmers' practice (Rs.34000/ha).

In Radauri village of Yamunanagar, happy seeder sown wheat (HD-2967) was demonstrated in 35 ha area covering 62 farmers. The average yield was observed 49.80q/ha as compared to conventional tillage sown wheat (47.9 q/ha).

Table 3: Performance of demonstrations on happy seeder sown wheat in KVKs of Punjab & Haryana

Name of KVK	Technology demonstrated	Crop/Variety	No. of farmers	Area (ha)	Demo Yield (q/ha)	Check Yield (Q/ha)	% increase	Demo BCR
Bathinda	Happy Seeder	Wheat (WH-1105)	32	24.8	50.0	48.7	2.67	2.06
Fatehgarh Sahib	Happy Seeder	Wheat (HD-2967)	50	20.0	50.63	44.8	13.01	2.3
Ropar	Happy Seeder	Wheat(HD-2967	15	50.0	51.89	48.5	7.00	3.27
Yamunanagar	Happy Seeder	Wheat(HD-2967)	62	35	49.80	47.9	4.00	3.23

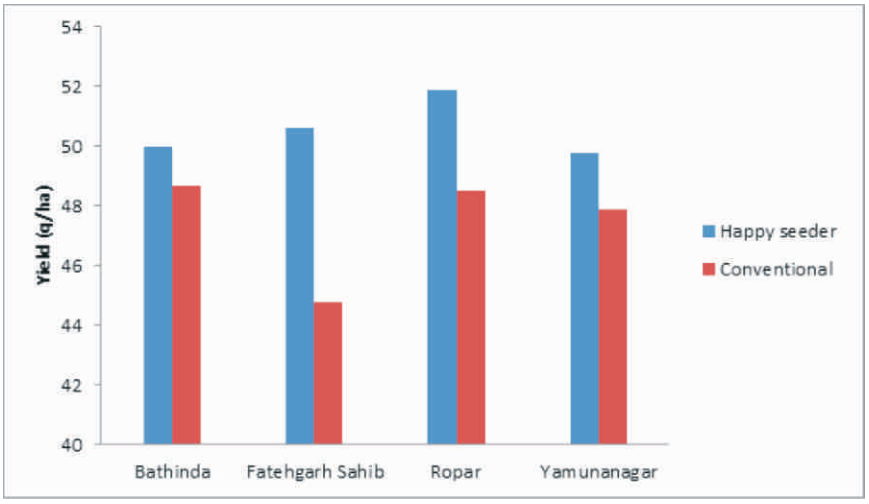


Fig.1 Comparative yields using happy seeder technology and conventional method for sowing of wheat

Efficient management of Paddy Straw: Bailer –cum- knotter:-

Burning of paddy straw is a common practice in the rice-wheat cropping system resulting in environmental pollution including respiratory and allergic problems in both human as well as animals. Further, valuable crop residues are wasted in addition to micro and macro-nutrients of soil.

Bailing of paddy residue with bailer-cum-Knotter

In Pindi Blochan village of Faridkot and Killi Nihal Singh of Bathinda village, bailer- cum-knotter technology was demonstrated for crop residue management. In Pindi Blochan, this technology was not followed by the farmers initially; but, after creating awareness among the farmers, the area under use of bailer cum knotter has reached to 612 ha (2015). In Faridkot, about 900 ha area is under paddy cultivation. The residue of which amounting to 7800 ton was being burnt at the start of project; now, the burning of crop residue has been reduced to 1700 ton in Kharif (2015). In this way, farmers have earned an additional income of Rs.1000 - 1500/ acre from selling bailed residue with the use of bailer cum knotter.

In Killi Nihal Singh, since the inception of the project, the area under bailer -cum- knotter has increased from zero to 20.8 ha; which is a significant achievement of the village for residue management.

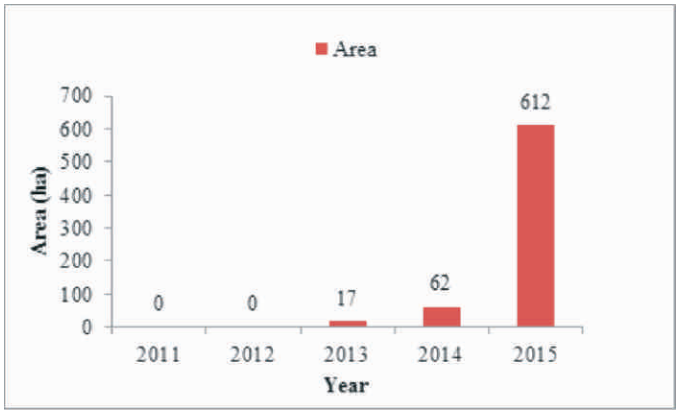


Fig: Area under straw bailing in Pindi Blochan

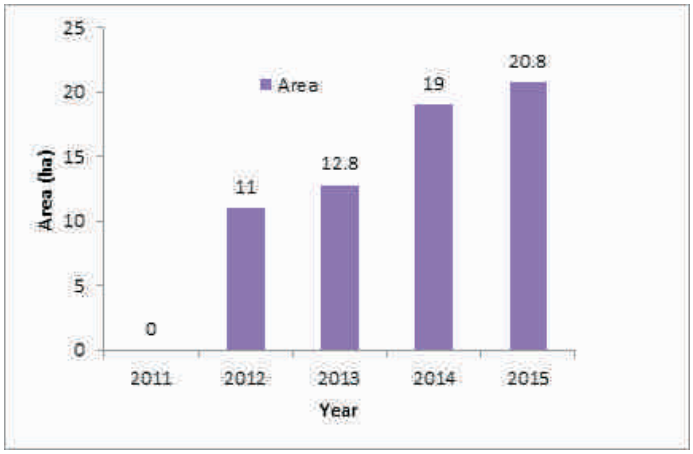


Fig: Area under straw bailing in Killi Nihal Singh

Resource Conservation through Laser Leveling in Punjab & Haryana:-

Declining water table and degrading soil health are the major concerns for the current growth rate and sustainability of the Indian Agriculture. Thus, proper emphasis is being given on the management of irrigation water usage for adequate growth of agriculture. The use of this technology was resulted in uniform application of irrigation water and saves water upto 10-15percent leading to 2-5percent increase in yield.

Laser leveling in progress at Farmer's field

After the inception of the NICRA project in Punjab and Haryana, demonstrations were conducted on laser land leveling on farmers' fields in rice –wheat systems to promote resource conservation technology among farmers.

In Punjab, the districts of Faridkot, Bathinda, Fatehgarh Sahib and Ropar disseminated this technology in their adopted villages. During last five years, the maximum area covered in district under laser leveling in Pindi Blochan of Faridkot, which has increased from 80 ha in 2011 to 1336 ha in 2015.

KVK of Yamunanagar and Sirsa also promoted laser leveling in their adopted villages. In Rupana of Sirsa, 1822 ha area was covered under laser leveling during 2015 which was only 92 ha in 2011. However, in Yamunanagar, during the inception of the project area under laser leveling was zero, which has gone up to 323 ha in 2015 .

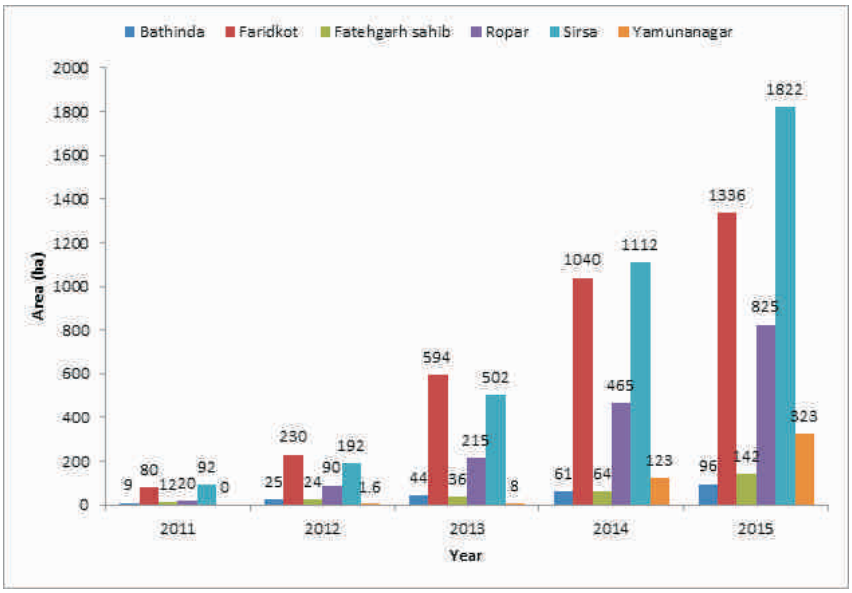


Fig: Area under Laser Leveler in NICRA villages of Punjab and Haryana

Direct Seeded Rice (DSR) for promoting water use efficiency:-

Researchers have developed appropriate direct seeding of paddy as alternatives to transplanted paddy. Framers can avoid problem like labour shortage during transplanting period due to peak demand by direct seeding of paddy. In case of delay in monsoon or shortage of water, DSR gives the flexibility to take up direct sowing of paddy with a suitable duration variety to fit into the left over season. This allows timely sowing of Rabi wheat as well. Direct sown rice consumes less water compared to flooded rice. Energy demand for pumping of irrigation water is also less and saving can be much higher during deficit rainfall situations compared to transplanted rice. The impact of paddy sown with direct seeded rice in NICRA villages is reported below.

In NICRA village Killi Nihal Singh, Bathinda, cultivation of Pusa Basmati-1121 through direct seeded rice (DSR) was demonstrated in 42 ha area of 21 farmers. Farmers of the village observed reduction in the labour and energy requirements, early crop maturity by 7-10 days and saved irrigation water by 10-15percent (Table 4).

Direct seeding of rice in Bathinda, Punjab

Crop stand after sowing

Table 4: Performance of DSR ove farmers' practice in Bathinda, Punjab

Name of Variety	No, of farmers	Area(ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Gross Return	Net Return
Pusa Basmati -1121	31	42	50.8	48.2	5.3	35,550/-	1,06,680/-	71,130/-

Demonstration on Direct seeded rice at Faridkot, Punjab

Germination of seed after sowing with DSR

In Pindi Blochan village of Faridkot, KVK scientists demonstrated direct seeded rice technology in 50 ha area covering 17 farmers resulting in 46.0q/ha yield as compared to farmers' practice (44.0q/ha). This method of cultivation helped in saving of 4-5 irrigations and early maturity of crop by 7-8 days and an increase in yield of 2.0q/ha.

Moisture conservation through Mulching in Kullu (H.P):-

The demonstration on in-situ moisture conservation was conducted in Pomegranate through plastic mulching in Chhoel-Gadouri village of district Kullu in Himachal Pradesh. The demonstration was conducted under rainfed conditions with three (3) life saving irrigations through pipes in mulched plot and five (5) irrigations were given by the farmers in local check plots. Drought conditions during flowering time (May) resulted in flower drop and low fruit set and dry spell during maturity affected the fruit quality. The demonstration was conducted on 2 ha area and B:C ratio was observed 3.05 as compared to farmers practice of 2.40 B:C ratio.

Table 5: Performance of economics of plastic mulching in pomegrante at Kullu, (H.P.)

Treatments	Date of mulching	Yield (kg/ha)	Gross cost (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
Mulching	15-20/05/15	9375	93594	281250	187656	3.05
Farmer's practice	-	8550	103750	256500	152750	2.40

Demonstration on polythene mulching in pomegranate in Chhohel-gadouri village

Water harvesting and recycling for supplemental irrigation in hilly regions:-

In Chhoel- Gadauri village of Kullu, simple construction of water storage tanks has brought a significant change in the cropping pattern. Due to drought and erratic rainfall, farmers generally grew non-remunerative cereal crops like maize and wheat. Under NRM module, three community water storage tanks were constructed in 2014 having 110 cu m water storage capacity.

Demonstration on diversification towards high value cash crop of tomato in Kharif, garlic and pea in Rabi season were conducted during 2015-16 against cropping sequence of maize-wheat in the rainfed area. Supplemental life saving irrigations were given during dry spells or at critical stages. Demonstration on tomato cultivation in rain fed area was conducted in an area of 4.6 ha covering 35 farmers during Kharif 2015.

In Rabi season 2015-16, garlic cultivation was demonstrated in an area of 2.52 ha and pea cultivation in 1.0 ha. The stored water was utilized for life saving irrigation during the dry spells experienced at different growth and developmental stages. In tomato crop, 4-5 life saving irrigations was given through water carrying pipes. During Rabi season, in garlic 3, life saving irrigations and in pea, 4 life saving irrigations were given through sprinkler method.

The net returns of the farmers has increased to Rs 2.97 lakhs/ha from tomato as compared to Rs 25000/ha from maize during kharif 2015. Similarly during rabi season, the net income of Rs 2.80 lakhs and Rs 1.67 lakhs/ha from garlic and pea, respectively was obtained in comparison to only Rs 45000-50000 /ha from conventional wheat grown under rain fed conditions.

Table 6: Performance of community water storage to enhance the income of farmers in Kullu, H.P.

Crop /season	No. of farmers	Area (ha)	Yield (kg/ha)	Gross cost (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	BCR
Kharif 2015							
Tomato	35	4.6	32744	96250	392928	296678	3.98
Rabi 2015-16							
Garlic	23	2.52	11850	74830	355500	280670	4.75
Pea	11	1.0	14100	59119	225600	166481	3.81

Community water storage tanks to enhance irrigation facilities
in vegetable crops at Kullu, H.P

In KVK Hamirpur adopted village Mann, farmer's usually having the problem of availability of water for irrigation especially during critical crop growth period . Under NICRA project, 35 small rain water harvesting structures were constructed in convergence with MNREGA during 2011-2015. Cultivation of vegetables like bitter gourd, cucumber, cauliflower and radish was done by ridged and furrows method and the farmers utilized harvested rain water for irrigation to the crops. In 2015-16, about 1.2 ha area was brought under vegetable cultivation with net return of Rs. 98000/ha . Consequently, there was an increase in irrigated area of the NICRA village which has boosted the production of crops. The number of vegetable growers have increased in NICRA village and the area under vegetable cultivation has significantly gone up resulting in additional income to the farmers.

Table 7: Performance of rain water harvesting to enhance the income of farmers in Hamirpur, H.P.

Crops grown	Area(ha)	Yield (q)	Net returns	BCR
Cauliflower	0.40	80	39000	2.56
Bitter gourd	0.20	45	27500	2.57
Cucumber	0.24	30	12000	1.66
Radish	0.32	56	20000	3.50

Green manuring with sunhemp /daincha for soil health and fertility:-

During the year, four KVKs of Punjab and Haryana (Bathinda, Fatehgarh Sahib, Faridkot & Yamunanagar) conducted demonstrations on Sunhemp/dhaincha as green manuring crops at the farmer's fields. Due to incorporation of green manuring, 82.5q/ha saving of nitrogen was achieved with the yield advantage of 74.1 q/ha in Paddy variety PR-124 in Faridkot.

FLD on Green manuring with sunhemp/Daincha

In Badauchhi village of Fatehgarh Sahib, demonstration on green manuring with daincha in 20 ha area of 58 farmers resulted in saving of 1/3rd nitrogen in rice and 1/2 nitrogen in basmati rice.

Leaf Colour Chart for application of Nitrogen fertilizer:-

Paddy requires certain nutrient elements for its establishment, survival and better yield. Among those nutrient elements, nitrogen (N) is the most important nutrient which is essential for photosynthesis and the yield. Unlike other crops, N can be managed effectively at real time during all the stages of crop growth by using Leaf Colour Chart (LCC).

In Pindi Balochan village of Faridkot and Rasidpur village of Ropar, KVKs demonstrated the application of leaf colour chart (LCC) for judicious use of fertilizer in paddy as a means of preserving soil health. 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.

Table 8: Details of application of urea with Leaf Colour Chart (LCC)

Technology demonstrated	Urea kg/ha	% Saving of Urea	Yield(q/ha)
Fertilizer application with Leaf Colour Chart in paddy (Faridkot)	250kg/ha	9.1%	72.4
Without use of Leaf Colour Chart (Faridkot)	275kg/ha	-	62.0
Fertilizer application with Leaf Colour Chart in paddy (Ropar)	237.5kg/ha	13.60%	61.8
Without use of Leaf Colour Chart (Ropar)	275kg/ha	-	61.0

FLD on Leaf Colour Chart for Nitrogen fertilizer

Biogas plant: Rural Energy Source in NICRA villages

KVKs of Bathinda , Fatehgarh Sahib, Faridkot and Sirsa under NICRA project installed biogas plants for alternate source of energy. Most of the families were dependent on the LPG and other traditional sources of energy for cooking, whereas, dung is available in abundance in the village for bio-gas as an alternate source of energy for domestic purposes. Generally, dung is disposed in open heaps with no records of FYM pits in the village, which produces Methane – the major green house gas (GHG) responsible for climate change. Initially, the number of biogas plants were less as the villagers were unaware of their benefits. After the start of NICRA project and subsequent motivation of the farmers, they started tilting towards the establishment of Biogas Plants.

During the last five years, 18 biogas plants in Badauchhi Kalan, 35 bio gas in Killi Nihal Singh, 6 bio gas plants in Fatehgarh Viran and 12 bio gas plants were installed in Pindi Blochan. It was observed that there is an average saving of seven (7) LPG cylinders of 14.2 kg LPG capacity with an approx. annual saving of Rs. 4900/-.

Efficient & renewable energy source-Bio-gas plant

Low cost Pheromone traps for the management of fruit fly in cucurbits:-

KVK Hamirpur worked on control of fruit fly in cucurbits by using pheromone traps. About 60-65 percent famers have adopted this technology. As far as progressive farmers are concerned, the adoption rate is above 90 percent. Earlier, farmer's resorted to indiscriminate application of insecticides for control of fruit fly in cucurbits, which was around 5-7 sprays. However, with the adoption of pheromone trap of fruit fly, numbers of spray applications have been reduced to only 2-3. Management of fruit fly resulted in about 25 per cent increase in yield over control. The benefit cost ratio of 2.78 was received over 2.25 in control in 3.8 ha area of 95 farmers.

Demonstration on Pheromone trap for fruit fly in cucurbits

II. Crop Production Module

Climate Resilient Cultivars

During the year 2015-16, 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

Under this intervention, two KVKs (Kullu and Kathua) laid demonstrations on drought/temperature tolerant varieties of wheat and Maize in 48.5 ha area covering 226 farmers (Table 6).

Demonstrations on drought/temperature tolerant varieties of wheat were conducted (HPW-236, HPW-155, HPW-349, HS-507, VL-829, Raj-3765 and WH-1142) in 36 ha area belonging to 156 farmers. Wheat variety WH-1142 has realized highest BCR 2.48 as against BCR of local check (1.81). Moreover, wheat variety WH-1142 out yielded local check by 42.86 percent.

KVK Kathua demonstrated drought/temperature tolerant variety of maize Dekalb Double over an area of 12.5 ha of 70 farmers. The variety out yielded local check variety by 29.16 per cent and higher BCR (3.1) was observed as compared to local variety (BCR of 2.4).

Table 9: Performance of demonstrations on drought/temperature tolerant varieties of different crops under NICRA by KVKs.

KVK	Crop	Variety	No. of farmers	Area (ha)	Demo Yield(q/ha)	Check Yield(Q/ha)	Percent increase	Demo BCR	Check BCR
Kullu	Wheat	HPW-236	9	1.66	29.10	24.20	20.25	2.29	2.08
Kullu	Wheat	HPW-155	24	4.45	29.8	24.2	23.14	2.34	2.08
Kullu	Wheat	HPW-349	50	9.31	31.2	24.2	28.93	2.45	2.08
Kullu	Wheat	HS-507	10	0.91	26.3	24.2	8.68	2.07	2.08
Kullu	Wheat	VL-829	20	3.35	28.5	24.2	17.77	2.24	2.08
Kullu	Wheat	VL-907	2	0.32	27.4	24.2	13.22	2.15	2.08
Kathua	Wheat	Raj-3765	36	14.0	18.6	14.0	32.85	2.3	1.81
Kathua	Wheat	WH-1142	5	2.00	20.0	14.0	42.86	2.48	1.81
Kathua	Maize	Dekalb double	70	12.5	31.0	24.0	29.16	3.1	2.40
Total (Drought/temperature tolerant varieties)			226	48.5					

Short duration varieties :-

During the year 2015-16, seven KVKs (Faridkot, Bathinda, Kullu, Hamirpur, Kathua, Yamunanagar and Fatehgarh Sahib) of the Zone demonstrated short duration varieties of Summer moong (SML-668), Maize composite (Bajaura makka and Girija), Black gram (P-93), Paddy (NDR-97 and PB-1121) and Toria (Bhawani). These varieties were demonstrated over an area of 39.1 ha belonging to 169 beneficiary farmers.

Demonstration on maize Bajaura Makka

Demonstration on Maize Girija Composite

Demonstration on Summer Moong (SML-668)

Demonstrations on SML-668 variety of Summer moong were conducted over an area of 10 ha and have benefitted 26 farmers with a BCR of 1.73 as compared to local variety with BCR of 1.58.

Demonstrations on Maize varieties Bajaura Makka and Bajaura Girija were conducted in Chhoel-gaddauri village of Kullu. Among the maize varieties, highest increase in yield (41.88%) was observed in maize variety Bajaura makka; whereas, the highest BCR (1.55) was observed in case of Maize variety Girija.

Demonstrations on Black gram variety P-93 were laid over an area of 1 ha of 7 farmers. The Black gram variety (P-93) exhibited 22.39 percent increase in grain yield with BCR of 2.88 as compared to local check (2.51).

Demonstrations on short duration variety of Paddy NDR-97 were conducted over an area of 2.5 ha of 15 farmers. The paddy variety exhibited 50 percent higher yield over local check.

Demonstrations on Pusa Basmati- 1121 variety were conducted over an area of 9.6 ha and benefitted 24 farmers. The BCR for demonstrated variety was recorded as 1.61 and for local check was 1.32.

Demonstrations on Toria (Bhawani) were carried out over an area of 1 ha of 20 farmers with a BCR of 1.6 as compared to local variety BCR of 1.38. Bhawani variety of toria yielded higher than local check by 27.45 percent.

Table 10: Performance of demonstrations on short duration varieties

KVK	Crop	Variety	No. of farmers	Area (ha)	Demo Yield (q/ha)	Check Yield (q/ha)	Percent increase	Demo BCR	Check BCR
Bathinda	Summer moong	SML-668	26	10	13.8	12.7	8.66	1.73	1.58
Kullu	Maize	Bajaura Makka	30	5.0	27.10	19.1	41.88	1.44	1.21
Kullu	Maize	Girija	47	10	29.20	20.6	41.75	1.55	1.31
Kullu	Black gram	P-93	7	1.0	8.2	6.7	22.39	2.88	2.51
Paddy	NDR-97	Paddy NDR-97	15	2.5	30	20	50.00	1.95	1.30
Yamuna nagar	Pusa Basmati	1121	24	9.6	34.25	32.5	5.38	1.61	1.32
Hamirpur	Toria	Bhawani	20	1.0	6.5	5.1	27.45	1.59	1.38
Total (short duration varieties)			169	39.1					

High yielding varieties:-

During the year 2015-16, KVKs of Sirsa and Hamirpur demonstrated high yielding varieties of wheat (HPW-360 and HPW-349); Maize (4640); Ghobhi Sarson (GSC-7) and Guar (HG 2-20) over an area of 21 ha benefitting 131 farmers. Among high yielding varieties of wheat, HPW-349 exhibited 25.00 per cent higher yield over the local check.

Demonstrations conducted on Maize variety 4640 exhibited 12.50 per cent increase in grain yield with BCR of 1.53 as compared to that of local checks (1.49). Similarly, demonstrations conducted on high yielding variety of Ghobhi Sarson (GSC-7) have resulted in 25.00 per cent higher yield over local check.

Table 11: Performance of High yielding varieties

KVK	Crop	Variety	No. of farmers	Area (ha)	Demo Yield (q/ha)	Check Yield (Q/ha)	Percent increase	Demo BCR	Check BCR
Hamirpur	Wheat	HPW-360	5	1.00	25	22	13.64	1.88	1.87
Hamirpur	Wheat	HPW -349	28	3.00	27.5	22	25.00	1.88	1.85
Hamirpur	Maize	4640	13	3.00	22.5	20	12.50	1.53	1.49
Hamirpur	Gobhi Sarson	GSC-7	50	2.00	7.25	5.85	23.93	1.45	1.35
Sirsa	Guar	HG-2-20	35	12.00	10.0	8.0	25.00	2.13	1.71
			131	21					

Introduction of new salt tolerant wheat variety KRL-19 in Rupana village of Sirsa

In Rupana village of Sirsa, under NICRA, new variety of wheat (KRL-19) was demonstrated during 2015-16 to manage crop production in saline soil; as approximately 120 ha area of the village is affected with salinity and the water table is so high that salts could not be leached down. Demonstrations were also conducted on another salt tolerant variety of wheat i.e. KRL-210, which was introduced during 2014-15. Wheat variety KRL-19 was demonstrated in 2 ha area of 5 farmers and KRL-210 was demonstrated in 32 ha area of 5 farmers. It was observed that the newly demonstrated variety of wheat KRL-19 resulted in higher BCR (1.8) as compared to KRL-210 with 1.5 BCR during 2015-16.

Other nearby villages (Mandsori & Nadhuthusar) have also adopted the recommended varieties after seeing the learning experiences of Rupana village.

Table 12: Performance of new salt tolerant wheat variety over farmer's practice

Variety	No. of farmers	Area (ha)	Yield (q/ha)	Economics of Demonstration (Rs./ha)			
				Gross Cost	Gross Return	Net Return	BCR
Wheat PBW -343 (Conventional variety)	46	14	10.2	28400	14280	-14120	0.5
Wheat KRL -210	15	32	34	28400	45360	16960	1.5
Wheat KRL-19	5	2	39	32400	59475	27075	1.8

Demonstration on Salt tolerant wheat variety (KRL-210) at Sirsa, Haryana

Demonstration on Salt tolerant wheat variety (KRL-19) at Sirsa, Haryana

Crop diversification for livelihood security and resilience to climate variability:-

Under this intervention, four KVKs (Kullu, Hamirpur , Kathua and Kinnaur) of the Zone conducted demonstrations on different pulse and vegetable crops for encouraging crop diversification viz, bitter gourd, bottle gourd, garlic, cabbage, cucumber, gram, okra and buckwheat etc. A total of 24.55 ha area of 235 farmers was covered under these demonstrations of crop diversification intervention (Table).

The crop diversification with incorporation of high value cash crop garlic (variety GHC-I) was conducted against cropping sequence of Maize-Wheat in 0.32 ha area of 4 farmers. Garlic variety GHC-I exhibited 389.27 per cent increase in yield over local check which resulted in higher BCR (3.17) as compared to local check with 0.21 BCR.

The demonstration on crop diversification with cabbage variety Charmant was conducted over 0.64 ha area of 10 farmers. Charmant variety of Cabbage recorded 18.75 per cent increase in yield with 2.8 BCR over local check with BCR 2.4.

The crop diversification with bottle gourd varieties Sharda and Shambu in village Mann of Hamirpur was demonstrated in 0.48 ha area of 5 farmers. Both the varieties of Bottle gourd resulted in 36.54 per cent increase in yield over local check and BCR was found to be 3.32 as compared to 2.8 of local check.

Cucumber variety Malav was demonstrated over 0.6 ha area of 6 farmers which has resulted into 45.76 per cent increase in yield over local check and recorded BCR of 2.53. Similarly, gram variety GNG-1581 was demonstrated over 6.5 ha area of 43 farmers and it has resulted in 43 per cent increase in yield over local check and recorded BCR of 2.6. Likewise, demonstration on

gobhi sarson using variety DGS-I were conducted over 4 ha area of 22 farmers, which exhibited 42.85 per cent increase in yield over local check and recorded 3.5 BCR.

Demonstrations on sesame varieties Punjab Til-1 and RT-346 in place of Maize were conducted over 2 ha area of 20 farmers. Among the sesame varieties, RT-346 recorded higher (21.43%) yield over local check and BCR was found to be 4.95.

Demonstrations on crop diversification with introduction of Mash variety Him Mash-1 was demonstrated over 6.5 ha area of 69 farmers. The variety exhibited 13.04 per cent increase in grain yield over local check with BCR of 5.47. Furthermore, demonstrations on crop diversification with drought tolerant varieties of Okra var. Varsha Uphaar and Okra A-4 were demonstrated in Said-Sohal village of Kathua over 2.91 ha area of 43 farmers. Okra variety A-4 resulted in 40.82 per cent increase in yield over local check and with 3.71 BCR.

Table 13: Performance of varieties demonstrated under crop diversification

KVK	Crop	Variety	No. of farmers	Area (ha)	Demo Yield (q/ha)	Check Yield (Q/ha)	Percent increase	Demo BCR	Check BCR
Kullu	Garlic	GHC-1	4	0.32	118.5	24.2	389.67	3.17	0.21
Hamirpur	Cabbage	Charmant	10	0.64	190	160	18.75	2.80	2.4
Hamirpur	Bitter gourd	Hamirpur	5	0.4	355	260	36.54	3.32	2.5
Hamirpur	Bottle gourd	Sharda Shambu	5	0.48	315	240	31.25	33.58	2.8
Hamirpur	Cucumber	Malav	6	0.6	172	118	45.76	2.53	1.8
Kathua	Gram	GNG-1581	43	6.5	6.00	5.00	20	2.57	2.25
Kathua	Gobhi Sarson	DGS-1	22	4.00	10	7.00	42.85	3.5	3.25
Kathua	Mash	Himmash-1	69	6.5	5.2	4.6	13.04	5.47	0
Kathua	Sesame	Punjab Til-1	10	1.00	4.00	3.50	14.28	4.46	4.45
Kathua	Sesame	RT-346	10	1.00	4.25	3.50	21.42	4.95	4.45
Kathua	Okra	Varsha Uphaar	32	2.08	117.00	84.50	38.46	3.65	2.64
Kathua	Okra	(A-4)	11	0.83	119.00	84.50	40.82	3.71	2.64
Kinnaur	Buckwheat (Ogla)	Sangla	4	0.1	7.57	6.52	16.10	1.58	1.53
Kinnaur	Buckwheat(Phafra)	Shimla -BI	4	0.1	808	7.24	21.55	1.83	1.70

In Telangi village of Kinnaur district, crop diversification in place apple cultivation with introduction of Buckwheat (Ogla) *Fagopyrum esculentum* variety Sangla was demonstrated over an area of 0.1 ha of 4 farmers which resulted in 16.10 percent increase in yield over local check with 6.52 BCR. Likewise, demonstration on another variety Shimla- BI of buckwheat (Phafra) *Fagopyrum tatricum* was conducted over 0.1 ha area of 4 farmers, which exhibited 21.55 per cent increase in yield over local check and recorded 1.70 BCR.

Location specific intercropping system with high sustainable yield index:-

Under this intervention, during the year 2015-16, KVK Kinnaur demonstrated the location specific intercropping systems with high sustainability of yield index technologies.

Demonstration on intercropping of apple variety Royal delicious with Rajmash variety Jawala was successfully conducted over an area of 0.4 ha of 5 farmers. The intercropping system exhibited 21.43 percent increase in yield over the local check. The BCR recorded for intercropping system was 1.87; whereas, intercropping for both the sown crops using local cultivars recorded BCR of 1.54 (Table13).

Table 14: Performance of location specific intercropping systems

KVK	Technology demonstrated	Crop/ variety	No. of farmers	Area (ha)	Demo Yield (q/ha)	Check Yield (Q/ha)	Percent increase	Demo BCR	Check BCR
Kinnaur	Intercropping	Apple (Royal delicious) with Rajmash (Jawala)	5	0.4	8.5	7	21.43	1.87	1.54

Intercropping of Apple with Rajmash, at KVK Kinnaur

Advancement in date of sowing to reduce terminal heat stress

In Chhoel–Gadauri village of Kullu district, during the months of December to February, low temperature and frost results into delayed nursery production of tomato under open conditions and causes heavy mortality of seedlings. This, ultimately delays the transplanting which results into crop failure due to heavy rainfall in July, high incidence of diseases and short duration of the cropping. To cope with the problem of low temperature, nursery raising in poly tunnels (78 sq.m) was demonstrated on 13 farmers' fields during Kharif 2015 for early transplanting of tomato. The transplanting could be advanced by almost one month and the duration of the crop increased as compared to the late transplanting. Early transplanting of tomato crop in an area of 1.5 ha under irrigated condition resulted in higher yield (32961Kg/ha) and net returns (Rs. 294288/ha) as compared to farmer's practice. Higher income was mainly due to early transplanting as compared to late planting in the 2nd fortnight of March and the duration of harvesting was more as compared to late planting.

Demonstration on polytunnels for raising early nursery of tomato

Table 15: Performance of early transplanted tomato under irrigated condition in NICRA village in Kullu

Comparison of Treatments	Date of sowing	Date of Transplanting	Fruit yield (kg/ha)	Gross cost (Rs/ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	Benefit cost ratio
Demonstration	8-10 /2/2015	10-16/3/2015	32961	101250	395538	294288	3.90
Farmer's practice	17-20 /2/2015	8-15/4/2015	25161	25161	201292	1007432	2.00

In village Wakherwan, Pulwama district, farmers had lost whole of their crop due to floods. Demonstration of 10 Polyhouses covering 50 farmers cultivating off-season vegetables like cauliflower (Var: Snow Ball-16), tomato (var; Shalimar-I) and brinjal (var: Shalimar Brinjal hybrid-I) gave net returns of Rs. 70,000/polyhouse. This intervention not only increased the production of vegetables in the area but also gave higher returns which were not possible earlier.

Protected vegetable cultivation under polyhouse at wakherwan , Pulwama (J&K)

III. Livestock and Fisheries Production Systems

Livestock and fisheries production system interventions are essential for livelihood and nutritional security. Interventions 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 are the activities carried under

the project. KVKs under NICRA have covered 2863 dairy animals with de-worming, mineral mixture supplementation, animal health check-up, artificial insemination, and animal health check-up; mitigation of mineral deficiencies in animals; breed Up gradation and also covered 1057 poultry birds for backyard poultry production. Silage making for availability of green fodder has been demonstrated by total of 91 farmers during lean period. Besides, maize, oat, sorghum and cow pea as fodder was demonstrated in 193.4 ha area of 290 farmers. Highlights of technology interventions are given below:

Use of community lands for fodder production during drought/floods:-

Good quality fodder production with high yielding improved cultivars is being promoted in most of NICRA villages to fulfill the requirement of availability of fodder for both at household level and village level. KVKs (Fatehgarh Sahib, Bathinda, Faridkot, Pulwama, Kullu,Yamunanagar and Bandipora) of Punjab, Haryana, Himachal Pradesh and Jammu & Kashmir have worked on fodder production. Demonstrations conducted on 193.4 ha area of 290 farmers cultivated fodder Maize (J-1006), Maize (African tall), Oats (Palampur-1), Sorghum (MP Chari) and Cow Pea (C-475), Jowar (HC-171, HC-308, HC-541), Berseem (HB-2) and Oat (HJ-8) during dry months under NICRA. This intervention resulted in substantial increase in milk production to the tune of 12-13 *l*/day as compared to 10-11 *l*/day of without intervention . This, extended the availability of fodder upto summer season.

Fodder maize (J-1006)

Maize+cow pea for fodder production

Demonstration on oats-Palampur-1

Fodder production

Oats var Sabzar for fodder production

Preservation of green fodder as silage for lean periods:-

Deferred onset and deficit rainfall conditions promoted adoption of silage making of green fodder in NICRA villages. Cultivation of fodder maize, sorghum and oats were taken up by several farmers to prepare silage using plastic drums and silo pits. A total of 91 farmers have demonstrated silage making units for availability of green fodder during scarcity of fodder.

Demonstration on Silage making in plastic drums at KVK Kullu

Availability of green fodder becomes critical for feeding milch animals in Chhoel-Gadouri village of Kullu district. Hence, conservation of maize + cowpea as silage in drums was demonstrated in the village with 25 farmers. Silage has been prepared during August-September and was used for feeding the animals during December, January and February. This helped in maintenance of good animal health and higher milk yield (0.8-1.0 liter/day) during peak winter months. In Pindi Blochan of district Faridkot also preserve fodder maize (Maize-J1006) as silage in silo pits, which was demonstrated by 3 farmers. It was observed that there was extensive increase in milk production to the tune 14.8 *l*/day as compared to 10-11 *l*/day milk yield following farmer's practice .

Feed supplementation to combat nutrient deficiency and heat stress in dairy animals:-

In order to maintain the productivity of dairy animals during lean period, demonstration of urea molasses mineral block (UMMB) as a supplement was carried out in NICRA village Said-

Feeding of Urea molasses mineral block

Distribution of mineral mixture

Table 16: Economic impact of feeding UMMB in Kathua district, J&K

Parameter	Cluster-1	Cluster-2	Cluster-3	Cluster-4
Increased milk yield (l/d)	1.1	1.4	0.9	1.5
Increased income from the ale of milk/day/cow@INR 30/l	33	42	27	45
UMMB intake/d/cow (Kg)	14	1	1	1
Cost of feeding UMMB @ INR 20/kg	20.00	20.00	20.00	20.00
Net profit (INR)	13.00	22.00	7.00	25.00

Sohal of Kathua district. Supplementation of UMMB at the rate of 1 kg/d/cow resulted in increased milk yield by 0.9-1.5 l/day (Table).

In Chohhoel-Gaduri village of Kullu district, demonstrations on area specific mineral mixture supplementation, improved cultivars for year round production of green fodder and silage making were carried out. Feeding of area specific mineral mixture (50 g/animal/day) for four months resulted in improvement in general and reproductive health of 117 lactating cows. Introduction of new fodder varieties in Kharif and Rabi season along with perennial grasses and tree fodder resulted in substantial increase in milk yield. The practice of green fodder supplementation along with dry crop residues being continued for eight to ten months in a year and was only for 5-6 months earlier.

Animal health camps:-

Under this intervention, two KVKs (Pulwama, Faridkot and Bandipora) of the Zone organized animal health check-up camps for disease diagnosis and its treatment. Animals were treated for various ailments/ diseases including parasitic infestation mastitis repeat breeding and productivity loss as well as making aware the farmers about importance of animal disease management for better animal productivity. A total of 369animals of 244 farmers were treated in the camps.

De-worming of animals

During the year 2015-16, five KVKs (Fatehgarh Sahib, Bathinda, Chamba and Bandipora)

Animal health check-up camp in NICRA village at Wakherwan, Pulwama

Control of Mastitis

conducted demonstrations on de-worming aspect using albendazole, butox and ivermectin. Eight hundred sixty three (863) animals of 483 farmers were de-wormed during the period . Increase in availability of quality fodder throughout the year increased milk production as well as farmer's income.

Artificial Insemination of animals

Under this intervention, KVK Hamirpur and Faridkot under NICRA performed artificial insemination of animals to improve productivity and profitability. A total of 235 animals of 233 farmers were treated for artificial insemination.

Climate Literacy:-

Climate literacy was provided through a village level weather station, which helped in daily monitoring of weather and created awareness among village farmers regarding climatic events like rainfall, temperature, humidity, wind speed and direction etc., mobile SMS on weather forecasting, prediction of rainfall and forewarning of pests and diseases etc.

Popularizing Backyard Poultry Breeds:-

Backyard poultry plays an important role in improving the economic status and fulfilling the protein requirement of the households as well as in fulfilling the nutritional requirement for family health. During the year, five KVKs namely Pulwama, Kinnaur, Faridkot, Bathinda and Bandipora have worked on promotion of backyard poultry breeds viz., Vanraja colored strain and Russian Merino. Rearing of these poultry breeds was demonstrated with a total of 1057 birds to 262 farmers . Resilience and impact of introduction of improved breeds on farmers' income was assessed at different locations. Cold stress tolerant backyard poultry breed (Vanraja) rearing was taken by 50 farmers in NICRA village Wakherwan, Pulwama, Jammu & Kashmir with 500

Popularization of backyard poultry

chicks. The growth performance was significant in Vanraja than local birds and live weight of four weeks old Vanraja and Desi chicks ranged from 345to 370 and 118 to 155 g respectively. Age at first egg laying in Vanraja and local birds was 182 and 217 days, respectively. A similar trend was observed in number of eggs laid per bird (64 and 21 in Vanraja and local bird respectively) in 40 weeks period.

Azolla as protein rich fodder to livestock during lean period:-

The technology of Azolla production for livestock feeding was adopted by seven farmer of NICRA village in Hamirpur district as an alternate fodder during lean period (April-June). About 35-40 % livestock rearers have adopted technology of Azolla cultivation. Under rain-fed condition in NICRA village of district Hamirpur, there is unavailability of green fodder during lean period. After introduction of Azolla cultivation, the green fodder in the form of Azolla is available for off season fodder supply to livestock. The use of Azolla as protein rich fodder to livestock resulted in 10-15 per cent increase in milk yield.

The technology of *Azolla* cultivation has proved useful to provide balanced nutrition to the livestock, especially in lean period of the year under rain-fed situation. Hence Azolla units have been established to cope with scarcity of green fodder in NICRA village and adjoining villages.

Demonstration on Azolla production

Custom Hiring implements

Spaneo garlic planter

Bailer

Zero Till Drill

Power weeder

Power Sprayer

Mist blower

Happy seeder

Laser leveler

IV. Institutional Interventions as enabling support systems

Building support systems in the village comprised of strengthening existing institutions and initiation of new institutions i.e., Village Climate Risk Management Committee (VCRMC) which plays a crucial role in mobilizing the communities in the village for active participation. VCRMC manages the custom hiring centre (CHC) for farm implements, seed bank, fodder bank, small weather station in the village, ensures participation of farmers in capacity development programs and exposure visits to learning sites.

Custom hiring centre for farm implements

Appropriate agriculture mechanization is necessary to achieve timeliness in field operations, increased productivity, reduced cost of production and minimized farm drudgery. It also imparts dignity to farm work and makes farming attractive to educated rural youth. It is very important for reducing hard work and for meeting the shortage of labour. The main objective of custom hiring centers is to supply farm implements to small and marginal farmers at minimum price on hire basis to enable them to carry out farm operations on time. Small equipments like weeders, markers, sprayers, drum seeder etc. are also made available in custom hiring centers.

The quality and precision of the operations are equally important for higher yields; for example, sowing of the required quantity of seed at proper depth and uniform application of given dose of fertilizer can only be possible with the use of proper mechanical devices. The rates for hiring the implements/machines are fixed by Village Climate Risk Management Committee (VCRMC). Different types of farm machineries are available in the CHCs, the most popular being zero till drill, rotavator, happy seeder, multi-crop planter, power weeder and chaff cutter.

Under this intervention, 12 KVKs (Kullu, Bathinda, Yamunanagar, Ropar, Chamba, Faridkot, Fatehgarh Sahib, Pulwama, Bandipora , Sirsa, Kathua and Kinnaur) established custom hiring centres for providing farm machineries to the farmers for performing various field activities. The farm implements included power weeder, paddy direct sowing machine , happy seeder, power sprayer, rotavator, mist blower, portable sprinkler system with pump set, laser leveler, power tiller, power weeder, spray pump, bush cutter, reaper binder, tractor mounted, zero till drill, multi crop ridge planter, harrow ridger, bush cutter, maize sheller, reaper binder, water lifting, etc. The CHCs implements were used by **712** farmers in **778.68** ha area. Rent of the equipments varied from Rs. 10.00 to Rs. 200.00 per hour depending upon the type of equipment and the district and total revenue generated was Rs.**117505** during 2015-16 (Table).

Table : Performance of different implemens and their revenue generated under NCRA during 2015-16

Implements/ equipments	Area	Farmers benefitted	Revenue generated (Rs.)
Happy seeder	52.8	92	8240
Laser land leveler	46	56	19300
Zero Till Drill	48.5	28	7250
Rotavator	141	134	34600
Direct seeded rice	42	32	3360
Maize planter	9	18	900
Potato Planter	3.5	5	600
Power weeder	8.32	29	5350
Power sprayer	104.56	98	6770
Straw Reaper	62	29	3100
Pre-seed cleaner	12	15	6000
Mist blower	70	25	1250
Bund maker machine	18	30	450

Implements/ equipments	Area	Farmers benefitted	Revenue generated (Rs.)
Fodder cutter	26	17	6400
Maize cob sheller	5	38	3550
Tractor mounted sprayer	10	12	1875
Straw Reaper	62	29	3100
Spice tooth harrow	42	18	5250
Wheel hoe	16.0	7	160
Total	778.68	712	117505

3. Capacity Building of NICRA Farmers

Capacity building of farmers is done to make them aware about the activities undertaken under NICRA project and about various climate resilient technologies demonstrated under the project. This module consists of training programmes conducted/organized on different need based aspects with the apparent objective of making the farmers of NICRA villages potential human resource with socially and financially comfortable and make their agricultural practices climate resilient.

A total of 276 capacity building programmes were conducted in different thematic areas during the year 2015-16 under NICRA viz., crop production /management, horticultural crops, pest and disease management in different crops, nutrition management, farm/crop diversification, resource conservation technology, livestock management, farm implements and machinery, women empowerment, value addition, etc. for 4275 farmers..

Under crop production/management/crop diversification, 42 programmes on different aspects were organized in which 785 farmers and 194 farm women participated and benefitted. Under resource conservation technology, 56 training programmes for skill up-gradation of 577 farmers and farm women were organized. Two programmes were conducted to aware regarding crop diversification for 59 farmers. Four programmes were organized for farm implements and machinery for 74 farmers and 9 farm women. For proficiency in live stock management, twenty programmes were conducted for 299 farmers and 111 farm women. A total of 38 capacity

building programmes were organized under pest and disease management for 651 farmers and farm women.

Under horticultural crops production, 18 training programmes were conducted for skill up-gradation of 90 farmers and 42 farm women. To boost the value addition related activities among the farm women, 36 programmes were organized. Eighteen training programmes were organized to enhance knowledge under horticultural crops to 132 farmers and farm women. Under fish farming, one progarmme was organized for ten farm women. One (1) programme was organized on vermi-composting to enhance the productivity of crops to 24 farmers. One training programme each on home science and home nutrition and child care was conducted in which 20 farm women participated in each training.

Table 26: Details of capacity building programmes carried out under NICRA

Thematic area	No. of courses	No. of farmers		
		Male	Female	Total
Crop production/management/crop diversification	42	785	194	979
Resource conservation Technology	56	534	43	577
Farm/ Crop Diversification	2	59	0	59
Farm implements and Machinery	4	74	9	83
Live stock management	20	299	111	410
Pest and Disease Management	38	523	128	651
Horticultural Crops	18	90	42	132
Fodder & Feed management	27	246	110	356
value addition	36	444	100	544
Women empowerment	1	0	23	23
Fodder & Feed management	27	246	110	356
Weed Control	1	31	0	31
Vermi -composting	1	18	6	24
Fish farming	1	10	0	10
Home science	1	0	20	20
Human nutrition and child care	1	0	20	20
Total	**276**	**3359**	**916**	**4275**

Training programme on Water Conservation

4. Extension Activities under NICRA

During the year 2015-16, in order to generate mass awareness about the impact of climate resilient technologies, large numbers of extension activities were organized by KVKs under NICRA at KVKs farms and in the NICRA villages. A total of 495 extension programmes were organized in which 9081 farmers including 2588 farm women participated. The details of extension activities organized are as under:

Under extension activities, 96 method demonstrations on different technologies were organized, in which 1877 farmers and farm women participated. Thirty one (31) field days on enhancing knowledge of different crops were conducted benefitting 1309 farmers and 166 farm women. Similarly, 146 awareness camps on different facets of climate resilient technologies were organized, in which 2940 farmers and 1069 farm women participated. Likewise, 10 exposure visits of 543 farmers and 96 farm women were conducted.

A total of 282 agro advisories were issued benefitting 3148 farmers and farm women. Moreover, 27 group discussions, involving 291 farmers and 429 farm women, were organized to discuss the problems related to climate resilient practices benefitting in soil health management, fertilizer doses, plant protection measures, integrated nutrient and insect pest management etc. World Environment day was celebrated by KVK Kathua, in which 80 farmers and farm women participated. One programme was organised to celebrate ICAR foundation day, in which 71 farmers and 19 farm women participated. Forty (40) field visits of 280 farmers were organized under NICRA during 2015-16 and 11 Kisan Ghosti were organized to discuss about the different climate resilient practices with 135 farmers (Table).

Field day on Happy Seeder Sown Wheat

Celebrating Soil Health Day

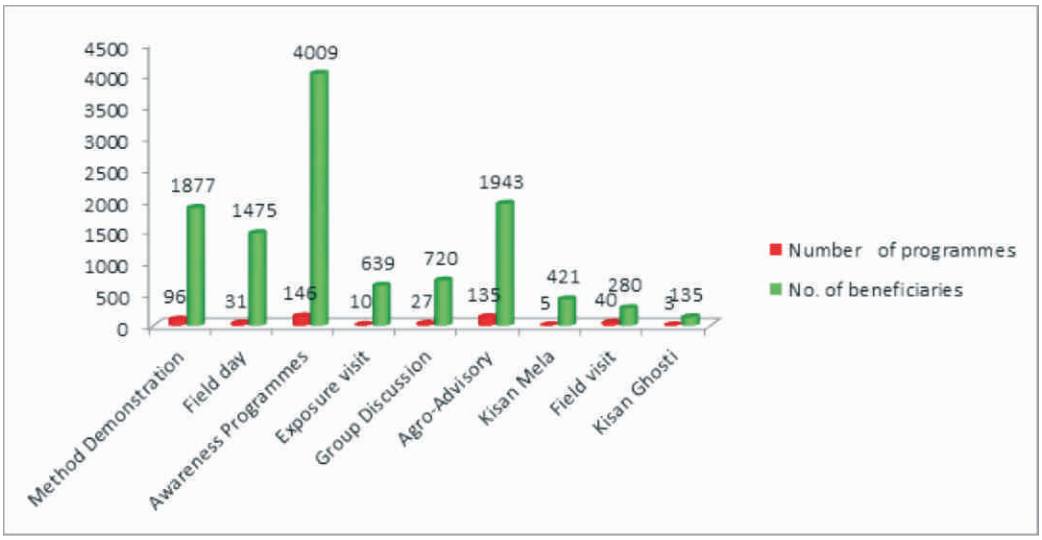
Field day on Maize

Parthenium Awareness Week

Table 27: Details of Extension Activities carried out under NICRA by KVKs

Name of the activities	Number of programmes	No. of beneficiaries		
		Male	Female	Total
Method Demonstration	96	1299	578	1877
Field day	31	1309	166	1475
Awareness Programmes	146	2940	1069	4009
Exposure visit	10	543	96	639

Name of the activities	Number of programmes	No. of beneficiaries		
		Male	Female	Total
Group Discussion	27	429	291	720
Agro-Advisory	135	1839	104	1943
Celebration of Enviornment day	1	28	52	80
Celebration of ICAR foundation day	1	71	19	90
Kisan Mela	5	208	213	421
Field visit	40	280	0	280
Kisan Ghosti	3	135	0	135
Total	**495**	**9081**	**2588**	**11669**



5.Case Studies of NICRA Interventions

5.1 Solar Cooker: An Alternate Energy Source in NICRA village

In the NICRA village Rasidpur, Ropar, Punjab, an effort was made to reduce dependence on conventional fuels and decrease environmental pollution by introducing the use of Solar Cooker at household level. It is the simplest device to operate and can be satisfactorily used for cooking in the presence of sunshine to reduce the cost of conventional fuel, thereby improving the quality of life of rural people. In this project, 15 solar cookers were procured from the School of Energy Studies for Agriculture under Punjab Agricultural University, Ludhiana and were provided to the farm families on 50% cost sharing basis who were keen on adopting this technology during the year 2015-16.

Demonstration on Solar cooker

Problems associated with the use of Convention Fuel

Problem reported with the use of kerosene, which is used by 25% households, includes unpleasant odour, limited supply and adulteration. In case of non- commercial fuels, firewood which is used by 47.50 % households was considered as unclean, giving smoke, creating health problems, laborious to collect, difficult to procure and difficult to store. Average saving on fuel per year by the rural households after adopting solar cooker is calculated as a gross reduction of Rs.1740 per year and a net saving of 33.33 per cent.

Table : Problems associated with the use of Conventional Fuels:

Energy Sources Commercial Energy Sources	Problem faced	Frequency (Percentage)
Electricity	Expensive	23(38.00)
(n=60)	Dangerous	24(40.00)
	Frequent Power failure	24(40.00)
LPG	High initial investment	44(36.60)
(n=120)	Dangerous	41(34.10)
	Delay in supply	45(37.50)
Kerosene	Unpleasant odour	17(34.00)
(n=50)	Adulteration	14(28.00)
	Limited supply	17(34.00)
Non-Commercial Energy Sources		
Firewood	Unclean atmosphere	28(29.50)
(n=95)	Smoke and Health problems	27(28.40)
	Laborious	27(28.40)
	Difficulty in procurement	28(29.50)
	Storage Problem	27(28.40)
Cow dung cakes	Smoke and Health problems	35(30.40)
(n=115)	Laborious	29(25.20)
	Difficulty in procurement	29(25.20)
Agricultural wastes	Unclean atmosphere	29(26.40)
(n=110)	Smoke and Health Problems	30(26.10)
	Laborious	31(27.00)
	Difficulty in procurement	29(25.20)
	Storage Problem	28(24.30)
Renewable Energy Sources		
Bio- gas (n=10)	Seasonal Irregularity	04(40.00)
	Choking	04(40.00)
	Irregular feeding of the Pit	04(40.00)
Solar Energy (n=5)	Unpredictable sunlight	04(80.00)

Acceptability of Solar Cooker in NICRA adopted village:

Table 2 shows that solar cooker is being accepted by the households with logical reasoning and the rural women are convinced with the advantages associated with its use. The scores given by respondents on a three point continum scale varying from "Strongly Agree", "Agree" and "Disagree" are presented. In NICRA village, the acceptability score was 2.02 out of 3, which indicates a good acceptability and subsequent adoption of solar cooker in this area. It is evident that overall acceptability of solar cooker is fairly appreciable in NICRA adopted village.

Table : Subjective Responses regarding Acceptability for Adoption of Solar Cooker

Acceptability statement regarding Solar cooker	NICRA villages (N=200)			Mean Score
	Strongly Agree	Agree	Disagree	
Saves Fuel and Money	64 (32.00)	76 (38.00)	60(30.00)	**2.02**
Promotes Environmental Cleanliness	68 (34.00)	72 (36.00)	60 (30.00)	**2.04**
Reduces the dependence on Fossil Fuel	60 (30.00)	72(36.00)	68 (34.00)	**1.96**
Exposes to the Novel way of cooking	56 (28.00)	76 (38.00)	68 (34.00)	**1.94**
Requires less attention	64 (32.00)	76 (38.00)	60(30.00)	**2.02**
Reduces the fear of accident	64 (32.00)	68 (34.00)	68 (34.00)	**1.98**
Keeps kitchen and utensils clean	68 (34.00)	72 (36.00)	60 (30.00)	**2.04**
Relieves Drudgery of home maker	72 (36.00)	72(36.00)	56(28.00)	**2.08**

Impact with use of solar cooker:

I. Reduction in Fuel Expenditure:

Average saving on fuel per year by the rural households after adopting solar cooker is calculated as a gross reduction of Rs.1740 per year and a net saving of 33.33 per cent. (Table).

Table : Reduction in Fuel Expenditure per year after adopting Solar Cooker

Avg. Fuel Expenditure/year before adopting Solar Cooker	Avg. Fuel Expenditure/year after adopting Solar Cooker	Gross Reduction in Fuel Expenditure/year	Net Saving/ year
Rs. 5220 / year	Rs. 3480 / year	Rs. 1740 per year	33.33 %

II. Reduction in carbon emission :

With the use of solar cooker, six LPG cylinder/ year can be saved which costs to Rs. 3408 and with this 254 kg/year carbon emission can be reduced.

Table 4: Saving with use of solar cooker

Parameters	Without Solar cooker	With Solar cooker	Saving
No. of LPG cylinder used /year	18	12	6
Cost (Rs.)/ year	Rs. 10224	Rs. 6816	Rs. 3408
Co_2 Emmission (kg)/year	762.45	508.30	254.15

5.2 Stress resistant and short duration Rice-NDR-97 in Said-Sohail village of Kathua

Said-Sohal village of district Kathua has been adopted by Krishi vigyan Kendra Kathua to demonstrate and facilitate adoption of climate resilient technologies for sustaining and increasing agricultural productivity. According to the International Rice Research Institute (IRRI), Philippines about 38% of the world's land area, where 70% of the population lives and 70% of global food supply is produced, suffers from drought. The selected village is also an ecologically vulnerable to the vagaries of climate variability such as droughts. The extreme weather events add to the chaos in farming and livelihoods of farmers in the rainfed village of Said.

Demonstration on Rice –NDR 97 at KVK Kathua

In the baseline survey, farmers of the village demanded rice varieties that are resistant to moisture stress and can yield well under drought conditions. Keeping, the farmers demand into consideration, Krishi Vigyan Kendra Kathua introduced NDR-97 variety of rice in the village under the NICRA intervention of popularizing drought tolerant and short duration varieties. The technology has been proven to be a success for the farmers in the village.

Demonstrations on NDR-97 in the *kharif* season of the year 2015

The NDR-97 variety of rice is being introduced by Krishi vigyan Kendra Kathua in the village Said-Sohal of Kathua district in 2.5 ha area of 15 farmers.

PROVEN BENEFICIAL TRAITS

The traits of the variety perceived by the farmers of the village are discussed as below:

Short duration:

The variety matures in about 110 days which results in reduction of time period and risks of moisture stress. It gives an opportunity for early sowing of next crop, thus increases the cropping intensity of rainfed village.

Less water requirement:

The variety needs critical irrigation at initial stages and later can thrive well under limited available water. Thus, the amount of water required for cultivation of paddy reduces drastically in case of NDR-97, as compared to the other rice varieties.

Economic Impact

The economic impact of the introduced variety of rice in comparison to the existing rice varieties has been presented in Table:

Table : Performance of Economics of Rice variety NDR-97

Yield (per hectare)			Economics of demonstration (Rs./ha)				Economics of Local (Rs./ha)			
NDR-97	Local check	% increase	Gross Cost	Gross Return	Net Return	BCR	Gross Cost	Gross Return	Net Return	BCR
30	20	50	18500	36000	17500	1.94	18500	24000	5500	1.29

Social Impact:

The variety introduced by KVK Kathua in the *kharif* season of 2015 has gained popularity in the targeted Said-Sohal and adjoining villages. KVK has received about 100 queries about the technology and farmers are enthusiastic about the traits of the varieties, they themselves have seen under Front line Demonstrations during Kharif 2015. During Kharif season of the year the area under the variety is 5.8 of 36 farmers.

5.3 Salt tolerant wheat varieites KRL-210, KRL-213 and KRL-19 for salt affected soils of NICRA village Rupana, district Sirsa

The NICRA village Rupana, in Sirsa district, has approximately 120 ha of area affected with salts. The water table is so high that salts could not be leached down. Clone eucalyptus was planted by KVK, Sirsa in the village, but the seedlings survived only in the field where water table was comparatively low. Even in *Rabi* season, the traditional wheat varieties could not withstand owing to higher salt accumulation in root zone. In the *Rabi* 2013-14, KVK introduced salt tolerant wheat variety KRL-210 for salt affected area of the village. Initially seed of variety KRL 210 was demonstrated to 15 farmers in the year 2013-14. The variety was very effective compared to traditional variety PBW 343. The seed of variety was procured in the seed bank for sowing during next crop year in the salt affected area.

View of salt tolerant wheat varieties at KVK Sirsa (Haryana)

In the next year 2014-15, a new variety KRL 213 was also introduced in the village which proved even more effective than KRL 210. During 2015-16, new variety of wheat KRL-19 was introduced in NICRA village, which proved more beneficial than other varieties of wheat demonstrated earlier. In this way, this intervention benefitted the farmers and proved to be a boon for the farmers of village. Wheat variety KRL-19 was demonstrated in 2 ha area of 5 farmers and KRL-210 was demonstrated in 32 ha area of 5 farmers. It was observed that the new demonstrated variety of wheat KRL-19 resulted in higher BCR 1.8 as compared to KRL-210 with resulted BCR as 1.6.

Table : Economics of demonstrations during Rabi 2013-14

Name of variety	Area (ha)	Yield(q/ha)	No. of farmers	Economic of Demonstration (Rs./ha)			
				Gross Cost	Gross Return	Net return	BCR
PBW -343	14	10.2	46	28400	14280	14120	0.5
KRL-210	6	32.4	15	28400	45360	16960	1.5

Table : Economics of demonstrations during Rabi 2014-15

Name of Variety	No. of farmers	Area (ha)	Yield (Q/ha)	Economics of Demonstration (Rs./ha)			
				Gross Cost	Gross Return	Net Return	BCR
KRL210	80	32	34	30500	49300	18800	1.6
KRL213	15	6	39	30500	56550	26050	1.8

During 2015-16, new variety of wheat KRL-19 was introduced in NICRA village which proved more beneficial than other varieties of wheat demonstrated earlier. Demonstrations were conducted on wheat KRL-210 32 ha of 5 farmers and demonstrations on KRL-19 were conducted on only 2 ha of 5 farmers , it was observed that wheat variety KRL-19 is more beneficial as compared to other varieties of wheat.

Table : Economics of demonstrations during Rabi 2015-16

Name of Variety	No. of farmers	Area (ha)	Yield (Q/ha)	Economics of Demonstration (Rs./ha)			
				Gross Cost	Gross Return	Net Return	BCR
KRL-210	5	32	34	32400	51850	19450	1.6
KRL-19	5	2	39	32400	59475	27075	1.8

6. Monitoring of TDC-NICRA

Zonal Monitoring Committee visits to NICRA KVKs under ICAR-ATARI-I during 2015-16

Indian Council of Agricultural Research (ICAR) constituted the Zonal Monitoring Committee, for periodical review of progress under Technology Demonstration Component under NICRA to evaluate the work being done by Krishi Vigyan Kendras.

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. During the year 2015-16 following KVKs were visited by ZMC.

1. A brief report of ZMC visit to KVK Yamunanagar (Haryana)

The Zonal Monitoring Committee (ZMC) visited Yamunanagar on 13th April 2015, to review the technical and financial progress achieved by this Krishi Vigyan Kendra (KVK) under TDC of NICRA in Zone-I.

District Yamunanagar has been selected under the project to mitigate the effect of frost in winter. Other climatic vulnerabilities in the district are untimely rainfall, prolonged dry spells, and fluctuation in temperature, decreasing water table and heat wave in summer. The NICRA village Radauri is located at 12 km from the KVK. The average annual rainfall in the village is 750 mm. Total cultivated areas in the village is 356.8 ha which is irrigated through bore wells. Major crops of the village are paddy, wheat and sugarcane. Large ruminants (522 cows and 200 buffaloes) are the major livestock in the village.

Technical Progress under the Project:

***NATURAL RESOURCE MANAGEMENT*:** Under this module, main climate vulnerabilities are water scarcity and deteriorating soil health. The interventions identified were laser land leveling, renovation of defunct water harvesting structures, irrigation through underground pipe lines, integrated nutrient management under climate variability in rice and sugarcane, soil test based nutrient application, and tank silt application.

KVK Yamunanagar demonstrated laser land leveling in 91.5 ha area of 25 farmers, sowing of

wheat with Zero Till Drill in 10.4 ha area of 26 farmers, sowing of wheat with happy seeder in 29.6 ha area of 74 farmers, green manuring in 2.4 ha area of 6 farmers and underground pipeline for irrigation in 1.6 ha area of 4 farmers while these technologies have been adopted in 115 ha, 70 ha, 35 ha, 20 ha and 110 ha additional area, respectively. The KVK also demonstrated direct seeded rice in 3.2 ha area of 8 farmers but response of farmers towards this technology was not satisfactory probably due to being knowledge intensive one. Response of farmers to micro irrigation (drip and sprinkler methods) was also not enthusiastic due to high initial cost and erratic supply of electricity. The KVK demonstrated vermi-composting to 20 farmers during 2014-15 and farmers' response to the technology was good.

CROP PRODUCTION: Under this module, main climate vulnerabilities are water scarcity, moisture stress in Rabi season, losses due to pests and diseases and burning of paddy stalks. Major interventions proposed were replacing paddy with less water requiring crop like turmeric, inter cropping of wheat/ onion/ garlic/ sarson + sugarcane; alternate cropping with poplar + turmeric, poplar+wheat + sugarcane etc; economically viable cropping systems paddy - wheat - summer moong, paddy - potato - onion etc; direct seeding in paddy, zero till seeding of wheat, micro irrigation systems in vegetables, low cost poly house cultivation of vegetable crops; low tunnel raising of vegetable nursery; adapted varieties and timely surveillance for pest and disease management in rice (sheath blight and stem rot neck blast), wheat (powdery mildew and yellow & brown rust, aphids); control of shoot and top borers in sugarcane; and IPM in rice and sugarcane.

The work done by KVK on direct seeding in paddy, zero till seeding of wheat and micro irrigation systems have already been discussed under NRM module. Intercropping of onion, wheat, mustard and garlic with sugarcane was demonstrated in 4.8 ha area of 13 farmers with adoption of this technology on 6 ha additional area in NICRA village. INM in wheat (32.4 ha area of 81 farmers) and paddy (11.6 ha area of 29 farmers) were demonstrated with adoption of these technology on 50 ha and 40 ha additional area respectively. Likewise, introduction of short duration paddy variety PUSA 1509 (4.2 ha area of 12 farmers) and rust resistant varieties of wheat HD 2967 & DPW 621-50 (39.6 ha area of 99 farmers) were demonstrated with adoption of these technology on 16 ha and 100 ha additional area respectively. Besides, seed of yellow rust resistant wheat variety WH-1105 was produced in the NICRA village which covered 16 ha area in the next year. The KVK demonstrated cultivation of summer moong for soil health improvement in rice-wheat cropping system in 14 ha area of 36 farmers but due to untimely rains during reproductive phase of wheat during last 2 years delayed harvesting of wheat crop by 10-15 days and affected sowing of moong crop.

Livestock and Fisheries: The major climatic vulnerabilities are mortality and morbidity losses due to biotic and abiotic stresses and fodder scarcity. The major interventions identified were

prophylaxis and mitigation of mineral deficiencies in livestock, fodder conservation through silage and hay, and promotion of fodder production through improved varieties.

To mitigate mineral deficiency in livestock, supplementation of mineral mixture was demonstrated on 17 animals of 17 livestock owners. Presently, 155 animals of the village are fed with mineral mixture in the NICRA village. Control of ecto and endo parasites and deworming were demonstrated on 188 animals which are now being practiced on 412 animals. Besides, cultivation of root rot resistant & high yielding variety of berseem (HB-1) was demonstrated in 1.2 ha area of 25 farmers during 2014-15. It was raised for dual purpose and seed has been kept for sowing next year.

Institutional Interventions: Major issues were low seed replacement rate due to poor availability of improved seed, poor access to farm implements, poor access to livestock services and losses due to highly uncertain weather. The proposed interventions were seed production of summer moong and wheat through farmer groups; community managed farm machinery custom hiring centre; training 2-3 rural youth as livestock service providers for prophylaxis; agro advisory based on IMD weather forecast, and village weather observatory; training 2-3 rural youth for maintaining farm machinery; and promotion and capacity building for mushroom production as livelihood source.

Custom Hiring Centre (CHC) has been established in the village. An amount of Rs. 22680 has been generated on account of rent of farm implements of CHC. Mushroom cultivation has been demonstrated to 10 farmers with 660 bags each of 10 kg which has increased to 1500 bags.

All the categories of farmers in the village have been involved in the implementation of the project. VCRMC was constituted in the village on 15.10.2011. There is no representation of farm

ZMC members interacting with farmers

Visit of ZMC to demonstration plot in NICRA village

women in the VCRMC. The committee met regularly. The farmers of the NICRA village are cooperative. Now KVK has involved farm women of the NICRA village in the project through vermi-composting and kitchen gardening.

Programme Coordinator interacting with the members

2. A brief report of ZMC visit to KVK Fatehgarh Sahib (Punjab)

The Zonal Monitoring Committee (ZMC) formed visited Fatehgarh Sahib on 14th April,2015 to review the technical and financial progress achieved by this Krishi Vigyan Kendra (KVK) under TDC of NICRA.

The NICRA village, Badauchhi Kalan, is about 12 km from the KVK. Frost and cold wave are the major climatic constraints in the village. Average annual rainfall is 877 mm. The total cultivated area in the village is 977 ha area out of which 880 ha area is irrigated mainly through tube wells. Rice and wheat are principal crops of the village. There are 1050 large ruminants in the NICRA village.

Technical Progress under the Project:

Natural Resource Management: Major climate vulnerabilities are terminal heat stress in wheat, burning paddy stalks, depletion of ground water and poor soil health. The major interventions identified were in-situ moisture conservation through bio mulching, residue incorporation in soil with turbo seeders, de-silting of ponds, green manuring with Sesbania and soil test based nutrient application.

For in-situ moisture conservation through bio mulching and residue incorporation in soil, the KVK demonstrated wheat sowing with happy seeder in 49.6 ha area of 70 farmers. The technology was adopted by the farmers in 19 ha additional area. Likewise, laser land leveling was

demonstrated in 17.2 ha area of 43 farmers, however increase in area under this technology was only 4 ha. Demonstration on green manuring with Sesbania was executed in 24 ha area of 54 farmers which was further adopted in 7 ha area. The major reasons for low adoption were unavailability of seed and uncertain supply of electricity for irrigation. Summer moong cultivation was demonstrated in 15.5 ha area of 43 farmers which was further adopted in 8 ha additional area. To minimize emission of Methane gas from open dung heaps and proper use of dung, 18 bio gas plants were installed in the village on 50 % cost sharing basis.

Crop Production: The main climatic vulnerability is terminal heat stress, depletion of ground water and losses due to pests and diseases. The key interventions identified were advancement of sowing dates and zero till sowing of wheat seed treated with Pseudomonas; crop diversification by growing fruit trees like bael (Aegle marmelosa), jamun (Syzyjium cumini), jack (Artocarpus heterophyllus), harda (Terminalia chebula), amla (Emblica officinalis); tensiometer in paddy for efficient irrigation; judicious use of nitrogen by using leaf color chart in paddy; micro irrigation systems - micro sprinklers; low cost poly house for cultivation of flower crops; Zero till sowing of summer mung (with Rhizobium culture) after harvesting of wheat; and need based spot treatment of insecticides for controlling aphids in wheat.

The work done on zero till sowing of wheat (Happy seeder) has been discussed in NRM section. For judicious use of nitrogen by using leaf color chart in paddy was demonstrated in 4 ha area of 5 farmers. For amelioration of manganese deficiency in wheat, two sprays of 0.5% MnSO4 was demonstrated in 25.2 ha area of 88 farmers.

Livestock and Fisheries: The main climate vulnerabilities are mortality and morbidity losses due to biotic and abiotic stress and fodder scarcity. The major interventions identified were prophylaxis and mitigation of mineral mixture deficiencies in livestock; fodder conservation through silage making; and production and supply of seedlings of fodder trees/ grasses.

The KVK demonstrated maize (variety- J 1006) as fodder crops in 12.73 ha area of 65 farmers. Additional area of 13.1 ha has come under this variety. Mineral mixture feeding was demonstrated on 108 animals of 53 livestock owners. Likewise, de-worming of young calves and heifers was demonstrated on 108 animals of 53 livestock owners.

Institutional Interventions: The vulnerabilities identified are low seed replacement, poor access to farm implementation and live stock services as well as losses due to highly uncertain weather. The major interventions identified were seed production of moong, wheat and berseem through farmer groups; community managed farm machinery custom hiring centre; training 2-3 rural youth as livestock service providers for prophylaxis; agro advisory based on IMD weather forecast and village weather observatory; training 2-3 rural youth for maintaining micro - irrigation systems and farm machinery; and capacity building on mushroom cultivation.

Custom Hiring Centre (CHC) of the NICRA village has been established. The amount of Rs. 24720 has been generated on account of rent of farm implements of CHC out of which Rs. 6120 has been spent on repairs of implements and Rs. 2700 on purchase of Jute yarn. The VCRMC has been constituted in the NICRA village on 11.06.2012. The meeting of VCRMC is regular. All the categories of farmers in the village have been involved in the implementation of the project.

KVK Staff interacting with members

ZMC members interacting with farmers

Members interacting with farmers on demonstration unit

3. A brief report of ZMC visits to KVK Ropar (Punjab)

The Zonal Monitoring Committee (ZMC) formed visited Fatehgarh Sahib on 8th July, 2015 to review the technical and financial progress achieved by this Krishi Vigyan Kendra (KVK) under TDC of NICRA.

The NICRA village, Rasidpur of district Ropar has been selected under the project to mitigate the effect of cold wave and frost which are major climatic constraints in the village. The average annual rainfall is 750 mm. The total cultivated area in the village is 282 ha and whole area is irrigated through tube wells. Rice, wheat and poplar are major crops of the village. The major cropping systems are rice-wheat, rice-potato-sunflower, rice-wheat-summer moong and cauliflower-potato-sunflower.

Technical Progress under the Project:

Natural Resource management: Major climate vulnerabilities are depletion of ground water and poor soil health. Major interventions proposed were reduced tillage; zero till seeding of wheat; direct seeding of paddy and using Tensiometer for efficient irrigation; incorporation of paddy residue into the soil; soil test based nutrient application; and renovation of defunct rainwater harvesting structures.

KVK Ropar demonstrated laser land leveling in 9.5 ha area, sowing of wheat with Zero Till Drill in 22.0 ha area, sowing of wheat with happy seeder in 9.0 ha area, green manuring with dhaincha in 7.0 ha area, sowing of summer moong with Zero Till Drill in 9.7 ha area, and DSR in 10 ha area while these technologies have been adopted in 40 ha, 30 ha, 14 ha, 10 ha, 60 ha and 20 ha additional area, respectively. Sprinkler irrigation in wheat was demonstrated in 0.4 ha area but this technology was not adopted due to availability of abundance of water and higher initial cost. The KVK also demonstrated bailing of wheat straw in 7.5 ha area but response of farmers towards this technology was not satisfactory due to unavailability of bailing machine and problem of lifting of bails.

Crop Production: Under this module, main climate vulnerabilities are terminal heat stress in wheat, water scarcity and loss due to pest and disease. Major interventions proposed were advancement in date of sowing of wheat; intercropping - wheat + gobhi sarson; economically viable cropping systems - paddy - wheat -summer mung, maize - potato - onion/ sunflower; Agri - horticulture system - fruit tree plantation; intercropping in orchards; micro irrigation system in kinnow and capsicum; protected cultivation of chilly nursery and capsicum; integrated nutrient management under climate variability in rice and potato; adapted varieties of wheat, rice & maize; and seed treatment in basmati rice (PUSA 1121) and potato against foot rot and late blight, respectively.

The KVK facilitated 6 farmers in establishing poplar nursery of different varieties in 0.8 ha area. It also worked on timely surveillance of yellow rust disease in wheat and its control in collaboration with Indian Institute of Wheat and Barley Research, Karnal.

Livestock and Fisheries: Under this module, main climate vulnerabilities are mortality and morbidity losses due to biotic and abiotic stresses; and fodder scarcity. Major interventions

proposed were prophylaxis and mitigation of mineral deficiencies in livestock; fodder conservation through silage making; and production and supply of seedlings fodder/ forage trees.

To mitigate the problem of anoestrus and repeat breeding in heifers, the KVK demonstrated supplementation of mineral mixture licking of UROMIN block to 85 animals of 48 livestock owners. It rectified the problems in 58.53 % animals. These demonstrations motivated other livestock owners to offer mineral mixture and UROMIN block to their 192 animals. The KVK also demonstrated de worming in 23 animals and fodder maize (variety-J 1006) in 6 ha area which is now being grown in 15 ha area. The KVK also organized animal health check up camp in which 19 animals were checked.

Institutional Interventions: Major issues were poor access to improved seed, farm implements and live stock services; and losses due to highly uncertain weather. The proposed interventions were seed production of moong, mash, wheat through farmer groups; community managed farm machinery custom hiring centre; training 2-3 rural youth as livestock service providers for prophylaxis; agro advisory based on IMD weather forecast and village weather observatory; training 2-3 rural youth for maintaining micro-irrigation systems and farm machinery; and promotion and capacity building on mushroom cultivation.

Custom Hiring Centre CHC of the NICRA village has been established. Happy (Turbo) Seeder -1, Forage Chopper Cum Loader -1, Semi Automatic Potato Planter -1, Rotary Power Weeder -1, Zero Till Drill -1, Multi crop planter-1, Pulverizing Roller 1) has been established in the village and implements are being used. An amount of Rs.35985 has been generated through custom hiring. VCRMC was constituted in the village and are meeting regularly.

Glimpse of interaction of ZMC members with farmers

A view of farmer's polyhouse

Vegetables for sale under NICRA

4. A brief report of ZMC visits to KVK Hamirpur (H.P)

The Zonal Monitoring Committee (ZMC) formed visited Hamirpur on 15th April, 2015 to review the technical and financial progress achieved by this Krishi Vigyan Kendra (KVK) under TDC of NICRA.

District Hamirpur has been selected under the project to mitigate the effect of drought. The average annual rainfall in the district is 1025 mm but erratic. Temperature during summer months hovers around 400 C but sometimes reaches up to 45^0 C. On the other hand, the average temperature in winter is about 100 C but it may dip up to 4^0 C. The NICRA village panchayat Man is 6 km away from KVK. Agriculture in the village is rainfed. Major crops of the village are maize and wheat.

Technical Progress under the Project:

NATURAL RESOURCE MANAGEMENT: Under this module, main climate vulnerabilities are water scarcity/drought. The interventions identified were trenches cum bunds in orchards; ridges and furrows in vegetable cultivation; use of organic mulches; renovation of defunct water harvesting structures; rainwater harvesting in poly-lined farm ponds; and lifting water from perennial streams.

Rainwater harvesting through poly-lined tank was demonstrated at 6 locations and 6 other poly-lined tanks were constructed by the farmers. However, other farmers were skeptical to adopt this due to higher initial cost. The KVK also constructed 12 roof water harvesting tanks. Besides, 35 tanks have been constructed by dovetailing with MGNREGA scheme. Water harvesting through these structures have brought 5.0 ha area of the village under multiple cropping. Munching for moisture conservation has been demonstrated in 4.32 ha area and it was further adopted in 4 ha additional area. Water saving technologies namely ridges and furrows methods for cultivation of cucurbits were demonstrated in 3.48 ha area and was further adopted

in 2.5 ha additional area. Besides, the KVK demonstrated vermi-composting to 69 farmers and it was further adopted by 30 farmers.

CROP PRODUCTION: Under this module, main climate vulnerabilities are water scarcity/drought leading to poor yield. Major interventions proposed were intercropping - maize + toria/ mash/soybean + wheat/ gobhi sarson/ gram, tomato + bean + cauliflower, arhar +wheat etc; drought tolerant crops like cowpea (Himachal lobia 1), arhar (Sarita) anola, ber; adapted varieties of blackgram (UG 218/ Him mash 1), gobhi sarson (Neelam/ Sheetal), toria (bhawani), french bean (Arka komal, Falguni, Contender), soybean (Harit soya, Palam soya, Shivalik), maize (KH 101, KH 9452, Mitra, PMZ 47), wheat (VL 616), barley (VL829); and micro irrigation systems - sprinkler and low cost drip.

Intercropping of Maize (Proline 3440) + Soybean (HARIT SOYA) and Maize (Proline 3440+ Cowpea (Himachal Lo bea 1) was demonstrated in 3.0 ha area which was further adopted in 05 ha additional area. Besides, the KVK demonstrated low water requiring varieties of okra (Tulsi) in 1.92 ha which was adopted by the farmers in 3.0 ha additional area and yellow rust resistant variety of wheat HPW 349 in 4.5 ha area which was adopted by the farmers in 15.0 ha additional area. Rainwater harvesting in the village increased the area under vegetables (cauliflower, bitter gourd, cucumber and lady finger) up to 2.5 ha and productivity of these crops also increased to the tune of 17.5 % in cauliflower, 39 % in bitter gourd, 27 % in cucumber and 24 % in lady finger.

Livestock and Fisheries: The major climatic vulnerabilities are mortality and morbidity losses due to biotic and abiotic stresses and fodder scarcity. The major interventions identified were prophylaxis and mitigation of mineral deficiencies in livestock; fodder conservation through silage and hay making and production and supply of seedlings of fodder trees/ grasses.

To mitigate mineral deficiency in livestock, supplementation of mineral mixture (371 animals) was demonstrated in the NICRA village. The animals of the village were vaccinated against diseases (HS, BQ and FMD) in collaboration with Animal Husbandry Department. For up-gradation of goat breed, 2 superior bucks of Beetal breed were given to 2 goat owners. For fodder conservation, the KVK demonstrated silage making in drums. To mitigate fodder scarcity, the KVK demonstrated Azolla cultivation as fodder to 96 farmers. Besides, plantation of guinea grass (5000 root slips) and mulberry (2000 plants) was done in the village

Institutional Interventions: Major issues were poor access to improved seed, farm implements, and live stock services; and losses due to highly uncertain weather. The proposed interventions were -Seed bank for pulses (arhar, blackgram & gram) through farmer groups; community managed farm machinery custom hiring centre; training 2-3 rural youth as livestock service providers for prophylaxis; agro advisory based on IMD weather forecast and village weather observatory; training 2-3 rural youth for maintaining micro-irrigation systems and farm machinery; and Promotion and capacity building on mushroom cultivation.

Custom Hiring Centre (CHC) (Power tiller-1, Power weeder-1, Bush cutter-1, Maize sheller-1, Spray pump -2, Multi crop planter-1, Sprinkler system -1, Manual seed drill -1, Manual weeder-1) has been established in the village and implements are being used except power weeder, sprinkler system, manual seed drill and manual weeder. An amount of Rs.137497 has been generated through custom hiring out of which Rs. 5451 were spent on repair of power tiller. VCRMC was constituted in the village and are meeting regularly. The committee has farmwoman representatives also.

Training 2-3 rural youth as livestock service providers for prophylaxis; agro advisory based on IMD weather forecast and village weather observatory; training 2-3 rural youth for maintaining micro-irrigation systems and farm machinery; and Promotion and capacity building on mushroom cultivation not taken up.

Visit of ZMC members to farmers' fields

Visit of ZMC to Village NICRA Office

Demonstrated plot under NICRA

7. Annual Review Workshop TDC-NICRA

ICAR-Agricultural Technology Application Research Institute, Zone-I, Ludhiana organized Review-cum-Action Plan Meeting of Krishi Vigyan Kendras (KVKs) of Zone-I under Technology Demonstration Component (TDC) of National Innovation in Climate Resilient Agriculture (NICRA) on 2nd May, 2015 at ICAR-Central Soil Salinity Research Institute (CSSRI), Karnal under the Chairmanship of Dr. D. K. Sharma, Director, ICAR-CSSRI, Karnal. Dr. Rajbir Singh, Director, ICAR-ATARI, Zone-I, Ludhiana and Dr. Keshava, Principal Scientist & Nodal officer NICRA from ICAR-ATARI, Zone-I Ludhiana to review the achievements made during the year 2014-15 and finalize action plan for the year 2015-16. A total of 53 participants took part in the meeting.

The meeting was Co-Chaired by, Dr. Y. G. Prasad, Coordinator, Technology Demonstration Component (TDC) of National Innovation in Climate Resilient Agriculture (NICRA), CRIDA, Hyderabad; Director of Extension Education (DEE) from Sher-e-Kashmir University of Agricultural Sciences & Technology (SKUAST), Jammu; Additional Director and Joint Director, Directorate of Extension, Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar; and Programme Coordinators (PCs)/Subject Matter Specialists (SMSs)/Senior Research Fellow (SRF) of Krishi Vigyan Kendras (KVKs) of Punjab, Haryana, Himachal Pradesh and Jammu & Kashmir under NICRA Project.

Dr. D. K. Sharma, in his inaugural address informed the house about the technologies developed by the institute and appropriateness of these technologies in making the Indian agriculture climate resilient. The institute had reclaimed 2 million ha salt affected soil in the country which helped in increasing the productivity. The recent bad weather would be opportunity for the agricultural scientists to face the climate change and its impact on agriculture.

Glimpses of Annual Review Workshop 2015-16

Dr. Rajbir Singh, Director, ICAR-Zone-I, Ludhiana emphasized on holistic and multi-stakeholder approach to cope with the weather related risks which have huge impacts on agriculture. Highlighting the importance of the project, he informed the house that 80 per cent of Parliament questions on ICAR are related to climate change/NICRA. Extreme climate happenings are increasing. He opined that success stories in the project would increase the visibility and credibility of the KVKs.

Dr. K. S. Risam, Director of Extension Education, Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu, in his remarks, discussed with the participants about recent weather vagaries and urged the KVKs to work on available technological options for climate resilient agriculture.

Dr. Y. G. Prasad, Coordinator, TDC of NICRA, briefed the house about whole NICRA project with specific details of its technology demonstration component and informed that 21 new districts had been included in XII plan out of which 1 (Bandipora) has been included from Zone-I. He stressed upon proper functioning of Village Climate Risk Management Committee (VCRMC), Custom Hiring Centres (CHCs) in the NICRA villages and requested the KVKs to demonstrate those technological interventions developed by National Agricultural Research and Education System which are climate resilient.

Afterwards, all the PCs of KVKs under NICRA Project presented the Annual Progress Report for the year 2014-15 and Annual Action plan for the year 2015-16. The presentations were focused on components of climate resilient villages such as natural resource management, crop production, livestock and fisheries, production systems and institutional approaches.

Recommendations/ Action Points

1. All KVK will submit hard copy of Annual Progress Report of 2014-15; Action Taken Report on the recommendations of last workshop of NICRA Project held during 12-14/05/2014 at UAS, Bangaluru; and Revised Action Plan 2015-16 to the ICAR-ZPD within 15 Days.
2. Each intervention under NICRA must address climate vulnerability. KVKs may demonstrate those technological interventions which are climate resilient and developed by institutions under National Agricultural Research and Education Systems of the country.
3. The KVKs will document 1 or 2 success stories of interventions on technologies addressing climate vulnerability and submit to the ICAR-ZPD within 2 months.
4. Each KVK will install Manual Weather Station in its NCRA Village (if not installed).
5. Standard units like, hectare for area, quintal per ha for yield, etc. should be used in reports as well as presentations.
6. Use of farm machineries/implements should be optimum in CHCs.
7. Efforts should be made to establish fodder bank in NICRA village.
8. KVK Sirsa should demonstrate Hydrogel technology in NICRA village.
9. Travel Seminar should be arranged for learning and larger impact.
10. Capacity building programme with CCAFS platform for KVK Staff should be organized.

Annexure-I

8. Annexures

Details of cutivars demonstrated under NICRA during 2015-16

KVK	Crop	Variety	Year of release	Potential yield (q/ha)	Days to mature	Remarks
Drought/temperature tolerant varieties						
Kullu	Wheat	HPW-236	2007	33	170-185	Recommended for rainfed conditions. This variety is resistant to karnal burnt, yellow & brown rust, grains are bolder, semi hard and amber coloured
Kullu	Wheat	HPW-155	2003	37-40	165-180	This variety is recommended for rainfed areas of high hills and irrigated and rainfed areas of mid and lower hills for timely sown conditions. Resistant to yellow and brown rust, plants are dark green in colour and grains are bolder, hard andamber.
Kullu	Wheat	HPW-349	2013	48	170-190	Resistant to yellow and brown rust recommended for irrigated and rainfed hilly areas of Northern India, grain are bold, hard and golden in colour. It contains high amount of iron and manganese compared to other varieties.
Kullu	Wheat	HS-507	2010	47	165	Recommended for irrigated and rainfed areas of lower and mid hills Resistant to yellow rust, brown rust, leaf blight and karnal bunt ,Grains are amber, semi hard and medium bold.
Kullu	Wheat	VL-829	2007	32		Recommended for early sown rainfed condition in low and mid hills, Mildly tolerant to yellow and brown rust,Protein Content is 11.4 percent.
Kullu	Wheat	VL-907	2009	28		Recommended for irrigated and rain fed areas of low and mid hills, resistant to yellow and brown rust This variety is medium tall and grains are hard.
Kathua	Wheat	Raj-3765	2014	20	157	Widely adopted in the states of Haryana, Delhi, Punjab Rajasthan U.P, Jammu region of J&K. Suitable for late sown irrigated and rainfed conditions.
Kathua	Wheat	WH-1142	2014	20	157	Suitable for timely sown under restricted irrigations conditions
Kathua	Maize	Dekalb double	Private Hybrids	31.0	115	Widely adopted by the farmers due to its higher production as compared to other

KVK	Crop	Variety	Year of release	Potential yield (q/ha)	Days to mature	Remarks
				High Yielding varieties		
Hamirpur	Wheat	HPW-360	2015	32	160	Early sown variety, uses residual moisture, yellow rust resistant, high yielding
Hamirpur	Wheat	HPW349	2011-12	35	150	Timely sown variety, yellow rust resistant .
Hamirpur	Maize	Pvt. hybrid	-	45	100	
Hamirpur	Ghobhi sarson GSC-7	GSC-7	2014	15	155	High yielding, medium height, comparatively resistant to lodging
Hamirpur	Toria	Bhawani	2006	8	80	Zaid crop, short duration, less water requirement
				Crop diversification		
Kullu	Garlic	GHC-I	1992	250	210	It is high yielding compared to other varieties. The cloves are large in size and easy for peeling.
Hamirpur	Cabbage	Charmant	Pvt. Hybrid	270	1st fortnight of February	High yielding, synchronous maturity and disease resistant
Hamirpur	Bitter gourd	Aman	Pvt. Hybrid	355	June -September	High yielding and disease resistant
Hamirpur	Bottle gourd	Sharda, Shambu	Pvt. Hybrid	370	June -September	High yielding and disease resistant
Hamirpur	Cucumber	Malav	Pvt. Hybrid	160	May-July	High yielding and disease resistant
Kathua	Gobhi Sarson	DGS-1	2000	19	10th July	Provides additional income to the farmers
Kathua	Mash Him Mash-1	Mash-1	2004	5.20	20th September	Provides additional income to the farmers
Kathua	Seasame	PB-Til No. 1	1995	4	7th September	Provides additional income to the farmers
Kathua	Okra	Varsha uphar	1996	117	28th October	Tolerant to yellow vein mosaic virus, tolerant to aphids and asides, fruits dark green, 12-15 cm long, first picking in 45 day.
Kathua	Okra	A-4	1995	119	28th October	Resistant to yellow vain mosaic virus, tolerant to aphids and jassids; fruits dark green, 12

Annexure-II

Head-wise Sanctioned Budget for the year 2015-16 under NICRA (Rupees in lakh)

S. no.	Name of KVK/ATARI -I	BE					RE				
		Operational expenses	TA	Total RC	NRC	Total	Operational expenses	TA	Total RC	NRC	Total
1.	ATARI, Zone-I, Ludhiana	7.50	1.00	8.50	4.00	12.50	7.50	1.00	8.50	4.00	12.50
2.	Bathinda	7.50	1.00	8.50	6.07	14.57	8.40	0.10	8.50	6.07	14.57
3.	Faridkot	7.50	1.00	8.50	6.25	14.75	7.50	1.00	8.50	6.25	14.75
4.	Fatehgarh sahib	6.00	1.00	7.00	5.00	12.00	6.58	0.42	7.00	5.00	12.00
5.	Ropar	6.25	1.00	7.25	2.48	9.73	6.25	1.00	7.25	2.48	9.72
6.	Sirsa	5.00	1.00	6.00	3.40	9.40	5.00	1.00	6.00	3.40	9.40
7.	Yamunanagar	6.50	1.00	7.50	4.40	11.90	6.50	0.68	7.18	4.40	11.58
8.	Chamba	5.25	1.00	6.25	2.50	8.75	5.25	1.00	6.25	2.50	8.75
9.	Hamirpur	5.25	1.00	6.25	4.90	11.15	5.48	1.00	6.48	4.90	11.38
10.	Kinnaur	5.25	1.00	6.25	1.00	7.25	5.25	1.00	6.25	1.00	7.25
11.	Kullu	6.00	1.00	7.00	6.65	13.65	6.00	1.00	7.00	6.65	13.65
12.	Kathua	6.00	1.00	7.00	2.15	9.15	6.00	1.00	7.00	2.15	9.15
13.	Bandipora	6.00	1.00	7.00	7.00	14.00	6.00	1.00	7.00	7.00	14.00
14.	Pulwama	7.00	1.00	8.00	6.20	14.20	7.00	1.09	8.09	6.20	14.20
	Total	**87.00**	**14.00**	**101.00**	**62.00**	**163.00**	**88.71**	**12.29**	**101.00**	**62.00**	**163.00**

Annexure-III

Contributors-NICRA ATARI/ KVKs of Zone - I

S. No.	KVK/District	State	Contributors
1.	ATARI Zone -I, Ludhiana	Punjab	Ashish Santosh Murai (Project Incharge) Pragya Bhadauria (Co PI)
2.	Bathinda	Punjab	Jatinder Singh Brar (Head) Gurmeet Singh Dhillon (Nodal Scientist)
3.	Fatehgarh Sahib	Punjab	Vipan Kumar Rampal (Head) Maninder Kaur (Nodal Scientist)
4.	Faridkot	Punjab	Jagdish Grover (Head) Rakesh Kumar (Nodal Scientist)
5.	Ropar	Punjab	Harinder Singh (Head) Sanjeev Ahuja(Nodal Scientist)
6.	Sirsa	Haryana	L.S. Beniwal (Head) D.S. Jakhar (Nodal Scientist)
7.	Yamunanagar	Haryana	B.R. Kamboj(Head) R.H. Taya(Nodal Scientist)
8.	Chamba	Himachal Pradesh	Rajiv Raina(Head) Sanjeev Kumar (Nodal Scientist)
9.	Hamirpur	Himachal Pradesh	Pradeep Kumar (Head) Anjana Thakur (Nodal Scientist)
10.	Kullu	Himachal Pradesh	K.C Sharma (Head) R.K. Rana (Nodal Scientist)
11.	Kinnaur	Himachal Pradesh	Pankaj Gupta(Head) R.S. Chandel (Nodal Scientist)
12.	Kathua	Jammu & Kashmir	AmrishVaid (Head) Berjesh Ajrawat (Nodal Scientist)
13.	Pulwama	Jammu & Kashmir	Fayaz Ahmad Misgar (Head) MuniburRehmaan (Nodal Scientist)
14.	Bandipora	Jammu & Kashmir	M.H. Samoon (Head)

Annexure-IV

Details of Research staff working under NICRA project in Zone-I

ATARI-Zone-I/KVKs	Name of Research Staff	Designation
ATARI Zone -I	Mrs. Gopi Pannu	Research Associate
Bathinda	Mr.Amardeep Singh	Senior Research Fellow
	Mr. Parkash Singh	Senior Research Fellow
Ropar	Ms. Karamjit Kaur	Senior Research Fellow
Faridkot	Mrs. Harmsimran Kaur	Senior Research Fellow
Fatehgarh Sahib	Mrs. Satvir Kaur	Senior Research Fellow
Kinnaur	Sh. Raj Kumar Negi	Senior Research Fellow
	Ms. Manju Deepti	Senior Research Fellow
	Mr/ Vikrant Singh	Field Assistant
	Mrs. Lalita Kumari	Field Assistant
Kullu	Mrs. Kirna Devi	Senior Research Fellow
	Mr. Deepak Sharma	Senior Research Fellow
Hamirpur	Mrs. Deepika Sharma	Senior Research Fellow
	Mr. Gulshan Sharma	Senior Research Fellow
Chamba	Mr. Jitender Thakur	Senior Research Fellow
	Mr. Rohit Rathore	Senior Research Fellow
	Mr. Partap Singh	Senior Research Fellow
	Mr. Ashwani Sharma	Senior Research Fellow
Sirsa	Mr. Vikram	Senior Research Fellow
	Mr. Pawan Kumar	Senior Rese arch Fellow
Yamunanagar	Mr. Ajay Kumar	Senior Research Fellow
	Mr. Nirnanjan Kumar Barod	Senior Research Fellow
Kathua	Mrs.Meenakshi	Senior Research Fellow
	Mr. Ankush Proach	Senior Research Fellow
Pulwama	Mr. Mohd. Zubair	Senior Research Fellow
	Mrs. Ruhul Nissa	Senior Research Fellow
Bandipora	Mr. Nazir Ahmad Mir	Senior Research Fellow

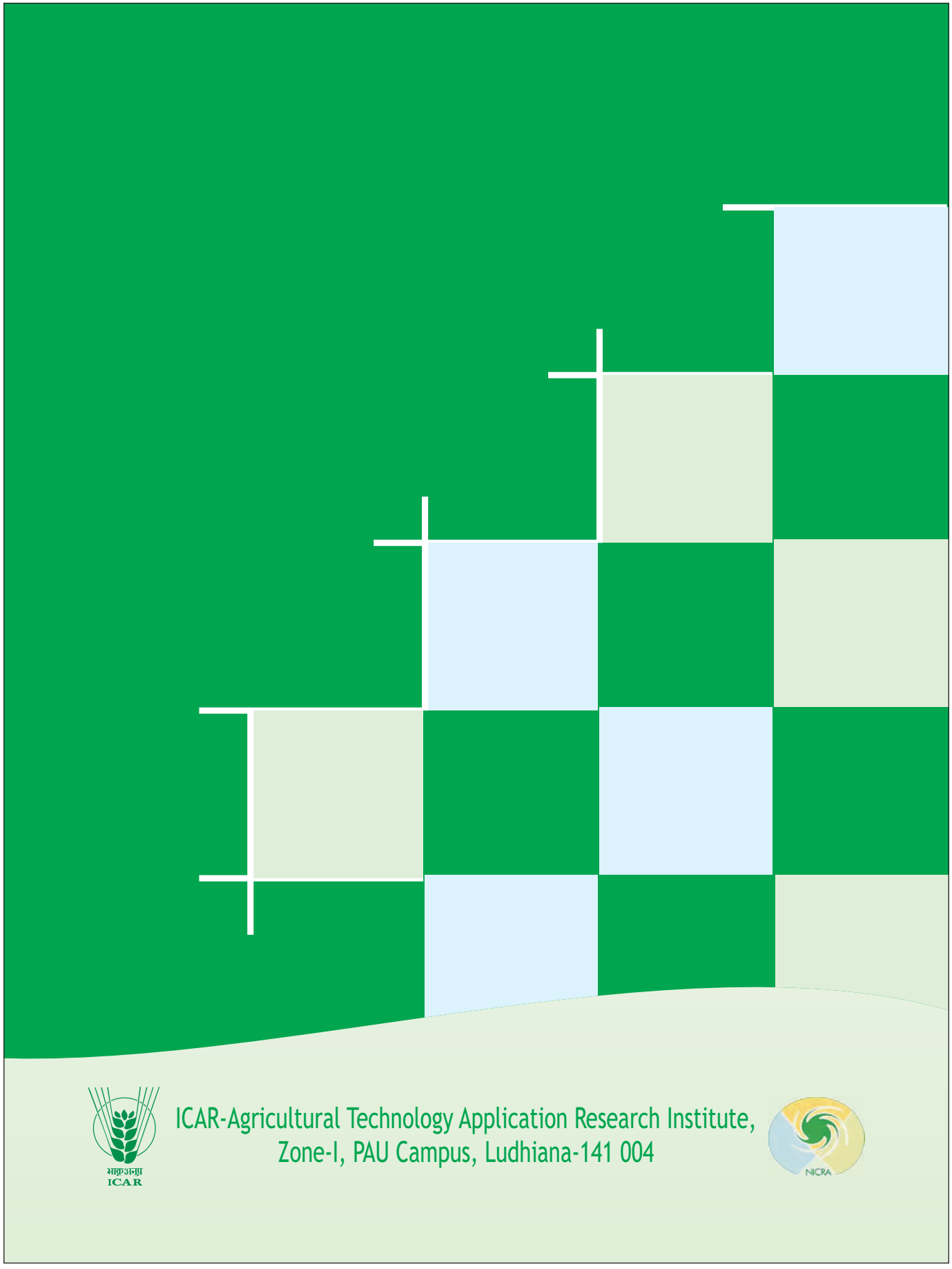
Annexure-V

Details of Equipments Purchased for Custom Hiring under NICRA in Zone-I

Name of KVK	Name of Equipments/Implements
Bathinda	
	Direct Seeded Rice
	Happy Seeder
	Power Sprayer
	Multi crop thresher
	Disc type bund maker
	Multi crop drill/Pump planter
Faridkot	
	Direct sowing of rice
	Rotavator
	Zero till drill
	Bed planter
	Multi crop thresher
	Tractor mounted spray pump
	Forage harvester
	Pre seed cleaner
	Spike tooth harrow
	Straw reaper
Fatehgarh Sahib	
	Reaper Binder
	Tractor mounted sprayer
	Multicrop ridge planter
	Zero till drill
	Water channel maker
	Harrow ridger
	Leveller metallic
Ropar	
	Forage chopper cum loader
	Semi Automatic potato planter
	Turbo Seeder
	Rotary power weeder

Name of KVK	Name of Equipments/Implements
Kinnaur	Multi Crop planter Pulverizing Roller Zero till drill
Kullu	Power Weeder Pruning Secateurs Grafting Knife Power Sprayer Chain Saw
Hamirpur	Power Weeder with accessories GK 100 Power Sprayer SR 420 Mist Blower Knap sack Farm Star 708
Chamba	Power tiller Power weeder Bush cutter Maize Sheller Spray pump
Pulwama	Maize cob sheller Weighing Balance Foot Sprayer Power Weeder Bush cutter Portable sprinkler
	Combined thresher (Paddy ,Oats ,Wheat etc.) Fertilizer- cum- seed drill Power tiller Tractor Cage wheel

Name of KVK	Name of Equipments/Implements
Bandipora	Land leveler Water Motor (0.5 Hp) Winnower
Kathua	Chaff cutter Power tiller Power sprayer Water pump Maize sheller
	Maize Planter Power Tiller Knap Sack Sprayer Maize Sheller Foot Sprayer Wheel Hoe Bund Maker



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