वार्षिक प्रतिवेदन
Annual Report
2015-16

National Innovations in Climate Resilient Agriculture
Technology Demonstration Component

NICRA
National Innovations in Climate Resilient Agriculture

ICAR-Agricultural Technology Application Research Institute Kolkata
Indian Council of Agricultural Research
Salt Lake City, Kolkata-700 097

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F. H. Rahman, D. Ghosh, K. S. Das, S. K. Mandal, P. P. Pal and S. K. Roy

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Preface

In the context of climate variability, farmers need to adapt quickly to increasing frequency of drought, flood and other extreme events to stabilize crop yields and farm income. Over the years, the National Agricultural Research System has developed an array of practices and technologies to foster stability in agriculture production against the onslaught of seasonal variations. A nation-wide project, National Innovations in Climate Resilient Agriculture (NICRA), has been launched in 2011 to address this challenge by application of science and technology. This project of ICAR aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. Technology Demonstration Component (TDC) of NICRA offers great opportunity to work with farmers and apply such technologies under field conditions to address current climate variability. This will enhance the pace of adoption of these resilient technologies. On-farm participatory demonstrations for climate resilience are being implemented in village clusters through KVKs in 121 climatically vulnerable districts across the country and by 7 core research institutes of ICAR. The emphasis has been on capturing and improving the understanding on performance of technologies in different agro-ecologies and farming systems. This also facilitates identification of what constitutes climate resilience in different bio-physical and socio-economic contexts. NICRA-KVKs prepared and implemented village level contingency crop plans and measures.

Technology Demonstration Component (TDC) of NICRA offers a great opportunity to work with farmers to address current climate variability with matching responses. Getting existing technologies into the hands of small and marginal farmers and developing new technologies like drought or flood tolerant crops to meet the demands of a changing climate also come under the purview of NICRA programme. Climatic vulnerability of selected 17 KVK districts of Bihar, Jharkhand, West Bengal and union Territory of A & N Islands assessed during implementation of NICRA programme brought forward definite requirement in terms of technological support, human resource development and overall empowerment of farming community to enable them to cope up with climate vulnerabilities like droughts, erratic rainfall, heat wave, flood, cyclonic storm. Plan of action, accordingly, was prepared for its implementation through executing technological interventions to initiate crop production, resource conservation, livestock and fish rearing, water harvesting etc. in the vulnerable villages of KVK districts. Formation of VCRMC and setting up of custom hiring centres under NICRA in all the adopted villages added to the grass-root level monitoring of the project followed by initiating farm mechanization as per suitability of small and marginal holdings.

Compilation of NICRA Annual Report of ICAR-ATARI Kolkata for 2015-16 depicts an assessment of endeavour put forth by the selected 17 NICRA- KVKs in the climatic vulnerable districts under close supervision and guidance of ICAR-ATARI Kolkata and simultaneous attainment in the arena of technology demonstration, VCRMC, institutional interventions, human resource development, seed production, extension activities, review workshop and others. The compilation of NICRA Annual Report 2015-16 has incorporated all the relevant and required information pertaining to accomplishment of ICAR-ATARI Kolkata and achievement of selected 17 NICRA implementing KVKs in combating the challenges due to climatic vulnerabilities in farming practices as well as livelihood pattern for the betterment of farmers, rural youths and other concerned.

I wish to express my sincere gratitude to Dr. Trilochan Mahapatra, Secretary, DARE and Director General, ICAR, Dr. A. K. Singh, Deputy Director General (Agricultural Extension), Dr. Ch. Srinivasanrao, Director and Dr. J. V. N. S. Prasad and Dr. M. Osman, Coordinators (NICRA-TDC), CRIDA and other officials of Division of Agricultural Extension, ICAR for providing guidance and help in compiling the Annual Report 2015-16. I acknowledge the assistance received from the Directors of Extension Education of State Agricultural Universities of this zone and contribution from Programme Coordinators of all selected 17 NICRA implementing KVKs in providing information in time. The support and help rendered by all the staff of ICAR-ATARI Kolkata are duly acknowledged.

Subrata Kumar Roy

(S. K. Roy)
Director, ICAR-ATARI Kolkata

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Executive Summary

ICAR- Agricultural Technology Application Research Institute Kolkata having seventeen NICRA implementing KVKs which carried out different activities under Technology Demonstration Components of National Innovations in Climate Resilient Agriculture Programme in various module benefitting 59766 farmers (NRM- 8775, Crop Production-5924, Livestock and Fisheries- 8778 Institutional Interventions- 3684, Capacity Building- 13538 and Extension Activities- 19067).

Under **Natural Resource Management** module improved drainage in flood prone areas, in-situ moisture conservation, construction/renovation of new water harvesting and recycling, structures/farm ponds/ checks dams/tank roof water harvesting tank, land shaping & rainwater harvesting structures, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods, green manuring, 5% model of irrigation, crop residue management, bunding of field, Broad Bed Furrow, soil test based nutrient application, micro irrigation techniques, compost pits *etc*. covered 1580.2 ha area which benefitted 8775 practicing farmers in the zone.

Under **Crop Production** module different area specific intervention were taken by the NICRA-KVKs *viz*; Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seedling), community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting, low temperature tolerance, promotion of pulses utilizing post-monsoon rainfall, integrated croppest/ disease management, growing vegetables as contingency crop, integrated crop management, integrated disease management, contingency crop, covering 1323.4 ha area which benefitted 5924 farmers.

Similarly under **Livestock and Fisheries** module various livestock centric interventions were carried out including use of community lands for fodder production during drought/flood, improved fodder/feed storage methods, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water, breed up-gradation, balanced feed & fodder management through mineral mixture, feed blocks & silage making, azolla feeding, breed animal health management through deworming and vaccination, fish pond cleaning and fish farming, pig farming, clean milk & fodder production *etc.* covered 9000 animals, produced fodder in 184.5 ha area benefitted 8778 livestock owners.

Institutional Interventions including **s**trengthening the existing or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centres, collective marketing group, introduction of weather index based insurance and climate literacy through a village weather station and awareness developed 546 units covering of 170 ha area of 3684 number of farmers in the Zone.

Village Climate Risk Management Committee (VCRMC) was constituted after in-depth discussion with the villagers about the mitigation of the climatic vulnerabilities of the villages and the strategies to be adopted under this programme. VCRMC became operational with opening of a bank account in their name being jointly handled by the President of VCRMC and the Programme Coordinator of the KVK concerned. The custom hiring of various farm tools and implements was being supervised by VCRMC apart from taking important decisions on the technological interventions to be implemented at the village in consultation with the KVK.

Custom hiring initiated in the NICRA adopted village under the supervision of VCRMC has become immensely popular among the farmers and substantial amount has also been generated. VCRMC constituted by Gumla KVK at Gunia village generated maximum amount of Rs. 22788/- during 2015-16, however, VCRMC of Manjhila village of KVK Nawada has generated the highest total amount of Rs 299212/- in VCRMC account so far.

A total 672 courses were conducted under **Capacity Building** on various thematic areas benefitting 13538 farmers and farmwomen (10858 males and 2680 females) during 2015-16. Thematic areas cover on crop management, natural resource management, nutrient management, integrated crop management, crop diversification, resource conservation technology, pest and disease management, livestock and fishery management, nursery raising, employment generation, nutrient garden, repair and maintenance of farm machineries and implements, integrated farming system, fodder and feed management, lac cultivation drudgery reduction with farm implements for woman, value addition, human nutrition and child care, rodent control *etc*.

A total of 1859 **Extension Activities** on various thematic areas benefiting 19067 practicing farmers (13503 males and 5564 females) during the reporting period. The extension activities were conducted on method demonstrations, agro advisory services, awareness animal health camp, Kishan Chaupal, Kishan Gosthi, resource conservation technologies, celebration field and farmers' days, diagnostic visits, group discussion, World Earth Day, technology week, kishan mela *etc*. All the 17 NICRA-KVKs have celebrated ***World Soil Day*** through conducting workshop, seminar, symposia, awareness camp on December 5, 2015 in the respective KVK and 2753 Soil Health Cards distributed among the farmers of NICRA villages.

NICRA Zonal Monitoring Committee constituted by ICAR has visited Port Blair, KVK and NICRA project sites, in order to develop an overall impression of the agro-climatic conditions of the Island ecosystem in the region, also went across a few surrounding islands during 15-18 March, 2016. The ZMC team during their visits interacted with the concerned KVK Scientists, villagers and VCRMC members and showed their satisfaction over the activities carried by the concerned KVK and the committee has given some suggestions for the improvement of the activities.

A number of interventions were taken up by NICRA KVKs during the year in convergence with developmental programs which are operational at the village level. Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development programmes or schemes during 2015-16. The prominent development schemes are MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram Sadak Yojana, BASF, NABARD, Sunderban Development Board, IWMP, Forest Department, IAP Yojana, RKVY *etc*. NICRA implementing KVKs being part of the different convergence programmes generated a handsome amount of Rs. 50062711/- during 2015-16.

1. INTRODUCTION

National Innovations in Climate Resilient Agriculture (NICRA) is a network project of Indian Council of Agricultural Research (ICAR) launched in February, 2011. The project aims at enhancing resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The objectives of this network project are:

- 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
- To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks
- To enhance the capacity building of scientists and other stakeholders in climate resilient agricultural research and its application

Both short and long term output is expected from the project pertaining to new and improved varieties of crops, livestock breeds, management practices that help in adaptation and mitigation and inputs for policy making to mainstream climate resilient agriculture in the developmental planning. The overall expected outcome is enhanced resilience of agricultural production to climate variability in vulnerable regions. Initially, 100 KVKs all over India were selected for implementation of the project. In addition to that 21 more KVKs throughout the country have been included for carrying out the project as per approved XII Plan. The research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management. The project is comprised of four components.

- Strategic research on adaptation and mitigation
- Technology demonstration on farmers' fields to cope up with current climate variability
- Sponsored and competitive research grants to fill critical research gaps
- Capacity building of different stakeholders

Under Technology Demonstration Component, seven districts of Bihar (Aurangabad, Buxar, Jehanabad, Nawada, Saran, Supaul and Banka), six of Jharkhand (Chatra, East Singhbhum, Gumla, Koderma, Palamu and Godda), three of West Bengal (Coochbehar, Malda and South 24 Parganas) and one of Andaman & Nicobar Islands (Port Blair) were selected. The overall focus of TDC under NICRA is to enhance resilience of farms and farming community to climate risk so as to ensure sustainability over a period of time. Enhancing resilience is the key to achieve sustainability in agriculture especially in the context of climate vulnerability.

The vulnerabilities of the respective KVK districts are mentioned here under:

Table. List of districts and KVKs with Climate vulnerability

S. N.	State	NARP Zone	Districts	Climate vulnerability
1	A&N Islands	Coastal Zone	Port Blair	Cyclone
2	Bihar	North West Alluvial Plain Zone (B1-I)	Saran	Flood/Drought
3	Bihar	North West Alluvial Plain Zone (B1-2)	Supaul	Flood/Drought
4	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Buxar	Flood/Drought
5	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Nawadah	Drought
6	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Aurangabad	Drought
7	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Jehanabad	Drought
8	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Banka	Drought
9	Jharkhand	Central and North Eastern Plateau Zone (B1-4)	Koderma	Drought
10	Jharkhand	Western Plateau Zone (B1-4)	Palamu	Drought/Heat wave
11	Jharkhand	South Eastern Plateau Zone (B1-4)	East Singhbhum	Drought/Heat wave
12	Jharkhand	Western Plateau Zone (B1-4)	Gumla	Drought
13	Jharkhand	Western Plateau Zone (B1-4)	Chatra	Drought/Heat wave
14	Jharkhand	South Eastern Plateau Zone (B1-4)	Godda	Drought/Heat wave
15	West Bengal	Terai Zone (WB-2)	Coochbehar	Heavy rainfall
16	West Bengal	Old Alluvial Zone (WB-3)	Malda	Flood
17	West Bengal	Coastal Saline Zone (WB-6)	South 24 Parganas	Cyclonic storm/heavy rainfall within short period

Table. Villages adopted by NICRA implementing KVKs of Zone II where the various technologies have been demonstrated are mentioned hereunder:

Name of KVK	Name of village
Aurangabad	Harigaon
Jehanabad	Sakrorha
Nawada	Manjhila
Saran	Affaur, Nagra
Supaul	Sadanandpur
Banka	Merha
Buxar	Kukurha
Chatra	Mardanpur Gari and Ambadhohar
East Singhbhum	Lowkeshra, Barunia and Pathargora
Gumla	Gunia
Koderma	Chopanadih
Godda	Bhelwa and Gunghasa
Palamu	Dulsulma and Murma
Cooch Behar	Khagribari
Malda	Brozolaltola, Meherchandtola, Jayramtola and Mahendrotola
South 24 Parganas	Bongheri
Port Blair	Badmaspahad and Port Mount

The village was selected based on vulnerability of agriculture to climatic variability. Highly vulnerable village may get priority in selection. Using secondary/ published data, the village which was relatively more vulnerable to climatic variability like prolonged drought, dry-spells, extreme rainfall events, hailstorms, extreme temperatures, cold and heat waves, frost, flood, seawater inundation, *etc* was to be selected. The village in the respective KVK represents the dominant cropping system of the district. The proportion of rainfed area in the village exceeds the district average. A higher proportion of small and marginal farmers were another consideration. Majority of the families in the selected village derive major portion of their family income from agriculture and allied activities. The climatic vulnerability of the village (frequency and intensity of droughts, floods, heat wave, cold wave, *etc*) represents that of the district. It was stressed that the selected village must represent the dominant farming system, climatic vulnerabilities and adverse weather situations of the selected district. The multidisciplinary team of KVK analyzed the constraints related to climatic variability based on secondary weather data, resource situation, farming systems and agricultural yields in the past few years. The major constraints resulting from climatic variability includes; water scarcity, recurrent droughts (early, mid season, terminal), cold wave, heat wave, flood, pest and diseases of crop and livestock, fodder scarcity, poor access to appropriate seeds/planting material and critical inputs and farm machinery (access and cost).

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

1. Analysis of climate constraints on village based long term data
2. Assessment of the natural resources status of village
3. Identification of major production systems and
4. Studying of existing institutional structures and identifies gaps.

Focus group interactions were organized with the community and finalized the interventions were implemented under four technological modules viz., Natural Resources, Crop Production, Livestock and Fisheries and institutional Interventions.

2. Interventions with Module

Module I: Natural Resource Management

This module consists of in-situ moisture conservation, water harvesting and recycling for supplemental irrigation, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods and rainwater harvesting structure development.

Module II: Crop Production

This module consists of introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seedling), community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting.

Module III: Livestock and Fisheries

Use of community lands for fodder production during drought/flood, improved fodder/feed storage methods, preventive vaccination, improved livestock demonstration, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water.

Module IV: Institutional Interventions

This module consists of strengthening the existing institutional interventions or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing group, introduction of weather index based insurance and climate literacy through a village weather station are part of this module.

2.1 Module I: Natural Resource Management

The major emphases of the intervention were on augmenting rainwater availability through its efficient use by adopting site-specific rainwater harvesting strategies. Major interventions under this theme included in-situ moisture conservation; construction/renovation of new water harvesting and recycling structures/farm ponds/checks dams/tank roof water harvesting tank; land shaping and RWH structure; improved drainage in flood prone areas; conservation tillage where appropriate; artificial ground water recharge and water saving irrigation methods; green manuring; 5% model of irrigation; crop residue management; bunding of field; broad bed furrow; soil test based nutrient application; micro irrigation techniques; compost pits; participatory soil health management through identification and correction of major and micro nutrients. The impact of interventions aimed and enhancing rainwater harvesting and utilization capacity was very significant across the clusters. The efforts in this area resulted in the creation of an additional rainwater harvesting capacity of over 2.60 million cu m leading to increase cropping intensity by bringing around 1907 ha of area under protective irrigation regime since the inception of the project.

2.1.1 In-situ Moisture Conservation - Resource Conservation Technology:

In-situ rainwater management through ridge and furrow method and broad bed furrow practice conserves rainwater at field level and also drains out excess water into community drainage channels. This water can also be utilized for recharging ground water to provide supplemental irrigation to post-rainy season crops, which is otherwise not possible with flat bed planting. Through these methods, soil moisture is managed by maximizing the use of rainfall through increased infiltration and moisture retention and reducing runoff and soil erosion. The performance of high yielding improved varieties is optimized by *in situ* moisture management. Surface runoff and deep drainage water is exploited as supplemental irrigation to post-rainy season crops like wheat and chickpea. These conservation technologies have been demonstrated in 17 NICRA adopted villages covering 459 farmers in 95.2 ha area. The performance of different technologies by the various KVKs is presented in the following table.

Plastic Mulching

Azolla cultural unit

Table. Performances of demonstration of in-situ moisture conservation technologies

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Summer Ploughing in Paddy (Var. Lalat)	62	17.5	34.7	25400	23662	1.93
Green manuring (dhaincha) in Paddy (Var. Lalat)	110	23.5	37.6	26800	25400	1.94
Brown manuring in Paddy (Var. Anjali)	21	3.7	28.6	18400	16320	1.89
Azolla in Paddy (Var. Lalat)	6	3.0	33.5	22500	20220	1.98
Zero Tillage in wheat	42	11.0	34.5	22300	21512	1.96
Zero Tillage in Maize	12	3.0	32.5	12000	10000	1.83
Repair of bund	12	3.5	28.5	17500	12650	1.72
Up gradation of monocropped land to multiple one with integration of fish	7	1.5	165.5	31300	25950	1.82
Optimization of horticultural production through land embankment development	8	1.0	186.0	23500	19525	1.83
Optimization of horticultural crops through land embankment	28	8.5	67.0	54800	62200	2.13
Organic mulching in vegetables (Tomato, brinjel)	15	2.0	256.2	60570	73500	2.21
Mulching	66	6.0	205.0	70000	62000	1.88
Plastic mulching Okra, cucumber	20	1.0	32.0	5000	7600	2.52
Use plant leaf mulching in ginger	30	8.5	532.0	399000	983000	3.46
Use paddy straw, forest leaves in elephant foot yam	20	1.5	300.0	282000	324000	2.14
Total	**459**	**95.2**				

Organic mulching

Summer Ploughing

Land Shaping

Brown Manuring

2.1.2 Water harvesting and recycling for supplemental irrigation:

Water harvesting and recycling for supplemental irrigation were demonstrated in 17 NICRA adopted villages by the different KVKs involving 1106 numbers of farmers. The performances of different indicators in the demonstrations are presented in following table.

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	45	30.0	45.0	75000	398000	6.3
Renovation of canal	115	2.00(km)	-	-	-	-
5% Model	15	6.0	37.0	55000	70000	2.3
Bora bandh	165	6.0	42.0	37000	45000	2.2
Renovation of Well for irrigation	70	25.0	40.0	10600	4300	1.5
Bund making leveling in paddy field	50	17.0	36.7	30540	19060	1.62
Natural mulching	15	4.0	288.8	45270	138400	4.05
Digging of small pits in Diara land for cucubits	14	4.0	80.0	45790	130708	3.85
New water harvesting structure in the paddy field	2	0.5	33.6	35334	15456	1.43
New water harvesting structure in the wheat field	1	0.3	36.5	33440	19659	1.57
Renovation of old water harvesting structure in paddy field	102	28.6	42.0	116299	68522	1.58
Raising of land embankment	30	4.0	200.0	45291	132909	3.93
Ground water recharge	45	9.5	-	-	-	-
Construction of new pond for wheat	62	7.5	34.0	35000	22000	1.62
Desiltation of defunct water harvesting structures	5	1.0	-	-	-	-
Renovation of pyne	230	4500(ft)	-	55000	-	-
Renovation of irrigation channel	10	22.0				
Newly Check dam	15	1.0	40.0	32500	20000	1.61
Renovation of common pond	65	146'x146'		106175		
10 bamboo boring	50	40				
Total	**1106**					

De-silting pond

5% Model

Renovation of Canal

Renovation of Canal

Excavation of pond

Renovation of Canal

2.1.3 Conservation tillage:

Sowing of *rabi* crops depends on the harvesting time of the preceding crop in *kharif* and also soil moisture status for undertaking land preparation for sowing. In case of wheat, this involves 2 to 3 or even more tillage operations for obtaining appropriate tilth before planting of wheat. In addition to the costs incurred and energy required, this causes delay in planting of wheat which often results in coincidence of vulnerable stage with high temperature stress during February/ March. This often leads to reduction in grain yield and loss to farmer. Zero till technology offers a viable and practical solution by avoiding repeated tillage for land preparation and sowing, reducing cost of cultivation and also permits planting early by 10-15 days. Advancement in sowing date is an adaptation to avoid terminal heat stress. Zero-tillage refers to direct drilling of wheat in unploughed paddy fields immediately after rice harvest using zero till drill or happy seeder. Conservation tillage in wheat, paddy, lentil, pea and chickpea demonstrated in 15 NICRA adopted villages in an area of 244.7 ha of 447 numbers of farmers. The technologies followed mainly by zero tillage operation. The results of the ZTD in various crops are presented in below table. Wheat with cultivation through ZTD showed maximum yield of 35-43 q/ha. Zero tillage technology showed very promising results in pulse and oilseed cultivation. Pea (Var. Arkel) gave highest economic return (B:C ratio:: 2.72) among the pulse demonstration through ZTD.

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	75	44.5	41.0	73000	78000	2.06
Sowing of paddy with ZTD machine	70	42.6	43.0	68000	76000	2.11
Sowing of lentil with ZTD machine	67	43.4	21.0	60000	59000	1.97
Sowing of chick pea with ZTD machine	60	43.5	18.0	83000	140000	2.68
Sowing of paddy with power tiller	73	34.7	41.0	58000	54000	1.93
Sowing of wheat (K-9107) with ZTD	55	20.5	36.0	33000	29000	1.87
Sowing of pea(Arkel) with ZTD	30	11.5	25.0	43000	74000	2.72
Sowing of Maize with ZTD	17	4.0	33.5	15000	14000	1.93
Total	**447**	**244.7**				

Zero tillage

Zero tillage

2.1.4 Artificial ground water recharge:

Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in paddy in 9 NICRA adopted villages covering 71.0 ha area in 100 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (56 q/ha) and benefit: cost ratio (2.14).

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	25	14.0	37.0	25200	19628	1.77
Water management through bunding of paddy fields (2.5 fit height and width 9 inch width)	55	48 .0	44.5	24000	16400	1.68
Ground water recharge through SRI by sub-soiler	20	9.0	56.0	38745	44419	2.14
Total	**100**	**71.0**				

Bunding in paddy field

2.1.5 Water saving irrigation methods:

Water saving irrigation methods like sprinkler irrigation, LEWA in rice, RBF in brinjal, micro-lift irrigation in paddy demonstrated in NICRA adopted villages covering an area of 81.0 ha in 358 farmers fields.

Table. Performance of different water saving irrigation methods

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Irrigation system (micro lift Irrigation system) for paddy	45	14.0	35.5	26200	20000	1.76
Application of biofertilizer in rice (var. MTU 7029)	92	34.8	69.0	35640	59500	2.66
Vermi-compost from biodegradable wastes	39	1.0	16.7	4400	3800	1.86
Production of pigeon pea (var. PRG-158) on farm bund	25	1.2	18.3	26947	39500	2.46
RBF in Brinjal	28	3.0	255.0	61910	64000	2.03
LEWA in rice (var. Rajendra sweta)	19	4.5	54.5	31970	38500	2.20
Sprinkler irrigation in rai (var. Bio-902	17	4.5	15.5	18000	39500	3.19
Sprinkler irrigation in green gram(Var. HUM-16)	14	3.0	19.0	14600	36000	3.46
Sprinkler irrigation in lentil (Var. Arun)	23	6.5	19.5	18000	42000	3.34
Sprinkler irrigation in chickpea (Var. PG-186)	28	7.0	14.2	15550	23000	2.47
RBF in cucumber (Var. Malini)	28	1.5	305.0	92525	129675	2.40
Total	**358**	**81.0**				

Sprinkler and LEWA in field

2.1.6 Other Demonstrations:

Effective utilization moisture through seed production of blackgram, in-situ vermicomposting in orchards, soil test based nutrient application, cleaning and renovation of old farm pond, renovation of well, planting forest trees, plant for biodiversity, forestation, soil test based nutrient application, bio pesticides in tomato, dolomite in gora paddy and cultivation of high yielding grass on farm bund were carried out in 1337 farmers' fields. Out of these demonstrations on in-situ vermicomposting in orchards showed highest economic return (BC::7.16).

Table. Performance of other demonstrations

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Effective utilization moisture through seed production of blackgram after flood	200	24.0	15.5	15500	45000	3.90
In-situ vermicomposting in orchards	30	6.5	107.0	32000	197200	7.16
Soil test based nutrient application	610	250.0	45.0	37000	30000	1.81
Cleaning & renovation of old farm pond	110	5.0	40.0	63000	125000	2.98
Renovation of old water harvesting structure (Well)	30	4.7	35.5	23000	38000	2.65
Planting forest trees for biodiversity, forestation	45	8.0		-	-	-
Soil test based nutrient application (FYM/ inorganic fertilizer)	230	29.0	32.5	9000	14000	2.56
Bio pesticides in tomato	30	6.0	162.3	53000	131750	3.48

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Dolomite in gora paddy	40	13.0	25.7	19000	14000	1.73
Cultivation of high yielding grass on farm bund	12	5.5	140	8000	16000	3.00
Total	**1337**	**351.7**				

2.1.7 Rainwater harvesting structures developed:

Rainwater harvesting (*ex-situ*) and efficient use to enhance resilience of farms, farm ponds brought about a perceptible change in crop production during *Kharif and rabi* season. Though the rainfall was less during the months of June and early part of July, the intense storms with rains which generated run-off and was stored in farm ponds created in farmers field. The harvested water was used for critical irrigations to wheat, vegetables, fodder *etc*. Farmers realized an additional yield and income from these crops. There were 131 number of rainwater harvesting structures have been developed which could store 602046.5 cu m of water. This intervention increased the cropping intensity to the maximum extent upto 300%. KVK wise these structures along with storage capacity and increase in cropping intensity are given in the following table.

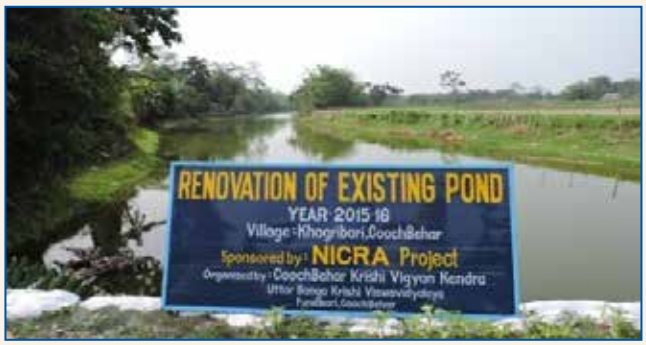
Table: KVK wise rainwater harvesting structures developed during 2015-16

KVK	RWH structures	No.	Storage capacity (cu m)	No. of farmers benefited	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Port Blair	Desilting Pond	2	4466	11	1.5	50
	Rain shelter	2	1307	10	1.5	50
Aurangabad	Pond	3	4771	12	7.5	100
	Canal	1	17100	100	2.5	120
Buxar	Farm pond	2	1918.4	18	6.5	90
Jehanabad	Pond	2	4000	300	40.0	100
	Checkdam	1	9321	30	20.0	76
	5% model	2	11.4	4	1.6	45
Nawada	Pyne	1	15995	100	16.0	100
	Well	3	124.3	200	17.0	73
	Pond	1	2317	45	16.0	50
Saran	Pond	2	13353	100	16.0	70
	Inlet Channel	1	2880	28	2.5	80
	Inlet Channel	1	2160	28	1.5	100
Supaul	Desiliting drainage channel	1	225	55	2.0	70
Chatra	Well	3	175	35	1.0	100
E. Singhbhum	5% Model	20	130	35	7.5	75
	Pond Renovation	2	25000	35	7.5	300
Gumla	Renovation of Pond	2	16250	35	14.0	220
	Bora bandh (Temporary check dam)	1	9321	70	55.0	45
	5% Model	3	150	90	22.0	250
Koderma	Defunct pond	2	18000	30	20.0	80
	Repaired well	2	70	10	7.0	80
	Jalkund	1	500	25	10.0	70
Palamu	Well	12	514.2	300	23.0	90
	Pond	3	20625	1500	10.0	80
	5% model	20	120	1000	4.0	120

KVK	RWH structures	No.	Storage capacity (cu m)	No. of farmers benefited	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Cooch Behar	Farm Ponds	10	30000	50	11.0	100
Malda	Small ditches for jute retting	15	230	180	9.5	100
S. 24 Pgs.	Landshaping and rain water harvesting structure	3	3849.5	22	6.0	100
	Renovated defunct water bodies	3	11052.7	25	20.0	100
	Renovated 4 Km long canal	1	375760	455	121.92	100
Godda	Ring Well	1	50	5	10.0	100
	Pond Renovation	1	300	25	35.0	100
Banka	Pond Renovation	1	10000	10	25.0	95
Total		**131**	**602046.5**	**4978**	**571.52**	**95**

Renovated well

New Well



Renovated Pond

Renovated Ahar

2.2 MODULE II- CROP PRODUCTION

Monsoon contingency action plans were prepared and implemented in NICRA KVKs which experienced delayed onset/ deficit rainfall conditions during 2015-16. Contingency crop plans for late planting (after mid July) involving appropriate crop, soil moisture, nutrient management measures, crop diversification *etc.* were taken up in NICRA villages. The impact of resilient practices and technologies is highlighted below:

2.2.1 Introducing drought resistant varieties:

During 2015-16 delayed onset of monsoon was experienced in several districts of Bihar and Jharkhand and a number of short duration and drought tolerant varieties were demonstrated to make effective use of the remaining growing season. Introduction of drought resistant varieties of paddy, brinjal, niger, maize pigeon pea, and ragi were demonstrated in 17 NICRA adopted villages involving 2182 number of farmers in 557.0 ha area. Performance of the different drought resistant varieties of various crops is presented in the following table.

Drought tolerant paddy varieties like Sahbhagi, Anjali, Naveen, Abhishek were demonstrated in 238.0 ha areas of 767 number of farmers' field. Among all the demonstrations short duration potato with variety pukkhraj gave maximum return (BC::3.41).

Table. Performance of different drought tolerant varieties

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Drought tolerant paddy (Var. Sahbhagi)	370	84 .0	245.5	190.9	77.7	56000	63350	2.13
Drought resistant paddy (Var. Anjali)	160	69.0	128.0	112.0	87.5	37500	26900	1.71
Sowing of drought tolerant paddy (Var. Sahbhagi) with ZTD machine	55	12.0	70.0	60.0	85.7	32750	45950	2.40
Sowing of drought tolerant paddy (Var. Sahbhagi) with Drum seeder machine	60	10.0	50.5	35.0	70.0	30000	42565	2.41
Drought tolerant paddy varieties (Var. Naveen)	25	7.0	44.7	30.5	67.6	35600	33200	1.93
DSR Transplanting (Var. Sahbhagi)	45	24.0	40.5	25.9	64.0	35200	39000	2.10
DSR Transplanting (Var. Abhishek)	52	32.0	48.60	35.2	72.4	38500	42800	2.11
Tolerant Varieties to submergence	32	45.0	46.0	36.0	53.9	33528	40482	2.20
Maize (Var. Suwan-1)	726	132.5	40	29.0	72.5	95167	186883	2.96
Maize (HQPM - 1)	92	12.0	44	30.0	68.1	12000	15000	2.25
Drought tolerant ragi (GPU-28)	172	32.0	41.5	23.2	152.3	20300	23560	2.16
Drought tolerant pigeon pea (Var. ICPL 88039)	102	27.0	21.4	15.4	71.9	22550	50650	3.24
Drought tolerant pigeon pea (Var. ICPL- 858063)	25	3.5	16.0	9.0	56. 5	20000	32000	2.60
Niger (Var. Birsa Niger -1)	27	4.0	4.5	2.8	62.2	9280	4500	1.48
Red gram (Var.-PGR-158)	18	3.0	16.5	9.2	55.7	18450	19570	2.06
Horse gram (Var. Birsa kulthi-1)	32	5.5	16.3	9.3	57.0	14500	15570	2.07
Contingent Crops Horse gram	40	8.0	21.0	13.0	61.9	38167	36833	1.96
Drought resistant brinjal (Var. CARI-Brinjal -1)	20	5.0	22.0	9.5	43.2	25000	35000	2.40
Draught tolerant wheat DPW-14	49	20.0	39.0	32.0	82.5	35240	23859	1.67
Short duration potato (Var. Pukkhraj)	53	15.5	260.0	141.5	54.4	51000	123000	3.41
Wheat (DPW-17)	27	6.0	45.4	35.8	78.8	12000	18000	2.50
Total	**2182**	**557.0**						

Abhishek


Anjali


Maize Var. HQPM-7

DPW-17

2.2.2 Introducing salt tolerant paddy varieties:

Salt tolerant varieties of paddy like CARI Dhan-5, Usar Dhan-5, Jarava, Geetanjali, SR-26B, Amalmona were introduced in 72.6 ha area in 162 farmers' fields. Javarva, Geetanjali and Amalmona varieties proved maximum salt tolerant potential by giving highest yield of 49.0 q/ha and more economic return (BC ratio of 2.35).

Table. Performance of different salt tolerant paddy varieties

Technology demonstrated (Salt tolerant varieties)	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
CARI Dhan-5	35	9.5	42.0	32.0	76.2	28250	22950	1.81
SR-26B	40	5.6	37.0	30.5	81.0	25095	28404	2.13
Usar Dhan-3	55	52.0	36.0	29.0	22.8	34734	15265	1.43
Jarava, Geetanjali, Amalmona	32	5.5	49.0	34.7	70.8	33500	45500	2.35
Total	**162**	**72.6**						


CARI Dhan -5


SR-268

2.2.3 Introducing flood tolerant varieties:

Flood tolerant varieties of paddy like Swarna sub 1 and Sabita were introduced through demonstration in 32.0 ha area in 125 farmers' fields.

Table. Performance of different flood tolerant varieties

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Temporary submergence rice variety (Var. Swarna Sub-1)	90	25.5	39.7	28.5	71.7	25500	33900	2.32
Flood tolerant paddy (Sabita)	35	6.5	43.2	37.7	32.0	30500	40175	2.31
Total	**125**	**32.0**						

Sabita

Swarna Sub-1

2.2.4 Advancement of planting dates of rabi crops in areas with terminal heat:

To avoid terminal heat stress in crops like rice, wheat, lentil, mustard, potato, *etc.* were sown in 12 days advance (avg) during rabi season. These demonstrations were carried out in seven NICRA adopted villages involving 393 number of farmers' fields.

Table. Performance of advancement of planting dates in different crops

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Short duration rice (Var. GB-1)	63	8.7	41.0	30.0	36.6	26900	26400	1.98
Wheat (Var. WR-544)	45	9.0	28.5	15.0	235.0	21000	17100	1.81
Wheat (HD2985)	65	18.0	47.0	32.0	48.7	30254	37741	2.24
Maize (Var. DHM 117)	45	4.0	67.0	59.0	20.0	22500	53000	3.35
Lentil (Var. Arun)	65	7.0	18.0	12.0	38.3	20000	40000	3.00
Mustard (Var. Shiwani)	50	15.0	10.5	6.6	53.8	17800	16700	1.93
Mustard (Var. Pusa Gold)	30	12.0	14.0	9.0	38.3	14000	26000	2.85
Potato (Var. K. Ashoka)	48	7.0	214.0	163.0	35.0	75000	50000	1.67
Potato (Var. Kufri giridhari)	12	3.5	311.0	285.0	9.1	120000	191000	2.59
Total	**393**	**72.1**						

Short duration rice (Var. GB-1)

Wheat (Var. WR-544)

Mustard (Pusa Gold)

2.2.5 Water saving paddy cultivation methods:

Water saving paddy cultivation through SRI, short duration varieties, direct seeded rice, brown manuring *etc.* have been demonstrated in 229.6 ha area of 702 number of farmers' fields. These interventions were carried out in 12NICRA adopted villages. Among all the interventions paddy cultivation with Sahbhagi variety showed highest increase in yield whereas paddy cultivation with variety Rajendra Sweta with ZTD gave maximum economic return in the tune of BC ratio of 2.97.

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	255	67.6	55.0	30.0	75.3	42288	45712	2.08
SRI (Var. MTU -7029)	58	4.5	49.5	39.5	27.0	25000	43600	2.74
Paddy Seed (Var. Sahbhagi)	136	61.5	51.0	27.5	83.1	18000	35000	2.94
Aerobic Rice (Var. Anjali) cultivation	72	33.5	27.5	18.6	45.2	20000	22375	2.11
Direct seeded brown manured rice	32	10.0	41.0	31.0	29.7	32000	35500	2.10
DSR (Var. Anjali)	50	29.5	37.0	27.0	35.0	22300	33100	2.48
SRI system in paddy (Var. Rajendra subhasini)	32	9.0	56.4	40.7	37.4	38450	58934	2.53
Sowing of paddy(Var. Rajendar sweta) with ZTD machine	40	8.0	55.0	42.0	28.8	33255	65800	2.97
Zero tilled rice	27	6.0	46.0	31.0	42.0	36560	45500	2.24
Total	**702**	**229.6**						

Paddy Seed (Var. Sahbhagi)

Paddy Seed (Var. Anjali)

2.2.6 Community nurseries for delayed monsoon:

To combat the situation of delayed monsoon intervention of staggered community nursery for paddy has become very popular in Bihar and Jharkhand. Seedlings of 25-30 days age are transplanted in July so as to complete

flowering of photosensitive varieties before October and harvesting by mid November to facilitate taking up of timely sowing of rabi crops. Such a practice ensures optimum performance of both kharif and rabi crops. However, Bihar experienced aberrant rainfall situations in 5 out of the previous 10 years impacting adversely rice production and livelihood of farmers. It appeared that failure of rain in July is responsible as transplanting of paddy is delayed with resultant adverse effect on productivity and a cascading negative impact on rabi crops. Delay in transplanting of paddy affects productivity as over aged seedlings suffer from low tillering ability various crops of different crop duration and varieties has been promoted. Besides paddy other crops like of cauliflower, brinjal, and tomato are followed for staggered nursery development. These intervention were demonstrated in 40.5 ha area of 231 numbers of farmers. These interventions were carried out in 12 NICRA adopted villages. Among all the demonstration the community nursery for cauliflower was the most promising one which showed highest increase in yield as well as economic return.

Table. Performance of Community nurseries

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Raised Community nursery of paddy (Var. Naveen)	25	3.0	49.0	41.2	20.3	38600	42900	2.11
Nursery Management of paddy (Var. Rajendra sweta)	35	6.0	53.0	43.5	24.6	40500	59520	2.46
Paddy (Var. Induri sambha)	15	3.0	49.5	43.2	28.4	32500	35292	2.08
Community nursery of paddy (Var. Lalat)	38	10.0	41.6	30.4	40.5	33000	25050	1.75
Community nursery of paddy (Var. Jaldi dhan 3)	48	9.5	42.0	31.0	45.3	44400	30535	1.68
Community nursery of cauliflower	18	3.5	411.0	345.0	23.4	45000	188800	5.19
Community nursery of brinjal	24	2.5	620.0	540.0	18.2	53000	200900	4.79
Community nursery of tomato	28	3.0	390.0	340.0	19.2	52800	63200	2.19
Total	**231**	**40.5**						

Community Nursery of paddy and brinjal

2.2.7 Location specific intercropping systems with high sustainable yield index:

Various intercropping systems were demonstrated in regions which are prone to drought. Intercropping systems are considered as one of the important adaptation mechanism for variable rainfall situations. Intervention on location specific intercropping was demonstrated in 12 NICRA adopted villages. The demonstrations were carried out in 99.0 ha area of 569 number of farmers' fields. Of all these intercropping intercropping of maize + ladies finger was found most popular which was undertaken in 166 number of farmers fields although maximum return (B:C:: 8.64) was found in Chilli + ladies finger intercropping.

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Maize (Var.X92 as main crop)+Ladies finger (HYV)	166	22.5	Maize: 85.0 Ladies Finger:1.0	Maize- 05	80.5	179500	157000	1.83
Chili (Var. Bullet as main crop)+Ladies finger(HYV)	50	5.0	Chili:48.0 Ladies Finger:0.5	Chili	85.5	305500	2397000	8.64
Maize + Redgram	20	5.0	Maize: 85.0 Redgram:0.5	Maize	98.9	28550	53200	2.96
Maize + Groundnut	15	2.0	Maize:75 Groundnut: 15	Maize	59.4	31500	45200	2.47
Sorghum (Var. CSV – 20)	90	26.0	28.0	10.4	170.0	9000	17000	1.60
Potato (Var. Pukhraj) + Maize (Var. Laxhmi)	60	7.0	Potato:88.0 Maize:135.0	Maize	52.0	75000	135600	2.88
Redgram (Var. Bahar)+ Millet (Var. GPU-28)	20	6.0	Redgram: 22.0 Millet: 12.5	Redgram	58.0	28000	85570	4.23
Potato (Var. Pukhraj) + Radish (Var. Pusa chetki)	25	5.5	Potato:195.5 Radish:40.4	Potato	80.0	27000	75550	3.89
Arhar+ Blackgram	40	6.0	Arhar:18.9 Blackgram: 17.23	Arhar	59.6	29000	49000	2.78
Cucumber + Beans	28	6.0	Cucumber: 12.5 +Beans: 11.7	Cucumber	30.5	45000	98000	3.25
Wheat+Mustard	40	6.0	Equally	Wheat	30.5	32000	29000	1.91
Okra (Mahyco 959) + Chilli (Surya)	15	2.0	Equally	Okra	140.0	195000	228000	2.15
Total	**569**	**99.0**						

Maize+ Red Gram

Maize+ Ground nut

2.2.8 Introduction of new crops/ crop diversification:

Crop diversification through introducing new crops in prevailing cropping pattern was demonstrated in the different NICRA adopted villages. These demonstration were carried out in 157.6 ha area of 916 number of farmers' fields. Introduction of *ol* (var. Gajendra) in the cropping pattern. District is the most promising one which gave maximum economic return (B:C:: 6.91).

Table. Performance of different crop diversification in NICRA villages

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Mustard (Var. Pusa bold)	75	35.0	10.5	7.0	53.0	24000	40000	2.67
Gram (Var. Pusa 362)	102	33.0	17.0	8.0	65.1	26000	46000	2.76
Onion(Var. N-53)	32	5.5	295.0	188.0	48.9	70000	305000	5.35
Tomato (Var. Param F1)	40	7.5	225.0	155.0	47.3	78000	157000	3.01
Chilli (Var. Surajmukhi)	45	7.8	95.0	56.0	80.0	76000	179000	3.35
Cabbage (Var. OM-3)	38	7.0	338.0	255.0	45.0	74000	225000	4.04
Radish (Var. Suhra-32)	42	6.3	127.0	82.0	59.0	70000	82000	2.17
French Bean (Var. FE-51 ANUPMA)	38	2.0	70.0	42.0	82.0	80000	106000	2.32
Cauliflower (Var. MSN-16)	50	6.0	225.0	127.0	80.7	82000	195000	3.37
Brinjal (Var. F1-Hybride Long)	35	8.5	240.0	170.0	48.7	78000	169000	3.16
Turmeric (Var. Rajendra soniya)	24	6.0	235.0	155.0	55.0	80000	300000	4.75
Ginger (Var. Nadiya)	30	3.0	225.0	170.0	45.0	100000	580000	6.80
Lentil (Short duration variety PL – 406)	35	9.0	15.0	5.5	85.0	17000	29000	2.70
Linseed (Short duration variety T397)	25	7.0	5.5	3.4	60.0	10000	18000	2.80
Ol (HYV. Gajendra)	45	3.0	795.0	240.0	230.0	95000	561940	6.91
Nutritional garden- Veg. seed Seem (*dolicus lablab*)	190	5.0	17.0	8.0	48.0	7000	16000	3.28
Tomato under mulching	70	6.0	82.0	40.0	65.0	9000	20000	3.23
Total	**916**	**157.6**						

Turmeric

Elephant foot yam

Onion

Cabbage

2.2.9 Other Demonstrations:

There are some other demonstrations in various aspects mentioned in the following table which was carried out in different NICRA adopted villages involving 644 numbers of farmers. Among all the demonstration cultivating contingency crops like brinjal, cauliflower, mushroom and short duration tomato, banana bunch cover and integrated fish farming were remunerative.

Table. Performance of other demonstration

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Low temperature tolerance - cultural practice -Banana bunch cover (Var. Malbhog & Dwarf Cavendish)	15	2.5	495.6	474.5	20.9	187500	399550	3.19
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (WBU-108) in jute AZO-PSB fallows with INM	28	5.3	15.7	9.5	48.4	29500	45500	2.54
Promotion of stem rot resistant Jute (var. JBO-2003H)	30	6.0	37.5	27.0	65.9	34500	49500	2.43
Integrated crop management of mustard (NC-1)	36	6.0	20.1	12.3	55.5	39560	48580	2.23
Integrated crop management of lentil (Maitri)	38	6.0	16.5	10.0	55.8	30500	42500	2.39
Integrated disease management in vegetables	45	5.5	249.0	220.0	35.5	95000	40500	1.42
Demonstration short duration vegetables as contingent crop Tomato (Var. PUSA Gaurav)	32	3.0	355.0	295.0	23.6	58500	188500	4.61
Contingency crop Brinjal (Var. PUSA Uttam)	20	2.0	386.0	312.0	35.5	58500	289950	6.63
Contingency crop Cauliflower (Var PUSA Sharad)	20	2.0	260.0	210.0	35.0	60000	228500	4.80
Contingency crop Radish (Var. PUSA Chetki)	37	2.0	160.0	120.0	60.0	56500	65000	2.15
Soil reclamation : Levelling /bunding and flooring for leaching of salt	32	9.0	39.0	32.0	65.0	39000	48000	2.23
Integrated fish farming	35	6.0	3.5	1.7	80.0	57000	133000	3.34
IFS….	32	6.0						
late blight disease of potato	12	2.2	311.0	285.0	9.12	120000	191000	2.59
Bio-control agent production	50					Rs. 50/Kg	Rs.500/Kg	
Mushroom	32	-	13.5	-	-	Rs. 25 / cylinder	Rs.55/ cylinder	3.2
Forest tree plantation	150	2000 Plant						
Total	**644**							

Bio-control agent production

Mushroom Production

Leveling /bunding

Jute (var. JBO-2003H)

2.3 MODULE III-Livestock & Fisheries

In this module, interventions include introduction of stress tolerant animal and poultry breeds, nutrient supplementation through area specific mineral mixtures, balanced ration using locally available feed material, fodder production in community lands especially during drought/flood situations, silage making for storage of green fodder and feeding during the dry season, improved shelters for reducing heat stress in livestock, captive rearing of fish seed in nursery ponds prior to stocking in main tanks in the village, breed selection and stocking ratios for fish production in farm ponds and monitoring of water quality in aquaculture and integrated farming system models in diverse agro ecosystems.

2.3.1 Use of community lands for fodder production during droughts / floods:

Community lands of an area of 182.5 ha involving 1098 number of farmers utilized for different fodder production were demonstrated in ten different NICRA adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration quality legume Sudan grass demonstrated showed maximum benefit return (B:C:: 5.54).

Table. Performance of different fodder demonstration in community lands

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Berseem	85	7.0	820.0	680.0	40.5	35500	90500	3.54
JHB-146	46	6.0	830.0	645.0	20.7	29000	72000	3.48
Quality legume fodder Berseem (Var. Muskavi)	39	3.5	975.0	850.0	31.0	34000	73000	3.14
Quality legume fodder Oat (Var. JHO-822)	37	4.0	540.0	430.0	29.0	29000	44000	2.51
Quality legume fodder Sudan chari	15	1.0	45.0	30.0	47.0	13000	35500	3.73
Quality legume fodder Sudan Grass	40	8.5	550.0	200.0	245.0	57000	259000	5.54
Fodder production of Maize/ Sudan	700	59.0	530.0	450.0	29.0	40000	90000	3.25
Fodder cultivation with improved varieties Hybrid Napier,	18	4.5	85.0	45.0	100.0	14500	18000	2.24
Sorghum (Moti)	10	2.0	335.7	255.5	31.3	19300	55000	3.84
Molases	88	75.0	21.0	16.0	37.5	9000	7000	1.78
Oat (Kent)	20	12	475.0	370.0	28.3	20000	23000	2.15
Total	**1098**	**182.5**						

Sudan Gass

Oat

Napier grass

Berseem

2.3.2 Improved fodder/feed storage methods:

Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. In 2015-16, delayed onset and deficit rainfall conditions were experienced in several states. There was reduction in area under millets and pulses, which are important to meet the fodder requirements in the rainfed areas. Short and medium duration fodder cultivars of several crops and fodder species both in *kharif* and *rabi* seasons were demonstrated in farmers' fields under rainfed and limited irrigation conditions to support income and cash flow from animal husbandry Improved fodder of rice bean and silage making were demonstrated in farmers fields. Silage making for 18 numbers and 1.5 ha of units showed very promising results.

Table. Performance of improved fodder

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder grass on farm bund (Rice bean Var. Bidhan-1)	25	1.5	198	-	-	1500	15500	13.60
Silage Making	40	18 nos	7.5	5	65.5	45	270	8.4

2.3.3 Preventive vaccination:

Various vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry, BQ vaccine, deworming etc. in 17 different NICRA adopted villages. Mortality rate reduce up to the extent of 100% and average increase in cattle milk yield upto 40% have been recorded after the vaccination camps organized.

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	No. of Unit	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle & PPR against goat	800	940	Mortality rate (70-80%) reduced	Mortality rate (40-50%) reduced	-	-	-	-

Technology demonstrated	No. of farmers	No. of Unit	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination HS,BQ	2900	1450	100 % Mortality reduced, Increase Milk yield Av. from 1.4 -1.8 lit/ day/cow	2.2% Mortality reduced, Av. Milk yield 1.4 lit/day/ cow	30.6	7050	8510	2.25
Vaccination for PPR in goat and Ranikhet in Poultry.	600	750	Occurrence of disease not recorded in vaccinated group.	Sporadic out break	-	-	-	-
Animal health camp (HS+BQ)	500	765	10 % mortality	65 %mortality	80% survival	34059	90581	3.76
Deworming (Febendazole) & Mineral mixture	100	500	12% mortality	100% Mortality	92% survival	623000	153000	1.2
Animal Treatment Camp Butox, Prajana,Sulpha Dimadin ,Oxytetra cycle	400	365	Reduced occurrence of diseases 92%	Occurrence of diseases 35%	61.95	-	-	-
Proper De-worming	1400	700	7	5	40.0	25	156	7.95
Vaccination raksha triovac	200	190	35	25	-	-	-	-
Total	**6900**	**5660**						

Vaccination Programme for livestock

2.3.4 Management of ponds / tanks for fish and duck rearing:

Composite and cat fish rearing in the existing pond or in renovated pond were demonstrated in 140 farmers fields of NICAR adopted villages. Khaki Campbell duck was also introduced through this intervention.

Table. Performance of composite and cat fish in the renovated ponds

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	90	20.0	785.0	290.0	300.5	20000	52000	3.60
Cat fish culture	35	2.5	1500.0	750.0	150.0	19000	76500	5.02
Renovation of defunct fish ponds and tilapia, singhi, magur, annabus & lata species cultivation	60	3.00	-	-	140.0	18000	65000	4.61
Total	**140**	**25.5**						

Fish production in renovated ponds

2.3.5 Livestock demonstration:

Demonstration of rural backyard poultry (kuroiler, Nicobari fowl), khaki Campbell duck, T X D breed of pig, mineral mixture and azolla as cattle feed were carried out in 480 number of farmers fields. Improved ornamental bird was introduced through this intervention which showed very promising results (B:C :: 5.94).

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rural backyard poultry Kuroiler Birds	40	180 nos	1.5 kg at 10 weeks	0.75 kg at 10 weeks	40	90/bird	35/bird	1.38
Backyard poultry (Improved Nicobari fowl)	25	155 nos	142 egg	75 egg	86	3000	4486	2.49
Replacement of local breed with Khaki Cambell	35	130 nos	Prodn: 21/duck/ month	Prodn: 15/duck/ month	40	Rs. 80 duck/ month	Rs. 70 duck/ month	1.87
Ornamental bird	10	30 nos	Hatchability-85%, fecundity-68%, chick	-	-	85pair/ bird/ year	420/pair/ bird/year	5.94
Improved breed of Pig (T & D)	35	40 nos	0.9 q/pig	0.5q/pig	80	32000	42500	2.32
Addition of mineral mixture	290	600 nos	1.75	1	31	1800	2500	2.38
Low cost Azolla production as supplementary cattle feed	45	95 unit	Prodn: 8.55 q/ yr; Milk: 46.85 l/ cow/month	Milk: 39.6 l/per cow/ month	32	740 / pit	695/pit	1.93
Total	**480**							

Livestock Production in NICRA village

2.3.6 Improved shelters for reducing heat stress in livestock:

Improved Poultry shed recorded low mortality rate and in shady area reduced heat stress. Standard spacing in improved shed resulted better performance in poultry and dairy animals. Interventions to reduce heat stress for higher survivability of backyard poultry and dairy animals were demonstrated of improved shelter.

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Mud based Shelter Bamboo+Paddy straw+mud	50	45	Mortality 10%	Mortality 80%	Survival 70%	-	-	-	-
Hut making	15	13	40	10	85	35	280	245	8
Improved shelters for poultry and livestock	30	25	-	-	-	-	-	-	-
Total	**95**	**83**							

Improved shelters for poultry and dairy animals

MODULE IV: Institutional Interventions

In this module, an innovative institutional intervention is the formation of village climate risk management committees (VCRMCs). VCRMCs play a crucial role in mobilizing the communities in the village for active participation. VCRMC manages the custom hiring centre for farm implements and micro-irrigation systems, seed and fodder bank, community nurseries, collection of farmers share in planting material and inputs, establishment of small weather station in the village, participation of farmers in capacity development programs and exposure visits to learning sites. Institutional interventions including seed bank, fodder bank, commodity groups, custom hiring for timely operations, community nursery raising, irrigation, collective marketing, climate literacy through a village level weather station and awareness developed of 3684 number of farmers in the Zone.

Seed Bank: Village level seed production of short

duration, drought and flood tolerant varieties was taken up by farmers and seed societies in several NICRA villages with the technical support of KVKs in rice, soybean, foxtail millet, greengram, pigeonpea, finger millet, chickpea, wheat, rapeseed and mustard. To tackle contingency situations, increased availability of tolerant varieties was accorded priority especially in the case of paddy, soybean and foxtail millet during 2015-16. It has become a regular practice to source seed of drought tolerant and short duration cultivars from few NICRA villages as interested farmers and seed societies have taken up this as a livelihood activity.

Fodder bank: Fodder bank was established in the village under NICRA project, green fodder shortage and dry fodder shortage is acute. The green fodder shortage was reduced from 86% to 36% within four years of NICRA project. In several NICRA villages in other districts seed of improved cultivars of fodder sorghum, maize, pearl millet, berseem, lucerne and oats was produced for use in regular and contingency situations.

Collective marketing: Collective marketing is where a number of growers work together to sell their combined crops. This may require additional storage, processing or packaging of the crop, with the costs shared by the collective.

Commodity group: An Agricultural Commodity can be defined as grain, livestock, poultry, fruit or any other items produced from agricultural activities. The general price level of an agricultural commodity, whether at a major terminal, port, or commodity futures exchange, is influenced by a variety of market forces that can alter the current or expected balance between supply and demand.

Climate literacy through village level weather station: The Village Climate Risk Management Committee (VCRMC), after the PRA to assess the climate related problems in the village and baseline survey. Then they followed recommendation by KVK and other institute scientist through village level weather station.

Table. Details of the various institutional interventions

Inter-ventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No. / Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	11	Rice- Drought tolerant/ Short Duration Var. Rajendra Sweta, Naveen, Jaldi Dhan 13, Madhuri	3.00	Quality seed	35	7.0
		Paddy Var. Lalat	37.50	Participatory approach market linkage	12	3 .2
		Wheat Var.-HUW-468	41.50	Participatory approach market linkage	8	1.9
		Paddy Var. Anjali	37.50	Multiplication of seeds	39	6.5
		Paddy Var. Sahbhagi	38.50	Multiplication of seeds	14	3.0
		Foundation seed Paddy	18.00	Seed production and storage	10	6.5
		Foundation seed Rapeseed and mustard	10.00	Seed production and storage	20	6.0
		Foundation seed Wheat	17.00	Seed production and storage	29	11.5
		Paddy Sahbhagi	58.00	Seed	8	3.5
		Paddy Rajendra Sweta	97.00	Seed	5	3.0
		Pigeon pea	9.00	The Seed given to the farmers for seed production will get refunded after production	14	7.5
		Paddy	10.00	-	40	7.5
		Gram	9.00		12	3.0
		Blackgram	27.00		27	4.0

Fodder bank	7	Oat JHO-851	5kg	-	5	1.0
		Berseem Wardan	10kg	-	7	1.0
		Mineral mixture	15 kg	-	109	2.0
		Urea and molasses	12 Kg	-	47	2.5
		Berseem JHB-146	10kg	-	7	1.5
		Jowar	35.5	Fodder use in drought spill/heavy rain	15	1.5
		Wheat straw	4.00	Urea treatment	15	5Unit
		Maize	3.00	-	25	2.0
		Sudan Grass	3.00	-	15	2.0
		Paddy & Wheat Straw	4.00	VCRMC is maintaining this	25	3.0
Commodity groups	6	Kitchen Gardening	-	Improved Variety Seed	43	2.5
		Veg Mustard Pusa sag 1			37	2.8
		5 group Fingerlings fish	120.00	Fish farming	52	7.5
		Fertilizer procurement/ storage/Sale counter	-	Farmers through PACS and cooperative society	250	30 unit
		Vegetable production and marketing.	5 groups handle 2,000 green vegetable and potato, Onion	1. Production oriented training.2. Linkage with market.	150	1.0
Custom hiring centre	16	Power tiller	5	-	305	3 unit
		Mould bold plough,	02/ Rs.36/hr	-	15	2.5
		Rotavator (4'),	02/ Rs. 55/hr	-	18	4.5
		Zero till seed drill,	02/ Rs. 80/hr	-	28	6.5
		Turbo seeder,	02/Rs. 157/ hr	-	26	3.5
		Power Duster,	02/Rs 20/ hr	-	29	2.5
		Power sprayer, Pumping Set,	02/Rs 20/hr	-	15	7.5
		Farm implements	-	Technology demonstration	254	55 unit
		Wheat Thresher, Zero Tillage Machine, Sprayer, Duster, Paddy Thresher etc	70.00	Implements is provided to the Group for hiring purpose	30	25 unit
		Wheat, Paddy, Lentil, Chick pea ZTD, Drum Seeder	-	ZTD, Drum Seeder	70	17 unit
		Water pump, thresher, power sprayer, weeder, SRI marker, Zero till drill	Water pump (2) @ Rs. 80/ hr, Thresher (1) @ Rs. 50/hr, Power sprayer (2) @ Rs. 25/hr, Weeder (5) @ Rs. 10/hr, SRI marker (5) @ Rs. 5/hr, Zero till drill (2) @ Rs. 55/hr		60	9 unit

		Conoweeder, duster, sprayer, SRI marker, Zero tillage machine	Conoweeder: Rs. 15/-	1. Weeding	40	4.5
			Duster: Rs.15/-	2. Dusting	40	3.0
			Sprayer:Rs.20 /-	3. Sprayer	39	3.5
			SRI Marker:	4. Sri marker	25	4.8
			Zero tillage Machine: 47/-	5. Zero tillage	75	7.5
		Farm implemented Zero-till ferti-seed, Laveler/ bund maker/FIRB planter/ Drum seeder/Weedicide/ Sprayer/Sub-soiler/Disc harrow/Bucket laveler/ connoweeder/marker/reaper/ threser/cultivator	5.00	Technology demonstration	620	325 unit
		VCRMC Equipments purchased under the project	8.00	Farm implements	265	7.5
Collective marketing	5	Onion/ Vegetable	6.00	-	45	11.0
		Milk production and marketing group.	3.00	1. Introduce new green fodder like Sudan grass, 2. Linkage with market.	35	5 unit
		Vegetables	3.00	Cooperative arrangement	75	32unit
Climate literacy through a village level weather station	16	Temperature, Relative humidity, Rain fall, Wind speed and direction	18.00		245	3 unit
		Weather station SMS/ Voice SMS	12.00	Data interpretation of AWS and forecasting/Advisory	67	1 unit
		AWS	17.00	-	150	1 unit
		Wheat	12.00	-	50	38 unit
Total					**3684**	**176.2 ha & 549 unit**

2.4.1 Village Climate Risk Management Committee (VCRMC)

Village Climate Risk Management Committee (VCRMC) was constituted after in-depth discussion with the villagers about the mitigation of the climatic vulnerabilities of the villages and the strategies to be adopted under NICRA.

VCRMC Meeting in NICRA villages

The members of the committee were selected by the villagers under the facilitation of KVKs where NICRA was being implemented. VCRMC became operational with opening of a bank account in their name being jointly handled by the President of VCRMC and the Programme Coordinator of the KVK concerned. The custom hiring of various farm tools and implements was being supervised by VCRMC apart from taking important decisions on the technological interventions to be implemented at the village in consultation with the KVK.

2.4.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

Timeliness of agricultural operations is crucial to cope with climate variability, especially in case of sowing and intercultural operations. Access to implements for planting in ridge-furrow, broad bed furrow and raised beds is essential for widespread adoption of resilient practices for *in situ* soil moisture conservation and drainage of excess water in heavy soils. In rainfed areas, availability of such farm implements to small and marginal farmers is important. Similarly in irrigated areas, residue management of *kharif* crops through zero till cultivation of *rabi* crops reduces the problem of burning of residues and adds to the improvement of soil health and increases water use efficiency. Custom hiring centres (CHCs) for farm implements were established in NICRA villages. A committee of farmers' manages the custom hiring centre. The rates for hiring the machines / implements are decided by the VCRMC. This committee also uses the revenue generated from hiring charges and deposits in a bank account opened in the name of VCRMC. The revenue is used for repair and maintenance of the implements and 25% share is earmarked as a sustainability fund. Different types of farm machinery are stocked in the CHCs, the most popular being zero till drill, Happy seeder, BBF planter, drum seeder, multi-crop planter, power weeder and chaff cutter. Each CHC was provided an initial sum of Rs. 6.25 lakhs for its establishment under NICRA project. Revenue generated through Custom hiring and under VCRMC in different KVKs were presented in the following table.

Table. Revenue generated through Custom hiring Centres and VCRMC in KVKs

Name of KVK	Revenue generated (Rs.)	
	From Custom Hiring Centres	Total under VCRMC
Aurangabad	12253.00	69824.00
Buxar	2240.00	30597.00
Chatra	37922.00	59482.00
Cooch Behar	19354.00	67340.00
East Singhbhum	3500.00	36900.00
Gumla	22788.00	84899.00
Jehanabad	5500.00	53332.00
Koderma	4470.00	30110.00
Malda	7050.00	32000.00
Nawada	10250.00	299212.00
Palamu	6600.00	24000.00
Port Blair	2380.00	30304.00
Saran	-	60000.00
Supaul	4400.00	67012.00
South 24 Parganas	8070.00	199840.00
Godda	30000.00	30000.00
Banka	-	-
Total	**176777.00**	**1174852.00**




Farm machinery at NICRA adopted villages

3. Capacity Building

A total of 672 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 13538 farmers and farm women (10858 male and 2680 female) during the year 2015-16. Thematic areas covered on SRI, scientific crop management, crop diversification, land shaping, green manuring, natural resource management, resource conservation technology, animal feed management, nursery raising, pest and disease management, weed control, vermicompost, value addition, livestock management, oilseed and pulse demonstration, farm implements, drudgery reduction *etc*. The HRD programme conducted on the basis of priority area of farmers or farm women.

Table. Details of HRD programme conducted in NICRA adopted villages during 2015-16

Thematic area	No.of KVKs	Topic of the training	No. of Courses	No. of beneficiaries		
				Male	Female	Total
Livestock and Fishery Management	17	Duckery as an additional source of income	12	180	55	235
		Management schedule for dual purpose poultry birds	11	270	45	315
		Feed and health management of livestock	30	470	110	580
		Feeding breeding and management of Goat and Pig under drought like situation.	20	340	60	400
		Prevention and control of live-stock Disease	22	380	140	520
		Scientific rearing of IMC	22	310	30	340
		Composite fish culture	14	260	40	300
Natural Resource Management	17	Production of quality compost using local resources	10	100	20	120
		Integrated farming methods in landshaping plots	10	120	30	130
		Vegetable cultivation on raised land embankment	12	95	37	132
		Integrated weed management in rice through land management	10	90	32	122
		Management of salt affected soil	14	100	32	132
		Impact of bunding in water conservation	10	175	17	192
		Increase of water holding capacity of sandy soil of Diara land	10	35	2	37
		Mulching and its impact	22	272	65	337
		Use of drip and sprinkler irrigation system				
Crop Management	17	Paddy and other cultivation through SRI	20	262	73	335
		Salt tolerant and deep water paddy cultivation	11	235	32	267
		Crop Management	10	172	32	204
		Water management	14	278	38	316
		Improved package of practices for pulse and oilseeds	12	150	27	177
		Quality seed production technology of cereals	9	145	25	170
Nutrient Management	12	Integrated Nutrient Management in pulses	10	140	30	170
		Application of sulphur in oil seed crop	6	140	10	150
		Green mannuring	12	240	34	274
		Soil health management	17	1100	526	1626

Integrated Crop Management	16	Cultivation Practices of Kharif pulses	10	200	45	245
		Scientific cultivation of crop management.	18	270	45	315
		Scientific cultivation of oilseeds	18	280	35	315
		Kisan chaupal	9	47	18	65
		Cultivation of potato	11	175	25	200
Crop Diversification	12	Increase in cropping intensity through introduction of black gram in jute fallows	10	130	15	145
		Crop Diversification through lentil cultivation	8	100	25	125
		Training on intercropping	10	120	25	145
		Cultivation of Millets	8	92	18	110
		Fodder production.	14	210	75	285
Resource conservation Technology	17	Zero Tillage	16	245	35	280
		Operation & Maintenance of Zero Tillage Machine	6	125	15	140
		Summer ploughing	10	110	30	140
		Direct seeding method of Paddy	7	80	30	110
		Use & importance of multi crop planter in Maize & protected Nursery.	8	60	25	85
		Crop residue management by using happy seeder	7	75	10	85
Pest and disease management	17	Integrate Pest Management	28	520	35	555
		Storage pest of pulses and their management	7	130	10	140
		Judicious pesticide application in crops	12	145	40	185
		Integrated Disease Management	14	290	35	325
		Crop Diversification of sustainable crop production	4	55	7	62
Nursery raising	10	Nursery raising and Management of major vegetable crops.	12	225	55	280
Employment Generation	9	Poultry farming for employment generation	6	140	35	175
Nutrition garden	6	Selection of Suitable crops for nutrition garden	6	110	52	162
Repair & Maintenance of farm machinery & Implements	16	Operation and maintenance of sprayer, duster and small agril. Implements and tools	8	150	42	192
Integrated Farming System	17	Integrated Farming System	7	143	33	176
Fodder and feed management	15	Skill/knowledge development on Fodder and feed management	9	112	52	164
Lac cultivation	3	Skill/knowledge development on Lac cultivation	9	55	27	82
Farm implements and machineries	15	Skill/knowledge development on Farm implements and machineries	11	175	89	264
Value addition	13	Skill/knowledge development on Value addition	9	135	35	170
Employment generation	13	Skill/knowledge development on Employment generation	10	95	120	215
Total			**672**	**10858**	**2680**	**13538**






Capacity Building programme conducted in NICRA adopted villages

4. Extension Activities

NICRA implementing KVKs conducted a total of 1859 extension activities on various thematic areas benefitting 19067 practicing farmers and farm women (13503 males and 5564 females) during 2015-16. The extension activities were conducted on Method demonstrations, Agro advisory services, Awareness camp, Animal Health Camp, Krishak Chaupal, Kishan gosthi Resource conservation technologies, celebration field and farmers' days, diagnostic visits, group discussion, Technology week, Kisan mela *etc*.

Table. Details of extension activities conducted in NICRA adopted villages during 2015-16

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services	672	1804	731	2535
Awareness	300	2000	1035	3035
Diagnostic visit	200	900	600	1500
Exposure visits	100	700	350	1050
Field Day	150	2000	700	2700
Group Discussion	110	1500	620	2120
Method demonstrations	50	686	300	986
KMAS Services	45	1950	350	2300
Farmers day	30	200	50	250
SHG	15	35	120	155
Campaign	10	320	100	420
Popular extension literature	2	-	-	0
Animal Health Camp	30	150	60	210
World earth day	5	130	25	155
Krishak Chaupal	3	35	15	50
Kishan Gosthi	6	230	180	410
Woman health and nutrition	5		80	80
Technology week	5	700	230	930
NICRA Workshop at ATARI Kolkata	1	23	3	26
Scientist visit to field	120	140	15	15
Total	**1859**	**13503**	**5564**	**19067**

Different extension activities at NICRA adopted villages

5. Soil Health Cards distribution and Observance of World Soil Day

December 5 declared by the International Union of Soil Sciences as 'World Soil Day' and to celebrate the importance of soil as a critical component of the natural system and as a vital contributor to human wellbeing, all the NICRA-KVKs have organized Seminar/symposia/workshop. The World Soil Day campaign aims to connect people with soil and raise awareness on their critical importance in our lives. One of the several ways of connecting people with soils is to restore and preserve the soil health. All the seventeen NICRA-KVKs of Zone-II distributed the Soil Health Cards among the farmers in NICRA adopted villages. A total 2753 numbers of Soil Health Cards were distributed on that particular day and cards were distributed by the public representatives like MP/MLAs and others in the respective KVKs. KVK wise distribution of soil health cards are presented in the following table.

Table- SHC card distribution at NICRA adopted villages during 2015-16

KVK	No of soil samples collected	No. of samples analysed	No of SHC distributed to the farmers
Port Blair	250	250	520
Aurangabad	50	50	50
Buxar	105	105	105
Jehanabad	106	106	106
Nawada	150	150	150
Saran	300	300	117
Supaul	120	120	200
Chatra	126	126	310
Singhbhum	8	8	80
Gumla	100	100	100
Koderma	128	128	128
Palamu	250	250	600
Coochbehar	110	110	95
Malda	25	25	10
S. 24 Pgs	182	182	182
Total	**1863**	**1863**	**2753**

Distribution of Soil Health Card

6. Zonal Workshop of NICRA (Technology Demonstration Component) held at ICAR-ATARI, Kolkata on April 21-22, 2016

The Zonal workshop of National Innovations on Climate Resilient Agriculture (Technology Demonstration Component) was held at ICAR-ATARI, Kolkata on 21-22nd April, 2016. The workshop was chaired by Dr S. K. Roy, Director, ICAR-ATARI Kolkata on April 21, 2016 and Dr. Ch. Srinivasa Rao, Director ICAR-CRIDA, Hyderabad on April 22, 2016. The workshop was attended by Dr. JNVS Prasad, NICRA-TDC Cooridinator, CRIDA, Hyderabad, Dr. S. C. Sarkar, Director of Extension Education, UBKV, Coochbehar, Dr. B. Shahi, Nodal Officer of KVKs of RAU Pusa, Dr. R. N. Singh, ADEE of BAU, Bihar, all the scientists of the ATARI, Kolkata, and all the Programme Coordinators of NICRA implementing KVKs of Zone II. One publication '*NICRA Newsletter- Towards Climate Smart Agriculture'* published by of ICAR-ATARI Kolkata was released.

The workshop started with welcome address by Dr. F. H. Rahman, Principal Scientist-cum- NICRA Nodal Officer, ICAR-ATARI Kolkata. In his welcome address Dr. Rahman presented the highlights of the salient achievements carried out by the 17 NICRA- KVKs of the zone.

Dr. S. K. Roy, ATARI Director while addressing the inaugural speech he asked all the NICRA-KVKs to prepare case studies/success stories based on the most successful and scalable technologies and those should be replicated in nearby areas. He mentioned that the intervention under NICRA should read vulnerability with existing cropping practices and preventing this vulnerability through NICRA intervention is to be a priority. He emphasized to take up new interventions model which have direct bearing with the climate change.

Dr. Ch. Srinivasa Rao, Director CRIDA, Hyderabad showed his satisfaction on the performances of KVKs' activities. He mentioned that the KVKs should focus on details of district on climate resilient information and suggested that if any modify is necessary. He also suggested that some of the presentation were excellent and few of them need improvement which should focus only on climate resilient activities. He emphasized that the successful technologies should be transferred from one KVK area to other areas of KVKs. He further mentioned that performance of NICRA activities would be evaluated and as per the report the project may be extended further. He appreciated a lot that KVKs generated a huge fund through convergence programme with other ongoing programmes in the respective district during last four years. He asked every NICRA-KVK to follow website of CRIDA for contingent planning if there will be delayed monsoon, flood, drought occurred and also requested any modification is required for any district they should send their inputs to CRIDA so that necessary changes may be done accordingly.

Dr. JVNS. Prasad, Coordinator, NICRA-TDC, CRIDA, Hyderabad mentioned that each intervention should be planned in relation to the climatic vulnerability like drought, cyclone, salinity, heat stress, flood etc. Overall he showed his satisfaction about the performance of NICRA-KVKs of this zone. He informed that there must be preparedness for handling climatic contingency. He emphasized on the following actionable points:

- Farmers wise and intervention wise data to be provided by every KVK
- There should be scientific data along with good action photograph will be more than previous year
- Intervention should be taken on farmers' field based on the variability of environmental condition
- Scientific data and good action photograph will be more than previous year
- Data on extent of climatic variability should be provided
- More focusing only NICRA intervention work for all KVKs
- Documentation of the successful intervention
- Need to improve of the performance of CHC and VCRMC
- Timely report on unseasonal rainfall and extreme events
- Well performing NICRA KVKs exchange their knowledge with other NICRA KVKs
- Contingency planning may be prepared to respond in time
- Mention on flooded, drought, upland, midland and lowland area at the village
- Provide information of contingency plan on NICRA villages

Dr. S. C. Sarkar, Director of Extension Education, UBKV, Coochbehar mentioned that the selection of site for NICRA-TDC activities is very important. Soil health cards distribution to the farmers needs to be undertaken in NICRA villages. Activities to be undertaken for womenfolk in the NICRA villages. Dr. B. N. Shahi, Nodal Officer of RAU KVKs mentioned that there are two

different situations prevailed in Bihar and accordingly activites to be taken for sustainable production. Dr. R. N. Singh, ADEE of BAU, Bihar, emphasized more convergence activities need to be undertaken for replicating the successful technologies. Dr. P. P. Pal, PS of ATATRI, Kolkata suggested that Socio-economy impact of NICRA technology to be studied. Dr. S. K. Mondal PS of ATATRI, Kolkata requested there must be more intervention to be considered for livestock and fishery in relation to climatic vulnerability.

In the technical session all the Programme Coordinators of NICRA-KVKs have presented one by one their salient achievements during 2015-16 and the action plan for 2016-17.

Some of the General recommendation came out of the workshop are mentioned as:

1. Vulnerability index should be measured and accordingly intervention to be executed
2. Large scale dissemination of successful technologies to be undertaken
3. After saturation of farmers in present NICRA village with technology then those should be replicated in neighbouring villages
4. Farmers wise and intervention wise data to be provided by every KVK
5. Performance of CHC and VCRMC need to be improved
6. Contingency planning may be prepared to respond in time
7. Detail of proven technology needs to be documentd
8. NICRA activities should not clubbed with KVKs normal activities
9. Topography situation of village data (Up, Mid & Low land) should be kept in each NICRA village
10. Socio-economic impact of the successful technology demonstration should be analysed
11. Intervention on livestock/fishery should be taken on proper climate resilient basis
12. One KVK member must be included in the VCRMC Bank account for transaction
13. There may be around 20% member from women section in VCRMC Committee
14. In absence of SRF two contractual staff as Field Assistant may be engaged on need basis with an honorarium of Rs. 5000-6000 p.m. per staff
15. Well performing NICRA KVKs exchange their knowledge with other NICRA KVKs
16. Documentation of the successful intervention to be prepared
17. Extension activities or training programme to be conducted on climate related issues
18. All KVKs should have GPS facility (Approx cost Rs. 8000/-)
19. Irrigation potential increasing trend through the construction of dam is to be studied
20. All the KVKs should prioritize their required equipments based on the budgetary provision.
21. The titles of the training under NICRA should be innovative with thrust on climate resilience.
22. For NRM activities Farmers share to be collected @ 10%
23. Any intervention under NICRA to be addressed with climate – cattle population to be related with supply of more organic manner which adds to increase in Carbon content of the soil

The workshop ended with vote of thanks proposed by Dr F. H. Rahman

7. Zonal Monitoring Committee Visists to NICRA KVK

The ICAR has constituted the monitoring committee to review the technical progress of different modules like NRM, crop production, livestock & fishery and institutional intervention in different NICRA implementing KVKs. The details of the visit along with proceedings are mentioned hereunder.

The Monitoring Committee comprised the following members:

Chairman: Dr. H. S. Sen, Former Director, ICAR-CRIJAF, Barrackpore

Vice- Chairman: Dr. S. K. Roy, Director, ICAR- ATARI, Kolkata

Member: Dr. P. Nanda Principal Scientist, ICAR-IIWM DDG (NRM) Nominee

Member: Dr. B. Gangaiah, Head, NRM Divison, ICAR-CIARI, Port- Blair

Member Secretary: Dr. F. H. Rahman, Pr. Scientist/Nodal Officer, NICRA at ATARI, Kolkata

Proceedings of the NICRA Zonal (Zone II) Monitoring Committee Visit to Port Blair KVK during March 15 to 18, 2016

The ZMC of NICRA team consisting of Dr. H. S. Sen (Chairman), former Director, ICAR-CRIJAF, Barrackpore, Dr. P. Nanda (Member), Principal Scientist, ICAR-IIWM, Bhubaneswar as DDG(NRM) Nominee, Dr. B. Gangaiah, HOD (NRM) CIARI, Port Blair as CRIDA Director's Nominee and Dr. F. H. Rahman, Principal Scientist, ICAR-ATAR Kolkata as Member Secretary visited Port Blair, KVK and NICRA project Sites, in order to develop an overall impression of the agro-climatic conditions of the Island ecosystem in the region, also went across a few surrounding islands during 15-18 March, 2016. The 'NICRA', hereafter referred to as 'project', sites were located in Port Blair, Badmaspahar and Port Mount villages. There are reasonings to believe that the island ecosystem is likely to be the most sensitive than any other ecosystem due to climate change phenomenon. In a rare and all-time tragic incident the Andaman and Nicobar Islands had a devastating toll of 10,136 people dead and hundreds of thousands rendered homeless when the Indian Ocean-triggered earthquake Tsunami struck the islands on 26 December, 2004. The islands were just north of the earthquake epicentre, and the Tsunami reached a height of 15 metres (49 ft) in the southern Nicobar Islands. The A&N island ecosystems comprise of 572 islands, of which 38 are inhabited by people from the mainland and indigenous tribes. The areas could be characterized as highly stressed due to drought/cyclone/sea water inundation, and the crops susceptible to diseases and pests.

Of the total 181 households spread over different NICRA villages 85 were landless, 76 were marginal (up to 0.4 ha holding area), 44 were small (up to 1.3 ha holding area), and the rest 20 come under medium and large categories. Overall literacy among 1145 population was about 65 % evenly distributed among male and female.

The climatic pattern, particularly the rainfall, holds the key to suggest future agricultural practices in the island ecosystem. To draw any tangible conclusion on the trend minimum 35 year data are required, however an approximate trend may be drawn from 16 year data provided (2000-2015) for Port Blair. The average (16 years) annual rainfall is 3008.3 mm. The majority of the rainfall is received as SW monsoon (May-Sep including May receive pre-monsoon showers). The percent SW rains of the annual amount varied from 57.2 to 79.4, showing a marginal decrease in the trend with time. Although there was possibly no clear trend of change observed for the SW rains over time, the annual amount showed marginal increase in the amount with minimum 3400 mm rains received in the years 2005, 2008, 2011, 2012 & 2013, and a sharper increase in the trend in case of non-monsoon rains. Number of incidents on flood and breaching of embankments has been reported to decrease over the last about two decades due mainly to various land conservation measures undertaken. The entire island is highly humid ranging from 70–90 % and the temperature varying from 20 to 30˚C throughout the year.

The ZMC team during their visits to the sites was accompanied by the project personnel. Following the presentation made initially at the project for an overview of the problems and the activities undertaken in-depth discussions took place with the farmers at individual sites. The team went to Havelock and Baratang areas for an understanding of the problems of ecosystem. Discussion was also held with the VCRMC members & experienced farmers particularly the womenfolk as well as the government officials in each area to share their experience. Following are the salient recommendations intervention-wise emanating from the discussion directly related to the project sites.

Water resource	Provision of irrigation facility and optimal utilization of available water are important interventions for mitigation of climate induced adverse impacts on agro economy in a island ecosystem. Out of the total 68.75 ha net cultivated area 58.75 ha area is rainfed, and negligible area under irrigation. There are scopes to increase the area under irrigation particularly during post-monsoon period. There are at present 36 tanks and 22 bore wells covering 22 and 5 ha area, respectively. There are two patches where drip irrigation systems were operating and another 6 rainwater harvesting structures were created which are defunct now. Total 3 tanks and 1 well have been constructed by the project. Among the improved irrigation systems in use are 2 drip systems and 6 defunct rain-water harvesting structures. Among the various activities undertaken by the project to augment the water resources are pond desilting, water stored in Broad Bed and Furrow models (BBF) for utilization of degraded land and flooded areas, new pond construction, and low cost rain shelter. There are practically no data available on groundwater status in terms of its use and quality, excepting some sketchy information provided of drawdown of the groundwater by 2-3 m over the last 10 years. As groundwater availability is uncertain and if available will be saline, harvesting of overland runoff and storage is of critical importance. Shallow open dugwells suppoted by water harvesting structures in the upstream could assure critical irrigation to the crop during drought. Hence more emphasis should be given on creation of water resources through runoff harvesting and recycling and use of pressurized irrigation system (drip and sprinkler) for minimized/optimal use of available water need to be taken up under the project. It is recommended to prepare master plan on increasing water resource use for different islands. Following steps are suggested: (1) Minimum 25 year database of rainfall and ET are required to work out probable availability of excess rainfall water for irrigation. (2) For storing excess rainwater structures and for appropriate crop planning commensurate with the factors like climate, crop water requirement, soil properties & land configuration, water table status, and other relevant factors there are methods/ expertise available in the country. Water may be stored for its exploitation in various water harvesting structures like fresh ponds, re-excavation of existing ponds and canals, BBF or other land shaping measures, etc. It is recommended that the project/ATARI may take initiative to draw the necessary plan. (3) For the use of groundwater for the purpose of irrigation in the island ecosystems being highly fragile in nature there is always a word of caution that the equilibrium should not be disturbed. It is recommended to collaborate with the experts (say, CGWB) in relevant fields for hydrological survey of the groundwater for its exploitation through tube wells. The project/ATARI may take initiative for drawing the desired plan.
Minimizing irrigation requirement	This is advisable to mitigate the effect of warming on agriculture by provision of irrigation water and especially its use at critical irrigation under water stress. It appears that no systematic attempt has been made to minimize irrigation requirement for crops, which is obviously a key strategy to mitigate adverse effect. *In-situ* moisture conservation through polymulch and organic mulching with coconut has been practised to increase soil moisture conservation and thereby decrease irrigation requirement for *rabi* crops. Attempts have been made sporadically without any systematic efforts so far to minimize irrigation requirement particularly for vegetables and other horticultural crops through, say, trickle, sprinkler or pitcher irrigation. Low discharge- high frequency irrigation methods like drip, sprinkler and pitcher are ideal to increase water use efficiency and cover larger area under irrigation. Drips are particularly useful as well for poor quality water use not otherwise permissible for conventional irrigation. Project/ ATARI may work out plans to avail government promotional programmes to implement drip irrigation in selected areas useful for horticultural and plantation crops.
Climate change & crop planning	At the priority it is necessary to work out relevant to the island ecosystem trends of change of the climate for at least 25 years based on the past data available, for which there are a number of useful models suggested. Target should be to predict change of temperature, rainfall pattern (distribution and intensity/storms), wind speed, relative humidity & other related climatic parameters, sea level rise & related hydrological parameters. The study should project on the scope for sea water inundation of the cultivable lands particularly the lowlying areas in future. The project/ATARI

	may organize for a special initiative to be taken up in collaboration with IMD, ISRO and agro-meteorologists specialized in this field of activities. Out of 198.6 ha under gross cultivated area, net cultivated area comprises of 78.8 ha (53.1 %), cultivable wasteland 79.9 ha, pasture land 1.5 ha, while rainfed area is 68.8 ha. In the field of crop planning a number of Integrated farming system models, mostly pond water based, were developed and implemented in the NICRA village sites. Organic farming was practiced through compost and vermiculture and use of *Trichoderma harzanium* was implemented to minimize the soil born diseases in this hot and wet climate. Vegetables like CIARI Brinjal-1, CIARI-Amaranthus, CIARI-Poi-1 and Sweet potato like CIARI-SP-1 and paddy like Sabhagi are generally recommended against drought conditions prevalent in the island. Promotion of HQPM maize variety was conducted as FLD in two farmers' fields. Following are the recommendations for different types of drought conditions. To combat early season drought (delayed monsoon) vegetables like CIARI Brinjal-1, leafy vegetables CIARI-amaranthus-1 and CIARI-poi-1 are specifically recommended. Besides, it is recommended for this situation broadcasting of seeds (Paddy cv. C-14-8), and preparation of community based nursery near the pond. For normal monsoon followed by 15-20 day dry spell, it is recommended life saving irrigation to the crops, short duration leafy vegetables like amarathus, Indian spinach, low water requirement crops like sweet potato and elephant foot yam, use of coconut/arecanut husk, and leaf and paddy straw mulching to the bed and coconut basin. For mid-season drought with long dry spells of 2 consecutive week rainless period it is recommended to grow CIARI Brinjal-1, leafy vegetables CIARI-Amaranthus-1 and CIARI-poi, broadcasting of seeds (paddy cv. C-14-8), preparation of community based nursery nearby pond. For terminal drought it is recommended to grow short duration green gram cv. CIARI-Mong -1 sown into the fallow land, sowing of perennial red gram (local) and sweet potato. Mass tree plantation is another major programme taken up which should mitigate climate change effect; but the effect through increasing C storage in plants and soil as a result of this practice may also be initiated possibly at 5-yearly intervals with respect to more areas covered. One unit of Napier grass fodder unit has developed in the village. Sudan grass and cowpea have been successfully demonstrated as fodder crops in barren or marginal lands. In waterlogged or flood prone areas it is suggested to introduce *Coix lachryma* jobi, for which the project may take the help of CSSRI, Regional Station Canning Town. It is urged upon to prepare the integrated farming module, specific to farmer's needs, in such way as to apportion the area with suitable fodders since there is acute shortage of the same for the cattle and other animals in the islands. The ICAR-IFGRI and NDRI may be collaborated with for this purpose. It is suggested that project may take up programmes to motivate and train farmers on establishing nursery for flower or other commercially important horticultural plants, and if possible, create polyhouse for round the year planning for which there are financial schemes available with the government and public sector undertakings.
Soil resource	Out of 81 ha areas under project sandy loam soils occupy 67.5 %, clay loam 31.1 %, red laterite 4.9 % area. Benchmark survey should be conducted, using NBSS&LUP or any other appropriate agencies having the relevant expertise, to identify representative land situations having distinct land and water availability characteristics. ATARI may organise and oversee that the project, with assistance from CRIDA, may work out 'soil health' indices , which together with benchmark data will help facilitate appropriate crop and water management strategies with focus on mitigating climate change, which will be important basis for crop planning in future. No such programme was initiated so far in the islands. Project has taken initiative to increase soil analyses up to 350 samples for which some facilities have been created in their laboratory. However, it is stressed that some more facilities for soil sampling and analyses may be created for which attention of ATARI is drawn. It is suggested as possibly necessary to extend routine soil analyses programmes (N, P, K, C, pH) to few other islands having diverse agro-ecologies like Havelock and Baratang and a few others at one year

	intervals on rotational basis so as to make an overall impression at the end of, say, 10 years of the impact of climate change on soil and plantations for which concurrent data on forest/plantation and crop yield for each site may also be documented.
Conservation tillage	This is regarded as an important practice to build up soil C and combat adverse impact of climate change, on which there are no studies made so far. Project/ATARI may take initiative to conduct such programmes in selected soils, cropping systems, and land topographies for which zero tillage equipments may be procured. Collaboration with CIMMYT or other appropriate agencies may be sought for this purpose.
Custom hiring of agricultural machineries	There were considerable interests shown by the farmers for custom hiring of agricultural machineries. The existing facility is of good use and may be augmented to provide such facilities like wheat thresher, maize sheller (bigger size), spray machines, zero tillage equipment, etc. There were large demands for bigger tractors for custom hiring.
Alternate farming practice & roles of women folks	The interest shown by womenfolk in the islands was exemplary as large numbers of women have always participated and took active part in the discussion. They have been in a number of cases found to own or take active physical part in farming also with inquisitiveness to learn and improve farming practice, a lesson for other areas to follow. The women folk have been taking active interest, get involved in direct farming activities, and take leading role in crop planning, animal husbandry and goatery. They have a desire to learn advance farming practices, input management and marketing of the farm produce. Following could be the areas for entrepreneurship where women also may take significant role. These are: (1) Preparation of feed concentrate as fodder supplement since grass/fodder alone may not suffice to feed cattle and animals, their health condition being in general very poor, for which collaboration may be sought with ICAR-NDRI. (2) Entrepreneurship like coconut shell handicrafts and oyster mushroom cultivation. (3) Low-cost rain shelter has been implemented in a few areas, which may be extended to larger areas with improved design to prevent crop damage from high intensity rains and heat stress during off-season, particularly useful for horticultural crops. (4) Establishing poly houses and nurseries for flower and other commercially important horticultural plants. (5) Construction of cross-ventilated poultry sheds and scientific cultivation of poultry, duckery, piggery and goatery with emphasis on introduction of local breeds resistant to survive under adverse conditions with high yielding ability, (6) Cultivation of ornamental fishes of commercial importance under protected systems. (7) Scientific/composite fish cultivation (including sale of fishlings) in ponds. (8) Frequent health camp of cattles and other domesticated animals including emphasis on AI of cattles, (9) Allied practices like apiary, mushroom, vermin-composting & composts out of local forest falls and other wastes, etc. Model alternate farming practices with agriculture at the epicenter should be introduced location-wise to ensure continuous flow of income on sustainable basis. This will also ensure production and use of more of organic composts for agriculture and build up soil organic Carbon.
VCRMC	VCRMC is advised to organize more awareness meetings among the famers of different land holding categories as well as in adjoining villages. Being a remote and difficultly accessible area the island ecosystem should strive to develop self reliant technologies, for which a major approach could be to set up small and medium scale industries on value addition of several local products. VCRMC should take a major role towards this, and project/ATARI may lend all possible help for this.
Marketing strategy	It is advisable for VCRMC to form cooperatives and fetch higher return for the farmers themselves by avoiding middlemen. The SHGs may also be useful for this purpose. The project may advise and encourage them.
Introduction of new plant species	The island ecosystem is an extremely rich repository of flora and fauna typical of surviving under these adverse climatic and soil conditions. The project may take special initiative through their own efforts and also encourage & train the farmers to identify new plant species for registration under PPVFRA.

Additional remark	The project personnel are working very hard to develop and implement technologies, but still there are lot of scope to increase its activities with systematic approach in a number of directions. A number of areas for future has been suggested, most of them will require collaboration with other agencies for which attention of ATARI is drawn for special initiatives to be undertaken considering the remoteness and thereby the need to become self-reliant as early as possible to combat extreme vulnerable nature of the islands to climate change, severe stress situations on a multiple of areas under normal circumstances, and extreme hardship under which the farmers and the personnel of the project are working. The soil laboratory at Port Blair should be more equipped as early as possible and personnel trained for this purpose.

Zonal Monitoring Committee visits KVK and NICRA villages at Port Blair

8. Convergence Programme

A number of interventions were taken up by NICRA KVKs during the year in convergence with developmental programs which are operational at the village level. Support from these developmental programs was used for scaling up of proven interventions in the village. In case of NRM, support was mobilized for various water harvesting structures, recharge structures, micro irrigation systems, polythene lining of farm ponds, deepening of drainage channels, distribution of green manuring seed to large number of farmers, tree planting including horticulture, *etc*. In crop production, convergence with line departments was used for increasing the spread of HYV of food crops, promotion of cultivation practices such as SRI, Direct Seeded Rice in various states. In case of animal husbandry, interventions such as animal vaccination camps, and health camps, timely availability of medicines, large scale production and availability of improved fodder crop seed, planting material and material for silage making were taken up in convergence. Capacity building of the farmers in NICRA villages was also taken up in convergence in the form of trainings and exposure visits as part of the ongoing programs. Efforts were made to enhance the coverage of theinterventions in the village with the support of the line departments through convergence.

Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development programmes or schemes during 2015-16. The prominent development schemes are MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram Sadak Yojana, BASF, NABARD, Sunderban Development Board, IWMP, Forest Department, IAP Yojana, RKVY *etc*. NICRA implementing KVKs being part of the different convergence programmes generated a handsome amount of Rs. **50062711/-** during 2015-16. The details of the different convergence programmes carried out by the KVKs are mentioned in the following table.

Table: Convergence of Ongoing Development Programmes/Schemes in NICRA implementing KVKs

KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
Port Blair	During the high tide period sea water are entered and affected 23 ha of paddy land at Port Mout village	Construction and repaired Sluice gate to check the sea water intrusion.	3,80,000.00
Total			**3,80,000.00**
Aurangabad	National Micro Irrigation System Project	Sprinkler irrigation system	1005237.00
	Adarsh Dairy Gram Yojna	Milk chilling plant	1482000.00
	Pradhan Mantri Gram Sadak Yojna	Construction of road (4 km)	17600000.00
	IAP Yojna	PACS godown	1769000.00
	National Agriculture Development yojna	PACS godown	1145000.00
	National Agriculture Development Yojna	Threshing floor	78000.00
	Animal Husbandry Department	Veterinary Hospital	4000000.00
	National Agriculture Development Yojna	Rice mil	3440000.00
Total			**30519237.00**
Banka	Soil Conservation	Advisory	
Total			

KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
Buxar	MGNREGA	Earth and Brick soling at DakshinTola, Earth work at PashimTola, CC floor of Middle school, Earth work at high school ground, CC Work of floor of Kannaya Vidyalaya, CC Work of floor of Harijantola, Earth work at kabir ground	4105500.00
Total			**4105500.00**
Jehanabad	MGNREGA	Field Bunding, Pyne Renovation	-
	Irrigation Department	Pyne Renovation	-
Total			
Nawada	MLA Fund	P.C.C. Road	199500.00
	MGNERGA	Renovation of Aahar(Ratoiya)	272500.00
	MGNERGA	Brick Soling	322474.00
	MGNERGA	P.C.C. Raod	472000.00
	14th Beet Aayog	Sinking	75000.00
	13th Beet Aayog	P.C.C. Raod	198500.00
Total			**1539974.00**
Saran	MGNERGA	Water harvesting structures, Renovation of Ponds and drainage channels/irrigation channels, land leveling and site development	-
	Department of Agriculture, Saran	National Mission on Oilseeds and Oil Palm, National Food Security Mission, National Horticulture Mission, State Plan for Promotion of Organic Agriculture, Rashtriya Krishi Vikas Yojana, Mukhya Mantri Tibra Beej Vistar Yojana, Village Seed Production Programme, Farm Mechanization	-
Total			
Supaul	ATMA/DAO	Vermi Compost Production.	120000.00
Total			**120000.00**
Chatra	WADI Project of NABARD with (TDF)	Plantation of fruit plants in 80(ha) area	350000.00
	MGNERGA	Construction of new pond under MANREGA	640000.00
Total			**4140000.00**
East Singhbhum	Fisheries Department	Fingerlings -150000	30000.00
	District Agriculture Officer	Vermincompost – 70 unit	350000.00
	ITDA, East Singhbhum	Power tiller-1 no, Paddy transplanter-1, Cultivator-1 no, Diesel pumset-2	480000.00
Total			**860000.00**
Godda	Creation of irrigation well under NRM	Installation of lift irrigation with the help of World Vision India. Installation of Drip with the help of Department of Soil Conservation	250000.00 40000.00
	Crop Production	Plantation of fruit tree with the help of Department of Horticulture, Demonstration of HQPM under NFSM by ATMA	19000.00
	Institutional Intervention	Construction of community platform through MNREGA	65000.00
Total			**349000.00**

KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
Gumla	MGNERGA	Well digging (No. - 02)	400000.00
	MGNERGA	Goat shed (No. – 08)	160000.00
Total			**560000.00**
Palamu	BAIF	Vaccination	50000.00
	Fishery Department, Palamu	Jeera, 70 Lakh	49000.00
	DAO, Palamu	Mize seed	14000.00
Total			**113000.00**
Cooch Behar	MGNERGA	Vermi-compost & Azolla production	350000.00
	TSP	Vermin-compost production	50000.00
	NABARD bank	Banana bunch cover	200000.00
Total			**5000000.00**
Malda	MGNERGA	Reconstruction of road.	650000.00
	MGNERGA	Reconstruction of drainage channel.	450000.00
Total			**1100000.00**
S. 24 Pgs.	IWMP	NRM	496000.00
	RKVY	NRM	780,000.00
Total			**1276000.00**
Grand Total			**50062711.00**

Convergence Programme through NICRA Project

9. Visit of Dignitaries

List of Dignitaries visited NICRA Villages during 2015-16

Name of KVK	Name of VIPs/Experts	Date of visit
Aurangabad	S. K. Ojha, District Agriculture officer, Aurangabad	25.06.2015
	Srikant Kumar, District Horticulture Officer, Aurangabad	23.12.2015
Banka	Dr. A. K. Singh, Ex Director, ICAR-ATARI, Kolkata	09.09.2015
	Dr. A.K. Jaisawal, Director, LAC Research Institute, Ranchi	16.10.2015
	Dr. R. K. Sohane, Director of Extension Education, BAU, Sabour, Bhagalpur	07.01.2016
Buxar	ZMC-NICRA Team comprising Dr. H. S. Sen, Ex Director CRIJAF, Dr. K. Sreenivas Reddy, CRIDA, Dr. A. Upadhyay, ICAR-RCER, Patna and Dr. F.H. Rahman, ICAR-ATARI Kolkata	21.05.2015
Chatra	Sri. Amit Kumar, DC Chatra	31.01.2016
	Smt. Sweta Kumari, DDM, NABARD	
	Sri. Ashok Kumar Singh, District Agriculture officer, Chatra	
	Sri. Ashok Ram, District Soil Conservation officer, Chatra	
	Md. Zulkal Nain, Chief Beuro, Dainik Jagran (Hindi News paper)	31.10.2015
	Sri. Santosh Kumar, ETV Bihar Jharkhand	
Cooch Behar	Prof. T. K. Hath, Director Research, UBKV, Cooch Behar	09.07.2015
	Mr. Asish Das, DDM, NABARD Bank, Cooch Behar	
	Dr. Prabhat Pal, Head of Dept., Dept. of Agril. Extension, UBKV	29-30.03.2016
East Singhbhum	Smt. Sonia Samant, Chairman, Zila Parishad, East Singhbhum	15.09.2015
	Dr. Jitendra Kumar Sinha, DAHO, East Singhbhum	17.10.2015
	Sri Kalipada Mahato, District Agriculture officer , East Singhbhum	15.11.2015
Godda	Dr. A. K. Singh, Vice-Chancellor, BAU, Sabour (Ex Director, ICAR – ATARI, Kolkata)	13.10.2015
	Sri Laxman Oraon, District Horticulture Officer , Godda	04.11.2015
	Sri Rakesh Kumar Singh, Dy. P. D., ATMA, Godda	02.03.2016
Gumla	Smt. Premi Devi, Block Pramukh, Ghaghra	22.07.2015
	Arun Oraon, Block Development Officer, Ghaghra	
Jehanabad	ZMC-NICRA Team comprising Dr. H. S. Sen, Ex Director CRIJAF, Barrokpore, Dr. K. Sreenivas Reddy, CRIDA, Dr. A. Upadhyay, ICAR-RCER, Patna and Dr. F.H. Rahman, Principal Scientist, ATARI, Kolkata	20.05.2015
Nawada	Dr. Dilip Monga Head, CICR, Regional Station, Sirsa ,Haryana	07.05.2015
	Sri Dharmweer Pandey , Deputy Director (Agril), Gaya , Bihar	22.07.2015
	Dr. S. P. Poonia , Research Platform , Coordinator , CSISA-CIMMYT , ICAR-RCER, Patna	01.09.2015
	Dr. S. M Abbas , Chief Geologist (ret) O.N.G.C, Dehradun	03.11. 2015
	Sri Ashwini Kumar , P.D. ATMA , Nawada	04.02.2016
Koderma	Sri Sandeep Kumar Bakshi, Jabalpur Organic Farming	16.03.2016
Palamu	Dr. Gorge Joseph, Vice- Chancellor, BAU, Ranchi	31.10.2015
	Dr. D. K. Singh Dron, Director of Research , BAU, Ranchi	
	Dr. R. P. Singh, Director of seed and farm, BAU, Ranchi	
	Admond Minz, District Agriculture officer , Palamu	07.12.2015
	Umes Prasad, District Horticulture Officer, Palamu	04.02.2016

Port Blair	Dr. S. Dam Roy, Director, ICAR-CIARI, port Blair	13.11.2015 & 13.03.2016
	Dr. V U M Rao, P C , AICRPAM and Dr. K. V. Rao , PS I/c NICRA-TDC, Hyderabad	20.01.2016
	ZMC-NICRA Team comprising Dr. H.S. Sen, Former Director CRIJAF (ICAR), Dr. P. Nanda Principal Scientist, ICAR-Indian Institute of Water Management and Dr. F.H. Rahman, Principal Scientist, ATARI, Kolkata	15-18.03.2016
Saran	ZMC-NICRA Team comprising Dr. H. S. Sen, Ex Director CRIJAF, Barrokpore, Dr. K. Sreenivas Reddy, CRIDA, Dr. A. Upadhyay, ICARRCER, Patna and Dr. F.H. Rahman, Principal Scientist, ATARI- Kolkata	22.05.2015
Supaul	Dr. R. K. Sohane, Director of Extension Education, BAU, Sabour	19.06.2015
	Dr. Umesh Singh, Principal, MBAC, Agwanpur	25.01.2015
South 24 Paraganas	Heads of different KVKs of Assam, Nagaland, Orissa	13.01.2016
	Prof. Saon Banerjee, Faculty of Agro Physics and Meteorology, BCKV	21.01.2016
	Dr. Ronika Chakraborty, Assistant Professor, Lancaster University, UK	08.03.2016






Dignitaries visited NICRA- KVKs

10. Success stories of NICRA Village Farmers

(i) Amelioration of cultivated acidic soil

Name: Anchar Ali and Khalirur Rahman
Village : Khagribari, Dist: Coochbehar, WB

A study was conducted to find out the ameliorative measures taken by KVK to amend the acidic nature of

soil since inception of NICRA activities at the village Khagribari. Average pH of 100 nos. of samples tested during 2011-12 indicated that average pH value was 5.34 being minimum of 4.92 and maximum of 6.04. During the year 2011-12 to 2014-15 liming was done once either during rabi before potato or during pre-kharif before jute in each year. Subsequently soil samples were collected from same plots during this year and results of analysis

further clearly indicates a rise in pH and gradual shifting of acidic nature towards neutral. pH of 100 samples tested during this year ranges from 5.4 to 6.31 with an average of 5.86.

(ii) Improved irrigation system in Harigaon village

Village: Harigaon
Dist: Aurangabad, Bihar

In NICRA village Harigaoun a channel of 2.3 km was very poor condition. This channel was affected by siltation and very low quantity of water save during rainy season but not sufficient to irrigate paddy crop in kharif. History of this channel was very much sufficient to

irrigate paddy, wheat & other rabi crop as well as summer crops. After the survey in 2013-14 VCRMC decided to rejuvenation of this channel. In 2014-15 2.3 km channel was rejuvenated at 10fit depth and 25fit top width. After rejuvenation of channel approx 270000 m^3 water stored

in rainy season. This was sufficient to irrigate paddy during early withdraw of mansoon. Increase in wheat yield due to application of 3 irrigations at critical growth stages previously farmers apply one or no irrigation for cultivation of wheat as well as use of sprinkler irrigation in pulses. In this village farmers not cultivate any summer crop but after that they cultivate summer moong and til. In 2014-15 21 ha area under summer moong in 2015-16 25 ha area under moong and 10 ha area under Til. Ground water also recharged and increase water table up to 3fit near the channel. Availability of water for animal and human in peak summer period.

(iii) Integrated Farming-A source of Income

Name: Suresh Singh
Village – Sakrorha, Dist: Jehanabad, Bihar

Mr. Suresh Singh is a progressive farmer of village Sakrorha of Jehanabad district, Bihar. His educational qualification is matric. After matriculation he was selected for several jobs like- sipahi in Army, VLW on Block level & in Indian Railway but due to his keen interest in Agriculture he sacrificed the job and completely involved

in Agriculture. Initially he did only traditional farming. In 2011 a project NICRA was launched in his village through KVK, Jehanabad to face draught like situation. From that time he is continuously in touch with KVK, motivated & inspired by KVK scientists.

He started a goat farm in his village. The farm was established with six local goats reared under stall fed intensive management. Initially he faced number of problems like high cost of production, mortality & low price of produce but goatry has been the successful venture for Mr. Suresh Singh after the arrangement of

one pair of goat (Sirohi breed) for breed up gradation by NICRA Project. Accordingly Mr. Suresh Singh introduced changes in his goat farm by receiving technical guidance from the scientist of KVK on health management of goat, consequently his goat farming project become viable & profitable.

A pond was renovated in the field of Mr. Suresh Singh under NICRA project as rain water harvesting structure after that he started integrated farming system near his pond. He has vermicompost unit, goat farm, duck farm, poultry farm, dairy farm, vegetable production near his pond. Plantation around pond like tick wood, Shisom, Guava.

He also uses following modern agricultural implements for performing agricultural operation on time.

1. Zero tillage machine to save agricultural inputs like seed, fertilizer & water.
2. Sprinkler system to irrigate wheat & pulses.
3. Power reaper for harvesting of wheat, paddy & Jai.
4. Rotavator for quality field preparation.

(iv) Impact of Lift irrigation device on agriculture expansion in Rabi and Summer season

Name: Baiju Pahan
Village: Gunia, Dist: Gumla, Jharkhand

Shri. Baiju Pahan is a 25 years old farmer of Gunia Village & dropout from the school at the age of 15 and use to migrate every rabi and summer season to other state for family food. His field is 1 km away from his house but it was uncultivated due to lack of irrigation facilities and due to financial problems he was unable to invest on irrigation system, although there is small perennial river (Masaria).

In 2012 KVK Gumla under NICRA project established a Micro lift irrigation system on Masaria river near by his field. In 2014 he took 3 acre land on lease and started

cultivation of wheat (1 acre), Mustard (1 acre) and bottle gourd (1 acre).

Shri Bhagat became an example for others farmers in the village and inspired other farmers to start summer

vegetables cultivation like Bottle gourd, Okra, Cow pea, Tomato and other vegetables. After establishment of Micro irrigation lift system 12 ha of fallow land is converted in cultivable land during summer season. During scarcity of water (rainfall) about 25 ha of area is also irrigated through this lift irrigation system in kharif and rabi season. This intervention increased cropping intensity of village about 250%.

Impact:-

Impact factor	Area (ha)	Before Adoption Net income (Rs.)	After Adoption Net income (Rs.)
Agricultural Practice			
Wheat (var-K-9107)	0.4	4000.00	7900.00
Mustard (var – Pusa mahak)	0.4	-	6000.00
Bottle gourd (var. – Warad)	0.4	-	26000.00
Total	**1.20**	**4000.00**	**39900.00**

(v) Fish Farming

Name: Uday Singh
Village: Murma, Dist: Palamu, Jharkhand

In spite of being a high rainfall district (1200 mm). The climate becomes hot and dry during the summer with serious water scarcity. The rainy season starts from mid – June and continues up to October. Usually the winter season lasts from October to February with maximum temperature of 30^0C. Summer season starts from March

and continues up to mid-June with temperature sometimes touching as high 48^0C.

Erratic rainfall at the onset and during crop growth period is a major issue resulting in periodic crop failures and drought impacting agriculture and livelihoods. However, the high rainfall and frequent high intensity rain events are great opportunity to store water and use for critical / life saving irrigation.

Sri udai singh is a progressive farmer of Palamu district .He was doing work in the field of fish farming. He got training from KVK, Palamu and other national organization (such as National Fishery Development Board Hyderabad) in the farming in a common pond of village murma. He has form a committee named as "मुरमा

मलय मत्सय जीवी सहयोग समिति" with help of KVK, Palamu. 71 family involved this village and he is active member of the committee. He purchase spawn of fish such as Kalta, Rahu, Miral and grass carp from Ramsager, Westbangal and got production of fish as about 15-20 quintal per season as a community approach.

(vi) Relay Cropping

Name: Umeshwar Kumar Singh
Village: Affaur, Dist: Saran, Bihar

Shri Umeshwar kumar Singh evolved relay cropping of vegetables with paddy [Brinjal-Tomato-cucumber/long melon-Paddy]. Sowing of brinjal in nursery was done by 15th August and transplanting in the main field by 15th September at 6 feet ×3 feet distance on permanent beds. Seedlings of Tomato were raised in a separate nursery in last week of November and transplanting was done in between the rows of brinjal at a distance of 4 feet. The plant geometry was so maintained that there was no shading effect of Brinjal on tomato. Now cucumber and long Melon was sown directly in between the plants of tomato at a distance of 2 feet by 25th February or the atmospheric temperature was around 22-23°c. The creepers were allowed to grow on the ground and no staking was done. To prevent the fruit from soil contact natural mulch of grass, weeds and paddy straw was done. For managing probable nocturnal insect pests inhabiting in the grass mulch, Neem based insecticide was used prepared by the farmers himself. Sesbania was grown in the field by 25-30th May and it was incorporated in the field at 45 days duration irrespective of monsoon break with supplemental irrigation. Short duration paddy was then taken in the field after puddling. Thus farmers get could get gross economic return of Rs. 60000.00 from one ha of land.

Transplanting of Brinjal on Permanent Beds

Transplanting operation of tomato in between rows of brinjal

Sesbania taken after cucurbits

Paddy after Sesbania

11. Newspaper coverage


दैनिक जागरण

कृषि के लिए वरदान साबित हुआ जल संरक्षण


श्रमदान से ग्रामीणों ने दुरुस्त किया चेकडैम


औरंगाबाद-आसपास

स्प्रिंक्लर साबित हो रहा वरदान


निक्रा ने मेढ़ा गांव को लिया गोद, छाएगी हरियाली


दैनिक जागरण

बक्सर जागरण


अरहर व चना की खेती के लिए आगे आया केवीके


हिन्दुस्तान

100 किसानों को मिला स्मार्ट किसान का सम्मान


पलामू प्रमंडल

पलामू में बारिश ने 13 साल का तोड़ा रिकॉर्ड, 29.5% भूमि पर रोपनी


दैनिक जागरण

शिविर में हुई पशुओं की जांच


The Daily Telegrams


The Daily Telegrams

Soil health cards to be given


गुमला जागरण

नदी पर बांध बनाकर ग्रामीणों ने रोका पानी

जिला कृषि विज्ञान केन्द्र के प्रयास से निक्रा किसानों में आशा का संचार


गुमला

भारी बारिश से जनजीवन-कारोबार ठप

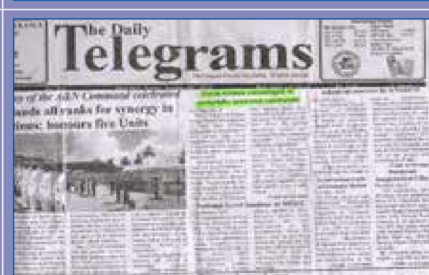

'निकरा' ने मरदनपुर के किसानों को दिखाई राह


दैनिक जागरण

बीज उत्पादन से बढ़ाएं आमदनी


हिन्दुस्तान

जैविक खाद का करें उपयोग


The Daily Telegrams


बकरी गरीबों का एटीएम : डॉ शारदा

12. Publications

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Singh A K, Ghosh D, Rahman F H, Das K S and Mondal S K. 2016. Effective soil health management for profitable agriculture. In: Souvenir of Eastern Zone Regional Agriculture Fair 2016 on "Shaping profitable agri-enterprises with effective soil health management" held at Orissa University of Agriculture and Technology, Bhubaneswar during February 2016.

13. Expenditure Statement of 17 KVKs during 2015-16

Table. Expenditure details during 2015-16

Zone/KVK	RE for 2015-16 (Rs. in lakh)				Expenditure from 01.04.15 to 31.03.16 (Rs.)	Closing Balance on 01.04.16 (Rs.)
	Contingencies	TA	NRC	Total		
ATARI Kolkata	5.50	2.25	2.00	9.75	897645.00	77355.00
Aurangabad	7.25	0.25	4.25	11.75	1175000.00	1175000.00
Buxar	6.25	0.25	4.25	10.75	847598.00	227402.00
Chatra	7.50	0.25	4.25	12.00	1199000.00	1000.00
Cooch Behar	7.25	0.50	4.25	12.00	1173281.00	26719.00
E.Singhbhum	6.25	0.50	4.25	11.00	1098000.00	2000.00
Gumla	7.00	0.75	5.25	13.00	1256442.58	43557.42
Jehanabad	6.50	0.30	4.25	11.05	1143807.00	(-) 38807.00
Koderma	6.25	0.25	4.25	10.75	772850.00	302150.00
Malda	6.25	0.50	4.25	11.00	394840.00	515160.00
Nawada	7.00	0.25	4.25	11.50	1103134.00	46866.00
Palamu	6.75	0.50	4.25	11.50	947630.00	202370.00
Port Blair	6.50	1.00	4.25	11.75	765319.00	409692.00
Saran	7.00	0.25	4.25	11.50	1143333.00	6667.00
South 24 Pgs.	7.50	0.50	4.25	12.25	1223770.00	8680.00
Supaul	6.25	0.20	4.25	10.70	877151.00	192849.00
Banka	8.50	0.25	7.00	15.75	1556303.00	18697.00
Godda	8.50	0.25	7.00	15.75	1550000.00	25000.00
Total	124.00	9.00	80.75	213.75	19125103.58	-

Annexure -1

Contributors - NICRA KVKs of Zone II

Sl. no.	KVK / District	State	Contributors
1.	Aurangabad	Bihar	Dr. Nitya Nand
2.	Banka	Bihar	Dr. Kumari Sarda
3.	Buxar	Bihar	Dr. R. C. Verma and Dr. Deokaran
4.	Jehanabad	Bihar	Dr. Shobha Rani
5.	Nawada	Bihar	Er. S. K. Misra
6.	Saran	Bihar	Dr. R. K. Jha
7.	Supaul	Bihar	Dr. S. K. Choudhary
8.	Chatra	Jharkhand	Dr. R. K. Singh
9.	East Singhbhum	Jharkhand	Dr. Arti Ekka
10.	Godda	Jharkhand	Dr. Ravi Shanker
11.	Gumla	Jharkhand	Dr. Sanjay Kumar
12.	Koderma	Jharkhand	Dr. Chanchila Kumari
13.	Palamu	Jharkhand	Dr. L. K. Das
14.	Coochbehar	West Bengal	Dr. Sanjay Kr. Das and Dr. Sujan Biswas
15.	Malda	West Bengal	Dr. Prabir Ganguly
16.	S. 24 Pgs	West Bengal	Dr. N. J. Maitra
17.	Port Blair	A & N Islands	Dr. Nagesh Ram