Annual Report 2014 -15

NATIONAL INNOVATIONS ON CLIMATE RESILIENT AGRICULTURE

ICAR-Zonal Project Directorate, Zone-II
Indian Council of Agricultural Research
Bhumi Vihar Complex, Sector-III, Block-GB
Salt Lake City,Kolkata-700 097

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PREFACE

A K Singh

National Innovations on Climate Resilient Agriculture (NICRA) is a multi-institutional, multi-disciplinary network project launched by Indian Council of Agricultural Research in 2011. The project aims to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. 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 15 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. Two more districts from the zone have also been included from this year for implementing the activities in various interventions. 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 Zone II for 2014-15 depicts an assessment of endeavour put forth by the selected 15 NICRA KVKs in the climatic vulnerable districts under close supervision and guidance of Zonal Project Directorate 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 Annual Report 2014-15 has incorporated all the relevant and required information pertaining to accomplishment of Zonal Project Directorate, Zone II and achievement of selected 15 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. S. Ayyappan, Secretary, DARE and Director General, ICAR, Dr. A. K. Singh, Deputy Director General (Agricultural Extension), Dr. Ch. Srinivasanrao, Director and Dr. Y. G. Prasad, Coordinator (NICRA-TDC), CRIDA and other officials of Division of Agricultural Extension, ICAR for providing guidance and help in compiling the Annual Report 2014-15. I acknowledge the assistance received from the Directors of Extension Education of State Agricultural Universities of this zone and cooperation of all the selected 15 NICRA implementing KVKs in providing information in time. The support and help rendered by all the staff of ZPD, Zone II are duly acknowledged.

Kolkata
04.07.2015

A K Singh
Zonal Project Director

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Executive Summary

Fifteen KVKs of Zone II carried out the different activities under Technology Demonstration Components in various module benefitting 62461 farmers (NRM- 10461, crop production- 5405, Livestock and fisheries- 7527 institutional interventions- 3386, capacity building- 11381 and extension activities- 24301).

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 & RWH, 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 1574.4 ha area which benefitted 10461 practicing farmers in Zone-II.

Under Crop Production module different area specific intervention were taken by the 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 crop/pest/disease management, growing vegetables as contingency crop, integrated crop management, integrated disease management, contingency crop, covering 1162.0 ha area which benefitted 5405 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 7887 animals, produced fodder in 165.5 ha area benefitted 7527 livestock owners in Zone-II.

Institutional Interventions including strengthening 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 523 units covering of 165.5 ha area of 3386 number of farmer 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 is operational with 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 were 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 been generated. VCRMC constituted by Gumla KVK at Manjhila village generated maximum amount of Rs. 21370.00 during 2014-15.

A total 552 courses were conducted under Capacity Building on various thematic areas benefitting 11381 farmers and farmwomen (9310 males and 2071 females) during 2014-15. 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 2115 Extension Activities on various thematic areas benefiting 24301 practicing farmers (19402 males and 4899 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 15 KVKs have celebrated 86th ICAR Foundation Day at the respective KVK and adopted village on 16th July 2014 where 100 progressive farmers were felicitated in each of NICRA-KVK.

1. INTRODUCTION

National Innovations on 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 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

* Additional KVKs since 2015-16

Villages adopted by NICRA implementing KVKs of Zone II.

Name of KVK	Name of village
Aurangabad	Harigaon
Jehanabad	Sakrorha
Nawada	Majhila
Saran	Darihara
Supaul	Sadanandpur
Banka	Mehra (Proposed)
Buxar	Kukurha
Chatra	Mardanpur
East Singhbhum	Lowkeshra, Barunia and Pathargora
Gumla	Gunia
Koderma	Chopanadih
Godda	Bara and Gunghasa (Proposed)
Palamu	Dulsulma and Murma
Cooch Behar	Khagribari
Malda	Brozolaltola, Meherchandtola, Jayramtola and Mahendrotola
South 24 Parganas	Bongheri
Port Blair	Badmaspahad and Port Mount

2. INTERVENTIONS WITH MODULES

MODULE I: NATURAL RESOURCE MANAGEMENT

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.

MODULE II: CROP PRODUCTION

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 shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water.

MODULE IV: INSTITUTIONAL INTERVENTIONS

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 was on augmenting rainwater availability through its efficient use by adopting site-specific rainwater harvesting strategies. Similarly, soil types varied too from deep vertisols to medium and shallow alfisols. Hence, the runoff and infiltration capacity; therefore the water harvesting potential also varied. In high rainfall vertisol areas runoff was harvested in farm ponds for tiding over mid-season droughts. In low rainfall shallow alfisols, the runoff was harvested in percolation ponds, trench come bunds and CCTs for facilitating infiltration and re-charging of groundwater. 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; improved drainage in flood prone areas; conservation tillage whare 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 11.3 lakh cu m leading to increase cropping intensity by bringing around 650 ha of area under protective irrigation regime. More importantly some of the technical and institutional interventions on optimizing pond size and groundwater sharing have drawn the attention of the state government for mainstreaming in regular programmes. These initiatives paved way to better crop productivity and higher profits due to augmented rainwater availability and its improved management. Thus, NRM interventions rightly played the role of flagship interventions.

2.1.1 In-situ Moisture Conservation - Resource Conservation Technology: In-situ moisture conservation

through resource conservation technology demonstrated in 15 NICRA adopted villages covering 391 farmers in 81.8 ha area. The performance of different technologies by the various KVKs is presented in the following table.

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)	53	15.5	31.3	19300	18260	1.94
Green manuaring (dhaincha) in Paddy (Var. Lalat)	96	21.0	35.5	21400	21200	1.90
Brown manuaring in Paddy (Var. Anjali)	16	2.5	24.6	16300	13220	1.81
Azolla in Paddy (Var. Lalat)	3	1.0	32.3	19500	19220	1.98
Zero Tillage in wheat	35	9.0	32.5	18200	20512	2.12
Repair of bund	12	3.5	28.5	17500	12650	1.72
In- situ moisture conservation through Land leveling for brinjal	16	7.0	288.8	42259	135191	4.20
Up gradation of monocropped land to multiple one with integration of fish	3	0.9	165.5	28400	22950	1.80
Optimization of horticultural production through land embankment development	6	0.3	185.5	21500	17525	1.81
Optimization of horticultural crops through land embankment	24	7.3	65.0	52700	60200	2.14
Organic mulching in vegetables (Tomato, Var.- Rakhi)	10	1.0	256.2	57540	72500	2.26
Mulching	60	4.0	200	50000	52000	2.04
Plastic mulching Okra, cucumber	16	0.3	30	3000	4500	2.50
Use plant leaf mulching in ginger	26	7.5	531.0	397000	943000	3.37
Use paddy straw, forest leaves in elephant foot yam	15	1.0	300.0	280000	320000	2.14
Total	**391**	**81.8**				

Organic Mulching

Land shaping technology for multiple cropping

Polythene mulching in Cucumber

Azolla in Paddy

2.1.2 Water harvesting and recycling for supplemental irrigation: Water harvesting and recycling for supplemental irrigation were demonstrated in 15 NICRA adopted villages by the different KVKs involving 1070 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	39	25.9	40.0	70000	370000	6.2
Construction of canal	110	2.2 (km)	-	-	-	-
5% Model	6	6.0	35.0	50000	60000	2.2
Bora bandh	160	6.0	40.0	35000	40000	2.14
Renovation of Well for irrigation	65	24.8	40.0	10000	4000	1.4
Bund making leveling in paddy field	45	15.0	35.7	30240	18060	1.59
Natural mulching in brinjal field	7	3.0	288.8	42259	135191	4.20
Digging of small pits in Diara land for cucubits	6	3.0	-	43291	120708	3.78
New water harvesting structure in the paddy field	1	0.2	33.6	31334	12265	1.39
New water harvesting structure in the wheat field	1	0.2	35.7	30240	15759	1.52
Renovation of old water harvesting structure in paddy field	93	26.6	42.0	106299	67722	1.63
Raising of land embankment in brinjal field	24	4.0	200.0	43291	128909	3.98
Ground water recharge	42	9.0	-	-	-	-
Renovation of check dam for long gourd	12	12.0	168.0	34011	70989	3.09
Tank silt application in bitter gourd field	22	5.0	142.0	34421	85279	3.48
Construction of new pond for wheat	57	7.5	-	-	-	-
Desiltation of defunct water harvesting structures	3	0.4	-	-	-	-
Renovation of pyne	225	4000 (ft)	-	50000	-	-
Renovation of irrigation channel	2	20.0				
Check dam construction	150	85.0				
Total	**1070**					

Bora bandi

Renovated pond

Check dam construction

Irrigation through 5% model

Before and after De-silting of channel

2.1.3 Conservation tillage: Conservation tillage in wheat, paddy, lentil, pea and chickpea demonstrated in 15 NICRA adopted villages in an area of 231.2 ha of 395 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 35-42 q/ha. Zero tillage technology showed very promising results in pulse and oilseed cultivation. Pea (Var. Arkel) gave highest economic return (B:C ratio of 2.75) 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	70	43.0	40.0	70000	75000	2.07
Sowing of paddy with ZTD machine	65	41.0	42.0	65000	72000	2.10
Sowing of lentil with ZTD machine	62	42.0	20.0	57000	55000	1.96
Sowing of chick pea with ZTD machine	55	42.0	17.0	80000	100000	2.25
Sowing of paddy with power tiller	68	33.7	40.0	55000	50000	1.90
Sowing of wheat (K-9107) with ZTD	50	19.5	35.0	30000	25000	1.83
Sowing of pea(Arkel) with ZTD	25	10.0	24.0	40000	70000	2.75
Total	**395**	**231.2**				

Zero Tillage

2.1.4 Artificial ground water recharge: Artificial ground water recharge done by field bunding, water management and ground water recharge through SRI by sub soiler in paddy in 9 NICRA adopted villages covering 64 ha area in 86 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (54 q/ha) and benefit: cost ratio of 2.23.

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 12 NICRA adopted villages covering an area of 71.1 ha in 310 farmers fields.

Bunding in paddy field

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	21	12.0	35.24	23200	15628	1.67
Water management through bunding of paddy fields (2.5 fit height and width 9 inch width)	50	45 .0	43.5	20000	12400	1.62
Ground water recharge through SRI by sub-soiler	15	7.0	54.0	33644	41417	2.23
Total	**86**	**64.0**				

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	35	12.0	33.5	23200	17000	1.73
Application of biofertilizer in rice (var. MTU 7029)	85	32.8	67.2	31640	55500	2.75
Vermi-compost from biodegradable wastes	35	-	15.7	4100	3700	1.90
Production of pigeon pea (var. PRG-158) on farm bund	20	0.8	15.3	23947	37500	2.56
RBF in Brinjal	25	2.0	253.0	59810	61000	2.01
LEWA in rice (var. Rajendra sweta)	15	4.0	54.2	30970	38000	2.23
Sprinkler irrigation in rai (var. Bio-902	14	4.0	15.0	17000	39000	3.29
Sprinkler irrigation in green gram(Var. HUM-16)	10	2.5	18.0	12600	33000	3.61
Sprinkler irrigation in lentil (Var. Arun)	21	6.0	18.5	16000	39000	3.43
Sprinkler irrigation in chickpea (Var. PG-186)	25	6.0	12.2	13450	22000	2.63
RBF in cucumber (Var. Malini)	25	1.0	305.0	91525	119675	2.30
Total	**310**	**71.1**				

2.1.6 Other Demonstrations: Demonstrations like oyster mushroom cultivation, effective utilization moisture through seed production of blackgram, in-situ vermicomposting in orchards, soil test based nutrient application, cleaning & 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 1047 farmers' fields. Out of these demonstrations on in-situ vermicomposting in orchards showed highest economic return.

Table. Performance of other demonstration

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 (Var. WBU-108 & PU-30) after flood	180	22.0	14.5	12500	44000	4.52
In-situ vermicomposting in orchards	25	6.0	107.0	30000	195200	7.50
Soil test based nutrient application	405	240.0	42.0	31000	25000	1.80
Cleaning & renovation of old farm pond	100	4.0	-	60000	120000	3.00
Renovation of old water harvesting structure (Well)	25	4.0	-	20000	35000	2.75
Planting forest trees (700 Bel) plant for biodiversity, forestation	40	6.0	-	-	-	-
Soil test based nutrient application (FYM/ inorganic fertilizer)	202	26.0	-	5000	11000	3.20
Bio pesticides in tomato	25	5.0	159.3	50000	121750	3.43
Dolomite in paddy	35	11.0	23.7	16000	9000	1.56
Cultivation of high yielding grass on farm bund	10	5.0	-	6000	13000	3.16
Total	**1047**	**329.0**				

2.1.7 Rainwater harvesting structures created: There were 421 number of rainwater harvesting structures have been developed which could store 1130323 cu m of water. This intervention increased the cropping intensity to the maximum extent upto 425%. 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 created during 2014-15

KVK	RWH structures	No.	Storage capacity (cu m)	No. of farmers benefited		Protective irrigation potential (ha)		Increase in cropping intensity (%)
				Before	After	Before	After	
Port Blair	New Pond	3	6294	0	6	0	0.8	50
	Rain shelter	2	1307	0	5	0	0.8	50
Aurangabad	Pond	9	12882	0	9	0	7.0	100
	Canal	1	171000	0	110	0	2.2	120
Buxar	Farm pond	7	7554	0	15	0	5.5	82
Jehanabad	Pond	4	8000	0	560	0	85.0	100
Nawada	Pyne	2	31990	0	105	0	30.0	76
	Well	11	440	0	225	0	15.0	45
	Pond	4	9085	0	40	0	30.0	100
Saran	Pond	5	39959	5	159	10	31.0	73
	Inlet Channel	1	2880	0	23	1	2.0	43
	Inlet Channel	1	2160	0	24	0.5	1.5	53
	Leveling of land eroded due to flood	2	0	0	226	0	0	59
	Leveling	20	0	0	10	0	0	72
	Bund Making	30	0	0	25	0	0	25
Supaul	Drainage channel	2	350	0	80	0	0	100
Chatra	Well	5	200		50		1.0	75
East Singhbhum	5% Model	40	150	0	50	1	6.5	425
	Pond Renovation	2	44577	5	50	2	14.0	220
Gumla	Renovation of Pond	4	52926	15	25	14	25.0	45
	Bora bandh (Temporary check dam)	6	55926	0	78	0	110.0	220
Koderma	Defunct pond	3	29000	20	100	8	22.0	45
	Repaired well	6	200	24	25	5	20.0	45
Palamu	Well	35	1400	400	750	15.0	22.0	70
	Pond	5	53200	1600	2300	4.0	9.0	85
	5% model	55	300	0	1300	0	3.0	72
Cooch Behar	Farm Ponds	21	61220	36	77	10.1	20.0	120
Malda	Small ditches for jute retting	65	4260	0	205	0	17.0	-
S. 24 Pgs.	Landshaping and rain water harvesting structure	35	45044	0	40	0	9.0	100
	Renovated defunct water bodies	34	122258	0	40	17	38.0	100
	Renovated 4 Km long canal	1	365760	0	450	0	121.9	100
Total		**421**	**1130323**	**2105**	**7162**	**87.5**	**649.2**	**91.5**

Renovated Canal

Renovated Ahar

Renovated well

Renovated pond

2.2 MODULE II: CROP PRODUCTION

2.2.1 Introducing drought resistant varieties: Under crop production module introduction of drought resisitant varieties of paddy, brinjal, niger, maize pigeon pea, and ragi were demonstrated in 15 NICRA adopted villages involving 2143 number of farmers in 533.23 ha area. Performance of the different drought resistant varieties of various crops is presented in the following table.

Demonstration of Sahbhagi

Demonstration of HD 2967

Demonstration on Sweet Potato

Demonstration on Sunflower

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)	358	80.7	244.2	190.9	221.3	51000	58340	2.14
Drought resistant paddy (Var. Anjali)	152	67.0	126.0	112.0	87.4	34500	22900	1.67
Sowing of drought tolerant paddy (Var. Sahbhagi) with ZTD machine	45	10.0	65.0	60.0	80.0	29750	42750	2.43
Sowing of drought tolerant paddy (Var. Sahbhagi) with Drum seeder machine	50	8.0	48.5	35.0	55.6	26975	40565	2.50
Drought tolerant paddy varieties (Var. Naveen)	25	7.0	85.7	60.3	111.1	35600	33200	1.93
DSR Transplanting (Var. Sahbhagi	35	22.0	38.5	25.9	55.0	30200	32200	2.06
DSR Transplanting (Var. Abhishek)	42	28.0	45.5	35.2	60.4	32500	35700	2.09
Tolerant Varieties to submergence	22	42.0	45.0	36.0	45.7	30528	37482	2.23
Maize (Var. Suwan-1)	722	129.7	229.2	123.6	327.2	91167	182883	2.00
Maize (HQPM - 1)	89	10.0	42.0	30.1	40.0	90560	183995	2.03
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, MAL-13, PRG153)	95	25.0	20.8	15.4	35.5	18850	48950	3.59
Drought tolerant pigeon pea (Var. ICPL- 858063)	20	2.3	14.0	9.0	44.8	17000	29000	2.70
Niger (Var. Birsa Niger -1)	23	2.0	4.0	2.8	23.2	7260	4000	1.56
Niger (Var. Birsa Niger -3)	27	10	4.60	2.9	61.4	8500	5300	1.62
Red gram (Var.-PGR-158)	14	1.5	15.2	9.2	35.6	16350	18560	2.13
Horse gram (Var. Birsa kulthi-1)	28	4.0	15.3	9.3	45.1	12400	13560	2.09
Contingent Crops Horse gram	35	6.0	20.0	13.0	55	33167	34833	2.05
Drought resistant brinjal (Var. CARI- Brinjal -1)	15	3.0	21.0	9.5	135	120000	150000	2.25
Draught tolerant variety DBU -14	46	18.0	38.0	32.0	28.3	33240	20759	1.62
Short duration variety (Var. Pukkhraj)	50	14.5	258.0	1415	22.6	49000	111000	3.26
Drought resistant Dhania (Var. CARI broad Dhania-1)	10	1.0	1.0	0.4	160	14500	24500	2.68
Wheat (HD- 2967)	22	4.0	44.4	35.8	24.0			-
Sunflower (KBSH-53)	32	4.6	Yet to be harvested					
Sweet Potato (Sree vardhini)	14	0.9	Yet to be harvested					
Total	**2143**	**533.3**						

Drought tolerant paddy varieties like Sahbhagi, Anjali, Naveen, Abhishek were demonstrated in 222.7 ha areas of 707 number of farmers' field. Among all these varieties cultivation of Sahbhagi variety with drum seeded showed highest yield potential (48.5 q/ha) and economic return (B:C ratio of 2.50) with maximum increase (55.6%) as compared to local check.In the demonstrations under pulse and oilseeds, ICPL- 858063, Mal- 13 and PRG 153 varieties of pigeon pea gave the maximum economic return (B:C ratio of 3.95).

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 66.5 ha area in 120 farmers' fields. Javarva, Geetanjali and Amalmona varieties proved maximum salt tolerant potential by giving highest yield of 48.0 q/ha and more economic return (BC ratio of 2.43).

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	15	3.5	40.0	32.0	35.6	24250	18850	1.78
Usar Dhan-3	60	58.0	36.0	29.0	22.8	34734	15265	1.43
SR-26B	25	2.5	36.0	30.5	18.7	22095	26404	2.19
Jarava, Geetanjali, Amalmona	20	2.5	48.0	34.7	40.5	29400	42100	2.43
Total	**120**	**66.5**						

Demonstration on CARI Dhan

Demonstration on Usar Dhan - 3

2.2.3 Introducing flood tolerant varieties: Flood tolerant varieties of paddy like Swarna sub 1 and Sabita were introduced through demonstration in 25.9 ha area in 100 farmers' fields. Javarva, Geetanjali and Amalmona varieties proved maximum salt tolerant potential by giving highest yield of 43.25 q/ha and more economic return (BC ratio of 2.57).

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)	75	22.4	38.7	28.5	38.5	18200	28700	2.57
Flood tolerant paddy (Var. Sabita)	25	3.5	43.3	37.7	32.0	28100	38075	2.35
Total	**100**	**25.9**						

Seed bed for deep water paddy Swarna Sub-1

Demonstration on Sabita Variety

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, rajmash etc. were sown in 12 days advance (avg) during rabi season. These demonstrations were carried out in seven NICRA adopted villages involving 383 number of farmers' fields in 69.4 ha area.

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)	35	3.9	49.0	37.0	35.6	22500	35450	2.57
Wheat (Var. K - 9107)	40	7.0	28.5	15.0	235.0	21000	17100	1.81
Wheat (Var. Helna)	30	3.5	38.0	25.0	55.0	20000	24800	2.24
Wheat (HD2985)	55	18.0	47.0	32.0	48.7	28254	34741	2.23
Maize (Var. DHM 117)	45	4.0	67.0	59.0	20.0	22500	53000	3.35
Lentil (Var. Arun)	55	5.0	18.0	12.0	38.3	16000	37000	3.31
Mustard (Var. Shiwani)	45	14.0	10.5	6.6	53.8	15800	14700	1.93
Mustard (Var. Pusa Mahak)	30	12.0	14.0	9.0	38.3	14000	26000	2.85
Rajmash (Var. PT303)	38	11.0	5.5	3.2	45.6	6700	8300	2.23
Potato (Var. K. Ashoka)	40	3.0	214.0	163.0	35.0	72000	44000	1.61
Total	**383**	**69.4**						

Short duration rice variety (GB-1)

Early sown wheat variety (K 9107)

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 211.1 ha area of 656 number of farmers' fields. These interventionswere carried out in 12 NICRA 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 3.23.

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	250	65.6	54.0	30.0	75.3	38288	42712	2.11
SRI (Var. MTU -7029)	55	3.53	49.0	39.5	27.0	23000	40600	2.76
Paddy Seed (Var. Sahbhagi)	130	59.0	50.0	27.5	83.1	15000	30000	3.00
Aerobic Rice (Var. Anjali) cultivation	68	31.5	26.5	18.6	45.2	16000	17275	2.07
Direct seeded brown manured rice	26	8.0	40.0	31.0	29.7	28928	30572	2.05
DSR (Var. Anjali)	45	27.5	36.0	27.0	35.0	18300	29100	2.59
SRI system in paddy (Var. Rajendra subhasini)	25	7.0	55.4	40.7	37.4	34450	52934	2.53
Sowing of paddy(Var. Rajendar sweta) with ZTD machine	35	6.0	55.0	42.0	28.8	27255	60745	3.23
Zero tilled rice	22	3.0	45.0	31.0	42.0	26554	40445	2.52
Total	**656**	**211.1**						

Aerobic Rice (Var. Anjali) cultivation

Demonstration on Sahbaghi

2.2.6 Community nurseries for delayed monsoon: Delayed monsoon is now a common phenomenon in Bihar and Jharkhand districts of this Zone. To combat the situation one intervention of staggered community nursery for various crops of different crop duration and varieties has been promoted. Community nursery development of rice, cauliflower, brinjal, and tomato were demonstrated in 25.5 ha area of 190 numbers of farmers. These interventions were carried out in 10 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)	20	1.5	48.0	41.2	18.3	35600	38900	2.09
Nursery Management of paddy (Var. Rajendra sweta)	30	3	52.0	43.5	22.6	35780	54620	2.52
Paddy (Var. Induri sambha)	10	1.0	48.5	41.2	22.4	29300	31262	2.06
Community nursery of paddy (Var. Lalat)	30	7.0	35.6	30.4	16.3	29800	16020	1.53
Community nursery of paddy (Var. Jaldi dhan 3)	40	6.5	38.0	31.0	20.3	38340	18735	1.48
Community nursery of cauliflower	15	2.5	410.0	345.0	23.4	40200	182800	5.54
Community nursery of brinjal	20	2.0	620.0	540.0	18.2	50400	200600	4.98
Community nursery of tomato	25	2.0	390.0	340.0	19.2	48800	60200	2.23
Total	**190**	**25.5**						

Community nursery of paddy

Community nursery of brinjal

2.2.7 Location specific intercropping systems with high sustainable yield index: Intervention on location specific intercropping was demonstrated in 10 NICRA adopted villages. The demonstrations were carried out in 77.3 ha area of 509 number of farmers' fields. Of all these intercropping intercropping of maize + ladies finger was found most popular which was undertaken in 509 number of farmers fields although maximum return (B:C ratio of 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)	160	19.3	Maize: 90.0 Ladies Finger:0.5	Maize-05	-	175500	147000	1.83
Chili (Var. Bullet as main crop)+Ladies finger(HYV)	45	3.0	Chili:47.0 Ladies Finger:0.5	-	-	300500	2297000	8.64
Maize + Redgram	15	4.0	25.5	13.6	98.9	25550	50100	2.96
Maize + Groundnut (1:3)	10	1.0	21.2	13.6	55.4	28500	42100	2.47
Sorghum (Var. CSV – 20)	85	23.0	28.0	10.4	170.0	6000	10000	2.67
Potato (Var. Pukhraj) + Maize (Var. Laxhmi)	55	5.0	Potato:88.0 Maize:135.0	-	-	70000	131600	2.88
Redgram (Var. Bahar)+ Millet (Var. GPU-28)	15	4.0	Redgram: 22.0 Millet: 12.5	-	-	25000	80520	4.23
Potato (Var. Pukhraj) + Radish (Var. Pusa chetki)	20	3.5	Potato:195.5 Radish:40.4	-	-	23900	68850	3.89
Arhar+ Blackgram	35	4.0	Arhar:18.9 Blackgram: 17.2	Equal 15.2	59.6	25500	45500	2.78
Cucumber + Beans	20	3.5	Cucumber: 12.5 +Beans: 11.7	Approx : 9.7	30.5	40000	90000	3.25
Wheat+ Mustard	35	4.0	39.7 (Wheat eq.)	31.3	28.8	28000	25500	1.91
Okra (Mahyco 959) + Chilli (Surya)	10	1.0	9.5	4.2	140.0	190000	220000	2.15
Groundnut + Red Gram	2	1.0	16.7	15.2	9.8	30775	30025	1.97
Red Gram +Sorghum	2	1.0	10.4	8.7	17.4	15340	11240	1.73
Total	**509**	**77.3**						

Groundnut+ Red Gram

Red Gram+ Sorghum

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 122.1 ha area of 772 number of farmers' fields. Introduction of *ol* (var. Gajendra) in the cropping pattern. Ol (Var Gajendra) is the most promising one which gave maximum economic return (B:C ratio of 7.04).

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)	62	27.0	9.5	7.0	43.7	20000	35000	2.75
Gram (Var. Pusa 362)	90	30.0	15.0	8.2	59.1	23000	41000	2.78
Onion(Var. N-53)	25	3.5	290.0	188.2	45.9	65000	255000	3.92
Tomato (Var. Param F1)	35	5.6	220.0	155.3	40.3	72000	148000	3.05
Chilli (Var. Surajmukhi)	40	6.6	85.2	56.0	55.0	70000	175000	3.50
Cabbage (Var. OM-3)	30	4.5	335.3	255.1	38.0	70000	220000	4.14
Radish (Var. Suhra-32)	37	4.3	125.2	82.1	55.0	65000	78000	2.20
French Bean (Var. FE-51 ANUPMA)	35	1.6	65.4	42.2	57.0	70000	100000	2.42
Cauliflower (Var. MSN-16)	40	4.5	220.0	127.0	70.7	75000	190000	3.53
Brinjal (Var. F1-Hybride Long)	25	6.5	230.0	160.0	48.7	72000	160000	3.23
Turmeric (Var. Rajendra soniya)	15	4.0	230.2	155.0	45.0	75000	290000	4.86
Ginger (Var. Nadiya)	18	2.5	220.5	170.2	35.0	90000	480000	5.30
Lentil (Short duration varietyPL – 406)	30	7.0	10.4	5.5	80.0	10000	20000	3.00
Linseed (Short duration variety T397)	15	5.0	4.5	3.4	50.0	4000	15592	4.80
Ol (HYV. Gajendra)	35	2.0	790.2	240.3	230.0	88000	531940	7.04
Nutritional garden- Veg. seed Seem (*dolicus lablab)*	180	3.5	15.4	8.2	48.0	2000	4000	3.00
Tomato under mulching	60	4.0	80.3	40.1	65.0	6000	15000	3.50
Total	**772**	**122.1**						

Cultivation of ol

Cultivation of turmeric

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 532 number of farmers. Among all the demonstration cultivating contingency crops like brinjal, cauliflower and short duration tomato and banana bunch cover, integrated fish farming were remunerative.

Table. Performance of other demonstrations

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)	10	1.0	490.6	474.5	15.9	181500	398750	3.19
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (WBU-108) in jute AZO-PSB fallows with INM	21	2.3	15.7	9.5	48.3	26500	39725	2.49
Promotion of stem rot resistant Jute (var. JBO-2003H)	22	3.0	36.5	27.0	40.9	31400	45800	2.45
Integrated crop management of mustard (NC-1)	30	4.0	19.1	12.3	47.5	29560	35580	2.20
Integrated crop management of lentil (Maitri)	30	3.0	15.5	10.0	45.9	26100	38900	2.49
Integrated disease management in vegetables	40	3.5	248.0	220.0	20.3	88600	27500	1.31
Demonstration short duration vegetables as contingent crop Tomato (Var. PUSA Gaurav)	25	1.0	355.0	295.0	23.6	48500	176500	4.63
Contingency crop Brinjal (Var. PUSA Uttam)	14	1.0	385.0	312.0	22.9	48050	275950	6.74
Contingency crop Cauliflower (Var PUSA Sharad)	15	1.0	250.0	210.0	28.0	52500	207500	4.95
Contingency crop Radish (Var. PUSA Chetki)	30	1.0	150.0	120.0	32.2	48500	50000	2.03
Soil reclamation : Levelling /bunding and flooring for leaching of salt	25	7.0	38.0	32.0	20.6	31095	35404	2.13
Integrated fish farming	45	15.0	2.5	1.7	78.0	48000	121000	3.52
Poon (*Calophyllum inophyllum*) a bio-shield tree for coastal zone	105	8.6	1050 plant					
Forest tree plantation	120	9.5	1115 plant					
Total	**532**	**60.9**						

Poon (*Calophyllum inophyllum*) a bio-shield tree for coastal zone

IFS Model

Contingency crop Brinjal

Disease management of vegetables

2.3 MODULE III: LIVESTOCK & FISHERIES

2.3.1 Use of community lands for fodder production during droughts / floods: Community lands of an area of 164.5 ha involving 982 number of farmers utilized for different fodder production were demonstrated in eight different NICRA adopted villages. Berseem, oat, MP chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration quality legume Sudan grass demonstrated in 25 number of farmers' fields showed maximum benefit return (B:C ratio of 6.0).

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 (Var. Wardan)	70	5.3	820	680	40.5	30100	85600	3.84
JHB-146	41	4.0	830	645	20.7	24200	65450	3.70
Quality legume fodder Berseem (Var. Muskavi)	35	2.3	975	850	31.0	32500	69300	3.13
Quality legume fodder Oat (Var. JHO-822)	35	3.4	540	430	29.0	25000	39500	2.58
Quality legume fodder MP chari	10	2.0	45	30	47.0	10550	30450	3.89
Quality legume fodder Sudan Grass	35	7.0	550	200	245.0	50000	250000	6.00
Fodder production of Maize/Sudan	650	55.0	530	450	29.0	35890	85109	3.37
Fodder cultivation with improved varieties Hybrid Napier	12	2.5	85	45	100.0	10500	12500	2.19
Sorghum (Moti)	04	1.0	335	255	31.4	18700	48400	3.58
Molases	75	72	21	16	37.5	6600	4200	1.64
Oat (Kent)	15	10	475	370	28.4	16800	16450	1.97
Total	**982**	**164.5**						

Demonstration on MP Chari at farmers field

Demonstration of sudan grass

Demonstration of barseem at farmers field

Demonstration of Oat

2.3.2 Improved fodder/feed storage methods: Improved fodder of rice bean and silage making were demonstrated in farmers fields. Silage making for 35 numbers 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)	20	1.00	198.2	-	-	1200	15200	13.60
Silage Making	35	15 nos	7.5	5.0	65.5	35	260	8.42

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 15 different NICRA adopted villages. Mortality rate reduced up to the extent of 100% and average increase in cattle milk yield upto 20% 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	679	735	Mortality rate (70-80%) reduced	Mortality rate (40-50%) reduced	-	-	-	-
Vaccination HS,BQ	2800	1330	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	6050	7510	2.25
Vaccination for PPR in goat and Ranikhet in Poultry.	469	550	Occurrence of disease not recorded in vaccinated group.	Sporadic out break	-	-	-	-
Animal health camp (HS+BQ)	300	365	10 % mortality	65 %mortality	80% survival	32059	88581	3.76
Deworming (Febendazole) & Mineral mixture	50	255	12% mortality	100% Mortality	92% survival	593000	123000	1.20
Animal Treatment Camp Butox, Prajana,Sulpha Dimadin ,Oxytetra cycle	330	260 nos	Reduced occurrence of diseases 92%	Occurrence of diseases 35%	61.95	-	-	-
Proper De-worming	1124	500	5	7	40.0	22	153	7.95
Vaccination raksha triovac	146	120	25	35	40.0	-	-	-
Total	**5898**	**3855**						

Vaccination and health checkup of animals

2.3.4 Management of ponds / tanks for fish 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	Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	75	18.6	780.0	290.0	300.5	17100	49500	3.89
Cat fish culture	25	1.6	-	-	120.0	15500	72500	5.67
Renovation of defunct fish ponds and tilapia, singhi, magur, annabus & lata species cultivation	40	1.0	-	-	140.0	15000	60000	5.00
Total	**140**	**21.2**						

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 387 number of farmers fields. Improved ornamental bird was introduced through this intervention which showed very promising results (B:C ratio of 6.4).

Fish production Stress tolerant fish –tilapia

Table. Performance of livestock demonstration in NICRA adopted villages

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
Rural backyard poultry Kuroiler Birds	30	100 nos	1 kg at 10 weeks	0.75 kg at 10 weeks	33	82/bird	22/bird	1.25
Backyard poultry (Improved Nicobari fowl)	15	145 nos	140 egg	75 egg	86	2314	3486	2.46
Replacement of local breed with Khaki Cambell	20	110 nos	Prodn: 21/duck/month	Prodn: 15/ duck/month	40	Rs. 50 duck/ month	Rs. 66 duck/ month	2.32
Ornamental bird	7		Hatchability-85%, fecundity-68%, chick	-	-	75/pair/bird/ year	405/pair/ bird/year	6.40
Improved breed of Pig (T & D)	25	28 nos	0.9 q/pig	0.5q/pig	80	28000	40500	2.45
Addition of mineral mixture	260	570 nos	1.75	1.0	31	1500	2100	1.60
Low cost Azolla production as supplementary cattle feed	30	70 unit	Prodn: 8.55 q/yr; Milk: 46.85 l/ cow/month	Milk: 39.6 l/ per cow/month	32	727/pit	685/pit	1.94
Total	**387**							

Ornamental bird rearing

Improved pig of breed

Khaki campbel and Rural backyard poultry Kuroiler Birds

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)	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	40	35	Mortality 10%	Mortality 80%	Survival 70%	-	-	-	-
Hut making	15	13	7	4	75	15	180	165	12.0
Improved shelters for poultry and livestock	10	7	-	-	-	-	-	-	-
Total	**65**	**55**							

Improved shelters for poultry

Improved shelter or piggery

2.4 MODULE IV: INSTITUTIONAL INTERVENTIONS

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 3386 number of farmers in the Zone.

Table. Details of the various institutional interventions

Interventions	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	10	Rice- Drought tolerant/ Short Duration Var. Rajendra Sweta,Naveen, Jaldi Dhan 13,Madhuri	2	Quality seed	30	6.5
		Paddy Var. Lalat	36.5	Participatory approach market linkage	10	3.0
		Wheat Var.-HUW-468	39.5	Participatory approach market linkage	5	1.6
		Paddy Var. Anjali	35.5	Multiplication of seeds	35	6.0
		Paddy Var. Sahbhagi	36.5	Multiplication of seeds	10	2.0
		Paddy (Variety – Anjali)	125.0	Registration of Seed done by farmers.	20	6.0
		Foundation seed Paddy	15.5	Seed production and storage	4	6.0
		Foundation seed Rapeseed and mustard	9.5	Seed production and storage	15	6.0
		Foundation seed Wheat	15.0	Seed production and storage	25	11.0
		Paddy Sahbhagi	55.0	Seed	6	3.0
		Paddy Rajendra Sweta	97.0	Seed	5	3.0
		Pigeon pea	7.0	The Seed given to the farmers for seed production will get refunded after production	12	7.0
		Paddy	8.5		35	7.0
		Gram	6.5		12	3.0
		Blackgram	27.0		27	4.0
Fodder bank	6	Oat JHO-851	0.05	-	5	1.0
		oat JHO-99-2	0.05	-	6	1.0
		oat JHO-822	1.4	-	30	2.5
		Berseem Wardan	0.10	-	7	1.0
		Berseem JHB-146	0.10	-	7	1.5
		Jowar	35.5	Fodder use in drought spill/ heavy rain	15	1.5
		Wheat straw	4.5	Urea treatment	5	5Unit
		Maize	3.0		20	2.0
		Sudan Grass	3.0		10	2.0
		Paddy & Wheat Straw	4.0	VCRMC is maintaining this	20	2.5

Commodity groups	9	Kitchen Gardening	-	Improved Variety Seed	35	1.0
		Veg Mustard Pusa sag 1			34	2.5
		5 group Fingerlings fish	120	Fish farming	50	7.0
		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	14	Power tiller	3	-	300	3 unit
		Mould bold plough,	01/ Rs.36/hr	-	5	2.5
		Rotavator (4'),	01/ Rs. 55/hr	-	15	4.5
		Zero till seed drill,	01/ Rs. 80/hr	-	25	6.5
		Turbo seeder,	01/Rs. 157/ hr	-	22	3.5
		Power Duster,	01/Rs 20/ hr	-	26	2.5
		Power sprayer, Pumping Set	01/Rs 20/hr	-	10	7.5
		Farm implements	-	Technology demonstration	252	55 unit
		Wheat Thresher, Zero Tillage Machine, Sprayer, Duster, Paddy Thresher etc	70	Implements is provided to the Group for hiring purpose	28	25 unit
		Wheat, Paddy, Lentil, Chick pea ZTD, Drum Seeder	-	ZTD, Drum Seeder	68	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		58	9 unit
		Conoweeder, duster, sprayer, SRI marker, Zero tillage machine	Conoweeder: Rs. 15/-	1. Weeding	34	3.5
			Duster: Rs.15/-	2. Dusting	36	2. 3
			Sprayer: Rs.20/-	3. Sprayer	39	3.3
			SRI Marker:	4. Sri marker	25	4.4
			Zero tillage Machine: 47/-	5. Zero tillage	75	7.4
		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	Technology demonstration	600	300 unit
		VCRMC Equipments purchased under the project	3	Farm implements	258	6.5

Collective marketing	4	Onion/ Vegetable	5	-	39	10.5
		Milk production and marketing group.	3	1. Introduce new green fodder like Sudan grass 2. Linkage with market.	28	4 unit
		Vegetables	3	Cooperative arrangement	68	29 unit
Climate literacy through a village level weather station	15	Temperature, Relative humidity, Rain fall, Wind speed and direction	15		235	3 unit
		Weather station SMS/Voice SMS	8	Data interpretation of AWS and forecasting/Advisory	65	1 unit
		AWS	15	-	145	1 unit
		Wheat	5	-	45	38 unit
Total					**3386**	**165.5 ha & 523 unit**


Seed bank

Mini weather station

Zero tillage machine


Mass production of *Trichoderma spp*

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. The members of the committee were selected by the villagers under the facilitation of KVKs where NICRA was being implemented. VCRMC is actively operational with 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

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. Farm tools and implements, which were beyond the reach of resource-poor farmers due to non-availability and cost factor, became available at an affordable price through custom hiring. 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	17385.00	54926.00
Buxar	1700.00	26987.00
Chatra	18560.00	59482.00
Cooch Behar	7787.00	65632.00
East Singhbhum	7700.00	25700.00
Gumla	21370.00	62111.00
Jehanabad	1000.00	51091.00
Koderma	2460.00	20181.00
Malda	4000.00	29751.00
Nawada	5870.00	263552.00
Palamu	12000.00	17400.00
Port Blair	6955.00	20494.00
Saran	9280.00	107370.00
Supaul	1000.00	43324.00
South 24 Parganas	3750.00	184962.00
Total	**120817.00**	**1032963.00**

Village Climatic Risk Management Committee constituted by Gumla KVK at Majhiala Village generated maximum amount of Rs. 21370.00 through custom hiring during 2014-15 and overall the highest amount of Rs. 263552.00 is deposited in Jay Prakash VCRMC at Nawada KVK.

Implements in CHC

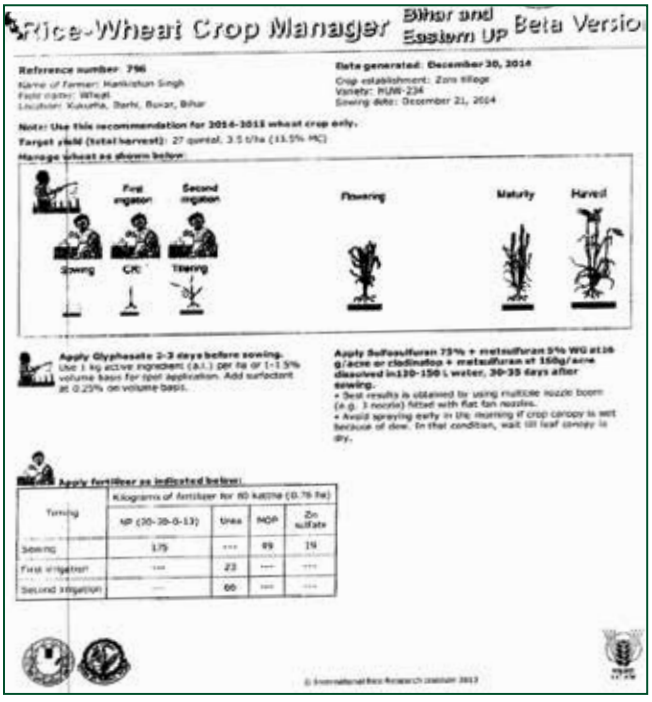
3. Capacity Building Programme

A total of 552 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 11381 farmers and farm women (9310 male and 2071 female) during the year 2014-15. 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 2014-15

Thematic area	No.of KVKs	Topic of the training	No. of Courses	No. of beneficiaries		
				Male	Female	Total
Livestock and Fishery Management	15	Duckery as an additional source of income	10	160	45	205
		Management schedule for dual purpose poultry birds	12	240	40	280
		Feed and health management of livestock	21	455	95	550
		Feeding breeding and management of Goat and Pig under drought like situation.	16	300	40	340
		Prevention and control of live-stock Disease	20	370	120	490
		Scientific rearing of IMC	21	300	25	325
		Composite fish culture	12	255	35	290
Natural Resource Management	15	Production of quality compost using local resources	7	95	17	112
		Integrated farming methods in landshaping plots	6	100	27	127
		Vegetable cultivation on raised land embankment	8	80	32	112
		Integrated weed management in rice through land management	6	60	26	86
		Management of salt affected soil	12	97	28	125
		Impact of bunding in water conservation	8	170	15	185
		Increase of water holding capacity of sandy soil of Diara land	8	30	0	30
		Mulching and its impact	17	265	60	325
Crop Management	15	Paddy cultivation through SRI	17	256	70	326
		Salt tolerant and deep water paddy cultivation	10	230	35	265
		Crop Management	8	170	30	200
		Water management	12	275	35	310
		Improved package of practices for pulse and oilseeds	8	137	25	162
		Quality seed production technology of cereals	7	140	20	160
Nutrient Management	8	Integrated Nutrient Management in pulses	7	140	30	170
		Application of sulphur in oil seed crop	6	140	10	150
		Green mannuring	12	240	34	274
Integrated Crop Management	14	Cultivation Practices of Kharif pulses	7	180	30	210
		Scientific cultivation of crop management.	16	260	40	300
		Scientific cultivation of oilseeds	16	275	30	305
		Kisan chaupal	9	45	15	60
		Cultivation of potato	9	160	15	175

Thematic area	No.of KVKs	Topic of the training	No. of Courses	No. of beneficiaries		
				Male	Female	Total
Crop Diversification	14	Increase in cropping intensity through introduction of black gram in jute fallows	6	125	10	135
		Crop Diversification through lentil cultivation	6	95	20	115
		Training on intercropping	7	100	20	120
		Cultivation of Millets	6	88	16	104
		Fodder production.	13	200	70	270
Resource conservation Technology	15	Zero Tillage	14	230	30	260
		Operation & Maintenance of Zero Tillage Machine	6	125	15	140
		Skill/knowledge development on Resource conservation technology	6	95	45	140
		Summer ploughing	6	100	20	120
		Direct seeding method of Paddy	5	75	25	100
		Use & importance of multi crop planter in Maize & protected Nursery.	4	45	20	65
		Crop residue management by using happy seeder	5	72	5	77
Pest and disease management	15	Integrate Pest Management	24	500	30	530
		Storage pest of pulses and their management	7	130	10	140
		Judicious pesticide application in crops	8	135	35	170
		Integrated Disease Management	14	270	20	290
		Crop Diversification of sustainable crop production	4	50	5	55
Nursery raising	7	Nursery raising and Management of major vegetable crops.	10	190	50	240
Employment Generation	7	Poultry farming for employment generation	6	130	30	160
Nutrition garden	6	Selection of Suitable crops for nutrition garden	6	90	48	138
Repair & Maintenance of farm machinery & Implements	10	Operation and maintenance of sprayer, duster and small agril. Implements and tools	8	140	38	178
Integrated Farming System	10	Integrated Farming System	7	140	30	170
Fodder and feed management	10	Skill/knowledge development on Fodder and feed management	7	100	45	145
Lac cultivation	3	Skill/knowledge development on Lac cultivation	4	45	22	67
Farm implements and machineries	14	Skill/knowledge development on Farm implements and machineries	10	170	88	258
Value addition	13	Skill/knowledge development on Value addition	8	130	30	160
Employment generation	12	Skill/knowledge development on Employment generation	9	85	125	210
Human nutrition and child care	8	Skill/knowledge development on Human nutrition and child care	8	30	145	175
Total			**552**	**9310**	**2071**	**11381**



Soil health card provided to the farmers

Different activities of Capacity Building

4. Extension Activities

NICRA implementing KVKs conducted a total of 2115 extension activities on various thematic areas benefitting 24301 practicing farmers and farm women (19402 males and 4899 females) during 2014-15. 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 2014-15

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services	1207	2824	955	3779
Awareness	83	1898	587	2485
Diagnostic visit	176	821	427	1248
Exposure visits	22	642	138	780
Field Day	95	1693	465	2158
Group Discussion	100	1367	454	1821
Method demonstrations	44	785	196	981
KMAS Services	62	4450	150	4600
Farmers day	42	820	175	995
Commodity groups	25	175	65	240
Popular extension literature	48	885	270	1155
Animal Health Camp	20	1400	150	1550
World earth day	5	130	25	155
Krishak Chaupal	4	82	45	127
Kishan Gosthi	5	220	170	390
Sugarcane & Kisan Diwash	4	180	130	310
Woman health and nutrition	3	20	70	90
Community health checkup for women	6	25	62	87
Technology week	3	600	200	800
NICRA Workshop at ZPD-II, Kolkata	1	45	5	50
Soil test camp	5	200	40	240
Scientist visit to field	155	140	120	260
Total	**2115**	**19402**	**4899**	**24301**

Diagnostic services


Swacchh Bharat Abhiyan 2014




World Earth Day 2014

World Environment Day 2014

86th ICAR Foundation Day

5. NICRA Review Workshop

The review workshop of National Initiative on Climate Resilient Agriculture (Technology Demonstration Component) was held at Zonal Project Directorate, Kolkata on 21.11.2014. The workshop was chaired by Dr A. K. Singh, Zonal Project Director, Zone II and attended by all the scientists of the Zonal Project Directorate, Kolkata, Dr P. Chatterjee, Former Programme Officer of the Zonal Project Directorate, Kolkata and all the Programme Coordinators-cum-Principal Investigators of NICRA implementing KVK of Zone II. The workshop started with welcome address by Dr F. H. Rahman, Principle Scientist of the directorate. One publication 'NICRA News - At a Glance' prepared by Coochbehar KVK was released.

Dr. A. K. Singh while addressing the inaugural speech he presented a brief account of expectation from the KVKs of Zone II in implementing the project. Dr Singh showed his concern about the timely submission of AUC and reports from all the KVKs. He emphasized to take up new interventions model which have direct bearing with the climate change. He asked all the NICRA implementing KVKs to send success stories or case studies to ICAR News/ICAR Reporter regularly. Dr. Singh also emphasized that each KVK should have soil health card and for this every KVK should analyse at least 1000 number of soil samples. He made an announcement in the house that Gumla KVK has been selected for Best Performing NICRA-KVK 2014 of Zone II and he congratulated the Programme Coordinator of the KVK. He opined that other PCs/ of PIs should discuss with PC of Gumla KVK and to share experiences about the activities carried out by Gumla KVK.

Dr. P. P. Pal, Principal Scientist of the directorate in his brief speech mentioned that the activities under PPV&FRA and NIFTD should be conducted in their respective areas and also showed his concern for timely submission of reports

to the KVKs who are also implementing PPV&FRA and NIFTD programme.

Dr. Manasi Chakraborty, SMS (Home Science), S 24 Parganas KVK gave a presentation on food and nutritional security while sharing her experiences during her exposure visit to Peru and Bolivia few days back.

Dr. F. H. Rahman made one presentation on the salient achievements of NICRA-KVKs during 2013-14 and he raised some issues pertaining to submission of quarterly performance report, statement of expenditure, audit utilization certificate etc. He also shared with the house about the Adaptation Fund under NICRA where successful interventions would be out scaled in other areas by adopting two more villages. In this regard, few KVKs have been selected KVKs (KVKs- Uttar Dinajpur, West Midnapore, Godda, Banka and Ranchi in place of Malda) for carrying out the activities under the Adaptation Fund of NICRA.

In the technical session all the Programme Coordinators/ PIs of the KVKs have presented one by one their salient achievements during 2013-14 and the action plan for 2014-15.

Following points came out during the whole day workshop:

- NRM activities will be more during the coming months of 2014-15 in every KVK
- Success story of crocodile bund at Malda is to be documented
- HRD activities to be conducted more effectively
- One research paper on successful intervention of DSR is to prepared by Koderma KVK
- Organic mulching intervention to be carried out in large scale
- Azolla cultivation for soil application as well as animal feed may be promoted in more areas
- Plastic mulching in raised bed furrow method of cucumber cultivation conducted by Coochbehar KVK to be outscaled in more areas and one paper in this aspect is to be prepared and submit to the directorate within 10 days
- Activities conducted by Supaul and Jahanabd KVK are very less. More activities in NRM and crop production module need to be taken
- Nutrient status initially and finally to be analysed for any trial or demonstration particularly in nutrient management
- Data for any demonstration are to be quantified – particularly in Buxar KVK all interventions should have quantified data
- Brown manuring and residual moisture demonstration by Buxar KVK are to be documented
- Every NICRA-KVK should have seed bank and fodder bank
- Convergence programme for cleaning of irrigation channels at Palamu is worthful – a case study is to be prepared
- Lac cultivation at Palamu – A success story is to be prepared and submit to the Directorate
- Minimum requirement of the fund as per the viable action plan is required to submit to the Directorate
- Breed upgradation by crossing BB Goat with Sirohi conducted by Jehanabad KVK should be stopped
- Village level weather station should be established at Jehanabad KVK as all other KVKs has already established the same
- Zero tillage in wheat, direct seeding and drum seeded of paddy at Aurangabad KVK are to be outscaled in more areas
- No animal and fisheries activities have been conducted by Aurangabad KVK so far - interventions in this module need to be undertaken
- Broad bed furrow method of cultivation at Port Blair is to be outscaled by making convergence with state government
- Huge number of NRM activities like creation of WHS have been undertaken at Gumla and Nawada KVKs

View of Review workshop organized

– among those the successful interventions are to be outscaled in some other areas

- Case studies on Use of WhatsApp messenger as ICT tool in pest & disease diagnosis and collaborative venture with Private Hospital for *Brucellosis* screening in dairy animals conducted by S 24 Parganas (Nimpith) KVK need to be documented
- The amount in VCRMC bank account of KVKs - Koderma, Buxar, Palamu, Chatra, Port Blair, and East singhbhum need to be increased
- Soil samples analyzing data from each KVK has to be submitted to the PC of Palamu KVK for preparation of soil health card
- The present status of the VCRMC Bank account of each KVK has to be submitted to the PC of Nimpith KVK
- One publication on the basis of successful technologies has to be brought out – all the KVKs have to submit their 2/3 successful interventions to the Directorate

The workshop ends with Vote of Thanks proposed by Dr P.P.Pal

6. NICRA Zonal Workshop

The Zonal workshop of National Initiative on Climate Resilient Agriculture (Technology Demonstration Component)was held at Zonal Project Directorate, Kolkata on 23-24th2015. The workshop was chaired by Dr A. K. Singh, Zonal Project Director, Zone II and attended by Dr H.S. Sen, Former Director of ICAR-CRIJAF, Barrackpore and Chairman of Zonal Monitoring Committee to NICRA-KVKs of Zone II, Dr. Y. G. Prasad, Project Coordinator, Dr. JNVS Prasad, Co- PI, NICRA-TDC and Dr. S.Kundu, Scientist, CRIDA, Hyderabad, all the scientists of the Zonal Project Directorate, Kolkata, and all the Programme Coordinators-cum-Principal Investigators of NICRA implementing KVK of Zone II. The workshop started with welcome address by Dr F. H. Rahman, Principal Scientist of the directorate.

Dr. A. K. Singh, Zonal Project Director while addressing the inaugural speech he presented a brief account of expectation from the KVKs of Zone II in implementing the project. He asked all the NICRA-KVKs to prepare case studies/success stories based on the most successful and scalable technologies conducted by the KVKs. 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. The aim with NICRA is to make 'Climate Smart Village'. He emphasized to take up new interventions model which have direct bearing with the climate change. Dr Singh showed his concern about the timely submission of AUC and reports from all the KVKs.

Dr. H.S. Sen, Chairman of Zonal Monitoring Committee to NICRA-KVKs of Zone IIshowed his satisfaction on the performances of KVKs' activities which he visited various KVKs during the Zonal Monitoring Committee visits during last two years. He emphasized that the KVKs should focus on climatic vulnerability while taking up any intervention in the NICRA site. He proposed that CRIDA should take an initiative for providing district wise data on climate change effect mainly on rainfall, temperature, evaporation, soil moisture stress etc. upto the next two or three years. Each intervention should be planned in relation to the climatic vulnerability like drought, salinity, acidity, high rainfall, heat stress etc. Soil health aspects like physical, chemical and biological parameters should be addressed while planning to take any intervention.

Dr.Y.G. Prasad, Project Coordinator, NICRA-TDC, CRIDA, Hyderabad while addressing he informed that two more KVKs from this zone- KVK Godda and Banka were also included as per the approved XII Plan EFC of NICRA for implementing NICRA activities from this year. He also shared the information that NICRA has been renamed as 'National Innovations on Climate Resilient Agriculture'. He emphasized on the following actionable points:

- NRM activities will be more during the coming months of 2015-16in every KVK
- Farmers wise and intervention wise data to be provided by every KVK
- Scientific data and good action photograph will be more than previous year.
- More focusing of the climate vulnerability
- 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
- Orientation programme is to organize for new KVKs on Climate vulnerability, Nature of intervention, NRM, Crop, Livestock, Institutional intervention etc. at CRIDA, Hyderabad
- Action Plan for 2015-16 may be prepared in revised

format and timely send to CRIDA for BE finalization

- Prioritization may be given in Non-recurring contingencies expenditure
- Village level contingency planning may be prepared and to report within 1st week of June
- Documentation like Success story may be prepared. Each KVK has to prepare at least two success stories and submit to the ZPD by 15th May 2015
- Best Report or Best presentation will be given to the KVK during the NICRA Review Workshop to be held in first week of June 2015
- ZPD may present NICRA-KVKs performance in the Annual NICRA Workshop
- ZPD may present KVKs activity in Annual NICRA workshop
- One CD published by FAO on climate smart agriculture will be provided to each KVK

Dr. J.N.V.S. Prasad, Co- PI, NICRA-TDC opined that the each and every intervention should be climate focused. IPCC reports may be consulted through internet while initiating any intervention. He enquired about whether all the KVKs are provided any weather station or not. Only Supaul KVK is not having such weather station and he remarked that with the two new KVKs like Godda and Banka, SupaulKVK will be provided the mini weather station.

Dr. S. Kundu Scientist, CRIDA, Hyderabad made one presentation on Village level C balance study through EX-ACT model where he has provided the templates for Data collection/proforma etc.

In the technical session all the Programme Coordinators/ PIs of the KVKs have presented one by one their salient achievements during 2014-15 and the action plan for 2015-16.

Following proceedings came out during the technical session KVK wise which are mentioned below:

SOME OF THE GENERAL RECOMMENDATION CAME OUT OF THE TWO DAYS WORKSHOP WHICH ARE MENTIONED AS:

- One KVK member must be included in the VCRMC Bank account for transaction
- There may be around 20% member from women section in VCRMC Committee
- NRM activities may be assessed on long term basis at least for 10 years
- Revised copy of Action plan 2015-16 is to be submitted by 10th May 2015
- In absence of SRF contractual staff or daily paid labour may be engaged during full season on need basis
- There is a provision of Rs. 4.0 lakh to procure implements under CHC
- Recent variety of crops (not older than 10 years) to be taken for demonstration
- Extension activities or training programme to be conducted on climate related issues
- All KVKs prepared a project for NABARD for upscaleing of successful intervention
- All KVKs should have Water Level Meter (Approx cost Rs. 4000/-) to measure the ground water level
- All KVKs should have GPS facility (Approx cost Rs. 10000/-)
- Irrigation potential increasing trend through the construction of dam is to be studied
- One KVKs in each state may be provided with one STFR kit
- All the KVKs should prioritize their required equipments based on the budgetary provision.
- The titles of the training under NICRA should be innovative with thrust on climate resilience.
- For NRM activities Farmers share to be collected @ 10%
- 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 ends with vote of thanks proposed by Dr H. K. De.

View of Zonal workshop organized

7. Zonal Monitoring Committee Visit to NICRA-KVKs

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. Four visits have so far been conducted in various KVKs. The details of the visit along with proceedings are mentioned hereunder.

7.1 FIRST VISIT:

The Monitoring Committee comprised the following members:

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

Vice-Chairman: Dr. A. K. Singh, Zonal Project Director, Zone II

Members:

1. Dr. A. Haris, Principal Scientist, ICAR RC ER, Patna as DDG's (NRM) Nominee
2. Dr. Sammi Reddy (CRIDA, Director CRIDA nominee
3. Dr. U. S. Jaiswal (DEE-BAU nominee

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

Proceedings of the NICRA Zonal (Zone II) Monitoring Committee Visit to three KVKs-Aurangabad, Nawada of Bihar and Koderma of Jharkhand during Oct 30-Nov 1, 2013

The KVK-NICRA Monitoring team of Zone II (vide ZPD II letter no. No.F.ZPD/II/NICRA/ZMC/2013, Date: 31.08.2013) comprised of (1) Dr. H. S. Sen (Chairman), (2) Dr. A. K. Singh (Vice Chairman), (3) Dr. U. S. Jaiswal (DEE-BAU nominee) (4) Dr. Sammi Reddy (CRIDA, Director CRIDA nominee), and (5) Dr. F. H. Rahman (Member Secretary, ZPD-II). The team visited three drought prone areas (Aurangabad & Nawada) in Bihar, and Koderma in Jharkhand. The visits were well organized and well attended by large number of farmers including women participants, members of VCRMC, and representatives of the respective KVK. Inputs were invited freely from all followed by opinions offered by the Monitoring Committee members. Field visits were also arranged (Village Harigaon, Aurangabad; Village Manjhila, Nawada; and Village Chopnadi, Koderma) for site inspection of the interventions practised. Dr. A. K. Singh (Vice Chairman) and Dr. U. S. Jaiswal (DEE-BAU nominee) were present with the team only upto Aurangabad KVK village Harigaon. Following were the discussions and salient recommendations emanating there from.

The general impressions of different stakeholders during the course of discussion in different areas were that:

i. Water and soil are the primary resources for improving crop productivity, and need to be attended in the first instance
ii. Each area had a vast majority from either marginal land holding or landless category
iii. It was accepted by the farmers in each area that climate change has taken place over the last few decades very perceptively, resulting in delayed and uncertain monsoon
iv. Marketing is a great constraint felt by the farmers in each area
v. Critical inputs like lack of timely supply of inputs have been felt by many in general cultivation
vi. It was invariably felt by the farmers in each area that the NICRA scheme has made a striking impact on the farmers resulting in economic benefit mainly through improvement of crop productivity and allied activities
vii. It was also encouraging to find at each site farmers from the adjoining villages (outside the periphery of NICRA village) joining the meeting and urging for adoption of improved interventions
viii. The guidelines formulated for the formation of VCRMC and their functioning may kindly be placed before the monitoring team during its future meet. The enthusiasm and impact of the members of the team were praiseworthy.

Intervention-wise observations and discussions are as follows for necessary actions to be taken under each:

Committee visits different KVKs

Water resource	The annual rainfall throughout the belt covered varied between 1000-1150 mm, although occasionally there were scarcities n certain years. It was the right approach to store the excess rainwater either on community basis or at individual farmers' holdings in any of the following forms: (i) Ahar, (ii) renovated pond, (iii) excavated pond. Although commendable efforts were made by the NICRA team to ensure maximum storing of water, notably at Nawada and Koderma Centres, it was urged by the Monitoring Team that this particular intervention be followed up more scientifically using the softwares available for this purpose for rainfed farming. The exercise may start with probability analysis of rainfall and evaporation to make an estimate on the amount of excess rainfall likely be available. Further, it is advisable to planting, preferably, of perennial or semi-perennial crops of farmers' choice on the raised bunds around the excavated ponds, and pisciculture (preferably composite culture) in the ponds after proper testing of its quality. Appropriate steps should also be taken stop grazing of the plantation crops or select such crops which are not likely to be grazed, also stop poaching of the fishes. This will fetch the farmers round the year high additional return. At Koderma it was very interesting to find a kind of recharge well developed at hardly 10-15 feet depth from the surface *(locally known as 'Nadi kund')*. Recharge takes place sufficiently fast from the adjoining water stream. Water is lifted by a small diesel pump to hardly 10 feet height to irrigate crops continuously for 6-8 hours, as reported. Detailed study including analysis of the water for its usefulness for irrigation should be conducted on this technique round the year. Other bore wells being used for irrigation at each site should subjected to water analysis for its usefulness for irrigation, and recharge capacity to be tested. All open bore wells should be covered with wire mesh to avoid any accident.
Minimizing irrigation requirement	This is recognized as one of the important methods to mitigate gas emission and consequently climate change. Water is a scarce commodity at each site visited. It is strongly recommended to ensure water availability during critical crop growth period through the above techniques and develop appropriate irrigation method for irrigation. SRI is one such efficient technique recognized for rice crop provided water is assured for this purpose. Appropriate planning is necessary for this purpose using such water saving techniques during non-rainy season. Although sprinkler irrigation is reported to be in practice at few locations, attempts may be made to use at the appropriate locations such techniques as trickle or pitcher (earthen) irrigation. While trickle irrigation may be tried for seasonal or perennial crops like chilli, tomato, brinjal, other fruit crops, pitcher irrigation, which is highly cost effective, is useful for vegetables crops. Ground water and other water sources should be checked in respect of water quality and heavy metal contamination at an interval of 3-5 years.
Climate change, crop planning, and availability of weather data	It has been reported to the monitoring team that necessary data on relevant meteorological data have been collated from the nearby IMD stations for sufficient period of time. Attempt may be made to predict the weather (aberrations) for the coming years, keeping in view the climate change predictions based on the climate data referred above, with as much dependability as possible, for which technology is available, and finally the crop diversification along with contingency planning, depending on water requirement of crops, farmers' choice and market demand of crops. It was interesting to find a few drought tolerant rice varieties have been tried, one of which is Sahbhagi (110 days duration), developed by CRRI, at Koderma. More attention should be paid in identifying suitable low water requiring crop varieties of both rice and non-rice. The cropping intensity, which is at present low to very low, understandably due to less and uncertain rainfall, should be invariably improved in phases. In general there appeared to be lack of adequate fodder for the animals. It is necessary to include fodder having minimum water requirement in the crop planning. Scope for including NIFTD at each place may be explored. Seed bank of the cultivable cereals, to start with, may be established at each location. Another approach to reduce water requirement is to introduce paira cropping under residual soil moisture following rice harvest for which suitable crop(s) should be identified. One of such crops tried and found successful in large areas is lathyrus (low toxin contens, viz. var. Nirmal).

	In at least one station (Nawada) it was observed that to ensure safety of the equipments the weather station was located on the roof top. As per accepted guidelines of the IMD, all meteorological equipments should be stationed at the ground level under normal field situation. This needs to be rectified at the earliest.
Soil resource	There are lack of appropriate soil data observed at almost each site. Even the texture of the soils could not be reported properly at any site, although soil major nutrient status are being analysed from the farmers' fields as per reports received. This may be ensured, and urgent necessary steps taken as per suggestions below: Each centre should have portable soil testing kit along with portable pH metre in the first hand. At Koderma however mobile soil testing van was reported to be available, functioning of which should be regularly monitored by the ZPD. All fertilizer recommendations should be made on soil test basis. It may be appreciated that other minimum soil parameters (physical, biological, soil organic C, and relevant micronutrients status field-wise are also necessary to assess soil health, which may be monitored at every 5 years interval. CRIDA may identify the minimum set of parameters to be analysed as inputs to soil health assessment, develop simple protocol for each, and ZPD may ensure training through deployment of appropriate staff at each centre. It has been reported that the benchmark soil survey has been conducted at each site, which may please be collected and placed before the monitoring team in future for their understanding. At Koderma, it was found that although major equipments were available at their KVK laboratory, there were no staff available to do the analyses, which is sheer waste of money spent on this. It is suggested to take up 'biochar', a highly C-rich resource, as pilot studies at a few locations only representing various soil textures and C levels. ZPD may initiate such programme in order to enrich soil C level. Economics of such practices may also be monitored.
Conservation tillage	It is widely recognized as a major practice to mitigate climate change phenomenon. Zero tillage has been accepted by farmers at each site, mainly for their understanding that (i) it advances the date of rabi sowing following kharif rice harvest, and (ii) decreases irrigation requirement of the rabi crop, (iii) increases the yield of rabi crop. Residual mulching of the kharif harvest along with non-burning of the crop residues following the harvest of kharif harvest, resulting in less toxic gas emission , as well as faster re-building of the deteriorated soil structure, caused due to puddling of kharif soil, and lower energy inputs required for the cultivation, are also other scientific reasons for popularization of conservation tillage. It is recommended to spread this technology along with manufacturing of zero tillage equipment at lower cost and make these available more abundantly for custom hiring along with other agricultural equipments through district level machinery hubs. It was very encouraging to hear some farmers in Koderma suggesting development of solar energy operated pumps. The ZPD may give appropriate attention towards this.
Agricultural machineries	At each site it was proposed to make tractors of higher capacities (say, 45HP) available since the present facilities are unable to operate efficiently with disc and mould board ploughs, etc. particularly in heavy soils common at these sites. Shelters may be provided to protect and maintain the farm implements at each site against corrosion against rains and heat.
Alternate farming vis-à-vis land holding	Generally, the land holdings are very small in each area visited, and about 70-80 % farmers are either marginal holders or landless farmers. It appears that much more emphasis needs to be given on alternate farming especially for these group of farmers to ensure continuous flow of income. The alternate farming may include nurseries for flower & fruit plants (preferably under artificial/ protected system, apiary, ornamental fish culture, mushroom, etc. it has been observed that arrangements have been made for periodical health check-up for domestic animals including cattle & buffaloes, goats, poultry birds, etc., which are praiseworthy. But this exercise may be given much more emphasis with supply of improved

	breeds, more scientific arrangements for their rearing including housing, preparation and supply of artificial feeds, and more frequent health check-ups. Ducks and pigs may also be added to the list. In order to mitigate climate change it is suggested to add N-inhibitors to the feed supplement . It was heartening to observe at least one farmer (Jai Pal Prasad) at Nawada following scientific nurseries under polyhouse. This should a model for all others to follow. Sri Prasad may be encouraged more for scientific practice through training, supply of improved varieties, saplings, etc.
VCRMC	The VCRMC in general at all places are doing good jobs, and the members are highly enthusiastic. The assets are growing, and it is time to think of registering the Committee with carefully drawn bye-laws and compositions. A minimum of 20 % may be reserved for the ladies, and all category of farmers should be represented in the committee.
Marketing strategy	The Monitoring Team opines that adoption of better marketing strategy so as to minimize the role of middlemen to absorb bulk of the profit may be given due attention. Formation of farmers' cooperative may be the starting point towards this for which a sub-committee under VCRMC may be formed. ZPD may discuss this aspect with all sections of farming community.
Transfer of technology	It was heartening to observe in all the three NICRA adopted villages farmers from the adjoining villages showing significant interest to come under the fold of NICRA. This is encouraging, and appropriate studies may be taken up by the NICRA team to monitor as far objectively as possible the diffusion of technology from the present sites where the studies are underway. Finally, it is very important that the farmers in the study areas should undergo awareness/ training of the climate change phenomenon and its impact on farming in long run, and possible strategies to be taken to mitigate such effects.

7.2 SECOND VISIT:

The Monitoring Committee comprised the following members:

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

Vice-Chairman: Dr. A. K. Singh, Zonal Project Director, Zone II

Members:

1. Dr. A. Haris, Principal Scientist, ICAR RC ER, Patna as DDG's (NRM) Nominee
2. Dr. Sumanta Kundu, Scientist, CRIDA as Director's (CRIDA) nominee
3. Dr. H. Bhattacharya, DEE, UBKV

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

Proceedings of the NICRA Zonal (Zone II) Monitoring Committee Visit to three KVKs of West Bengal during Feb 17.02.2014 to 21.02.2014

The committee comprising of Dr. H. S. Sen, former Director, CRIJAF (Chairman); Dr. Sumanta Kundu representing Director, CRIDA, Hyderabad (Member);Dr. H. Bhattacharya, DEE, UBKV (Member) and Dr. F. H. Rahman, Senior Scientist, ZPD II (Member Secretary) visited three KVKs viz. Malda, Coochbehar and S 24 Parganas in West Bengal during 17 to 21 Feb 2014. The essential features of the three stations are as follows:

Malda KVK (under UBKV): (i) Occurrence of flood along with prolonged drought spell as climate induced constraints. Average rainfall in that area is 1450mm. During the month of July-August, severe flood occurs almost every year. At that time for 2 to 21/2 months lands remain submerged. Existing rice varieties in that area do not survive; (ii) Major crops grown are rice, jute, maize, blackgram, wheat & vegetables. Scientists at KVK tried for other economically profitable crops like turmeric, ginger, yam in their farm which have good prospect in that area. (iii) Location is Panchayat Dakshin Chandipur under Taluk Manikchak spread over 4 villages in 484 ha area. (iv) Supply of Wheat seeds (variety PBW 343), providing training for mushroom cultivation, low cost vermicomposting with polythene bags, collection and maintenance of mango germplasm are some of the major activities of this KVK.

Coochbehar KVK (under UBKV): (i) High rainfall with erratic and uneven distribution during kharif season; (ii) Major crops are rice, jute, potato, mustard/wheat, banana & vegetables; (iii) Location is village Khagribari under Panchayat Patlakhawa having the present population of the village as 6912 with 1686 numbers of households of which 316, 1174, 133, 61 and 2 numbers of household belong to landless, marginal, small, medium and large category, respectively, also indicating gradually decreasing landholding pattern with advancement of time.

South 24 Parganas KVK (under Ramkrishna Mission

Ashram): High rainfall and proneness to cyclones and flood coupled with existence of coastal saline soils (Sundarbans delta) are the essential features; (ii) Major crops are rice and vegetables coupled with sugarcane and fruit crops in limited areas, (iii)The site is located in Village Bongheri having total household of 406 comprising of SC community dominating 96.30% of the total population of 1680 (406 households) spread over cultivable land of 216.53 ha of which 13% is high, 15% is medium and 72% is low land. The committee visited each site, discussed with farmers in fields, and also interacted KVK scientists/ SMSs along with local population including womenfolk and the VCRMC members. The salient points emanating from the discussion and recommendations of the Monitoring Team are reproduced below centre- and intervention-wise.

MALDA KVK

Water resource	Renovation of canals, ponds, shallow tube wells as well as creation of RWH structures were also among the mandates to generate additional water resources. The farmers felt strongly of the need for higher availability of water for irrigation through renovation of existing structures. Database quantifying the improvements made in each should however be recorded. The team visited Narayanpur, a flood prone area, where the farmers showed considerable concern to re-excavate a 2-km long derelict channel to relieve them of drainage congestion. The farmers also showed concern to renovate existing shallow TW and create new shallow TW especially in diara lands. It is recommended to collaborate with the experts in relevant fields for hydrological survey of the ground water before planning for its exploration through re-excavation or fresh excavation of existing ponds and canals, shallow and semi-deep TW particularly in areas having acute shortage of water for irrigation. It would be preferable to combine such practices with creation of drainage facilities, wherever possible, so that the excess water may be re-utilized for irrigation. Farmers showed their concern about checking seepage loss of water from the ponds, for which it would be advisable to take help of experts for appropriate technologies available.
Minimizing irrigation requirement	In-situ moisture conservation in vegetable fields with organic mulch was successfully demonstrated with 45 farmers, Attempt should be made to develop technologies to minimize irrigation requirement particularly for vegetables and other horticultural crops through, say, trickle, sprinkler or pitcher irrigation. Retting of jute in large body of stagnant water was recognized as one of the constraints to produce good quality fibre alongside wastage of water and energy. Newer technologies are reportedly available to minimize water use for which the centre is advised to consult CRIJAF and NIRJAFT. Polythene lining can be recommended in the farm ponds to reduce the seepage losses.
Climate change & crop planning	Multi-tier cropping practices with horticulture crop species were demonstrated with 15 farmers, and blackgram seed production programme was tried successfully as a remunerative enterprise with 25 farmers. Among other practices introduction of turmeric and elephant foot yam was attempted with 60 farmers. Significantly, most of the local varieties were replaced by HYV with 300 farmers under FLD. Among other attempts to increase cropping intensity significant was introduction of vegetables and forage with jute and maize with 150 farmers. Location specific Integrated Faming Systems (IFS) with maize+okra, maize+bitter gourd+okra,maize+bitter gourd+cowpea, maize+jute+okra were some of the successful demonstrations made with yield advantage as well as ensuring continuous flow of income to the farmers. Hybrid maize may be introduced to ensure higher return. In flood prone areas it is suggested to collaborate with CRRI to introduce deep water/ floating rice varieties along with associated improved cultural practices. Introduction of line sowing in jute, as successfully developed by CRIJAF, will pave the way for minimizing water requirement, which may be an important intervention for climate change. Increasing cropping intensity leads not only increase in the income of the farmers, but also paves the way to mitigate climate change, for which it is further suggested to felicitate and encourage farmers to create polyhouses at affordable costs and grow seedlings even under off-seasons and under adverse flood prone or water-scarce situations. Growing perennial crops on the raised bunds of the excavated ponds along with pisciculture and/or duckery in the ponds will ensure higher return to farmers. More areas should be brought under IFS developed location-wise with emphasis on use of remunerative crops and demand/access to markets, of which farmers were very much aware of. Technology was demonstrated for vermicompost production using 'vermibags' developed by the centre, use of which should be spread to other areas/ farmers to encourage more use of organic composts at affordable prices and build up soil organic C status, a basic necessity to mitigate climate change.

	It will be advisable to compile relevant data on climatic parameters (minimum 25 years) for probability analysis of rainfall and atmospheric temperature, and predict there from the future climate change scenario based on various climate change models available. The centre/ZPD may take initiative in this respect. This will facilitate generate future crop and water resource planning in scientific mode.
Soil resource	Benchmark survey should be conducted, using NBSS&LUP or any other appropriate agencies having the relevant expertise, to establish the soil taxonomies along with documenting other soil properties, for the three representatives land situations having distinct land and water availability characteristics. The KVK, 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.
Conservation tillage	Efficacy of zero tillage was successfully demonstrated in wheat in 8.66 ha area with 65 farmers. There was cost saving under zero tillage in contrast to traditional practice under each component like land preparation, seed, irrigation water use, fertilizer, weeding, harvest & disposal leading to benefit-cost ratio worked out as 2.36 in case of the former in contrast to 1.22 for the latter. Farmers showed considerable interest in this practice, and the centre/ ZPD may take necessary initiative to involve more farmers under the practice, recognized as one the significant practices for climate change mitigation, and extend necessary facilities as a special intervention. Necessary practices may be developed for newer range of crops like maize, jute, etc.
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 (for tall trees/orchards like mango), multi-row jute seed sowing machine, jute hand held weeding implements (consult CRIJAF), etc. There were demands for bigger tractors for custom hiring.
Alternate farming practice & roles of women folks	In-house production (low-cost technology) of azolla as poultry feed has been developed, which is commendable. An animal shelter also has been developed, and such practice should be spread to other farmers as well. The animal health is found to be weak in general. It is praiseworthy to find good number of animal health camps organized, but this should be increased to many more, preferably at each three months interval. It is suggested to seek for much larger tie-ups with line department officials due to the want of experts in the KVK. Improved breeds should be introduced. Such animals, other than cattles, like poultry, duckery, goatery, piggery may be introduced and scientifically reared. Other alternate farming practices like apiary, mushroom, ornamental fish cultivation, etc. having market demand/ access should be introduced, particularly for landless or marginal farmers. Women may take significant participation in most of them listed above, as well as for preparation of handicrafts using locally available raw materials, as acts to reduce drudgeries. Model alternate farming practices along 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 C. 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 centre may take the help of CSSRI, Regional Station Canning Town.
VCRMC	There should be more women participation, and the committee should be registered, for which ZPD may take necessary initiative. VCRMC is advised to organize more awareness meetings among the famers of different land holding categories as well as in adjoining villages.
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 centre may advise and encourage them.
Introduction of new plant species	The centre/ ZPD may take initiative to for the farmer's registration of some new pulse species with PPVFRA identified by them. This will greatly encourage them.

General facilities	It was heartening to make note the serious constraints under which the centre was working. This includes lack of approach road to the KVK, being possibly non-existent in the rainy season, for which UBKV being the controlling centre should take immediate steps. The laboratory facilities are meager, and logistic supports like electricity, housing, etc. are also weak. Immediate steps should be taken to fill up all the vacant posts of SMS. For better maintenance of the farm, it has been suggested to explore the possibility of contractual assignment to private agencies if permitted by the university rules.

COOCHBEHAR KVK

Water resource	Thirty-two percent of total cultivated area is irrigated using bore well by lifting ground water. Due to erratic distribution of rainfall observed it is recommended to renovate existing pond for water harvesting, store and recycle the same for use in crop production during winter experiencing minimal rains. Though there exist a number of small and large size water bodies most of them are seasonal and cannot be used as source of irrigation during critical stages of *rabi* crops because of the fact that (a) water holding capacity of the soil is very poor due to its coarse texture, and (b) average depth of ponds ranges from 5.5 - 7.0 ft from the ground level. Total 15 numbers of ponds having average depth of 5-7 ft. were selected for renovation at different corners of the village which however remain dry from December onwards but ponds having depth of 9 ft. or more can retain water throughout the year. Considering this, depth of selected ponds was increased from 5.5 - 7.0 ft. up to 10.5 - 11 ft (from ground level), so that water to be stored in the water bodies can be used for life saving irrigation to *rabi* crops with special emphasis on vegetables during mid December to mid March. Raised bed and furrow method of irrigation in vegetables is also recommended for saving irrigation water and fuel. Besides, attempts should be made to check the seepage loss of water using appropriate technologies for which necessary collaboration may be sought from relevant agencies. There are scopes to renovate large number of silted up ponds. The existing silted-up drainage canals need to be excavated and one-way sluice gates to be provided in order to retain water within it for irrigation. However, It is recommended to collaborate with the experts in relevant fields for hydrological survey of the ground water before planning for its exploration through re-excavation or fresh excavation of existing ponds and canals, shallow and semi-deep TW particularly in areas having acute shortage of water for irrigation. It would be preferable to combine such practices with creation of drainage facilities, wherever possible, so that the excess water may be re-utilized for irrigation.
Minimizing irrigation requirement	Organic mulching was used in tomato involving 30 farmers covering 2.54 ha area, poly-mulching in banana involving 9 farmers covering 1ha area. In tomato there was saving of 11.76 ha-cm irrigation water (29.55 %), reduction in cost of irrigation by Rs. 3,420.00 /ha, 30.21% increase in WUE, less weed population, and fuel savings @ 57 lit. diesel/ha. In banana there was saving of 9.94 ha-cm irrigation water (29.8 %), reduction in cost of irrigation by Rs. 3,090.00/ha, 30.72 % increase in WUE, less weed population, and fuel savings @ 51.49 lit. diesel/ha. It is therefore suggested to use organic / poly-mulching materials in vegetables and poly-mulching in banana for *in-situ* moisture conservation and thereby to save irrigation water as well as fuel. Water cucumber could be one of the uses for poly mulching. Keeping in view the unimodal rainfall distribution it was envisaged that Broad Bed & Furrow method of irrigation might reduce irrigation water requirement for cultivation of *rabi* vegetables especially in the *terai* zone. For these purpose 28 demonstration units of brinjal covering 2.20 ha and 22 demonstration unit of cucumber covering 2.30 ha area were brought under BBF method of irrigation. This resulted in the saving of 8.14 ha-cm irrigation water (29.50 %), reduction in cost of irrigation by Rs. 2,363/ha, 30.85 %increase in WUE, and fuel savings @ 39.37 lit. diesel/ha in cucumber, and saving of 10.10 ha-cm irrigation water (30.5 %), reduction in cost of irrigation by Rs. 2,610/ha, 30.72 % increase in WUE, and fuel savings @ 43.50 lit. diesel/ha in brinjal. It is therefore strongly suggested to use BBF method to raise *rabi* vegetables. It is also recommended to develop appropriate technologies like trickle, sprinkler, or pitcher method of irrigation especially for *rabi* vegetables and orchards in order to minimize water requirement substantially.

	In *boro* rice, SRI method of cultivation was found beneficial from demonstrations conducted in 2.46 ha area with the results of (i) production of 259 g more grain per cu.m. of water use, (ii) 24.91% saving in irrigation water, (iii) reduction in irrigation cost by Rs. 8225 per ha, 37.50% yield increment, and finally (iv) saving of 1457 lit. (3211-1754) of water per kg. of grain. SRI method is therefore strongly recommended for *boro* rice in the *terai* region. However, on each methodology, it is necessary to make 'impact anaysis' scientifically in order to validate the results.
Climate change and crop planning	Average annual rainfall of the village was fairly high (3000 mm), 75 % of which is received during June – September. Decadal trends of rainfall indicate that average rainfall during the decade decreased by almost 500 mm in each decade as reflected in average annual rainfall nearly during 80s, 3500 mm during 90s and 3000 mm during last decade. Length of winter also decreasing across the decade. In view of the trends on changing climate observed over the last three decades, it is suggested to conduct probability analyses of rainfall and temperature, and based on this the future trend of the climatic scenario with the help of climate change models available to work out scientifically future cropping and water use strategies to mitigate climate change. The *terai* region is essentially rice-oriented with jute grown profitably (for good quality fibre produced) in majority of the areas. The major cropping systems are jute-rice-fallow, fallow-rice-fallow, jute-rice potato, fallow-rice-potato, jute-rice-wheat/mustard/rice/vegetable, fallow-rice- wheat/mustard/rice/ vegetable, jute-vegetable-fallow. Large area remains fallow for a major part of the season. In medium-lowland situations rice variety Swarna Sub-1, a submergence tolerant variety has been identified (foundation seeds were collected from BCKV), while Gotra-Bidhan-1, a short duration (115-125 day) variety for early maturing has been identified through NICRA. In NICRA village site, some farmers are going towards cultivation of direct seeded rice particularly in upland when the rainfall is scanty. Considering the problem, KVK Cooch behar tried to promote brown-manuring (*Sesbania* co-culture) in direct-seeded rice. In this method, germinated rice seeds were broadcast with *dhaincha* seeds and *dhaincha* plants were killed at 25 DAS with 2,4-D @0.5 kg ai/ha and incorporated with paddy weeder at 35 DAS. KVK Coochbehar demonstrated the technology satisfactorily in 1 ha involving 6 farmers. For prevalence of stem rot disease ((*Macrophomina phaseolina*) in jute JBO-2003(H) has been identified to overcome the problem. Major problem of banana cultivation is development of scar on fruit by scarring beetle (*Colaspis hypochlora)* under hot & humid climate of *terai* region. Appropriate technology was developed (with bunch cover) by NICRA resulting in (i) infestation of scarring beetle reduced by 95 %, shooting-harvest interval reduced by 8 days, return per plant increased by Rs. 27.00, and 11.49 % increase in net income. There are scopes to increase cropping intensity by introducing wide array of vegetables suitable to low soil pH and associated features, and having low requirements with good market demand/ access. Growing perennial crops on the raised *bunds* of the excavated ponds along with pisciculture and/or duckery in the ponds will ensure higher return to farmers.
Soil resource	Soils of the village are mostly coarse textured (sandy loam), poor in water retention, having low pH, poor in nutrient status and very often characterized by boron and zinc deficiency. There are reasonably good source of organic materials viz., Natural vegetations (Forest and agro-forestry species), Crop residues as soil amendments, FYM as bulky organic manures, and Lime as soil amendment. Since the quality of compost used the farmers is not good the centre initiated
	demonstration programme (50 nos.) successfully on preparation of compost through NADEP method using locally available organic sources like cowdung, farm/kitchen waste and other locally available organic materials. Efforts to be made to introduce vermicompost using appropriate technology. It is recommended to conduct benchmark survey of the soils through appropriate agency like NBSS&LUP having the expertise. The KVK, 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.
Conservation tillage	Zero tillage technology in wheat for cutting down the time required for land preparation as well as conservation of resources was taken up. Large scale demonstration programme was carried out over 28.80 ha involving 179 farmers, and the results obtained were 34.14 % increase in grain yield, saving of

	26.02 lit. of diesel per ha towards land preparation and irrigation, saving of 43 mandays per ha towards entire growing season of wheat, saving of Rs. 8,041 per ha towards mandays requirement & Rs. 1,166 per ha towards fuel consumption during land preparation. This technology should be expanded to other areas being a key technology to mitigate climate change.
Custom hiring of agricultural machineries	A good number of farm equipments (Multicrop thresher, Reaper, Zero tillage machine, Motorised Knapsack mist blower, SRI marker, Water pump, Paddy weeder) were used for custom hiring by farmers and the total revenue earned was above Rs. 23,000/- annually. There were demands by the farmers to augment this facility.
Alternate farming practice & roles of women folks	For alternate farming following steps were taken viz., Vaccination and animal Health Camp, Promotion of fodder and Azolla as alternative cattle feed. It is suggested to develop in-house production (low-cost technology) of azolla as poultry feed. Animal shelter structure may be developed. The animal health is found to be weak in general. The animal health camps should be increased to many more, preferably at each three months interval at each site. It is suggested to seek for much larger tie-ups with live department officials. Improved breeds should be introduced. Such animals, other than cattles, like poultry, duckery, goatery, piggery may be introduced and scientifically reared. Other alternate farming practices like apiary, mushroom, ornamental fish cultivation, etc. having market demand/ access should be introduced, particularly for landless or marginal farmers. Women may take significant participation in most of them listed above, as well as for preparation of handicrafts (say jute handicrafts, *sital pati*, etc.) using locally available raw materials, as acts to reduce drudgeries. Model alternate farming practices along 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 C. Significant steps should be taken to identify fodder crops location-wise in collaboration with NIFD. The team noted with great satisfaction an extra-ordinary initiative with an array of activities for various developmental works, both in-house and also in field, partly relevant to act on climate change mitigation, by a section of womenfolk in a hamlet under the same village Khagribari, which could be a model for others. The concerned SMS (Home Science) also deserves high appreciation for her leadership and imaginative quality.
VCRMC	There should be more women participation, and the committee should be registered, for which ZPD may take necessary initiative. VCRMC is advised to organize more awareness meetings among the famers of different land holding categories as well as in adjoining villages.
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 centre may advise and encourage them.
General facilities	Since the KVK site does not represent low pH soil, a typical characteristic of the *terai* region soil it is strongly suggested that UBKV may adopt another site for KVK representing the typical *terai* features so as to validate the results through demonstrations.

SOUTH 24 PARGANAS KVK

Water resource	Based on PRA survey it was revealed that the area is mostly rainfed (86 %) with rice only grown during kharif, and out of the rest 14 % rainwater conserved in pond meets 10 % and canals 4 % for rabi crops. Underground water is hardly available, since the good quality water aquifer is located at large depths, to meet irrigation needs through tube or dug wells at the farmers' own initiatives. It is recommended to collaborate with the experts in relevant fields for hydrological survey of the ground water before planning for its exploration through re-excavation or fresh excavation of existing ponds and canals, semi-deep TW throughout the area having acute shortage of water for irrigation. It would be preferable to combine such practices with creation of drainage facilities, wherever possible, so that the excess water may be re-utilized for irrigation. It is necessary that appropriate agency could be employed through collaboration for which the centre/ZPD may take initiative for drawing desired plan for water use pattern in long term perspectives since this component is considered a key area to

	mitigate climate change. However, the centre has done a commendable work to protect the area from flood/ saline water inundation over a few km stretches during the last catastrophic cyclone ('Aila') which devastated a major part of Sundarbans. Besides, raised bed and furrow method of irrigation in vegetables is also recommended to create additional water resources. From excavation/renovation of ponds, 110 farmers were benefitted. More number of farmers are interested to participate in NICRA project activities. Increasing cropping intensity, reduction in migration from Aila affected area are some of the impact of this project.
Minimizing irrigation requirement	It appears that no attempt has been made to minimize irrigation requirement for crops, which is also recognized as a key strategy to mitigate climate change. In-situ moisture conservation through poly or organic mulching in vegetable fields could be one of the methods to conserve soil moisture and thereby decrease irrigation requirement for rabi crops. Emphasis may be given to develop technologies to minimize irrigation requirement particularly for vegetables and other horticultural crops through, say, trickle, sprinkler or pitcher irrigation for which appropriate agencies may be taken help of.
Climate change & crop planning	It is suggested to conduct probability analyses of rainfall and temperature with the help of at least 25-year data, and based on this the future trend of the climatic scenario with the help of climate change models available to work out scientifically future cropping and water use strategies to mitigate climate change. Adequate scope exists to plan future cropping models with appropriate water use models. Cropping intensity in the study area is 122.13% which is considerably below that at the state level. During rabi season, vegetables and pulses are the principal crops. Pulses are particularly salt sensitive and therefore necessary care should be exercised to select suitable salt tolerant pulses for the reason that the soils are potentially saline in nature. Vegetables should be identified having low water requirements. Since lowlands (30-60 cm waterlogging) comprise of 72 % of the total cultivated lands in kharif high yielding semi-deep water rice varieties tolerant to this situation need to be identified. It appears that adequate efforts have not been made to identify such rice varieties, for which collaboration with CSSRI, Regional Research Station Canning Town or CRRI, Cuttack need to be sought for. Besides, the area is flood prone, for which the areas susceptible to deep submergence should be identified, and flood tolerant/ floating, deep water tolerant rice may be identified through active collaboration with CRRI, and the varieties may be conserved for use in the event of such adverse situation to arise in future. Options for tissue culture of mangroves should be found out. Every attempt should be made to increase cropping intensity through introduction of suitable multi-tier horticulture crop species having good market demand/access. Suitable forage crops should be identified for growing in marginal land situations since there is acute crisis for it in view of poor animal health. Suitable hybrid fodder maize can be tried for milch animals. A location-specific appropriate crop calendar may be developed depending on land situation and water availability. Use of agro-forestry species and incorporation of green leaves as manures in soils through periodical cuttings may help enrich soil organic C to mitigate climate change trend. Increasing cropping intensity leads not only increase in the income of the farmers, but also paves the way to mitigate climate change, for which it is further suggested to felicitate and encourage farmers to create polyhouses at affordable costs and grow seedlings even under off-seasons and under adverse flood prone or water-scarce situations. Growing perennial crops on the raised bunds of the excavated ponds along with pisciculture and/or duckery in the ponds will ensure higher return to farmers. More areas should be brought under IFS developed location-wise with emphasis on use of remunerative crops and demand/access to markets, of which farmers were very much aware of. Technology may be developed and demonstrated for vermicompost production, use of which should be spread to other areas/ farmers to encourage more use of organic composts at affordable prices and build up soil organic C status, a basic necessity to mitigate climate change.
Soil resource	Only 28 % of the cultivated lands are medium and low lands, and the rest 72 % are lowlands. It did not appear to the team that the area is typically salt affected, which is an essential feature of the Sundarbans area, the latter playing a very important role to mitigate climate change. Coastal saline area, as it typically exists in Sundarbans, comprises of large water bodies i.e. back barrier environments, salt marshes, mangroves, sea grasses, beaches, to speak the least, having significant role to mitigate climate change, in particular, for the entire adjoining land mass. Moreover, it forms as the first line of defense

	to protect the land mass from the backlashes due to increasing number of cyclones taking place due to climate change with time. Attention is particularly drawn to the ICAR/NICRA authorities to pay attention to this role the coastal ecosystem say, Sundarbans, is likely to play, and assign this task to a host of appropriate agencies for an in-depth study. As for the present site, it is not expected for KVK to conduct such in-depth studies, but they may have an additional site typically deeper into Sundarbans area to generate some basic information and work out strategies to mitigate climate change for the coastal flood/ cyclone prone areas high rainfall areas. Based on these preliminary information generated a fresh initiative may be undertaken by ICAR/NICRA to launch an in-depth study through a host of institutes carefully identified as proposed above. The present site does not characterize the typical harsh environment of Sundarbans even to the limited extent since the soils are not typically saline in nature. However, the detailed data are lacking on soil characteristics, and it is suggested that an appropriate agency say, NBSS&LUP may be collaborated with to conduct benchmark survey in the area. Since salinity is highly dynamic in nature both temporarily and spatially, KVK may arrange for portable EC and pH metre for quick assessment of the parameters in situ especially during rabi season. The KVK, 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.
Conservation tillage	Efforts should be made to standardize and introduce zero tillage practices, known for its efficacy to mitigate climate change, for non-rice crops to be identified for this purpose. However, since majority of the soils are medium to heavy texture in nature, only handful of non-tuber vegetables may be suitable for this purpose.
Custom hiring of agricultural machineries	The facility may be augmented suiting particularly to the needs of low land holding areas.
Alternate farming practice & roles of women folks	Livestock in the present site comprises of indigenous cow (9.23%), goat (18.46%), special type of sheep known as "garole" (13.84%), duck (27.69%) and local poultry birds (30.78%). The animal health is found to be weak in general. The animal health camps should be increased to many more, preferably at each three months interval at each site. It is suggested to seek for much larger tie-ups with live department officials. Improved breeds should be introduced. Such animals, other than cattles, like poultry, duckery, goatery, piggery may be introduced and scientifically reared. Other alternate farming practices like apiary, mushroom, ornamental fish cultivation, etc. having market demand/ access should be introduced, particularly for landless or marginal farmers. Women may take significant participation in most of them listed above, as well as for preparation of handicrafts (say jute handicrafts, sital pati, etc.) using locally available raw materials, as acts to reduce drudgeries. Model alternate farming practices along 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 C. Significant steps should be taken to identify fodder crops location-wise in collaboration with NIFD. Promotion of fodder and Azolla as alternative cattle feed may be explored. It is suggested to develop in-house production (low-cost technology) of azolla as poultry feed and vermicompost for use in soil. Animal shelter structure may be developed.
VCRMC	There should be more women participation, and the committee should be registered, for which ZPD may take necessary initiative. VCRMC is advised to organize more awareness meetings among the famers of different land holding categories as well as in adjoining villages.
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 centre may advise and encourage them.
General facilities	As suggested above, another site deeper into Sundarbans area may be identified since the present alone does not represent the typical harsh coastal high rainfall flood or cyclone prone area in order to generate the minimum basic information before launching more in-depth studies by separate agencies, the latter to be looked after by ICAR.

7.3 THIRD VISIT:

The Monitoring Committee comprised the following members:

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

Vice-Chairman: Dr. A. K. Singh, Zonal Project Director, Zone II

Members:

1. Dr. Bikas Das, ICAR, RC ER, Plandu, as DDG's (NRM) Nominee

2. Dr. A. Shanker, Principal Scientist, CRIDA as Director's (CRIDA) nominee

3. Dr. Ashok Kumar, DEE's (BAU, Ranchi), Nominee

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

Proceedings of the NICRA Zonal (Zone II) Monitoring Committee Visit to three KVKs (Chatra, Palamu and Gumla) of Jharkhand during 12-14 March 2015

The team comprising of the following members viz., (1) Dr. H. S. Sen (Chairman), (2) Dr. Arun Shanker, PS, CRIDA-Director's Nominee, (3) Dr. Bikash Das, Sr. Scientist, ICAR RCER, RC, Ranchi, Palandu, DDG's (NRM) Nominee, (4) Dr. Ashok Kumar, PC KVK Simdega, DEE (BAU) Nominee and (5) Dr. F.H.Rahman, NICRA Nodal Scientist, ZPD II (Member Secretary) visited three NICRA-KVKs in Jharkhand during 12-14 March, 2015. The sites were located at KVKs - Chatra, Palamu and Gumla. Chatra (village Mardanpur) is having a total population of 1062 having a literacy percentage of only 26 % (female literacy 22 %) and ST community dominating about 96 % of the total population. Small and Marginal farmers constitute about 90 % of the total land holding. The village is characterized by late arrival of monsoon with erratic distribution of rainfall, high wind velocity during the month of late November & first week of December, temperature fluctuating between 0 to 48˚C, and heat wave common in late March. Palamau is having the NICRA site in villages Dulshulma and Murma with a total geographical area of about 500.8 ha out of which 215.1 is cultivable. The total population of the site is 1881 out of which ST community comprises of 88 % with literacy percentage only 26 % (female literacy only 4.3 %). Small and Marginal farmers comprise of 76 % of the total farm population.Total 19 famers out of 361 are landless. The area is characterized by late arrival of monsoon with erratic distribution of rainfall, high wind velocity in late November and early December, temperature fluctuating between -1 and 47˚C, and heat wave common in the second fortnight of March. The NICRA activities under Gumla district are located in village Gunia.The Marginal and Small farmers comprise of 94 % of the total holding, while 8 out of total 320 households are landless. The total population is 2025 with literacy percentage varying from 52 % amongst male to 39 % amongst females. ST community constitutes about 85% % of the total population. The climate is characterized by drought, erratic rainfall distribution, heat waves, hailstorm and cold waves. Following are the relevant observations made item and centrewise.

CHATRA KVK

Water resource	Presently the areas (ha) covered under different sources of irrigation are 35 under Tanks, 70 under Open Wells, and 43 under Lift Irrigation. There are 5 ha area covered through Pump sets, while there 13 ha area is covered through defunct water harvesting structures. The water table depth in bore wells is about 100 m and a drawdown of more than 1 m water level observed in bore wells over the past 10 years. The area needs major attention to create major water resources. One of them may be Ghogra Gadda Check Dam proposal for which already submitted for a total of about Rs 7.0 lakh. Besides, there should be repair of 17 Wells. It has been urged to send proposal for the repair of Prem Bundh Check Dam in Geri village. Besides, proposal may be sent to implement Lift Irrigation once the Check Dams are repaired. It has also been suggested that approach may be made to the appropriate authority to prepare well logs for a few relevant site for a clear understanding of future attempts to exploit underground water in the aquifer through tube or bore wells for their sustainable use.Study of aquifer characteristics through, say CGWB, will help determine the future prospects of exploitation of underground water in right quantity and quality more comprehensively. The ZPD-II may arrange to help the NICRA site work out design dimensions for water harvesting structures depending upon soil characteristics and rainfall pattern for efficient rainwater storage and recycling and prepare appropriate cropping system for rainfed cultivation with the help of software and expertise available.

Minimizing irrigation requirement	Various strategies could be adopted to minimize water or irrigation requirement for long term use of limited irrigation water available. These could be (i) Mulching, (ii) Introduction of short duration varieties of rice for which the Centre may be in touch with CRRI or its substation at Hazaribagh for upland research, (ii) Introduction of improved irrigation practices like drip/trickle, sprinkler, or pitcher. Long term planning may be made toposequence-wise not only to cover larger area under irrigation with limited water available, but also making sure at the same time to keep the soil moist for majority of the crop growth period to mitigate adverse effect due to climate change
Climate change & crop planning	The major cropping system at present are rice-fallow, rice-vegetables, rice-wheat, and maize-redgram. Capsicum and fruit yam have already been introduced in the related villages. One important strategy is the introduction of short duration crop varieties with low water requirement and high market values. Promotion of drip irrigation for vegetable cultivation can also ensure sufficient income generation from available water resources. It has been urged that the local forest and fruit species having abundant growth like bamboo species, palash, mahua, imli, jamun, ber, etc. should also be explored systematically. Promotion of lac cultivation through availing quality brood lac will help in proper utilization of the large number of host plants that in available in the region.It is also proposed that attempts may be made to increase cropping intensity especially through introduction of spices like black pepper, etc. There is immense scope to introduce integrated farming practice under organic cultivation keeping in view of the availability of local animals,aquatic species,etc. The forest tree leaves, twigs, etc. under natural cycles of defoliation, availability of animal litres, and the forest soils which are expected to be a rich source of beneficial microbial population all might help in the processmay be a source to produce rich quality organic manures. Thus the strategy should also be keep the soil under vegetative cover to the most possible and increase the soil organic C, a key item to mitigate the adverse climate effect due to climate change.
Soil resource	The soil textures are either sandy loam (56 %) or Clay (44 %). It is suggested to have the soil benchmark studied through appropriate agency like ICAR-NBBS&LUP as early as possible. The soils at definite grids (say, 500 metres or toposequence-wise) should be analysed periodically for fertility including micronutrients, organic carbon, relevant microbial parameters from crop active root depths (not more than 2 years interval), and relevant soil physical properties (once in 5 years) through local laboratories in universities or nearby having suitable expertise and facilities.The ZPD-II may arrange to have data bank on soil health for which protocols should be prepared by CRIDA and the NICRA KVK management appropriately trained to analyse relevant parameters for MDS with the target for future soil management strategies monitored in accordance with the soil health indices and their changes to be worked out in due course.
Conservation tillage	In order to ensure minimum disturbance of the soil as one of the important strategies to minimize impact due to adverse climatic change area under zero tillage should be increased. Already 35 ha area is under zero tillage for wheat cultivation. More area (20ha at present) should be brought under direct seeded rice.
Custom hiring of agricultural machineries	Facilities under custom hiring is encouraging (Rs. 52,000/- already deposited to bank) should be increased few folds. At least one more zero tillage equipment should be provided. Wheat thresher and power tiller facilities may be enhanced.
Alternate farming practice & roles of women folks	In view of encouraging animal farming improved breeds should be introduced in more number, and low cost animal sheds may be developed locally. Use of womenfolk may be given sufficient thrust to develop handicrafts out of forest products, especially bamboo, cultivation of mushroom, apiary, etc. Womenfolk may play an important role in preparing organic manures. The ZPD-II may take initiative in this regard to get them trained to produce the manures and use them for crop cultivation for sustainability in yield.
VCRMC	The number should be increase from 4 at present to at least to 10-12 immediately with sufficient participation of women members. The KVK management may sensitize the farmers of their roles as VCRMC members, which appears to be wanting, for development of the areas from field scale to marketing.
Marketing strategy	The VCRMC may take initiative to develop appropriate protocol to market the products available locally for the nearby market to avoid the interference of the middlemen.

Introduction of new plant species	The centre/ ZPD may take initiative to for the farmer's registration of some new forest and fruit species with PPVFRA identified by them. This will greatly encourage them.

PALAMU KVK

Water resource	The area is having 4 tanks, 51 open wells, 9 bore wells, and sources like check dams/ canals for irrigation. Besides, there are 55 defunct water harvesting structures in the village. In the bore wells water table is located at a depth of 6-38 m, and drawdown of water table to the extent of 6 m has been observed over the past 10 years, which is alarming. There is a distinct trend of decreasing rainfall with time. During the last year only 460 mm was received, due to which about 75 % of rice crop was estimated as damaged, and the damage took place also for other crops like maize, arhar, etc. Water harvesting and recycling (through renovation of wells) for supplemental irrigation have been demonstrated through 31 farmers. It is suggested to renovate Malai check dam which might solve the water constraint for irrigation to a great extent. It has also been suggested that approach may be made to the appropriate authority to prepare well logs for a few relevant site for a clear understanding of future attempts to exploit underground water in the aquifer through tube or bore wells for their sustainable use. Study of aquifer characteristics through, say CGWB, will help determine the future prospects of exploitation of underground water in right quantity and quality more comprehensively. The ZPD-II may arrange to help the NICRA site work out design dimensions for water harvesting structures depending upon soil characteristics and rainfall pattern for efficient rainwater storage and recycling and prepare appropriate cropping system for rainfed cultivation with the help of softwares and expertise available. Technology on water harvesting in plastic lined dobha can be introduced in the region for which support of ICAR RCER, RC, Ranchi may be obtained.
Minimizing irrigation requirement	All necessary measures should be undertaken to decrease water or irrigation requirement of crops. For vegetable crops and orchards in particular such low volume -high frequency irrigation methods like sprinkler, drip and pitcher may be tried or intensified. ZPD-II may provide training to the staff as well as the farmers for this purpose. Such practices like (i) Mulching (wheat straw), (ii) Introduction of short duration varieties of rice for which the Centre may be in touch with CRRI or its substation at Hazaribagh for upland research, may be implemented. SRI has been found useful in water saving in 5 ha area with 45 farmers, and this recorded higher B:C value also as compared to conventional cultivation. Long term planning may be made toposequence-wise not only to cover larger area under irrigation with imited water available, but also making sure at the same time to keep the soil moist for majority of the crop growth period to mitigate adverse effect due to climate change
Climate change & crop planning	In view of serious trend of decline in irrigation water availability with time, it is advisable to prepare contingency plans toposequence-wise and keep the necessary resources handy. Instead of upland more attention may be given for medium land situations, and such crops like direct seeded rice (cv. Sabhagi), short duration maize (HQPM-1), gram, jackfruit have been found useful . Such other low water requiring crops having local demand like ragi, elephant foot yam, turmeric, niger, arhar, maize, etc also may be intensified. It has been found that F1 hybrid vegetable has been introduced with success. Intercropping practices like maize + til, maize + arhar have been found as useful. Organic agriculture for elephant foot yam, haldi, onion, gram, tomato, etc has been found highly successful, and more such attempts may be made, since organic agriculture is known as a potential practice to increase organic C in soil and thereby combat the adverse impact due to climatic change. Forest species like bamboo, mahua, lac, palash may be grown in more number which will be a useful tool to combat the adverse climate change impact. It is suggested to introduce cotton during rabi/summer seasons or even in kharif if the decreasing trend in rainfall continues with assistance from Cotton Corporation of India (for marketing etc). It is also proposed that attempts may be made to increase cropping intensity especially through introduction of spices like black pepper, etc.
Soil resource	Major soil textures are sandy (16 %), Sandy loam (14 %), Loamy sand (23 %), Loamy (12 %), Silty clay loam (15 %), and Clay (20 %). It is suggested to have the soil benchmark studied through appropriate agency like ICAR-NBBS&LUP as

	early as possible. The soils at definite grids (say, 500 metres or toposequence-wise) should be analysed periodically for fertility including micronutrients, organic carbon, relevant microbial parameters from crop active root depths (not more than 2 years interval), and relevant soil physical properties (once in 5 years) through local laboratories in universities or nearby having suitable expertise and facilities. The ZPD-II may arrange to have data bank on soil health for which protocols should be prepared by CRIDA and the NICRA KVK management appropriately trained to analyse relevant parameters for MDS with the target for future soil management strategies monitored in accordance with the soil health indices and their changes to be worked out in due course.
Conservation tillage	Zero tillage is strongly recommended for the area in order to ensure minimum disturbance of the soil as one of the important strategies to minimize impact due to adverse climatic change. Necessary facilities may be created for this purpose.
Custom hiring of agricultural machineries	Tractor is being used in the area. Konoweeder, sprayers are available. Paddy, wheat and maize thresher are required. It was also urged to provide maize grinder, parboil drum, dal mill which will be useful for the village. So far Rs. 17,400/- has been deposited in the bank account.
Alternate farming practice & roles of women folks	Emphasis may be given to introduce improved animal species like Hybrid Pig TND and other animal species, useful particularly for landless farmers, for which assistance from line departments may be sought. Various vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry BQ vaccine, deworming etc. In NICRA adopted village mortality rate reduce up to the extent of 100% and average increase in cattle milk yield up to 20% have been recorded after the vaccinations camps organized. Composite fish rearing in the existing pond or in renovated pond were demonstrated of 5 farmer's field in NICRA adopted villages. For removing drudgery amongst the womenfolk it is suggested to introduce in large number mushroom (oyster) cultivation, apiary, vermicompost (for organic cultivation), forest product-based handicrafts, preparation of polybags for cotton cultivation (for advancement of sowing) , etc.
VCRMC	There are at present 7 members, and this should be increased to at least 12, out of which 25-50 % should be lady members.
Marketing strategy	VCRMC may take initiative to form sub-groups to develop direct marketing programmes in the nearby big market to minimize the role of middlemen as far as possible.
Introduction of new plant species	The centre/ ZPD may take initiative to for the farmer's registration of some new forest and fruit species with PPVFRA identified by them. This will greatly encourage them.

GUMLA KVK

Water resource	There are 5 tanks (command area 6 ha), 24 open wells (15 ha), 11 lift irrigations (50 ha), 2 river water sources, 2 defunct rainwater harvesting structures in the village. Depth of water table in the bore wells is about 40 m, drawdown of water table during the past 10 years has been recorded as 1-1.5 m. Underground water has in a few places found to be saline and sodic in nature. Following activitiesrelated to water resource management were undertaken: 1. Bora Bandi 2. Medbandi 3. Well renovation 4. Pond renovation 5. Canal cleaning 6. New pond creation 7. Installation of irrigation lift device It is suggested that approach may be made to the appropriate authority to prepare well logs for a few relevant site for a clear understanding of future attempts to exploit underground water in the aquifer through tube or bore wells for their sustainable use. Study of aquifer characteristics through, say CGWB, will help determine the future prospects of exploitation of underground water in right quantity and quality more

	comprehensively. The ZPD-II may arrange to help the NICRA site work out design dimensions for water harvesting structures depending upon soil characteristics and rainfall pattern for efficient rainwater storage and recycling and prepare appropriate cropping system for rainfed cultivation with the help of softwares and expertise available. Attempts to use lift irrigation after renovating the check dams are praiseworthy, and more such attempts may be made in future.
Minimizing irrigation requirement	To enhance the water use efficiency capacity building programme was organized on micro irrigation and two units of drip irrigation system was also installed in the farmer's field, to demonstrate the technology for effective utilization and water budgeting. High density Guava and Mango was also demonstrated with drip irrigation system. All necessary measures should be undertaken to decrease water or irrigation requirement of crops. For vegetable crops and orchards in particular such low volume -high frequency irrigation methods like sprinkler, drip and pitcher may be tried or intensified. ZPD-II may provide training to the staff as well as the farmers for this purpose. Such practices like (i) Mulching, (ii) Introduction of short duration varieties of rice for which the Centre may be in touch with CRRI or its substation at Hazaribagh for upland research, may be implemented.
Climate change & crop planning	Following contingency cropping strategies were undertaken: *Early season drought (delayed onset)* – Seedling raised near water source, Broadcast seeding of rice, Short duration paddy variety (Gora Paddy), Field preparation before monsoon.Maize sown across the slope, Earthing up in maize and Red gram, Intercropping in Red gram & Black gram. *Normal onset followed by 15-20 days dry spell* - Lifesaving irrigation given to crops, Short duration variety use, Selected low water requirement crops like sweet potato, Ragi, Niger, Kulthi&Seasmam, Old seedling of paddy used for transplanting, Date of sowing shifted for 15 days. *Mid season drought (long dry spell, consecutive 2 weeks dry spells)* – Life saving irrigation given to crops, Short duration variety use, Selected low water requirement crops like sweet potato, Ragi, Niger,Kulthi & Seasmam, Old seedling of paddy used for transplanting, Date of sowing shifted for 15 days. *Terminal drought*– Changing for black gram, horse gram, red gram, linseed, etc., linseed sown in fallow lands, cultivation of vegetable crops. The cropping intensity of the area is 115 %. In future attempts will be made to implement number of integrated farming system models suitable for the area, use of organic agriculture, introduction of drought tolerant plant varieties, and promotion of HQPM (maize) for fodder demonstration. Organic agriculture is known as a potential practice to increase organic C in soil and thereby combat the adverse impact due to climatic change. Fruit crops have tremendous potential for this district. Promotion of technologies like *in situ* orchard establishment and capacity building programme on nursery management will go a long way in expansion of area under horticultural crops.
Soil resource	Major soil textures are Sandy loam (65.18%), Clay loam (29.10%), and Red laterite (5.66 %). Out of the gross cultivated area of 523.23 ha (89.75% of total, cultivable wasteland is 8.0%, pasture land is 2.2%, rainfed is 85%, net irrigated area is 14%, and gross irrigated area is 15%. It is suggested to have the soil benchmark studied through appropriate agency like ICAR-NBBS&LUP as early as possible. The soils at definite grids (say, 500 metres or toposequence-wise) should be analysed periodically for fertility including micronutrients, organic carbon, relevant microbial parameters from crop active root depths (not more than 2 years interval), and relevant soil physical properties (once in 5 years) through local laboratories in universities or nearby having suitable expertise and facilities. The ZPD-II may arrange to have data bank on soil health for which protocols should be prepared by CRIDA and the NICRA KVK management appropriately trained to analyse relevant parameters for MDS with the target for future soil management strategies monitored in accordance with the soil health indices and their changes to be worked out in due course.
Conservation tillage	Attempts have already been undertaken on the conservation practices to mitigate the moisture stress and enhancing the water conservation and soil health through promotion of crop rotation, mulching and crop residue management and demonstration on zero tillage and multi crop planter also promotion of low water requiring crop.

Custom hiring of agricultural machineries	It is important to provide necessary facilities for more implements like threshers, zero tillage equipment, dal mills, maize grinders, parboil drums, etc. Considering the site is doing a challenging job efficiently in the area, it may be prudent to provide them tractors and power tillers as a special case for the NICRA sites.
Alternate farming practice & roles of women folks	For removing drudgery amongst the womenfolk it is suggested to introduce in large number mushroom (oyster) cultivation, apiary, vermicompost (for organic cultivation), forest product-based handicrafts, etc. Animal rearing is important particularly for landless farmers. Womenfolk may be engaged more in rearing of animals of improved breeds. Attempts may be made to create low-cost shelter belts
VCRMC	Committees consisting of at least 12 members, which may include25-50 % lady members, should be ensured at each NICRA site for close liaison with the farming community and regular introspection for improvement under guidance of the Centre.
Marketing strategy	VCRMC may take initiative to form sub-groups to develop direct marketing programmes in the nearby big market to minimize the role of middlemen as far as possible.
Introduction of new plant species	The centre/ ZPD may take initiative to for the farmer's registration of some new forest and fruit species with PPVFRA identified by them. This will greatly encourage them.

7.4 FOURTH VISIT:

The Monitoring Committee comprised the following members:

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

Vice-Chairman: Dr. A. K. Singh, Zonal Project Director, Zone II

Members:

1. Dr. Ashutosh Upadhyaya (SWCE), Head & PS, ICAR RCER, Patna as DDG's (NRM) nominee
2. Dr. K. Srinivasan Reddy (SWCE), PS, CRIDA as CRIDA-Director's nominee
3. Dr. A. K. Singh, Professor (Agronomy), BAU, Bhagalpur as DEE's (BAU, Bhagalpur) nominee and
4. Dr. Mithilesh Kumar, Assoc. Dir Res, RAU, Pusa as DEE's (RAU, Pusa) Nomonee,

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

Proceedings of the NICRA Zonal (Zone II) Monitoring Committee Visit to three KVKs of Bihar during 20-22 May 2015

The committee comprised of Dr. H. S. Sen, former Director, ICAR-CRIJAF as the Chairman, Dr. Ashutosh Upadhyaya (SWCE), Head & Principal Scientist, ICAR Res. Complex for ER, Patna as ICAR DDG's (NRM) nominee, Dr. K. Srinivasan Reddy (SWCE), Principal Scientist, ICAR-CRIDA, Hyderabad as CRIDA Director's nominee, Dr. A. K. Singh, Professor (Agronomy), BAU, Bhagalpur as DEE's (BAU, Bhagalpur) nominee for first two (Jehanabad and Buxar), Dr. Mithilesh Kumar, Assoc. Director Research, RAU, Pusa as DEE's (RAU, Pusa) nominee for the last visit (Saran KVK), and Dr. F.H.Rahman, PS, ZPD II, Kolkata as Member Secretary. The committee visited three stations viz., Jehanabad, Buxar and Saran in Bihar during 20-22 May, 2015. All the three stations are hot and dry. In Jehanabad the total household families are 176, out of which 5 are large land holders (4.8 ha average land holding), 24 medium (3.12 ha), 72 small (1.44 ha), 135 marginal (0.53 ha) and 140 landless. Total population is 2175, out of which 1170 are male (38 % literate) and 1005 are female (10 % literate). Average annual rainfall is 1051 mm, and the rainfall received through SW monsoon during 2011 is 97.9 %. The area is characterized by drought. In Buxar, the population of Kukurha village is about 5825 which comprised of total male and female population of about 2996 (66.6 %) and 2829 (47.8 %), respectively. There are 639 households, out of which 5 are large land holders, 53 medium, 102 small, 207 marginal and 273 landless. Average (25 years) annual rainfall is 1079.5 mm out of which 83 % is received during June to September (SW). Rainfall is characterized by (i) late arrival of monsoon & early cessation, (ii) erratic distribution, (iii) 15-20 days interval between two rainfall events, (iv) more quantity of rainfall in short span, and (v) sometime rainfall with high wind velocity during the month of late November & first week of December. Other climatic features include (i) heat wave in the end of *rabi* and summer season, (ii) cold wave in *rabi* season, (iii) moisture stress & intermittent drought in *kharif* season, and (iv) wide fluctuation in temperature 6^0 C to 46^0 C annually. In Siwan (village Aphkur) total number of household is 4000, out of which 100 are large (average size 4.5 ha), 400 medium (average 2.5 ha), 1500 small (average 1.20 ha), 2000 marginal (average 0.4 ha), and there are no landless labours. There

are 1900 belonging to OBC, 800 SC, and the rest 1300 unreserved. Average annual rainfall received is 1140 mm, out of which 85 % is received during June to September through SW monsoon. Temperature may vary from 2 to 45˚C, although yearly average is recorded as 26-35˚C (Tmax) and 10-16˚C (Tmin).

JEHANABAD KVK

Water resource	There are 8 tanks covering 80 ha as command area, 20 open wells covering 50 ha area, 11 bore wells covering 55 ha, 10 lift irrigations covering 37.5 ha, and 3 pynes covering 100 ha. Discharge of water from bore wells at a few places was found to be low due to higher suction head. Besides there are 4 direlict channels which need to be renovated for rainwater harvesting. The KVK renovated 5 ponds and undertook construction of checkdams at different locations of pyne. The depth of ground water in bore wells is around 10 m. It was interesting to see fairly good area covered with multiple cropping systems particularly with bore well and lift irrigation. It would be worth KVK create more water resources. It was suggested to the KVK with assistance from the local enthusiasts and expertise available to create a master plan on water resource maps and suggest irrigation and drainage network for the entire area, and submit the same to ZPD-II/ NICRA for their due consideration. Some corrective measures in the newly constructed check dams also need to be undertaken, and at one such construction site it has been pointed out to replace three sluice gates constructed side by side by one only, and close the other two, and use rubber gasket along the sides to prevent leakage of water and ease of operation. Wherever possible drip and pitcher irrigation system need to be undertaken. It is suggested that ZPD-II may extend facility to train up the KVK staff for scientific approach to create on-farm water resources along with their design dimensions from rainfall based on rainfall characteristics and soil properties for appropriate multiple crop planning for which experts and necessary softwares are available. The water resources so created may be utilized also for composite fish culture, duckery and plantation crops on the *bund* around it. It will be necessary for this purpose to work out probability analyses of rainfall and evaporation data for more than 30 years to compute excess rainfall available. It has been suggested that KVK with assistance of the farmers may take up study on groundwater depths and their fluctuations over time at definite grids all over the area, which will give the idea on depths of underground water availability at different times of the year in order to exploit it for bore wells and lift irrigations. The aquifer characteristics of the area may be undertaken through CGWB or only other similar organization, and the results generated there from may be utilized for exploiting underground water for irrigation through tubewells. ZPD-II may extend help for this purpose.
Minimizing irrigation requirement	Capacity building programme and demonstration was done on micro irrigation using sprinkler irrigation system for efficient utilization of water. After motivation farmers have also purchased their own sprinkler system and have used for wheat and pulse irrigation. Direct seeded rice and SRI method of cultivation were practised to minimize water requirement in rice. Low water requiring crops like redgram, linseed, gram, lentil, kulthi, urd, toria, elephant footyam, etc. were adopted. In water saving irrigation methods at some sites raised bed furrow irrigation, drip irrigation and LEWA demonstrations were presented but its role in improving water productivity were not properly documented.
Climate change & crop planning	In view of climate change to take place continually, as experienced by the farmers, over time every effort should be undertaken to introduce such crops which are drought tolerant and heat resistant and more and more area should be brought under irrigation without adversely affecting the ecology, very importantly the underground water. Besides *rabi*/summer crops mentioned above it is suggested to adopt cotton over large area for which CCI might come in handy for help. Large areas may be brought under forest species including bamboo and fodder crops which are locally suitable. Following practices on crop management were followed: (i) raising of paddy seedling near pond, (ii) direct seeding of rice, (iii) cultivation of drought tolerant paddy variety Sahbhagi, Sabour Ardhjal, (iv) SRI method of paddy cultivation, (v) cultivation of redgram, linseed, gram and lentil, kulthi, urd, maize, toria, potato, elephant footyam, maize+potato, redgram+millet, gram+linseed,, lentil+mustard, (vi) Nutrition gardening. It should be targeted to reach up to 300% cropping intensity by fully exploiting water available during dry rabi/ summer season. It is suggested to introduce biofertilizer and organic manure in large areas, and the farmers should be trained for this purpose. Units for vermicompost and brown manuring may be established. For increased moisture conservation plastic and straw mulching have been demonstrated. Data

	should be generated on soil moisture status and temperature up to active root depth for mulched and non-mulched areas for tangible conclusion on the efficacy of mulching practices.
Soil resource	Twenty percent of the soils is sandy loam and 80 % clay loam in texture. It is suggested to (i) collaborate with NBSS&LUP for benchmark soil analysis of the area, (ii) analyze relevant soil chemical including micronutrients and physical data at an interval of 12 months (for chemicals) at 500 m grids, and (iii) generate data on soil health with the help of units like CRIDA having the requisite expertise. A laboratory with minimum soil analysis facility may be developed at the KVK. A soil testing kit is recommended for the KVK. Fertilizer recommendations should be made based on soil tests only.
Conservation tillage	Various interventions under this has been undertaken like sowing of wheat by zero tillage, crop residue management. More of such practices should be undertaken.
Custom hiring of agricultural machineries	Under CHC different farm implements/Machinery were used: Power Reaper Zero till seed cum fert. drill. Rotavator and power tiller
Alternate farming practice & roles of women folks	In the area of livestock management suitable local breeds say, pig (T&D), goat, etc. may be introduced along with preventive vaccination against FMD & HS+BQ of cattle and PPR in goat. Strategy should be taken to develop climate change resilient hybrid animals in particular in view of their low resilience in general as compared to local animals. Methods may be developed to decrease fish mortality against low temperature and deficient oxygen status. Demonstration of mineral mixture and use of dewormer may be practised for enhanced productivity. It is suggested to use low cost bamboo base poultry shelter. Azolla has been found useful as feed, and may be encouraged. 'Pashu chocolate' developed by this centre is considered to help combat climate change to produce more milk yield in cattle breeds particularly in Jersey compared to desi. Women may have important roles in say, azolla cultivation, cattle feed & mineral mixture management, vermicompost, poultry and duckery, etc. besides VCRMC & marketing management. In institutional interventions, it was felt that there is a scope of establishing strong linkage with KVKs and State Government extension agencies and other input suppliers. So, frequency of awareness campaigns, capacity building activities, farmers fairs, engagement strategies and facilitation of dialogue and discussion among themselves can improve their ability to cope up with climate change and have climate resilient agriculture. It is important to study impact analysis and prepare a success story of NICRA project for 4 years conducted so far. Also separate study may be initiated for diffusion of the successful technologies/ models demonstrated at the site to adjoining villages. ZPD-II may facilitate and oversee the implementation and progress of such studies.
VCRMC	Number of members should be increased to minimum 15 with at least 20-25 % as women amongst them. It is also suggested that the unit should be registered for which ZPD-II may take initiative.
Marketing strategy	It is suggested to form a cooperative under the initiative of VCRMC. A unit should be formed under it to look after marketing of the produce of the entire area in the nearby local/big markets to fetch good prices without involving middlemen on daily/ periodic basis. Links may also be made with local reputed cooperative 'Sudha cooperative Dairy Ltd.', Patna.
Introduction of new plant species	Farmers should be made aware of and encouraged to register new plants with PPVFRA, a GoI department and get financial benefit thereof. ZPD-II may facilitate the process.

BUXAR KVK

Water resource	There are 8 tanks, 45 open wells and 100 bore wells, besides 2 check dams and 1 canal. There are 2 direlict water harvesting structures required to be renovated for use for rain water harvesting structures. Besides, 6 water storage structures (tanks) were reported to be completely dried up, and it is recommended to (a) take up hydrological study and (b) mix up soils in the tank beds with bentonite/FYM/straw to prevent leaching of water through it wherever required based on hydrological study. It is recommended to create check dam on Nuni rivulet. Suggested to include Kunhar bund, Biswswari bund and Chotni fall (water diversion/check dam structure 3 nos.) for which they may seek cooperation with Minor Irrigation Department. Bijhoura to Kukurha 1.5 km long irrigation channel is strongly recommended to be re-

	excavated to create additional water resource for which the KVK may arrange visit of the local experts and draw up the plan and submit for execution. The depth to groundwater in bore wells varies from 8-23m. Discharge of water from bore wells at a few places was found to be low due to higher suction head. Major intervention included digging of farm ponds, repair and renovation of existing rain water harvesting infrastructure such as de-siltation of well, tanks, repair of sluice gates, etc. Water harvesting and recycling (farm percolation pond) for supplemental irrigation were demonstrated involving 06 numbers of farmers. Attempts were made to artificially recharge groundwater by field bunding. It is suggested that ZPD-II may extend facility to train up the KVK staff for scientific approach to create on-farm water resources along with their design dimensions from rainfall based on rainfall characteristics and soil properties for appropriate multiple crop planning for which experts and necessary softwares are available. The water resources so created may be utilized also for composite fish culture, duckery and plantation crops on the bund around it. It has been suggested that KVK with assistance of the farmers may take up study on groundwater depths and their fluctuations over time at definite grids all over the area, which will give the idea on depths of underground water availability at different times of the year in order to exploit it for bore wells and lift irrigations. The aquifer characteristics of the area may be undertaken through CGWB or only other similar organization, and the results generated therefrom may be utilized for exploiting underground water for irrigation through tubewells. ZPD-II may extend help for this purpose.
Minimizing irrigation requirement	Short duration varieties of rice like Moti, Sbhagi, Naveen were tried. Water saving paddy cultivation methods through short duration varieties, direct seeded rice, have been demonstrated in 12.52 ha area of 38 Number of farmer's field. SRI method of cultivation of rice was practised to save water for irrigation resulting in higher benefit : cost value of 2.20. Low water requiring crops like pigeon pea and coriander were introduced. Organic mulching in okra was demonstrated. Data should be generated on soil moisture status and temperature up to active root depth for mulched and non-mulched areas for tangible conclusion on the efficacy of mulching practices. It is recommended to introduce cotton being highly drought tolerant in large areas for which CCI may come handy to help. It is strongly suggested to introduce water saving irrigation systems like drip, sprinkler and pitcher. In water saving irrigation methods at some sites raised bed furrow irrigation, drip irrigation and LEWA demonstrations were presented but its role in improving water productivity were not properly documented.
Climate change & crop planning	In view of climate change to take place continually, as experienced by the farmers, over time every effort should be undertaken to introduce such crops which are drought tolerant and heat resistant and more and more area should be brought under irrigation without adversely affecting the ecology, very importantly the underground water. Under crop production module introduction of drought resistant varieties of paddy namely, Naveen, Sahbhagi and Shusak Samrat, as well as Bajra ICMV 155,Wheat WR544, pigeon pea PRG158 and coriander were demonstrated. Water saving paddy cultivation methods through short duration varieties, direct seeded rice, have been demonstrated in 12.52 ha area of 38 Number of farmer's field. To combat drought different other strategies followed were (i) live saving irrigation in nursery rice field, (ii) introduction of short duration rice var. Jaldidhan 13, Prabhat and Turanta, (iii) selection of low water requirement crops like Bajra, Mandua, Urdbean, moongbean, redgram var. Sharad, lentil, linseed, turmeric, vegetable crops like potato, cauliflower and amaranthus, and (iv) use of Dapog method and mat method of rice nursery. It should be targeted to reach up to 300% cropping intensity by fully exploiting water available during dry rabi/ summer season. It is suggested to introduce biofertilizer and organic manure in large areas, and the farmers should be trained for this purpose. Units for vermicompost and brown manuring may be established.
Soil resource	Different soil textures of the area were 1.61 % for loamy sand, 11.26 % for loam, 40.25 % for silty clay loam, and 46.86 % for clay. It is suggested to (i) collaborate with NBSS&LUP for benchmark soil analysis of the area, (ii) analyze relevant soil chemical including micronutrients and physical data at an interval of 12 months (for chemicals) at 500 m grids, and (iii) generate data on soil health with the help of units like CRIDA having the requisite expertise. A laboratory with minimum soil analysis facility may be developed at the KVK. A soil testing kit is recommended for the KVK. Fertilizer recommendations should be made based on soil tests only.

Conservation tillage	Various practices followed included direct seeded rice cultivation, deep summer ploughing through mould board, zero tillage in rabi wheat and pulses, and crop residue management through happy seeder. More of such practices should be undertaken.
Custom hiring of agricultural machineries	It has been strongly urged to arrange power tiller for the area.
Alternate farming practice & roles of women folks	In the area of livestock management suitable local breeds say, pig (T&D), goat, etc. may be introduced along with preventive vaccination. Various vaccination camps were organized against Ecto and Endo parasites of cattle, Nutrient deficiency (Milk fever, Pica) reproductive cases (Anoestrus) BQ vaccine, deworming Diarrheic cases with conyulsions and death in sheep, etc. In NICRA adopted village mortality rate reduced up to the extent of 90% and average increase in cattle milk yield up to 22 % have been recorded after the vaccinations camps organized. Composite fish rearing in the existing pond or in renovated pond were demonstrated of 4 farmer's field in NICRA adopted villages. Besides, duckery was also practised in a number of ponds. Attempts should intensify on forest tree plantation. Demonstrations were also made on oyster cultivation. Strategy should be taken to develop climate change resilient hybrid animals in particular in view of their low resilience in general as compared to local animals. Methods may be developed to decrease fish mortality against low temperature and deficient oxygen status. 'Pashu chocolate' developed by Jehanabad KVK is considered to help combat climate change to produce more milk yield in cattle breeds particularly in Jersey compared to desi. Women may have important roles in say, azolla cultivation, cattle feed & mineral mixture management, vermicompost, poultry and duckery, etc. besides VCRMC & marketing management. In institutional interventions, it was felt that there is a scope of establishing strong linkage with KVKs and State Government extension agencies and other input suppliers. So, frequency of awareness campaigns, capacity building activities, farmers fairs, engagement strategies and facilitation of dialogue and discussion among themselves can improve their ability to cope up with climate change and have climate resilient agriculture. It is important to study impact analysis and prepare a success story of NICRA project for 4 years conducted so far. Also separate study may be initiated for diffusion of the successful technologies/ models demonstrated at the site to adjoining villages. ZPD-II may facilitate and oversee the implementation and progress of such studies.
VCRMC	Number of members should be increased to minimum 15 with at least 20-25 % as women amongst them. It is also suggested that the unit should be registered for which ZPD-II may take initiative.
Marketing strategy	It is suggested to form a cooperative under the initiative of VCRMC. A unit should be formed under it to look after marketing of the produce of the entire area in the nearby local/big markets to fetch good prices without involving middlemen on daily/ periodic basis. Links may also be made with local reputed cooperative 'Sudha cooperative Dairy Ltd.', Patna.
Introduction of new plant species	Farmers should be made aware of and encouraged to register new plants with PPVFRA, a GoI department and get financial benefit thereof. ZPD-II may facilitate the process.

SARAN KVK

Water resource	Renovation of water harvesting structures and ponds/water reservoirs was emphasized at a number of places. A total of 5 each of check dam and ponds was excavated last year. Depth water in the bore well is 18-20 m. Discharge of water from bore wells at a few places was found to be low due to higher suction head. Storage of water on the soil surface through field leveling and bunding acted on ground water recharge. It is suggested that ZPD-II may extend facility to train up the KVK staff for scientific approach to create on-farm water resources along with their design dimensions from rainfall based on rainfall characteristics and soil properties for appropriate multiple crop planning for which experts and necessary softwares are

	available. The water resources so created may be utilized also for composite fish culture, duckery and plantation crops on the bund around it. It has been suggested that KVK with assistance of the farmers may take up study on groundwater depths and their fluctuations over time at definite grids all over the area, which will give the idea on depths of underground water availability at different times of the year in order to exploit it for bore wells and lift irrigations. The aquifer characteristics of the area may be undertaken through CGWB or only other similar organization, and the results generated therefrom may be utilized for exploiting underground water for irrigation through tubewells. ZPD-II may extend help for this purpose.
Minimizing irrigation requirement	Following strategies were adopted viz., (i) to enhance the water use efficiency capacity building programme was organized on micro irrigation, (ii) drip irrigation system/Sprinkler Irrigation System was installed in the farmer's field in convergence with Government of Bihar under NHM to demonstrate the technology for effective utilization, (iii) water availability, water resource creation through water harvesting, future water demand and water budgeting are being worked out, (iv) irrigation through PVC pipes instead of open channels was carried out at a number of places. Low water requiring crops were grown. High density guava and litchi was demonstrated with drip irrigation practice. It is recommended to introduce cotton being highly drought tolerant in large areas for which CCI may come handy to help. It is strongly suggested to introduce water saving irrigation systems like pitcher along with drip and sprikler. In water saving irrigation methods at some sites raised bed furrow irrigation, drip irrigation and LEWA demonstrations were presented but its role in improving water productivity were not properly documented. Use of Pusa Varidhar and other Hydrogels were used this season. Attempts may be made to retain more water in soil through organic and polythene mulching on cropped soils. Data should be generated on soil moisture status and temperature up to active root depth for mulched and non-mulched areas for tangible conclusion on the efficacy of mulching practices.
Climate change & crop planning	Following strategies were adopted in the event of water scarcity/ drought namely, (i) rice seedlings raised near water source and community nurseries were preferred wherever possible, (ii) short duration paddy varieties (Sahbhagi, Prabhat, Rajendra Bhagwati) were grown, (iii) lifesaving irrigation was given to crops, (iv) low water requiring crops maize, red gram, sesame, jowar were grown, (v) application of anti-transpirants was made. It should be targeted to reach up to 300% cropping intensity by fully exploiting water available during dry rabi/ summer season. As mentioned in the previous column cotton being drought tolerant may be grown over large areas. It has been urged to introduce HQPM (hybrid maize) to ensure nutritional aspect also. Different drought and flood tolerant varieties of suitable crops may be grown. It is suggested to introduce biofertilizer and organic manure in large areas, and the farmers should be trained for this purpose. Units for vermicompost and brown manuring may be established.
Soil resource	The soil textures were mainly dominated by sandy loam (75 %) and clay loam (25 %). It is suggested to (i) collaborate with NBSS&LUP for benchmark soil analysis of the area, (ii) analyze relevant soil chemical including micronutrients and physical data at an interval of 12 months (for chemicals) at 500 m grids, and (iii) generate data on soil health with the help of units like CRIDA having the requisite expertise. A laboratory with minimum soil analysis facility may be developed at the KVK. A soil testing kit is recommended for the KVK. Fertilizer recommendations should be made based on soil tests only.
Conservation tillage	Various practices followed included zero tillage in rabi wheat and pulses, and crop residue management. More of such practices should be undertaken.
Custom hiring of agricultural machineries	Power tillers may be provided
Alternate farming practice & roles of women folks	It is recommended to introduce IFS ensuring higher cropping intensity. It should encompass along with arable crops including fodder crops & forestry species animal husbandry, fishery, duckery, and other allied practices. In the area of livestock management suitable local breeds say, pig (T&D), goat, etc. may be introduced

	along with preventive vaccination against FMD & HS+BQ of cattle and PPR in goat. Demonstration of mineral mixture and use of dewormer may be practised for enhanced productivity. It is suggested to use low cost bamboo base poultry shelter. Azolla has been found useful as feed, and may be encouraged. Strategy should be taken to develop climate change resilient hybrid animals in particular in view of their low resilience in general as compared to local animals. Methods may be developed to decrease fish mortality against low temperature and deficient oxygen status. 'Pashu chocolate' developed by Jehanabad KVK is considered to help combat climate change to produce more milk yield in cattle breeds particularly in Jersey compared to desi. Women may have important roles in say, azolla cultivation, cattle feed & mineral mixture management, vermicompost, poultry and duckery, etc. besides VCRMC & marketing management. In institutional interventions, it was felt that there is a scope of establishing strong linkage with KVKs and State Government extension agencies and other input suppliers. So, frequency of awareness campaigns, capacity building activities, farmers fairs, engagement strategies and facilitation of dialogue and discussion among themselves can improve their ability to cope up with climate change and have climate resilient agriculture. It is important to study impact analysis and prepare a success story of NICRA project for 4 years conducted so far. Also separate study may be initiated for diffusion of the successful technologies/models demonstrated at the site to adjoining villages. ZPD-II may facilitate and oversee the implementation and progress of such studies.
VCRMC	Number of members should be increased to minimum 15 with at least 20-25 % as women amongst them. It is also suggested that the unit should be registered for which ZPD-II may take initiative.
Marketing strategy	It is suggested to form a cooperative under the initiative of VCRMC. A unit should be formed under it to look after marketing of the produce of the entire area in the nearby local/big markets to fetch good prices without involving middlemen on daily/ periodic basis. Links may also be made with local reputed cooperative 'Sudha cooperative Dairy Ltd.', Patna.
Introduction of new plant species	Farmers should be made aware of and encouraged to register new plants with PPVFRA, a GoI department and get financial benefit thereof. ZPD-II may facilitate the process.

Zonal monitoring committee visits different KVKs

8. Expenditure Statement of 15 KVKs during 2014-15

Table. Expenditure details during 2014-15

Zone/KVK	RE for 2014-15			Expenditure from 1st April 2014 to 31st March, 2015			Closing Balance on 01.4.15 Total
	Contingencies	TA	Total	Contingencies	TA	Total	
ZPD, Zone II	5.00	2.00	7.00	409313	93182	502495	197505
Aurangabad	17.50	0.50	18.00	1760000	40000	1800000	-
Buxar	12.00	0.50	12.50	1100000	50000	1150000	(-) 9026
Chatra	11.00	0.50	11.50	1100000	50000	1150000	858
Cooch Behar	8.00	0.50	8.50	810000	40000	850000	30129
E.Singhbhum	9.00	0.50	9.50	784078	50000	834078	115922
Gumla	10.00	0.50	10.50	756748	50000	806748	243252
Jehanabad	12.00	0.50	12.50	1176433	40000	1216433	33567
Koderma	10.00	0.50	10.50	929526	44367	973893	46789
Malda	9.00	0.50	9.50	478021	40000	518021	439284
Nawada	12.00	0.50	12.50	1320000	30000	1350000	4340
Palamu	12.00	0.50	12.50	1000000	40000	1040000	210000
Port Blair	9.00	0.50	9.50	477278	40000	517278	468663
Saran	16.00	0.50	16.50	1600000	50000	1650000	3047
South 24 Pgs.	17.00	0.50	17.50	1705464	40000	1745464	4118
Supaul	12.00	0.50	12.50	1200000	49820	1249820	33380
Total	**181.50**	**9.50**	**191.00**	**16606861**	**747369**	**17354230**	

9. Convergence by NICRA with ongoing Development Programmes/Schemes

Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development programmes or schemes during 2014-15. The prominent development schemes are NAIP, MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram SadakYojana, Chief Minister Sadak Yojna, Backward Rural Grant Fund, Silk Board, Sunderban Development Board, NFSM, IWMP, IVRI, PDADMAS, Forest Department, MESO, IAP Yojana etc. NICRA implementing KVKs being part of the different convergence programmes generated a handsome amount of Rs. 22,08,29,339/- during 2014-15. 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	-	-	-
Aurangabad	National micro irrigation system project	Sprinkler irrigation system	1005237.00
	Adarsh Dairy gram yojna	Chilling plant	1482000.00
	Pradhan Mantri Gram Sarak Yojna	Construction of road (4 km)	17600000.00
	IAP yojna	PACS Godown	1769000.00
	RKVY	PACS Godown	1145000.00
	RKVY	Threshing Floar	78000.00
	Animal Husbandry Department (Under construction)	Veterinary Hospital	4000000.00
	RKVY (Under Process)	Rice mil	3440000.00
Total			30519237.00
Buxar	Roral development	Village link way using Brick soloing (350 feet)	500000.00
	MLA Fund	Village link way using Brick soloing (1700 ft)	1000000.00
	RKVY	SRI in Rice (56.0 acre)	145264.00
	RKVY	Seed village (100.0 acre)	34800.00
	Mukhyemantri Tibra Beej Bistar Yojana	Seed production (22 acre)	3828.00
	RKVY	Integrated Seed Village Scheme (in 5.0 ha area Wheat Var. PBW-343)	16120.00
	RKVY	Seed Village (in 40.0 ha area Wheat Var. HUW-234 & K307)	124000.00
	RKVY	SWI in Wheat Var. PBW-343 in 13.0 acre	16120.00
	RKVY	Chickpea in 6.0 area (Var. 362)	11280.00
	RKVY	Lentil in 5.0 acre area Var. K75	6700.00
Total			1858112.00
Jehanabad	MANREGA	Pyne Renovation(2 km)	500000.00
	MANREGA	Raising of bund height (400 feet)	358600.00
	D.A.O. (Organic farming)	Vermicompost 20 unit (10 bed each)	600000.00
	Plantation (Forest Department)	Papaya Plant 1000	30000.00
Total			**1488600.00**
Nawada	Vaccination & Animal Camps	Supply vaccines and Drugs (1404)	18,000.00
	Backward Rural Grant Fund	1250 mt P.C.C Road (Vidyasagar)	1,90,000.00
	Pradhan Mantri Gramin Sarak Yojna	2250 mt Pakka Road (Bhaluyahi to Upper Majhila)	1,02,00,000.00
	Chief Minister Sarak Yojna	1300 mt Pakka Road (Mathurapur to Vidyasagar)	96,00,000.00
	MANREGA	Brick Soling (300 ft) Drainage (500 ft)	5,00,000.00
	Backward Rural Grant Fund	120 ft P.C.C. Road(Gadi Majhila)	88,000.00
	BRGF through Zila Parisad	410 ft P.C.C. Road (Gadi Majhila)	4,00,000.00
	4th Finance Ayog	300 ft Drainage line (Gadi Manjhila)	1,50,000.00
	13th Finance Ayog	200 ft P.C.C. Road (Gadi Majhila)	2,05,000.00
	MANREGA	One Pond (Gadi Manjhila) (200x150x10 ft)	4,68,000.00

KVK	Development Scheme/Programme	Nature of work	Amount (Rs.)
Nawada	MANREGA	200 ft Irrigational Channel	70000.00
	13th Finance Commission Govt. of India (Gram Panchayt)	One Aganwadi Building	480000.00
	Backward Rural Grant Fund	100 ft P.C.C.(Amarpur)	860000.00
	Chief Minister Sarak Yojna	1.5 km Pakka Road	8200000.00
	Backward Rural Grant Fund	250 ft P.C.C. (Upper Mjhila)	250000.00
	Backward Rural Grant Fund	200ft P.C.C. (Dudhiyatand)	200000.00
	Gram Panchayt	One Community Hall	500000.00
	MANREGA	One MANREGA Bhavan	1000000.00
	CM Vikash Yojana	100 ft P.C.C. (Amarpur)	88000.00
	MANREGA	200 ft P.C.C. (Dudhiyatand)	142000.00
	4th Finance Ayog	2 pices handpump (Upper & Gadi Majhila)	31000.00
	District Administration	250 ft PCC Road (Vidyasagar)	200000.00
	13th Finance Ayog	300 ft P.C.C. (Upper Mjhila)	252000.00
	MANREGA	3200 no Plantation of forest trees	900000.00
Total			**13,279,000.00**
Supaul	District Agriculture Office	Vermi compost production unit	126000.00
		Intercropping (Maize+Pea)	30000.00
		Zero tillage wheat	31250.00
		Lentil demonstration	3840.00
		Boro paddy	82500.00
	Bamboo Mission	Bamboo plantation	4800.00
	Central Silk Board	Mulbery plantation	162000.00
		Mulbery house	2880000.00
Total			**3320390.00**
Chatra	MNREGA	Construction of Well	320000.00
	Ministry of Tribal development through KAPAT	Construction of new pond	1800000.00
	MNREGA	Water lifting pump through solar system	350000.00
	District Agricultural Office	Drip irrigation system	180000.00
	Bank of India Chatra Branch	Kisan Credit Card	400000.00
Total			**3050000.00**
East Singhbhum	MESO	Well (15 feet Dia &30 feet deep) in Lowkeshra Village	150000.00
	ATMA	Kishan Mela & Training cum Exposure visit	180000.00
	Pradhan Mantri Gramin Sarak Yojna	3km pakka road in Pathergora village &	30000000.00
		1km pakka road in Lowkeshra Village	6700000.00
	MANREGA	2 pond in Lowkeshra Village	200000.00
		Kachcha irrigation channel (400 feet) Barunia Village	100000.00
Total			**37330000.00**

KVK	Development Scheme/Programme	Nature of work	Amount (Rs.)
Gumla	Minor Irrigation Division	Creation of two pucca check dam	39400000.00
	MLA Development fund	Establishment of 02 unit of lift irrigation	2000000.00
	Minor Irrigation Division	Establishment of 05 unit of irrigation unit devices	1800000.00
	Through Ghagra block	Establishment of 01 unit of irrigation unit devices	200000.00
	Micro Economic Socio Organization (MESO)	Creation of 38 schemes under NRM	8900000.00
Total			**52300000.00**
Koderma	Exposure visit	Extension	15000.00
	Farmers' Field School	Extension	29000.00
Total			**44000.00**
Palamu	Scheme of Development of enriched fruit plantation & Vegetable Cultivation (Dept. of Horticulture, Palamu)	Establishment of Jackfruit garden in one ha.	30000.00
	Renovation of old drainage channel collaboration through Dep. of Irrigation, Jharkhand	Repair of land of Malaydam	74000000.00
Total			**74030000.00**
Cooch Behar	MGNREGA	Construction of Pucca vermicompost pit and re excavation of pond	1000000.00
Total			**1000000.00**
Malda	Government of West Bengal	Extension of river bund	1500000.00
	MGNREGA	Renovation of village road	550000.00
Total			**2050000.00**
S. 24 Pgs.	IWMP	Construction of culvert over canal "Balir Khal"	100000.00
	IWMP	Rainwater harvesting structure, renovation of defunct water body	100000.00
	Sudarban Development Board, Govt. of W.B.	Sluice gate repairing	10000.00
	Sudarban Development Board, Govt. of W.B.	Construction of culvert over canal "Kripakhalir Khal"	350000.00
Total			**560000.00**
Grand Total			**220829339.00**

10. List of Dignitaries visited NICRA Villages during 2014-15

Name of KVK	Name of the Dignitaries Visited	Date of visit
Aurangabad	Indraveer Pathak, District Cooperative Officer, Aurangabad	05.07.2014
	Sri Deelip Singh, IFFCO, Aurangabad	09.08.2014
	Dr. A. K. Singh, ZPD, Zone II, Kolkata	11.09.2014
Buxar	Dr. Rasheed Sulaiman V., Director, Centre for Research on Innovation and Science Policy (CRISP)	15.11.2014
	Dr. Syliecpronder, DURDUE University, USA	15.11.2014
	Dr. R. K. Mallik, Coordinator, CSISA, India	16.11.2014
	Amy Pope, Programme Coordinator, BMGF, USA	11.12.2014
	Jacob Hersaman, CRS - India, USA	
	Vasey Mwaja, BMGF, USA	
	Sudhanshu Singh, IRRI, Philippines	
	Tony Costlenan, CRS - India, USA	
	Rachel Omvska, CRS - India, USA	
Chatra	Prafulla Kumar Behera, LDM, Chatra	16.07.2014
	Om Parkash Gupta, District Fishery Officer, Chatra	
	Dr. Farhat Jabbar, DAHO, Chatra	
	Arvind Kumar, District Animal Officer, Chatra	
	ZMC-NICRA Team - Dr. H. S. Sen, Ex Director CRIJAF, Barrokpore, Dr. A. Suanker, CRIDA, Dr. B. Das, HARP, Ranchi, Dr. F. H. Rahman, PS, ZPD, Kolkata	12.03.2015
Coochbehar	Team from Bhutan as representatives of Department of Agriculture, Royal Government of Bhutan,	28.07.2014
East Singhbhum	Dr. Sohan Ram, University Professor-cum-Chief Scientist, BAU, Ranchi	18.07.2014
	Smt. Sonia Samant, Zilla Parishad Adhyaksh, East Singhbhum	22.07.2014
Gumla	Shri Ravindra Gupta, BDO, Bishunpur	16.07.2014
	Shri Pratik Sen Gupta, Associate Consultant Climate change and sustainability Service Risk Advisory Service Ernst and Young	22. 07.2014
	Shri Mohit Singh, Deputy PD, ATMA, Gumla	15. 08. 2014
	Shri A.K. Vishwash, DDM, NABARD, Gumla	30. 09. 2014
	Shri Jitendra Kumar Chaudhary, LDM, Gumla	
	Dr. V. K. Agrawal, Chief Scientist, Soil Science,	09. 09. 2014
	Dr. P. K. Singh, Chief Scientist, Entomology, BAU, Ranchi	
	ZMC-NICRA Team - Dr. H. S. Sen, Ex Director CRIJAF, Barrokpore, Dr. A. Suanker, CRIDA, Dr. B. Das, HARP Plandu Ranchi, Dr. F. H. Rahman, PS, ZPD, Kolkata	14. 03. 2015

Name of KVK	Name of the Dignitaries Visited	Date of visit
Jehanabad	Sri Arun Kumar, M. P., Jehanabad	01.10.2014
	Sri A. K. Sinha, DAO, Jehanabad	
	Sri Omprakash, PD, ATMA, Jehanabad	01.07.2014
Nawada	Sri Rameshwar Singh, DDC, Nawada	16.07.2014
	Sri Prateek Sengupta, Associate Consultant Climate Change & Sustainbility Service , Ernst & Young LLP, Kolkata	26.07.2014
	Dr. S. P. Gupta, Assoc. Prof (Irrigation & Drainage Engg.) College of Agril. Engg, RAU, Pusa, Bihar	11.10.2014
	Dr. U. K. Dubey, Deputy Registar, PPV & FR Authority, New Delhi	29.11.2014
	Dr. A. K. Singh, ZPD, Zone II, Kolkata	09.01.2015
	Dr. S. B. Verma, Chairman, Deptt. of Animal Genetics & Breeding, B. V. Collage, Patna	09.01.2015
	Sri R. K. Das, General Manager, NABARD, Patna	19.01.2015
	Sri Mithleshh Kumar, DGM, NABARD, Patna	22.01.2015
	Sri Rameshwar Singh, DDC, Nawada	10.02.2015
	Dr. V. U. M. Rao, Co-ordinator, AICRPAM, CRIDA, Hyderabad	24.02.2015
Palamu	Dr. A. K. Singh ZPD, Zone II, Kolkata	14.03.2014
	Dr. George John, Hon'ble, Vice Chancellor, BAU, Ranchi	15.01.2015
	Dr. R. P. Singh Ratan, DEE, BAU, Ranchi	13.02.2015
	Dr. P. P. Singh, DY Director, SAMETI, Jharkhand	23.02.2015
	ZMC-NICRA Team - Dr. H. S. Sen, Ex Director CRIJAF, Barrokpore, Dr. A. Suanker, CRIDA, Dr. B. Das, HARP Plandu Ranchi, Dr. F. H. Rahman, PS, ZPDII, Kolkata	13.03.2015
Port Blair	Dr. A. K. Singh, ZPD II, Kolkata	07.04.2014
Saran	ZMC-NICRA Team - Dr. H. S. Sen, Ex Director CRIJAF, Barrokpore, Dr. K. Sreenivas Reddy, CRIDA, Dr. A. Upadhyay, Head, ICARRCER, Patna, Dr. F. H. Rahman, Principal Scientist, ZPD, Zone II, Kolkata	22.05.2015
Supaul	Dr. R. K. Sohane, DEE, BAU, Bhagalpur	20.08.2014
	Dr. S. K. Roy, Principal Scientist, ICAR, ZPD II, Kolkata	
	Dr. Umesh Singh , Principal, MBAC	
	Dr. R. C. Yadav, ADR, RRS, Saharsa	
	Sri S. K. Chaudhary, JDA, Saharsa	
	Dr. Rajesh Kumar, Principal, BPSAC	26.03.2015
South 24 Paraganas	CIFE, QRT Members	28.11.2014
	Smt. Pratima Naskar, M.P.	05.07.2014
	Dr. Tarun Naskar, MLA, Joynagar, Assembly Constituency	28.10.2014

Views of Dignitories visited different KVKs

11. SUCCESS STORY OF PROGRESSIVE FARMER

i) FISH FARMING

Farmer Name: - Udai Singh
Father Name: - Late Nema Singh
Village: - Murma, Block: - Satbarwa
District: - Palamu

Thematic Area - Fish farming

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 "eqjek ey; eRl; thoh lg;ksx lfefr"wwith help of KVK, Palamu. 71 families 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.

ii) PIG FARMING

Name: - Shri Samsai Oraon
Age: - 54 years
Village: - Belagarha, Block: - Ghaghra
Address: - Po. Belagarha, Dist. Gumla, Jharkhand
Contac details: - 9308489565

Gumla is a tribal dominated district of Jharkhand. About 70% farmers belongs from scheduled tribe community. Farming situation is entirely rainfed. Rice, Maize, Ragi, Blackgram, Niger and groundnut are the major crops. In general land holding is small and their livelihood mostly depends on forest based products, Livestock rearing and Crop production. By nature they are meat lovers and hence huge demand exists for poultry, pork and meat. Hence in order to maximize farm productivity and income the technology interventions through Integrated farming system were developed in participatory mode by the KVK Gumla on farmer's field.

TECHNOLOGICAL INTERVENTION

Considering the physical, social and economical limitation of the district, a small Integrated farming system model was developed in the field of samsai oraon (Tribal farmer) in Belagarha village of Ghaghra block during 2010-11 to 2013-14. The model comprises in two ha area in the vicinity of tribal settlement and integrated with six components. The critical input assistance was provided under NICRA. Technological intervention was made through 03 piglets (Cross breed T & D), Fifty thousand Fingerlings for fish production, high yielding paddy variety (Lalat), Maize (Suwan-1), Plantation of Sixty Mango fruit plant, Vegetable seed crop Pumpkin (Var. – MPH-1) , One Vermicompost unit for waste recycle and renovation of well. The capacity Building programme and technological backstopping was provided to the villagers in whom the beneficiary farmers also participated.

IMPACT

Mr. Samsai oraon successfully harvested higher paddy yield 38.5 Q/ha after intervention as compared to 26.0 Q/ha paddy yield before the intervention. Maize cultivar Suwan-1 provided 40 Q/ha as compared to local cultivar yield 27 Q/ha. The vegetable yield increased considerably after intervention which gave 0.18 lakh net return from pumpkin cultivation. In second year the no. of piglet increased to 15 including with 3 pigs.

He adopted composite fish production in 1.25 acre of pond. Before intervention Mr. Oraon has a defunct bari

Impact factor	Area (Acre)	Before Adoption Net income (Rs.)	After Adoption Net income (Rs.)
Agricultural Practice			
Piggery	0.50	0	45000
Fisheries	1.25	3000	10000
Paddy	2.00	8960	18960
Maize	0.75	5860	10200
Wheat	--	--	14200
Fruit plant (Mango-60 nos) + Veg	0.50	10000	23000
Vermicompost	-	-	2500
Total	**5.0**	**27820**	**123860**

well, no proper care and maintenance was made by him for maintaining the proper water level i'e 6 to 8 feet water. Renovation was done under input assistance. After renovation the water level is being maintained and effective use of water is also being made.

Now he has become a role model not only for the villagers of Belagarha but also for entire Ghaghra block of Gumla district. 10 farmers of the nearby villages motivated by his success and try to adopt this IFS model. Line department officials including of bankers and other stakeholders has visited his site and appreciated the IFS model.

iii) "KRIPAKHALI" CANAL – THE LIFELINE OF BONGHERI FARMERS

Bongheri, a frequent flood prone and cyclone hit coastal village in Sundarban area, is still on its way to recover from the after-shock of "Aila". The 4-km long Kripakhali Canal was the only source of sweet water irrigation for 560 farm families covering an area of 200 acre. During Aila (super cyclone coupled with flooding) in 2009, the canal was heavily silted up along with brackish water inundation. This resulted in severe reduction of storage capacity and rendered the available water unsuitable for agricultural usage. The defunct sluice gate could not control the further backflow of sea water into the canal. Farmers had no scope of taking a second crop during pre-kharif (Summer) or post-kharif (Rabi). Even the productivity of Kharif paddy reduced from 21.12 q/ha in 2007 to 15.86 q/ha in 2010. Area under chilli and other vegetables reduced drastically leading to severe limitation for scope of agricultural labour work. Farmers and farm women had no other choice than opting for seasonal migration during the lean period. The rate of migration increased to 12%. A daily migrant had to travel 40 minute by cycling, 4 hour by train/bus/auto and another 40 minute by walking to reach Kolkata and back. 1736 Kilo Calories of energy were lost, only due to travel, per person per day!

The National Initiative on Climate Resilient Agriculture (NICRA) was launched in this village in 2011 with a promise to bring the smile back to the faces of these 560 farm families. A planned intervention along with the active support of the villagers helped them not to wait longer. The villagers could reap the harvest in the very next season after the intervention.

INTERVENTION

Under the NRM activities of NICRA project, the canal was renovated including re-excavation of the silt all along the 1-km length with a depth varying from 3-4 ft, strengthening of the canal embankment and plantation of trees along the embankment. The defunct sluice gate was renovated through financial assistance from SDB, GoWB.

IMPACT

As a result, 3600 acre-inch of fresh rainwater could be harvested during 2012 monsoon season. The assured irrigation facilities, thus created, helped the farmers to take up Sunflower in 100 acre, Chilli in 50 acre and other vegetables in another 50 acre. The earth work created job opportunity of 9000 person-days during the period of

canal renovation. The increase in agricultural activities assured another 6000 person-days of labour work for the villagers. The villagers now have a happier option to remain attached with their families throughout the year as they can take up cultivation during Rabi or Summer season. The rate of migration has come down to 8%. Productivity of paddy (now 37 q/ha) has been restored well above the "before Aila" average. More importantly, with the assured fresh water irrigation, farmers now have a diversified cropping choice in the form of different vegetables as well as Oil seeds (sunflower) and Sugarcane. Thus, the overall intervention helped to return Bongheri its "lifeline" of agriculture in true sense.

iv) INTEGRATED FARMING SYSTEM

Farmer Name: - Vinod kumar
Father Name: - Sri Rupesh Yadav
Village: - Gadi Mnajhila, Block: - Kawakol
District: - Nawada

A pond of dimension 42m x 27m x 13m was excavated in the year 2013-14 under NICRA project . After excavation the rain water was harvested (stored) in the pond. In 2014-15 in kharif the stored water was utilized in the transplanting of the kharif paddy in 01 ha and for supplementary irrigation in the dry spell .The fish keeping was started. The fruits and forest species is transplanted on the bank of pond. On the bund Pigeon pea is shown and harvested. On the side strip of pond the vegetable is grown in kharif rabi and zaid by utilizing the water from pond as per need.

IFS model -farmers move towards at project area

The return from this pond is given below.

Economics

Crop	Are (Acr)	Cost of production	Return (Rs)	Net Income
Pigeonpea	0.2	1350	8700	7350
Cabage	02	1500	8000	6500
Cauliflower		1650	10000	8350
Spong guard		1200	3000	1800
Okra		1150	3600	2450
Bottle guard		550	1500	950
Fish	0.2	5000	20000	15000
Total	**-**	**12400**	**54800**	**42400/-**

The water is available whole year in this pond due to automatic recharging capability of the pond. The farmer is planning to establish Dairy unit beside the pond to generate more income.

v) GUAVA BASED FARMING SYSTEM

Name: Shri Umeshwar Singh
Village: Affaur, Block: Nagra, Dist: Saran
Contact no. 08084041776

INTERVENTION

For enhancing the productivity and profitability of the farm land, Shri Umeshwar Singh innovated a Guava based multiple cropping system taking 4 crops per year apart from main crop of guava. He established a guava garden, keeping planting geometry in such a manner that there was easy movement of tractor operated farm implements and no shading effect of guava canopy on the agricultural crops. Four rows of kharif maize were planted in between the two rows of guava. After the harvest of maize, Toria was taken that could be harvested in mid January. Summer vegetables like bottle gourd and okra was taken. Banana was planted all around the guava garden to give a protective wall and to act as wind break from hot and high speed westerly wind, apart from giving additional yield. During summer months, natural mulch of paddy straw was applied and worms were released in the field for in-situ vermicomposting, moisture retention and nutrient supply for longer period.

IMPACT

Shri Umeshwar Singh took a Gross Income of Rs. 12000/ ha from Maize, 9000/ha from Toria, 15000/ha from Bottle Gourd and okra in 2011, the initial year of intercropping in guava orchard that successively increased to Rs. 16300/ ha from Maize, 13200/ha from toria, 22000/ha from Bottle Gourd + okra and 1900 /ha from Banana apart from 52000/ha from Guava. Due to intensive care and regular fertilizer application in annual crops, the yield of main crop also increased during the years. Seeing the successful cultivation of this farming system of Shri Singh, some neighboring farmers also started cultivation in the same manner and now the village is known for guava cultivation in the district and Shri Singh is a role model in the district.

12. Newspaper coverage of various activities


Training on feed and fodder for livestock


MORE LOCAL NE


केवीके के परियोजना से देश को लाभ

किसानों को मिली खेती की जानकारी


सब्जी उत्पादन व सूकर पालन में आगे बढ़े


निकरा जांच दल ने किया प्रक्षेत्र का अवलोकन


केसीसी का लाभ उठायें किसान : एलडीएम


अल्प वृष्टि से सुखाड़ की स्थिति


मेदिनीनगर

पलामू जिले में लाह उत्पादन की असीम संभावना!


गुमला जागरण

झाई जोन क्षेत्र में जल संचयन का अनूठा प्रयास


100 किसानों को दिया गया स्मार्ट कार्ड


हिन्दुस्तान

धान की फसल के लिए सोना साबित हो रही बारिश


दैनिक जागरण

बकरी पालन से समृद्धि की बताई तरकीब

13. Publications

F. H. Rahman *et al.* (2014). Smart Practices and Technologies for Climate Resilient Agriculture. Pub. By CRIDA Hyderabad, July 2014

F. H. Rahman and A.K. Singh: (2015) Combating Climatic Vulnerability in Indian Agriculture Through Application of Improved Production and Risk Management Technologies. Compendium (ASC2015ABS1418116861): XII Agricultural Science Congress, Sustainable Livelihood Security for Smallholder Farmers. 3-6 February, 2015, ICAR-National Dairy Research Institute, Karnal, Haryana.

A. K. Singh, S.K. Roy, H.K. De, N.C. Banik, F. H. Rahman, P.P. Pal and S.K. Mondal (2014). Staggered community nurseries for delayed monsoon in the Eastern part of the country - A climate resilient approach. In: Book of Abstracts of National Seminar on Adaptation and mitigation strategies of climate change for sustainable livelihood. Uttar Banga Krishi Viswavidyalaya, Coochbehar. Apr 7-9, 2014.

F. H. Rahman andA. K. Singh (2014).Staggered paddy nursery as a contingency measures for delayed transplanting. Book of Abstracts. 79th Annual Convention of Indian Society of Soil Science. ANGRAU, Hyderabad, November 24-27, 2014.

Sujan Biswas and F. H. Rahman (2015). Influence of mode and time of n application at different level through urea on n use efficiency of winter rice. Souvenir and Book abstracts: National Conference on Indigenous Innovation and foreign technology transfer in fertilizer industry: needs, constraints and desired simplification. ICAR-CRIJAF, Barrackpore, January 17, 2015

F. H. Rahman, Sanjib Kumar, K. S. Das, S. K. Mondal and H. K. De (2015). Effect of application of soil test based fertilizer along with micronutrients on paddy productivity. Souvenir and Book abstracts: National Conference on Indigenous Innovation and foreign technology transfer in fertilizer industry: needs, constraints and desired simplification. ICAR-CRIJAF, Barrackpore, January 17, 2015

Sanjay Kumar and F. H. Rahman (2015). Green Technology for Sustainable Agriculture. Souvenir and Book abstracts: National Conference on Indigenous Innovation and foreign technology transfer in fertilizer industry: needs, constraints and desired simplification. ICAR-CRIJAF, Barrackpore, January 17, 2015

F. H. Rahman, S. K. Roy, S. K. Mondal, K. S. Das, H. K. De, Diptanjan Ghosh (2015). Study on Green Technologies Demonstrated in Selected Districts in Jharkhand. Global Social Science Conference on Management of Sustainable Livelihood Systems. 14-17 February 2015, OUAT, Bhubaneshwar